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2





THE  
CABINET  
OF  
Curiosities.



**VOL. I.**

*Natural & Artificial.*

HARTFORD,

1822.





**CABINET**

OF

**CURIOSITIES,**

**Natural, Artificial, and Historical,**



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**AUTHENTIC RECORDS,**

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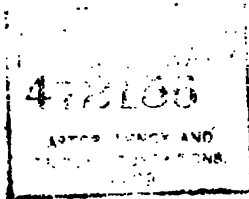
VOL. I.



HARTFORD:

.....

1822.



**DISTRICT OF CONNECTICUT, SS.**

**L. S.** **BE IT REMEMBERED**, That on the twenty-first day of September, in the forty-seventh year of the Independence of the United States of America, **SAMUEL G. GOODRICH**, of the said district, hath deposited in this Office, the title of a Book, the right whereof he claims as proprietor, in the words following, to wit:

*“ Cabinet of Curiosities, Natural, Artificial, and Historical, selected from the most authentic records, ancient and modern.”*

In conformity to the Act of the Congress of the United States, entitled, “An Act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned.”

**CHAS. A. INGERSOLL,**  
*Clerk of the District of Connecticut.*

A true copy of Record, examined and sealed by me,

**CHAS. A. INGERSOLL,**  
*Clerk of the District of Connecticut.*

E. & H. Clark, printers,  
Middletown, (Conn.)

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THE object of this work is not to play upon credulity, or minister food to superstition. On the contrary, its design is to *instruct* those who read it, by introducing them to an acquaintance with the wonderful works of Nature and Art, and with some of the most extraordinary deeds and occurrences, which the history of man affords.

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# NATURAL CURIOSITIES.



## ATMOSPHERICAL PHENOMENA.

### METEORS.

**T**HE nature of these splendid phenomena of the heavens cannot be so well elucidated as by an extract from the travels of M. M. Humboldt and Bonpland to the equinoctial regions of the New Continent. The sublime wonders described by the former of these travellers, were witnessed by them at Cumana, a city of South America, and capital of the province of that name.

“The night of the 11th of November, 1779, was cool and extremely beautiful. Toward the morning, from half after two, the most extraordinary luminous meteors were seen towards the east. M. Bonpland, who had risen to enjoy the freshness of the air in the gallery, perceived them first. Thousands of bolides, (fire-balls,) and falling stars, succeeded each other during four hours. Their direction was very regular, from north to south. They filled a space in the sky, extending from the true east  $30^{\circ}$  towards the north and south. In an amplitude of  $60^{\circ}$  the meteors were seen to rise above the horizon at east-north-east, and at east to describe arcs more or less extended, falling toward the south, after having followed the direction of the meridian. Some of them attained a height of  $40^{\circ}$ ; and all exceeded  $25^{\circ}$  or  $30^{\circ}$ . There was very little wind in the low regions of the atmosphere, and this blew from the east. No trace of clouds was to be seen. M. Bonpland relates, that from the beginning of the phenomenon, there was not a space in the firmament equal in extent to three diameters of the moon, which was not filled at every instant with bolides and falling stars. The first were fewer in number, but as they were seen of different sizes, it was impossible to fix the limit between these two classes of phenomena — All these meteors left luminous traces from five to ten degrees in length, as often happens in the equinoctial regions. The phosphorescence of these traces, or luminous bands, lasted seven or eight seconds. Many of the falling stars had a very distinct nucleus, as large as the disc of Jupiter, from which darted *sparks of vivid light*. The bolides seemed to burst as by ex-

plosion; but the largest, those from  $1^{\circ}$  to  $1^{\circ} 15'$  in diameter disappeared without scintillation, leaving behind them phosphorescent bands (*trabes*) exceeding in breadth fifteen or twenty minutes, or sixtieth parts of a degree. The light of these meteors was white, and not reddish, which must be attributed, no doubt, to the absence of vapours, and the extreme transparency of the air. For the same reason, under the tropics, the stars of the first magnitude have, at their rising, a light evidently whiter than in Europe.

“Almost all the inhabitants of Cumana were witnesses of this phenomenon, and did not behold these bolides with indifference; the oldest among them remembered, that the great earthquakes of 1766 were preceded by similar phenomena. The fishermen in the suburbs asserted, that the *fire-work* had begun at one o'clock; and that, as they returned from fishing in the Gulf, they had already perceived very small falling stars towards the east. They affirmed; at the same time, that igneous meteors were extremely rare on those coasts after two in the morning.

“The phenomenon ceased by degrees after four o'clock, and the bolides and falling stars became less frequent; but we still distinguished some toward the north-east, by their whitish light, and the rapidity of their movement, a quarter of an hour after sun-rise. This circumstance will appear less extraordinary, when I state that in full day light, in 1788, the interior of the houses in the town of Popayan was highly illumined by an aerolite of immense magnitude. It passed over the town when the sun was shining clearly, about one o'clock. M. Bonpland and myself, during our second residence at Cumana, after having observed on the 26th of September, 1800, the immersion of the first satellite of Jupiter, succeeded in seeing the planet distinctly with the naked eye, eighteen minutes after the disc of the sun had appeared in the horizon. There was a very slight vapour in the east, but Jupiter appeared on an azure sky. These facts prove the extreme purity and transparency of the atmosphere under the torrid zone. The *mass* of diffused light is so much less, as the vapours are more perfectly dissolved. The same cause that weakens the diffusion of the solar light, diminishes the extinction of that which emanates either from a bolis, Jupiter, or the moon, seen on the second day after her conjunction.

“The researches of M. Chladni having singularly fixed the attention of the scientific world upon the bolides and falling stars at my departure from Europe, we did not neglect, during the course of our journey from Caraccas to the Rio Negro, to inquire every where, whether the meteors of the 12th of No-

vember had been perceived. In a savage country, where the greater number of the inhabitants sleep out in the air, so extraordinary a phenomenon could not fail to be remarked, except when concealed by clouds from the eye of observation. The Capuchin missionary at San Fernando de Apura, a village situated amid the savannahs of the province of Varinas; and the Franciscan monks stationed near the cataracts of the Oroonoko, and at Maroa, on the banks of the Rio Negro; had seen numberless falling stars and bolides illumine the vault of heaven. Maroa is south-west of Cumana, at one hundred and seventy-four leagues distance. All these observers compared the phenomenon to a beautiful fire-work, which had lasted from three till six in the morning. Some of the monks had marked the day upon their ritual; others had noted it by the nearest festivals of the church. Unfortunately, none of them could recollect the direction of the meteors, or their apparent height. From the position of the mountains and thick forests which surround the missions of the cataracts and the little village of Maroa, I presume that the bolides were still visible at  $20^{\circ}$  above the horizon. On my arrival at the southern extremity of Spanish Guyanna, at the little fort of San Carlos, I found a party of Portuguese, who had gone up the Rio Negro from the Mission of St. Joseph of the Maravitains, and who assured me, that in that part of Brazil, the phenomenon had been perceived, at least as far as San Gabriel das Cachoeiras, consequently as far as the equator itself.

“I was powerfully struck at the immense height which these bolides must have attained, to have been visible at the same time at Cumana, and on the frontiers of Brazil, in a line of two hundred and thirty leagues in length. But what was my astonishment, when at my return to Europe, I learnt, that the same phenomenon had been perceived on an extent of the globe of  $64^{\circ}$  of latitude, and  $91^{\circ}$  of longitude; at the equator, in South America, at Labrador, and in Germany! I found accidentally during my passage from Philadelphia to Bordeaux, in the memoirs of the Pennsylvanian Society, the corresponding observations of Mr. Ellicott (lat.  $30^{\circ} 42'$ ;) and, upon my return from Naples to Berlin, I read the account of the Moravian Missionaries among the Eskimoes, in the library of Gottingen.—Several philosophers had already discussed at this period the coincidence of the observation in the north with those at Cumana, which M. Bonpland and I had published in 1800.”

The bolides, or fire-balls, and falling stars, so striking an example of which is given above, are of all sizes, from a *small shooting star* of the fifth magnitude, to a cone or cylinder

der of two or three miles in diameter. They differ in consistency as much as in dimensions, and in colour, as much as in either. Occasionally, they are a subtile, luminous, and pellucid vapour; and sometimes a compact ball, or globe, as though the materials of which they are formed, were more condensed and concentrated. Not unfrequently they have been found to consist of both, and consequently to assume a comet-like appearance, with a nucleus or compact substance in the centre, or towards the centre, and a long, thin, pellucid, or luminous mane, or tail, sweeping on each side. They are sometimes of a pale white light; at others, of a deep igneous crimson; and, occasionally iridescent and vibratory. The rarer meteors appear frequently to vanish on a sudden, as though abruptly dissolved or extinguished in the atmospheric medium, their flight being accompanied by a hissing sound, and their disappearance by an explosion. The most compact of them, or the nuclei of those which are rarer, have often descended to the surface of the earth, and with a force sufficient to bury them many feet under the soil; generally exhibiting marks of imperfect fusion and considerable heat. The substance is, in these cases, for the greater part metallic; but the ore of which they consist, is not any where to be found, in the same constituent proportions, in the bowels of the earth. Under this form, the projected masses are denominated aerolites, or meteoric stones.

It may not be uninteresting to preface a succinct account of the most surprising of these meteors, by a brief notice of the hypotheses which have been imagined concerning them; however justly the learned Humboldt may have concluded, that we are still "as ignorant on this subject, as men were in the days of Anaxagoras." Sir J. Pringle contended, with other philosophers, that they are revolving bodies, or a kind of terrestrial planets. Doctor Halley conjectured them to consist of combustible vapours, accumulated and formed into concrete bodies on the outskirts, or extreme regions of the atmosphere, and to be suddenly set on fire by some unknown cause; an opinion which, with little difference, has been since entertained by Sir W. Hamilton and Dr. King. Dr. Blagdon regarded them altogether as electrical phenomena. M. Izarn believed them to consist of volcanic materials, propelled into the atmosphere in the course of explosions of great violence. M. Chladni supposed them to be formed of substances existing exteriorly to the atmosphere of the earth, and other planets, which have never incorporated *with them*, and are found loose in the vast ocean of space, being *there combined* and inflamed by causes unknown to us. *Lastly*, the most favourite hypothesis is, that the whole, or, at

least, the more compact division of these meteors, are made up of materials thrown from immense volcanoes in the moon. This hypothesis, which was started by M. Olbers, in 1795, has been since very plausibly supported by the celebrated Laplace, but does not apply to the smaller and less substantial meteors, named shooting stars. Hence, these philosophers derive the latter phenomena from some other cause, as electricity, or terrestrial exhalations; and observe, in support of the distinction they find it necessary to make, that shooting stars must be of a different nature from fire-balls, since they sometimes appear to ascend as well as to fall. This observation has been especially dwelt on by M. M. Chladni and Benzenburg, both of them favourably noticed, as accurate observers, by Humboldt.

On the 21st of March, 1676, two hours after sunset, an extraordinary meteor was seen to pass over Italy. At Bononia, its greatest altitude in the south-south-east was  $38^{\circ}$ ; and at Sienna,  $58^{\circ}$  towards the north-north-east. In its course, which was from east-north-east to west-south-west, it passed over the Adriatic sea, as if coming from Dalmatia. It crossed all Italy, being nearly vertical to Rimini and Savigniano, on the one side, and to Leghorn on the other: its perpendicular altitude was at least thirty-eight miles. At all the places near its course, it was heard to make a hissing noise as it passed, like that of artificial fire-works. In passing over Leghorn, it gave a very loud report, like that of a cannon; immediately after which, another sort of sound was heard, like the rattling of a deeply-loaded waggon passing over the stones, which continued for several seconds. The professor of mathematics at Bononia calculated the apparent velocity of this surprising meteor, at not less than one hundred and sixty miles in a minute of time, which is above ten times as swift as the diurnal rotation of the earth under the equinoctial, and not many times less than that with which the annual motion of the earth about the sun is performed. It there appeared larger than the moon in one diameter, and above half as large again in the other; which, with the given distance of the eye, made its real smaller diameter above half a mile, and the larger one in proportion. It is, therefore, not surprising, that so great a body, passing with such an amazing velocity through the air, however rarified it may be in its upper regions, should occasion so loud a hissing noise as to be heard at such a distance. It finally went off to sea towards Corsica.

Two luminous meteors of great magnitude were observed at *Leipsic*, within the space of six years. On the 22d of May, 1680, about three in the morning, the first of these was seen,

to the great terror of the spectators, descending in the north, and leaving behind it, a long white streak where it had passed. As the same phenomenon was witnessed in the north-north-east, at Haarburg, and also at Hamburg, Lubec, and Stralsund, all of which places are about a hundred and fifty English miles from Leipsic, it was concluded that this meteor was exceedingly high above the earth. The second meteor was still more terrific. On the 9th of July, 1686, at half past one in the morning, a fire-ball with a tail was observed in 8 1-2 degrees of Aquarius, and 4 degrees north, which continued nearly stationary for seven or eight minutes, with a diameter nearly equal to half the moon's diameter. At first, its light was so great, that the spectators could see to read by it; after which, it gradually disappeared. This phenomenon was observed at the same time in several other places, more especially at Schlaitza, a town distant from Dantzic forty English miles towards the south, its altitude being about 6° above the southern horizon. At Leipsic, it was estimated to be distant not more than sixty English miles, and to be about twenty-four miles perpendicular above the horizon, so that it was at least thirty miles high in the air.

A very extraordinary meteor, which the common people called a flaming sword, was first seen at Leeds, in Yorkshire, on the 18th of May, 1710, at a quarter after ten at night. Its direction was from south to north: it was broad at one end, and small at the other; and was described by the spectators as resembling a trumpet, moving with the broad end foremost. The light was so sudden and bright, that they were startled at seeing their own shadows, when neither sun nor moon shone upon them. This meteor was, in its course, seen, not only in Yorkshire and Lancashire, but also in the counties of Nottingham and Derby, notwithstanding which, each of those who observed it, although so many miles distant from each other, fancied it fell within a few yards of him. In disappearing, it presented bright sparklings at the small end.

A blazing meteor was, on the 19th of March, 1719, seen in every part of England. In the metropolis, about a quarter after eight at night, a sudden powerful light was perceived in the west, far exceeding that of the moon, which then shone very bright. The long stream it gave out, appeared to be branched about the middle; and the meteor, in its course, turned pear-fashioned, or tapering upwards. At the lower end, it came at length to be larger and spherical, although not so large as the full moon. Its colour was whitish, with an eye of blue, of a most vivid dazzling lustre, which seemed in brightness very nearly to resemble, if not to surpass, that of

the body of the sun in a clear day. This brightness obliged the spectator to turn his eyes several times from it, as well when it was a stream, as when it was pear-fashioned and a globe. It seemed to move, in about half a minute, or less, about the length of twenty degrees, and to disappear about as much above the horizon. Where it had passed, it left behind a track of a cloudy or faint reddish yellow colour, such as red-hot iron or glowing coals have : this continued more than a minute, seemed to sparkle, and kept its place without falling. This track was interrupted, or had a chasm towards its upper end, at about two-thirds of its length. No explosion was heard ; but the place where the globe of light had been, continued for some time after it was extinct, of the same reddish yellow colour with the stream, and at first, sparks seemed to issue from it, such as proceed from red hot iron beat out on an anvil.

It was agreed by all the spectators in the capital, that the splendour of this meteor was little inferior to that of the sun. Within doors, the candles did not give out any light ; and in the streets, not only all the stars disappeared, but the moon, then nine days old, and high near the meridian, the sky being very clear, was so far effaced as scarcely to be seen : it did not even cast a shade, where the beams of the meteor were intercepted by the houses ; so that, for a few seconds of time, there was in every respect a resemblance of perfect day.

The perpendicular height of this surprising meteor was estimated at 64 geometrical miles ; and it was computed to have run about 300 of these miles in a minute. It was seen, not only in every part of Great Britain and Ireland, but likewise in Holland, in the hither parts of Germany, in France, and in Spain, nearly at the same instant of time. The accounts from Devonshire, Cornwall, and the neighbouring counties, were unanimous in describing the wonderful noise, which followed its explosion. It resembled the report of a large cannon, or rather of a broadside, at some distance, which was soon followed by a rattling noise, as if many small arms had been promiscuously discharged. This tremendous sound was attended by an uncommon tremour of the air ; and every where in those counties, not only the windows and doors of the houses were sensibly shaken, but, according to several of the reports, even the houses themselves, beyond the usual effect of cannon, however near.

On the 11th of December, 1741, at seven minutes past one in the afternoon, a globe of fire, somewhat larger than the horizontal full moon, and as bright as the moon appears at any time when the sun is above the horizon, was seen at Peckham,



in Surry, in a south-south-east direction, moving towards the east with a continued equable motion, and leaving behind it a narrow streak of light, whiter than the globe itself, throughout its whole course. Towards the end, it appeared less than at the beginning of its motion; and within three or four seconds suddenly vanished. Its apparent velocity was nearly equal to half the medium velocity of the ordinary meteors called falling or shooting stars; and its elevation, throughout the whole of its course, about twenty degrees above the horizon.

On the 18th of August, 1783, an uncommon meteor was seen in several parts of Great Britain, as well as on the continent. Its general appearance was that of a luminous ball, which, rising in the north-north-east, nearly of a globular form, became elliptical, and gradually assumed a tail as it ascended. In a certain part of its course, it underwent a remarkable change, which might be compared to bursting, and which, it ought to be observed, has been since frequently noticed in the passage of the aerolites, or meteoric stones, particular mention of which will be made hereafter. After this it no longer proceeded as an entire mass, but was apparently divided into a great number, or cluster of balls, some larger than others, and all carrying a tail, or leaving a train behind. Under this form, it continued its course with a nearly equable motion, dropping, or casting off sparks, and yielding a prodigious light, which illuminated all objects to a surprising degree; until, having passed the east, and verging considerably to the southward, it gradually distended, and was at length lost to the sight. The time of its appearance was 9h. 16m. P. M. mean time of the meridian of London, and it continued visible about half a minute.

This beautiful meteor having been seen in Shetland and in the northern parts of Scotland, ascending from the north, and rising like the planet Mars, little doubt was entertained of its course having commenced beyond the farthest extremity of this island, somewhere over the northern ocean. Having proceeded over Essex, and the Straits of Dover, it probably entered the continent not far from Dunkirk, where, as well as at Calais and Ostend, it was thought to be vertical. Still holding on its course to the southward, it was seen at Brussels, at Paris, and at Nuits in Burgundy; insomuch, that there was sufficient proof of its having traversed thirteen or fourteen degrees of latitude, describing a track of at least one thousand miles over the surface of the earth;—a length of course far exceeding the extent of what had been then ascertained of any similar phenomenon.

*During the passage of this meteor over Brussels, the moon*

appeared quite red, but soon recovered its natural light. The results of several observations give it an elevation of more than fifty miles above the surface of the earth, in a region where the air is at least thirty thousand times rarer than here below. Notwithstanding this great elevation, the fact of a report having been heard some time after it disappeared, rests on the testimony of too many witnesses to be controverted. It was compared to the falling of some heavy body in a room above stairs, or to the discharge of one or more large cannon at a distance: this report was loudest in Lincolnshire, and the adjacent counties, and also in the eastern parts of Kent.

Supposing the transverse diameter of this meteor to have subtended an angle of 30 minutes when it passed over the zenith, and that it was fifty miles high, it must have been almost half a mile across. The tail sometimes appeared ten or twelve times longer than the body; but most of this was train, and the real elongation behind seems seldom to have exceeded twice or thrice its transverse diameter; it consequently was between one and two miles in length. Now, if the cubical contents be considered, for it appeared equally round and full in all directions, such an enormous mass must afford just matter of astonishment, when the extreme velocity with which it moved is considered. This velocity, agreeably to the observations of Sir W. Herschel and several other astronomers, could not have been less than 20 miles in a second, exceeding that of sound above ninety times, and approaching toward that of the earth in her annual orbit. At such a rate, it must have passed over the whole island of Great Britain in less than half a minute, and would, in the space of less than seven minutes, have traversed the whole diameter of the earth!

On the 4th of October of the above year, 1783, two meteors were seen in England. The first, at three in the morning, on account of the early hour, was witnessed by but few spectators, who represented it as rising from the north to a small altitude, and then becoming stationary with a vibratory motion, and an illumination like day-light: it vanished in a few moments, leaving a train behind. This sort of tremulous appearance has been noticed in other meteors, as well as their continuing stationary for some time, either before they begin to shoot or after their course is ended. The second of these meteors appeared at forty-three minutes past six in the evening, and was much smaller, and also of much shorter duration, than the one seen in August. It was first observed to the north, like a stream of fire similar to that of the common shooting stars, but larger; and having proceeded some distance under this form, suddenly burst out into that intensely bright

bluish light peculiar to such meteors, which may be most aptly compared to the blue lights of India, or to some of the largest electrical sparks. The illumination was very great; and on that part of its course where it had been so bright, a dusky red streak or train was left, which remained visible about a minute, and was thought by some gradually to change its form. Except this train, the meteor had not any tail, but was nearly of a round body, or, perhaps, somewhat elliptical. After moving not less than ten degrees in this bright state, it became suddenly extinct, without any appearance of bursting or explosion.

## AEROLITES.

These phenomena, otherwise called meteoric stones, have been ascertained, by recent observations, to be connected with the showers, or fireballs, described above. Scoriaceous masses have frequently been either actually seen to fall at the time of the disappearance of the latter, or have been found some miles on the surface of the earth. Most of the stones which have fallen from the atmosphere, have been preceded by the appearance of luminous bodies, or meteors. These masses burst with an explosion, and then the shower of stones falls to the earth. Sometimes the stones continue luminous till they reach the earth, but more commonly their luminousness disappears at the time of their explosion. These showers move in a direction nearly horizontal, and seem to approach the earth before they explode.

The stones which fall immediately after their explosion, are of various sizes. They commonly burn themselves a considerable way from the earth. They are often found in fragments of a very irregular shape, or in masses of several tons. They usually possess the qualities of iron, and are often covered with a thin crust of iron pyrites, or sulphur. The stones are sometimes found in pieces of iron, and have been found to contain a large quantity of the following impurities: iron, copper, zinc, lead, tin, silver, gold, platinum, and arsenic. They have also been found to contain small quantities of nickel, cobalt, and manganese. They are sometimes found in pieces of iron, and have been found to contain a large quantity of the following impurities: iron, copper, zinc, lead, tin, silver, gold, platinum, and arsenic. They have also been found to contain small quantities of nickel, cobalt, and manganese.

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of a very large stone which fell near the river Negos, ce. In the chronicle of Count Marcellin, there is an account of three immensely large stones having fallen in Thrace, year 452 before the Christian æra. To proceed to modern, and well authenticated instances of the fall of

On the 7th of November, 1492, a little before noon, a dread-der-clap was heard at Ensisheim, in Alsace, instantly which a child saw a huge stone fall on a field newly sown wheat. On searching, it was found to have penetrated the earth about three feet, and weighed 260 lbs. making its fall equal to a cube of thirteen inches the side. All the contemporary writers agree in the reality of this phenomenon, ob-though that, if such a stone had before existed in a ploughed field must have been known to the proprietor.

The celebrated astronomer Gassendi relates an instance of an aerolite descent, of which he was himself an eye witness. On the 26th of November, 1627, the sky being clear, he saw a stone fall on Mont Vasis, in the south-east extremity of the Alpes, near Nice. While in the air, it seemed to be about 12 inches in diameter; was inclosed in a luminous circle of colour like a rainbow; and in its fall produced a sound like the report of a cannon. It weighed 59 lbs. was very hard, of a metallic colour, and had a specific gravity considerably greater than that of marble.

In the year 1672, two stones fell near Verona, in Italy, the largest weighing 300, the other 200 lbs. This phenomenon was observed in the evening, by three or four hundred persons. The stones fell, with a violent explosion, in a sloping direction, in a calm weather. They appeared to burn, and ploughed the ground.

Lucas, the traveller, relates that when he was at Lacedæmon, town of Greece, near the gulf of Salonica, a stone weighing 72 lbs. fell in the vicinity. It was observed to come from the northward, with a loud hissing noise, and seemed to descend in a small cloud, which exploded when the stone struck the ground. It looked like iron dross, and smelt of sulphur.

In September, 1753, several stones fell in the province of Savoy, to the west of Geneva: one in particular fell at Pont-d'Ain, and another at Liponas, places nine miles distant from each other. The sky was clear, and the weather warm. A loud noise, and a hissing sound, were heard at those two places, and for several miles round, on the fall of these stones, which exactly resembled each other, were of a darkish dull red colour, very ponderous, and manifesting on their surface that they had suffered a violent degree of heat. The largest

weighed about 20 lbs. and penetrated about six inches into the ploughed ground; a circumstance which renders it highly improbable that they could have existed there before the explosion. This phenomenon has been described by the astronomer De La Lande, whose strict inquiries on the spot enabled him to testify the truth of the circumstances he relates.

In the year 1768, three stones were presented to the French Academy of Sciences, which had fallen in different parts of France; one at Luce, in the Maine; another at Aire, in Artois; and the third in Cotentin. They were all externally of the same identical appearance; and on the former of them, a particular report was drawn up by Messrs. Fougereux, Cadet, and Lavoisier. This report states, that on the 18th of September, 1768, between four and five in the afternoon, there was seen, near the above village of Luce, a cloud in which a short explosion took place, followed by a hissing noise, but without any flame. The same sound was heard by several persons about ten miles from Luce; and, on looking up, they perceived an opaque body describe a curve in the air, and fall on a piece of green turf near the high road. They immediately ran to the spot, where they found a kind of stone, half buried in the earth, extremely hot, and weighing about seven and a half pounds.

In the particular instance now to be cited, very distinct traces were left to show the progress of aerolites through the air. During the explosion of a meteor near Bordeaux, on the 20th of August, 1789, a stone in diameter about fifteen inches, fell through the roof of a cottage, and killed a herdsman and some cattle. Part of this stone is now in the Greville Museum, and part in the Museum of Bordeaux.

On the 24th of July, 1790, between nine and ten at night, a shower of stones fell near Agen, in Guienne, near the southwest angle of France. First a luminous ball of fire was seen traversing the atmosphere with great rapidity, and leaving behind it a train of light which lasted about fifty seconds; soon after this, a loud explosion was heard, and sparks were seen to fly off in all directions. This was soon after followed by the fall of stones, over a considerable extent of ground, and at various distances from each other. These were all alike in appearance, but of many different sizes, the greater number weighing about two ounces, but many a vast deal more. Some fell with a hissing noise, and entered the ground; but the smaller ones remained on the surface. The only damage done by this shower of stones was, that they broke the tiles of several houses, in falling on which, they had not the sound of *hard and compact* substances, but of a matter in a soft half-

melted state. Such as fell on straws, adhered to them, and could not be readily separated;—a manifest proof that they were in a state of fusion.

On the 18th of December, 1795, several persons, near the house of Captain Topham, in Yorkshire, heard a loud noise in the air, followed by a hissing sound, and soon after felt a shock, as if a heavy body had fallen to the ground at a little distance from them. In reality, one of them saw a huge stone fall to the earth, at the distance of eight or nine yards from the place where he stood. When he first observed it, it was seven or eight yards above the ground; and in its fall, it threw up the mould on every side, burying itself twenty-one inches in the earth. This stone, on being dug up, was found to weigh 56 lbs.

On the 17th of March, 1798, a body, burning with an intense light, passed over the vicinity of Ville Franche, on the Saone, near Lyons, accompanied by a hissing sound, and leaving behind a luminous track. This phenomenon exploded with a great noise, about twelve hundred feet from the ground, and one of the splinters, still luminous, having been observed to fall in a neighbouring vineyard, was traced. It was about a foot in diameter, and had penetrated twenty inches into the ground.

On the 4th of July, 1803, a ball of fire struck a public house at East Norton, in Oxfordshire. The chimney was thrown down, the roof partly torn off, the windows shattered to atoms, and the dairy, &c. converted into a heap of rubbish. It was of considerable magnitude, and, on coming in contact with the house, exploded with great noise, and a very oppressive sulphureous smell. Several fragments of stones were found on the spot, having a surface of a dark colour, and varnished, as if in a state of fusion, with numerous globules of a whitish metal, combining sulphur and nickel. The indentures on these surfaces render it probable that the ball was soft when it descended; and it was obviously in a state of fusion, as the grass, &c. were burnt where the fragments fell. The motion of the fire-ball, while in the air, was very rapid, and apparently parallel to the horizon.

The latest remarkable fall of aerolites in Europe, of which there is a distinct account, was in the vicinity of Laigle, in Normandy, early in the afternoon of the 26th of April, 1812. A fiery globe of a very brilliant splendour, which moved in the air with great rapidity, was followed in a few seconds by a violent explosion, which lasted five or six minutes, and was heard to the extent of more than thirty leagues in every direction. *Three or four reports*, like those of a cannon, were *followed by a discharge resembling a fire of musquetry*, after

which a dreadful rumbling was heard, like the beating of a drum. The air was calm, and the sky serene, with the exception of a few clouds, such as are frequently observed. The noise proceeded from a small cloud of a rectangular form, the largest side being in a direction from east to west. It appeared motionless all the time the phenomenon lasted; but the vapour of which it was composed, was projected momentarily from the different sides, by the effect of the successive explosions. This cloud was about half a league to the north-north-east of the town of Laigle, and was at so great an elevation, that the inhabitants of two hamlets, a league distant from each other, saw it at the same time over their heads. In the whole canton over which this cloud hovered, a hissing noise, like that of a stone discharged from a sling, was heard; and a multitude of meteoric stones were seen to fall at the same time.

The district in which they fell, forms an elliptical extent of about two leagues and a half in length, and nearly one in breadth; the greatest dimension being in a direction from south-east to north-west, forming a declination of about  $22^{\circ}$ . This direction, which the meteor must have followed, is exactly that of the magnetic meridian; which is a remarkable result. The number of these stones was reckoned to exceed three thousand; and the largest of them weighed nearly 20 lbs. They were friable some days after their fall, and smelt strongly of sulphur. They subsequently acquired the degree of hardness common to these stones.

While, in Europe, these phenomena thus strongly confirmed the long exploded idea of the vulgar, that many of the luminous meteors observed in the atmosphere, are masses of ignited matter, an account of one of precisely the same description was received from the East-Indies. On the 19th of December, 1798, at eight in the evening, a large fire-ball, or luminous meteor, was seen at Benares, and at several places in its vicinity. It was attended by a loud rumbling noise; and, about the same time, the inhabitants of Krakhut, fourteen miles from Benares, saw the light, heard what resembled a loud thunder-clap, and, immediately after, the noise of heavy bodies falling around them. Next morning the mould in the fields was found to have been turned up in many spots; and unusual stones of various sizes, but of the same substances, were picked out of the moist soil, generally from a depth of six inches. One stone fell through the roof of a hut, and buried itself in the earthen floor.

From these multiplied evidences, it is proved that, in various parts of the world, luminous meteors have been seen moving through the air with surprising rapidity, in a direction more or

less oblique, accompanied with a noise, commonly like the whizzing of cannon-balls, followed by explosion, and the fall of hard, stony, or semi-metallic masses in a heated state. The constant whizzing sound; the fact of stones being found similar to each other, but unlike all others in the vicinity, at the spots towards which the luminous body, or its fragments had been seen to move; the scattering or ploughing up of the soil at those spots, always in proportion to the size of the stones; the concussion of the neighbouring ground at the same time; and especially, the impinging of the stones on bodies somewhat above the earth, or lying loose on its surface, are circumstances perfectly well authenticated in these reports; proving that such meteors are usually inflamed, hard masses, descending rapidly through the air to the earth.

#### AURORA BOREALIS, AND AURORA AUSTRALIS.

These splendid meteors are generally considered as the result of a combination of the two powers of magnetism and electricity. When the *light*, or *aurora*, appears chiefly in the north part of the heavens, it is called the AURORA BOREALIS, or NORTHERN LIGHTS; and when chiefly in the south part, the AURORA AUSTRALIS, or SOUTHERN LIGHTS. Where the coruscation is more than ordinarily bright and streaming, which, however, seldom occurs in the north, it is denominated LUMEN BOREALE; and where these streams have assumed a decided curvature, like that of the rainbow, they are distinguished by the name of LUMINOUS ARCHES.

The aurora is chiefly visible in the winter season, and in cold weather. It is usually of a reddish colour, inclining to yellow, and sends out frequent coruscations of pale light, which seem to rise from the horizon in a pyramidal, undulating form, shooting with great velocity up to the zenith. This meteor never appears near the equator; but of late years has frequently been seen towards the south pole.

The aurora borealis has appeared at some periods more frequently than at others. This phenomenon was so rare in England, or so little regarded, that its appearance was not recorded in our annals between a remarkable one observed on the 14th of November, 1554, and a very brilliant one on the 6th of March, 1716, and the two succeeding nights, but which was much strongest on the first night. Hence it may be inferred, that the state of either the air or earth, or perhaps of both, is not at all times fitted for its production.

The extent of these appearances is surprisingly great. The very brilliant one referred to above, was visible from the west of Ireland to the confines of Russia, and the east of Poland,



extending over, at the least, thirty degrees of longitude, and, from about the fiftieth degree of latitude, over almost all the northern part of Europe. In every place, it exhibited, at the same time, the same wonderful features. The elevation of these lights is equally surprising: an aurora borealis which appeared on the 16th of December, 1737, was ascertained, by a mean of thirty computations, to have an average height from the earth of 175 leagues, equal to 464 English miles.

Captain Cook, in his first voyage round the world, observes, that these coruscations are frequently visible in southern latitudes. On the 16th of September, 1770, he witnessed an appearance of this kind about 10 at night, consisting of a dull, reddish light, and extending about twenty degrees above the horizon. Its extent was very different at different times, but it was never less than eight or ten points of the compass. Rays of light, of a brighter colour, passed through and without it; and these rays vanished and were renewed nearly in the same time as those in the aurora borealis, but had little or no vibration. Its body bore S. S. E. from the ship, and continued without any diminution of its brightness, till twelve o'clock, when the observers retired. The ship was at this time within the tropic of capricorn.

On the 17th of February, 1773, during his second voyage, Captain Cook speaks of a beautiful phenomenon that was observed in the heavens. "It consisted of long columns of a clear, white light, shooting up from the horizon to the eastward, almost to the zenith, and spreading gradually over the whole southern parts of the sky. These columns even sometimes bent sideways at their upper extremity; and, although in most respects similar to the northern lights, (the *aurora borealis* of our hemisphere,) yet differed from them in being always of a whitish colour; whereas, ours assume various tints, especially those of a fiery and purple hue. The stars were sometimes hidden by, and sometimes faintly to be seen through, the substance of these southern lights, *aurora australis*. The sky was generally clear when they appeared, and the air sharp and cold, the mercury in the thermometer standing at the freezing point; the ship being then in 58 degrees south." On six different nights of the following month (March) the same phenomenon was observed.

#### LUMEN BOREALE, OR STREAMING LIGHTS.

On the 8th of October, 1726, uncommon streams of light were exhibited in every part of the heavens, about eight o'clock in the evening. They were seen throughout England, as well as in the southern parts of Europe. They were mostly point-

ed, and of different lengths, assuming the appearance of flaming spires or pyramids; some again were truncated, and reached but half way; while others had their points reaching up to the zenith, or near it, where they formed a sort of canopy, or thin cloud, sometimes red, sometimes brownish, sometimes blazing as if on fire, and sometimes emitting streams all around it. This canopy was manifestly formed by the matter carried up by the streaming on all parts of the horizon. It sometimes seemed to ascend with a force, as if impelled by the impetus of some explosive agent below; and this forcible ascent of the streaming matter gave a motion to the canopy, and sometimes a gyration, like that of a whirlwind. This was manifestly caused by the streams striking the outer part of the canopy; but if they struck the canopy in the centre, all was then confusion. The vapours between the spires, or pyramids, were of a blood-red colour, which gave those parts of the atmosphere the appearance of blazing lances, and bloody-coloured pillars. There was also a strange commotion among the streams, as if some large cloud, or other body, was moving behind and disturbing them. In the northern and southern parts, the streams were perpendicular to the horizon; but in the intermediate points, they seemed to decline more or less in one way or the other; or rather to incline towards the meridian. Several persons declared, that, in the time of the streaming, they heard a hissing, and in some places a crackling noise, like what is reported to be often heard in earthquakes.

At Naples, on the 16th of December, 1737, early in the evening, a light was observed in the north, as if the air was on fire, and flashing. Its intenseness gradually increasing, about seven o'clock it spread to the westward. Its greatest height was about 65 degrees. Its extremities were unequally jagged and scattered, and followed the course of the westerly wind; so that for a few hours it spread considerably wider, yet without ever reaching the zenith. About eight o'clock, a very regular arch, of a parabolic figure, was seen to rise gently, to two degrees of rectangular elevation, and to twenty degrees of horizontal amplitude. At ten, the intenseness of the colour disappeared; and by midnight, not any traces of this phenomenon were left. It was seen throughout Italy, as the subsequent accounts will show.

At Padua, on the appearance of this extraordinary meteor, the air was calm, and the barometer remarkably high. At five in the afternoon, a blackish zone, with its upper limb, of a sky-colour, appeared near the horizon: and above this zone was another, very luminous, resembling the dawn pretty far advanced. The highest zone was of a red fiery colour. A

little after six o'clock, the upper parts of these zones emitted an abundance of red streamings, or rays; their vivid colour being occasionally intermixed with whitish and dark spots. In a few seconds after, there issued from the west, a red and very bright column, which ascended to the third part of the heavens, and which, a little after, became curved like a rainbow. At half past eight, almost instantaneously, the bright zone, from eight degrees west to fifty degrees east, became more vivid, and rose higher; and above this, appeared a new large one, of a red fiery colour, with several successive streamings tending upward, and exceeding sixty degrees of altitude; the western part having assumed the form of a thin cloud.—At midnight, these splendid lights disappeared entirely.

At Bononia, this surprising meteor spread to such an extent, as to occupy about one hundred and forty degrees of the heavens. Its light was so vivid, that houses could be distinguished, at eight in the evening, at a very considerable distance; and these were so reddened, that many persons thought there was a fire in the neighbourhood. At that time, the aurora formed itself into a concave arch towards the horizon; and in half an hour, at its eastern limit, a pyramid was displayed, of a more intense colour towards the north, from the centre of which, there shot up vertically a streak of light, between a white and a yellow colour.—A very dark narrow cloud crossed the whole phenomenon, and went to terminate in the pyramid. At the upper part, a very considerable tract of the heavens was enlightened by a very vivid red light, which was interrupted by several streaks or columns of a bright yellowish light. These streamings shot up vertically, and parallel to each other, the narrow cloud seeming to serve them as a basis. Under the cloud, there issued forth two tails of a whitish light, hanging downward on a basis of a weak red, and seeming to kindle and dart the light downward. A white streak, which passed across these two tails, and extended from one end of the phenomenon to the other, in a position almost parallel to the above mentioned cloud, gave a splendid effect to the whole. This surprising meteor, disappeared a little after nine o'clock; but an abundance of falling stars were afterward seen in the south.

Similar observations were made at Rome; but in Great Britain, where this phenomenon was likewise seen, different appearances were displayed. At Edinburgh, at six in the evening, the sky appeared to be in flames. An arch of red light reached from the west, over the zenith, to the east, its northern border being tinged with a colour approaching to *blue*. This aurora did not first form in the north, as usually

happens, and after forming an arch there, rise toward the zenith; neither did the light shiver, and spread itself, by sudden jerks, over the hemisphere, as is common; but gradually and gently stole along the face of the heavens, till it had covered the whole hemisphere: this alarmed the vulgar, and was indeed a strange sight. At Rosehill, in Sussex, it appeared as a strong and very steady light, nearly of the colour of red ochre. It did not dart or flash, but kept a steady course against the wind, which blew fresh from the south-west. It began in the north-north-west, in form of a pillar of light, at a quarter past six in the evening: in about ten minutes, a fourth part of it divided from the rest, and never joined again. In ten minutes more, it described an arch, but did not join at top; and at seven o'clock it formed a bow, disappearing soon after. It was lightest and reddest at the horizon, and gave as much light as a full moon.

## LUMINOUS ARCHES.

In the month of March, 1774, a very beautiful luminous arch was seen at Buxton. It was white, inclining to yellow: and its breadth in the crown was apparently equal to that of the rainbow. As it approached the horizon, each leg of the arch became gradually broader. It was stationary and free from any sensible coruscations. Its direction was from north-east to south-west; and its crown, or most elevated part, not far from the zenith. This phenomenon lasted about half an hour.

The grandest spectacle of this kind, which appears to have been seen in Great Britain, was observed at Leeds, in Yorkshire, on the 12th of April, 1783, between the hours of nine and ten at night. A broad arch of a bright pale yellow, and having an apparent breadth of about fifteen degrees, arose in the heavens, and passed considerably south of the zenith. Such was its varied density, that it appeared to consist of small columns of light, having a sensible motion. After about ten minutes, innumerable bright coruscations shot out at right angles from its northern edge, elongating themselves more and more, till they had nearly reached the northern horizon. As they descended, their extremities were tipped with an elegant crimson, such as is produced by the electric spark in an exhausted tube. After some time, this beautiful northern light ceased to shoot, and, forming a range of bright yellow clouds, which extended horizontally about the fourth of a circle, its greatest portion, which darted from this arch towards the north, as well as the cloud-like and more stationary auro-ra, became so dense as to hide the stars from view. *The moon was eleven days old, and shone brightly during this*

Belonging to this class of meteors is the *DRACO VOLANS*, a fiery exhalation, frequent in marshy and cold countries. It is most common in summer : and, although principally seen playing near the banks of rivers, or in boggy places, still it sometimes mounts up to a considerable height in the air, to the no small terror of the amazed beholders. Its appearance is that of an oblong, sometimes roundish, fiery body, with a long tail. It is entirely harmless, frequently sticking to the hands and clothes of the spectators, without doing them the least injury.

#### SPECTRE OF THE BROKEN.

This is one of those curious and interesting atmospherical phenomena, or deceptions, which proceed from one common cause, an irregularity in the tenuity of the atmospheric fluid. This fluid is commonly of an homogeneous, or equable tenuity, and consequently suffers the rays of the sun to penetrate it without any obstruction or change ; but is at times irregular, and composed of parts of bodies of a denser medium than its general texture and constitution. Under these circumstances, the fluent ray, if it do not enter the denser medium in a direct or perpendicular line, will be either reflected, or refracted, or both ; and the object surveyed through it, will assume a new, and, not unfrequently, a grotesque or highly magnified appearance.

The *SPECTRE OF THE BROKEN* is an aerial figure which is sometimes seen among the Hartz mountains in Hanover. This phenomenon has been witnessed by various travellers, and among them, by M. Haue, from whose relation the following particulars are extracted. " Having ascended the Broken (mountain) for the thirtieth time, I was at length so fortunate as to have the pleasure of seeing this phenomenon. The sun rose about four o'clock, and the atmosphere being quite serene towards the east, its rays could pass without any obstruction over the Heinrichshohe mountain. In the south-west, however, towards the mountain Achtermannshohe, a brisk west wind carried before it thin transparent vapours. About a quarter past four, I looked round, to see whether the atmosphere would permit me to have a free prospect to the south-west, when I observed, at a very great distance towards the Achtermannshohe, a human figure of monstrous size ! A violent gust of wind having almost carried away my hat, I clapped my hand to it ; and in moving my hand towards my head, the colossal figure did the same.

" The pleasure which I felt at this discovery can hardly be described ; for I had already walked many a weary step in the hope of seeing this shadowy image, without being able to

gratify my curiosity. I immediately made another movement, by bending my body, and the colossal figure before me repeated it. I was desirous of doing the same once more, but my colossus had vanished. I remained in the same position, waiting to see whether it would return; and in a few minutes it again made its appearance on the Achtermannshohe. I then called the landlord of the neighbouring inn, and having both taken the position which I had taken alone, we looked towards the Achtermannshohe, but did not perceive any thing. We had not, however, stood long, when two such colossal figures were formed over the above eminence, which repeated their compliments by bending their bodies as we did, after which they vanished. We retained our position, kept our eyes fixed on the spot, and in a little time the two figures again stood before us, and were joined by a third." [that of a traveller who then came up and joined the party.] "Every movement made by us, these figures imitated; but with this difference, that the phenomenon was sometimes weak and faint, sometimes strong and well defined."

In Clarke's "Survey of the Lakes," a phenomenon similar to that of the Spectre of the Broken, is recorded to have been observed in the years 1743, and 1744, on Souter-Fell, a mountain in Cumberland. It excited much conversation and alarm at the time, and exposed to great ridicule those who asserted they had witnessed it. It is, however, too well attested not to deserve a short notice here, and may be referred to the same causes by which the above aerial images on the Broken mountain were produced.—The relation is as follows:

Souter-Fell is a mountain about half a mile in height, inclosed on the north and west sides by precipitous rocks, but somewhat more open on the east, and easier of access. At Wilton Hall, within half a mile of this mountain, on a summer's evening, in the year 1743, a farmer and his servant, sitting at the door, saw the figure of a man with a dog, pursuing some horses along Souter-Fell side, a place so steep that a horse could scarcely travel on it. They appeared to run at a very great pace, till they got out of sight at the lower end of the Fell. On the following morning the farmer and his servant ascended the steep side of the mountain, in full expectation that they should find the man lying dead, being persuaded that the swiftness with which he ran must have killed him; and imagined also that they should pick up some of the shoes which they thought the horses must have lost, in galloping at so furious a rate. They were, however, disappointed, as not *the least vestige of either man or horses appeared, not so much as the mark of a horse's hoof on the turf.*

On the 23d of June of the following year, 1744, about half past seven in the evening, the same servant, then residing at Blakehills, at an equal distance from the mountain, being in a field in front of the farm-house, saw a troop of horsemen riding on Souter-Fell side, in pretty close ranks, and at a brisk pace. Having observed them for some time, he called out his young master, who, before the spot was pointed out to him, discovered the aerial troopers; and this phenomenon was shortly after witnessed by the whole of the family. The visionary horsemen appeared to come from the lowest part of Souter-Fell, and were visible at a place called Knott: they then moved in regular troops along the side of the Fell, till they came opposite to Blakehills, when they went over the mountain. They thus described a kind of curvilinear path, and their first as well as their last appearance, was bounded by the foot of the mountain. Their pace was that of a regular swift walk; and they were seen for upwards of two hours, when darkness intervened. Several troops were seen in succession, and frequently the last, or last but one in the troop, would quit his position, gallop to the front, and then observe the same pace with the others. The same change was visible to all the spectators; and the sight of this phenomenon was not confined to Blakehills, but was witnessed by the inhabitants of the cottages within a mile. It was attested before a magistrate by the two above-cited individuals in the month of July, 1785. Twenty-six persons are said in the attestation to have witnessed the march of these aerial travellers.

It should be remarked, that these appearances were observed on the eve of the rebellion, when troops of horsemen might be privately exercising; and as the imitative powers of the Spectre of the Broken demonstrate that the actions of human beings are sometimes pictured in the clouds, it seems highly probable, on a consideration of all the circumstances of this latter phenomenon on Souter-Fell, that certain thin vapours must have hovered round the summit of the mountain when the appearances were observed. It is also probable that these vapours may have been impressed with the shadowy forms which seemed to "imitate humanity," by a particular operation of the sun's rays, united with some singular, but unknown refractive combinations then taking place in the atmosphere.

#### THE MIRAGE.

*This very curious phenomenon, which was remarked by M. Monge, one of the French savants belonging to the Institute*

of Cairo, in the hot and sandy desert between Alexandria and that city, is described by him as resulting from an inverted image of the cerulean sky intermixed with the ground scenery; the neighbouring villages appearing to be surrounded with the most beautiful sheeting of water, and to exist, like islands, in its liquid expanse, tantalizing the eye by an unfaithful representation of what the thirsty traveller earnestly desires.

Doctor Clarke, in his interesting travels, introduces the following animated description of this phenomenon. "Here [at the village of Utko] we procured asses for our party, and, setting out for Rosetta, began to re-cross the desert, appearing like an ocean of sand, but flatter and firmer as to its surface, than before. The Arabs, uttering their harsh guttural language, ran chattering by the side of our asses; until some of them calling out '*Raschid!*' we perceived its domes and turrets, apparently upon the opposite side of an immense lake or sea, that covered all the intervening space between us and the city. Not having in my own mind, at the time, any doubt as to the certainty of its being water, and seeing the tall minarets and buildings of Rosetta, with all its groves of dates and sycamores, as perfectly reflected by it as by a mirror, insomuch that even the minutest detail of the architecture, and of the trees, might have been thence delineated, I applied to the Arabs to be informed in what manner we were to pass the water. Our interpreter, although a Greek, and therefore likely to have been informed of such a phenomenon, was as fully convinced as any of us that we were drawing near to the water's edge, and became indignant, when the Arabs maintained, that within an hour we should reach Rosetta, by crossing the sands in the direct line we then pursued, and that there was no water. 'What,' said he, giving way to his impatience, 'do you suppose me an idiot, to be persuaded contrary to the evidence of my senses?' The Arabs, smiling, soon pacified him, and completely astonished the whole party, by desiring us to look back at the desert we had already passed, where we beheld a precisely similar appearance. It was, in fact, *the mirage*, a prodigy to which every one of us were then strangers, although it afterwards became more familiar. Yet upon no future occasion did we ever behold this extraordinary illusion so marvelously displayed. The view of it afforded us ideas of the horrible despondency to which travellers must sometimes be exposed, who, in traversing the interminable desert, destitute of water, and perishing with thirst, have sometimes this deceitful prospect before their eyes."

*This appearance is often seen, when the sun shines, upon the extensive flat sand upon the shores of the Bristol channel,*



in Somersetshire, and probably on the sea-shore in other parts of England; the cause is, we believe, the evaporation of water.

FATA MORGANA.

These optical appearances of figures in the sea and air, in the Faro of Messina, are the great delight of the populace who, whenever the vision is displayed, run about the street shouting for joy, and calling on every one to partake of the glorious sight. To produce this pleasing deception, many circumstances must concur which are not known to exist in any other situation. The spectator must stand with his back to the east, in some elevated place behind the city, that he may command a view of the whole bay, beyond which the mountains of Messina rise like a wall, and darken the background of the picture. The winds must be hushed, the surface quite smoothed, the tide at its height, and the waters pressed up by currents to a great elevation in the middle of the channel. All these events coinciding, as soon as the sun surmounts the eastern hills behind Reggio, (on the Calabrian coast opposite,) and rises high enough to form an angle of forty-five degrees on the water before the city, every object, existing or moving at Reggio, will be repeated a thousand-fold in this marine-looking glass, which, by its tremulous motion, is, as it were, cut into facets. Each image will pass rapidly off in succession, as the day advances, and the stream carries down the wave on which it appeared.—Thus the parts of this moving picture will vanish in the twinkling of an eye. Sometimes the air is at that time so impregnated with vapours, and undisturbed by winds, as to reflect objects in a kind of aerial screen, rising about thirty feet above the level of the sea. In cloudy, heavy weather, they are drawn on the surface of the water, bordered with fine prismatic colours.

Swinburne, in his travels, cites Father Angelucci as having been the first to describe this phenomenon accurately. His relation is as follows. "On the 15th of August, 1643, as I stood at my window, I was surprised with a most wonderful and delectable vision. The sea, which washes the Sicilian shore, swelled up, and became, for 12 miles in length, like a chain of dark mountains; while the waters near our Calabrian coast grew quite smooth, and in an instant appeared as one polished mirror, reclining against the aforesaid ridge. On this glass was depicted, in *chiar-oscuro*, a string of several thousands of pilasters, all equal in altitude, distance, and degree of light and shade. In a moment they lost half their height, and bent into *arcades*, like Roman aqueducts. A long cornice was next

formed on the top, and above it rose castles innumerable, all perfectly alike. These soon split into towers, which were shortly after lost in colonnades, then in windows, and at last, ended in pines, cypresses, and other trees, even and similar. This was the Fata Morgana, which, for twenty-six years, I had thought a mere fable."

## ATMOSPHERICAL REFRACTION.

A surprising instance of atmospherical refraction occurred at Hastings, on the 26th of July, 1798. W. Latham, Esq. F. R. S., sitting in his dining-room, situated on the parade, close to the sea-shore, and nearly fronting the south, about five in the afternoon, had his attention suddenly drawn, by a great number of people running down to the sea-side. On inquiring the reason, he was informed, that the coast of France was plainly to be distinguished by the naked eye. On going down to the shore, he was surprised to find that, even without the assistance of a telescope, he could very plainly see the cliffs on the opposite coast; which, at the nearest part, are between forty and fifty miles distant, and are not to be discerned, from that low situation, by the aid of the best glasses. They appeared to be only a few miles off, and seemed to extend for some leagues along the coast. Pursuing his walk along the shore to the eastward, close to the water's edge, and conversing on the subject with the sailors and fishermen, they could not, at first, be persuaded of the reality of the appearance; but soon became so thoroughly convinced, by the cliffs gradually appearing more elevated, and approaching nearer as it were, that they pointed out, and named to him the different places they had been accustomed to visit, such as the Bay, the Old Head or Man, the Windmill, &c. at Boulogne; together with St. Vallery, and other places on the coast of Picardy. This they afterwards confirmed, when they viewed them, thus refracted, through their telescopes, observing that the above places appeared as near as if they had been sailing, at a small distance, into the harbours.

From the eastern cliff, which is of a very considerable height, a most beautiful scene presented itself to Mr. Latham's view, for there he could at once see Dungeness, Dover Cliffs, and the French coast, all along from Calais, Boulogne, &c. to St. Vallery; and, as some of the fishermen affirmed, as far to the westward even as Dieppe. By the telescope, the French fishing-boats were plainly to be seen at anchor, and the different colours of the land on the heights, with the buildings, were perfectly discernible. This curious phenomenon continued in the highest splendour till half past eight o'clock, notwithstand-

ing a black cloud for some time totally obscured the face of the sun, and then vanished gradually. So remarkable an instance of atmospherical refraction had not been before witnessed by the oldest inhabitant of Hastings. It was likewise observed at Winchelsea, and other places along the coast. The day was remarkably hot, without a breath of wind stirring.

PARHELIA, OR MOCK SUNS.

On the 5th of February, 1674, near Marienberg in Prussia, the sky every where serene, the sun, which was still some degrees above the horizon, was seen to lance out very long and reddish rays, forty or fifty degrees towards the zenith, notwithstanding it shone with great lustre. Beneath this planet, towards the horizon, there hung a somewhat dilute small cloud, at the inferior part of which, there appeared a mock sun, of the same apparent size with the true sun, and of a somewhat red colour. Soon after, the true sun descending gradually to the horizon, towards the said cloud, the spurious sun beneath it grew clearer and clearer, insomuch that the reddish colour in this apparent solar disc vanished, and put on the genuine solar light, in proportion as it was approximated by the genuine disc of the sun. The latter, at length, passed into the lower counterfeit sun, and thus remained alone. This phenomenon was considered the more extraordinary, as it was perpendicular under the sun, instead of being at its side, as parhelia usually are; not to mention the colour, so different from that which is usual in mock suns, nor the great length of the tail, cast up by the genuine sun, of a far more vivid and splendid light than parhelia use to exhibit. This appearance was soon followed by an exceedingly intense frost, which lasted till the 25th of March, the whole bay being frozen up from the town of Dantzic to Hela in the Baltic Sea.

On the 28th of August, 1698, about eight o'clock in the morning, there was seen at Sudbury, in Suffolk, the appearance of three suns, which were then extremely brilliant. Beneath a dark, watery cloud, in the east, nearly at its centre, the true sun shone with such strong beams, that the spectators could not look at it; and on each side were the reflections. Much of the firmament was elsewhere of an azure colour. The circles were not coloured like the rainbow, but white; and there was also, at the same time, higher in the firmament, and towards the south, at a considerable distance from the other phenomena, the form of a half moon, but apparently of double the size, with the horns turned upward. This appearance was within of a fiery red colour, imitating that of the rainbow.

These phenomena faded gradually, after having continued about two hours.

Two mock suns, an arc of a rainbow inverted, and a halo, were seen at Lyndon, in the county of Rutland, on the 22d of October, 1621, at eleven in the morning. There had been an aurora borealis the preceding night, with the wind at west-south-west. The two parhelia, or mock suns, were bright and distinct, and in the usual places, namely, in the two intersections of a strong and large portion of a halo, with an imaginary circle parallel to the horizon, passing through the true sun. Each parhelion had its tail of a white colour, and in direct opposition to the true sun; that towards the east being 20 degrees or 25 degrees long, and that towards the west 10° or 12°, both narrowest at the remote ends. The mock suns were evidently red towards the sun, but pale or whitish at the opposite sides, as was the halo also. Still higher in the heavens, was an arc of a curiously inverted rainbow, about the middle of the distance between the top of the halo and the vertex. This arc was as distinct in its colours as the common rainbow, and of the same breadth. The red colour was on the convex, and the blue on the concave of the arc, which seemed to be about 90° in length, its centre being in or near the vertex. On the top of the halo was a kind of inverted bright arc. This phenomenon was seen on the following day, and again on the 26th. On the 11th of the preceding month, September, a very splendid and remarkable aurora borealis, presenting truly unaccountable motions and removals, was witnessed at Rutlandshire, in Northamptonshire, and at Bath.

## LUNAR RAINBOW.

This very rare phenomenon was witnessed at Glapwell Hall, in Derbyshire, on the 25th of December, 1710, about eight in the evening, with a remarkable and very unusual display of colours. The moon had passed her full about twenty-four hours, and the evening had been rainy; but the clouds were dispersed and the moon then shone pretty clear. This iris lunaris had all the colours of the solar iris, exceedingly beautiful and distinct, only faint in comparison with those which are seen in the day; as must necessarily have been the case, both from the different beams by which it was occasioned, and the disposition of the medium. What most surprised the observer was the largeness of the arc, which was not so much less than that of the sun, as the different dimensions of their bodies, and their respective distances from the earth, seemed to require; but the *entireness and beauty of its colours furnished a charming spectacle.*

## CONCENTRIC RAINBOWS.

This extraordinary phenomenon, which is seen at sun-rise on the Cordilleras of the Andes, in South America, was first witnessed by Ulloa and his companions in the wild heaths of Pambamarca, and is thus described by him. "At day-break the whole of the mountain was enveloped in dense clouds, which at sun-rise were dissipated, leaving behind them vapours of so extreme a tenuity as not to be distinguishable to the sight. At the side opposite to that where the sun rose on the mountain, and at the distance of about sixty yards from the spot where we were standing, the image of each of us was seen represented, as if in a mirror, three concentric rainbows, the last, or most exterior colours of one of which touched the first of the following one, being centered on the head. Without the whole of them, and at an inconsiderable distance, was seen a fourth arc purely white. They were all perpendicular to the horizon; and in proportion as any one of us moved from one side to the other, he was accompanied by the phenomenon, which preserved the same order and disposition. What was, however, most remarkable, was this, that although six or seven persons were thus standing close together, each of us saw the phenomenon as it regarded himself, but did not perceive it in the others. This, adds Bouguer, is a kind of apotheosis, in which each of the spectators, seeing his head adorned with a glory formed of three or four concentric crowns of a very vivid colour, each of them presenting varieties similar to those of the first rainbow, tranquilly enjoys the sensible pleasure of reflecting that the brilliant garland he cannot discover in the others, is destined for himself alone."

A similar phenomenon is described by Mr. Hagarth, F. R. S. as having been seen by him on the 13th of February, 1780. His relation is as follows. "In ascending, at Rhealt, the mountain which forms the eastern boundary of the vale of Clwyd (in Denbigshire) I observed a rare and curious phenomenon. In the road above me, I was struck with the peculiar appearance of a very white shining cloud, which lay remarkably close to the ground. The sun was near setting, but shone extremely bright: I walked up to the cloud, and my shadow was projected into it, its superior part being surrounded, at some distance, by a circle of various colours, whose centre appeared to be near the situation of the eye, and whose circumference extended to the shoulders. This circle was complete, except what the shadow of my body intercepted. It exhibited the *most vivid colours*, the red being outermost, all of them appearing in the same order and proportion as they are pre-

sented to the view by the rainbow. It resembled very exactly what in pictures is termed A GLORY, surrounding the heads of saints: not indeed that it exhibited the luminous radiance that is painted close to the head, but an arch of concentric colours placed separately and distinctly from it. As I walked forward, this glory approached or retired, just as the inequality of the ground shortened or lengthened my shadow. The cloud being sometimes in a small valley below me, sometimes on the same level, or on higher ground, the variation of the shadow and glory became extremely striking and singular. To add to the beauty of the scene, there appeared, at a considerable distance, to the right and left, the arches of a white shining bow. These arches were in the form of, and broader than a rainbow; but were not completely joined into a semicircle above, on account of the shallowness of the cloud."

## THUNDER AND LIGHTNING.

To conceive justly of the nature of thunder and lightning, we have only to view the effects of a common electrical machine, and its apparatus, in an apartment. These experiments mimic the great, wonderful, and terrific phenomena of nature. The stream, or spark, from the machine to the hand, represents the shaft of lightning from the clouds to the earth; and the snapping noise of the diminutive spark corresponds with the explosion produced by the shaft of lightning which we call thunder. In what manner the clouds become electrified, and, in short, what is the nature of electricity itself, our present range of experiments so little qualify us to determine, that a century will perhaps elapse, before a philosophical precision can be attained.—At present, we only know for certain, that the electrical power displays itself, merely on the surface of bodies; and whether it is a fluid *per se*, a vacuum restoring itself, or whatever its nature may be, the state of experimental knowledge does not enable us to determine.

The obvious analogy between lightning and electricity had long been suspected, and was placed beyond a doubt by Doctor Franklin, who was the first to conceive the practicability of drawing down lightning from the clouds.—Having found by previous experiments, that the electric fluid is attracted by points, he apprehended that lightning might likewise possess the same quality; although the effects of the latter, would in that case, surpass those of the former in an astonishing degree. Flashes of lightning, he likewise observed, are generally seen *crooked and waving* in the air; and the electric *spark, drawn from an irregular body at some distance, when*

it is drawn by an irregular body, or through a space in which the best conductors are disposed in an irregular manner, always exhibits the same appearance.

Lightning strikes the highest and most pointed objects in its way, in preference to others, as high hills, trees, spires, masts, &c. ; and all pointed conductors receive and throw off the electric fluid more readily, than those which are terminated by flat surfaces. Lightning is observed to take the best and readiest conductor ; and this is also the case with electricity, in the discharge of the Leyden phial ; whence Doctor Franklin inferred that, in a thunder-storm, it would be safer for a person to have his clothes wet than dry. Lightning burns, dissolves metals, rends some particular bodies, such as the roots and branches of trees, strikes persons with blindness, destroys animal life, deprives magnets of their virtue, and reverses their poles ; and these are the well known properties of electricity.

Lightning not only gives polarity to the magnetic needle, but to all bodies which have any portion of iron in them, as brick, &c. ; and, by observing which way the poles of these bodies lie, the direction in which the stroke has passed, may be known with the utmost certainty.

In order to demonstrate, by actual experiment, the identity of the electric fluid with the matter of lightning, Doctor Franklin contrived to bring lightning from the heavens, by means of an electrical kite, which he raised on the approach of a thunder-storm ; and, with the electricity thus obtained, charged phials, kindled spirits, and performed all other electrical experiments, as they are usually exhibited by an excited globe or tube. This happened in 1752, a month after the French electricians, pursuing the method which he had proposed, had verified the same theory ; but without any knowledge on his part of what they had done. On the following year, he further discovered that the air is sometimes electrified positively, and sometimes negatively ; and that, in the course of one thunder-storm, the clouds change from positive to negative electricity several times. He was not long in perceiving that this important discovery was capable of being applied to practical use ; and proposed a method, which he soon accomplished, of securing buildings from being damaged by lightning, by means of conductors, the use of which is now universally known.

From a number of judicious experiments made by him, Signor Beccaria concludes, that the clouds serve as conductors, to convey the electric fluid from those parts of the earth which are overloaded with it, to those where it is exhausted.

The same cause by which a cloud is first raised, from vapours dispersed in the atmosphere, draws to it those which are already formed, and still continues to form new ones, till the whole collected mass extends so far as to reach a part of the earth where there is a deficiency of the electric fluid, and where the electric matter will discharge itself on the earth. A channel of communication being thus produced, a fresh supply of electric matter is raised from the overloaded part, which continues to be conveyed by the medium of the clouds, till the equilibrium of the fluid is restored between the two places of the earth. He further observes, that as the wind constantly blows from the place where the thunder cloud proceeds, the sudden accumulation of such a prodigious quantity of vapours must displace the air, and repel it on all sides. Indeed, many observations of the descent of lightning, confirm his theory of the mode of its ascent; for it often throws before it, the parts of conducting bodies, and distributes them along the resisting medium, through which it must force its passage; and on this principle, the longest flashes of lightning seem to be produced; by its forcing in its way, part of the vapours in the air. One of the chief reasons why the report of these flashes is so much protracted, is the vast length of the vacuum, made by the passage of the electric matter; for although the air collapses the moment after it has passed, and the vibration, on which the sound depends, commences at the same moment, still, when the flash is directed towards the person who hears the report, the vibrations excited at the nearer end of the track, will reach his ear much sooner than those from the remote end, and the sound will, without any echo or repercussion, continue till all the vibrations have successively reached him. The rattling noise of the thunder, which makes it seem as if it passed through arches, or were variously broken, is probably owing to the sound being excited among clouds hanging over one another, and the agitated air passing irregularly between them.

Among other precautions pointed out by Doctor Franklin, he recommends to those who happen to be in the fields, at the time of a thunder-storm, to place themselves within a few yards of a tree, but not quite near it. Signor Beccaria, however, cautions persons not to depend on a higher, or, in all cases, a better conductor than their own body; since, according to his repeated observations, the lightning by no means descends in one undivided track, but bodies of various kinds conduct their share of it at the same time, in proportion to their quantity and conducting power. The late earl Stanhope, in his *principles of Electricity*, observes, that damage *may be done by lightning, not only by the main stroke and*



lateral explosion, but likewise, by what he calls **THE RETURNING STROKE**; that is, by the sudden violent return of that part of the natural share of electricity of any conducting body, or any combination of conducting bodies, which had been gradually expelled from such body or bodies respectively, by the superinduced elastic electrical pressure of a thunder-cloud's electrical atmospheres.

Among the awful phenomena of nature, none have excited more terror than thunder and lightning. It is recorded of several of the profligate Roman Emperors, who had procured themselves to be deified, that when they heard the thunder, they tremblingly concealed themselves, acknowledging a divine power greater than their own—*a Jupiter thundering in the heavens.*

#### REMARKABLE THUNDER-STORMS.

A few instances in which the effects of these storms have been particularly characterized, will be both interesting and instructive.

That fermented liquors are apt to be soured and spoiled by thunder, is a fact well known; but that dried substances should be so acted on, is a still more remarkable phenomenon, and not so easy of explanation. It happened, however, some years ago, that in the immense granaries of DANZIC, the repositories of the corn, of Polish growth, intended for exportation, the wheat and rye, which were before dry and sweet, were, by the effect of a violent thunder-storm in the night, rendered clammy and stinking, insomuch that it required several weeks to sweeten them, and render them fit for shipping.

The effects of a thunder-storm on a house and its furniture, at NEW FORGE, Ireland, on the 9th of August, 1707, were very singular. It was observed, that the day was throughout close, hot, and sultry, with scarcely any wind, until towards the evening, when a breeze came on with misling rain, which lasted about an hour. As the air darkened after sun-set, several faint flashes of lightning were seen, and thunder-claps heard, as at a distance; but between ten and eleven o'clock they became, in their approach, very violent and terrible, progressively increasing in their intensity, and coming on with more frequency, until towards midnight. A flash of lightning, and clap of thunder, louder and more dreadful than all the rest, came simultaneously, and shook and inflamed the whole house. The mistress, being sensible at that instant of a strong sulphureous smell in her chamber, and feeling a thick gross dust fall on her hands and face as she lay in bed, concluded *that part of her house had been thrown down by the thunder,*

or set on fire by the lightning. The family being called up, and candles lighted, both the bed-chamber, and the kitchen beneath it, were found to be filled with smoke and dust. A looking-glass in the chamber had been broken with such violence, that not a piece of it was to be found of the size of half a crown: several of the pieces were stuck in the chamber door, which was of oak, as well as on the other side of the room. The edges and corners of some of the pieces of broken glass, were tinged of a light flame colour, as if they had been heated by the fire.

On the following morning, it was found that the cornice of the chimney next the bed-chamber had been struck off, and a breach, twenty inches in breadth, made in the wall. At this part, there was seen on the wall, a smuted scar or trace, as if left by the smoke of a candle, which pointed downward to another part of the wall, where a similar breach was made. Within the chamber, the boards on the back of a large hair trunk, filled with linen, were forced in: two thirds of the linen were pierced or cut through, the cut appearing of a quadrangular figure. Several pieces of muslin and wearing apparel, which lay on the trunk, were dispersed about the room, not in any way singed or scorched, notwithstanding the hair on the back of the trunk, where the breach was made, was singed. In the kitchen, a cat was found dead, with its legs extended as in a moving posture, without any other sign of being hurt, except that the fur was singed a little about the rump.

In the parish of SAMFORD-COURTNEY, near Oakhampton, in Devon, on the 7th of October, 1811, about three in the afternoon, a sudden darkness came on. Several persons being in the church-porch, a great fire-ball fell among them, and threw them down in various directions, but without any one being hurt. The ringers in the belfry declared, that they never knew the bells go so heavy, and were obliged to desist ringing. Looking down from the belfry into the church, they perceived four fire-balls, which suddenly burst, and the church was filled with fire and smoke. One of the congregation received a blow in the neck, which caused him to bleed both at the nose and mouth. He observed the fire and smoke to ascend to the tower, where a large beam, on which one of the bells was hung, was broken, and the gudgeon breaking, the bell fell to the floor. One of the pinnacles of the tower, next the town, was carried away, and several of the stones were found near a barn, at a considerable distance from the church.

On the 15th of December, 1754, a vast body of lightning fell on the *great hulk* at Plymouth. It burst out a mile or two *to the westward of the hulk*, and rushed towards it with in-

credible velocity. A portion of the derrick (a part of the apparatus which serves to hoist in, and fix the mast of the men of war) was cut out, of a diameter of at least eighteen inches, and about fifteen feet in length: this particular piece was in three or four places girt with iron hoops, about two inches broad, and half an inch thick, which were completely cut in two by the lightning, as if done by the nicest hand and instrument. The lightning was immediately succeeded by a dreadful peal of thunder, and that by a most violent shower of hail, the hail-stones being as large as nutmegs, and for the greatest part of the same size and shape.

Among the many fatal accidents by lightning which have befallen ships, the following is a remarkable instance. In the year, 1746, a Dutch ship lay in the road of Batavia, and was preparing to depart for Bengal. The afternoon was calm, and towards evening the sails were loosed, to take advantage of the wind which then constantly blows from the land. A black cloud gathered over the hills, and was brought by the wind towards the ship, which it had no sooner reached, than a clap of thunder burst from it, and the lightning set fire to the main-top-sail: this being very dry, burned with great fury; and thus the rigging and masts were set on fire. An attempt was immediately made to cut away the mast, but this was prevented by the falling of the burnt rigging from the head of the mast. By degrees, the fire communicated to the other masts, and obliged the crew to desert the ship, the hull of which afterwards took fire, and, burning down to the powder magazine, the upper part was blown into the air, and the lower part sunk where the ship was at anchor.

In crossing the Atlantic, in the month of November, 1749, the crew of an English ship observed a large ball of blue fire rolling on the water. It came down on them so fast, that before they could raise the main-tack, they observed the ball to rise almost perpendicularly, and within a few yards of the main chains: It went off with an explosion as if hundreds of cannon had been fired off simultaneously, and left behind it a great smell of brimstone. The main-top-mast was shattered into a thousand pieces, and spikes driven out of the main-mast which stuck in the main deck. Five seamen were knocked down, and one of them greatly burnt, by the explosion. The fire-ball was of the apparent size of a large mill-stone, and came from the N. E.

The ingenious and indefatigable Professor Richman lost his life on the 6th of August, 1753, as he was observing, with M. Sokolow, engraver to the Royal Academy of St. Petersburg, the effects of electricity on his gnomon, during a thunder-storm.

t was ascertained that the lightning was more particularly directed into the professor's apartment, by the means of his electrical apparatus, for M. Sokolow distinctly saw a globe of blue fire, as large as his clenched hand, jump from the rod of the right gnomon, towards the forehead of Professor Richman, who at that instant was about a foot distant from the rod, observing the electrical index. The globe of fire which struck the Professor, was attended with a report as loud as that of a pistol. The nearest metal wire was broken in pieces, and its fragments thrown on M. Sokolow's clothes, on which, burnt marks of their dimensions were left. Half of the glass vessel was broken off, and the metallic filings it contained thrown about the room. Hence it is plain, that the force of the lightning was collected on the right rod, which touched the filings of metal in the glass vessel. On examining the effects of the lightning in the Professor's chamber, the door-case was found split half through, and the door torn off, and thrown into the chamber. The lightning, therefore, seems to have continued its course along the chain conducted under the ceiling of the apartment.

In a Latin treatise, published by M. Lomonosow, member of the Royal Academy of Sciences of St. Petersburg, several curious particulars are mentioned relative to this melancholy catastrophe. At the time of his death, Professor Richman had in his left coat-pocket seventy silver coins, called rubles, which were not in the least altered by the accident which befel him. His clock, which stood in the corner of the next room, between an open window and the door, was stopped; and the ashes from the hearth thrown about the apartment. Many persons without doors declared that they actually saw the lightning shoot from the cloud to the Professor's apparatus at the top of his house. The author, in speaking of the phenomena of electricity, observes, that he once saw, during a storm of thunder and lightning, brushes of electrical fire, with a hissing noise, communicate between the iron rod of his apparatus and the side of his window, and that these were three feet in length, and a foot in breadth.

## REMARKABLE STORM IN CATSKILL.

The following account of a remarkable storm which occurred at Catskill, July 26th, 1819, is copied from Silliman's Journal of Science and Arts.

In several places in the mountainous country of New-England, it has been supposed, by many of the inhabitants, that *clouds have in various instances burst, or suddenly discharged great quantities of water.* As the phenomena indicated by

this phraseology have, in almost all instances in which they have occurred in that section of the country, existed in thinly settled regions, or in the night, in consequence of which, the accounts given of them are imperfect; I suppose that it may be gratifying to some of your readers to see a detailed account of the storm which occurred here.

This storm exhibited phenomena analogous to those, which have occurred from what is called the bursting of a cloud, and in some respects more remarkable than any of which I have heard.

To render the description more intelligible, a few explanatory observations may be useful.

The *township* of Catskill is situated on the west side of the Hudson, and is bounded on the east by that river; on the north by the township of Athens; on the west by Cairo; and on the south by Saugerties. The *town* is estimated to be about one hundred and twenty miles north from the city of New-York. Three rivers, or creeks, as they are here customarily called, have their courses, in part, through this township; the Kiskatom, the Kaaterskill, and the Catskill. The Kiskatom rises, if I am correctly informed, between the Catskill mountains and the Round Top,\* a mountain in Cairo; and runs about five miles in the township of Catskill, and empties into the Kaaterskill. The Kaaterskill is a fine mill-stream, which rises in the Catskill mountains, and empties into the Catskill, about two miles from the mouth of the latter stream.

The Catskill, which I shall usually denominate the *Creek*, rises in Middleburgh, in Schoharie county, and empties, after a course of about forty miles, into the Hudson. The Catskill mountains lie westward from the town, and are distant from it in their nearest part about seven or eight miles. The *town* is situated along the creek, and commences at the point of land, formed by the junction of that stream and the Hudson. The principal buildings are situated along Main-street, which commences about a quarter of a mile from the Hudson, and lies on the east side of the creek, to which it is in a good degree parallel, throughout its whole course. Several dwelling-houses, stores, and other buildings, are situated on Water-street, nearer to the creek; and several on the hill, east of Main-street; and others elsewhere. There are a number of streets and lanes, which intersect these streets at right angles, and pass to the creek. The hill rises abruptly to the height of about one hun-

\* The highest peak of the Catskill mountains is also called Round Top.

dred and fifty feet. Main-street is estimated to be about thirty or forty feet above low water mark.

From the point of land formed by the junction of the Hudson and Catskill, a wharf has been extended, about one-fourth of a mile, to a small island in the Hudson, formed by the opposing currents of the two streams. To the south end of this island there have been considerable additions of *made land*. The whole of this ground is now called the *Point*. On it, several dwelling-houses, stores, and other buildings, have been erected.

At the north end of Main-street, the Catskill and Susquehannah turnpike commences, and runs in a W. N. W. course about eighty-eight miles, to the Susquehannah river. From two to two and a half miles from the Point, is situated along this road, the small village of Jefferson. About two miles further, on the same road, is the village of Madison; and two miles beyond, Woolcott's mills.

The village of Jefferson is built on an elevated plain, lying on the north side of the creek, and is about three-fourths of a mile in length, and nearly half a mile in breadth. The land rises abruptly from the interval, which borders the creek, to the height of about one hundred and fifty feet. The margin of this plain, or hill, which faces the southeast, was probably, in ancient times, the border of a lake, which, at some remote period, burst its barriers, and emptied its waters into the Hudson. At Madison, there was a large lake, the banks of which are distinctly visible at a considerable distance, and strikingly so from the south end of Schuneman's mountain. The dam existed at the mill-seat of the late Ira Day, Esq.

The state of the weather previously to the commencement of the storm was as follows:—

The sky was cloudy, *the air thick*, (to adopt common language,) and very sultry; the clouds were low and heavy, the wind blew from the S. W. Debility and languor were generally complained of. No thermometrical, or barometrical observations were made within my knowledge.

About half past 3 o'clock P. M. three distinct clouds, dense and black, arose in the southeast, in quick succession. A brisk shower followed. A fresh wind blew for a little period; but before 4 o'clock a calm ensued, which lasted nearly an hour. A short suspension of the rain took place soon after 5 o'clock. The whole quantity which had descended between this time and the commencement of the storm, was considerable. About half past five, another dense and black cloud, accompanied by a fresh wind, *arose from the S. W.* Shortly before the cloud *reached the zenith*, three vivid streaks of lightning issued from

it, appearing like branches of the same flash. These were followed by three very sharp peals of thunder, instantaneously succeeding each other.

About the same time, or immediately after, a very thick and dark cloud rose *up* rapidly from the N. E. They met immediately over the town. At this instant, a powerful rain commenced. The air soon after became so obscure, that trees, and buildings, and other large objects, could not be discerned at the distance of a few yards. The obscurity did not appear to arise from a fog of the usual kind; but from the abundance of the rain, and the low descent of the clouds, which appeared to rest upon the ground, or to hang a little above it. After the clouds met, the wind became very variable, and blew for short periods from almost every point of the compass. At times it came with so much force, as to drive the rain, in a very unusual manner, through the crevices in doors and windows, and the roofs of dwelling-houses. Many houses, which had never before been known to leak, at this time admitted great quantities of water. In several instances the wind suddenly abated, and a calm of a few minutes ensued. The lightning and thunder were unusually severe. The thunder frequently resembled a violent crash, and was as sudden, and of as short continuance, as the sound occasioned by the firing of a cannon, or by the snapping of a whip. The rain descended at times in very large drops; and at times, in streams and sheets.

During the storm, four or five intermissions, each of about eight or ten minutes, occurred also in the rain. In each instance it excited a hope that the storm was approaching its termination; but this hope was soon dissipated by the appearance of fresh torrents. The extreme violence of the rain terminated before half past six o'clock, though it continued to descend with considerable briskness until about nine; and moderately until about ten; and it did not entirely cease until about eleven. The quantity which fell from the commencement to the termination of the storm, it is difficult to ascertain with exactness. It seems probable from the facts hereinafter mentioned, that it exceeded fifteen inches on a level. Some remarkable phenomena occurred in various places.

At the Point, just before the clouds met, two sloops were observed sailing before the wind, under a full press of sail, one sailing rapidly up stream, the other more rapidly down. They met near the north end of the island, when the N. E. wind prevailed. About the same time, the sloop Admiral started from the lower wharf for New-York. At the moment of starting, *two persons on board* received slight electrical shocks from *one of the three streaks* of lightning before mentioned. *Seven*

ral panes of glass were also broken in a store, situated a few feet distant. One of these persons, immediately after the shock, noticed strong luminous flashes, or sparks, on one of his arms, and felt a jar throughout his frame, and a sensation similar to that which is experienced, when the hand or foot is asleep; the other felt a jar similar to that occasioned by a smart blow upon the breast. No other injury was done to the store, nor any whatever to the vessel. When the sloop had proceeded on her course about three-fourths of a mile, the air had become so obscure, that those on board were unable at the distance of a few yards, to discern any objects. At this time, another flash of lightning was discharged about the vessel, and one of the persons before mentioned, received a much more powerful shock, which occasioned his falling down instantaneously upon the deck. He was at this time drenched in water, and from this cause, probably, soon revived, so far as to get up, and find his way into the cabin. In a little time, he felt no other inconvenience from the shock, than a sensation of numbness, which affected his arms for an indefinite period. While he lay upon the deck, a young gentleman standing near him, observed numerous flashes, or sparks of light, about his body, strongly resembling those issuing from a firebrand when whirled swiftly round. They were accompanied by a crackling, or snapping noise. Another person on board experienced a lighter shock, which occasioned so much numbness in one of his arms, that for a few minutes, he was unable to use it. There was an iron spindle at the top of the mast for suspending the colours; but no lightning rod. No injury, however, was done to the vessel. Was that part of the cloud, from which the lightning issued, lower than the top of the mast? Several of those who were on the deck observed, that at this time, the rain descended in streams and sheets. The young gentleman above mentioned, states, that at one period, the water on the quarter-deck accumulated so rapidly from the rain only, as to be higher than the tops of his shoes.

A gentleman, who was in the south store, at the Point, feeling much anxiety for his friends on board the sloop, observed the phenomena of the storm, with more exactness, than any other person, with whom I have conversed. His account is as follows. When the two clouds met, they appeared to fall down upon the river, between the store and Livingston's wharf, upon the east bank. The cloud rested upon the water in such a manner, that he could discover no space between them. As it came over, it appeared extremely dark at the bottom, and as white as a snow-bank at the top. The air suddenly became so obscure, that he was unable to see any



part of a large periauger, which lay at his wharf thirty feet distant, except that he could barely discern the poles. He particularly noticed, that he could not see any appearance of drops of rain; but the water appeared to descend in large streams and sheets. The descent of rain was most copious between a quarter before 6 o'clock, and a quarter after 6. In this half hour, he estimates the descent of water to have exceeded twelve inches upon a level. At an inn, thirty rods northward, the family were unable to see a large sloop, lying in the creek, at the distance of twenty rods. At another inn, in the near neighbourhood, a man, who stood for a considerable period at the front door, was unable to see any part of a large barn, only four rods distant. Sometime after the clouds met, two different persons, residing in this house, distinctly observed a water spout, rising up from the river, and nearly opposite, with a broad bottom, and ascending with a whirling motion to the clouds, in form of a pretty regular cone. The innkeeper, sometime in the afternoon, noticed two other water spouts, from three-fourths of a mile to a mile up stream. These rose up in like manner, with broad bottoms, and terminated in points, as they reached the clouds. At what period these phenomena occurred, they could not distinctly recollect. The whole quantity of water which fell at the Point, is estimated to have exceeded fifteen inches upon a level. I am persuaded that this estimate is not too large.

The rain extended with equal or greater violence about eight miles west from the Point, about three miles north, and about seven miles south. On the east side of the Hudson, at a little distance, it did not descend with peculiar violence, or in a very unusual quantity. At Athens, four miles north, it was far less severe than in Catskill; and at Cairo, ten miles west, it was light. Should we then estimate the whole tract, on which the rain descended with peculiar violence, and in quantities never before known in this section of the country, since its first settlement, at eighty square miles, we probably should not be very wide from the truth; and on this whole tract, I am persuaded, that the water fell full fifteen inches upon a level. On a considerable part of the tract, there is reason to believe, that the quantity exceeded eighteen inches.

In proof of the correctness of this estimate, I allege the following facts.

Main-street was flooded to such a degree, that, notwithstanding the descent to the creek is rapid, a sloop's boat might have sailed, in many parts of it, without difficulty, and for a considerable time.

*A large tub, measuring twenty-six inches across at the top,*

in the inside, and very nearly as large at the bottom, and fifteen and a half inches deep, was standing in an open yard, about thirty rods west of the south end of Main-street, and north of the dwelling house of Mr. J. D. It was empty when the rain commenced, and before sunset it was filled, and had run over. Several persons, who had examined it from time to time, were of opinion, that no water could have fallen into it, except that which descended directly from the clouds. In front of the house, on the south side, is a large court yard. From the gate to the front door, is a gravelled walk several rods in length. This walk is raised higher than the adjoining grounds on each side. The owner, returning home a little before sunset, found the water on this walk, from six inches to a foot deep. The water at this height, must have been constantly and rapidly passing off into the creek. It is not known that water has been accumulated here from any other rain, to the depth of half an inch.

About forty or fifty rods N. W. from this place, a small wash-tub, standing in open ground, being twelve inches in depth, and having two inches of water in it when the rain commenced, was observed about sunset to be full and running over. How long it had been filled is not known.

Two empty potash kettles, each of the capacity of ninety gallons, standing on the west side of a high and spacious building, about the middle of Main-street, the one about twelve, the other about sixteen feet from the building, so situated that they probably caught no water, except that which descended perpendicularly from the clouds, were nearly or quite filled. Much of the rain descended in a very slanting direction.

A common sized pail, in a yard fifty rods north, and a wash-tub, in another yard, were both filled, and ran over, before sunset.

A large bathing-tub, situated on the west side of a high building, and so posited that it could not probably have caught more than two thirds as much as it would have done in open ground, had thirteen inches of water in it.

At Mr. John Ashley's farm, five miles west from the Court-house, a common sized wash-tub, standing in open ground, was filled, and ran over, before sunset.

I have been credibly informed, that at Madison, in a field, lying north of the turnpike, a large tub, estimated to be sixteen inches in depth, and an iron kettle, of the capacity of twelve to fifteen gallons, both empty when the rain commenced, and both standing many yards distant from any building, were filled, and ran over.

About six miles south of the Court-house, an empty barrel, standing in open ground, caught eighteen inches of water.

At Woolcott's mills, several persons compared the descent of rain, to water running through a riddle.

The *effects* produced by the storm, were such as were never known to have occurred in any other instance in this vicinity.

There were no remarkable ravages at the Point, nor in the village. From the banks of a brook which crosses the turnpike road, about one quarter of a mile above the north end of Main-street, and empties into the Creek, some thousands of tons of earth, and stones, and rocks in solid masses, were washed out, and borne, chiefly on to the flats, or left remaining within the present banks. This ravage did not exceed a third of a mile in length. Near the mouth of this brook, the ascent up the hill, to the Jefferson plain, commences. Near the top of the hill, several large gullies were formed, on the south-western edge of the road. These are now greatly altered in their appearance. At the cross-roads, in the village of Jefferson, the rain was so abundant about 6 o'clock, and the cloud so low and dense, that one of the inhabitants, a man of observation, was unable to discern a pretty large dwelling-house, only four rods distant from his own door, where he was standing. On Jefferson plain, the water covered the ground generally, to such an extent, that it ran into the doorways of many barns, and covered the floors, to the depth of several inches. On a field lying south-west from the turnpike, and containing about thirty acres, it was supposed by several of the inhabitants, that the water, sometime before sunset, stood about eighteen inches deep on a level. As the plain is nearly level, it seems improbable that much water should have run from other grounds on to this. This estimate, therefore, I suppose is too large. The water from this ground is conjectured to have passed off chiefly in one place. On the south-eastern margin of the plain, (which formed at some remote period, as I suppose, the bank of a lake,) about thirty rods distant from the turnpike road, there was previously a gully, of considerable extent, worn down in the progress of ages by the current of a small spring, at the bottom, and by successive rains. The exact dimensions of this gully cannot now be ascertained. Its length, from the margin of the plain north-westward, towards the old post-road to Albany, which runs at right angles to the turnpike, somewhat exceeded one hundred and fifty feet. At the west end, it was of inconsiderable extent; near the margin of the plain, (which, in reference to the creek, and its intervals, is a sharp hill, of about one hundred

and fifty feet in height,) it was wide and deep. The water from the above mentioned field, is supposed to have passed off into this gully. Whatever the fact may have been, the gully was at some period during the storm, enlarged in an astonishing manner in length, breadth, and depth. The ground here, and throughout the plain, is composed of sand, covered by a rich bed of soil. In this place, it was well turfed with short grass and had, as I suppose, never been dug, or ploughed. It was also, to some extent, covered with forest trees. The dimensions of the present ravine, as measured by myself, in company with a friend, by means of a line, August, 1819, were as follows. At the west end, where it extends across the old post-road to Albany, into the field above mentioned, it terminates in a point. At five paces from the west end, it was thirty-six feet wide; at seventeen paces, fifty feet; and at thirty-two paces, seventy-five feet. That part of the ravine which was almost wholly formed at this time, extends from the west end about one hundred and ten paces. The width, in this place, is about one hundred and fifty feet, and the depth about eighty. From this place to the margin of the plain, the distance is about fifty paces. Throughout this distance, the ravine gradually widens and grows a little deeper. The width near the margin is about one hundred and ninety feet.

About sixty or eighty rods northward from the turnpike, on the old post-road, another gully was formed, of about eight or ten rods\* in length, and in some places ten or twelve feet deep. This has been to a considerable extent filled up, and the adjoining grounds lowered. About one hundred rods distant from this place, in a north-western course, a large and deep ravine, having several branches, was excavated, being about ninety paces in length, and from two to six rods in width. Generally, it was from two to four rods in width, and in some places thirty or forty feet deep.

At Woolcot's mills, two large gullies were formed, about ten or twelve rods apart, one six or eight rods east, the other three or four rods west of his store. I have repeatedly examined this place. The eastern gully is estimated to be about twenty rods in length. Near its commencement, it is ten or twelve feet deep on the western side, and about six feet on the eastern. The average width is about two rods. Throughout a considerable part of its course, a ledge of red sandstone, horizontally stratified, forms the bottom. Here it is less deep. It crosses the turnpike, and terminates at the bank of

\* This I believe is an American word substituted for the *rood*, *pole*, or *perch* of 16 1-2 feet, which it is used to express.—Ed.

the creek. When this gully was formed, the current of water ran directly by the side, and against a part of a dwelling-house situated on the south side of the turnpike. A Mr. June, whose family occupied the main part of the building, in assisting to remove a sick woman in the evening, from that part which had become partially undermined, stepped from the door into the water, which was supposed to be about two feet deep. But such was the impetuosity of the current, which had already worn a channel ten feet deep, that in spite of every effort, he was carried into the creek, and drowned. His corpse was found a day or two afterwards, about three quarters of a mile down stream. A vast quantity of earth, of stones, and rocks in rolled masses, some of them supposed to weigh a ton or upwards, were washed out, and forced into the creek, where they now remain, forming a new bank, of about one hundred feet in length, of about seventy feet in breadth, and of about eight or ten feet in height, above the former bed of the stream. There was no stream in this place previously to the storm.

The western gully was occasioned by the prodigious rise and enlargement of a small brook which runs at its bottom. The usual width of this brook does not exceed a yard; its depth is inconsiderable. It crosses the turnpike road, and is crossed by a small bridge, at a little distance from which, it empties into the Catskill. About six or eight rods south of the bridge, stood a pretty large distillery; a few rods north of the bridge, and near the mouth of the brook, was situated a plaster-mill, a little further north was situated a spacious grist-mill, on the south bank of the creek. The water, during the storm, rose to such a height in the brook, that it undermined the distillery. This lodged against the bridge, which soon gave way. The whole mass, together with the large tubs of the distillery, and a prodigious quantity of earth and stones, which accompanied them in their descent, crowded away the plaster-mill. The whole was precipitated down the bank into the creek, and broke through a part of the grist-mill, which soon became so far undermined, that it tumbled down a day or two afterwards.

The quantity of earth, and stones, and rocks in rolled masses, carried into the creek from the brook, is greater than from the eastern gully. The length of the heap, (which unites with the lower one,) and forms a new bank, interior to the old one, is about one hundred and eighty feet; the width about one hundred: and the average height above the former bed of the stream, as much as five or six. Among the stones and rocks *in rolled masses*, washed out from these two gullies, and lying

before hid under the soil, are several superb specimens of petrified marine shells, some of them agglutinated in considerable masses, and having an argillaceous and calcareous cement.

About one mile westward, on the same road, is a small brook, usually containing not more water than might pass through a cylindrical tube of six inches in diameter. Here the water accumulated to such a degree, that the brook overflowed all its banks, and became of the size and force of a large and rapid mill-stream. A blacksmith's shop, standing a little westward from the brook, was carried off, and a large ravine excavated. Generally, ravages occurred here, similar to those which existed at Woolcott's mills: and a considerable number of rocks, estimated to weigh from half a ton to a ton each, were driven by the current many rods into the creek. It will be recollected, that a mile west from this place, the rain was moderate.

In the neighbourhood of Madison, the storm produced ravages not less remarkable. At no great distance northward from the village, is a mountain, estimated to be six hundred feet perpendicular height above the plain below. The south end of this mountain, which abuts upon the flat which I mentioned as having probably been the bed of an ancient lake; is about one mile north north-west from Madison church. The brow of the mountain here, is about half the elevation of the summit. There is at this place a ledge of horizontal rocks, running a considerable distance, and terminating abruptly, with a perpendicular precipice of twenty or thirty feet. The surface of the mountain descends from some distance back to this place. The water accumulating from above, poured down the precipice with such impetuosity, as to uproot all the trees in its course, down to the bottom, a distance of several hundred feet. The descent is rapid from the foot of the precipice to the bottom of the mountain. Throughout this distance, a large ravine was formed. All the trees, and earth, and stones beneath, were washed away, down to the solid rock which lay below; and the whole mass, except the trees, was precipitated beyond the road which winds near the base, upon a tract of arable and meadow land which it covered, as I was informed by Mr. S. a gentleman who had examined the ground with attention, to the extent of two acres, and to the depth of from six to ten feet. No water, if I am not misinformed, has been known to run in this place heretofore. The descent of the water down the precipice occasioned a loud roaring sound, like that of distant rolling thunder, and excited no small astonishment at the distance of a mile.

*On the eastern declivity of the same mountain, about two*

miles north of Madison church, a portion of ground, about forty-five feet in length, and of about the same breadth, was entirely removed to the average depth of four feet. This ground and all that adjoining to it, was previously covered with forest trees. The trees on this plot were all borne away. It is remarkable that the excavation commenced suddenly, both of the full width and depth, at the top. Neither was there any appearance of water having run from the grounds above, decayed leaves and brush-wood being in place. I have examined this spot, but received the above particulars from a respectable farmer, residing in the neighbourhood.

In a south-western course from Madison, distant from one to two miles, there is a high and sharp ridge, on which are several similar ravages. This ridge or mountain, which is upwards of four hundred feet in perpendicular height, above the plain below, was throughout, so far as can be seen on the eastern side, covered thickly with forest trees. The eastern declivity is as steep generally, as the sharp roof of a dwelling-house. The largest excavation is about two hundred and thirty feet wide at the bottom. Owing to the steepness of the declivity, I could not measure its length, or the width at the top. I estimated the height to exceed three hundred feet. Tracing it from the bottom up the declivity, about one hundred and fifty feet, it becomes forked, or divided into two branches with a tongue of land between, which is covered with trees and shrubs. Below the fork, all the trees, except two small ones and the shrubs, were torn up by the roots, and carried by the force of the waters to the bottom. The ground which was composed of soil of a moderate thickness, and of gravel and stones underneath, was washed away to the depth of four, five, or six feet in most places; and in some instances to the depth of ten feet or upwards. Below this, are ledges of horizontal rocks, which have been laid bare to a considerable extent, and which were before invisible, rising tier above tier, and receding from below upwards. A great quantity of earth and stones were washed into the plain below, together with a part of the trees and shrubs, and carried to the distance of ten, twenty, and, in some instances, thirty rods. A much larger mass was immediately at the bottom. The trees have been since chiefly removed. There are two or three other similar excavations not far distant. They may be seen at the distance of fifteen or twenty miles, on the high grounds eastward.

South of this ridge, at the distance of one or two miles, another of less elevation, presenting on the eastern declivity similar ravages, in two or more places. These I did not examine particularly.

Generally, it may be stated, that within the limits of this township, there are nine or ten similar excavations on the sides of mountains and sharp ridges, which were occasioned by this storm; that in each instance, there exists no reason to believe that the water was accumulated from the neighbouring grounds; that the ravages commenced suddenly, and are large and deep at their commencement; that the dead leaves and brush lying immediately above, and at the sides, do not appear to bear any marks of a change of position, nor to have been in any manner disturbed from the flowing of water; and that the configuration of the ground is in each instant such, as to forbid the supposition, that the water might have accumulated from the adjoining ground. Did a cloud, highly surcharged with water, rest upon each of these places, till its contents were emptied? Did waterspouts discharge themselves here?

In the same range, further south, the storm raged with great violence, and produced ravages not less remarkable. On the west side of the Kaaterskill, about three and a half miles from the town, a small brook empties into that stream. This brook is usually from one to two feet in width, and does not contain more water than might pass through a cylindrical tube of six or eight inches in diameter. The distance from the source of the brook to its mouth, is about three quarters of a mile. The country bordering it is hilly. In the afternoon and evening of the storm, the brook was enlarged to a surprising extent. For half a mile from its mouth upwards, it became from two to four rods in width, except in certain places, where it was six, eight, and ten rods wide. In some places, it was twenty feet deep. The quantity of earth, and stones, and rocks in rolled masses, washed out of the banks during the afternoon, was prodigiously great. It has been estimated by several judicious persons, to exceed a hundred thousand tons. The average width of the ravine, I estimated to be four or five rods. I am not confident of the exactness of these estimates, nor are they intended to be very exact, particularly as relates to the quantity. In some places, huge rocks, washed out of the banks, have been heaped up by the waters, to the height of from ten to fifteen feet, and several rods in width. A considerable number of these rocks are estimated to weigh from six to ten tons each. I measured one, which was ten feet in length, seven feet in breadth, and eighteen inches in thickness. This rock, which is a mass of compact carbonate of lime, is almost wholly made up of organic remains.\* Se-

\* I visited this ground, Sept. 1, 1820, in company with James Pearce, Esq. of New-York, (now of Catskill.) During our rambles



veral others are considerably larger. To strangers examining this ground hereafter, it may be satisfactory to know, that before the rain commenced, all the ground from the mouth of the brook upwards, to the place where the banks become steep and high, and the ravine suddenly narrower, was level, and covered with a good bed of soil, well turfed over, with a few forest trees interspersed. The trees and soil have all disappeared, and huge rocks and smaller stones now occupy the place. Thousands of tons of earth and stones, were also earned into the fields, south-west, south, and east from the road, the Kaaterskill turnpike, which crosses the brook from twenty to forty rods above its mouth. A considerable tract of valuable arable land was ruined by this cause.

About half a mile farther up the Kaaterskill, and four miles from the town, the turnpike road (called the little Delaware Turnpike) to the Catskill mountains, crosses the stream. On the western side of the stream, at the distance of several rods from the bridge, is situated a pretty large well-built dwelling house. Before sunset, the water rose in the creek at this place, nineteen feet above its usual level. The creek here is several rods in width, and the banks generally pretty high. The water overflowed the banks so far, as to surround the house to a considerable depth, and to threaten, in the opinion of the owner, who is a judicious farmer, the safety of his family. Under this unavoidable, he removed them to the high grounds a little west, where they remained in an open waggon, till the flood began to subside. Farther up the Kaaterskill, much mischief was done to seven farms along the banks. A large amount of hay was cut down, much grain was injured, many sheep feeding on the meadows, and some neat cattle were drowned, and various trees a valuable land covered with mud and stones.

About one mile westward from the bridge which crosses the Kaaterskill, in the place as mentioned, and along the same turnpike road, a track of mountains the size of sixes. It heads about a mile distant, in a north-west direction, and after crossing the same, runs about three quarters of a mile further, in a diagonal course, when it empties into the Kaaterskill. Down to the mouth of the brook, the brook was one or two rods in width. In the course of the day, the water rose to such a height, and ran with such impetuosity, that it wore a

mass of organic  
specimens  
temperature  
of good

wide and deep ravine, extending throughout almost its whole course. It now resembles the bed of a considerable river, and is said to be in many places about one hundred feet in width. Large ledges of rocks, before invisible, and lying several feet under the soil, were laid bare. They generally run at right angles to the current. Huge portions from these ledges were undermined and broken off, by the force of the accumulated waters, and carried down stream to considerable distances. I measured one, which was twelve feet in length, upwards of four feet in width, and two and a half in thickness, which was disengaged from its former position, and carried down stream, upwards of one hundred and twenty feet. It now lies crosswise to the current. The descent in this place is not very rapid. A few yards distant from this, is another, which is supposed to have been originally united to it, and measuring seven feet in length. It is considerably wider and thicker than the main portion. At some distance below, there is a fall in the brook of fifteen or twenty feet, over a ledge of rocks, and several rods in width. Before the storm, it was of inconsiderable magnitude. At the bottom of the fall, a large cavity was formed in the rocks, of between one and two rods in length, several yards in width, and estimated to be six or eight feet deep. A huge rock, which appears to have been formerly imbedded in this cavity, was disengaged by the impetuous force of the waters, and carried down stream several rods, and near to the opposite bank. It lies lengthwise, or parallel to the current, a direction opposite to that which it originally sustained. This rock is upwards of twenty-one feet in length, six feet in width, and four in thickness. This fall is about a quarter of a mile in a southern direction from the turnpike road. Below the fall, the bed of the stream is worn several yards deeper than before the storm. Some remarkable ravages, as I am informed, were occasioned by the storm between the fall and the mouth of the brook, and between the road and the source of the brook. A number of the foregoing assertions are made on the authority of Mr. Anthony Abeel, a respectable farmer, who resides in the near neighbourhood, and who accompanied me to the spot when I visited it.

In most of the places where the foregoing ravages exist, it seems probable that a greater quantity of rain descended than in the town; and this is the general opinion of the intelligent ants residing in those neighbourhoods.

The whole amount of damage occasioned by the storm in the township, was estimated by judicious persons, to have exceeded fifty thousand dollars.

*During the same afternoon, there was a remarkable tempest.*

of rain, in the township of Chester, in Massachusetts, and in some portion of the adjoining country. From the great rise which took place in the waters of Chester river, the effects of which I observed in the following September, while riding along its banks, and which will be visible for a century to come; and from the many large collections of stones and rocks in rolled masses which were tumbled down the hills, from the sudden gushing of the water, in momentary brooks, and larger streams, and from the account published in the newspapers, I concluded that the quantity of water which descended in that region, was as great as at Catskill. It would be gratifying, if some gentleman in Chester would give the public a detailed account of that storm. Between Catskill and Chester, which is upwards of fifty miles eastward, there was not in most places, at the same period, an unusual quantity of rain, and in many places there was little or none.

On the same afternoon, I rode on horseback from Montrose, in Pennsylvania, distant from Catskill, in a south-western direction, about one hundred and thirty, or one hundred and forty miles to the Great Bend. About half past three o'clock, dense black clouds, accompanied by lightning and thunder, rose up slowly from the south-west. At four o'clock, a violent shower commenced, which continued about an hour. As the clouds drew near, I observed that they moved much more rapidly than I had supposed, and that they rolled along the hills below the tops of the forest trees.

It would seem from these facts, that there was an unusual state of the atmosphere, operating in a greater or less degree, over an extensive tract of country.

It is worthy of notice, that on Thursday afternoon, the fifteenth of July, only eleven days before, an uncommon shower occurred at Catskill. I left home that afternoon on horseback, on a journey to the westward. It had been cloudy through the day: the air was very close and sultry. I had not proceeded more than a mile, before I was obliged to stop, on account of a very sudden shower, which came up from the south-west, attended with sharp lightning, and heavy thunder. The rain poured down in torrents. It was of a short continuance; but fell full six inches deep on a level. I thought at the time, that it was the most powerful rain which I had ever witnessed. An empty pail, standing in a garden near to my house, caught about six inches of water in it. Considerable rain fell at other periods, during the month of July. I believe I am authorized in the conclusion, therefore, that the *whole quantity* which fell in this town during that month, exceeded twenty-four inches on a level.

I have not the means of determining whether similar rains have, or have not occurred in other countries. It is stated in the *Christian Observer*, that the mean annual quantity of rain is at Rome thirty-nine inches; in England thirty-two; and at Petersburg sixteen. It is also stated in the same work, (Vol. 8th, page 733,) that "the quantity of rain which fell in September, (1818,) was equal to four inches in depth, a quantity perhaps unprecedented at the like season, in the meteorological annals of this country, (England.) The depth of rain in the two preceding months, was likewise unusually great, having exceeded seven inches." In many tropical regions, the mean annual quantity greatly exceeds that which exists in the countries above mentioned.

## HAIL STORMS.

On the 17th of July, 1666, a violent storm of hail fell on the coasts of Norfolk and Suffolk. At North Yarmouth, the hail-stones were comparatively small; but at Snapebridge, one was taken up which measured a foot in circumference; at Seckford Hall, one which measured nine inches; and at Melton, one measuring eight inches. At Friston Hall, one of these hail-stones, being put into a balance, weighed two ounces and a half. At Aldborough, it was affirmed that several of them were as large as turkeys' eggs. A carter had his head broken by them through a stiff felt hat: in some places it bled, and in others, tumours arose: the horses were so pelted that they hurried away his cart beyond all command. The hail-stones were white, smooth without, and shining within.

On the 25th of May, 1686, the city of Lille, in Flanders, was visited by a tremendous hail-storm. The hail-stones weighed from a quarter of a pound to a pound weight, and even more. One among the rest, was observed to contain in the centre a dark brown matter, and being thrown into the fire, gave a very loud report. Others were transparent, and melted instantly before the fire. This storm passed over the city and citadel, leaving not a whole glass in the windows on the windward side. The trees were broken, and some beaten down, and partridges and hares killed in abundance.

In 1697, a horrid black cloud, attended with frequent lightnings and thunder, coming with a south-west wind out of Carnarvonshire, and passing near Snowdon, was the precursor of a most tremendous hail-storm. In the part of Denbighshire bordering on the sea, all the windows on the weather side were broken by the hail-stones discharged from this cloud, and the poultry and lambs, together with a large mastiff, killed. In the north part of Flintshire, several persons had their heads

broken, and were grievously bruised in their limbs. The main body of this hail storm fell on Lancashire, in a right line from Ormskirk to Blackburn, on the borders of Yorkshire. The breadth of the cloud was about two miles, within which compass it did incredible damage, killing all descriptions of fowl and small creatures, and scarcely leaving a whole pane of glass in any of the windows where it passed. What was still worse, it ploughed up the earth, and cut off the blade of the green corn, so as utterly to destroy it, the hail-stones burying themselves in the ground. These hail-stones, some of which weighed five ounces, were of different forms, some round, others semi-spherical; some smooth, others embossed and crenulated, like the foot of a drinking glass, the ice being very transparent and hard; but a snowy kernel was in the midst of most of them, if not of all. The force of their fall showed that they descended from a great height. What was thought to be most extraordinary in this phenomenon was, that the vapour which disposed the aqueous parts thus to congeal, should have continued undispersed for so long a tract as upwards of sixty miles, and should, during this extensive passage, have occasioned so extraordinary a coagulation and congelation of the watery clouds, as to increase the hail-stones to so vast a bulk in so short a space as that of their fall.

On the 4th of May, 1767, at Hitchin, in Hertfordshire, after a violent thunder-storm, a black cloud suddenly arose in the south-west, about two o'clock in the afternoon, the wind then blowing strongly in the east, and was almost instantly followed by a shower of hail, several of the hail-stones which fell measuring from seven or eight to thirteen or fourteen inches in diameter. The extremity of the storm fell near Offley, where a young man was killed, and one of his eyes was beaten out of his head, his body being in every part covered with bruises. Another person, nearer to Offley, escaped with his life, but was much bruised. At a nobleman's seat in the vicinity, seven thousand squares of glass were broken, and great damage was done to all the neighbouring houses. The large hail-stones fell in such immense quantities, that they tore up the ground, and split many large oaks and other trees, cutting down extensive fields of rye, and destroying several hundred acres of wheat, barley, &c. Their figures were various, some being oval, others round, others pointed, and others again flat.

#### HURRICANES.

The ruin and desolation accompanying a hurricane can scarcely be described. Like fire, its resistless force rapidly consumes every thing in its track. It is generally preceded by

an awful stillness of the elements, and a closeness and mistiness in the atmosphere, which make the sun appear red, and the stars of more than an ordinary magnitude. But a dreadful reverse succeeding, the sky is suddenly overcast and wild; the sea rises at once from a profound calm into mountains; the wind rages and roars like the noise of cannon; the rain descends in a deluge; a dismal obscurity envelopes the earth with darkness; and the superior regions appear rent with lightning and thunder. The earth, on these occasions, often does, and always seems to tremble, while terror and consternation distract all nature; birds are carried from the woods into the ocean; and those whose element is the sea, fly for refuge on land. The affrighted animals in the fields, assemble together, and are almost suffocated by the impetuosity of the wind, in searching for shelter, which, when found, serves them only for destruction. The roofs of houses are carried to vast distances from their walls which are beaten to the ground, burying their inmates beneath them. Large trees are torn up by the roots, and huge branches shivered off, and driven through the air in every direction, with immense velocity. Every tree and shrub that withstands the shock, is stripped of its boughs and foliage. Plants and grass are laid flat to the earth. Luxuriant spring is in a moment changed to dreary winter. This direful tragedy ended; when it happens in a town, the devastation is surveyed with accumulated horror; the harbour is covered with wrecks of boats and vessels; and the shore has not a vestige of its former state remaining. Mounds of rubbish and rafters in one place; heaps of earth and trunks of trees in another; deep gullies from torrents of water; and the dead and dying bodies of men, women, and children half buried, and scattered about, where streets but a few hours before were, present to the miserable survivors a shocking conclusion of a spectacle to be followed by famine, and, when accompanied by an earthquake, by mortal diseases.

Such is the true and terrific picture of a hurricane in the West-Indies, as drawn by Doctor Mosely, in his treatises on tropical diseases!

On the Indian coast, hurricanes are both frequent and disastrous. On the 2d of October, 1746, the French squadron, commanded by Le Bourdonnai, being at anchor in Madras roads, a hurricane came on, which in a few hours destroyed nearly the whole of the fleet, together with twenty other ships belonging to different nations. One of the French ships foundered in an instant, and only six of the crew were saved. On the 30th of Dec. 1760, during the siege of Pondichery, a *tremendous hurricane drove on shore and wrecked three British*

ships belonging to the besieging squadron : the crews were saved. On the 20th of October of the following year, 1761, the British fleet, then lying in Madras roads, had to encounter a violent hurricane. The men of war put to sea, and were thus providentially saved ; but all the vessels which still lay at anchor were lost, and scarcely a soul on board saved. On the 29th of October, 1768, another hurricane was on the coast of Coromandel, fatal to the Chatham Indiaman, which neglected to put to sea.

In the West-Indies, the late tremendous hurricane of the 21st of October, 1817, was particularly severe at the Island of St. Lucie. All the vessels in the port were entirely lost. The Government-house was blown down, and all within its walls, comprising the governor, his lady, and child, his staff, secretaries, servants, &c. amounting to about thirty persons, buried in its ruins : not one survived the dreadful accident ; and still more horrid to relate, the barracks of the officers and soldiers were demolished, and all within them (about two hundred persons) lost. All the estates on the island were reduced to a heap of ashes. At Dominica, nearly the whole of the town was inundated, with an immense destruction of property.

In Great Britain, a dreadful hurricane, commonly called the great storm, set in at ten at night, on the 26th of November, 1703, and raged violently until seven the next morning. It extended its ravages to every part of the kingdom. In the capital, upwards of two thousand stacks of chimneys were blown down. The lead on the tops of several churches was rolled up like skins of parchment. Many houses were levelled with the ground, and by the fall of the ruins, 21 persons were killed, and more than 200 wounded. The ships in the Thames broke from their moorings : four hundred wherries were lost, and many barges sunk, with a great loss of lives. At sea, the destruction was still greater : twelve ships of war, with upwards of eighteen hundred men on board, were totally lost, together with many merchantmen.

#### HURRICANE IN NEW-HAMPSHIRE, SEPT. 17 TH, 1821.

Perhaps the most awful tornado that ever occurred in New-England, took place on Sunday evening last week, extending from Croydon southeasterly through the towns of Wendell, New-London, Sutton, and Warner. A violent storm of wind and hail was indeed felt in many other towns, but the ravages, so far as we have ascertained, are confined to those above mentioned.

*About six o'clock, Sunday evening, after an extremely fine and warm day, a dark cloud was observed to rise rapidly in*

the north and north-west, and passing in a southeasterly direction, illumined in its course by incessant flashes of the most vivid lightning. There was a most terrifying commotion in the cloud itself; and its appearance gave notice that irresistible power and desolation were its attendants. Few, however, apprehended the danger that was threatening, or that their dwellings, which had long withstood the fury of the tempest, were to be swept away like leaves by the wind of autumn.

In Cornish and Croydon, we understand, considerable injury was done. The house of Deacon Cooper, of Croydon, was much injured; his barn and its contents entirely blown away. Passing on in a direction E. S. E. in its progress, collecting to a more narrow compass its force, it kept its track along the low lands, till it came to the farm and buildings of a Mr. Harvey Huntoon, in Wendell, about 80 rods from the borders of the Sunapee Lake. The people in the house, eight in number, were frightened by the appearance of the cloud. Soon they saw the air before it, filled with birds and broken limbs of trees. In an instant the house and two barns were prostrated to the ground. A side of the house fell upon Mr. H. and his wife, who were standing in the kitchen. The next instant it was blown off and dashed to pieces. The woman was carried across the field with the current. A Mrs. Wheeler, who with her husband and child were then living in the house, had taken her child and fled to the cellar. Mr. W. found himself in the cellar covered with timbers and brick, and much injured. A child eleven months old was sleeping upon a bed in the west part of the house: and the gown which it wore was soon after found in the water on the shore of the lake, 150 rods from the house, and we learn, that on the Wednesday following, the mangled body of the child was found on the west shore of the lake, where it had floated by the waves. Though the sun was an hour above the horizon, yet it was as dark as midnight. The air was filled with leaves, fragments of trees, and gravel. The bedstead on which the child lay, was found in the woods eighty rods from the house northerly and out of the general track of the wind. The bed and bedding have not yet been found. A number of bricks were thrown more than an hundred rods from the house; large pieces of timber belonging to the house and barns, some seven and eight inches square and twelve feet long, were carried eighty and ninety rods; a pair of cart-wheels were separated from the body and spire, carried about sixty rods, and dashed in pieces; a large iron pot was blown upwards of seven rods; nearly all the trees of a middling sized orchard were blown down, many of *them torn up and carried from seventy to an hundred rods in*



the woods—casks, furniture, clothing, and dead fowls were found at a much greater distance. The only furniture found near the house was a kitchen chair. A bureau was blown across the lake, two miles wide at this place, and, excepting the drawers, was found half a mile beyond the lake, the whole distance being two miles and three quarters! From the buildings, the land rises about 100 feet in the distance of 50 rods, then descends to the lake. A door post of the barn, of beech, 13 feet long, 8 by 12 inches square, was blown through the air, up this rising ground, forty-four rods.—A large hemlock log, 60 feet in length and 3 feet in diameter at the butt and nearly 2 at the top, was moved from its bed, where it had lain eight or ten years, and carried by the wind up hill and over two large rocks 17 inches above the ground, situated about six feet from where it lay, to the distance of six rods. The rise of land in this distance is found to be ten feet six inches. It struck a rock, which breaking it in two, stopped its progress. A piece of wood, heavily timbered, 100 rods east, of 40 acres, was entirely prostrated; not a whole tree is standing on any part of it. A horse was blown up the rise before mentioned, 40 rods, and so injured as to make it necessary to kill him. No human lives were lost excepting that of the child. All the other seven persons, however, were much injured, and some of them very severely. A house and barn belonging to Mr. Isaac Eastman were much shattered, but not entirely ruined.—The width of the tornado in Wendell is thought to have been half a mile.

From Wendell, the hurricane passed across the lake in a most sublime and terrific pyramidal column to New-London, where the destruction of buildings and property is represented to have been the greatest; but we have not heard of any deaths at that place, nor have we any particulars from that town sufficiently minute to justify a detail.

On Saturday last, with several gentlemen from Concord, Hopington, and Warner, we visited the ruins in the late mentioned town, near the Kearsarge mountain, in that part formerly called the Gore. No person can conceive, without visiting the spot, the horrors of that instant—it was but an instant when all was over; when houses, barns, trees, fences, fowls, &c. were all lifted from the earth, into the bosom of the whirlwind, and anon dashed into a thousand pieces.—No language can give an adequate representation of even the present scene, much less of that terrible wrath of the elements, which, for a few seconds, was felt by the sufferers. We stood amidst the ruins, almost discrediting our own vision, but awfully impressed with the thought, that the place was one, where the *hand of Omnipotence* had been put down in anger, to teach

man his impotence, in a manner that should be understood and remembered. It can hardly however be said, that we stood among the ruins, for most of them had been carried beyond our sight. A few large stones remaining in their places, and others strewed on each side for several feet, indicated where a stone-wall had stood; a few fragments of timber and a small quantity of hay, which had since been gathered together, denoted the spot where stood the barns; a few timbers and bricks, and at one place the floor remained, of what composed the dwellings of the two Savarys; and the feathers here and there discovered in the dust, showed that the very fowls of heaven, that had often sported with the clouds, could not fly the swift destruction.

From the mountain, there is a rapid descent into the gore. In the valley, formed between the mountain and a high hill S. E. before it, stood seven dwelling houses, comprising all the habitations in that part of the gore. The tornado came over the mountain in the direction of the buildings, and first struck the barn of Mr. William Harwood, carrying it away; passing onward, it injured the houses of Messrs. F. Goodwin, J. Ferrin, and Abner Watkins, completely destroying Ferrin's barn, and unroofing Watkins'. Next, in the direction of the wind, stood the dwelling of Daniel Savary, of which nothing remains but a part of the floor and bricks. Apprehending a wind, Mr. Samuel Savary, aged 72 years, the father of the proprietor of the buildings, who was himself absent, went up stairs to fasten down a window. The women started to his assistance, when, as they represent, the house seemed to whirl, and instantly rose above their heads, while what was left behind, timbers, bricks, &c. almost literally buried six of the family in the ruins. The body of the aged Samuel Savary was found at the distance of six rods from the house, his brains dashed out against a stone. Elizabeth, his wife, was very much injured by the falling timbers, which fell across her.—Mary, the wife of Daniel S., was severely bruised on her head, arms, and breast, and an infant which she held in her arms, was killed. The three children were much bruised, but had sufficiently recovered to tell us their artless tale, and show the traces of the storm. This family were extricated by the assistance of the elder Mrs. Savary, who, though now scarcely able to move, had the most surprising strength in removing the timbers and bricks, beneath which, could be faintly heard the cries of the sufferers.

The house of Mr. Robert Savary, was also demolished. Mrs. S. says she anticipated a shower, and went into a bed-room, to take up a child, and was conscious of nothing more, till she

found herself confined among the timbers, greatly bruised, but the child unhurt—her husband buried altogether in the bricks, with the exception of his head; and two of their children completely covered up in splinters and rubbish. This family, consisting of eight persons, were all wounded, but none dangerously.

Mr. John Palmer, who lives up a rise, distant half a mile, and was out of the door, saw the cloud coming over the mountain, in shape, as he represents, like a tunnel, the air filled with leaves, limbs of trees, &c.—He immediately attempted to enter the door, but was caught by the arm; at the same instant the breast-work and chimney gave way, and a part of the frame buried Mrs. P. who was attempting to force open the door for her husband, under the bricks and timber. Mrs. P. was considerably hurt, the remainder of the family not materially injured.

The wind, in passing from the Savarys to Palmer's, tore up every thing in its course, throwing splinters of the buildings, pieces of furniture, crockery, &c. in every direction for a mile; ten hives of bees were destroyed: the legs, wings, and heads of fowls were to be seen lying about; several acres of corn and potatoes adjacent to the buildings, were swept off clean, not leaving an ear, save at some distance a few in heaps; stones half buried in the earth were overturned, and we saw one which would weigh 500 lbs. moved several feet; a hemlock log 60 feet in length, half buried in the earth, was taken from its bed and carried six rods forward, while a knot from the same log was carried 15 paces back, and driven with great force two feet under the turf; a bridge covered with large oaks split in the middle, was torn up, and the timbers strewed for a quarter of a mile in a southerly direction.

From these dwellings it passed over the hill two and an half miles, and down, perhaps, one hundred feet, where it swept off all the buildings of Mr. Peter Flanders, killing a Miss Anna Richardson, and an infant child. All the others, seven in number, were wounded, some badly, and Mr. F. so severely, that until within a day or two his life was despaired of. They informed us that no sound of wind was heard, although some might have observed the cloud, until the crash of the buildings took place, and then all was over in an instant.

The buildings of Deacon Joseph True, situated in a corner of Salisbury, were next swept away. Mr. T. and his father-in-law, a Mr. Jones, who, with his wife were there on a visit, being at the door, saw the whirlwind approach, and had just time to hide themselves, one under his shop a few paces distant, and the other down by a pile of wood—when the build-

ings were whirled aloft, and stripped into splinters, with the exception of some heavy sticks of timber, one of which plunged endways into the ground two feet, by the side of Jones, lying by the wood, and the other end leaning upon the pile, protecting him from other sticks which fell across. Neither Jones nor True was hurt. And by their exertions, Mrs. True and three or four children were dug out from beneath the bricks, where they were actually buried more than a foot. The oven had just been heated, and the bricks were so hot, that in removing them from his children, Mr. T. had his fingers burnt to the bone! Mrs. T. and several of the family were badly burnt, and one child is so disfigured as hardly to be known. The youngest child, an infant seven weeks old, was found at the distance of one hundred feet, under the bottom of a sleigh, the top of which cannot be found.—The amazing power of the wind may be faintly imagined from the evidences now to be seen. In one place near Deac. True's, a hemlock log two and a half feet through and thirty-six feet long, and nearly half buried in the earth, was moved one or two rods. At another place, two hemlock logs of the same size with the other, one 65 feet long, and the other about 40, lying across each other, were moved about twelve feet and left in the same situation as before. The entire top of one of the chimneys was carried 10 rods and left the bricks together on one spot. Mr. True saw a tree whirling perpendicularly in the air to an immense height. An elm tree standing a little south of Savary's, measuring 17 inches diameter, whose enormous roots refused to yield, and being too tough to break, was twisted round like a wither;—and a few ash trees, standing at the foot of the hill, were stripped of bark and limbs, and split literally into basket-stuff!

## THE MONSOONS.

The setting in of the Monsoon, or tropical sea-wind, in the East-Indies, is thus described by Forbes in his *Oriental Memoirs*. The scene was at Baroche, where the British army was encamped. "The shades of evening approached as we reached the ground, and just as the encampment was completed, the atmosphere grew suddenly dark, the heat became oppressive, and an unusual stillness presaged the immediate setting in of the monsoon. The whole appearance of nature resembled those solemn preludes to earthquakes and hurricanes in the West-Indies, from which the East in general is providentially free. We were allowed very little time for conjecture; in a few minutes the heavy clouds burst over us.

*"I had witnessed seventeen monsoons in India, but this ex-*

ceeded them all in its awful appearance and dreadful effect. Encamped in a low situation, on the borders of a lake formed to collect the surrounding water, we found ourselves in a few hours in a liquid plain. The tent-pins giving way, in a liquid soil, the tents fell down, and left the whole army exposed to contending elements. It requires a lively imagination to conceive the situation of an hundred thousand human beings in every description, with more than two hundred thousand elephants, camels, horses, and oxen, suddenly overwhelmed by this dreadful storm, in a strange country, without any knowledge of high or low ground; the whole being covered by an immense lake, and surrounded by thick darkness, which prevented our distinguishing a single object, except such as the vivid glare of lightning displayed in horrible forms. No language can describe the wreck of a large encampment thus instantaneously destroyed and covered with water: amid the cries of old men and helpless women, terrified by the piercing shrieks of their expiring children, unable to afford them relief. During this dreadful night, more than two hundred persons and three thousand cattle perished, and the morning dawn exhibited a shocking spectacle."

The south-west monsoon generally sets in very early in the inland parts of India. "At Anjengo," observes the author, "it commences with great severity, and presents an awful spectacle; the inclement weather continues, with more violence, from May to October: during that period, the tempestuous ocean rolls from a black horizon, literally 'darkness visible,' a series of floating mountains heaving under hoary summits, until they approach the shore, when stupendous accumulations, flow in successive surges, and break upon the beach; every ninth wave is observed to be generally more tremendous than the rest, and threatens to overwhelm the settlement. The noise of these billows equals that of the loudest cannon, and, with the thunder and lightning, so frequent in the rainy season, is truly awful. During the tempestuous monsoon I passed at Anjengo, I often stood upon the trembling sand-bank, to contemplate the solemn scene, and derive comfort from that sublime and omnipotent decree: 'Hitherto shalt thou come, but no further; and here shall thy proud wave be stayed!'"

#### WHIRLWINDS AND WATER-SPOUTS.

[See Plate, No. 1.]

In number 302 of the Monthly Magazine, Sir Richard Phillips, in describing a water-spout observed by him, points

the connexion between those phenomena, and offers a very philosophical explanation of the formation of the latter.

“ It happened to him,” he observes, “ on the 27th of June, 1817, about seven in the evening, to witness the formation, operation, and extinction of what is called a water-spout. His attention was drawn to a sudden hurricane which nearly tore up the shrubs and vegetables in the western gardens, and filled the air with leaves and small collections of the recently-cut grass. Very dark clouds had collected over the adjacent country, and some stormy rain, accompanied by several strokes of lightning, followed this hurricane of wind. The violence lasted a few minutes, and the writer being drawn to an eastern balcony, it was evident that a whirlwind agitated a variety of substances which had been raised into the air. The storm proceeded from west to east, that is, from Hampstead over Kentish-Town towards Holloway. In about five minutes, in the direction of the latter place, a magnificent projection was visible from the clouds. It descended two-thirds of the distance from the clouds towards the earth, and evidently consisted of parts of clouds descending in a vortex, violently agitated like smoke from the chimney of a furnace recently supplied with fuel. It then shortened, and appeared to be drawn up towards the stratum of clouds.

It finally drew itself into the cloud; but a small cone, or projecting thread of varying size and length, continued for ten minutes. At the time, and for half an hour after, a severe storm of rain was visibly falling from the ruins of clouds connected with it, the extent being exactly defined by the breadth of Holloway, Highgate, and Hornsey. About two hours after, on walking from Kentish-Town towards Holloway, it was found that one of the heaviest torrents of rain remembered by the inhabitants had fallen around the foot of Highgate-hill; and some persons having seen the projecting cloud, an absolute belief existed that a water-spout had burst at the crossing of the new and old roads. On proceeding towards London, various accounts agreeing with the superstition or preconceived notions of the by-standers, were given; but, in the farm-yard, at the three-mile-stone, it appeared that some hay-makers were stacking hay from a waggon which stood between two ricks, and that the same whirlwind which passed over Kentish-Town, had passed over the loaded waggon with an impetus sufficient to carry it above twenty yards from its station, and to put the men upon it, and on the rick, in fear of their lives. Passing the road, it carried with it a stream of hay, and, nearly *unroofing a shed on the other side, filled the air to a great height with fragments of hay, leaves, and boughs of trees,*

which resembled a vast flight of birds. The family of the writer beheld the descending cloud, or water-spout, pass over, and they saw its train, which, at the time, they took to be a flight of birds. They afterwards beheld the descending cloud draw itself upward, and they, and other witnesses, describe it as a vast mass of smoke working about in agitation; to them it was nearly vertical in a northern direction; and to persons a quarter of a mile north, it was nearly vertical in a southern direction; and all agree that it drew itself up without rain, and was followed near the earth by the train of light bodies. It appeared, also, on various testimony, to let itself down in a gradual and hesitating manner, beginning with a sort of knob in the cloud, and then descending lower, and curling and twisting about till it shortened, and gradually drew itself into the cloud."

The inferences which Sir Richard draws from what he saw and heard, are as follow: "That the phenomenon, called a water-spout, is a mere collection of clouds, of the same rarity as the mass whence they are drawn. That the descent is a mechanical effect of the whirlwind, which creating a vacuum, or high degree of rarefaction, extending between the clouds and the earth, the clouds descended in it by their gravity, or by the pressure of the surrounding clouds or air. That the convolutions of the descending mass, and the sensible whirlwind felt at the earth, as well as the appearance of the commencement, increase and decrease of the mass, all demonstrate the whirl of the air to be the mechanical cause.—That the same vortex, whirl, or eddy of the air, which occasions the clouds to descend, occasions the loose bodies on the earth to ascend.—That, if in this case, the lower surface had been water, the same mechanical power would have raised a body of foam, vapour, and water, towards the clouds.—That, as soon as the vortex or whirl exhausts or dissipates itself, the phenomena terminate by the fall to the lower surface of the light bodies or water, and by the ascent of the cloud.—That when water constitutes the light body of the lower surface, it is probable that the aqueous vapour of the cloud, by coalescing with it, may occasion the clouds to condense, and fall at that point, as through a syphon.—That if the descending cloud be highly electrified, and the vortex pass over a conducting body, as a church steeple, it is probable it may be condensed by an electrical concussion, and fall at that spot, discharging whatever has been taken up from the lower surface, and producing the strange phenomena of showers of frogs, fish, &c.—And lastly, it appears certain, that the action of the air, on the mass of clouds, pressing towards the mouth of

the vortex as to a funnel, (which, in this case, it exactly represented,) occasioned such a condensation, as to augment the simultaneous fall of rain to a prodigy."

In the month of July, 1800, a water-spout was seen rapidly to approach a ship navigating between the Lipari Islands. It had the appearance of a viscid fluid, tapering in its descent, and proceeding from the cloud to join the sea. It moved at the rate of about two miles an hour, with a loud sound of rain, passing the stern of the ship, and wetting the after part of the mainsail. It was thence concluded, that water-spouts are not continuous columns of water, as has been confirmed by subsequent observations.

In November, 1801, about twenty miles from Trieste, in the Adriatic sea, a water-spout was seen eight miles to the southward: round its lower extremity was a mist, twelve feet high, nearly of the form of an Ionian capital, with very large volutes, the spout resting obliquely on its crown. At some distance from this spout, the sea began to be agitated, and a mist rose to the height of about four feet: a projection then descended from the black cloud which was impending, and met the ascending mist about twenty feet above the sea, the last ten yards of the distance being described with great rapidity. A cloud of a light colour appeared to ascend in this cloud like quicksilver in a glass tube. The first spout then snapped at about one third of its height, the inferior part subsiding gradually, and the superior curling upward.

Several other projections from the cloud, appeared with corresponding agitations of the water below, but not always in spouts vertically under them: seven spouts in all were formed; and two other projections re-absorbed. Some of the spouts were not only oblique, but curved, the ascending cloud moving most rapidly in those which were vertical. They lasted from three to five minutes, and their dissipation was not attended with any fall of rain. For some days before, the weather had been very rainy, with a S. E. wind; but no rain had fallen on the day of observation.\*

The corresponding phenomena of whirlwinds have been occasionally productive of much mischief, as the following brief narratives will show. On the 30th of October, 1669, about six in the evening, the wind being then westwardly, a formidable whirlwind, scarcely of the breadth of sixty yards, and which spent itself in about seven minutes, arose at Ashly,

\* In the plate representing the two figures of a water-spout, the passage of a cluster of aerolites, or meteoric stones, through the air, is likewise described; and to that subject, the reader's attention is directed in viewing the plate.



in Northamptonshire. Its first assault was on a milk-maid, whose pail and hat were taken from off her head, and the former carried many scores of yards from her, where it lay undiscovered for some days. It next stormed a farm-yard, where it blew a waggon body off the axletrees, breaking in pieces the latter, and the wheels, three of which, thus shattered, were blown over a wall. Another waggon, which did not, like the former, lie across the passage of the wind, was driven with great speed against the side of the farm-house. A branch of an ash-tree, so large that two stout men could scarcely lift it, was blown over a house without damaging it, although torn from a tree 100 yards distant. A slate was carried nearly 200 yards, and forced against a window, the iron bar of which it bent. Several houses were stripped; and in one instance, this powerful gust, or stream of air, forced open a door, breaking the latch; whence it passed through the entry, and forcing open the dairy door, overturned the milk-paas, and blew out three panes of glass. It next ascended to the chambers, and blew out nine other panes. Lastly, it blew a gate-post, fixed two feet and a half in the ground, out of the earth, and carried it many yards into the fields.

On the 30th of October, 1731, at one in the morning, a very sudden and terrific whirlwind, having a breadth of two hundred yards, was experienced at Cerne-Abbas, in Dorsetshire. From the south-west side of the town, it passed to the north-east, crossing the centre, and unroofing the houses in its progress. It rooted up trees, broke others in the middle, of at least a foot square, and carried the tops a considerable distance. A sign-post, five feet by four, was broken off six feet in the pole, and carried across a street forty feet in breadth, over a house opposite. The pinnacles and battlements of one side of the church-tower were thrown down, and the leads and timber of the north aisle broken in by their fall. A short time before, the air was remarkably calm. It was estimated that this sudden and terrible gust did not last more than two minutes.

About the middle of August, 1741, at ten in the morning, several peasants being on a heath near Holkham, in Norfolk, perceived, about a quarter of a mile from them, a wind like a whirlwind, approach them gradually, in a straight line from east to west. It passed through the field where they were ploughing, and tore up the stubble and grass in the ploughed ground, for two miles in length, to the breadth of thirty yards. *In reaching an enclosure at the top of a rising ground, it appeared like a great flash or ball of fire, emitting smoke, and accompanied by a noise similar to that of carts passing over*

a stony ground. Both before and after the wind passed, there was a strong smell of sulphur; and the noise was heard long after the smoke had been perceived. This fiery whirlwind moved so slowly forward, that it was nearly ten minutes in proceeding from the enclosure to a farm-house in the vicinity, where it did much mischief.

## MOUNTAINS.

### THE MOUNTAINS OF THE ANDES IN SOUTH AMERICA.

Among the wonders, or uncommon phenomena of the world, may be classed stupendous Mountains; and of these the Andes, in South America, are the loftiest, the most extensive, and, therefore, the most wonderful. Descriptions of objects which are striking, because they are vast, often fail in exciting appropriate ideas; and however accurate or poetical may be the accounts of this class of Nature's Prodigies, no just notions of their vastness can be conveyed by any written or graphical representation. The magnitude of an object must be seen to be duly conceived, and mountain-wonders will be best felt by those who have visited Wales, Scotland, Switzerland, or the mountainous regions of America or Asia.

The stupendous mountains, called by the Spaniards the Cordilleras, (from cord, or chain, pronounced by them *Cor-dil-le-ras*), or Chains of the Andes, (An-des,) stretch north and south, near the western coast, from the Isthmus of Darien, through the whole of the continent of South America, to the Straits of Magellan. In the north, there are three chains of separate ridges, but in advancing from Popayan towards the south, the three chains unite into a single group, which is continued far beyond the equator. In the kingdom of Quito,\* the more elevated summits of this group are ranged in two rows, which form a double crest to the Cordilleras. The extent of the Andes Mountains is not less than four thousand three hundred miles.

Rocks rich in gems, and mountains big with mines,  
That on the high equator ridgy rise,  
Whence many a bursting stream auriferous plays.

-THOMPSON.

In this country, the operations of nature appear to have been carried on, on a large scale, and with a bolder hand, than elsewhere; and in consequence, the whole is distinguished by a peculiar magnificence. Even the plain of Quito, which may be considered as the base of the Andes, is more elevated above the sea than the summits of many European mountains. In

\* Pronounced *Que-to*, the *i* in all European languages being sound as *ee*.

different places the Andes rise more than one third above the famous Peak of Teneriffe, the highest land in the ancient hemisphere. Their cloud-enveloped summits, though exposed to the rays of the sun in the torrid zone, are covered with eternal snows, and below them the storm is seen to burst, and the exploring traveller hears the thunder roll, and sees the lightnings dart beneath his feet.

Throughout the whole of the range of these extensive mountains, as far as they have been explored, there is a certain boundary, above which the snow never melts, which boundary in the torrid zone, has been ascertained to be 14,600 feet, or nearly three miles, above the level of the South Sea.

The ascent to the plain of Quito, on which stands Chimborazo, Cotopaxi, Pichincha, &c. is thus described by Don Juan de Ulloa :

“ The ruggedness of the road from Taraguaga, leading up the mountain, is not easily described. The declivity is so great, in some parts, that the mules can scarcely keep their footing ; and, in others, the acclivity is equally difficult. The trouble of sending people before to mend the road, the pain arising from the many falls and bruises, and the being constantly wet to the skin, might be supported ; but these inconveniences are augmented by the sight of such frightful precipices, and deep abysses, as excite constant terror. The road, in some places, is so steep, and yet so narrow, that the mules are obliged to slide down, without making any use whatever of their feet. On one side of the rider, in this situation, rises an eminence of many hundred yards ; and, on the other is an abyss of equal depth ; so that, if he should give the least check to his mule, and destroy the equilibrium, both must inevitably perish.

“ Having travelled nine days in this manner, slowly winding along the sides of the mountains, we began to find the whole country covered with a hoar-frost ; and a hut, in which we reposed, had ice in it. At length, after a perilous journey of fifteen days, we arrived upon a plain, at the extremity of which, stands the city of Quito, the capital of one of the most charming regions in the world. Here, in the centre of the torrid zone, the heat is not only very tolerable, but, in some places, the cold is even painful. Here the inhabitants enjoy the temperature and advantages of perpetual spring ; the fields being constantly covered with verdure, and enamelled with flowers of the most lively colours. However, although this beautiful region is more elevated than any other country in the world, and it employs so many days of painful journey in the ascent, it is itself overlooked by tremendous mountains ; their

sides being covered with snow, while their summits are flaming with volcanoes. These mountains seem piled one upon the other, and to rise with great boldness to an astonishing height. However, at a determined point above the surface of the sea, the congelation is found at the same height in all the mountains. Those parts which are not subject to a continual frost, have here and there growing upon them a species of rush, resembling the broom, but much softer and more flexible. Towards the extremity of the part where the rush grows, and the cold begins to increase, is found a vegetable with a round bulbous head. Higher still, the earth is bare of vegetation, and seems covered with eternal snow. The most remarkable of the Andes, are the mountains of Chimborazo, Cotopaxi, and Pichincha."

#### CHIMBORAZO, THE MOST LOFTY OF THE ANDES.

This is the most majestic of the Andes, and has a circular summit, 22,000 feet, or above four miles high. On the shores of the South Sea, after the long rains of winter, when the mistiness of the air has suddenly diminished, Chimborazo appears like a cloud in the horizon. It detaches itself from the neighbouring summits, and raises its lofty head over the whole chain of the Andes. Travellers, who have approached the summits of Mont Blanc and Mont Rose, are alone capable of feeling the effect of such vast, majestic, and solemn scenery.

The bulk of Chimborazo is so enormous, that the part which the eye embraces at once, near the limit of the snows, is 22,968 feet, or four miles and a third in breadth. The extreme rarity of the strata of air, across which, the summits of the Andes are seen, contributes greatly to the splendour of the snow, and the magical effect of its reflection. Under the tropics, at a height of 16,400 feet, upwards of three miles, the azure vault of the heavens appears of an indigo tint; while, in so pure and transparent an atmosphere, the outlines of the mountains detach themselves from the sky, and produce an effect at once sublime, awful, and profoundly impressive.

With the exception of the newly-discovered Asiatic mountains, Chimborazo is the highest known mountain in the world. Humboldt, Bonpland, and Montufar, were persevering enough to approach within 1600 feet of the summit of this mighty king of mountains. Being aided in their ascent by a train of volcanic rocks, destitute of snow, they thus attained the amazing height of nearly four miles above the level of the sea; and the former of these naturalists is persuaded, *that they might have reached the highest summit, had it not*

been for the intervention of a great crevice, or gap, which they were unable to cross. They were, therefore, obliged to descend, after experiencing great inconveniences, and many unpleasant sensations. For three or four days, even after their return into the plain, they were not free from sickness, and an uncomfortable feeling, owing, as they suppose, to the vast proportion of oxygen in the atmosphere above. Long before they reached the above surprising height, they had been abandoned by their guides, the Indians, who had taken alarm, and were fearful of their lives. So great was the fall of snow on their return, that they could scarcely recognize each other, and they all suffered dreadfully from the intenseness of the cold.

A great number of Spaniards formerly perished in crossing the vast and dangerous deserts which lie on the declivity of Chimborazo; being now, however, better acquainted with them, such misfortunes seldom occur, especially as very few take this route, unless there be a prospect of calm and serene weather.

#### COTOPAXI.

This mountain is the loftiest of those volcanoes of the Andes which, at recent epochs, have undergone eruptions. Notwithstanding it lies near the Equator, its summits are covered with perpetual snows. The absolute height of Cotopaxi, is 18,876 feet, or three miles and a half, consequently it is 2,622 feet, or half a mile, higher than Vesuvius would be, were that mountain placed on the top of the Peak of Teneriffe! Cotopaxi is the most mischievous of the volcanoes in the kingdom of Quito, and its explosions are the most frequent and disastrous. The masses of scorix, and the pieces of rock, thrown out of this volcano, cover a surface of several square leagues, and would form, were they heaped together, a prodigious mountain. In 1738, the flames of Cotopaxi rose 3000 feet, or upwards of half a mile, above the brink of the crater. In 1744, the roarings of this volcano were heard at the distance of six hundred miles. On the 4th of April, 1768, the quantity of ashes ejected at the mouth of Cotopaxi was so great, that it was dark till three in the afternoon. The explosion which took place in 1803, was preceded by the sudden melting of the snows which covered the mountain. For twenty years before, no smoke or vapour, that could be perceived, had issued from the crater; but in a single night, the subterraneous fires became *so active*, that at sun-rise, the external walls of the cone, heated to a very considerable temperature, appeared naked, and of the dark colour which is peculiar to vitrified scorix. "A

port of Guayquil," observes Humboldt, "fifty-two leagues distant, in a straight line from the crater, we heard, day and night, the noise of this volcano, like continued discharges of artillery; and we distinguished these tremendous sounds even in the Pacific Ocean."

The form of Cotopaxi is the most beautiful and regular of the colossal summits of the high Andes. It is a perfect cone, rich, covered with a perpetual layer of snow, shines with dazzling splendour at the setting of the sun, and detaches itself in the most picturesque manner from the azure vault above. This covering of snow conceals from the eye of the observer even the smallest inequalities of the soil; no point of rock, no rocky mass, penetrating this coat of ice, or breaking the regularity of the figure of the cone.

## MOUNT ETNA.

[See Plate, No. 2.]

The majestic Etna, which the ancients considered, not unreasonably, as one of the highest mountains in the world, and the summit of which they believed that Deucalion and Pyrrha sought refuge, to save themselves from the universal deluge, is situated on the plain of Catania, in Sicily.

Its elevation above the level of the sea has been estimated 10,963 feet, upwards of two miles. On clear days it is distinctly seen from Valetta, the capital of Malta, a distance of 100 miles. It is incomparably the largest burning mountain in Europe.

From its sides other mountains arise, which, of different ages, have been ejected in single masses from its enormous crater. The most extensive lavas of Vesuvius do not exceed seven miles in length, while those of Etna extend fifteen, twenty, and some even to thirty miles. The crater of Etna is seldom less than a mile in circuit, and sometimes is two or three miles; but the circumference of the Vesuvian crater never more than half a mile, even when widely distended, in the most destructive conflagrations. Lastly, the earthquakes occasioned by these adjacent volcanoes, their eruptions, their showers of ignited stones, and the destruction and desolation which they create, are severally proportionate to their respective dimensions.

A journey up Etna is considered as an enterprise of importance, as well from the difficulty of the route, as from the distance, it being thirty miles from Catania to the summit of the mountain. Its gigantic bulk, its sublime elevation, and the extensive, varied, and grand prospects which are presented from its summit, have, however, induced the curious in every age to ascend and examine it; and not a few have transmitted,

through the press, the observations which they have made during their arduous journey. From its vast base, it rises like a pyramid to the perpendicular height of two miles, by an acclivity nearly equal on all sides, forming with the horizon an angle of about fifteen degrees, which becomes greater on approaching the crater; but the inclination of the steepest part of the cone no where exceeds an angle of forty-five degrees. This prodigious volcano may be compared to a forge, which, in proportion to the violence of the fire, to the nature of the fossil matters on which it acts, and of the gases which urge and set it in motion, produces, destroys, and re-produces, a variety of forms.

The top of Etna being above the common region of vapours, the heavens, at this elevation, appear with an unusual splendour. Brydone and his company observed, as they ascended in the night, that the number of the stars seemed to be infinitely increased, and the light of each was brighter than usual. The whiteness of the milky way was like a pure flame which spread across the heavens; and, with the naked eye, they could observe clusters of stars which were invisible from below. They likewise noticed several of those meteors called falling stars, which appeared as much elevated here, as when viewed from the plain beneath.

This single mountain contains an epitome of the different climates throughout the world, presenting at once all the seasons of the year, and all the varieties of produce. It is accordingly divided into three distinct zones or regions, which may be distinguished as the torrid, temperate, and frigid, but which are known by the names of the cultivated region, the woody or temperate region, and the frigid or desert region. The former of these extends through twelve miles of the ascent towards the summit, and is almost incredibly abundant in pastures and fruit-trees of every description. It is covered with towns, villages, and monasteries; and the number of inhabitants spread over its surface is estimated at 120,000. In ascending to the woody or temperate region, the scene changes; it is a new climate, a new creation. Below, the heat is suffocating; but here, the air is mild and fresh. The turf is covered with aromatic plants; and the gulfs, which formerly ejected torrents of fire, are changed into woody valleys. Than this, nothing can be more picturesque, the inequality of the soil displaying every moment some variety of scene: here, the ash and flowering thorns form domes of verdure; and there, the chesnut-trees grow to an enormous size. The one called *castagno di cento cavalli*, according to Brydone and Glover, has a circumference of 204 feet. Many of the

oaks also are of a prodigious size. Mr. Swinburne measured one which had a circumference of 28 feet. The last, or desert region, commences more than a mile above the level of the sea. The lower part is covered with snow in winter only; but on the upper half of this sterile district, the snows continually lie.

The upper part, which may properly be called the cone of Etna, is in a right line, about a mile, or somewhat more, in ascent. It is described by Sir William Hamilton as a little mountain, about a quarter of a mile perpendicular, and very steep, situated in the middle of a gently-inclined plane, about nine miles in circumference. The cavity was, according to his perception, shaped like a funnel, diminishing until it terminated in a point, and having an outer circumference of two miles and a half round.—Great changes have since taken place. Spallanzani also reached the edge of the crater, and found it to be an oval of about a mile and a half in circuit, having its edges in many places indented by projecting lavas or scoriæ. The bottom was nearly a horizontal plane, about two-thirds of a mile in circumference; hence issued a constant column of smoke, and hence, as well as from the sides, arose several streams of smoke resembling thin clouds. Within the aperture, a liquid ignited matter was clearly seen, constantly undulating, boiling, rising, and falling, without spreading over the bottom. This was, no doubt, the melted lava which had issued from the bottom of the gulf. Neither of the above travellers, nor Brydone, dared to venture down the crater, which they found too hot; but M. D'Orville, more adventurous, by the means of ropes, which two or three men held at a distance, descended as far as possible. His view was, in a great measure, intercepted by the small flames and smoke; but in the centre, he saw a mass of matter which rose in the shape of a cone to the height of about sixty feet.

On the vastness and beauty of the prospect, from the summit of Etna, all authors agree; and Spallanzani observes, that there is not, perhaps, any elevated region on the whole globe which offers at one view so fine an extent of the sea and land. M. Houel was stationed there at sunrise, when the horizon was clear, and without a single cloud. The coast of Calabria was, he says, undistinguishable from the adjoining sea; but in a short time, a fiery radiance began to appear from behind those Italian hills, which bounded the eastern part of the prospect. The fleecy clouds which generally appear early in the morning, were tinged with purple; the atmosphere became strongly illuminated, and, reflecting the rays of the sun, seemed to be filled with a bright refulgence of flame. Although the



heavens were thus enlightened, the sea still retained its dark azure, and the fields and forest did not yet reflect the rays of the sun. The gradual rising of this luminary, however, soon diffused light over the hills which lie below the peak of Etna. This last stood like an island in the midst of the ocean, with luminous points multiplying every moment around, and spreading over a wider extent with the greatest rapidity. It was, he said, as if the world had been observed suddenly to spring from the night of non-existence.

The most sublime object, however, which the summit of Etna presents, is the immense mass of its own colossal body. Its upper region exhibits rough and craggy cliffs, rising perpendicularly, fearful to the view, and surrounded by an assemblage of fugitive clouds, to increase the wild variety of the scene. Amid the multitude of woods in the middle or temperate region, are numerous mountains, which, in any other situation, would appear of a gigantic size, but which, compared to Etna, are mere mole-hills. Lastly, the eye contemplates with admiration the lower region, the most extensive of the three, adorned with elegant villas and castles, verdant hills and flowery fields, and terminated by the extensive coast, where to the south, stands the beautiful city of Catania, to which the waves of the neighbouring sea serve as a mirror.

Etna has been celebrated as a volcano from the remotest antiquity. Eruptions are recorded by Diodorus Siculus, as having happened 500 years before the Trojan war, or 1698 years before the Christian era.

In 1669, the torrent of burning lava inundated a space fourteen miles in length, and four in breadth, burying beneath it part of Catania, till at length it precipitated itself into the sea. For several months before the lava broke out, the old mouth, or great crater of the summit, was observed to send forth much smoke and flame, and the top had fallen in, so that the mountain was much lowered.

Eighteen days before, the sky was very thick and dark, with thunder, lightning, frequent concussions of the earth, and dreadful subterraneous bellowings. On the 11th of March, about sunset, an immense gulf opened in the mountain, into which, when stones were thrown, they could not be heard to strike the bottom. Ignited rocks, fifteen feet in length, were hurled to the distance of a mile; while others of a smaller size were carried three miles. During the night, the red hot lava burst out of a vineyard twenty miles below the great crater, and ascended into the air to a considerable height. In its course, it destroyed 5000 habitations, and filled up a lake several fathoms deep. It shortly after reached Catania, and

the walls, whence it ran for a considerable length into the sea, forming a safe and beautiful harbour, which was, however, soon filled up by a similar torrent of inflamed matter. In the stream, the hideous deformity of which, devoid of ornament, still disfigures the south and western borders of the city, and on which, part of the noble modern city is built. In 1794, showers of scorix and sand, which, after a lapse of many years, followed this eruption, formed a mountain, called *Rosso*, having a base of about two miles, and a particular height of 750 feet. On the 25th, the whole mountain, even to the most elevated peak, was agitated by a tremendous earthquake. The highest crater of Etna, which was the loftiest parts of the mountain, then sunk into the sea, and in the place which it had occupied, there appeared nothing but a wide gulf, more than a mile in diameter, from which issued enormous quantities of smoke, ashes, and stones.

809, twelve new craters opened about half way down the mountain, and threw out rivers of burning lava, by which the adjacent estates were covered to the depth of thirty or forty feet, and during three or four successive nights, a very large quantity of red hot lava was distinctly seen, in its whole extent, descending down from the mountain.

811, several mouths opened on the eastern side of the mountain: being nearly in the same line, and at equal distances, they presented to the view a striking spectacle,—torrents of burning matter, discharged with the greatest force from the interior of the volcano, illuminated the horizon to a great extent. An immense quantity of matter, which was discharged to considerable distances, was discharged from these craters, the largest of which continued for several months to pour out torrents of fire. Even at the time when it had the appearance of being choaked, there suddenly issued from it a shower of ashes, which descended, in the form of rain, on the city of Catania and its environs, as well as on the fields situated at a very considerable distance. A roaring, resembling the noise of a sea in the midst of a tempest, was heard to proceed from the interior of the mountain; and this sound, accompanied from time to time by dreadful explosions, resembling the noise of a cannon, re-echoed through the valleys and spread terror on every side.

#### MOUNT VESUVIUS, NEAR NAPLES.

[See Plate, No. 3.]

This celebrated volcano, which has for so many ages attracted the attention of mankind, and the desolating erup-

tions of which, have been so often and so fatally experienced, is distant, in an eastern direction, about seven miles from Naples. It rises, insulated, upon a vast and well-cultivated plain, presenting two summits on the same base, in which particular it resembles Mount Parnassus. One of these, La Somma, is generally agreed to have been the Vesuvius of Strabo and the ancients; the other, having the greatest elevation, is the mouth of the volcano, which almost constantly emits smoke. Its height above the level of the sea, is 3900 feet, and it may be ascended by three different routes, which are all very steep and difficult, from the conical form of the mountain, and the loose ashes which slip from under the feet: still, from the base to the summit, the distance is not more than three Italian miles. The circumference of the platform on the top, is 5,024 feet, or nearly a mile. Thence may be seen Portici, Capræa, Ischia, Pausilippo, and the whole coast of the gulf of Naples, bordered with orange trees: the prospect is that of Paradise seen from the infernal regions.

On approaching the mountain, its aspect does not convey any impression of terror, nor is it gloomy, being cultivated for more than two-thirds of its height, and having its brown top alone barren. There all verdure ceases; yet, when it appears covered with clouds, which sometimes encompass its middle only, this circumstance rather adds to, than detracts from, the magnificence of the spectacle. Upon the lavas which the volcano long ago ejected, and which, like great furrows, extend into the plain, and to the sea, are built houses, villages, and towns. Gardens, vineyards, and cultivated fields, surround them; but a sentiment of sorrow, blended with apprehensions about the future, arises on the recollection that, beneath a soil so fruitful and so smiling, lie edifices, gardens, and whole towns swallowed up. Portici rests upon Herculaneum; its environs upon Resina; and at a little distance is Pompeii, in the streets of which, after more than seventeen centuries of non-existence, the astonished traveller now walks. After a long interval of repose, in the first year of the reign of Titus, (the seventy-ninth of the Christian era,) the volcano suddenly broke out, ejecting thick clouds of ashes and pumice stones, beneath which Herculaneum, Stabia, and Pompeii, were completely buried. This eruption was fatal to the elder Pliny, the historian, who fell a victim to his humanity and love of science. Even at this day, in speaking of Vesuvius, the remembrance of his untimely death excites a melancholy regret. *All the coast to the east of the gulf of Naples was, on the above occasion, ravaged and destroyed, presenting nothing but a long succession of ejected matters from Herculaneum to Stabia.*

The destruction did not extend to the western part, but stopped at Naples, which suffered comparatively little.

Thirty-eight eruptions of Vesuvius are recorded in history up to the year 1806. That of 1779 has been described by Sir William Hamilton, as among the most remarkable from its extraordinary and terrific appearance. During the whole of July, the mountain was in a state of considerable fermentation, subterraneous explosions, and rumbling noises being heard, and quantities of smoke thrown up with great violence, sometimes with red hot stones, scoriæ, and ashes. On the 5th of August, the volcano was greatly agitated, a white sulphureous smoke, apparently four times the height and size of the volcano itself, issuing from the crater, at the same time that vast quantities of stones, &c., were thrown up to the supposed height of 2000 feet. The liquid lava, having cleared the rim of the crater, flowed down the side of the mountain to the distance of four miles. The air was darkened by showers of reddish ashes, blended with long filaments of a vitrified matter resembling glass.

On the 7th, at midnight, a fountain of fire shot up from the crater to an incredible height, casting so bright a light, that the smallest objects were clearly distinguishable at any place within six miles of the volcano. On the following evening, after a tremendous explosion, which broke the windows of the houses at Portici, another fountain of liquid fire rose to the surprising height of 10,000 feet, (nearly two miles,) while puffs of the blackest smoke accompanied the red hot lava, interrupting its splendid brightness here and there by patches of the darkest hue. The lava was partly directed by the wind towards Ottainano, on which so thick a shower of ashes, blended with vast pieces of scoriæ, fell, that, had it been of longer continuance, that town would have shared the fate of Pompeii. It took fire in several places; and had there been much wind, the inhabitants would have been burned in their houses, it being impossible for them to stir out. To add to the horror of the scene, incessant volcanic lightning darted through the black cloud that surrounded them, while the sulphureous smell and heat would scarcely allow them to draw their breath. In this dreadful state they remained nearly half an hour. The remaining part of the lava, still red hot and liquid, fell on the top of Vesuvius, and covered its whole cone, together with that of La Somma, and the valley between them, thus forming one complete body of fire, which could not be less than two miles and a half in breadth, and casting a heat to the distance of at least six miles around.

*The eruption of 1794, is accurately described by the above*

writer; but has not an equal degree of interest with the one cited above. We subjoin a few particulars, among which is a circumstance well deserving notice, as it leads to an estimate of the degree of heat in volcanoes. Sir William says, that, although the town of Torre del Greco was instantly surrounded with red hot lava, the inhabitants saved themselves by coming out of the tops of their houses on the following day. It is evident, observes Mr. Kirwan, that if this lava had been hot enough to melt even the most fusible stones, these persons must have been suffocated.

This eruption happened on the 15th of June, at ten o'clock at night, and was announced by a shock of an earthquake, which was distinctly felt at Naples. At the same moment, a fountain of bright fire, attended with a very black smoke, and a loud report, was seen to issue, and rise to a considerable height, from about the middle of the cone of Vesuvius. It was hastily succeeded by other fountains, fifteen of which were counted, all in a direct line, tending for the space of about a mile and a half downward, towards the towns of Resina and Torre del Greco. This fiery scene—this great operation of nature—was accompanied by the loudest thunder, the incessant reports of which, like those of a numerous heavy artillery, were attended by a continued hollow murmur, similar to that of the roaring of the ocean during a violent storm. Another blowing noise resembled that of the ascent of a large flight of rockets. The houses at Naples were for several hours in a constant tremour, the doors and windows shaking and rattling incessantly, and the bells ringing. At this awful moment the sky, from a bright full-moon, and star-light, became obscured; the moon seemed eclipsed, and was soon lost in obscurity. The murmur of the prayers and lamentations of a numerous population, forming various processions, and parading the streets, added to the horrors of the scene.

On the following day, a new mouth was opened on the opposite side of the mountain, facing the town of Ottainano: from this aperture a considerable stream of lava issued, and ran with great velocity through a wood which it burnt; but stopped, after having run about three miles in a few hours, before it reached the vineyards and cultivated lands. The lava which had flowed from several new mouths on the south side of the mountain, reached the sea, into which it ran, after having overwhelmed, burnt, and destroyed the greater part of Torre del Greco, through the centre of which it took its course. This town contained about 18,000 inhabitants, all of whom escaped, with the exception of about fifteen, who through age or infirmity, were overwhelmed in their houses by the lava.

Its rapid progress was such, that the goods and effects were entirely abandoned.

It was ascertained sometime after, that a considerable part of the crater had fallen in, so as to have given a great extension to the mouth of Vesuvius, which was conjectured to be nearly two miles in circumference. This sinking of the crater was chiefly on the west side, opposite Naples, and, in all probability, occurred early in the morning of the 18th, when a violent shock of an earthquake was felt at Resina, and other places situated at the foot of the volcano. The clouds of smoke which issued from the now widely extended mouth of Vesuvius, were of such a density as to appear to force their passage with the utmost difficulty. One cloud heaped itself on another, and, succeeding each other incessantly, they formed in a few hours such a gigantic and elevated column, of the darkest hue, over the mountain, as seemed to threaten Naples with immediate destruction, it having at one time been bent over the city, and appearing to be much too massive and ponderous to remain long suspended in the air.

From the above time till 1804, Vesuvius remained in a state of almost constant tranquillity. Symptoms of a fresh eruption had manifested themselves for several months, when at length on the night of the 11th of August, a deep roaring was heard at the Hermitage of Salvador, and the places adjacent to the mountain, accompanied by shocks of an earthquake, which were sensibly felt at Resina. On the following morning, at noon, a thick black smoke rose from the mouth of the crater, which, dilating prodigiously, covered the whole volcano. In the evening, loud explosions were heard; and at Naples, a column of fire was seen to rise from the aperture, carrying up stones in a state of complete ignition, which fell again into the crater. The noise by which these igneous explosions were accompanied, resembled the roaring of the most dreadful tempest, and the whistling of the most furious winds; while the celerity, with which the substances were ejected, was such, that the first emission had not terminated, when it was succeeded by a second. Small monticules were at this time formed of a fluid matter, resembling a vitreous paste of a red colour, which flowed from the mouth of the crater; and these became more considerable in proportion as the matter accumulated.

In this state, the eruption continued for several days, the fire being equally intense, with frequent and dreadful noises. On the 28th, amid these fearful symptoms, another aperture, ejecting fire and stones, situated behind the crater, was seen from Naples. The burning mass of lava which escaped from the crater on the following day, was distinguished from Torre

del Greco, having the appearance of a vitreous fluid, and advancing towards the base of the mountain between the south and south-west. It reached the base on the 30th, having flowed from the aperture, in less than twenty-four hours, a distance of 3,053 feet, while its mean breadth appeared to be about 350, but at the base 869 feet. In its course, it divided into four branches, and finally reached a spot called the Guide's Retreat. Its entire progress to this point was more than a mile, so that, taking a mean proportion, this lava flowed at the rate of eighty-six feet an hour.

At the time of this eruption, Kotzebue was at Naples. Vesuvius lay opposite to his window, and when it was dark, he could clearly perceive in what manner the masses of fire rolled down the mountain. As long as any glimmering of light remained, that part of the mountain was to be seen, on the declivity of which, the lava formed a straight but oblique line. As soon, however, as it was perfectly dark, and the mountain itself had vanished from the eye, it seemed as if a comet with a long tail stood in the sky. The spectacle was awful and grand!

He ascended the mountain on the morning succeeding the opening of a new gulf, and approached the crater as nearly as prudence would allow. From its centre, ascended the sulphureous yellow cone, which the eruption of this year had formed; on the other side, a thick smoke perpetually arose from the abyss opened during the preceding night. The side of the crater opposite to him, which rose considerably higher than that on which he stood, afforded a singular aspect; for it was covered with little pillars of smoke, which burst forth from it, and had some resemblance to extinguished lights. The air over the crater was actually embodied, and was clearly to be seen in a tremulous motion. Below, it boiled and roared dreadfully, like the most violent hurricane; but occasionally a sudden deadly stillness ensued for some moments, after which, the roaring recommenced with double vehemence, and the smoke burst forth in thicker and blacker clouds. It was, he observes, as if the spirit of the mountain had suddenly tried to stop the gulf, while the flames indignantly refused to endure the confinement.

It is remarkable, that the great eruption of 1805, happened on the 12th of August, within a day of that of the preceding year. Subterraneous noises had been previously heard, and a general apprehension of some violent commotion prevailing, the inhabitants of Torre del Greco and Annunciata, had left their homes, through the apprehension of a shower of fire and ashes, similar to that which buried Pompeii. The

stream of lava took the same course with that of 1794, described above, one of the arms following the direction of the great road, and rolling towards the sea. The stream soon divided again, and spreading itself with an increased celerity, swept away many houses and the finest plantations. The other branch, at first, took the direction of Portici, which was threatened; but turning and joining the preceding one, formed a sort of islet of boiling lava in the middle, both ending in the sea, and composing a promontory of volcanic matters. In the space of twenty minutes, the whole extent of ground which the lava occupied, was on fire, offering a terrible yet singular spectacle, as the burning trees presented the aspect of white flames, in contrast with those of the volcanic matters, which were red. The lava swept along with it enormous masses of whatever occurred in its course, and, on its reaching the sea, nothing was to be seen or heard for a great extent of shore, beside the boiling and hissing arising from the conflict of the water and fire.

It remains now to introduce a slight notice of the eruption of 1806, which, without any sensible indication, took place on the evening of the 31st of May, when a bright flame rose from the mountain to the height of about 600 feet, sinking and rising alternately, and affording so clear a light, that a letter might have been read at the distance of a league around the mountain. On the following morning, without any earthquake preceding, as had been customary, the volcano began to eject inflamed substances from three new mouths, pretty near to each other, and about 650 feet from the summit. The lava took the direction of Torre del Greco and Annunciada, approaching Portici, on the road leading from Naples to Pompeii. Throughout the whole of the second of June, a noise was heard, resembling that of two armies engaged, when the discharges of artillery and musketry are very brisk. The current of lava now resembled a wall of glass in a state of fusion, sparks and flashes issuing from it from time to time, with a powerful detonation. Vines, trees, houses,—whatever objects, in short, it encountered on its way, were instantly overthrown or destroyed. In one part, where it met with the resistance of a wall, it formed a cascade of fire. In a few days, Portici, Resina, and Torre del Greco, were covered with ashes thrown out by the volcano; and, on the ninth, the two former places were deluged with a thick black rain, consisting of a species of mud filled with sulphureous particles. On the first of July, the ancient crater had wholly disappeared, being filled with ashes and lava, and a new one was formed in the eastern part of the mountain, about 600 feet in



depth, and having about the same width at the opening. Several persons, on the above day, descended about half way down this new mouth, and remained half an hour very near the flames, admiring the spectacle presented by the liquid lava, which bubbled up at the bottom of the crater, like the fused matter in a glass-house. This eruption continued until September, made great ravages, and was considered as one of the most terrible that had occurred in the memory of the inhabitants.

#### MOUNT HECLA, IN ICELAND.

On proceeding along the southern coast of Iceland, and at an inconsiderable distance from Skaalholt, this mountain, with its three summits, presents itself to the view. Its height is five thousand feet, or nearly a mile above the level of the sea. It is not a promontory, but lies about four miles inland. It is neither so elevated nor so picturesque as several of the surrounding Icelandic mountains; but has been more noticed than many other volcanoes of an equal extent, partly through the frequency of its eruptions, and partly from its situation, which exposes it to the view of many ships sailing to Greenland and North America. The surrounding territory has been so devastated by these eruptions, that it has been deserted.

The natives asserted that it was impossible to ascend the mountain, on account of the great number of dangerous bogs, which, according to them, are constantly emitting sulphureous flames, and exhaling smoke; while the more elevated summit in the centre is covered with boiling springs and large craters, which continually propel fire and smoke. To the south and west, the environs present the most afflicting results of frequent eruptions, the finest part of the territory being covered by torrents of melted stone, sand, ashes, and other volcanic matter; notwithstanding which, between the sinuosities of the lava in different parts, some portion of meadows, walls, and broken hedges may be observed. The devastation is still greater on the north and east sides; which present dreadful traces of the ruin of the country and its habitations. Neither plants nor grass are to be met with, to the extent of two leagues round the mountain, in consequence of the soil being covered with stones and lava; and in some parts, where the subterraneous fire has broken out a second time, or where the matter which was not entirely consumed has again become ignited, the fire has contributed to form small red and black hillocks and eminences, from scorïæ, pumice-stones, and ashes. The nearer *the mountain*, the larger are these hillocks, and there are some *of them*, the summits of which, form a circular hollow, where

the subterraneous fire ejects the matter. On approaching Hecla, the ground becomes almost impassable, particularly near the higher branches of lava thrown from the volcano. Round the latter, is a mountain of lava, consisting of large fused stones, from forty to seventy feet high, and in the form of a rampart or wall. These stones are detached, and chiefly covered with moss, while between them are very deep holes, so that the ascent on the western side requires great circumspection. The rocks are completely reduced to pumice, dispersed in thin horizontal layers, and fractured in every direction, from which some idea may be formed of the intensity of the fire that has acted on them.

Sir Joseph Banks, Dr. Solander, Dr. James Lind of Edinburgh, and Dr. Van Troil, a Swede, were the earliest adventurous travellers who ascended to the summit of Mount Hecla. This was in 1772; and the attempt was facilitated by a preceding eruption in 1766, which had greatly diminished the steepness and difficulty of the ascent. On their first landing, they found a tract of land sixty or seventy miles in extent, entirely ruined by lava, which appeared to have been in a state of complete liquefaction. To accomplish their undertaking, they had to travel from three hundred to three hundred and sixty miles over uninterrupted tracts of lava. In ascending, they were obliged to quit their horses at the first opening from which the fire had burst:—a spot, which they describe as presenting lofty glazed walls and high glazed cliffs, differing from any thing they had ever seen before. At another opening above, they fancied they discerned the effects of boiling water; and not far from thence, the mountain, with the exception of some bare spots, was covered with snow. This difference of aspect, they soon perceived to be occasioned by the hot vapour ascending from the mountain. The higher they proceeded, the larger these spots became; and, about two hundred yards below the summit, a hole about a yard and a half in diameter, was observed, whence issued so hot a stream, that they could not measure the degree of heat with a thermometer. The cold now began to be very intense. Fahrenheit's thermometer, which at the foot of the mountain was at 54, fell to 24; while the wind became so violent, that they were sometimes obliged to lie down, from a dread of being blown into the most dreadful precipices. On the summit itself, they experienced, at one and the same time, a high degree of heat and cold; for, in the air, Fahrenheit's thermometer constantly stood at 24, but when placed on the ground, it rose to 153.

Messrs. Olafsen and Povelsen, two naturalists, whose travels in Iceland were undertaken by order of his Danish Ma-

jesty, after a fatiguing journey up several small slopes, which occurred at intervals, and seven of which they had to pass, at length reached the summit of Mount Hecla at midnight. It was as light as at noon-day, so that they had a view of an immense extent, but could perceive nothing but ice : neither fissures, streams of water, boiling springs, smoke, nor fire, were apparent. They surveyed the glaciers in the eastern part, and in the distance, saw the high and square mountain of Hærdabreid, an ancient volcano, which appeared like a large castle.

Sir G. S. Mackenzie, in his recent travels in Iceland, ascended Mount Hecla; and from his account, we extract the following interesting particulars. In proceeding to the southern extremity of the mountain, he descended, by a dangerous path, into a valley, having a small lake in one corner, and the opposite extremity bounded by a perpendicular face of rock, resembling, in its broken and rugged appearance, a stream of lava. While advancing, the sun suddenly broke through the clouds, and the brilliant reflection of his beams, from different parts of this supposed lava, as if from a surface of glass, delighted our traveller by the instantaneous conviction that he had now attained one of the principal objects connected with the plan of his expedition to Iceland. He hastened to the spot, and all his wishes were fully accomplished in the examination of an object which greatly exceeded the expectations he had formed. On ascending one of the abrupt pinnacles, which rose out of this extraordinary mass of rock, he beheld a region, the desolation of which can scarcely be paralleled. Fantastic groups of hills, craters, and lava, leading the eye to distant snow-crowned jockuls, (inferior mountains,) the mist rising from a water-fall; lakes, embosomed among bare bleak mountains; an awful profound silence; lowering clouds; marks all around of the furious action of the most destructive of elements; all combined to impress the soul with sensations of dread and wonder. The longer himself and his companions contemplated this scene, the more unable they were to turn their eyes from it; and a considerable time elapsed, before they could bring themselves to attend to the business which had tempted them to enter so frightful a district of the country.

Having proceeded a considerable distance along the edge of a stream of lava, a narrow part of which they crossed, they gained the foot of the south end of Mount Hecla. While, in ascending, they had to pass over rugged lava, they experienced no great difficulty in advancing; but when they reached the *steepest part* of the mountain, which was covered with loose

slags, they sometimes lost at one step by the yielding of these, a space which had been gained by several.

Having passed a number of fissures, by leaping across some, and stepping along masses of slags which lay over others, they at length reached the summit of the first peak. The clouds now became so thick, that they began to despair of being able to proceed any further : it was, indeed, dangerous even to move ; for the peak consists of a very narrow ridge of slags, not more than two feet broad, having a precipice on each side, several hundred feet in depth. One of these precipices forms the side of a vast hollow, which seems to have been one of the craters. At length, the sky cleared a little, and enabled them to discover a ridge below, which seemed to connect the peak they had ascended with the middle or principal one. They lost no time in availing themselves of this opportunity, and, by balancing themselves like rope-dancers, succeeded in passing along a ridge of slags, so narrow that there was scarcely room for their feet. After a short, but very steep, ascent, they gained the highest part of this celebrated mountain.

Its earliest eruption is said to have happened in 1004, since which time upwards of twenty have occurred. That of 1693 was the most dreadful, and occasioned terrible devastations, the ashes having been thrown over the island in every direction, to the distance of more than one hundred miles. In 1723, a fire broke out among the surrounding lava ; and also in that to the west of the volcano, in 1754, which lasted for three days. There has not been any eruption of lava since 1766 ; but for some years after, flames issued from the volcano.

#### THE GEYSERS.

[See Plate, No. 4.]

These celebrated fountains, or hot spouting water springs, being nearly connected with the operations of subterraneous fire, so visible in every part of Iceland, may be properly introduced after the description of Mount Hecla, given above.

They are seldom very near the volcanoes, but are dispersed over the whole country, and are even to be found on the summits of several of the ice mountains. The largest and most remarkable of these, is situated in a large field, about sixteen miles to the north of Skaalholt. At a great distance from it, on one side, are high mountains covered with ice, and on the other, Hecla is seen rising above the clouds, while opposite to it, is a ridge of rocks, at the foot of which, water from time to time rushes forth. At the distance of a mile and a half, a loud *roaring noise is heard like that of a torrent precipitated from*

stupendous rocks, each ejection being accompanied by violent subterraneous detonations. The depth of the opening from which the water rushes, has not been ascertained, but some seconds elapse before a stone thrown in, reaches the surface. The Danish traveller, Olafsen, asserts, that the water rises as high as sixty fathoms; while Van Troil estimates the highest jet at not more than sixty feet: the latter allows, however, that the jets may be more elevated, particularly in bad weather. The greatness of the explosive power is evinced by its not only preventing stones thrown in from sinking, but even forcing them up to a very great height, together with the water, and splitting the pebbles into a thousand pieces. The heat was found by Van Troil to be two hundred and twelve degrees of Fahrenheit, the boiling point. The edges of the pipe or basin are covered by a coarse stalactitic rind, and the water has been found to have a petrifying quality. The opening is perfectly circular, in diameter nineteen feet, and forms above, on the surface of the ground, a basin fifty-nine feet in diameter, the edge of which is nine feet above the orifice or hole.

In speaking of the Geysers, or hot spouting springs, Horrebøw observes, that if you fill a bottle at one of them, the water it contains will boil three or four times, at the same time with the water in the well. The inhabitants boil their meat in it, by putting the meat in a vessel of cold water, which they place in the hot spring.

Sir G. S. Mackenzie, whose recent travels in Iceland we have already cited, visited the Geysers at a season favourable to his observations, the latter end of July. He found the cultivation of the surrounding territory much higher than might have been inferred from the idea generally entertained of the barren and unproductive state of Iceland. All the flat ground in that quarter of the island was swampy, but not so much so as to impede the progress of the party, who, having passed several hot springs to the eastward of Skaalholt, and others rising among the low hills they had left to the right, in proceeding to the great Geyser, came to a farm-house, situated on a rising ground in the midst of the bogs. Here the people were busily employed in making hay, a scene which afforded a pleasing change from the dreary solitude they had quitted; the whole of this extensive district, which abounds in grass, would, if drained, our traveller observes, prove a very rich pasture country. Farther on, they came to several cottages at the foot of the mountain, round which they turned, and came in sight of the hill, having the Geysers at one of its sides. This hill, in height *not more than three hundred feet*, is separated from the mountain, towards the west, by a narrow slip of flat boggy ground,

connected with that which extends over the whole valley. Having crossed this bog, and a small river which ran through it, the party came to a farm-house at the east end of the hill, and arrived at a spot where the most wonderful and awful effects of subterraneous heat are exhibited.

On the east side of the hill there are several banks of clay, from some of which, steam rises in different places; and in others, there are cavities, in which water boils briskly. In a few of these cavities, the water being mixed with clay, is thick and varies in colour; but is chiefly red and gray. Below these banks there is a gentle and uniform slope, composed of matter, which, at some distant period, has been deposited by springs which no longer exist. The strata or beds thus formed, seemed to have been broken by shocks of earthquakes, particularly near the great Geyser. Within a space not exceeding a quarter of a mile, numerous orifices are seen in the old incrustations, from which boiling water and steam issue, with different degrees of force. At the northern extremity, is situated the great Geyser, sufficiently distinguishable from the others by every circumstance connected with it. On approaching this spot, it appeared that a mount had been formed of irregular, rough-looking depositions, upon the ancient regular strata, the origin of which had been similar. The slope of the latter has caused the mount to spread more on the east side; and the recent depositions of the water may be traced till they coincide with them. The perpendicular height of the mount is about seven feet, measured from the highest part of the surface of the old depositions. From these, the matter composing the mount may be readily distinguished, on the west side, where a disruption has taken place. On the top of this mount is a basin, which was found to extend fifty-six feet in one direction, and forty-six in another.

At a quarter before three o'clock in the afternoon, when the party reached the spot, they found the basin full of hot water, a little of which was running over. Having satisfied their curiosity at that time, they proceeded to examine some other places, whence they saw water ascending. Above the great Geyser, at a short distance, they came to a large irregular opening, the beauties of which, the writer observes, it is hardly possible to describe. The water with which it was filled, was as clear as crystal, and perfectly still, although nearly at the boiling point. Through it they saw white incrustations, forming a variety of figures and cavities, to a great depth, and carrying the eye into a vast and dark abyss, over which the crust supporting them formed a dome of an inconsiderable

thickness ; a circumstance, which, though not of itself agreeable, contributed much to the effects of this awful scene.

Having pitched their tent at the distance of about one hundred yards from the Geyser, and so arranged matters as that a regular watch might be kept during the night, Sir G. S. Mackenzie took his station at eleven o'clock, and his companions lay down to sleep. About ten minutes before twelve, he heard subterraneous discharges, and waked his friends. The water in the basin was greatly agitated, and flowed over, but there was not any jet. The same occurred at half past two. At five minutes past four, on Saturday morning, an alarm was given by one of the company. As our traveller lay next the door of the tent, he instantly drew aside the canvass, when, at the distance of little more than fifty yards, a most extraordinary and magnificent appearance presented itself. From a place they had not before noticed, they saw water thrown up, and steam issuing with a tremendous noise. There was little water ; but the force with which the steam escaped, produced a white column of spray and vapour, at least sixty feet high. They enjoyed this astonishing and beautiful sight until seven o'clock, when it gradually disappeared.

The remaining part of the morning was occupied in examining the environs of the Geysers ; and at every step they received some new gratification. Following the channel, which had been formed by the water escaping from the great basin during the eruptions, they found several beautiful and delicate petrifications. The leaves of birch and willow were seen converted into white stone, and in the most perfect state of preservation, every minute fibre being entire. Grass and rushes were in the same state, and also masses of peat. Several of these rare and elegant specimens were brought safely to Great Britain. On the outside of the mount of the Geyser, the depositions, owing to the splashing of the water, are rough and have been justly compared to the heads of cauliflowers. They are of a yellowish brown colour, and are arranged around the mount, somewhat like a circular flight of steps. The inside of the basin is comparatively smooth ; and the matter forming it is more compact and dense than the exterior crust ; when polished, it is not devoid of beauty, being of a gray colour, mottled with black and white spots and streaks. The white incrustation formed by the water of the beautiful cavity before described, had taken a very curious form at the water's edge, very much resembling the capital of a Gothic column.

MONT BLANC, IN SWITZERLAND, WITH THE GLACIERS.

*This mountain, so named on account of its white aspect, belongs to the great central chain of the Alps. It is truly gi-*

gauntic, and is the most elevated mountain in Europe, rising no less than 15,872 feet, somewhat more than three miles above the level of the sea, and 14,624 feet above the lake of Geneva, in its vicinity. It is encompassed by those wonderful collections of snow and ice, called "GLACIERS," two of the principal of which, are called Mont Dolent and Triolet. The highest part of Mont Blanc, named the Dromedary, is in the shape of a compressed hemisphere. From that point it sinks gradually, and presents a kind of concave surface of snow, in the midst of which, is a small pyramid of ice. It then rises into a second hemisphere, which is named the Middle Dome; and thence descends into another concave surface, terminating in a point, which, among other names bestowed on it by the Savoyards, is styled "Dome de Goute," and may be regarded as the inferior dome.

The first successful attempt to reach the summit of Mont Blanc was made in August, 1786, by Doctor Paccard, a physician of Chamouni. He was led to make the attempt by a guide, named Balma, who, in searching for crystals, had discovered the only practicable route by which so arduous an undertaking could be accomplished. The ascent occupied fifteen hours, and the descent five, under circumstances of the greatest difficulty, the sight of the Doctor, and that of his guide, Balma, being so affected by the snow and wind, as to render them almost blind, at the same time, that the face of each was excoriated, and the lips exceedingly swelled.

On the first of August of the following year, 1787, the celebrated and indefatigable naturalist, M. de Saussure, set out on his successful expedition, accompanied by a servant and eighteen guides, who carried a tent and mattresses, together with the necessary accommodations and various instruments of experimental philosophy. The first night, they passed under the tent, on the summit of the mountain of La Cote, 4986 feet above "the Priory," a large village in the vale of Chamouni, the journey thither being exempt from trouble or danger, as the ascent is always over turf, or on the solid rock; but above this place, it is wholly over ice or snows.

Early next morning, they traversed the Glacier of La Cote, to gain the foot of a small chain of rocks, inclosed in the snows of Mont Blanc. The glacier is both difficult and dangerous, being intersected by wide, deep, irregular chasms, which frequently can be passed only by three bridges of snow, which are suspended over the abyss. After reaching the ridge of rocks, the tract winds along a hollow, or valley, filled with snow, which extends north and south to the foot of the high-



est summit, and is divided at intervals by enormous crevices. These show the snow to be disposed in horizontal beds, each of which answers to a year, and notwithstanding the width of the fissures, the depth can in no part be measured. At four in the afternoon, the party reached the second of the three great platforms of snow they had to traverse, and here they encamped at the height of 9312 feet above the Priory, or 12,768 feet, nearly two miles and a half above the level of the sea.

From the centre of this platform, enclosed between the farthest summit of Mont Blanc, on the south, its high steps, or terraces, on the east, and the Dome de Goute on the west, nothing but snow appears. It is quite pure, of a dazzling whiteness, and on the high summits, presents a singular contrast with the sky, which, in these elevated regions, is almost black. Here no living being is to be seen; no appearance of vegetation; it is the abode of cold and silence. "When," observes M. de Saussure, "I represent to myself Dr. Paccard and James Balma first arriving, on the decline of day, in these deserts, without shelter, without assistance, and even without the certainty that men could live in the places which they proposed to reach, and still pursuing their career with unshaken intrepidity, it seems impossible to admire too much their strength of mind and their courage."

The company departed at seven the next morning, to traverse the third and last platform, the slope of which is extremely steep, being in some places thirty-nine degrees. It terminates in precipices on all sides; and the surface of the snow was so hard, that those who went foremost were obliged to cut places for the feet with hatchets. The last slope of all, presents no danger; but the air possesses so high a degree of rarity, that the strength is speedily exhausted, and on approaching the summit, it was found necessary to stop at every fifteen or sixteen paces, to take breath. At eleven, they reached the top of the mountain, where they continued four hours and a half, during which time, M. de Saussure enjoyed, with rapture and astonishment, a view, the most extensive as well as the most rugged and sublime in nature, and made those observations which have rendered this expedition important to philosophy.

A light vapour, suspended in the lower regions of the air, concealed from the sight the lowest and most remote objects, such as the plains of France and Lombardy; but the whole surrounding assemblage of high summits appeared with the *greatest distinctness*.

*M. de Saussure* descended with his party, and the next

morning reached Chamouni, without the smallest accident. As they had taken the precaution to wear veils of crape, their faces were not excoriated, nor their sight debilitated. The cold was not found to be so extremely piercing as it was described by Dr. Paccard. By experiments made with the hygrometer on the summit of the mountain, the air was found to contain a sixth portion only of the humidity of that of Geneva; and to this dryness of the air, M. de Saussure imputes the burning thirst which he and his companions experienced. The balls of the electrometer diverged three lines only, and the electricity was positive. It required half an hour to make water boil, while at Geneva, fifteen or sixteen minutes sufficed, and twelve or thirteen at the sea side. None of the party discovered the smallest difference in the taste or smell of bread, wine, meat, fruits, or liquors, as some travellers have pretended is the case at great heights; but sounds were of course much weakened, from the want of objects of reflection. Of all the organs, that of respiration was most affected, the pulse of one of the guides beating ninety-eight times in a minute, that of the servant, one hundred and twelve, and that of M. de Saussure, one hundred and one; while at Chamouni, the pulsations respectively were forty-nine, sixty, and seventy-two. A few days afterwards, Mr. Beaufoy, an English gentleman, succeeded in a similar attempt, although it was attended with greater difficulty, arising from enlargements in the chasms in the ice.

## THE PEAK OF TENERIFFE.

The Island of Teneriffe has received its present name from the inhabitants of the adjacent island Palma, in whose language *tener* signifies snow, and *iffe*, a hill. In extent, wealth, and fertility, it exceeds all the other Canary islands. It continues to rise on all sides from the sea, until it terminates in the celebrated Peak, which is, however, situated rather in the southern part than in the centre of the island. The ascent on the north side is more gradual than at the other parts, there being a space along the shore about three leagues in breadth, bounded on the sides by high mountains, or rather cliffs; but more inland, it rises like a hanging garden all the way, without any considerable interruption of hills or valleys. The form of this island is triangular, extending itself into three capes, the nearest of which is about eighty leagues from the coast of Africa. In the middle, it is divided by a ridge of mountains, which have been compared to the roof of a church, the Peak forming the *spire* or *steeple* in the centre.

*The elevation of the Peak of Teneriffe, according to the*

most accurate measurement, made by Cordier, is 12,166 feet, nearly two miles and one-third above the level of the sea. In the ascent, the first eminence is called Monte Verde, or the green mountain, from the high fern with which it is covered, and presents a level plain of considerable extent. Beyond this is the Mountain of Pines, which are said to have formerly grown there in great abundance: but its steep sides are now become craggy and barren, and its whole appearance very different from that of the eminence described above. After passing this summit, the traveller reaches a plain, on which the natives have bestowed the name of Monton de Trigo, and upon which the peak in reality stands. It is a mountainous platform, rising more than seven thousand feet, nearly a mile and a half, above the level of the sea: and here the currents of lava, hitherto concealed by the vegetation, begin to appear in all their aridity and confusion, a few lowly shrubs and creeping plants alone diversifying the surface of a desert, the most arid and rugged that can be imagined.

The following extract, is from an account published in the first volume of the Transactions of the Geological Society, by the Hon. Mr. Bennet.

At the distance of thirty-four leagues from the island, Mr. Bennet had a very distinct view of the Peak, rising like a cone from the bed of the ocean. The rocks and strata of Teneriffe, he observes, are wholly volcanic, the long chain of mountains, which may be termed the central chain, traversing the island from the foot of the second region of the Peak, and sloping down on the eastern, western, and northern sides, to the sea. Towards the south, or more properly the S. S. W. the mountains are nearly perpendicular, and though broken into ridges, and occasionally separated by deep ravines, that are cut transversely, as well as longitudinally, there are none of those plains, nor that gradual declination of strata, which the south-eastern and north-western sides of the island exhibit.

Mr. Bennet ascended the Peak in the month of September 1810. We give the abridged account of this expedition in his own words.

The road to the city of Orotava, is a gradual and easy slope for three or four miles, through a highly cultivated country. Leaving the town, after a steep ascent of about an hour through a deep ravine, we quitted the cultivated part, and entered into forests of cedars, the trees of which, are of large size. The wood of this tree is strong; the soil deep, and formed of decomposed rocks, sand, ash and pumice. I examined several channels of the river, it crosses upon the way, and there was no appearance of any other

aving this forest, the tract passes over a series of green hills, which we traversed in about two hours, and at last halted to water our mules at a spot where there is a small spring of bad and brackish water issuing from a lava rock. The range is of considerable depth. The range of green hills extending a mile or two further, the soil shallowing by degrees, till at length, the trees and shrubs gradually dwindling in, the Spanish broom alone covers the ground. Leaving behind us this range of green hills, the track, still ascending, leads for several hours across a steep and difficult mass of lava rock, broken here and there into strange and fantastic forms, worn into deep ravines, and scantily covered in places with a thin layer of yellow pumice. As we proceeded on our march, the hills on our left gradually rose in height, till the summits were lost in those of the central chain; while, on our right, we were rapidly gaining an elevation above the lower range of the Peak. We met with several small conical hills, the mouths of extinct volcanoes, the decomposed lava on the sides of the craters having a strong red ochreous tint. At length, an immense undulated plain spreads itself like a fan, on all sides, nearly as far as the eye can reach. This plain is bounded on the west-south-west, and south-south-west, by a range of steep perpendicular precipices and mountains, many leagues in circumference, called by the Spaniards *Las Paldas*. This plain, or desert, for we had long left all show of vegetation, except a few stunted plants of Spanish broom, a sensation of change was felt in the atmosphere: the wind was keener and sharper, and the climate like that of England in the month of Autumn. All here was sad, silent, and solitary. We saw at a distance the fertile plains on the coast, lying as it were under our feet, and affording a cheerful contrast to the sterile isolation with which we were surrounded; we were at least seven or eight thousand feet above the level of the sea, and had reached the bottom of the second region of the Peak. Having reached the top of the peak, we found ourselves at the bottom of a steep hill, a few feet of which is a mass of lava. After a short rest, we began to descend, and in about an hour, the point of our feet was sinking into the soft sand, and we were sinking knee deep in the afternoon, at the close of the day, we were in the which, descending to the bottom of the second range of the Peak, divides the range of the Peak into two parts, one running to the north-west, and the other to the south-west.

It was here we were surrounded by a thick growth of dry branches of the *Opuntia*, and other plants of the

ing a part of a sail over a portion of the rock, and laid ourselves down to sleep. I passed the best part of the night by the fire, the weather being very cold. As I stood by the fire, the view of the mountain and terrific, the moon rose about the middle of the night, in her third quarter, gave sufficient light to show the extent and wilderness by which we were surrounded. The rocks and the upper regions which we had seen in the morning had appeared above our heads, while, below, the lava had appeared of such a height in the morning, that it would have cost us a day's labour to climb, lay stretched as plains and meadows; from the uncommon rarity of the atmosphere, the whole vault of heaven appeared studded with innumerable stars, while the valleys of Orotava were hidden from our view by a thin veil of light fleecy clouds, that floated far beneath the elevated spot we had chosen for our resting place; the solemn stillness of the night was only interrupted by the crackling of the fire round which we stood, and by the whistling of the wind, which, coming in hollow gusts from the mountain, resembled the roar of distant cannon.

Between two and three in the morning, we resumed, on foot, our ascent of the mountain, the lower part of which we had climbed on horseback the preceding evening; the ascent, however, became much more rapid and difficult, our feet sinking deep in the ashes at every step. From the uncommon sharpness of the acclivity, we were obliged to stop often to take breath; after several halts, we at last reached the head of the pumice hill. After resting some short time here, we began to climb the stream of lava, stepping from mass to mass. The ascent is steep, painful, and hazardous; in some places, the stream of lava is heaped up in dykes or embankments; and we were obliged to clamber over them as one ascends a steep wall.

We halted several times during the ascent, and at last reached a spot called La Cueva, one of the numerous caves that are found on the sides of the mountain; this is the largest of them and is filled with snow and the most delicious water, which was just at the point of congelation. The descent into it is difficult, it being thirty or forty feet deep. One of our party let himself down by a rope: he could not see the extent of the cave, but the guides declared it to be three hundred feet in length, and to contain thirty or forty feet of water in depth. The roof and sides are composed of a fine stalactitic lava, similar to that found on Vesuvius, and it is of the same nature as that which flowed on the surface. We rested here about half an hour, during which we had an opportunity of observ-

ng the rising of the sun, and that singular and rapid change of night into day, the consequence of an almost entire absence of twilight. As we ascended the north-east side of the mountain, this view was strikingly beautiful; at first, there appeared a bright streak of red on the horizon, which gradually spread itself, lighting up the heavens by degrees, and growing brighter and brighter, till at last the sun burst forth from the bed of the ocean, gilding, as it rose, the mountains of Teneriffe, and those of the great Canary; in a short time, the whole country to the eastward lay spread out as a map. The great Canary was easily to be distinguished; and its rugged and mountainous character, similar to that of the other islands, became visible to the naked eye. The cold at this time was intense, the wind keen and strong, and the thermometer sunk to 32 degrees. After a short, though rapid ascent, we reached the summit of the second stage of the mountain, passing over a small plain of white pumice, on which were spread masses of lava, and at length arrived at the foot of the cone. This division of the mountain forms what is generally termed the *Peak of Teneriffe*: it represents the present crater of Vesuvius, with this difference, however, that while the surface of that mountain is composed of a black cinder or ash, the superficies of this appears to be a deposit of pumice of a white colour, of scoræ and lava, with here and there considerable masses that were probably thrown out when the volcano was in action. Numerous small cavities, on the side of the mountain emitted vapour, with considerable heat. Here begins the only fatiguing part of the ascent; the steepness of the cone is excessive; at each step our feet sunk into the ash, and large masses of pumice and lava rolled down from above; we were all bruised, and our feet and legs were cut, but not materially hurt: at last, we surmounted all difficulties, and seated ourselves on the highest ridge of the mountain. This uppermost region does not appear to contain in superficies more than an acre and a half, and is itself a small crater, the walls of which are the different points on which we sat, and are plainly visible from below. Within, the lava is in the most rapid state of decomposition. The surface is hot to the feet, and the guides said it was dangerous to remain long in one spot; as it was, some of us sunk to our knees in the hot deposit of sulphur; upon striking the ground with the feet, the sound is hollow, similar to what is produced by the same impulsion on the craters of *Vesuvius* and *Solfaterra*. I estimate the depth of the crater to be, from the highest ridge to the bottom, about two hundred feet, forming an easy and gradual descent.

*The view from the summit is stupendous: we could plainly*

discover the whole form of the island, and we made out distinctly three or four of the islands, which collectively, are called the Canaries; we could not, however see, *Lancerothe* or *Fuerteventura*, though we were told that other travellers had distinguished them all.

From this spot, the central chain of mountains that runs from south-west to north-east, is easily to be distinguished. These, with the succession of fertile and woody valleys, commencing from *San Ursula*, and ending at Las Horcas, with the long line of precipitous lava rocks that lay on the right of our ascent, and which traverse that part of the island running from east to west, from their point of departure at the *Canales*, to where they end in an abrupt headland on the coast, with their forests, and villages, and vineyards, the port with the shipping in the roads, the towns of Orotava with their spires glittering as the morning sun burst upon them, afford a cheerful contrast to the streams of lava, the mounds of ash and pumice, and the sulphurated rock on which we had taken our seat. The sensation of extreme height was in fact one of the most extraordinary I ever felt; and though I did not find the pain in my chest, arising from the rarity of the atmosphere, near so acute as on the mountains of Switzerland, yet there was a keenness in the air, independent of the cold, that created no small uneasiness in the lungs. The respiration became short and quick, and repeated halts were found necessary. The idea also of extreme height was to me more determinate and precise than on the mountains of Switzerland; and though the immediate objects of vision were not so numerous, yet as the ascent is more rapid, the declivity sharper, and there is here no mountain like Mont Blanc towering above you, the 12,000 feet above the level of the sea, appeared considerably more than a similar elevation above the lake of Geneva. We remained at the summit about three quarters of an hour, our ascent having cost us the labour of four hours, as we left the *Estancia* at ten minutes before three, and reached the top of the peak before seven. Our thermometer, which was graduated to the scale of Fahrenheit, was, during our ascent, as follows: at Orotava, at eight in the morning,  $74^{\circ}$ ; at six in the evening, at La *Estancia*,  $50^{\circ}$ ; at one, in the following morning,  $42^{\circ}$ ; at La *Cueva*, at half past four,  $32^{\circ}$ ; at the bottom of the cone,  $36^{\circ}$ ; at the top of the peak, one hour and a half after sunrise,  $33^{\circ}$ . The descent down the cone is difficult from its extreme rapidity, and from the fall of large stones, which loosen themselves from the beds of pumice. Having at last scrambled to the bottom, we pursued our march down the other course of the lava, that is to say, down its westerly side, having ascend-

ed its eastern. The ravines and rents in this stream of lava are deep and formidable; the descent into them is always painful and troublesome, often dangerous; in some places, we let ourselves down from rock to rock. I can form no opinion why there should be these strange irregularities in the surface of this lava; in places, it resembles what sailors term the trough of the sea, and I can compare it to nothing but as if the sea in a storm had by some force become on a sudden stationary, the waves retaining their swell. As we again approached *La Cueva*, we came to a singular steep valley, the depth of which, from its two sides, cannot be less than one hundred to one hundred and fifty feet, the lava lying in broken ridges one upon the other, similar to the masses of granite rock that time and decay have tumbled down from the top of the Alps; and, except from the scoræ, or what Milton calls "the Fiery Surge," they in no degree bear the marks of having rolled as a stream of liquid matter.

We descended the pumice hill with great rapidity, almost at a run, and arrived at *La Estancia* in little more than two hours. We then mounted our mules, and following the track by which we had ascended the preceding day, we reached, about four o'clock, the country house of our hospitable friend Mr. Barry.

## STROMBOLI.

This is the principal of the cluster of small islands, lying to the north of Sicily, named the Lipari Isles, the whole of which contain volcanoes. At a distance, its form appears to be that of an exact cone, but on a closer examination it is found to be a mountain having two summits of different heights, the sides of which have been torn and shattered by craters. The most elevated summit, inclining to the S. W. is, agreeably to Spallanzani, about a mile in height.

In this volcanic mountain, the effects of a constantly active fire are every where visible, heaping up, destroying, changing, and overturning, every instant, what itself has produced, and incessantly varying in its operations. At the distance of one hundred miles, the flames it emits are visible, whence it has been aptly denominated the light-house of that part of the Mediterranean Sea.

From the more elevated summit, all the inner part of the burning crater, and the mode of its eruption, may be seen. It is placed about half way up, on the N. W. side of the mountain, and has a diameter not exceeding 250 feet. Burning stones are thrown up at regular intervals of seven or eight minutes, ascending in somewhat diverging rays. While a por-



tion of them roll down towards the sea, the greater part fall back into the crater; and these being again cast out by a subsequent eruption, are thus tossed about until they are broken and reduced to ashes. The volcano, however, constantly supplies others, and seems inexhaustible in this species of productions. Spallanzani affirms that, in the more violent eruptions, the ejected matter rises to the height of half a mile, or even higher, many of the ignited stones being thrown above the highest summit of the mountain.

The erupted stones, which appear black in the day-time, have at night a deep red colour, and sparkle like fire-works. Each explosion is accompanied by flames or smoke, the latter resembling clouds, in the lower part black, in the upper, white and shining, and separating into globular and irregular forms. In particularly high winds from the S. or S. E. the smoke spreads over every part of the island. Spallanzani observed this volcano on a particular night, when the latter of these winds blew with great violence. The clear sky exhibited the appearance of a beautiful aurora borealis over that part of the mountain on which the volcano is situated, and which from time to time became more red and brilliant, in proportion as the ignited stones were thrown to a greater height. The violence of the convulsions depends on that of the wind.

The present crater has burned for more than a century, without any apparent change having taken place in its situation. The side, from which the showers of ignited matter fall into the sea, is almost perpendicular, about half a mile broad at the bottom, and a mile in length, terminating above in a point. In rolling down, the lava raises the fine sand like a cloud of dust. While this was observed by Spallanzani, the volcano suddenly made an eruption. Numerous pieces of lava, of a dark red colour, and enveloped in smoke, were ejected from the top of the precipice, and thrown high into the air. A part of them fell on the declivity, and rolled down, the smaller preceded by the greater; and, after a few bounds, dashed into the sea, giving out a sharp hissing sound. The more minute fragments, from their lightness and the hindrance of the sand, rolled slowly down, and striking against each other, produced nearly the same sound as hail-stones falling on a roof. In a few minutes, another explosion followed, without any sensible noise; and two minutes after, a third eruption took place, with a much louder explosion than the first, and a far more copious ejection of lava. The eruptions, which were almost innumerable during the time Spallanzani remained there, all exhibited the same appearances.

*On the night following the one above described, the volca-*

no raged with still greater violence, and rapidly hurled to a great height, thousands of red hot stones, forming diverging rays in the air. Those which rolled down the precipice, produced a hail of streaming fire, which illuminated the steep descent. Independently of these ignited stones, there was in the air which hovered over the volcano, a vivid light which was not extinguished when that was at rest. It was not properly flame, but real light reverberated by the atmosphere, impregnated by extraneous particles, and more especially by the ascending smoke. Besides varying in intensity, it appeared constantly in motion, ascending, descending, dilating, and contracting, but always remaining perpendicular over the mouth of the volcano, which showed that it was occasioned by the conflagration within the crater. The detonations in the greater eruptions resembled the roaring of distant thunder; but, in the more moderate ones, the explosions of a mine. In the smallest they were scarcely audible. Each was some seconds later than the ejection.

Near the mouth of the volcano is a small cavern, and a projection above, which secures it from the entrance of the ignited stones. From this cavern Spallanzani was enabled to look down into the very bowels of the volcano. He describes the edges of the crater as of a circular form, and not more than 340 feet in circumference, the internal sides contracting as they descend, and assuming the shape of a truncated inverted cone. The crater itself, to a certain height, is filled with a liquid red hot matter, resembling melted brass. This is the fluid lava, which appears to be agitated by two distinct motions, the one intestine, whirling and tumultuous, and the other, that by which it is impelled upward. This liquid matter is raised, sometimes with more, and sometimes with less rapidity, within the crater; and when it has reached within twenty-five or thirty feet of the upper edge, a sound is heard not unlike a short clap of thunder, while at the same moment a portion of the lava, separated into a thousand pieces, is thrown up with indescribable swiftness, accompanied by a copious eruption of smoke, ashes, and sand. A few moments before the report, the superficies of the lava is inflated and covered with large bubbles, some of which are several feet in diameter; on the bursting of these, the detonation and fiery shower take place. After the explosion, the lava within the crater sinks, but soon rises again as before, and new bubbles appear, which again burst and produce new explosions. When the lava sinks, it gives little or no sound; but when it rises, and particularly when it begins to be inflated with bubbles, it is accompanied by a noise similar, in proportion to the difference of magnitude, to that of liquor boiling vehemently in a cauldron.

## THE HIMALAYA MOUNTAINS, BETWEEN INDIA AND THIBET.

The great Himalayan snowy range, says Mr. Fraser, is only the high elevated crest of the mountainous tract that divides the plains of Hindostan from those of Thibet, or Lesser Tartary. Far as they predominate over, and precipitously as they rear themselves above the rest, all the hills that appear in distant ranges, when viewed from the plains, are indeed only the roots and branches of this great stem; and, however difficult to trace, the connexion can always be detected between each inferior mountain and some particular member of its great origin.

The horizontal depth of this mountainous tract, on that side which overlooks Hindostan, is no doubt various; but, from the difficulty of the country, a traveller performs a journey of many days before he reaches the foot of the immediate snowy cliffs. The best observations and survey do not authorize the allowance of more than an average depth of about sixty miles from the plains to the commencement of these, in that part of the country that forms the subject of this narrative. The breadth of the snowy zone itself in all probability varies still more; for huge masses advance in some places into the lower districts, and in others, the crest recedes in long ravines, that are the beds of torrents, while behind, they are clothed by a succession of the loftier cliffs. Every account we receive of a passage through them, (and this is no doubt found most commonly where the belt is narrowest,) gives a detail of many days' journey through the deserts of snow and rocks; and it is to be inferred, that on the north-east side they advance to, and retreat from, the low ground in an equal irregular manner. Indeed, some accounts would induce the belief, that long ranges, crowned with snow-clad peaks, project in various places from the great spine, and include habitable and milder districts, for, in all the routes of which we have accounts, that proceed in various directions towards the Trans-Himalayan countries, hills covered with snow are occasionally mentioned as occurring, even after the great deserts are passed, and the grazing country entered. The breadth, then, of this crest of snow-clad rock itself cannot fairly be estimated at less than from seventy to eighty miles.

The great snowy belt, although its loftiest crest is broken into numberless cliffs and ravines, nevertheless presents a barrier perfectly impracticable, except in those places where hollows that become the beds of rivers, have in some degree intersected it, and facilitated an approach to its more remote recesses; and courageous and attentive perseverance has here

and there discovered a dangerous and difficult path, by which a possibility exists of penetrating across the range. Few rivers told their course wholly through it: indeed, in the upper part of the Sutlej alone has been traced beyond this rocky barrier; and there is a path along its stream, from different parts of which, roads diverge, that lead in various directions through the mountain. No reasonable doubt can now exist of the very long and extraordinary course which this river takes.

Captain Webb, of the Bengal establishment, was lately employed on a survey of a province of Kumaon. On the 21st day of June, his camp was 11,680 feet above Calcutta. The surface was covered with very rich vegetation as high as the snow: very extensive beds of strawberries in full flower; and plenty of currant-bushes in blossom all around, in a clear spot of rich black mould soil, surrounded by a noble forest of pine, oak, and rhododendra. On the 22d of June, he reached the top of Pilgoenta-Churhae, (or ascent,) 12,642 feet above Calcutta. He was prevented from distinguishing very distant objects by a dense fog around him; but there was not the smallest patch of snow near him, and the surface, a fat black mould through which the rock peeped, was covered with strawberry plants, (not yet in flower,) butter-cups, dandelion, and a profusion of other flowers. The shoulders of the hill above him, about 450 feet more elevated, were covered with the same to the top; and above 500 feet below was a forest of pine, rhododendron, and birch. There was some snow seen below in deep hollows, but it dissolves in the course of the season.

These facts led Captain Webb to infer, that the inferior limit of perpetual congelation on the Himala mountains is *beyond* 13,500 feet, at least, above the level of Calcutta: and that the level of the table land of Tartary, immediately bordering on the Himala, is very far elevated beyond 8000 feet, the height at which it has been estimated: and although I may not be able either to make all the deductions which they will afford, or to shun any errors that they may involve, they will till, I think, yield some ground of inference to estimate the height to which I ascended; and consequently, give some approximation to the heights of the surrounding peaks.

On the night of the 16th of July, we slept at Bheemkeuar, near the source of the Coonoo and Bheem streams. There is no wood near this place, even in the very bottom of the valley, and we had left even the stunted birch at a considerable distance below: but there was a profusion of flowers, ferns, thistles, &c. and luxuriant pasturage. Captain Webb's *limit of wood is at least as high as 12,000 to 12,300 feet.*

would, therefore, presume the site of Bheemkeudar to be considerably above that level; say 13,000 to 13,300 feet above the level of Calcutta. From thence we ascended at first rather gradually, and then very rapidly, till we left all luxuriant vegetation, and entered the region of stripped and scattered and partially melting snow, (for nearly two miles of the perambulator.) From calculating the distance passed, and adverting to the elevation we had attained, I would presume that this was at least 1500 feet above Bheemkeudar, or from 14,500 to 15,000 feet above Calcutta.

We proceeded onwards, ascending very rapidly, while vegetation decreased gradually to a mere green moss, with here and there a few snow-flowers starting through it; snow fast increasing, till at length we entered on what I presume was the perennial and unmelting snow, entirely beyond the line of vegetation, where the rock was bare even of lichens: and in this we ascended, as I think, about 800 feet; for, though Bamsooroo Ghaut may not be so far above this line, we continued ascending, even after crossing that point, and I would incline to estimate this utmost extent of ascent at 2000 feet more, or nearly 17,000 feet above the level of Calcutta.

Whilst proposing to consider the point of 16,000 to 16,500 feet as that of inferior congelation, I must observe, that there was no feeling of *frost* in the air, and the snow was moist, though hard, chiefly through the influence of a thick mist, which, in fact, amounted to a very small drizzling rain which fell around: all which would seem to indicate, that the true line of congelation had not there been attained; but we were surrounded by snow which evidently never melted. To a great depth below it extended all over the hills, very little broken, while on the valleys from whence the Coonoo and Bheem streams issue, at full 2000 feet below, it lay covering them and the surrounding mountains in an unbroken mass, many hundred feet thick. Thus, though it may seem contradictory, the line of perpetual congelation, in fact seems fixable at even below the point I have ventured to indicate; and, I presume might, on these grounds, be placed somewhere between 15 and 16,000 feet above the level of Calcutta.

The result of all the considerations that arise out of the foregoing remarks, is a belief, that the loftiest peaks of the Himala range will be found to fall considerably short of the height attributed to them by Mr. Colebrooke; and that their loftiest peaks do not more than range from 18,000 to 22 or 23,000 feet above the level of the sea.

Having reached the top of an ascent, we looked, says Mr. Fraser, down upon a very deep and dark glen, called *Pala*

Gadh, which is the outlet to the waters of one of the most terrific and gloomy valleys I have ever seen. But it would not be easy to convey, by any description, a just idea of the peculiarly rugged and gloomy wildness of this glen: it looks like the ruins of nature, and appears, as is said to be, completely impracticable and impenetrable. Little is to be seen except dark rock: wood only fringes the lower parts and the water's edge: perhaps the spots and streaks of snow, contrasting with the general blackness of the scene, heighten the appearance of desolation. No living thing is seen; no motion but that of the waters; no sound but their roar. Such a spot is suited to engender superstition, and here it is accordingly found in full growth. Many wild traditions are preserved, and many extravagant stories related of it.

The glen above described is by far the most gloomy savage scene we have yet met with. I regret that the weather did not permit a sketch of it to be attempted. Beyond this, we could see nothing in the course of the river but rocky banks. The opposite side is particularly precipitous; yet along its face, a road is carried, which is frequented as much as this, and leads to villages still farther up. By the time we had reached the village, the clouds which had lowered around and sunk down on the hills, began to burst with loud thunder and heavy rain. The noise was fearfully reverberated among the hills; and during the night more than once, the sound was heard of fragments from the brows of the mountains, crashing down to the depths below with a terrific din. Our quarters were good. I slept in a temple, neat, clean, and secure from the weather.

## VOLCANIC MOUNTAINS OF ALBAY.

The following details of the dreadful eruption of the Volcano of Albay, in the Island of Luconia, one of the Philippines, on the 1st of February, 1814, are from an eye witness of the dreadful scenes it presented.

During thirteen years, the Volcano of Albay had preserved a profound silence. It was no longer viewed with that distrust and horror with which volcanoes usually inspire those, who inhabit the vicinity. Its extensive and spacious brow had been converted into highly cultivated and beautiful gardens. On the first day of January last, no person reflected, in the slightest degree, upon the damages and losses which so bad a neighbour had once occasioned. Previously to the former eruptions, there had been heard certain subterraneous sounds, which were *presages of them*. But upon the present occasion *we remarked nothing, except that on the last day of January*

we perceived some slight shocks. In the night, the shocks increased. At two in the morning, one was felt more violent than those hitherto experienced. It was repeated at four, and from that time they were almost continual until the eruption commenced.

The day broke, and I scarcely ever remarked in Camarines a more serene and pleasant morning. I observed, however that the ridges nearest to the volcano were covered with mist, which I supposed to be the smoke of some house that might have been on fire in the night. But at eight o'clock the volcano began suddenly to emit a thick column of stones, sand, and ashes, which with the greatest velocity, was elevated into the highest regions of the atmosphere. At this sight we were filled with the utmost dread, especially when we observed, that in an instant the brow of the volcano was quite covered. We had never seen a similar eruption, but were convinced that a river of fire was flowing towards us, and was about to consume us. The first thing which was done in my village was to secure *the holy sacrament from profanation!* we then betook ourselves to flight. The swiftness with which the dreadful tide rolled towards us, did not give us time either for reflection or consultation. The frightful noise of the volcano caused great terror even in the stoutest hearts. We all ran, filled with dismay and consternation, endeavouring to reach the highest and most distant places, to preserve ourselves from so imminent a danger. The horizon began to darken, and our anxieties redoubled. The noise of the volcano continually increased, the darkness augmented, and we continued our flight. But, notwithstanding our swiftness, we were overtaken by a heavy shower of huge stones, by the violence of which many unfortunate persons were in a moment killed. This cruel circumstance obliged us to make a pause in our career, and to shelter ourselves under the houses; but the flames and burnt stones which fell from above, in a short time reduced them to ashes.

The sky was now completely overcast, and we remained enveloped and immersed in a thick and palpable darkness. From that moment reflection was at an end. The mother abandoned her children, the husband his wife, and the children forgot their parents.

In the houses we had no longer any shelter. It was necessary to abandon, or perish with them; yet, to go out uncovered, was to expose one's self to a danger not less imminent, because many of the stones were of an enormous size, and they fell as thick as drops of rain. It was necessary to defend ourselves as well as we could. Some covered themselves with *hides*, others with tables and chairs, and others with boards

ea-trays. Many took refuge in the trunks of trees, others in the canes and hedges, and some hid themselves in a place where the brow of a mountain protected them.

About ten o'clock the heavy stones ceased to fall, and a rain of sand succeeded. At half past one, the noise of the stones began to diminish, and the horizon to clear a little; at two, it became quite tranquil; and we now began to see the dreadful ravages which the darkness had hitherto concealed from us. The ground was covered with dead bodies, of whom had been killed by the stones, and the others injured by the fire. Two hundred perished in the church of Budiao, and thirty-five in a single house in that village. The joy the living felt at having preserved themselves, was in a moment converted into the extremity of sorrow at finding themselves deprived of their relations and friends. Fathers found their children dead, husbands their wives, and wives their husbands in the village of Budiao, where there were very few who had not lost some of their nearest connexions. In other places the ground and many persons extended upon the ground, wounded or mangled in a thousand ways. Some with their legs broken, some without arms, some with their skulls fractured, and others mangled with wounds. Many died immediately, others on the following days, and the rest were abandoned to the most melancholy fate, without physicians, without medicines, and in want of even of necessary food.

The populous towns were entirely destroyed by the eruption; more than twelve hundred of the inhabitants perished at the ruins; and twenty thousand who survived the catastrophe, were stripped of their possessions and reduced to beggary.

The subsequent appearance of the volcanic mountain was melancholy and terrific. Its side, formerly so well cultivated, and which afforded a prospect the most picturesque, is now become a barren sand. The stones, sand, and ashes, now cover it, in some places exceed the depth of ten and twelve yards; and on the ground where lately stood the village of Budiao, there are spots, in which the cocoa-trees are discovered. In the ruined villages, and through the whole extent of the eruption, the ground remains buried in the sand to a depth of half a yard, and scarcely a single tree is left standing. The crater of the volcano has lowered more than one hundred and twenty feet; and the south side discovers a spacious and horrid mouth which is frightful to the view. Three openings have opened at a considerable distance from the principal crater, through which also smoke and ashes are continually emitted. In short, the most beautiful villages of



Camarines, and the principal part of that fine province, deeply covered with barren sand.

ISLANDS WHICH HAVE RISEN OUT OF THE SEA.

It is to the Grecian Archipelago and the Azores that we to look for the grandest and most surprising instances of phenomenon. We will select an example from each of th groupes of islands, beginning with the former.

Before we enter, however, on the somewhat minute det we shall have to bring forward on this very curious and in esting subject, it may not be improper to observe, that Island of Acroteri, of great celebrity in ancient history, pears to have its surface composed of pumice stone, encru by a surface of fertile earth; and that it is represented by ancients as having risen, during a violent earthquake, from sea. Four neighbouring Islands are described as having: milar origin, notwithstanding the sea is in that part of Archipelago of such a depth as to be unfathomable by sounding line. These arose at different times: the first, l before the commencement of the Christian era; the secc in the first century; the third, in the eighth; and the fou in 1573.

To proceed to a phenomenon of a similar nature, belong to the same cluster of Islands, which being of a more rec date, we are enabled to enter into all its particulars. T are such as cannot fail to interest and surprise.

On the 22d of May, 1707, a severe earthquake was fel Stanchio, an island of the Archipelago; and on the ensy morning, a party of seamen, discovering not far off what t believed to be a wreck, rapidly rowed towards it; but find rocks and earth instead of the remains of a ship, haste back, and spread the news of what they had seen in Sant ni, another of these islands. However great the apprel sions of the inhabitants were at the first sight, their surp soon abated, and in a few days, seeing no appearance of or smoke, some of them ventured to land on the new isla Their curiosity led them from rock to rock, where they fo a kind of white stone, which yielded to the knife like bri and nearly resembled that substance in colour and consist. They also found many oysters sticking to the rocks; and w they were employed in collecting them, the Island movd i shook under their feet, on which they ran with precipitation their boats. Amid these motions and tremblings the isl increased, not only in height, but in length and breadth: occasionally, while it was raised and extended on the one si *it sunk and diminished* on the other. The person to wh

They are indebted for this narrative, observed a rock to rise out of the sea, forty or fifty paces from the island, which, having been thus visible for four days, sunk, and appeared no more; several others appeared and disappeared alternately, till at length they remained fixed and unmoved. In the meantime, the colour of the surrounding sea was changed: at first it was of a light green, then reddish, and afterwards of a pale yellow, accompanied by a noisome stench, which spread itself over a part of the Island of Santorini.

On the 16th of July, smoke first appeared, not indeed on the island, but issuing from a ridge of black stones which suddenly rose about sixty paces from it, where the depth of the sea was unfathomable. Thus there were two separate islands, the one called the White, and the other the Black Island, from the different appearances they exhibited. This thick smoke was of a whitish colour, like that of a lime-kiln, and was carried by the wind to Santorini, where it penetrated the houses of the inhabitants.

In the night between the 19th and 20th of July, flames began to issue with the smoke, to the great terror of the inhabitants of Santorini, especially of those occupying the castle of Perissa, who were distant about a mile and a half only from the burning island, which now increased very fast, large rocks continually springing up, which sometimes added to its length, and sometimes to its breadth. The smoke, also increased, and there not being any wind, ascended so high as to be seen at Candia, and other distant islands. During the night, it resembled a column of five, fifteen, or twenty feet in height; and the sea was then covered with a scurf or froth, in some places reddish, and in others yellowish, from which proceeded such a stench, that the inhabitants throughout the whole island of Santorini burnt perfumes in their houses, and made fires in the streets, to prevent infection. This, indeed, did not last above a day or two; for a strong gale of wind dispersed the smoke, and drove the smoke on the vineyards of Santorini, by which the grapes were, in one night, parched up and destroyed. This smoke also caused violent head-aches, attended with retchings.

On the 31st of July, the sea smoked and bubbled in two different places near the island, where the water formed a perfect circle, and looked like oil when beginning to simmer. This continued above a month, during which time many fishes were found dead on the shore of Santorini. On the following night, a dull hollow noise was heard, like the distant report of several cannon, which was instantly followed by flames of fire, shooting up to a great height in the air, where they

suddenly disappeared. The next day, the same hollow sound was several times heard, and succeeded by a blackish smoke, which, notwithstanding a fresh gale blew at the time, rose up to a prodigious height, in the form of a column, and would probably in the night have appeared as if on fire.

On the 9th of September, the White and Black Islands united; after which, the western end of the island grew daily in bulk. There were now four openings only which emitted flames; these issued forth with great impetuosity, sometimes attended with a noise like that of a large organ-pipe, and sometimes like the howling of wild beasts.

On the 12th, the subterraneous noise was much augmented, having never been so frequent or so dreadful as on that and the following day. The bursts of this subterraneous thunder, like a general discharge of the artillery of an army, were repeated ten or twelve times within twenty-four hours, and, immediately after each clap, the large furnace threw up huge red hot stones, which fell into the sea at a great distance. These claps were always followed by a thick smoke, which spread clouds of ashes over the sea and the neighbouring islands.

On the 18th of September, an earthquake was felt at Santorini. It did but little damage, although it considerably enlarged the burning island, and in several places gave vent to the fire and smoke. The claps were also more terrible than ever; and, in the midst of a thick smoke, which appeared like a mountain, large pieces of rock, which afterwards fell on the island, or into the sea, were thrown up with as much noise and force, as balls from the mouth of a cannon. One of the small neighbouring islands was covered with these fiery stones, which being thinly crusted over with sulphur, gave a bright light, and continued burning until that was consumed.

On the 21st, a dreadful clap of subterraneous thunder was followed by very powerful lightnings, and at the same instant the new island was so violently shaken, that part of the great furnace fell down, and huge burning rocks were thrown to the distance of two miles and upwards. This seemed to be the last effort of the volcano, and appeared to have exhausted the combustible matter, as all was quiet for several days after: but on the 25th, the fire broke out again with still greater fury, and among the claps, one was so terrible, that the churches of Santorini were soon filled with crowds of people, expecting every moment to be their last: and the castle and town of Scaro suffered such a shock, that the doors and windows of the houses flew open. The volcano continued to rage during the *remaining* part of the year; and in the month of January,

1708, the large furnace, without one day's intermission, threw out stones and flames, at least once or twice, but generally five or six times a day.

On the 10th of February, in the morning, a pretty strong earthquake was felt at Santorini, which the inhabitants considered as a prelude to greater commotions in the burning island; nor were they deceived, for soon after the fire and smoke issued in prodigious quantities. The thunder-like claps were redoubled, and all was horror and confusion: rocks of an amazing size were raised up to a great height above the water; and the sea raged and boiled to such a degree as to occasion great consternation. The subterraneous bellowings were heard without intermission, and sometimes in less than a quarter of an hour there were six or seven eruptions from the large furnace. The noise of repeated claps, the quantity of huge stones which flew about on every side, the houses at Santorini tottering to their very foundations, and the fire, which now appeared in open day, surpassed all that had hitherto happened, and formed a scene terrific and astonishing beyond description.

The 15th of April was rendered memorable by the number and violence of the bellowings and eruptions, by one of which nearly a hundred stones were thrown at the same instant into the air, and fell again into the sea at about two miles distant. From that day until the 22d of May, which may be considered as the anniversary of the birth of the new Island, things continued much in the same state, but afterwards the fire and smoke subsided by degrees, and the subterraneous thunders became less terrible.

On the 15th of July, 1709, the Bishop of Santorini accompanied by several friars, hired a boat to take a near view of the island. They made directly toward it on that side where the sea did not bubble, but where it smoked very much. Being within the range of this vapour, they felt a close suffocating heat, and found the water very hot; on which they directed their course toward a part of the island at the furthest distance from the large furnace. The fires, which still continued to burn, and the boiling of the sea, obliged them to make a great circuit, notwithstanding which they felt the air about them to be very hot and sultry. Having encompassed the island, and surveyed it carefully from an adjacent one, they judged it to be two hundred feet above the sea, about a mile broad, and five miles in circumference; but, not being thoroughly satisfied, they resolved to make an attempt at landing, and accordingly rowed toward that part of the island where they perceived neither fire nor smoke. When, however, they had proceeded to *within the distance of a hundred yards*, the great furnace

discharged itself with its usual fury, and the wind blew upon them so dense a smoke, and so heavy a shower of ashes, that they were obliged to abandon their design. Having retired somewhat further, they let down their sounding lead, with a line ninety-five fathoms in length, but it was too short to reach the bottom. On their return to Santorini, they observed that the heat of the water had melted the greater part of the pitch employed in caulking their boat, which had now become very leaky.

From that time until the 15th of August, the fire, smoke, and noises continued, but not in so great a degree; and it appears that for several years after, the island still increased, but that the fire and subterraneous noises were much abated. The most recent account we have been enabled to collect, is that of a late traveller who in 1811, passed this island at some distance. It appeared to him like a stupendous mass of rock, but was not inhabited or cultivated. It had then long ceased to burn.

We have stated that similar eruptions of islands have occurred in the group of the Azores. Thus, in December 1720, a violent earthquake was felt on the island of Terceira. On the following morning, a new island, which had sprung up in the night, made its appearance, and ejected a huge column of smoke. The pilot of a ship, who attempted to approach it, sounded on one of these newly formed islands, with a line of sixty fathoms, but could not find a bottom. On the opposite side, the sea was deeply tinged with various colours, white, blue, and green; and was very shallow. This island was larger on its first appearance, than at some distance of time afterwards; it at length sunk beneath the level of the sea, and is now no longer visible.

“What can be more surprising,” observes the author of the preceding account, “than to see fire, not only force its way out of the bowels of the earth, but likewise make for itself a passage through the waters of the sea! What can be more extraordinary, or foreign to our common notions of things, than to observe the bottom of the sea rise up in a mountain above its surface, and become so firm an island as to be able to resist the violence of the greatest storms! I know that subterraneous fires, when pent up in a narrow passage, are able to elevate a mass of earth as large as an island; but that this should be done in so regular and precise a manner, that the water of the sea should not be able to penetrate and extinguish those fires; and that, after they should have exhausted themselves, the mass of earth should not fall down, or sink again with its own weight, *but still remain* in a manner suspended over the great arch be-

low—this seems to me more surprising than any of the facts which have been related of Mount Etna, Vesuvius, or any other volcano.”

In the first part of the Transactions of the Royal Society for the year 1812, Captain Tillard, of the British Navy, has published his very interesting narrative of a similar phenomenon, which occurred in the same sea near the Azores. We give this narrative in his own words.

Approaching the island of St. Michael's on Sunday the 12th of June, 1811, in his Majesty's sloop Sabrina, under my command, we occasionally observed, rising in the horizon, two or three columns of smoke, such as would have been occasioned by an action between two ships, to which cause we universally attributed its origin. This opinion was, however, in a very short time changed, from the smoke increasing and ascending in much larger bodies than could possibly have been produced by such an event; and, having heard an account, prior to our sailing from Lisbon, that in the preceding January or February, a volcano had burst out within the sea near St. Michael's, we immediately concluded that the smoke we saw proceeded from that cause, and, on our anchoring the next morning in the road of Ponte del Gada, we found this conjecture correct as to the cause, but not as to the time; the eruption of January having totally subsided, and the present one having only burst forth two days prior to our approach, and about three miles distant from the one before alluded to.

Desirous of examining as minutely as possible a contention so extraordinary between two such powerful elements, I set off from the city of Ponte del Gada on the morning of the 14th, in company with Mr. Read, the Consul General of the Azores, and two other gentlemen. After riding about twenty miles across the N. W. end of the island of St. Michael's, we came to the edge of the cliff, whence the volcano burst suddenly upon our view in the most terrific and awful grandeur. It was only a short mile from the base of the cliff, which was nearly perpendicular, and formed the margin of the sea; this cliff being, as nearly as I could judge, from three to four hundred feet high. To give you an adequate idea of the scene by description, is far beyond my powers; but for your satisfaction, I shall attempt it.

Imagine an immense body of smoke rising from the sea, the surface of which, was marked by the slippery rippling of the waves, occasioned by the light and steady breezes incidental to these climates in summer. In a quiescent state, it had the appearance of a circular cloud revolving on the water like a horizontal wheel, in various and irregular involutions, expand-

ing itself gradually on the lee side, when suddenly a column of the blackest cinders, ashes, and stones, would shoot up in the form of a spire, at an angle of from ten to twenty degrees from a perpendicular line, the angle of inclination being universally to windward; this was rapidly succeeded by a second, third, and fourth shower, each acquiring greater velocity, and overtopping the other, till they had attained an altitude as much above the level of our eye, as the sea was below it.

As the impetus, with which the columns were severally propelled, diminished, and their ascending motion had nearly ceased, they broke into various branches, resembling a group of pines; these again forming themselves into festoons of white feathery smoke, in the most fanciful manner imaginable, intermixed with the finest particles of falling ashes, which at one time assumed the appearance of innumerable plumes of black and white ostrich feathers surmounting each other; and another, that of the light wavy branches of a weeping willow.

During these bursts, the most vivid flashes of lightning continually issued from the densest part of the volcano; and the cloud of smoke, now ascending to an altitude much above the highest point to which the ashes were projected, rolled off in large masses of fleecy clouds, gradually expanding themselves before the wind in a direction nearly horizontal, and drawing up to them a quantity of water-spouts, which formed a most beautiful and striking addition to the general appearance of the scene.

That part of the sea where the volcano was situated, was upwards of thirty fathoms deep, and at the time of our viewing it, the volcano was only four days old. Soon after our arrival on the cliff, a peasant observed he could discern a peak above the water: we looked but could not see it; however, in less than half an hour it was plainly visible, and before we quitted the place, which was about three hours from the time of our arrival, a complete crater was formed above the water, not less than twenty feet high on the side where the greatest quantity of ashes fell; the diameter of the crater being apparently about four or five hundred feet.

The great eruptions were generally attended with a noise like the continued firing of cannon and musquetry intermixed, as also with slight shocks of earthquakes; several of which having been felt by my companions, but none by myself, I had become half sceptical, and thought their opinion arose merely from the force of imagination; but while we were sitting within five or six yards of the edge of the cliff, partaking of a slight repast which had been brought with us, and were all busily engaged, one of the most magnificent bursts took place which we had

yet witnessed, accompanied by a very severe shock of an earthquake. The instantaneous and involuntary movement of each, was to spring upon his feet; and I said, "This admits of no doubt." The words had scarcely passed my lips, before we observed a large portion of the face of the cliff, about fifty yards on our left, falling, which it did with a violent crash. So soon as our first consternation had a little subsided, we removed about ten or a dozen yards further from the edge of the cliff, and finished our dinner.

On the succeeding day, June 15th, having the Consul and some other friends on board, I weighed, and proceeded with the ship towards the volcano, with the intention of witnessing a night view; but in this expectation we were greatly disappointed, from the wind freshening, and the weather becoming thick and hazy, and also from the volcano itself being clearly more quiescent than it was the preceding day. It seldom emitted any lightning, but occasionally as much flame as may be seen to issue from the top of a glass-house or foundry chimney. On passing directly under the great cloud of smoke, about three or four miles distant from the volcano, the decks of the ship were covered with fine black ashes, which fell intermixed with small rain. We returned the next morning, and late on the evening of the same day I took leave of St. Michael's to complete my cruize.

On opening the volcano clear of the N. W. part of the island, after dark on the 16th, we witnessed one or two eruptions, that, had the ship been near enough, would have been awfully grand. It appeared one continued blaze of lightning; but its distance from the ship, upwards of twenty miles, prevented our seeing it with effect. Returning again towards St. Michael's, on the 4th of July, I was obliged by the state of the wind, to pass with the ship very close to the island, which was now completely formed by the volcano, being nearly the height of Matlock High Tor, about eighty yards above the sea. At this time it was perfectly tranquil; which circumstance determined me to land, and explore it more narrowly. I left the ship in one of the boats, accompanied by some of the officers. As we approached, we perceived that it was still smoking in many parts, and, upon our reaching the island, found the surf on the beach very high. Rowing round to the lee side, with some little difficulty, by the aid of an oar, as a pole, I jumped on shore, and was followed by the other officers. We found a narrow beach of black ashes, from which the side of the island rose in general too steep to admit of our ascending; and where we could have clambered up, the mass of mat-



ter was much too hot to allow our proceeding more than a few yards in the ascent.

The declivity below the surface of the sea was equally steep, having seven fathoms of water at scarcely the boat's length from the shore, and at the distance of twenty or thirty yards we sounded twenty-five fathoms. From walking round it in about twelve minutes, I should judge that it was something less than a mile in circumference; but the most extraordinary part was the crater, the mouth of which, on the side facing St. Michael's, was nearly level with the sea. It was filled with water, at that time boiling, and was emptying itself into the sea by a small stream about six yards over, and by which I should suppose it was continually filled again at high water. This stream, close to the edge of the sea, was so hot, as only to admit the finger to be dipped suddenly in, and taken out again immediately.

It appeared evident, by the formation of this part of the island, that the sea had, during the eruptions, broken into the crater in two places, as the east side of the small stream was bounded by a precipice; a cliff between twenty and thirty feet high, forming a peninsula of about the same dimension in width, and from fifty to sixty feet long, connected with the other part of the island by a narrow ridge of cinders and lava, as an isthmus, of from forty to fifty feet in length, from which the crater rose in the form of an amphitheatre.

This cliff, at two or three miles distance from the island, had the appearance of a work of art resembling a small fort or block-house. The top of this we were determined, if possible, to attain; but the difficulty we had to encounter in doing so was considerable; the only way to attempt it was up the side of the isthmus, which was so steep, that the only mode by which we could effect it, was by fixing the end of an oar at the base, with the assistance of which, we forced ourselves up in nearly a backward direction.

Having reached the summit of the isthmus, we found another difficulty; for it was impossible to walk upon it, as the descent on the other side was immediate, and as steep as the one we had ascended; but by throwing our legs across it, as would be done on the ridge of a house, and moving ourselves forward by our hands, we at length reached that part of it where it gradually widened itself, and formed the summit of the cliff, which we found to have a perfectly flat surface, of the dimensions before stated. Judging this to be the most conspicuous situation, we here planted the Union, and left a *bottle sealed up*, containing a short account of the origin of the island, and of our having landed upon it, and naming it *Sabrina Island*.

Within the crater, I found the complete skeleton of a guard-fish, the bones of which, being perfectly burnt, fell to pieces upon attempting to take them up; and, by the account of the inhabitants on the coast of St. Michael's, great numbers of fish had been destroyed during the early part of the eruption, as large quantities, probably suffocated or poisoned, were occasionally found drifted into the small inlets or bays. The island, like other volcanic productions, is composed principally of porous substances, generally burnt to complete cinders, with occasional masses of a stone, which I should suppose to be a mixture of iron and lime-stone.

Sabrina Island has gradually disappeared, since the month of October, 1811, leaving an extensive shoal. Smoke was discovered still issuing out of the sea in the month of February, 1812, near the spot where this wonderful phenomenon appeared.

## SUBTERRANEAN CURIOSITIES.

### THE GREAT CAVE OF KENTUCKY.

Give me, ye powers, the wonderous scenes to show,  
Conceal'd in darkness, in the depths below.

FOR a very interesting account of this stupendous cavern, which is unparalleled in the history of subterraneous wonders, we are indebted to Dr. Nahum Ward, who published it in the MONTHLY MAGAZINE of October, 1816. It is situated in Warren County, and in a territory not mountainous, but broken, differing in this respect from all the other caverns hitherto known. The Doctor, provided with guides, two large lamps, a compass, and refreshments, descended a pit forty feet in depth, and one hundred and twenty in circumference; having a spring of fine water at the bottom, and conducting to the entrance of the cavern. The opening, which is to the north, is from forty to fifty feet high, about thirty in width. It narrows shortly after, but again expands to a width of thirty or forty feet, and a height of twenty, continuing these dimensions for about a mile, to the first *hoppers*,\* where a manufactory of salt-petre has recently been established. Thence to the second of these hoppers, two miles from the entrance, it is forty feet in width, and sixty in height. Throughout nearly the whole of the distance, handsome walls have been made by the manufacturers, of the loose lime-stones. The road is hard, and as smooth as a flag pavement. In every passage which the Doctor traversed, the sides of the cavern were perpendicular, and

\* A hopper is an inverted cone, into which corn is put at a mill before it runs between the stones.

the arches, which have bid defiance even to earthquakes, are regular. In 1802, when the heavy shocks of earthquakes came on which were so severely felt in this part of Kentucky, the workmen stationed at the second hoppers, heard about five minutes before each shock, a heavy rumbling noise issue from the cave, like a strong wind. When that ceased, the rocks cracked, and the whole appeared to be going in a moment to final destruction. However, no one was injured, although large portions of rocks fell in different parts of the cavern.

In advancing into the cavern, the avenue leads from the second hoppers, west, one mile; and thence, south-west, to the chief area or city, which is six miles from the entrance. This avenue, throughout its whole extent from the above station to the cross-roads, or chief area, is from sixty to one hundred feet in height, of a similar width, and nearly on a level, the floor or bottom being covered with loose lime-stone, and salt-petre earth. "When," observes the Doctor, "I reached this immense area, (called the chief city,) which contains upwards of eight acres, without a single pillar to support the arch, which is entire over the whole, I was struck dumb with astonishment.—Nothing can be more sublime and grand than this place, of which but a faint idea can be conveyed, covered with one solid arch at least one hundred feet high, and to all appearance entire."

Having entered the area, the Doctor perceived five large avenues leading from it, from sixty to one hundred feet in width, and about forty in height. The stone walls are arched, and were from forty to eighty feet perpendicular in height before the commencement of the arch.

In exploring these avenues, the precaution was taken to cut arrows, pointing to the mouth of the cave, on the stones beneath the feet, to prevent any difficulty in the return. The first which was traversed, took a southerly direction for more than two miles; when a second was taken, which led first east, and then north, for more than two miles further. These windings at length brought the party, by another avenue, to the chief city again, after having traversed different avenues for more than five miles. Having reposed for a few moments on slabs of lime-stone near the centre of this gloomy area, and refreshed themselves and trimmed their lamps, they departed a second time, through an avenue almost north, parallel with the one leading from the chief city to the mouth of the cavern; and, having proceeded upwards of two miles, came to the second city. This is covered with a single arch, nearly two hundred feet high in the centre, and is very similar to the chief city, *except in the number of its avenues which are two only.*

They crossed it, over a very considerable rise in the centre, and descended through an avenue which bore to the east, to the distance of nearly a mile, when they came to a third area, or city, about one hundred feet square, and fifty in height, which had a pure and delightful stream of water issuing from the side of a wall about thirty feet high, and which fell on a broken surface of stone, and was afterwards entirely lost to view.

Having passed a few yards beyond this beautiful sheet of water, so as to reach the end of the avenue, the party returned about one hundred yards, and passing over a considerable mass of stone, entered another, but smaller avenue to the right, which carried them south, through a third, of an uncommonly black hue, somewhat more than a mile; when they ascended a very steep hill about sixty yards, which conducted them within the walls of the fourth city. It is not inferior to the second, having an arch which covers at least six acres. In this last avenue, the extremity of which cannot be less than four miles from the chief city, and ten from the mouth of the cavern, are upwards of twenty large piles of salt-petre earth on the one side, and broken lime-stone heaped up on the other, evidently the work of human hands.

From the course of his needle, the Doctor expected that this avenue would have led circuitously to the chief city; but was much disappointed when he reached the extremity, at a few hundred yards distance from the fourth city. In retracing his steps, not having paid a due attention to mark the entrances of the different avenues, he was greatly bewildered, and once completely lost himself for nearly fifteen or twenty minutes. Thus, faint and wearied, he did not reach the chief area till ten at night: but was still determined to explore the cavern so long as his light should last. Having entered the fifth and last avenue from the chief area, and proceeded southeast about nine hundred yards, he came to the fifth area, the arch of which covers upwards of four acres of level ground, strewn with lime-stones, and having fire-beds of an uncommon size, surrounded with brands of cane interspersed. Another avenue on the opposite side, led to one of still greater capacity, the walls or sides of which were more perfect than any that had been noticed, running almost due south for nearly a mile and a half, and being very level and straight, with an elegant arch. While the Doctor was employed, at the extremity of this avenue, in sketching a plan of the cave, one of his guides, who had strayed to a distance, called on him to follow. Leaving the other guide, he was led to a vertical passage, which opened into a chamber at least 1800 feet in cir-

cumference, and the centre of the arch of which was 150 feet in height.

It was past midnight when he entered this chamber of eternal darkness ; and when he reflected on the different avenues through which he had passed since he had penetrated the cave at eight in the morning, and now found himself buried several miles in the dark recesses of this awful cavern—the grave, perhaps, of thousands of human beings—he felt a shivering horror. The avenue, or passage, which led from it, was as large as any he had entered ; and it is uncertain how far he might have travelled, had his lights not failed him. All those who have any knowledge of this cave, he observes, conjecture that Green River, a stream navigable several hundred miles, passes over three of its branches.

After a lapse of nearly an hour, he descended by what is called the “ passage of the chimney,” and joined the other guide. Thence returning to the chief area or city, where the lamps were trimmed for the last time, he entered the spacious avenue which led to the second hoppers. Here he met with various curiosities, such as spars, petrifications, &c. ; and these he brought away, together with a *mummy* which was found at the second hoppers. He reached the mouth of the cave about three in the morning, nearly exhausted with nineteen hours of constant fatigue. He nearly fainted on leaving it, and on inhaling the vapid air of the atmosphere, after having so long breathed the pure air occasioned by the nitre of the cave. His pulse beat stronger when withinside, but not so quick as when on the surface.

Here the Doctor observes, that he has hardly described half the cave, not having named the avenues between its mouth and the second hoppers. This part of his narrative is of equal interest with what has been already given. He states, that there is a passage in the main avenue, upwards of nine hundred feet from the entrance, like that of a trap-door. By sliding aside a large flat stone, you can descend sixteen or eighteen feet in a very narrow defile, where the passage comes on a level, and winds about in such a manner, as to pass under the main passage without having any communication with it, at length, opening into the main cave by two large passages just beyond the second hoppers. This is called the “ glauber-salt room,” from salts of that kind being found there. Next come the sick-room, the bat-room, and the flint-room, together with a winding avenue, which, branching off at the second hoppers, runs west and south-west for more than two miles. It is called the “ haunted chamber,” from the echo within : its arch is very *beautifully* incrustured with lime-stone spar ; and in many places

the columns of spar are truly elegant, extending from the ceiling to the floor. Near the centre of this arch is a dome, apparently fifty feet high, hung in rich drapery, festooned in the most fanciful manner, for six or eight feet from the hangings, and in colours the most rich and brilliant. By the reflection of one or two lights, the columns of spar and the stalactites have a very romantic appearance. Of this spar, a large cellar, called "Wilkins' armed chair," has been formed in the centre of the avenue, and encircled with many smaller ones. The columns of spar, fluted and studded with knobs of spar and stalactites; the drapery of various colours superbly festooned, and hung in the most graceful manner; these are shown with the greatest brilliancy by the reflection of the lamps.

In the vicinity of the "haunted chamber," the sound of a cataract was heard; and at the extremity of the avenue was a reservoir of water, very clear and grateful to the taste, apparently having neither inlet nor outlet. Here the air, as in many other parts of the cave, was pure and delightful. Not far from the reservoir, an avenue presented itself, within which were several columns of the most brilliant spar, sixty or seventy feet in height, and almost perpendicular, standing in basins of water; which, as well as the columns, the Doctor observes, surpass, in splendour and beauty, every similar work of art he had ever seen.

Returning by a beautiful pool of water, the Doctor came to the second hoppers, where he had found the mummy before alluded to. It had been removed from another cave, for preservation, and was presented to him by his friend Mr. Wilkins, together with the apparel, jewels, music, &c. with which it was accompanied. It has since been placed in the Washington museum, the proprietor of which thinks it probable that this mummy is as ancient as the immense mounds of the western country, which have so much astonished the world.

#### CAVE IN THE BLUE RIDGE, VIRGINIA.

The shower was now over, which had wet us to the skin—the sun was pouring down his most scorching rays—the heavy thunder had gone by; we threw around our delighted eyes, and beheld near us the lofty Alleghany rearing his shaggy head. The south branch of the Shenandoah river, with its banks covered with beautiful trees, was murmuring at our feet—a lovely plain stretched below us as far as the eye could reach; and we, with our guide, were now standing about half way up a hill about 200 feet high, and so steep that a biscuit may be thrown from its top into the river at its foot—we were standing at the mouth of WARE'S CAVE. This cavern derives

its name from *Barnet Ware*, who discovered it in the year 1804. It is situated near Madison's Cave, so celebrated, though the latter cannot be compared with the former. It would seem as if in this mountain, nature had strewed her beauties with a hand so prodigal, that it creates not only pleasure, but astonishment also.

There were three of us, besides our guide, with lighted torches, and our loins girded, now ready to descend into the cave. We took our lights in our left hands, and entered. The mouth was so small that we could descend only by creeping one after another. A descent of almost twenty yards, brought us into the first room. The cave was exceedingly cold, dark, and silent, like the chambers of death. In this manner we proceeded, now descending thirty or forty feet—now ascending as high—now creeping on our hands and knees, and now walking in large rooms, the habitations of solitude. The mountain seems to be composed almost wholly of limestone, and by this means, the cave is lined throughout with the most beautiful incrustations and stalactites of carbonated lime, which are formed by the continual dripping of the water. These stalactites are of various and elegant shapes and colours, often bearing a striking resemblance to animated nature. At one place we saw over our heads, what appeared to be a *water-fall*, of the most delightful kind. Nor could the imagination be easily persuaded that this was not in reality a water-fall; you could see the water dashing and boiling down—see its white spray and foam, &c.—but it was all solid carbonated limestone. Thus we passed onward in this world of solitude; now stopping to admire the beauties of a single stalactite; now wondering at the magnificence of a large room; now creeping through narrow passages, hardly wide enough to admit the body of a man, and now walking in superb galleries, until we came to the largest room, called *Washington-Hall*. This is certainly the most elegant room I ever saw. It is about 270 feet in length, about 35 in width, and between 30 and 40 feet high. The roof and sides are very beautifully adorned by the tinsels which nature has bestowed in the greatest profusion, and which sparkle like the diamond while surveyed by the light of torches. The floor is flat, and smooth, and solid. I was foremost of our little party in entering this room, and was not a little startled on approaching the centre, and by my small light seeing a figure, as it were, rising up before me out of the solid rock. It was not far from seven feet high, and corresponded in every respect to the common idea of a ghost. It was very white, and resembled a tall man clothed in a shroud. I went up to it sideways, though I could not really expect to

meet a ghost in a place like this. On examination, I found it was a very beautiful piece of the carbonate of lime, very transparent, and very much in the shape of a man. This is called *Washington's Statue*—as if nature would do that for this hero, which his delivered country has not done—rear a statue to his memory!

Here an accident happened which might have been serious. One of our party had purposely extinguished his light, lest we should not have enough to last. My companion accidentally put out his light, and in sport, came and blew out mine. We were now about sixteen hundred feet from daylight, with but one feeble light, which the falling water might in a moment have extinguished. Add to this, that the person who held this light, was at some distance viewing some falling water. “*Conticuere omnes, intentique ora tenebant.*” We, however, once more lighted our torches; but had we not been able so to do, we might, at our leisure, have contemplated the gloominess of the cavern, for no one would have come to us till the next day.

In one room we found an excellent spring of water, which boiled up, slaked our thirst, sunk again into the mountain, and was seen no more. In another room was a noble pillar, called the *Tower of Babel*. It is composed entirely of the stalactites of lime, or, as the appearance would seem to suggest, of petrified water. It is about 30 feet in diameter, and a little more than 90 in circumference, and not far from 30 feet high. It would appear as if there must be many millions of stalactites in this one pillar.

Thus we wandered in this world within a world, till we had visited *twelve* very beautiful rooms, and as many creeping places, and had now arrived at the end, a distance from our entrance of between twenty-four and twenty-five hundred feet; or, what is about its equal, *half a mile* from the mouth. We here found ourselves exceedingly fatigued; but our torches forbid us to tarry, and we once more turned our lingering steps towards the common world. When arrived once more at *Washington-Hall*, one of our company three times discharged a pistol, whose report was truly deafening. It was as loud as any cannon I ever heard, and as its sound reverberated and echoed through one room after another, till it died away in distance, it seemed like the moanings of spirits. We continued our wandering steps till we arrived once more at daylight, having been nearly three hours in the cavern. We were much fatigued, covered with dirt, and a cold sweat; yet we regretted to leave it. From the further end of the cave I gathered some hand-



some stalactites, which I put into my portmanteau, and preserved as mementoes of that day's visit.

CAVERN IN WATERTOWN, NEW-YORK.

There was discovered about three weeks since, on the north bank of the Black River, upon the land of James Le Ray, Esq. opposite to the village of Watertown, an extraordinary cavern, or grotto; the mouth of which is about 10 rods from the river, north of the falls, and of Cowan's Island.

The great extent of the cavern, and the great number of spacious rooms, halls, and chambers, into which it is divided, and the immense quantities of calcareous concretions which it contains, and different states of those concretions, from the consistence of lime mortar, to that of the most beautiful stalactites, as hard as marble, rendered it difficult, if not impossible, to describe it, and I shall only attempt to give a faint description of three or four rooms.

The mouth of the cavern is in a small hollow, about five feet below the surrounding surface of the earth; you then descend sixteen and a half feet into a room about 16 by 20 feet, and 8 feet high; and behold in front of you a large or table rock, 12 or 14 feet square, 2 feet thick, and elevated about four feet from the bottom of the cavern; the roof over head covered with stalactites, some of which reach to the rock. On your left hand, is an arched way, of 150 feet; and on your right hand is another arched way, 6 feet broad at the bottom, and 6 feet high, which leads into a large room. Passing by this arch about 20 feet, you arrive at another, which leads into a hall 10 feet wide, and 100 feet long, from 5 to 8 feet high, supported with pillars and arches, and the side bordered with curtains plaited in variegated forms as white as snow. Near the middle of this hall, is an arched way through, which, like the hall, is bordered with curtains, and hung over with stalactites; returning into the hall, you pass through another arch into a number of rooms on the left hand, curtained, and with stalactites hanging from the roof. You then descend about 10 feet into a chamber about 20 feet square, and two feet high, curtained in like manner, and hung over with stalactites. In one corner of this chamber, a small mound is formed about 12 feet in diameter, rising three feet from the floor; the top of which is hollow and full of water, from the drippings of stalactites above; some of which reach near to the basin.

Descending from this chamber, you pass through another arch into a hall, by the side of which you see another basin of water, rising about four inches from the floor; formed in the same way, but in the shape, size, and thickness of a large tray, full of the most pure and transparent water.

The number and spaciousness of the rooms, curtained and fitted with large plaits, extending along the walls from two or three feet from the roof; of the most perfect whiteness, resembling the most beautiful tapestry, with which the rooms are embroidered; and the large drops of water, which are constantly suspended on the roofs above; and the columns of rock resting on pedestals, which, in some places, appear to be needed to support the arches above—the reflection of the lights, the great extent and variety of the scenery of this amazing cavern, form altogether, one of the most pleasing and interesting scenes, that was ever beheld by the eye of mortal man.

His discovery immediately drew to it great numbers of people from the village and surrounding country; who were committing great depredations upon it, by breaking off and carrying away whatever they esteemed most curious; when Samuel Kennedy, Esq., Mr. Le Ray's agent, was applied to, to prevent further spoliation; who immediately directed the passage into the cavern to be enlarged; stairways to be made, and strong doors placed under lock and key; which has been done, and the door closed.

The discovery of this grotto, added to the extensive petrifications along the river in this vicinity, especially on Cowan's Island, of the once inhabitants of the deep, cannot fail to render Watertown, (to the curious at least,) a lasting place of re-

membrance. It may be proper to mention here, that the cavern has been partially explored, and that no one who has been into it, though some suppose they have travelled more than 1000 yds, pretend to have found the extent of it, or to know the number of rooms, halls, and chambers, which it contains.

## GROTTO OF ANTIPAROS.

[See Plate, No. 5.]

Antiparos, one of the Cyclades, is situated in the Ægean Sea, or Grecian Archipelago. It is a small island, about six or seven miles in circumference, and lies two miles to the west of the celebrated Paros, from which circumstance it derives its name, *anti* in the Greek language signifying *opposite to*. Its principal and most interesting grotto, though so inferior in size to the cavern in Kentucky, has attracted the attention of an infinite number of travellers. The entrance to this superb grotto is on the side of a rock, and is a large arch, formed of jagged stones, overhung with brambles and creeping plants, which bestow on it a gloominess at once awful and agreeable. Having proceeded about thirty paces within it, the traveller enters a low narrow alley, surrounded on every side by stones,

which, by the light of torches, glitter like diamonds; the whole being covered and lined throughout with small crystals, which give by their different reflections, a variety of colours. At the end of this alley or passage, having a rope tied round his waist, he is led to the brink of an awful precipice, and is thence lowered into a deep abyss, the gloom pervading which, makes him regret the "alley of diamonds" he has just quitted. He has not as yet, however, reached the grotto, but is led forward about forty paces, beneath a roof of rugged rocks, amid a scene of terrible darkness, and at a vast depth from the surface of the earth, to the brink of another precipice, much deeper and more awful than the former.

Having descended this precipice, which is not accomplished without considerable difficulty, the traveller enters a passage, the grandeur and beauty of which can be but imperfectly described. It is one hundred and twenty feet in length, about nine feet high, and in width seven, with a bottom of a fine green glossy marble. The walls and arched roof are as smooth and polished as if they had been wrought by art, and are composed of a fine glittering red and white granite, supported at intervals by columns of a deep blood-red shining porphyry, which, by the reflection of the lights, presents an appearance inconceivably grand. At the extremity of this passage, is a sloping wall formed of a single mass of purple marble, studded with springs of rock crystal, which, from the glow of the purple behind, appear like a continued range of amethysts.

Another slanting passage, filled with petrifications, representing the figures of snakes and other animals, and having towards its extremity two pillars of beautiful yellow marble, which seem to support the roof, leads to the last precipice, which is descended by means of a ladder. The traveller, who has descended to the depth of nearly one thousand five hundred feet beneath the surface, now enters the magnificent grotto, to procure a sight of which he has endured so much fatigue. It is in width three hundred and sixty feet; in length three hundred and forty; and in most places one hundred and eighty in height. By the aid of torchlight, he finds himself beneath an immense and finely-vaulted arch, overspread with icicles of white shining marble, many of them ten feet in length, and of a proportionate thickness. Among these, are suspended a thousand festoons of leaves and flowers, of the same substance, but so glittering as to dazzle the sight. The sides are planted with petrifications, also of white marble, representing trees; these rise in rows one above the other, and often enclose the points of the icicles. *From them* also hang festoons, tied as it were one to another, *in great abundance*; and in some places rivers of marble seem

to wind through them. In short, these petrifications, the result of the dripping of water for a long series of ages, nicely resemble trees and brooks turned to marble. The floor is paved with crystals of different colours, such as red, blue, green, and yellow, projecting from it and rendering it rugged and uneven. These are again interspersed with icicles of white marble, which have apparently fallen from the roof, and are there fixed. To these the guides fasten their torches; and the glare of splendour and beauty which result from such an illumination, may be better conceived than described.

To the above lively description we subjoin an extract from the one given by Dr. Clark, a learned traveller, who visited this celebrated grotto in 1802.

“The mode of descent is by ropes, which, on the different declivities, are either held by the guides, or are joined to a cable which is fastened at the entrance around a stalactite pillar. In this manner, we were conducted, first down one declivity, and then down another, until we entered the spacious chambers of this truly enchanted grotto. The roof, the floor, the sides of a whole series of magnificent caverns, were entirely invested with a dazzling incrustation as white as snow. Columns, some of which were five-and-twenty feet in length, pended in fine icicle forms above our heads; fortunately some of them are so far above the reach of the numerous travellers, who, during many ages, have visited this place, that no one has been able to injure or remove them. Others extended from the roof to the floor, with diameters equal to that of the mast of a first-rate ship of the line. The incrustations of the floor, caused by falling drops from the stalactites above, had grown up into dendritic and vegetable forms, which first suggested to Tournefort the strange notion of his having here discovered the vegetation of stones. Vegetation itself has been considered as a species of crystallization; and as the process of crystallization is so surprisingly manifested by several phenomena in this grotto, some analogy may perhaps be allowed to exist between the plant and the stone; but it cannot be said, that a principle of life existing in the former, has been imparted to the latter. The last chamber into which we descended, surprised us more by the grandeur of its exhibition than any other. Probably there are many other chambers below this, yet unexplored, for no attempt has been made to penetrate further: and, if this be true, the new caverns, when opened, would appear in perfect splendour, unsullied, in any part of them, by the smoke of torches, or by the hands of intruders.

## CAVERNS IN GERMANY AND HUNGARY, CONTAINING FOSSIL BONES.

Among the most remarkable of these caverns are those of Gaylenreuth, on the confines of Bayreuth. The opening to these, which is about seven feet and a half high, is at the foot of a rock of lime-stone of considerable magnitude, and in its eastern side. Immediately beyond the opening, is a magnificent grotto, of about three hundred feet in circumference, which has been naturally divided by the form of the roof into four caves. The first is about twenty-five feet long and wide, and varies in height from nine to eighteen feet, the roof being formed into irregular arches. Beyond this is the second cave, about twenty-eight feet long, and of nearly the same width and height with the former.

A low and very rugged passage, the roof of which is formed of projecting pieces of rocks, leads to the third grotto, the opening into which, is a hole three feet high, and four feet wide. This grotto is more regular in its form, and is about thirty feet in diameter, and nearly round; its height is from five to six feet. It is very richly and fantastically adorned by the varying forms of its stalactitic hangings. The floor is also covered with a wet and slippery glazing, in which several teeth and jaws appear to have been fixed.

From this grotto, commences the descent to the inferior caverns. Within only about five or six feet, an opening in the floor is seen, which is partly vaulted over by a projecting piece of rock. The descent is about twenty feet. This cavern is about thirty feet in height, about fifteen feet in width, and nearly circular; the sides, roof, and floor, displaying the remains of animals. The rock itself is thickly beset with teeth and bones, and the floor is covered with a loose earth, the evident result of animal decomposition, and in which numerous bones are imbedded.

A gradual descent leads to another grotto, which, with its passage, is forty feet in length, and twenty feet in height. Its sides and top are beautifully adorned with stalactites. Nearly twenty feet further is a frightful gulf, the opening of which is about fifteen feet in diameter; and, upon descending about twenty feet, another grotto, about the same diameter with the former, but forty feet in height, is seen. Here the bones are dispersed about; and the floor, which is formed of animal earth, has great numbers of them imbedded in it. The bones which are here found, seem to be of different animals; but in *this, as well as in the former caverns, perfect and unbroken bones are very seldom found.* Sometimes a tooth is seen pro-

jecting from the solid rock, through the stalactitic covering, showing that many of these wonderful remains may here be concealed. A specimen of this kind has been preserved, and is rendered particularly interesting, by the first molar tooth of the lower jaw, with its enamel quite perfect, rising through the stalactitic mass which invests the bone. In this cavern, the stalactites begin to be of a larger size, and of a more columnar form.

Passing on through a narrow opening in the rock, a small cave, seven feet long, and five feet high, is discovered; another narrow opening leads to another small cave; from which a sloping descent leads to a cave twenty-five feet in height, and about half as much in its diameter, in which is a truncated columnar stalactite, eight feet in circumference.

A narrow and most difficult passage, twenty feet in length, leads from this cavern to another, five-and-twenty feet in height, which is every where beset with teeth, bones, and stalactitic projections. This cavern is suddenly contracted, so as to form a vestibule of six feet wide, ten long, and nine high, terminating in an opening close to the floor, only three feet wide and two high, through which it is necessary to writhe, with the body on the ground. This leads into a small cave, eight feet high and wide, which is the passage into a grotto, twenty-eight feet high, and about three-and-forty feet long and wide. Here the prodigious quantity of animal earth, the vast number of teeth, jaws, and other bones, and the heavy grouping of the stalactites, produce so dismal an appearance, as to become a perfect model of a temple for a god of the dead. Here hundreds of cart-loads of bony remains might be removed, pockets might be filled with fossil teeth, and animal earth was found to reach to the utmost depth to which the workmen dug. A piece of stalactite, being here broken down, was found to contain pieces of bones, within it, the remnants of which were left imbedded in the rock.

From this principal cave, is a very narrow passage, terminating in the last cave, which is about six feet in width, fifteen in height, and the same in length. In this cave were no animal remains, and the floor was the naked rock.

Thus far only could these natural sepulchres be traced; but there is every reason to suppose, that these animal remains were disposed through a greater part of this rock.

Whence this immense quantity of the remains of carnivorous animals could have been collected, is a question which naturally arises; but the difficulty of answering it appears to be almost *insurmountable*.

## THE GROTTA DEL CANE.

This name has been given to a small cavern between Naples and Pozzuoli, on this account, that if a dog be brought into it, and his nose held to the ground, a difficulty of respiration instantly ensues, and he loses all sensation, and even life, if he be not speedily removed into purer air. There are other grottoes endowed with the same deleterious quality, especially in volcanic countries; and the pestiferous vapours they exhale are quickly fatal both to animals and men, though they do not offer to the eye the slightest indication of their presence. These vapours are, however, for the greater part, temporary; while that of the GROTTA DEL CANE is perpetual, and seems to have produced its deadly effects even in the time of Pliny. A man standing erect within does not suffer from it, the mephitic vapour rising to a small height only from the ground. It may, therefore, be entered without danger.

The smoke of a torch extinguished in this vapour, or gas, sinks downward, assumes a whitish colour, and passes out at the bottom of the door. The reason of this is, that the fumes which proceed from the torch, mix more readily with the gas than with the atmospherical air. It has been supposed, that the mischievous effects of the vapour were the result of the air being deprived of its elasticity; but it has been clearly demonstrated by M. Adolphus Murray, that they are solely to be attributed to the existence of carbonic acid gas.

The person who is the keeper, or guide, at the grotto, and who shows to strangers the experiment of the dog for a gratuity, takes the animal, when he is half dead and panting, into the open air, and then proceeds to throw him into the neighbouring lake of Agnano, thus insinuating that this short immersion in the water is necessary to his complete restoration. This, however, is a mere trick, to render the experiment more specious, and to obtain a handsome present from the credulous, the atmospherical air alone sufficing for that purpose.

The celebrated naturalist, the Abbe Spallanzani, projected a regular series of experiments on the mephitic vapour of this grotto, from a persuasion that they would tend to throw a new light on physiology and natural philosophy. Being, however, prevented from undertaking this, by his duties as a professor, his friend, the Abbe Breislak, who resided near the spot, engaged in the task; and the following is an abstract of his learned memoir on this subject.

*It is well known, the Abbe observes, that the mephitic vapour occupies the floor of a small grotto near the lake Agnano, a place highly interesting to naturalists from the phenom-*

na its environs present, and the hills within which it is included. This grotto is situated on the southeast side of the lake at a little distance from it. Its length is about twelve feet, and its breadth from four to five. It appears to have been originally a small excavation, made for the purpose of obtaining puzzolana, an earth which, being applied as mortar, becomes a powerful cement. In the sides of the grotto, among the earthy volcanic matters, are found pieces of lava, of the same kind with those which are met with scattered near the lake.

The Abbe is persuaded that, if new excavations were to be made in the vicinity of the grotto, at a level with its floor, or a little lower, the same mephitic vapour would be found; and thinks it would be curious to ascertain the limits of its extent. It would also be advantageous to physical observations, if the grotto were to be somewhat enlarged, and its floor reduced to a level horizontal plane, by sinking it two or three feet, and surrounding it by a low wall, with steps at the entrance. In its present state, it is extremely inconvenient for experiments, and the inclination of the ground towards the door causes a great part of the vapour, from the effect of its specific gravity, to make its way out close to the ground.

When the narrow limits of this place are considered, and the small quantity of the vapour which has rendered it so celebrated, there cannot be any doubt but that it has undergone considerable changes; since it does not appear probable that Pliny refers to the present confined vapour only, when, in enumerating many places from which a deadly air exhaled, he mentions the territory of Pozzuoli. The internal fermentations by which it is caused, are certainly much diminished in the vicinity of the lake Agnano. The water near its banks is no longer seen to bubble up, from the disengagement of a gas, as it appears from accounts not of very remote antiquity, to have done. The borders of the lake were attentively examined by the Abbe, when its waters were at the highest, and after heavy rains; but he could never discover a single bubble of air. A number of aquatic insects which sport on the surface, may at first sight occasion some deception; but a slight observation soon detects the error. If, therefore, we do not suppose those authors, who have described the ebullition of the water near the banks of the lake Agnano, to have been deceived, it must at least be confessed, that this phenomenon has now ceased. The quantity of the sulphureous vapours which rise in the contiguous stoves, called the stoves of St. Germano, must likewise be greatly diminished from what it anciently was: for, adjoining to the present stoves, we still find the remains of a spacious ancient fabric, with tubes of terra cotta.



inserted in the walls, which, by their direction, show for what purpose they were intended. It appears certain, that this was a building, in which, by the means of pipes properly disposed, the vapours of the place were introduced into different rooms, for the use of patients. To these ruins, however, the vapours no longer extend; so that, if this edifice had remained entire, it could not have been employed for the purpose for which it was intended. The veins of pyrites, which produced the more ancient conflagrations of the Phlegrean fields, between Naples and Cumæ, and which, in some places, are entirely consumed, approach their total extinction. To proceed to the experiments within the grotto.

The object of the first was to determine the height of the mephitic vapour at the centre of the grotto, that is, at the intersection of the line of its greatest length with that of its greatest breadth. This height varies according to the different dispositions and temperatures of the atmosphere, the diversity of winds, and the accidental variations which take place in the internal fermentations by which the vapour is produced. It may, however, be estimated, at a mean, at nearly nine English inches.

The second set of experiments regarded the degree of heat on entering into the mephitic: it was slightly sensible in the feet and lower part of the legs; notwithstanding which, on taking out of the vapour several substances which had remained in it for a long time, such as stones, leaves, the carcasses of animals, &c. the Abbe found that these were of the same temperature with the atmospheric air. Feeling in his body a slight degree of heat, which he could not perceive in the substances removed from the mephitic vapour, he was led by comparison to conclude, that the temperature of the latter was the same with the atmospherical air, agreeably to the principles of Dr. Cranford. He was, however, mistaken; for, in subsequent experiments, he found a very distinct degree of heat. He was now provided with a thermometer, his former one having been broken, and, having suspended it at the aperture of the grotto, three feet above the surface of the vapour, he found the mercury to stand at from sixty-two to sixty-four degrees of Fahrenheit; but on placing the ball on the ground so as to immerse it in the vapour, the mercury rose to eighty, and even eighty-two degrees. That the substances taken out of the mephitic did not exhibit this diversity of temperature, was, he thinks, owing to the quantity of humidity with which they are always loaded, and which produces on their surface a constant evaporation. He was the more particular in repeating these experiments, *because the naturalists who had, before him, made similar*

ones in the GROTTA DEL CANE, had not observed the vapour to produce any effect on the mercury in the thermometer.

Thirdly. He repeated for his own satisfaction, the usual experiments made by naturalists, with the tincture of turnsole, lime-water, the crystallizations of alkalies, the absorption of water, and the acidulous taste communicated to it; which prove, beyond all doubt, the existence of fixed air, or carbonic acid gas, in the vapour of the grotto. He ascertained, that it was not formed of fixed air alone, as might have been conjectured; but that the relative quantities of the different gases which compose its mephitic air, are as follow:—In one hundred parts, there are ten of vital air, or oxygenous gas; forty of fixed air, or carbonic acid gas; and fifty of phlogisticated air, or azotic gas.

Fourthly. The phenomena of magnetism and electricity were investigated by the Abbe in this grotto. With respect to the former, there was not any new appearance: the magnetic needle, being placed on the ground, and consequently immersed in the mephitic, rested in the direction of its meridian; and, at the approach of a magnetized bar, exhibited the usual effects of attraction and repulsion, in proportion as either pole was presented. As to the latter, electricity, it was impossible to make the experiments within the mephitic, not because this kind of air is a conductor of the electric fluid, as has been imagined, but because the humidity by which it is constantly accompanied, disperses the electric matter; and this, not being collected in a conductor, cannot be rendered sensible. He attempted several times to fire inflammable gas, with electric sparks, in the mephitic vapour, by means of the conductor of the electrophus; but, notwithstanding his utmost endeavours to animate the electricity, he could never obtain a single spark, the non-conductor becoming a conductor the moment it entered into the mephitic, on account of the humidity which adhered to its surface.

Fifthly. His latest experiments were directed to the theory of the combustion of bodies. He first endeavoured to ascertain whether those spontaneous inflammations that result from the mixture of concentrated acids with essential oils, could be obtained within the grotto. He placed on the ground a small vessel, in such a situation that the mephitic rose six inches above its edges, employing oil of turpentine, and the vitriolic and nitrous acids: the same inflammation, accompanied by a lively flame, followed, as would have taken place in the open atmospheric air. The dense smoke which always accompanies *these inflammations*, being attracted by the humidity of the *mephitic*, presented its undulations to the eye, and formed a

very pleasing object. As he had put a considerable quantity of acid in the vessel, he repeatedly poured in a little of the oil, and the flame appeared in the mouth of the vessel fifteen times successively. The oxygenous principle contained in the acids, and with which the nitrous acid principally abounds, undoubtedly contributed to the production and duration of this flame, though enveloped in an atmosphere inimical to inflammation.

The Abbe had, in the district of Latera, observed that in a mephitic of hydrogenous sulphurated or hepatic gas, a slow combustion of phosphorus took place, with the same resplendence as in the atmospheric air. On the present occasion, his first experiment, in the mephitic of Agnano, was made with common phosphoric matches, five of which he broke, holding them to the ground, and consequently immersed in the mephitic. They produced a short and transient flame, which became extinguished the moment it was communicated to the wick of a candle. His second experiment was as follows:— He placed on the ground, within the grotto, a long table, in such a manner as that one extremity was without the mephitic, while the other, and four-fifths of its length, were immersed in it. Along this table he laid a train of gun-powder, beginning from the end without the mephitic; and, at the other end, which was immersed in it to the depth of seven inches, he placed, adjoining to the gun-powder, a cylinder of phosphorus, eight lines in length. The gun-powder, without the mephitic, being fired, the combustion was soon communicated to the other extremity of the train, and to the phosphorus, which took fire with precipitation, burned rapidly with a bright flame, slightly coloured with yellow and green, and left on the wood a black mark, as of charcoal. The combustion lasted nearly two minutes, when the whole phosphoric matter was consumed.

In succeeding experiments no alteration was perceptible in the flame, or manner of burning, of the lighted phosphorus, either at the moment of its entrance into the mephitic, or during its continuance in it. When suddenly withdrawn, it ignited gun-powder equally well. Hence the Abbe deduces, that the mephitic gas of the GROTTA DEL CANE, however it may be utterly unfit for the respiration of animals, and for the inflammation of common combustible substances, readily allows that of phosphorus, which not only burns in it, but emits, as usual, luminous sparks.

THE GREAT CAVERN OF GUACHARO, IN SOUTH AMERICA\*.

*In a country where the people love what is marvellous, a cavern that gives birth to a river, and is inhabited by those*

\* Abridged from the Personal Narrative of Humboldt, vol. iii.

ands of nocturnal birds, the fat of which is employed in the Missions to dress food, is an everlasting object of conversation and discussion. Scarcely has a stranger arrived at Cumana, when he is told of the stone of Araya for the eyes; of the labourer of Arenas who suckled his child; and of the CAVERN OF GUACHARO, which is said to be several leagues in length; ill he is tired of hearing of them.

The Cueva del Guacharo is pierced in the vertical profile of a rock. The entrance is toward the south, and forms a vault eighty feet broad, and seventy-two feet high. The rock, that surmounts the grotto, is covered with trees of gigantic height. The mammee-tree, and the genipa with large and shining leaves, raise their branches vertically towards the sky; while those of the courbaril and the erythrina form, as they extend themselves, a thick vault of verdure. Plants of the family of polthos with succulent stems, oxalises, and orchideæ, of a singular structure, rise in the driest cliffs of the rocks; while creeping plants, waving in the winds, are interwoven in festoons before the opening of the cavern. We distinguished in these festoons a bignonia of a violet blue, the purple dolichos, and, for the first time, that magnificent olandra, the orange flower of which has a fleshy tube more than four inches long. The entrances of grottoes, like the view of cascades, derive their principal charm from the situation, more or less majestic, in which they are placed, and which in some sort determines the character of the landscape. What a contrast between the Cueva of Caripe, and those caverns of the North, crowned with oaks and gloomy larch-trees!

But this luxury of vegetation embellishes not only the outside of the vault, it appears even in the vestibule of the grotto. We saw with astonishment, plantain-leaved heliconias eighteen feet high, the praga palm-tree, and arborescent arums, follow the banks of the river even to those subterranean places. The vegetation continues in the cave of Caripe, as in those deep crevices of the Andes, half excluded from the light of day; and does not disappear, till, advancing into the interior, we reach thirty or forty paces from the entrance. We measured the way by means of a cord: and we went on about four hundred and thirty feet, without being obliged to light our torches.

Day-light penetrates into this region, because the grotto forms but one single channel, which keeps the same direction from southeast to northwest. Where the light begins to fail, we heard from afar the hoarse sounds of the nocturnal birds; sounds which the natives think belong exclusively to those subterraneous places. The guacharo is of the size of our fowls, *has the mouth of the goatsuckers and procnias*, and the port

of those vultures, the crooked beak of which is surrounded with stiff silky hairs. It forms a new genus, very different from the goatsucker by the force of its voice, by the considerable strength of its beak, containing a double tooth, by its feet without the membranes that unite the anterior phalanges of the claws. In its manners, it has analogies both with the goatsuckers and the alpine crow. The plumage of the guacharo is of a dark bluish-grey, mixed with small streaks and specks of black. It is difficult to form an idea of the horrible noise occasioned by thousands of these birds in the dark part of the cavern, and which can only be compared to the croaking of our crows, which, in the pine forests of the north, live in society, and construct their nests upon trees, the tops of which touch each other. The shrill and piercing cries of the guacharos strike upon the vaults of the rocks, and are repeated by the echo in the depth of the cavern. The Indians showed us the nests of these birds, by fixing torches to the end of a long pole. These nests were fifty or sixty feet high above our heads, in holes in the shape of funnels, with which the roof of the grotto is pierced like a sieve. The noise increased as we advanced, and the birds were affrighted by the light of the torches of copal. When this noise ceased around us, we heard at a distance the plaintive cries of the birds roosting in other ramifications of the cavern. It seemed as if these bands answered each other alternately.

The Indians enter into the Cueva del Guacharo once a year, near mid-summer, armed with poles, by means of which, they destroy the greater part of the nests. At this season, several thousands of birds are killed; and the old ones, to defend their brood, hover around the heads of the savage Indians, uttering terrible cries, which would appal any heart but that of man in an untutored state.

We followed, as we continued our progress through the cavern, the banks of the small river which issued from it, and is from twenty-eight to thirty feet wide. We walked on the banks, as far as the hills, formed of calcareous incrustations, permitted us. When the torrent winds among very high masses of stalactites, we were often obliged to descend into its bed, which is only two feet in depth. We learnt with surprise, that this subterraneous rivulet is the origin of the river Caripe, which, at a few leagues distance, after having joined the small river of Santa Maria, is navigable for canoes. It enters into the river Areo under the name of *Carno de Terrenzen*. We found on the banks of the subterraneous rivulet a great quantity of palm-tree wood, the remains of trunks, on which the Indians climb to reach the nests hanging to the roofs of the cavern. The rings, formed by the vestiges of the old

footstalks of the leaves, furnish, as it were, the footsteps of a ladder perpendicularly placed.

The grotto of Caripe preserves the same direction, the same breadth, and its primitive height of sixty or seventy feet, to the distance of 1458 feet, accurately measured. I have never seen a cavern in either continent, of so uniform and regular a construction. We had great difficulty in persuading the Indians to pass beyond the outer part of the grotto, the only part which they annually visit to collect the fat. The whole authority of the missionaries was necessary, to induce them to advance as far as the spot where the soil rises abruptly at an inclination of sixty degrees, and where the torrent forms a small subterraneous cascade.\* The natives connect mystic ideas with this cave, inhabited by nocturnal birds; they believe, that the souls of their ancestors sojourn in the deep recesses of the cavern. "Man," say they, "should avoid places which are enlightened neither by the sun, nor by the moon." To go and join the guacharoes, is to rejoin their fathers; is to die. The magicians and the poisoners perform their nocturnal tricks at the entrance of the cavern, to conjure the chief of the evil spirits.

At the point where the river forms the subterraneous cascade, a hill, covered with vegetation, which is opposite the opening of the grotto, presents itself in a very picturesque manner. It appears at the extremity of a straight passage, 240 toises in length. The stalactites, which descend from the vault, and which resemble columns suspended in the air, display themselves on a back-ground of verdure. The opening of the cavern appeared singularly contracted, when we saw it about the middle of the day, illumined by the vivid light reflected at once from the sky, the plants, and the rocks. The distant light of day formed somewhat of a magical contrast with the darkness that surrounded us in those vast caverns. We climbed, not without some difficulty, the small hill, whence the subterraneous rivulet descends. We saw that the grotto was perceptibly contracted, retaining only forty feet in its height; and that it continued stretching to the northeast, without deviating from its primitive direction, which is parallel to that of the great valley of Caripe.

The missionaries, with all their authority, could not prevail on the Indians to penetrate farther into the cavern. As the vault grew lower, the cries of the guacharoes became more shrill. We were obliged to yield to the pusillanimity of our guides, and trace back our steps. We followed the course of

\* We find this phenomenon of a subterranean cascade, but on a much larger scale, in England, at Yordas cave, near Kingsdale, in *Yorkshire*.

the torrent to go out of the cavern. Before our eyes were dazzled with the light of day, we saw, without the grotto, the water of the river sparkling amid the foliage of the trees that concealed it. It was like a picture placed in the distance, and to which the mouth of the cavern served as a frame. Having at length reached the entrance, and seated ourselves on the bank of the rivulet, we rested after our fatigues. We were glad to be beyond the hoarse cries of the birds, and to leave a place where darkness does not offer even the charms of silence and tranquility.

GRAND STAFFA CAVERN; OR FINGAL'S CAVE.

[See Plate. No. 6.]

By far the best description of this very extraordinary feature of the most wonderful island of the Hebrides, the whole of which constitutes as singular and romantic a spot as is any where to be found, has been given by Sir Joseph Banks, from whose more detailed account we extract the following particulars.

STAFFA, about seven miles N. N. E. of Jona, and equidistant westward from the shores of Mull, about one mile in length, and half a mile in breadth, is noted for the basaltic pillars which support the major part of the island, and for the magnificent spectacle afforded by the Cave of Fingal, one of the most splendid works of nature.

Notwithstanding the contiguity of this island to Mull and Jona, and the numerous vessels which navigate these seas, this wonderful Island was unknown to the world in general, and even to most of the neighbouring islanders, until near the close of the last century, when Sir Joseph, then on his voyage to Iceland, in consequence of information received in the sound of Jona from some gentlemen of Mull, was induced to sail thither. It is, indeed, slightly mentioned by Buchanan; but assuredly was not equally dead to fame at the time the Norwegians had sway in these parts; for from them it derives its name of Staffa.

The basaltic pillars stand in natural colonnades, mostly above fifty feet high, in the south-western part, upon a firm basis of solid unshapen rock; above these, the stratum, which reaches to the soil of the island, varies in thickness, in proportion to the distribution of the surface into hill and valley. The pillars are of three, four, and more sides; but the number of those with five and six, exceeds that of the others; one of seven sides, measured by Sir Joseph, was four feet five inches in diameter.

*On the west side of Staffa is a small bay, the spot where*

boats usually land. In this neighbourhood occurs the first group of pillars; they are small, and instead of being placed upright, are recumbent on their sides, and form a segment of a circle. Further on, is a small cave, above which, pillars again are seen, of somewhat larger dimensions, which incline in all directions; in one place, in particular, a small mass of them much resembles the ribs of a ship. Beyond the cave is the first continued range of pillars, larger than the former, and opposite to them is a small island called Bhuachaile, (pronounced Boo-sha-'lay,) or the Herdsman's Isle, separated from the main by a channel not many fathoms wide. The whole of this islet is composed of pillars without any strata above them; they are small, but by much the neatest formed of any in this quarter.

The first division of this islet, for, at high water, it is divided into two parts, makes a kind of cone, the pillars converging together towards the centre. On the other side, the pillars are in general recumbent; and in the front, next the main, the beautiful manner in which they are joined is visible from their even extremities; all these have their transverse sections exact, and their surfaces smooth; but with the larger pillars the reverse is the case, and they are cracked in all directions.

The main island opposite the Boo-sha-'lay, and thence towards the northwest, is entirely supported by ranges of pillars, pretty erect, which, although not apparently tall, from their not being uncovered to the base, are of large diameter; at their feet is an irregular pavement, made by the upper sides of such as have been broken off. This extends as far under the water as the eye can reach.

In proceeding along the shore, the superb cavern of Fingal appears, for such is the denomination given it by the Highlanders, to whom it is known. It is supported on each side by ranges of columns, and is roofed by the bottoms of such as have been broken away. From the interstices of the roof a yellow stalactitic matter has exuded, which precisely defines the different angles; and, varying the colour, tends to augment the elegance of its appearance. What adds to the grandeur of the scene, the whole cave is lighted from without, in such a manner, that the farthest extremity is plainly distinguished; while the air within, being constantly in motion, owing to the flux and reflux of the tides, is perfectly dry and wholesome, and entirely exempt from the damp vapours to which natural caverns are generally subject. The following are its dimensions:





	Ft.	In.	Ft.	In.	Ft.	In.
Stratum below, - -	11	0	17	1	19	8
Height of pillars, -	54	0	50	0	55	1
Stratum above, - -	61	6	51	1	54	7

The stratum above the columns is uniformly the same, consisting of numberless small pillars, bending and inclining in all directions, sometimes so irregularly, that the stones can only be said to have an inclination to assume a columnar form; in others more regularly; but never breaking into, or disturbing the stratum of large pillars, whose tops keep every where an uniform line. On the opposite side of the island is a cavern, called *Oua-nascarve*, or the *Cormorant's cave*; here the stratum under the pillars is lifted up very high, and the pillars are considerably less than at the northwest side. Beyond, a bay cuts deep into the island, rendering it not more than a quarter of a mile across. On the sides of this bay, especially beyond a little valley, which almost divides the island, are two stages of small pillars, with a stratum between, exactly resembling that above, formed of innumerable little pillars, shaken out of their places, and leaning in all directions. Beyond this, the pillars totally cease. The rock is of a dark-brown stone, without regularity, from the bay along the southeast end of the island; beyond which, a disposition to columnar formation is again manifested, extending from the west side, but in an irregular manner, to the bending pillars first described.

## NATURAL ICEHOUSES.

In a wood, about five leagues from Besançon, in the province of France, called *Franche Comte*, an opening, formed by two masses of rock, leads to a cavern more than nine hundred feet beneath the level of the country. It is in width sixty feet, and eighty feet high, at the entrance, and exhibits within an oval cavity of one hundred and thirty-five feet in breadth, and one hundred and sixty-eight in length. To the right of the entrance, is a deep and narrow opening, bordered with festoons of ice, which, distilling in successive drops on the bottom of the cavern, form a mass of about thirty feet in diameter. A similar one, but somewhat smaller, produced by the water which drips in less abundance from the imperceptible fissures in the roof, is seen on the left. The ground of the cavern is perfectly smooth, and covered with ice eighteen inches thick; but the top, on the outside, is a dry and stony soil, covered with trees, and on a level with the rest of the wood. The cold within this cavern is so great, that, however warm the external atmosphere may be at the time it is visited, it is impossible to remain in it for any continuance.

These natural icehouses are not unfrequent in France and Italy, and supply this agreeable luxury at a very cheap rate. Thus, in the same province, in the vicinity of Vesoul, is a cavern, which, in the hot season, when it is eagerly sought, produces more ice in one day than can be carried away in eight. It measures thirty-five feet in length, and in width sixty. The large masses of ice which hang pendent from the roof, have a very pleasing effect. When mists are observed in this cavern, they are regarded by the neighbouring peasantry as infallible prognostics of rain; and it is worthy of observation, that although the water in the interior is always frozen in the summer, it becomes liquid in the winter season.

A grotto near Douse, also in Franche Comte, forms a similar icehouse, and is remarkable on account of the various forms of its congelations, which represent a series of columns, sustaining a curious vault, which appears to be carved with figures of men, animals, trees, &c.

#### THE YANAR, OR PERPETUAL FIRE.

Captain Beaufort, of the royal Navy, F. R. S. among the interesting details of his late survey of Karamania, or the South coast of Asia Minor, describes this curious phenomenon; and from his account, the following particulars are extracted, as supplementary to the ample details of volcanoes already given.

Having perceived, during the night, a small but steady light among the hills, this was represented by the inhabitants as a *yanar*, or *volcanic light*; and, on the following morning, curiosity led him to visit the spot. In the inner corner of a ruined building he came to a wall, so undermined as to leave an aperture of about three feet in diameter, and shaped like the mouth of an oven. From this aperture, the flame issued, giving out an intense heat, but without producing any smoke on the wall; and although several small lumps of caked soot were detached from the neck of the opening, the walls were scarcely discoloured. Trees, brushwood, and weeds, grew close around this little crater; a small stream trickled down the hill in its vicinity; and the ground did not appear to feel the effect of its heat at more than a few yards distance. No volcanic productions were to be perceived near to it; but at a short distance, lower down on the side of the hill, was another hole or aperture, which had apparently been at some remote period the vent of a similar flame. It was asserted, however, by the guide, that, in the memory of the present race of inhabitants, there had been but one such volcanic opening, and that its size and appearance had been constantly the same.

is added, that it was never accompanied by earthquakes or noises; and that it did not eject either stones, smoke, or noxious vapours; but that its brilliant and perpetual flame could be quenched by any quantity of water. At this flame, as observed, the shepherds were in the habit of cooking their food.

This phenomenon appears to Captain Beaufort to have existed for many ages, and he is persuaded that it is the spot to which Pliny alludes in the following passage:—"Mount Chirra, near Phaselis, emits an unceasing flame, which burns day and night." Within a short distance, is the great mountain of Takhtalu, the naked summit of which rises, in an isolated peak, 7800 feet above the level of the sea. In the month of August, a few streaks of snow were discernible on the peak; but many of the distant mountains of the interior were completely white for nearly a fourth down their sides. It may hence be inferred, that the elevation of this part of Mount Taurus is not less than 10,000 feet, which is equal to that of Mount Etna.

Such a striking feature as this stupendous mountain, in a country inhabited by illiterate and credulous people, cannot fail to have been the subject of numerous tales and traditions. Accordingly, the Captain was informed by the peasants, that there is a perpetual flow of the purest water from the very summit; and that notwithstanding the snow, which was still lingering in the chasms, roses blew there all the year round. He was assured by the Agha of Deliktash that every autumn a midnight groan is heard to issue from the summit of the mountain, louder than the report of any cannon, but unaccompanied by fire or smoke. He professed his ignorance of the cause; but on being pressed for his opinion, gravely replied, that he believed it was an annual summons to the elect, to make the last of their way to Paradise. However amusing this theory may have been, it may possibly be true that such explosions take place. The mountain artillery described by Captains Lewis and Clarke, in their travels in North America, and similar phenomena which are said to have occurred in South America, seem to lend some probability to the account. The Jews have also a tradition, that when Moses fled from Egypt, he took up his abode near this mountain, which was therefore named Moossa-Daghy, or the mountain of Moses. Between this story, and the Yanar, as it has been described above, may there not have been some fanciful connexion? The site of this volcanic opening is at an inconsiderable distance from the mountain; and the flame issuing from the thicket which surrounds it, may have led to some confused association with the *burning bush on Mount Horeb*, recorded in Exodus.

## HERCULANEUM.

This city was, together with Pompeii and Stabia, involved in the common ruin occasioned by the dreadful eruption of Vesuvius, in the reign of Titus already described. It was situated on a point of land stretching into the Gulph of Naples, about two miles distant from that city, near where the modern towns of Portici and Resini, and the Royal Palace, by which they are separated, now stand. The neck of land on which it was built, and which has since disappeared, formed a small harbour. Hence the appellation of *Herculis Porticum*, the small haven of Hercules, sometimes given to Herculaneum, and thence, in all probability, the modern name of Portici. The latter being situated immediately above some of the excavations of Herculaneum, the just fear of endangering its safety, by undermining it, is given as a principal reason why so little progress has been made in the Herculanean researches.

The discovery of Herculaneum is thus explained. At an inconsiderable distance from the Royal Palace of Portici, and close to the sea-side, Prince Elbeuf, in the beginning of the last century, inhabited an elegant villa. To obtain a supply of water, a well was dug, in the year 1730, through the deep crust of lava, on which the mansion itself had been reared. The labourers, after having completely pierced through the lava, which was of considerable depth, came to a stratum of dry mud. This event precisely agrees with the tradition relative to Herculaneum, that it was in the first instance overwhelmed by a stratum of hot mud, which was immediately followed by a wide stream of lava. Whether this mud was thrown up from Vesuvius, or formed by torrents of rain, does not appear to have been decided. Within the stratum, the workmen found three female statues, which were sent to Vienna.

It was not until some years after, that the researches at Herculaneum were seriously and systematically pursued. By continuing Elbeuf's well, the excavators at once came to the theatre, and from that spot carried on their further subterraneous investigation. The condition of Herculaneum was at that time much more interesting, and more worthy the notice of the traveller, than it is at present. The object of its excavation having unfortunately been confined to the discovery of statues, paintings, and other curiosities, and not carried on with a view to lay open the city, and thus to ascertain the features of its buildings and streets, most of the latter were again filled up with rubbish as soon as they were divested of every thing moveable. The marble was even torn from the walls of the

temples. Herculaneum may therefore be said to have been overwhelmed a second time by its modern discoverers; and the appearance it previously presented, can now only be ascertained from the accounts of those who saw it in a more perfect state. Agreeably to them, it must at that time have afforded a most interesting spectacle.

The theatre was one of the most perfect specimens of ancient architecture. It had, from the floor upwards, eighteen rows of seats, and above these, three other rows, which, being covered with a portico, seem to have been intended for the female part of the audience, to screen them from the rays of the sun. It was capable of containing between three and four thousand persons. Nearly the whole of its surface was, as well as the arched walls which led to the seats, cased with marble. The area, or pit, was floored with thick squares of *giallo antico*, a beautiful marble of a yellowish hue. On the top stood a group of four bronze horses, drawing a car, with a charioteer, all of exquisite workmanship. The pedestal of white marble is still to be seen in its place; but the group itself had been crushed and broken in pieces by the immense weight of lava which fell on it. The fragments having been collected, might easily have been brought together again, but having been carelessly thrown into a corner, a part of them were stolen, and another portion fused, and converted into busts of their Neapolitan Majesties. At length, it was resolved to make the best use of what remained, that is, to convert the four horses into one, by taking a fore leg of one of them, a hinder leg of another, the head of a third, &c. and, where the breach was irremediable, to cast a new piece. To this contrivance the bronze horse in the court-yard of the Museum of Portici owes its existence; and, considering its patchwork origin, still conveys a high idea of the skill of the ancient artist.

In the forum, which was contiguous to the theatre, beside a number of inscriptions, columns, &c. two beautiful equestrian statues of the Balbi family were found. These are of white marble, and are deposited in the hall of the left wing of the Palace at Portici.

Adjoining to the forum stood the temple of Hercules, an elegant rotunda, the interior of which was decorated with a variety of paintings, such as Theseus returning from his Cretan adventure with the Minotaur; Telephus's birth; Chiron the centaur instructing Achilles, &c. These were carefully separated from the walls, and are here deposited in the museum.

The most important discovery, however, was that of a villa, at a small distance from the forum; not only on account of the *peculiarity of its plan*, but because the greater number of

the works of art were dug out of its precinct ; and more especially because it contained a library consisting of more than fifteen hundred volumes, which are likewise safely deposited in the museum, and which, were they legible, would form a great classic treasure. These will be considered under the head of PAPHRI.

The villa is conjectured to have belonged to one of the Balbi family. Although elegant, it was small, and consisted of a ground floor only, like those of Pompeii. Beside a number of small closets round an interior hall, it contained a bathing-room, curiously fitted up with marble and water-pipes, and a chapel of a diminutive size, without any window or aperture for daylight, the walls of which were painted with serpents, and within which, a bronze tripod, filled with cinders and ashes, was found standing on the floor.

The apartment which contained the library was fitted up with wooden presses around the walls, about six feet in height : a double row of presses stood insulated in the middle of the room, so as to admit a free passage on every side. The wood of which the presses had been made, was burned to a cinder, and gave way at the first touch ; but the volumes, composed of a much more perishable substance, the Egyptian or Syracusan papyrus, were, although completely carbonized, through the effect of the heat, still so far preserved as to admit of their removal to a similar set of modern presses, provided, however, with glass doors in the museum.

In the middle of the garden belonging to this villa, was a basin nearly of the size and form of the one in the Green Park, having its edges faced with stone, and the two narrow ends rounded off in a semi-circular form. This piece of water was surrounded by beds or *parterres* of various shapes ; and the garden was on every side enclosed by a covered walk supported by columns. Of these columns there were sixty-four, ten for each of the shorter, and twenty-two for each of the longer sides of the quadrangle : they were made of brick, neatly stuccoed over, exactly similar to those in the Pompeian barracks. Each pillar supported one end of a wooden beam, the other extremity of which rested on the garden-wall, thus forming an arbour, probably planted with vines, around the whole garden. Under this covered walk, several semi-circular recesses, which appear to have served as bathing-places, were built. The spaces between the pillars were decorated with marble busts and bronze statues, alternately arranged.

This garden was surrounded by a narrow ditch ; and another covered walk, of a considerable length, led to a circular balcony, or platform, the ascent to which was by four steps.

but which overhung the sea about fifteen feet. The floor of the balcony consisted of the very beautiful tessellated pavement, which now serves as the floor of one of the rooms of the Portici museum. From this charming spot, the prospect over the whole Bay of Naples, including the mountains of Sorrento, the Island of Capri, and Mount Pausilippo, must have been delightful.

## POMPEII.

[See Plate, No. 7.]

A great and rich town, which, after lying eighteen centuries in a deep grave, is again shone on by the sun, and stands amidst other cities, as much a stranger as any one of its former inhabitants would be among his descendants of the present day—such a town has not its equal in the world.

The distance from Naples to Pompeii is little more than ten English miles. Near the Torre dell' Annunziata, to the left, and amid hill splanted with vineyards, the town itself, which, throwing off its shroud of ashes, came forth from its grave, breaks on the view. The buildings are without roofs, which are supposed to have been destroyed by enemies in an unguarded state, or torn off by a hurricane. The tracks of the wheels, which anciently rolled over the pavement, are still visible. An elevated path runs by the side of the houses, for foot-passengers; and, to enable them in rainy weather to pass more commodiously to the opposite side, large flat stones, three of which take up the width of the road, were laid at a distance from each other. As the carriages, in order to avoid these stones, were obliged to use the intermediate spaces, the tracks of the wheels are there most visible. The whole of the pavement is in good condition; it consists merely of considerable pieces of lava, which, however, are not cut, as at the present, into squares, and may have been on that account the more durable.

The part which was first cleared, is supposed to have been the main street of Pompeii; but this is much to be doubted, as the houses on both sides, with the exception of a few, were evidently the habitations of common citizens, and were small and provided with booths. The street itself likewise is narrow: two carriages only could go abreast; and it is very uncertain whether it ran through the whole of the town; for, from the spot where the moderns discontinued digging, to that where they re-commenced, and where the same street is supposed to have been again found, a wide tract is covered with vineyards, which may very well occupy the places of the most splendid streets and markets, still concealed underneath.



Among the objects which attract particular attention, is a booth in which liquors were sold, and the marble table within, which bears the marks of the cups left by the drinkers. Next to this is a house, the threshold of which is inlaid by a salutation of black stone, as a token of hospitality. On entering the habitations, the visitor is struck by the strangeness of their construction. The middle of the house forms a square, something like the cross passages of a cloister, often surrounded by pillars : it is cleanly, and paved with party-coloured mosaic, which has an agreeable effect. In the middle is a cooling well; and on each side, a little chamber, about ten or twelve feet square, but lofty, and painted with a fine red or yellow. The floor is of mosaic; and the door is made generally to serve as a window, there being but one apartment which receives light through a thick blue glass. Many of these rooms are supposed to have been bed-chambers, because there is an elevated broad step, on which the bed may have stood, and because some of the pictures appear most appropriate to a sleeping-room. Others are supposed to have been dressing-rooms, on this account, that on the walls a Venus is described decorated by the Graces, added to which, little flasks and boxes of various descriptions have been found in them. The larger of these apartments served for dining-rooms, and in some there are suitable accommodations for cold and hot baths.

The manner in which a whole room was heated, is particularly curious. Against the usual wall a second was erected, standing at a little distance from the first. For this purpose large square tiles were taken, having, like our tiles, a sort of hook, so that they kept the first wall, as it were, off from them; a hollow space was thus left all around, from the top to the bottom, into which pipes were introduced, that carried the warmth into the chamber, and, as it were, rendered the whole of the place one stove. The ancients were also attentive to avoid the vapour or smell from their lamps. In some houses there is a niche made in the wall for the lamp, with a little chimney in the form of a funnel, through which the smoke ascended. Opposite to the house-door the largest room is placed; it is properly a sort of hall, for it has only three walls, being quite open in the fore part. The side rooms have no connexion with each other, but are divided off like the cells of monks, the door of each leading to a fountain.

Most of the houses consist of one such square, surrounded by rooms. In a few, some decayed steps seem to have led to an upper story, which is no longer in existence. Some habitations, however, probably belonging to the richer and more fashionable, are far more spacious. In these, a first court is

connected with a second, and even with a third, by passages : in other respects their arrangements are pretty similar to those above described. Many garlands of flowers and vine-wreaths, and many handsome pictures, are still to be seen on the walls. The guides were formerly permitted to sprinkle these pictures with fresh water, in the presence of travellers, to thus revive their former splendour for a moment : but this is now strictly forbidden ; and, indeed, not without reason, because the frequent watering might at length totally rot away the pictures.

One of the houses belonged to a statuary, whose workshop was still full of the vestiges of his art. Another appears to have been inhabited by a surgeon, whose profession is equally evident from the instruments discovered in his chamber. A large country-house near the gate, undoubtedly belonged to a very wealthy man, and would, in fact, still invite inhabitants with its walls. It is very extensive, stands against a hill, and has many stories. Its finely-decorated rooms are unusually spacious ; and it has airy terraces, from which you look down upon a pretty garden, that has been now again planted with flowers. In the middle of this garden is a large fish-pond, and near that, an ascent, from which, on two sides, six pillars stand. The hinder pillars are the highest, the middle somewhat lower, and the front the lowest : they appear, therefore, rather to have propped a sloping roof, than to have been destined for an arbour. A covered passage, resting on pillars, incloses the garden on three sides ; it was painted, and probably served, in rainy weather, as an agreeable walk. Beneath is a fine arched cellar, which receives air and light by several openings from without ; consequently its atmosphere is so pure, that in the hottest part of summer it is always refreshing. A number of *amphorae*, or large wine-vessels, are to be seen here, still leaning against the wall, as the butler left them when he carried up the last goblet of wine for his master. Had the inhabitants of Pompeii preserved these vessels with their stoppers, wine might still have been found in them ; but, it was, the stream of ashes running in, of course forced out the wine. More than twenty human skeletons of fugitives, who thought to save themselves here under ground, but who experienced a tenfold more cruel death than those suffered who were in the open air, were found in this cellar.

The destiny of the Pompeians must have been dreadful. It was not a stream of fire that encompassed their abodes : they could then have sought refuge in flight. Neither did an earthquake swallow them up ; sudden suffocation would then have spared them the pangs of a lingering death.—A rain of ashes

*buried them alive* BY DEGREES! We will read the delineation of Pliny:—"A darkness suddenly overspread the country; not like the darkness of a moonless night; but like that of a closed room, in which the light is of a sudden extinguished. Women screamed, children moaned, men cried. Here, children were anxiously calling their parents; and there, parents were seeking their children, or husbands their wives; all recognized each other only by their cries. The former lamented their own fate, and the latter that of those dearest to them. Many wished for death, from the fear of dying. Many called on the gods for assistance: others despaired of the existence of the gods, and thought this the last eternal night of the world. Actual dangers were magnified by unreal terrors. The earth continued to shake, and men, half distracted, to reel about, exaggerating their own fears, and those of others, by terrifying predictions."

Such is the frightful but true picture which Pliny gives us of the horrors of those who were, however, far from the extremity of their misery. But what must have been the feelings of the Pompeians, when the roaring of the mountain, and the quaking of the earth, awaked them from their first sleep? They also attempted to escape the wrath of the gods; and, seizing the most valuable things they could lay their hands upon in the darkness and confusion, to seek their safety in flight. In this street, and in front of the house marked with the friendly salutation on its threshold, seven skeletons were found: the first carried a lamp, and the rest had still between the bones of their fingers something that they wished to save. On a sudden, they were overtaken by the storm which descended from heaven, and buried in the grave thus made for them. Before the abovementioned country-house, was still a male skeleton, standing with a dish in his hand; and, as he wore on his finger one of those rings which were allowed to be worn by Roman knights only, he is supposed to have been the master of the house, who had just opened the back-garden-gate with the intent of fleeing, when the shower overwhelmed him. Several skeletons were found in the very posture in which they had breathed their last, without having been forced by the agonies of death to drop the things they had in their hands. This leads to a conjecture, that the thick mass of ashes must have come down all at once, in such immense quantities as instantly to cover them. It cannot otherwise be imagined how the fugitives could all have been fixed, as it were, by a charm in their position; and in this manner their destiny was the less dreadful, seeing that death suddenly converted them into motionless statues, and thus was stripped of all the horrors with which the fears of the sufferers had clothed him in imagination. But

what then must have been the pitiable condition of those, who had taken refuge in the buildings and cellars? Buried in the thickest darkness, they were secluded from every thing but lingering torment; and who can paint to himself without shuddering, a slow dissolution approaching, amid all the agonies of body and of mind? The soul recoils from the contemplation of such images.

To proceed now to the public edifices. The temple of Isis is still standing, with its Doric pillars, and its walls painted with emblems of the service of the deity, such as the hippopotamus, cocoa-blossom, ibis, &c. The sacred vessels, lamps, and tables of Isis are still to be seen. From a little chapel withinside, a poisonous vapour is said to have formerly arisen, which the heathen priests may have used for every species of deception. This vapour is said to have increased after the violent eruption of Vesuvius; but has not latterly given out the slightest smell.

A small Grecian temple, of which only two pillars remain, had been probably already destroyed by an earthquake, which, in the reign of Titus, preceded the dreadful eruption of the volcano — On the opposite side of this temple, there is still an edifice, called the quarters of the soldiers, because all sorts of arms, pictures of soldiers, and a skeleton in chains, were found there. By others it has been considered as the forum of Pompeii.

Two theatres, the smaller one particularly, are in an excellent state of preservation. The structure of this one is such as was usually adopted by the ancients, and is well deserving of modern imitation, as it affords the spectators commodious seats, a free view of the stage, and facility of hearing. Although sufficiently large to contain two thousand persons, the plebeians, standing in a broad gallery at the top, were quite as able to see all that was passing on the stage, as the magistrate in his marble balcony. In this gallery, the arrangements for spreading the sail-cloth over the spectators are still visible. — The stage itself is very broad, as it has no side walls; and appears less deep than it really is: A wall runs across it, and cuts off just as much room as is necessary for the accommodation of the performers. But this wall has three very broad doors; the middle one is distinguished by its height, and the space behind it is still deeper than in front. If these doors, as may be conjectured, always stood open, the stage was in fact large, and afforded besides, the advantage of being able to display a double scenery: if, for example, the scene in front was that of a street, there might have been behind a free prospect into the open field.

The cemetery lies before the gate of the high road. The tomb of the priestess Mammaea is very remarkable: it was erected, according to the epitaph, by virtue of a decree of the Decemvirs. In the midst of little boxes of stone, in square piles, and on a sort of altar, the family urns were placed in niches; and, withoutside these piles, the broken masks are still to be seen. In front of the cemetery, by the road side, is a beautiful seat, forming a semicircle, that will contain twenty or thirty persons. It was probably overshadowed by trees eighteen hundred years ago; under which the women of Pompeii sat in the cool evenings, while their children played before them, and viewed the crowds which were passing through the gate.

To the above particulars from the pen of the elegant and lively Kotzebue, the following details, given by a late very accurate traveller, are subjoined.

The entrance into Pompeii is by a quadrangular court, nearly of the size of the railed part of our Leicester Square. This court is surrounded on every side by a colonnade which supports the roof of a gallery; and the latter leads to several small apartments, not unlike the cells of a prison. The columns are of brick, stuccoed over, and painted of a deep red: they are in height from ten to twelve feet; are placed at about a like distance from each other; and are of the Doric order, fluted two thirds from the top, and well proportioned. After a variety of conjectures relative to the purpose to which this building was applied, it has been ascertained that it was either a barrack for soldiers, (various pieces of armour having been found in some of the cells,) or the *Praetorium* of the Governor, where a body of military must have been stationed. Adjacent to it stood the theatres, the forum, and one or two temples, all connected by very neat and well-paved courts.

The smaller of the theatres is to the right, and is called the covered theatre, because it was so constructed, that, by the means of canvas awnings, the spectators were defended from the sun and rain. A door through the wall leads to the different galleries, and to the open space in the centre, resembling the pit of a modern theatre. The interior is beautifully neat; and, with the exception of the spoliation of the marble slabs, removed to the Palace at Portici, with which the whole of the inside, not excepting the seats, had been covered, in excellent preservation. On each side are the seats for the magistrates; the orchestra, as in modern theatres, is in front of the stage; and the latter, with its brick wings, is very shallow. This theatre was calculated to contain about two thousand spectators.

From its level, a staircase leads to an eminence on which several public buildings are situated. The most conspicuous of these is a small temple said to have been dedicated to Isis, and having a secret passage, perforated in two places, whence the priests are supposed to have delivered to the deluded multitude the oracles of that deity.

Within a paved court, is an altar, of a round shape, on the one side, and on the other side a well. A cistern, with four apertures, was placed at a small distance, to facilitate the procuring of water. In this court, sacrifices and other holy rites are conjectured to have taken place, various utensils for sacrifice, such as lamps, tripods, &c. having been found, when the place was first excavated. One of the tripods is of the most admirable workmanship. On each of the three legs, a beautiful sphinx, with an unusual head-dress, is placed, probably in allusion to the hidden meanings of the oracles which were delivered in the abovementioned temple. The hoop, in which the basin for the coals was sunk, is elegantly decorated with rams' heads connected by garlands of flowers; and within the basin, which is of baked earth, the very cinders left from the last sacrifice, (nearly two thousand years ago,) are seen as fresh as if they had been the remains of yesterday's fire!

From the above court, you enter on a somewhat larger, with a stone pulpit in the centre, and stone seats near the walls. The spot, therefore, was either the auditory of a philosopher, or the place where the public orators pleaded in the presence of the people. Every thing here is in the highest order and preservation.

The great amphitheatre proudly rears its walls over every other edifice on the same elevated spot. It is a stupendous structure, and has twenty-four rows of seats, the circumference of the lowest of which is about 750 feet. It is estimated to have contained about 30,000 spectators. The upper walls are much injured, having partially projected above ground long before the discovery of Pompeii.

A corn field leads to the excavated upper end of the high street, which consists of a narrow road for carts, with foot-pavements on each side. The middle is paved with large blocks of marble, and the ruts of the wheels proclaim its antiquity, even at the time of its being overwhelmed. The foot-paths are elevated about a foot and a half from the level of the carriage road. The houses on each side, whether shops or private buildings, have no claim to external elegance: they consist of a ground floor only, and, with the exception of the door, have no opening towards the street. The windows of the private houses look into an inner square court,

and are in general very high. The apartments themselves are, with the exception of one in each house, which probably served as a drawing-room, both low and diminutive. In point of decoration, they are neat, and, in many instances, elegant: the floors generally consist of figured pavements, either in larger stones of various colours, regularly cut and systematically disposed, or are formed of a beautiful mosaic, with a fanciful border, and an animal or figure in the centre. The geometrical lines and figures in the design of the borders, have an endless variety of the most pleasing shapes, to display the fertile imagination of the artists. Their tessellated pavements alone must convince us that the ancients were well skilled in geometry. The ground is usually white, and the ornaments black; but other colours are often employed with increased effect.

The walls of the apartments are equally, if not still more deserving attention. They are painted, either in compartments, exhibiting some mythological or historical event, or simply coloured over with a light ground, adorned with a border, and perhaps an elegant little vignette in the centre or at equal distances. But few of the historical paintings now exist in Pompeii; for wherever a wall was found to contain a tolerable picture, it was removed and deposited in the museum at Portici. To effect this, the greatest care and ingenuity were required, so as to peel off, by the means of sawing pieces of wall, twenty and more square feet in extent, without destroying the picture. This however, was not a modern invention; for, among the excavated remains of Stabiæ, the workmen came to an apartment containing paintings which had been separated by the ancients themselves from a wall, with the obvious intent of their being introduced in another place. This was, however, prevented by the ruin of the city; and the paintings, therefore, were found leaning against the wall of the apartment.

- Another excavated portion of Pompeii is likewise part of a street, and, being perfectly in a line with the one already described, is conjectured to be a continuation, or rather the extremity of the latter; in which case Pompeii must have been a city of considerable importance, and its main street nearly a mile in length. The houses here, as in the other instance, are distributed into shops and private dwellings, some of the latter of which are distinguished by the remains of former internal elegance, such as tessellated pavements, pointed walls, &c.; most of them have likewise an interior court, surrounded by apartments.

## THE MUSEUM AT PORTICI.

The best statues, busts, vases, and, in short, whatever was supposed, from its materials or construction, to have a superior value, were packed in fifty-two chests, and conveyed to Palermo, at the time the court sought refuge in that city, on the French penetrating into the Neapolitan territory. What still remains, however, in the Museum, has a high intrinsic value; since who can behold, without the strongest emotions of admiration, the relics of the most transitory things, which, for nearly eighteen hundred years, have braved the ravages of time? Here are to be seen bread, corn, dough which was about to be placed in the oven, soap which had been used for washing, figs, and even egg-shells perfectly white, and in as good a state as if the cook had broken them an hour before. Here a kitchen presents itself, provided with every thing requisite: trivets and pots stand on the hearth; stew-pans hang on the wall; skimmers and tongs are placed in the corner; and a metal mortar rests on the shaft of a pillar. Weights, hammers, scythes, and other utensils of husbandry, are here blended with helmets and arms. Sacrificing bowls and knives; a number of well-shaped glasses; large and small glass bottles; lamps; vases; decorations for furniture; a piece of cloth; nets; and even shoe soles; all sorts of female ornaments,—necklaces, rings, and ear-rings; a wooden chess-board, reduced, indeed, to a cinder: all these things are more or less injured by the fire; but still are distinguishable at first sight.

Every apartment of the museum is laid with the most charming antique floors, which are partly mosaic, from Pompeii, and partly marble, from Herculaneum. Statues, vases, busts, chandeliers, altars, tables of marble and bronze, are all in as good a state as if they had just come from the hands of the artist. The coins which have been collected are very numerous, and fill several cases. Medallions of marble, containing on each side a bas-relief, are suspended by fine chains from the ceiling of one of the apartments, and are within the reach of the hand, so as to be conveniently turned and examined.

Most of the pictures found at Herculaneum, Pompeii, and Stabizæ, and now deposited in the museum, have been sawed from the walls of the edifices they adorned. These unique relics of ancient art, form an extensive gallery of genuine antique pictures, the only one in the world, and may on that account alone, be considered as an inappreciable treasure. *They are placed in a range of apartments on the ground floor,*



and are suspended against the walls in plain frames. Their size varies from a foot square, to whole-length groups, nearly as large as life. Beside the injury they have sustained by having been exposed to the heat of burning cinders, they have been impaired by the modern varnish which was intended to protect them: it would, therefore, not be right to subject their colouring to the rigid rules of art; but the grouping of the Minotaur, of the Telephus, of the sitting Orestes, and of the Bacchus and Ariadne, is admirable. In their paintings, as well as in their sculptures, the ancients were influenced by that love of simplicity which distinguishes their works from those of the moderns, and the result is, that in them the chief merits of composition are combined,—unity of subject, and unity of interest. When, again, it is considered, that the paintings collected in the museum at Portici were taken from the provincial towns, it must not be inferred, that those which were admitted in the chief seats of art corresponded in excellence with the Laocoon and the Apollo.—Such was the judgment of the ancients themselves, and their taste is not to be disputed.

The museum at Portici excels all others in ancient bronze, —a substance which, although dearer, more difficult to be wrought, more inviting to the rude grasp of avarice, and less beautiful than marble, forms the greater proportion of the statues. The larger of them had been originally composed of pieces connected by dove-tail joints; and these promiscuous fragments have been re-compiled into new figures, as in the instance of the single horse made from four, in the centre of the court-yard of the museum. Those fragments which had escaped fusion, were rent, inflated, or bruised, by the burning lava. In addition to these misfortunes, they have been made up unhappily; for the eye of an artist can sometimes detect two styles of art, evidently different, the large and the exquisite, soldered together in the same statue. The figures most admired, are the drunken Faun; the sleeping Faun; the sitting Mercury; the Amazon adjusting her robe; and an Augustus and a Claudius, both of heroic size.

The most remarkable objects in the museum at Portici, are the manuscripts, found in two chambers of a house at Herculaneum. Although they have been so frequently described, they must be seen, to furnish a correct idea of them. Before they are devolved, they resemble sticks of charcoal, or cudgels reduced to the state of a cinder, and partly petrified. They are black and chesnut-brown: and are unfortunately so decayed, that under each of them, as they lie in glass cases, a quantity of dust and detached fragments may be perceived. *Their characters are legible in a certain light only, by a glass*

and relief which distinguishes the ink, or rather black paint, from the tinder. Cut, crushed, crumbled on the edge, and caked by the sap remaining, in the leaves of the papyrus, they require in the operator great sagacity to meet the variety of injuries they have received; since, in gluing rashly the more delicate parts, he might reach the heart of a volume, while working at the outside. At first, it appeared almost impracticable ever to decypher a syllable of them; but to the industry and talents of man nothing is impossible, and his curiosity impels him to the most ingenious inventions.

\* \* \* As the preservation of the subterraneous cities of Herculaneum and Pompeii was owing to a natural cause, that of the dreadful eruption of Vesuvius in the seventy-ninth year of the Christian era, the details relative to these cities, and the interesting results to which their discovery has led, have been introduced among the class of natural wonders now under consideration.

## EARTHQUAKES.

*“ He looketh on the earth, and it trembleth: he toucheth the hills, and they smoke.”*

Among the most striking phenomena of earthquakes, which present a fearful assemblage of the combined effects of air, earth, fire, and water, in a state of unrestrained contention, may be noticed the following:—Before the percussion, a rumbling sound is heard, proceeding either from the air, or from fire, or, perhaps, from both in conjunction, forcing their way through the chasms of the earth, and endeavouring to liberate themselves: this, as has been seen, likewise happens in volcanic eruptions. Secondly, a violent agitation or heaving of the sea, sometimes preceding, and sometimes following the shock: this is also a volcanic effect. Thirdly, a spouting up of the waters to a great height—a phenomenon which is common to earthquakes and volcanoes, and which cannot be readily accounted for. Fourthly, a rocking of the earth, and, occasionally, what may be termed a perpendicular rebounding: this diversity has been supposed by some naturalists to arise chiefly from the situation of the place, relatively to the subterraneous fire, which, when immediately beneath, causes the earth to rise, and when at a distance, to rock. Fifthly, earthquakes are sometimes observed to travel onward, so as to be felt in different countries at different hours of the same day. This may be accounted for by the violent shock given to the earth at one place, and communicated progressively by an undulatory motion, successively affecting different regions as it passes along, in the same way as the blow given by a stone thrown into a lake, is not perceived at the shore until some time after

the first concussion. Sixthly, the shock is sometimes instantaneous, like the explosion of gunpowder, and sometimes tremulous, lasting for several minutes. The nearer to the observer the place where the shock is first given, the more instantaneous and simple it appears; while, at a greater distance, the earth seems to re-double the first blow, with a sort of vibratory continuation. Lastly, as the waters have, in general, so great a share in the production of earthquakes, it is not surprising that they should generally follow the breaches made by the force of fire, and appear in the great chasms opened by the earth.

#### EARTHQUAKE IN CALABRIA.

The dreadful earthquake which happened in Calabria, in 1638, is described by the Father Kircher, who was at that time on his way to Sicily to visit Mount Etna. In approaching the Gulf of Charybdis, it appeared to whirl round in such a manner as to form a vast hollow, verging to a point in the centre. On looking towards Etna, it was seen to emit large volumes of smoke, of a mountainous size, which entirely covered the whole island, and obscured from his view the very shores. This, together with the dreadful noise, and the sulphureous stench, which was strongly perceptible, filled him with apprehensions that a still more dreadful calamity was impending. The sea was agitated, covered with bubbles, and had altogether a very unusual appearance. The Father's surprise was still increased by the serenity of the weather, there not being a breath of air, nor a cloud, which might be supposed to put all nature thus in motion. He therefore warned his companions that an earthquake was approaching, and landed with all possible diligence at Tropæa, in Calabria.

He had scarcely reached the Jesuits' College, when his ears were stunned with a horrid sound, resembling that of an infinite number of chariots driven fiercely forward, the wheels rattling, and the thongs cracking. The tract on which he stood, seemed to vibrate, as if he had been in the scale of a balance which still continued to waver. The motion soon becoming more violent, he was thrown prostrate on the ground. The universal ruin around him now redoubled his amazement: the crash of falling houses, the tottering of towers and the groans of the dying, all contributed to excite emotions of terror and despair. Danger threatened him wherever he should flee; but, having remained unhurt amid the general concussion, he resolved to venture for safety, and reached the shore, *almost terrified* out of his reason. Here he found his companions, whose terrors were still greater than his own.

He landed on the following day at Rochetta, where the earth still continued to be violently agitated. He had, however, scarcely reached the inn at which he intended to lodge, when he was once more obliged to return to the boat: in about half an hour, the greater part of the town, including the inn, was overwhelmed, and the inhabitants buried beneath its ruins.

Not finding any safety on land, and exposed, by the smallness of the boat, to a very hazardous passage by sea, he at length landed at Lopizium, a castle midway between Tropæa and Euphæmia, the city to which he was bound. Here, wherever he turned his eyes, nothing but scenes of ruin and horror appeared: towns and castles were levelled to the ground; while Stromboli, although sixty miles distant, was seen to vomit flames in an unusual manner, and with a noise which he could distinctly hear. From remote objects his attention was soon diverted to contiguous danger; the rumbling sound of an approaching earthquake, with which he was by this time well acquainted, alarmed him for the consequences. Every instant it grew louder, as if approaching; and the spot on which he stood shook so dreadfully, that being unable to stand, himself and his companions caught hold of the shrubs which grew nearest to them, and in that manner supported themselves.

This violent paroxysm having ceased, he now thought of prosecuting his voyage to Euphæmia, which lay within a short distance. Turning his eyes towards that city, he could merely perceive a terrific dark cloud, which seemed to rest on the place. He was the more surprised at this, as the weather was remarkably serene. Waiting, therefore, until this cloud had passed away, he turned to look for the city; but, alas! it was totally sunk, and in its place a dismal and putrid lake was to be seen. All was a melancholy solitude—a scene of hideous desolation. Such was the fate of the city of Euphæmia; and such the devastating effects of this earthquake, that along the whole coast of that part of Italy, for the space of two hundred miles, the remains of ruined towns and villages were every where to be seen, and the inhabitants, without dwellings, dispersed over the fields. Father Kircher at length terminated his distressful voyage, by reaching Naples, after having escaped a variety of perils both by sea and land.

#### THE GREAT EARTHQUAKE OF 1755.

[See Plate, No. 8.]

This very remarkable and destructive earthquake extended over a tract of at least four millions of square miles. It appears to have originated beneath the Atlantic Ocean, the waves of which received almost as violent a concussion as the land.

Its effects were even extended to the waters, in many places where the shocks were not perceptible. It pervaded the greater portions of the continents of Europe, Africa, and America; but its extreme violence was exercised on the south-western part of the former.

LISBON, the Portuguese capital, had already suffered greatly from an earthquake, in 1531; and, since the calamity about to be described, has had three such visitations, in 1761, 1765, and 1772, which were not, however, attended by equally disastrous consequences. In the present instance, it had been remarked, that since the commencement of the year 1750, less rain had fallen than had been known in the memory of the oldest of the inhabitants, unless during the spring preceding the calamitous event. The summer had been unusually cool; and the weather fine and clear for the last forty days. At length, on the first of November, about forty minutes past nine in the morning, a most violent shock of an earthquake was felt: its duration did not exceed six seconds; but so powerful was the concussion, that it overthrew every church and convent in the city, together with the Royal Palace, and the magnificent Opera House adjoining to it; in short, not any building of consequence escaped. About one-fourth of the dwelling-houses were thrown down; and, at a moderate computation, thirty thousand individuals perished. The sight of the dead bodies, and the shrieks of those who were half buried in the ruins, were terrible beyond description; and so great was the consternation, that the most resolute person durst not stay a moment to extricate the friend he loved most affectionately, by the removal of the stones beneath the weight of which he was crushed. Self-preservation alone was consulted; and the most probable security was sought, by getting into open places, and into the middle of the streets. Those who were in the upper stories of the houses, were in general more fortunate than those who attempted to escape by the doors, many of the latter being buried beneath the ruins, with the greater part of the foot passengers. Those who were in carriages escaped the best, although the drivers and cattle suffered severely. The number, however, of those who perished in the streets, and in the houses, was greatly inferior to that of those who were buried beneath the ruins of the churches; for, as it was a day of solemn festival, these were crowded for the celebration of the mass. They were more numerous than the churches of London and Westminster taken collectively; and the lofty steeples in most instances, fell with the roof, insomuch that few escaped.

*The first shock, as has been noticed, was extremely short.*

but was quickly succeeded by two others ; and the whole, generally described as a single shock, lasted from five to seven minutes. About two hours after, fires broke out in three different parts of the city ; and this new calamity prevented the digging out of the immense riches concealed beneath the ruins. From a perfect calm, a fresh gale immediately after sprang up, and occasioned the fire to rage with such fury, that in the space of three days, the city was nearly reduced to ashes. Every element seemed to conspire towards its destruction ; for, soon after the shock, which happened near high water, the tide rose in an instant forty feet, and at the castle of Belem, which defends the entrance of the harbour, fifty feet higher than had ever been known. Had it not subsided as suddenly, the whole city would have been submerged. A large new quay sunk to an unfathomable depth, with several hundreds of persons, not one of the bodies of whom was afterwards found. Before the sea thus came rolling in like a mountain, the bar was seen dry from the shore.

The terrors of the surviving inhabitants were great and multiplied. Amid the general confusion, and through a scarcity of hands, the dead bodies could not be buried, and it was dreaded that a pestilence would ensue ; but from this apprehension they were relieved by the fire, by which these bodies were for the greater part consumed. The fears of a famine were more substantial ; since, during the three days succeeding the earthquake, an ounce of bread was literally worth a pound of gold. Several of the corn-magazines having been, however, fortunately saved from the fire, a scanty supply of bread was afterwards procured. Next came the dread of the pillage and murder of those, who had saved any of their effects ; and this happened in several instances, until examples were made of the delinquents.

The great shock was succeeded about noon by another, when the walls of several houses which were still standing, were seen to open, from the top to the bottom, more than a fourth of a yard, and afterwards to close again so exactly as not to leave any signs of injury. Between the first and the eighth of November, twenty-two shocks were reckoned.

A boat on the river, about a mile distant from Lisbon, was heard by the passengers to make a noise as if it had run aground, although then in deep water : they at the same time saw the houses falling on both sides of the river, in front of which, on the Lisbon side, the greater part of a convent fell, burying many of its inmates beneath the ruins, while others were precipitated into the river. The water was covered with *dust, blown by a strong northerly wind ; and the sun entirely*

obscured. On landing, they were driven by the overflowing of the waters to the high grounds, whence they perceived the sea, at a mile's distance, rushing in like a torrent, although against wind and tide. The bed of the Tagus was in many places raised to its surface; while ships were driven from their anchors and jostled together with such violence, that their crews did not know whether they were afloat or aground. The master of a ship, who had great difficulty in reaching the port of Lisbon, reported that, being fifty leagues at sea, the shock was there so violent as to damage the deck of the vessel. He fancied he had mistaken his reckoning, and struck on a rock.

The following observations, relative to this fatal earthquake, were made at Colares, about twenty miles from Lisbon, and within two miles of the sea. On the last day of October, the weather was clear, and remarkably warm for the season. About four o'clock in the afternoon, a fog arose, proceeding from the sea, and covering the vallies, which was very unusual at that season of the year. The wind shifted soon after to the east, and the fog returned to the sea, collecting itself, and becoming exceedingly thick. As the fog retired, the sea rose with a prodigious roaring. On the first of November, the day broke with a serene sky, the wind continuing at east; but about nine o'clock, the sun began to be obscured; and about half an hour after, a rumbling noise was heard, resembling that of chariots, and increasing to such a degree, that at length it became equal to the explosions of the largest artillery. Immediately a shock of an earthquake was felt; and this was succeeded by a second, and a third, at the same time that several light flames of fire, resembling the kindling of charcoal, issued from the mountains. During these three shocks, the walls of the buildings moved from east to west. In another spot, where the sea-coast could be descried, a great quantity of smoke, very thick, but somewhat pale, issued from the hill named the Fojo. This increased with the fourth shock, at noon, and afterwards continued to issue in a greater or less degree. Immediately as the subterraneous rumblings were heard, the smoke was observed to burst forth at the Fojo; and its volume was constantly proportioned to the noise. On visiting the spot whence it was seen to arise, no sign of fire could be perceived near it.

After the earthquake, several fountains were dried up; while others, after undergoing great changes, returned to their pristine state. In places where there had not been any water, *springs burst forth*, and continued to flow; several of these *spouted to the height of nearly twenty feet*, and threw up sand of various colours. On the hills, rocks were split, and the

earth rent; while towards the coast, several large portions of rock were thrown from the eminences into the sea.

At MADRID the shock was very sensibly felt, soon after ten in the morning, and lasted five or six minutes. At first, the inhabitants fancied they were seized with a swimming in the head; and, afterwards, that the houses were falling. In the churches, the sensations were the same, and the terror so great, that the people trod each other under foot in getting out. Those who were within the towers were still more affrighted, fancying every instant, while the shock lasted, that they were falling to the ground. It was not sensible to those who were in carriages, and very little so to foot passengers.

At GIBRALTAR it was felt about the same time as at Madrid, and began with a tremulous motion of the earth, which lasted about half a minute. A violent shock succeeded; and this again was followed by a second tremulous motion, of the duration of five or six seconds. Another shock, not so violent as the first, subsided gradually; and the whole lasted about two minutes. Several of the guns on the batteries were seen to rise, and others to sink, while the earth had an undulating motion. The greater part of the garrison and inhabitants were seized with giddiness and sickness: several fell prostrate; others were stupified; and many, who were walking or riding, became sick, without being sensible of any motion of the earth. Every fifteen minutes the sea rose six feet; and then fell so low, that the boats and small vessels near the shore were left aground, as were also numbers of small fish. The flux and reflux lasted till next morning, having decreased gradually from two in the afternoon.

In AFRICA this earthquake was felt almost as severely as it had been in Europe. A great part of the city of ALGIERS was destroyed. At ARZILLA, a town belonging to the kingdom of Fez, about ten in the morning, the sea suddenly rose with such impetuosity, that it lifted up a vessel in the bay, and impelled it with such force on the land that it was shattered in pieces; and a boat was found two musket-shots within land from the sea. At FEZ and MEQUINEZ, great numbers of houses fell down, and a multitude of people were buried beneath the ruins. At MOROCCO, similar accidents occurred: and at SALLE also, much damage was done. At TANGIER the earthquake began at ten in the morning, and lasted ten or twelve minutes. At TETUAN it commenced at the same time, but was of less duration; three of the shocks were so extremely violent, that it was feared the whole city would be destroyed.

*In the city of FUNCHAL, in the island of Madeira, a shock*



of this earthquake was felt at thirty-eight minutes past nine in the morning. It was preceded by a rumbling noise in the air, like that of empty carriages passing hastily over a stone pavement. The observer felt the floor beneath him immediately to be agitated by a tremulous motion vibrating very quickly. The shock continued more than a minute; during which space, the vibrations, although continual, were twice very sensibly weakened and increased in force. The increase after the first remission of the shock, was the most intense. During the whole of its continuance it was accompanied by a noise in the air; and this lasted some seconds after the motion of the earth had ceased, dying away like a peal of distant thunder rolling through the air. At three quarters past eleven, the sea, which was quite calm, suddenly retired several paces; when rising with a great swell, and without any noise, it as suddenly advanced, overflowed the shore, and entered the city. It rose fifteen feet perpendicular above high water mark, although the tide, which there flows seven feet, was at half ebb. The water immediately receded; and after having fluctuated four or five times between high and low water mark, it subsided, and the sea remained calm as before. In the northern part of the island, the inundation was more violent, the sea there retiring above a hundred paces at first, and suddenly returning, overflowed the shore, forcing open doors, breaking down the walls of several magazines and storehouses, and leaving great quantities of fish ashore, and in the streets of the village of Machico. All this was the effect of one rising of the sea, for it never afterwards flowed high enough to reach the high-water mark. It continued, however, to fluctuate here, much longer before it subsided, than at Funchal; and in some places farther to the westward, it was hardly, if at all, perceptible.

These were the phenomena with which this remarkable earthquake was attended, in those places where it was most violent. The effects of it, however, reached to an immense distance; and were perceived chiefly by the agitations of the waters, or some slight motion of the earth. Its utmost boundaries to the south are unknown; the barbarity of the African nations rendering it impossible to procure any intelligence from them, except where the effects were dreadful. On the north, however, we are assured, that it reached as far as Norway and Sweden. In the former kingdom, the waters of several rivers and lakes were violently agitated. In the latter, shocks were felt in several provinces, and all the rivers and lakes were *strongly agitated*, especially in Dalecarlia. The river Dale *suddenly overflowed* its banks, and as suddenly retired. At *the same time*, a lake at the distance of a league from it, and

with which it had no manner of communication, bubbled up with great violence. At Fahlun, a town in Dalecarlia, several strong shocks were felt.

In many places of Germany, the effects of this earthquake were very perceptible; but in Holland, the agitations were still more remarkable. At Alphen, on the Rhine, between Leyden and Woerden, in the afternoon of the first of November, the waters were agitated to such a violent degree, that buoys were broken from their chains, large vessels snapped their cables, small ones were thrown out of the water upon the land, and others, lying on land, were set afloat. At AMSTERDAM, about eleven in the forenoon, the air being perfectly calm, the waters were suddenly agitated in their canals, so that several boats broke loose; chandeliers were observed to vibrate in the churches; but no motion of the earth, or concussion of any building, was observed. At HAERLEM, in the forenoon, for nearly four minutes, not only the water in the rivers, canals, &c. but also all kinds of fluids in smaller quantities, as in coolers, tubs, backs, &c. were surprisingly agitated, and dashed over the sides, though no motion was perceptible in the vessels themselves. In these small quantities, also, the fluid apparently ascended prior to its turbulent motion; and in many places, even the rivers and canals rose one foot perpendicular.

The agitation of the waters was also perceived in various parts of Great Britain and Ireland. At BARLBOROUGH, in Derbyshire, between eleven and twelve in the forenoon, in a boat-house on the west side of a large body of water, called Pibley Dam, supposed to cover at least thirty acres of land, was heard a surprising and terrible noise; a large swell of water came in a current from the south, and rose two feet on the sloped dam-head at the north end of the water. It then subsided, but returned again immediately, though with less violence. The water was thus agitated for three quarters of an hour; but the current grew every time weaker and weaker, till at last it entirely ceased.

At EYAM-BRIDGE, in Derbyshire Peak, the overseer of the lead mines, sitting in his writing room, about eleven o'clock, felt a sudden shock, which very sensibly raised him up in his chair, and caused several pieces of plaster to drop from the sides of the room. The roof was so violently shaken, that he imagined the engine-shaft had been falling in. Upon this, he immediately ran to see what was the matter, but found every thing in perfect safety. At this time, two miners were employed in carting, or drawing along the drifts of the mines, *the ore and other materials to be raised up at the shafts. The drift in which they were working, was about a hundred and*

twenty yards deep, and the space from one end to the other, fifty yards or upwards. The miner at the end of the drift had just loaded his cart, and was drawing it along; but he was suddenly surprised by a shock, which so terrified him, that he immediately quitted his employment, and ran to the west end of the drift to his partner, who was no less terrified than himself. They durst not attempt to climb the shaft, lest that should be running in upon them: but while they were consulting what means they should take for their safety, they were surprised by a second shock, more violent than the first; which frightened them so much, that they both ran precipitately to the other end of the drift. They then went down to another miner, who worked about twelve yards below them. He told them that the violence of the second shock had been so great, that it caused the rocks to grind upon one another. His account was interrupted by a third shock, which, after an interval of four or five minutes, was succeeded by a fourth; and, about the same space of time after, by a fifth; none of which were so violent as the second. They heard, after every shock, a loud rumbling in the bowels of the earth, which continued about half a minute, gradually descending, or seeming to remove to a greater distance.

At SHIREBURN CASTLE, Oxfordshire, a little after ten in the morning, a very strange motion was observed in the water of a moat which encompasses the building. There was a pretty thick fog, not a breath of air, and the surface of the water all over the moat as smooth as a looking-glass, except at one corner, where it flowed into the shore, and retired again successively, in a surprising manner. How it began to move, is uncertain, as it was not then observed. The flux and reflux, when seen, were quite regular. Every flood began gently, its velocity increasing by degrees, until at length it rushed in with great impetuosity, till it had attained its full height. Having remained for a little time stationary, it then retired, ebbing gently at first, but afterwards sinking away with great swiftness. At every flux, the whole body of water seemed to be violently thrown against the bank; but neither during the time of the flux, nor that of the reflux, did there appear even the least wrinkle of a wave on the other parts of the moat. Lord Parker, who had observed this motion, being desirous to know whether it was universal over the moat, sent a person to the other corner of it, at the same time that he himself stood about twenty-five yards from him to examine whether the water *moved there* or not. He could not perceive any motion there; *but another person, who went to the northeast corner of the moat, diagonally opposite to his lordship, found it as conside-*

able there as where he was. His lordship imagining, that in all probability the water at the corner diagonally opposite to where he was, would sink as that by him rose, ordered the person to signify by calling out, when the water by him began to sink, and when to rise. This he did; but to his lordship's great surprise, immediately after the water began to rise at his own end, he heard the voice calling that it began to rise with him also; and in the same manner he heard that it was sinking at his end, soon after he perceived it to sink by himself. A pond just below, was agitated in a similar manner; but the risings and sinkings happened at different times from those at the pond where Lord Parker stood.

Shocks were also perceived in several parts of France, as at BAYONNE, BORDEAUX, and LYONS; and commotions of the waters were observed at ANGOULESME, BELLEVILLE, HAVRE DE GRACE, &c., but not attended with the remarkable circumstances abovementioned.

These are the most striking phenomena with which the earthquake of November 1, 1755, was attended on the surface of the earth. Those which happened below ground, cannot be known but by the changes observed in springs, &c. which were in many places very remarkable.

At TANGIER, all the fountains were dried up, so that there was no water to be had till night. A very remarkable change was observed in the medicinal waters of Toplitz, a village in Bohemia, famous for its baths. These waters were discovered in the year 762; from which time the principal spring had constantly thrown out hot water in the same quantity, and of the same quality. On the morning of the earthquake, between eleven and twelve in the forenoon, this principal spring cast forth such a quantity of water, that in the space of half an hour, all the baths ran over. About half an hour before his great increase of the water, the spring flowed turbid and muddy; then, having stopped entirely for a minute, it broke forth again with prodigious violence, driving before it a considerable quantity of reddish ochre. After this, it became clear, and flowed as pure as before. It still continued to do so, but he water was in greater quantity, and hotter, than before the earthquake. At Angoulesme, in France, a subterraneous noise, like thunder, was heard; and presently after, the earth opened, and discharged a torrent of water, mixed with red sand. Most of the springs in the neighbourhood, sunk in such a manner, that for some time, they were thought to be quite dry. In Britain, no considerable alteration was observed in the earth, *except that, near the lead mine abovementioned, in Derbyshire, a cleft was observed about a foot deep, six inches wide, and one hundred and fifty yards in length.*

At sea, the shocks of this earthquake were felt most violently. Off St. Lucar, the Captain of the Nancy frigate his ship so violently shaken, that he thought she had struck the ground; but, on heaving the lead, found she was at a great depth of water. Captain Clark, from Denia, in latitude thirty-six degrees twenty-four minutes, between nine and ten in the morning, had his ship shaken and strained as if she had struck upon a rock, so that the seams of the hull opened, and the compass was overturned in the bin. The master of a vessel bound to the American islands, in north latitude twenty-five degrees, west longitude forty degrees, and writing in his cabin, heard a violent noise as if he had imagined, in the steerage; and while he was asking what the matter was, the ship was put into a strange agitation, as if she had been suddenly jerked up, and supported by a rope fastened to the mast-head. He immediately came up with great terror and astonishment; and looking out of his cabin window, saw land, as he took it to be, at the distance of about a mile. Coming upon the deck, the land was not to be seen, but he perceived a violent current cross the way to the leeward. In about a minute, this current ran with great impetuosity; and at a league's distance, he saw three craggy-pointed rocks throwing up waters of various colours, resembling fire. This phenomenon, in about twenty minutes, ended in a black cloud, which ascended very high. After it had risen above the horizon, no rocks were seen; though the cloud, still ascending, was long visible, the weather being extremely clear. Between nine and ten in the morning, another ship, forty leagues west of St. Vincenza, was so strongly agitated, that the anchors, which were hauled up, bounced up, and the men were thrown a foot and a half perpendicularly up from the deck. Immediately after this the ship sunk in the water as low as the main-chains. The water showed a great depth of water, and the line was tinged with a yellow colour, and smelt of sulphur. The shock lasted ten minutes; but they felt smaller ones for the space of twenty-four hours.

#### EARTHQUAKES IN SICILY, AND IN THE TWO CALABRIAS

These Earthquakes began on the 5th of February, and continued until the latter end of the May following, without any infinite damage, and exhibiting at Messina, in the parts of Sicily nearest to the Continent, and in the two Calabrias, a variety of phenomena. The part of the Calabrian province most affected by this heavy calamity, lies between the eighteenth and thirty-ninth degrees of latitude, being the

point of the Continent; and the greatest force of the earthquakes was exerted at the foot of the particular mountains of the Appenines, named Monte Deio, Monte Sacro, and Monte Caulone, extending westward to the Tyrrhene sea. The towns, villages, and farm-houses, nearest to these mountains, whether situated on the hills, or in the plains, were totally ruined by the first shock, which happened about noon; and there the destruction of lives was the greatest. The towns still more remote, were, however, greatly damaged by the subsequent shocks, particularly those of the 7th, 26th, and 28th of February, and that of the 1st of March. The earth was in a constant tremour, and its motions were various, being either vortical, or whirling round, horizontal, or oscillatory, that is, by pulsations or beatings, from the bottom upwards. This variety increased the apprehensions of the unfortunate inhabitants, who momentarily expected that the earth would open beneath their feet, and swallow them up. The rains had been continual and violent, often accompanied by lightning and furious gusts of wind. There were many openings and cracks in the earth; and several hills had been lowered, while others were quite level. In the plains, the chasms were so deep, that many roads were rendered impassable. Huge mountains were severed, and portions of them driven into the valleys, which were thus filled up. The course of several rivers was changed; and many springs of water appeared in places which had before been perfectly dry.

From the city of Amantea, situated on the coast of the Tyrrhene Sea, in lower Calabria, proceeding along the western coast to Cape Spartivento, in upper Calabria, and thence along the eastern coast to Cape Alice, a part of Lower Calabria, on the Ionian Sea, the towns and villages, amounting to nearly four hundred, whether on the coast or inland, were either totally destroyed, or suffered greatly. At Casal Nuovo, the Princess Gerace, and upwards of four thousand of the inhabitants, lost their lives. At Bagnara, the number of dead amounted to upwards of three thousand; and Radicina and Palmi experienced a similar loss. The total amount of the mortality occasioned by these earthquakes, in Sicily and the two Calabrias, was, agreeably to the official returns, thirty-two thousand three hundred and sixty-seven; but Sir William Hamilton thought it still greater, and carries his estimate to forty thousand, including foreigners.

On the first shock of the earthquake, on the 5th of February, the inhabitants of Scylla escaped from their houses built on the rock, and, following the example of their prince, took shelter on the sea-shore. By this shock, the sea had been

raised and agitated so violently, that much damage had been done on the point of the Faro of Messina; but here it acted with still greater violence, for, during the night, an immense wave, which was falsely represented to have been boiling hot, and to have scalded many persons on its rising to a great height, flowed furiously three miles inland, and swept off in its return two thousand four hundred and seventy-three of the inhabitants, with the prince at their head, who were either at that time on the strand, or in boats near the shore.

The shocks felt since the commencement of these formidable earthquakes, amounted to several hundreds; and among the most violent, may be reckoned the one which happened on the 28th of March. It affected most of the higher part of Upper Calabria, and the inferior part of Lower Calabria, being equally tremendous with the first. Indeed, these shocks were the only ones sensibly felt in the capital, Naples. With relation to the former, two singular phenomena are recorded; at the distance of about three miles from the ruined city of Oppido, in Upper Calabria, was a hill, having a sandy and clayey soil, nearly four hundred feet in height, and nearly nine hundred feet in circumference at its basis. This hill is said to have been carried to the distance of about four miles from the spot where it stood, into a plain called *Campo di Bassano*. At the same time, the hill on which the city of Oppido stood, and which extended about three miles, divided into two parts: being situated between two rivers, its ruins filled up the valley, and stopped their course, forming two large lakes, which augmented daily.

The accounts from Sicily were of a most alarming nature. The greatest part of the fine city of Messina was destroyed by the shock of the 5th of February, and what remained was greatly injured by the subsequent shocks. The quay in the port had sunk considerably, and was in some places more than a foot beneath the water. The superb building, called the *Palazzata*, which gave the port a more magnificent appearance than any other in Europe could boast, was entirely thrown down; and the lazaretto greatly damaged. The citadel suffered little; but the cathedral was destroyed, and the tower at the point of the entrance of the harbour much damaged. The wave which had done so much mischief at Scylla, had passed over the point of land at the Faro, and swept away twenty-four persons. The accounts from Melazzo, Patti, Terra di Santa Lucia, Castro Reale, and from the island of Lipari were very distressing; but the damages done there by the earthquakes not so considerable as at Messina.

*Sir William Hamilton*, from the limited boundaries of these

earthquakes, was persuaded that they were caused by some great operation of nature of a volcanic kind. To ascertain this, he began his tour by visiting the parts of the coasts of the two Calabrias which had suffered most from this severe visitation. He every where came to ruined towns and houses, the inhabitants of which were in sheds, many of them built on such insalubrious spots, that an epidemic had ensued. These unfortunate people agreed that every shock they had felt, seemed to come with a rumbling noise from the westward, beginning usually with the horizontal motion, and ending with the vortical, or whirling motion, which last had ruined most of the buildings. It had also been generally observed, that, before a shock, the clouds seemed to be fixed and motionless; and that, after a heavy shower of rain, a shock quickly followed. By the violence of some of the shocks, many persons had been thrown down; and several of the peasants described the motion of the earth as so violent, that the tops of the largest trees almost touched the ground from side to side. During a shock, the oxen and horses, they said, kept their legs wide asunder, to prevent being thrown down, and gave evident signs of being sensible of the approach of each shock. Being thus warned, the neighing of a horse, the braying of an ass, or the cackling of a goose, drove them from their temporary huts.

From Monteleone, Sir William descended into the plain, and passed many towns and villages in a ruined state: the city of Mileto, lying in a bottom, was totally destroyed, without a house standing. Among the many examples, afforded by these earthquakes, of animals being able to live a long time without food, was that of two hogs, which had remained buried under a heap of ruins at Soriano for forty-two days, and were dug out alive. He had frequent opportunities to observe, that the habitations situated on high grounds, having a soil of a gritty sand-stone, somewhat like granite, but without its consistence, suffered less than those in the plain, the soil of which is a sandy clay. The latter were universally levelled with the ground. During the first shock, he was told that a fountain of water, mixed with sand, had been forced to a considerable height: prior to this phenomenon, the river was dry, but soon returned and overflowed its banks. The other rivers in the plain, underwent the like vicissitudes; to account for which, Sir William supposes the first impulsion of the earthquake to have come from the bottom upwards; and that such was the fact, the inhabitants attested. The surface of the plain having suddenly risen, the rivers, which are not deep, would naturally disappear; and the plain seeking with violence its former level, the rivers would necessarily return and



overflow, at the same time that the sudden depression of the boggy grounds would as naturally force out the water which lay hidden beneath the surface.

It had been stated, in the reports made to government, that two tenements, named Macini and Vaticano, had, by the effect of the earthquake, changed their situation. In this fact Sir William agrees, and he accounts for it in the following manner:—They were situated in a valley surrounded by high grounds, and the surface of the earth, which had been removed, had probably been long undermined by the little rivulets which flow from the mountains, and were in full view on the bare spot which the tenements had deserted. He conjectures, besides, that the earthquake having opened some depositions of rain-water, in the clayey hills which surrounded the valley, the water mixing with the loose soil, and taking its course suddenly through the undermined surface, had lifted it up, together with the large olive and mulberry trees, and a thatched cottage, floating the entire piece of ground, with all its vegetation, about a mile down the valley, where he saw it, with most of the trees erect. These two tenements occupied a space of ground about a mile in length, and half a mile in breadth. There were in the vicinity several deep cracks in the earth, not one of which was then more than a foot in breadth; but Sir William was credibly assured, that, during the earthquake, one had opened wide, and had swallowed up an ox, and nearly a hundred goats. In this valley, he saw hollows, in the form of inverted cones, from which water and sand had been ejected violently at the time of the earthquakes, similar to those which had been pointed out to him at Rosarno. As well at the latter place, as in every ruined town he visited, an interesting remark was made to him, namely, that the male dead were generally found under the ruins, in the attitude of struggling against the danger; but that the attitude of the females was usually with the hands clasped over the head, as if giving themselves up to despair, unless they had children near them: in this case, they were always found clasping them in their arms, or in some attitude which indicated their anxious care to protect them. How striking an instance of maternal tenderness!

Sir William travelled four days in the plain, in the midst of indescribable misery. Such was the force of the first shock, on the 5th of February, that the inhabitants of the towns were buried in an instant beneath the ruins of their houses. Of the population of the town of Polistene, which was badly situated between two rivers, subject to overflow their banks, two thousand one hundred individuals perished out of six thousand. It was built near a ravine of great depth; and, by the violent

motion of the earth, two huge portions of the ground on which a considerable part of the town, consisting of several hundreds of houses, stood, were detached into the ravine, and nearly across it, to the distance of about half a mile from their original position. What was most extraordinary, many of the inhabitants of these houses, who had taken this singular leap in them, were dug out alive, and several unhurt. Terra Nuova lost three-fourths of a population of sixteen hundred inhabitants; and near to this town, and to the ravine, many acres of land, covered with trees and corn-fields, had been detached and thrown into the latter, often without having been overturned, insomuch that the trees and crops were growing as well as if they had been planted there. Other such pieces of ground were lying in the bottom, in an inclined situation; and others, again, were quite overturned. Two immense portions of land, having been detached opposite to each other, filled the valley, and stopped the course of the river, the waters of which formed a great lake.

Having walked over the ruins of Oppido, Sir William descended into the ravine, which he carefully examined. Here he saw the wonderful force of the earthquake, which had produced exactly the same effects as in the ravine of Terra Nuova, but on a scale infinitely greater. The enormous masses of the plain, detached from each side of the ravine, lay in confused heaps, forming real mountains; and, having stopped the course of two rivers, great lakes were formed. He occasionally met with a detached piece of the surface of the plain, many acres in extent, with the large oaks and olive trees, having lupins and corn beneath them, growing as well, and in as good order at the bottom of the ravine, as their companions, from which they had been separated, did in the plain, at least five hundred feet higher, and at the distance of about three-quarters of a mile. Entire vineyards, which had taken a similar journey, were in the same order in the bottom. In another part of the ravine was a mountain, composed of a clayey soil, which was probably a portion of the plain, detached by an earthquake at some former period: it was in height about two hundred and fifty feet, and about four hundred feet in diameter at its basis. It was well attested, Sir William observes, that this mountain travelled down the ravine nearly four miles, having been put in motion by the first shock. The abundance of rain which fell at that time; the great weight of the newly detached pieces of the plain, which were heaped up at its back; the nature of its soil; and particularly its situation on a declivity; in his opinion, satisfactorily account for this phenomenon. The *Prince of Cariati* showed him two girls, one of the age of about

sixteen years, who had remained eleven days without food under the ruins of a house in Oppido; and the other about eleven years of age, who had been under the same circumstances six days, but in a very confined and distressing posture.

Sir William describes the port of Messina, and the town, in their half-ruined state, when viewed by moonlight, as strikingly picturesque. On landing, he was assured by several fishermen, that, during the earthquake of the 5th of February, at night, the sand near the sea was hot, and that in many parts they saw fire issue from the earth. This had been often repeated to him in the Calabrian plain; and the idea he entertained was, that the exhalations which issued during the violent commotions of the earth, were full of electric fire, just as the smoke of volcanoes is constantly observed to be during violent eruptions; for he did not, during any part of his tour, perceive an indication of volcanic matter having issued from the fissures of the earth. He was, therefore, convinced, that the whole damage had been done by exhalations and vapours only. In this city, where they had so long an experience of earthquakes, he was told, that all animals and birds are, in a greater or less degree, more sensible of an approaching shock of an earthquake than any human being; but that geese, above all, were the soonest and the most alarmed at the approach of a shock: if in the water, they quit it immediately, and they cannot be driven into it for some time after.

#### EARTHQUAKE IN MISSISSIPPI.

On the sixth day of January, 1812, during the earthquakes which destroyed New Madrid, and which were felt two hundred miles around, I happened to be passing in its neighbourhood, where the principal shock took place. The violence of the earthquake having disturbed the earthy strata impending over the subterraneous cavities, existing probably in an extensive bed of wood, highly carbonized, occasioned the whole superior mass to settle. This, pressing with all its weight upon the water that had filled the lower cavities, occasioned a displacement of this fluid, which forced its passage through, blowing up the earth with loud explosions. It rushed out in all quarters, bringing with it an enormous quantity of carbonized wood, reduced mostly into dust, which was ejected to the height of from ten to fifteen feet, and fell in a black shower, mixed with the sand, which its rapid motion had forced along; at the same time, the roaring and whistling produced by the impetuosity of the air escaping from its confinement, seemed to increase the horrible disorder of the trees, which every where encountered each other, being blown up, cracking and

splitting, and falling by thousands at a time. In the mean time, the surface was sinking, and a black liquid was rising up to the belly of my horse, who stood motionless, struck with a panic terror.

These occurrences occupied nearly two minutes; the trees, shaken in their foundation, kept falling here and there, and the whole surface of the country remained covered with holes, which, to compare small things with great, resembled so many craters of volcanoes, surrounded with a ring of carbonized wood and sand, which rose to the height of about seven feet.

I had occasion, a few months after, to sound the depth of several of these holes, and found them not to exceed twenty feet; but I must remark, that quicksand had washed into them. The country here was formerly perfectly level, and covered with numerous small prairies of various sizes, dispersed through the woods. Now it is covered with slaches (ponds) and sand hills or monticules, which are found principally where the earth was formerly the lowest; probably because, in such places, the water broke through with more facility.

A circumstance worth noticing, was a tendency to carbonization, that I perceived in all the vegetable substances soaking in the ponds produced by these eruptions. It was about seven months after the event had taken place, that I had occasion to make these remarks, on the spot before mentioned. The same earthquake produced a lake between St. Francis and Little Prairie, distant twenty-seven miles from the Mississippi river. This lake much resembles the Big lake on Red river, inasmuch as the trees are standing upright in all of them, and sunk about thirty feet when the water is high. They are all evidently modern lakes, whose beds were, not long since, part of the forest.

#### CONNEXION OF EARTHQUAKES WITH VOLCANOES.

##### ISLAND OF JAVA.

The connexion of earthquakes with volcanoes has been already noticed; and a remarkable instance of an occurrence of this nature is recorded in Raffles' History of Java. Papan-dayang was formerly one of the largest volcanoes in that island; but in the month of August, 1772, the greatest part of it was, after a short but severe combustion, swallowed up by a dreadful convulsion of the earth. This event was preceded by an uncommonly luminous cloud, by which the mountain was completely enveloped, and which so terrified the inhabitants dwelling at the foot and on its declivities, that they betook themselves to flight. Before they could all save themselves, how-

ever, the mountain began to give way, and the greater part of it actually *fell in* and disappeared in the earth. At the same time, a tremendous noise was heard, resembling the discharge of the heaviest cannon ; while the immense quantities of volcanic substances which were thrown out, and spread in every direction, propagated the effects of the explosion through the space of many miles.

It was estimated that an extent of ground, belonging to the mountain itself, and to its immediate environs, fifteen miles in length, and six in breadth, was by this commotion swallowed up in the bowels of the earth. Six weeks after the catastrophe, persons who were sent to examine the condition of the surrounding territory, reported, that it was impossible to approach the mountain, on account of the heat of the substances which covered its circumference, and which were piled on each other to the height of three feet. It has been reported, that forty villages, partly swallowed up by the opening of the earth, and partly covered by the substances ejected, were destroyed on this melancholy occasion, with the loss of nearly three thousand lives. A proportionate number of cattle was destroyed ; and the greater part of the plantations of cotton, indigo, and coffee in the adjacent districts, were buried beneath the volcanic matter. The effects of this explosion were long apparent on the remains of the volcanic mountain.

The very interesting work of Governor Raffles contains several curious and novel details relative to volcanic phenomena, a sketch of which is here introduced, on account of their intimate connexion with the subterraneous operations of nature, in the production of earthquakes. It may be considered as supplementary to the detailed account of volcanoes given at the commencement of this work.

There are in Java thirty-eight large mountains, which, although they differ from each other in external figure, agree in the general attribute of volcanoes, by their having a broad base, which gradually verges towards the summit, in the form of a cone. One of these is named Tankuban-Prahu, on account of its resembling, at a distance, a boat turned upside down : and forms a vast truncated cone. Its base extends to a considerable distance, and it is not only one of the largest mountains in the island, but a most interesting volcano. Although it has not for many ages had any violent eruption, as is evident from the progress of vegetation, and from the depth of black mould which covers its sides, its interior has continued in a state of uninterrupted activity. Its crater is large, and *has, in general, the shape of a funnel, but with its sides very irregular ; the brim, or margin, which bounds it at the top,*

has also different degrees of elevation, rising and descending along the whole course of its circumference. This may be estimated at a mile and a half; and the perpendicular depth on the south side, where it is very steep, is at least two hundred and fifty feet: towards the west it rises considerably higher. The bottom of the crater has a diameter of nine hundred feet, but is not regular in its form, which depends on the meeting of the sides below.

Near the centre it contains an irregular oval lake, or collection of water, the greatest diameter of which is nearly three hundred feet. The water being white, it exhibits the appearance of a lake of milk, boiling with a perpetual discharge of large bubbles, occasioned by the development of fixed air. Towards its eastern extremity are the remaining outlets of the subterraneous fires, consisting of several apertures, from which an uninterrupted discharge of sulphureous vapours takes place. These vapours rush out with an incredible force, with violent subterraneous noises, resembling the boiling of an immense caldron in the bowels of the mountain. When at the bottom, the force of the impression made on the spectator by this grand and terrific scene, is increased by the recollection of the dangers he had to encounter in the descent; while the extent of the crater, and the remains of the former explosions, afford an indescribable enjoyment, and fill his mind with the most awful satisfaction.

The explosions of mud, called by the natives *bledeg*, are a great curiosity. This volcanic phenomenon is in the centre of a lime-stone district, and is first discovered, on approaching it from a distance, by a large volume of smoke, which rises and disappears at intervals of a few seconds, and resembles the vapours arising from a violent surf. A dull noise, like that of thunder, is at the same time heard; and on a nearer approach, when the vision is no longer impeded by the smoke, a large hemispherical mass is observed, consisting of black earth, mixed with water, about sixteen feet in diameter, rising up to the height of twenty or thirty feet in a perfectly regular manner, and, as it were, pushed up by a force beneath. This mass suddenly explodes with a dull noise, and scatters, in every direction, a volume of black mud. After an interval of a few seconds, the hemispherical body of earth or mud again rises and explodes. In the same manner this volcanic ebullition goes on without interruption, throwing up a globular body of mud, and dispersing it with violence through the neighbouring plain. The spot where the ebullition occurs is nearly circular, and perfectly level, and is entirely covered with the earthy particles, impregnated with salt water, which

are thrown up from below. The circumference may be estimated at about half a mile. In order to conduct the salt water to the circumference, small passages, or gutters, are made in the loose muddy earth, which lead it to the borders, where it is collected in holes, or salt wells, dug in the ground, for the purpose of evaporation. The mud recently thrown up, possesses a degree of heat greater than that of the surrounding atmosphere, and emits a strong, pungent, and sulphureous smell. This volcanic phenomenon is situated near the centre of the large plain, which interrupts the series of the more considerable volcanoes, and owes its origin to the general cause of the numerous volcanic eruptions which occur in the Island of Java.

The tremendous violence with which nature marks the operations of volcanoes in these regions, will be best exemplified by the following details of the extraordinary and wide-spreading phenomena which accompanied the eruption of the Tomboro mountain, in the island of Sumbawa, one of the Javanese cluster. This eruption, which happened in April, 1815, was sensibly felt over the whole of the Molucca islands, over Java, and over a considerable portion of Celebes, Sumatra, and Borneo, to a circumference of a thousand statute miles from its centre, by TREMULOUS MOTIONS and LOUD EXPLOSIONS; while, within the range of its more immediate activity, embracing a space of three hundred miles around it, it produced the most astonishing effects, and excited the most alarming apprehensions. On Java, at the distance of three hundred miles, it seemed to be awfully present. The sky was overcast at noon-day with a cloud of ashes; the sun was enveloped in an atmosphere, the "palpable" density of which it was unable to penetrate; showers of ashes covered the houses, the streets, and the fields, to the depth of several inches; and, amid this darkness, explosions were heard at intervals, like the report of artillery, or the noise of distant thunder. Every one conceived, that the effects experienced might be caused by eruptions of some of the numerous volcanoes on the island; but no one could have conjectured, that the shower of ashes which darkened the air, and covered the ground of the eastern district of Java, could have proceeded from a mountain in Sumbawa, at the distance of several hundred miles.

The first explosions were heard at Java, on the evening of the 5th of April, and continued until the following day, when the sun became obscured, and appeared to be enveloped in a fog. The weather was sultry; the atmosphere close; and the pressure of the latter, added to the general stillness, seemed to forebode an earthquake. This lasted for several days, the explosions continuing, but not with so much violence as at

first. On the evening of the 10th, the eruptions, however, were more loud and more frequent; ashes fell in abundance; the sun was nearly obscured; and in several parts of the Island a TREMULOUS MOTION OF THE EARTH was felt. On the following day, the explosions were so tremendous as to shake the houses perceptibly in the more eastern districts.

In the Island of Sumbawa itself, there was a great loss of lives, and the surviving inhabitants were reduced to extreme misery. It appears from the account of the Rajah, who was a spectator of the eruption, that on the evening of the 10th of April, three distinct columns of flame, all apparently within the verge of the crater of the Tomboro mountain, burst forth, and, after ascending separately to a very great height, united their tops in the air. The whole of the mountain now appeared like a body of liquid fire, extending itself in every direction. Stones and ashes were precipitated; and a whirlwind ensued, which blew down the greater part of the houses in an adjoining village. It tore up by the roots the largest trees, and carried them into the air, together with men, horses, cattle, and whatever came within its influence. The sea rose nearly twelve feet higher than usual,—a phenomenon commonly attendant on earthquakes,—overwhelming the plantations of rice, and sweeping away houses, with whatever came within its reach. It is calculated that twelve thousand individuals perished. The trees and herbage of every description, along the whole of the north and west sides of the peninsula, were completely destroyed, with the exception of a high point of land near the spot where the village of Tomboro stood.

The extreme misery to which the inhabitants of the western part of the island were reduced, was dreadful to behold. The roads were strewed with dead bodies; the villages were almost entirely deserted, and the houses fallen down. The peasants wandered in all directions in search of food; and the famine became so severe, that one of the daughters of the Rajah died of hunger.

To judge of the violence of the eruption, it will suffice to state, that the cloud of ashes which had been carried with so much celerity as to produce utter darkness, extended, in the direction of the Island of Celebes, two hundred and seventeen nautical miles from the seat of the volcano; and, in a direct line towards Java, upwards of three hundred geographical miles.



## VIEW OF THE COAST NEAR STAPPEN, IN ICELAND.

[See Plate, No. 9.]

This singular and stupendous cliff is situated on the sea-coast, and is called *Snorfell-Yokul*. The word *yokul*, signifies in the Icelandic language, an ice mountain. These mountains, of which there are many in Iceland, have a terreous, or rocky base, covered with huge masses of ice, in some instances to a vast depth. One of these mountains, situated on the coast of Stappen, was ascended by Mr. Henderson, in 1815. "Having lodged at Stappen," says he, "on awakening the following morning, I obtained, through the windows of my apartment, a noble view of that magnificent work of God, the stupendous *Snorfell-Yokul*. Every surrounding object seemed swallowed up by its immensity; and as the atmosphere was pure and serene, I felt the resolution powerfully confirmed, which I had formed the preceding evening, of ascending the Yokul from this place. When this design was made known to the people of the place, they shook their heads, and maintained that it was impossible; while some of them seemed to look upon the attempt, as an act of presumptuous temerity. On the next day, however, Mr. Henderson, in company with several other persons, made the attempt, and with great difficulty and considerable danger, succeeded. About three o'clock," says he, "we ultimately succeeded in reaching the base of the highest peak, when all at once, a most tremendous precipice appeared at our feet, exceeding two thousand feet of nearly perpendicular depth, and displaying, in various parts of the profound valley of snow into which it opened, long and broad fissures, running parallel with its sides. Near the middle of this awful depth, we espied a huge circular aperture, the sides of which, were lined with green ice, and which seemed to have been formed by a cascade, poured down from some part of the snow-bank on which we stood, though we could not discover any marks of water. Skirting the brink of the frozen precipice, we ascended the north side of the peak, but, after climbing within three or four yards of its summit, we were debarred all further progress by a perpendicular wall of icy pillars, which completely surrounded the summit. From this point, however, the prospect was noble and commanding beyond imagination. The mountains about *Hecla*, crowded into view from the east; while the termination of the range of mountains that divides the peninsula resembled an innumerable multitude of *singular* looking islands; and what added greatly to the interest, excited by so extensive a prospect, was the beautiful gir-

ile of clouds which surrounded the Yokul, at least 3000 feet below us.

## BASALTIC AND ROCKY CURIOSITIES.

### THE GIANT'S CAUSEWAY.

[See Plate, No. 10.]

This vast collection of basaltic pillars is in the vicinity of Ballimony, in the county of Antrim, Ireland. The principal, or grand causeway, (there being several less considerable and scattered fragments of a similar nature,) consists of an irregular arrangement of many hundred thousands of columns, formed of a black rock, nearly as hard as marble. The greater part of them are of a pentagonal figure, but so closely and compactly situated on their sides, though perfectly distinct from top to bottom, that scarcely any thing can be introduced between them. These columns are of an unequal height and breadth: several of the most elevated, visible above the surface of the strand, and at the foot of the impending angular precipice, are of the height of about twenty feet, which they do not exceed, at least not any of the principal arrangement. How deeply they are fixed in the strand, has never yet been ascertained.

This grand arrangement extends nearly two hundred yards, as it is visible at low water; but how far beyond is uncertain: from its declining appearance, however, at low water, it is probable that it does not reach beneath the water to a distance equal to that which is seen above. The breadth of the principal causeway, which runs out in one continued range of columns, is in general from twenty to thirty feet: in some parts it may, for a short distance, be nearly forty. From this account are excluded the broken and scattered pieces of the same kind of construction, which are detached from the sides of the grand causeway, as they do not appear to have ever been contiguous to the principal arrangement, although they have been frequently comprehended in the width, which has led to such wild and dissimilar representations of this causeway, in the different accounts that have been given. Its highest part is the narrowest, at the very spot of the impending cliff, whence the whole projects; and there, for about the same space in length, its width is not more than from twelve to fifteen feet. The columns of this narrow part incline from a perpendicular a little to the westward, and form a slope on their tops, by the unequal height of their sides; and in this way a gradual ascent is made at the foot of the cliff, from the head of one column to the next above, to the top of the great causeway, which, at the distance of about eighteen feet from

the cliff, obtains a perpendicular position, and lowering from its general height, widens to between twenty and thirty feet, being for nearly three hundred feet always above the water. The tops of the columns being, throughout this length, nearly of an equal height, form a grand and singular parade, which may be walked on, somewhat inclining to the water's edge. But from the high water mark, as it is perpetually washed by the beating surges, on every return of the tide, the platform lowers considerably, becoming more and more uneven, so as not to be walked on but with the greatest care. At the distance of a hundred and fifty yards from the cliffs, it turns a little to the east, for the space of twenty or thirty yards, and then sinks into the sea. The figure of these columns is, with few exceptions, pentagonal, or composed of five sides; and the spectator must look very narrowly indeed to find any of a different construction, having three, four, or six sides. What is very extraordinary, and particularly curious, is, that there are not two columns in ten thousand to be found, which either have their sides equal among themselves, or display a like figure.

The composition of these columns, or pillars, is not less deserving the attention of the curious observer. They are not of one solid stone in an upright position, but composed of several short lengths, nicely joined, not with flat surfaces, but articulated into each other like a ball and socket, or like the joints in the vertebræ of some of the larger kind of fish, the one at the joint having a cavity, into which the convex end of the opposite is exactly fitted. This is not visible unless on disjoining the two stones. The depth of the concavity or convexity is generally about three or four inches. It is still farther remarkable, that the convexity and correspondent concavity of the joint, are not conformable to the external angular figure of the column, but exactly round, and as large as the size or diameter of the column will admit; consequently, as the angles of these columns are in general very unequal, the circular edges of the joints are seldom coincident with more than two or three sides of the pentagonal, and are, from the edge of the circular part of the joint to the exterior sides and angles, quite plain. It ought likewise to be noticed as a singular curiosity, that the articulations of these joints are frequently inverted, in some of them the concavity being upwards, in others the reverse. This occasions that variety and mixture of concavities and convexities on the tops of the columns, which is observable throughout the platform of this *causeway*, without any discoverable design or regularity with respect to the number of either.

The length of these particular stones, from joint to joint, is various: they are in general from eighteen inches to two feet long; and for the greater part, longer towards the bottom of the columns than nearer the top, the articulation of the joints being there somewhat deeper. The size, or diameter, likewise, of the columns is as different as their length and figure: in general, they are from fifteen to twenty inches in diameter. Throughout the whole of this combination, there are no traces of uniformity or design, except in the form of the joint, which is invariably by an articulation of the convex into the concave of the piece next above or below it: nor are there traces of a finishing in any part, whether in the height, length, or breadth. If there be particular instances in which the columns above water have a smooth top, others near them, of an equal height, are more or less convex or concave, which shows them to have been joined to pieces that have been washed away, or by other means taken off. It cannot be doubted but that those parts, which are constantly above water, have gradually become more and more even, at the same time that the remaining surfaces of the joints must necessarily have been worn smoother, by the constant action of the air, and by the friction in walking over them, than where the sea, at every tide, beats on the causeway, continually removing some of the upper stones, and exposing fresh joints. All the exterior columns, which have two or three sides exposed to view, preserve their diameters from top to bottom; it may be inferred, that such is also the case with the interior columns, the tops of which alone are visible.

Notwithstanding the general dissimilitude of the columns, relatively to their figure and diameter, they are so arranged and combined at all the points, that a knife can scarcely be introduced between them, either at the sides or angles. It is most interesting to examine the close contexture and nice insertion of the infinite variety of forms exhibited on the surface of this grand parade. From the great dissimilarity of the figures of the columns, the spectator would be led to believe the causeway a work of human art, were it not, on the other hand, inconceivable that the genius or invention of man should construct and combine such an infinite number of columns, which should have a general apparent likeness, and still be so universally dissimilar in their figure, as that on the minutest examination, not two in ten or twenty thousand should be found having their angles and sides equal among themselves, or those of one column to those of another. As there is an infinite variety in the configuration of the several parts, so are there *not any traces of regularity or design in the outlines of*

this curious phenomenon: including the broken or detached pieces of a similar structure, they are extremely scattered and confused. Whatever may have been their original state, they do not at present appear to have any connexion with the grand or principal causeway, as to any supposable design or use in its first construction; and as little design can be inferred from the figure or position of the several constituent parts.

The cliffs, at a great distance from the causeway, exhibit in many parts similar columns. At the depth of ten or twelve feet from the summit of the cape of Bengore, the rock begins to assume a columnar tendency, and forms a range of massy pillars of basalt, which stand perpendicular to the horizon, presenting in the sharp face of the promontory, the appearance of a magnificent gallery or colonnade, upwards of sixty feet in height. This colonnade is supported on a solid base of coarse, black, irregular rock, nearly sixty feet thick, abounding in blebs and air holes; but, though comparatively irregular, it evidently affects a peculiar figure, tending in many places to run into regular forms, resembling the shooting of salts and many other substances during a hasty crystallization. Beneath this great bed of stone, stands a second range of pillars from forty to fifty feet high, more exactly defined, and emulating, in the neatness of its columns, those of the Giant's Causeway. This lower range is upborne by a layer of red ochre stone, which serves as a relief to show it to greater advantage. The two admirable natural galleries, with the interjacent masses of irregular rock, form a perpendicular height of one hundred and seventy feet, from the base of which the promontory, covered with rock and grass, slopes down to the sea a considerable space, so as to give an additional height of two hundred feet, making in all nearly four hundred feet of perpendicular elevation, and presenting a mass, which for beauty and variety of colouring, for elegance and novelty of arrangement, and for the extraordinary magnitude of its objects, cannot, perhaps, be rivalled by any thing at present known.

The promontory of Fairhead raises its lofty summit more than four hundred feet above the level of the sea, and forms the eastern termination of Ballycastle bay. It presents a vast compact mass of rude columnar stones, the forms of which are extremely gross, many being a hundred and fifty feet in length. At the base of these gigantic columns, lies a wild waste of natural ruins of an enormous size, which, in the course of successive ages, have been tumbled down from their foundations by storms, or some more powerful operations of nature. These *massive bodies* have occasionally withstood the shock of their *fall*, and often lie in groupes, and clumps of pillars, resembling

artificial ruins, and forming a very novel and striking landscape.

Many of these pillars lie to the east, in the very bottom of the bay, at the distance of about one-third of a mile from the causeway. There the earth has evidently fallen away from them upon the strand, and exhibits a very curious arrangement of pentagonal columns, in a perpendicular position, apparently supporting a cliff of different strata of earth, clay, rock, &c. to the height of a hundred and fifty feet. Some of these columns are from thirty to forty feet high, from the top of the sloping bank beneath them; and being longer in the middle of the arrangement, shortening on either of the sides, have obtained the appellation of *organs*, from a rude likeness in this particular to the exterior or frontal tubes of that instrument. As there are few broken pieces on the strand, near this assemblage of columns, it is probable that the outside range, as it now appears, is in reality the original exterior line towards the sea; but how far these columns extend internally into the bowels of the incumbent cliff is unknown. The very substance, indeed, of that part of the cliff which projects to a point, between the two bays on the east and west of the causeway, seems composed of similar materials; for, besides the many pieces which are seen on the sides of the cliff, as it winds to the bottom of the bays, particularly on the eastern side, there is at the very point of the cliff, and just above the narrow and highest part of the causeway, a long collection of them, the heads or summits of which, just appearing without the sloping bank, make it evident, that they lie in a sloping position, and about half way between the perpendicular and horizontal. The heads of these columns are likewise of mixed surfaces, convex and concave; and they evidently appear to have been removed from their original upright position, to the inclining or oblique one they have now assumed, by the sinking or falling of the cliff.

## NATURAL BRIDGES.

### NATURAL BRIDGES OF ICONONZO.

Amid the majestic and varied scenery of the Cordilleras of South America, that of their valleys most forcibly strikes the imagination of European travellers. Their enormous height is not discoverable but at a considerable distance, and while the spectator is on one of those plains which extend from the sea-coasts to the foot of the central chain. The flats, or table lands, *which surround the snow-clad summits of the mountains, are themselves, for the greater part, of an elevation of from even to nine thousand feet, nearly a mile and three-quarters*

above the level of the sea. This circumstance diminishes, to a certain degree, the impression of greatness produced by the colossal masses of Chimborazo, Cotopaxi, and Antisana, when seen from the flats of Riobamba, or from those of Quito. It is not, however, with the valleys as with the mountains: deeper and narrower than those of the Alps and the Pyrenees, the valleys of the Cordilleras present situations still more wild than these, and more adapted to fill the soul with admiration and with terror. Fissures and chasms present themselves, having their bottoms and sides ornamented with a vigorous vegetation, and of such a depth, that Vesuvius and the Puy-de-Dome might be placed within several of them, and not show their summits above the edge of the neighbouring mountains. In passing along the back of the Andes, from Pasto to Villa d'Ibarra, and in descending the Loxa towards the banks of the river of the Amazons, the traveller reaches the celebrated fissures of Chota and Cutaco, the former of which is nearly a mile, and the latter upwards of three-quarters of a mile in perpendicular depth. To give a more complete idea of the grandeur of these geological phenomena, it should be observed, that the bottoms of these fissures are by one-fourth only, less elevated above the level of the sea, than the passages of St. Gothard and Mount Cenis.

The valley of Icononzo, or of Pandi, is less remarkable for its dimensions, than for the extraordinary form of its rocks, which appear as if shaped by the hand of man. Their naked and barren summits form the most picturesque contrasts with the tufts of trees and herbaceous vegetables which cover the edges of the fissure. The little torrent, which has worked itself a passage through the valley of Icononzo, bears the name of Rio de la Summa Paz. It descends from the eastern chain of the Andes, which, with the kingdom of New Granada, separates the basin of the river of Madelena from the vast plains of the Meta, Guaviare, and Orinoco. This torrent, confined within a bed almost inaccessible, could not have been crossed without many difficulties, had not Nature herself formed two BRIDGES OF ROCKS, which are justly regarded in the country as among the objects most worthy of the attention of travellers. These NATURAL BRIDGES are on the route from Santa-Fe de Bogota to Papayan and Quito.

Icononzo is the name of an ancient village of Muyscas Indians situated on the south side of the valley, and of which scarcely any vestige now remains, except a few scattered huts. The nearest inhabited place to this remarkable spot is the little village of Pandi, or Mercadillo, distant about a mile. The road from Santa-Fe to Fusagasuga, and thence to Pandi, is

one of the most difficult and least beaten to be met with in the Cordilleras. None but those who passionately love the beauties of Nature, would fail to prefer the usual road which leads from the flat of Bogota to the banks of the Madelena, to the perilous descent from the Paramo de San-Fortunato, and the mountains of Fusagasuga, towards the Natural Bridges of Icononzo.

The deep chasm through which the torrent of Summa Paz precipitates itself, occupies the centre of the valley of Icononzo. Near the first natural bridge, it maintains, for a length of nearly four-fifths of a mile, a direction from east to west. The river forms two fine cascades, the one at the spot where it enters the chasm on the west of Doa, and the other at that where it leaves it, in descending towards Melgar. It is possible that this chasm, which resembles, but on an enormous scale, the gallery of a mine, may have been the result of an earthquake, and that, at its formation, the compact bed of quartz, composing the superior stratum of rock, had resisted the force which tore asunder these mountains. The uninterrupted continuation of this quartzose bed would thus form the bridge, which affords a passage from one part of the valley to the other. This surprising natural arch is forty-eight feet in length, forty in width, and eight feet in thickness at the centre. By experiments carefully made on the fall of bodies, its height above the level of the water of the torrent, has been ascertained to be about three hundred and twenty feet. The depth of the torrent at the mean height of the water, may be estimated at twenty feet. The Indians of the valley of Icononzo, for the security of travellers, have formed a fence of reeds, which extends to the road leading to this first natural bridge.

At the distance of sixty feet below, is another, to which the traveller is conducted by a path descending along the edge of the chasm. Three enormous masses of rock have fallen into such positions as enable them reciprocally to support each other. The one in the centre forms the key of the vault,—an accident which may have conveyed to the natives of this spot an idea of arched masonry, which was unknown to the people of the new world, as well as to the ancient inhabitants of Egypt. It is uncertain whether these portions of rock have been projected from a distance, or are merely the fragments of an arch which has been destroyed on the spot, but which was originally similar to the upper natural bridge. This last supposition is rendered probable by an analogous accident, observable in the Coliseum at Rome, where there are seen, in a wall half fallen, several stones which were arrested in their descent, because in falling they happened to form an arch. In the midst



of this second natural bridge is an aperture of about twenty-five feet in every direction, through which the eye reaches the bottom of the abyss. The torrent appears to run into a dark cavern, whence a mournful sound proceeds, formed by the cries of an infinity of nocturnal birds which inhabit the chasm, and which at first sight may be taken for those bats of a monstrous size, so well known in the equinoctial regions. They can only be perceived by the help of lighted brands, thrown into the chasm to illuminate its sides; and thousands of them may thus be distinguished, skimming along the surface of the water. Their plumage is uniformly of a brown grey colour; and M. Humboldt, from whose account these particulars are extracted, was assured by the Indians, that these hitherto undescribed birds are of the size of a chicken, with the eyes of an owl, and a curved beak. On account of the depth of the valley, it was impossible to obtain a near view of them.

The elevation of the bridges of Icononzo—these surprising productions of nature—above the level of the ocean, is two thousand seven hundred feet, somewhat more than half a mile. In concluding his description of them, M. Humboldt noticed several other natural bridges, among which is that of Cedar-creek, in Virginia. It is an arch of lime-stone, having an aperture of ninety feet, and an elevation of two hundred and twenty feet above the level of the water of the creek. He considers this, as well as the bridge of earth, called Rumichaca, which is on the declivity of the porphyritic mountains of Chumban, in the South American province of Los Pastos; together with the bridge of Madre de Dios, named Dantcu, near Totonilco, in Mexico; and the perforated rock near Grandola, in the province of Alentejo, in Portugal, as geological phenomena, which have some resemblance to the natural bridges of Icononzo; but he doubts whether, in any other part of the world, there has yet been discovered an accidental arrangement so extraordinary as that of three masses of rock, which, reciprocally sustaining each other, form a natural arch.

#### ROCK BRIDGE IN VIRGINIA.

[See Plate, No. 11.]

On a lovely morning, toward the close of spring, I found myself in a very beautiful part of the Great Valley of Virginia. Spurred onward by impatience, I beheld the sun rising in splendour, and changing the blue tints on the tops of the lofty Alleghany mountains, into streaks of purest gold, and nature seemed to smile in the freshness of beauty. A ride of about fifteen miles, and a pleasant woodland ramble of about two, brought myself and companion to the great Natural Bridge.

Although I had been anxiously looking forward to this time, and my mind had been considerably excited by expectation, yet I was not altogether prepared for this visit. This great work of nature, is considered by many, as the second great curiosity in our country, Niagara falls being the first. I do not expect to convey a very correct idea of this bridge, for no description can do this.

The Natural Bridge is entirely the work of God. It is of solid lime-stone, and connects two huge mountains together by a most beautiful arch, over which, there is a great waggon road. Its length, from one mountain to the other, is nearly 80 feet, its width about 35, its thickness 45, and its perpendicular height over the water is not far from 220 feet. A few bushes grow on its top, by which the traveller may hold himself as he looks over. On each side of the stream, and near the bridge, are rocks projecting ten or fifteen feet over the water, and from 200 to 300 feet from its surface, all of lime-stone. The visitor cannot give so good a description of this bridge, as he can of his feelings at the time. He softly creeps out on a shaggy projecting rock, and looking down a chasm of from 40 to 60 feet wide, he sees, nearly 300 feet below, a wild stream foaming and dashing against the rocks beneath, as if terrified at the rocks above. This stream is called Cedar Creek. The visitor here sees trees under the arch, whose height is 70 feet; and yet, to look down upon them, they appear like small bushes of perhaps two or three feet in height. I saw several birds fly under the arch, and they looked like insects. I threw down a stone, and counted 34 before it reached the water. All hear of heights and of depths, but they here *see* what is high, and they tremble, and *feel* it to be deep. The awful rocks present their everlasting butments, the water murmurs and foams far below, and the two mountains rear their proud heads on each side, separated by a channel of sublimity. Those who view the sun, the moon, and the stars, and allow that none but *God* could make them, will here be impressed, that none but an *Almighty* God could build a bridge like this.

The view of the bridge from below, is as pleasing as the top view is awful. The arch from beneath, would seem to be about two feet in thickness. Some idea of the distance from the top to the bottom may be formed, from the fact, that as I stood on the bridge, and my companion beneath, neither of us could speak with sufficient loudness to be heard by the other. A man from either view, does not appear more than four or five inches in height.

*As we stood under this beautiful arch, we saw the place*

where visitors have often taken the pains to engrave their names upon the rock. Here Washington climbed up 25 feet and carved his own name, where it still remains. Some, wishing to immortalize their names, have engraven them deep and large, while others have tried to climb up and insert them high in this book of fame.

A few years since, a young man, being ambitious to place his name above all others, came very near losing his life in the attempt. After much fatigue, he climbed up as high as possible, but found that the person who had before occupied his place was taller than himself, and consequently had placed his name above his reach. But he was not thus to be discouraged. He opens a large jack-knife, and in the soft lime-stone, began to cut places for his hands and feet. With much patience and industry he worked his way upwards, and succeeded in carving his name higher than the most ambitious had done before him. He could now triumph, but his triumph was short, for he was placed in such a situation, that it was impossible to descend, unless he fell upon the ragged rocks beneath him. There was no house near, from whence his companions could get assistance. He could not long remain in that condition, and, what was worse, his friends were too much frightened to do any thing for his relief. They looked upon him as already dead, expecting every moment to see him precipitated upon the rocks below and dashed to pieces. Not so with himself. He determined to ascend. Accordingly, he plies himself with his knife, cutting places for his hands and feet, and gradually ascended with incredible labour. He exerts every muscle. His life was at stake, and all the terrors of death rose before him. He dared not to look downwards, lest his head should become dizzy; and perhaps on this circumstance his life depended. His companions stood at the top of the rock, exhorting and encouraging him. His strength was almost exhausted; but a bare possibility of saving his life still remained, and hope, the last friend of the distressed, had not yet forsaken him. His course upwards, was rather obliquely than perpendicularly. His most critical moment had now arrived. He had ascended considerably more than 200 feet, and had still further to rise, when he felt himself fast growing weak. He thought of his friends and all his earthly joys, and he could not leave them. He thought of the grave, and he dared not meet it. He now made his last effort, and succeeded. He had cut his way not far from 250 feet from the water, in a course almost perpendicular; and in a little less than two hours, his anxious companions reached him a pole from the top, and drew him up. They received him

with shouts of joy ; but he himself was completely exhausted. He immediately fainted away on reaching the spot, and it was sometime before he could be recovered !

It was interesting to see the path up these awful rocks, and to follow in imagination this bold youth as he thus saved his life. His name stands far above all the rest, a monument of hardihood, of rashness, and of folly.

## THE CAPE OF THE WINDS.

The fortress of Mankoop, in the Crimea, is of a very extraordinary magnitude, and may be described as being literally stationed on the clouds. It covers the summit of a semi-circular insulated mountain, which, from its frightful aspect, its altitude, and craggy perpendicular sides, independently of every other consideration than as a surprising work of nature, fills the mind with wonder on entering the defile. In this singular situation, where there are not any visible means of ascent towards the height, and still less of conveying the necessary materials for the completion of so astonishing a work, the Genoese constructed this citadel, perhaps without a parallel in Europe, the result of their wealth, address, and enterprise. Being at a remote distance from the coast, it is natural to conjecture that it was employed to curb the hostile spirit of the natives towards the maritime colonial possessions. The latest possessors of this fortress were Jews, in the cemetery of whose colony, the traveller meets with ruined tombs of marble and stone, lying beneath the trees he has to pass in his ascent.

The whole of the passage up the mountain is steep and difficult ; nor is it rendered more practicable by the amazing labours of its original possessors, whose dilapidated works occur almost at every step. On reaching the summit, caverns and gloomy galleries, perforated in the rock, present on every side their dark mouths. On the most elevated part of this extraordinary eminence, is a beautiful plain, covered with fine turf ; it is partly fenced in by the mouldering wall of the fortress, but otherwise open to the surrounding precipices. From this spot, the adjacent mountains, valleys, hills, woods, and villages, may be discerned. "While," observes the traveller, by whom these details are supplied, "with dismay and caution we crept on our hands and knees to look over the brink of these fearful heights, a half-clad Tartar, wild as the winds of the north, mounted without a saddle, and without any other bridle except the twisted stem of a wild vine, on a colt equally un subdued, galloped to the very edge of the precipice, where, as his horse stood *prancing* on the borders of eternity, he amused *himself with pointing out to us the different places in the vast*

district which the eye commanded. We entered one of the excavated chambers,—a small square apartment, which led to another on our right hand : and, on our left, a narrow passage conducted us to an open balcony, with a parapet in front, formed of the rock, on the very face of one of the principal precipices, whence the depth below might be contemplated with less danger. The vultures which hovered over the valleys, did not appear larger than swallows ; and the tops of the hills, covered by tufted woods, with the villages scattered amid the rocks and defiles, appeared at so intimidating a depth, that the blood chilled at the view. At length, being conducted to the north-eastern point of the crescent, that being the shape of the summit on which the fortress of Mankoop was built, and descending a few stone steps, neatly hewn out in the rock, we entered by a square door the cavern, called by the Tartars **THE CAPE OF THE WINDS**. It has been chiseled, like the rest, out of the solid stone ; but is open on four sides. From the amazing prospect here commanded of all the surrounding country, it probably served as a post of military observation. The apertures, or windows, are large arched chasms in the rock ; through these, a most extensive range of scenery over the distant mountains and rolling clouds forms a sublime spectacle. There is nothing in any part of Europe to surpass the tremendous grandeur of the place. Beneath the cavern, is another chamber leading to the several cells on its different sides ; these have all been cut out of the same rock.”

The party, in descending, pursued a different route, which if they had taken in their ascent, would, our traveller observes, have afforded them a view of the sublimest scenery imaginable. They now passed beneath an old arched gateway of the citadel, once its principal entrance. This road flanks the northern side of the mountain ; and the fall into the valley is so bold and profound, that a single false step would precipitate both horse and rider. By alighting, the danger is avoided ; and the terror of the descent compensated by the noblest scenery the eye ever beheld. It was dark before they reached the bottom ; and they had some difficulty to regain the principal road which leads through the defile, owing principally to the trees which project over all the lanes in the vicinity of Tartar villages, and so effectually obstruct the passage of persons on horseback, that they were in continual danger of being thrown. The defile itself is not without danger in certain seasons of the year, immense masses of lime-stones detaching themselves from the rocks above, and carrying all before them in their descent. Several of these masses, detached from the northern precipices, had crossed the river at the bottom, and by the

prodigious velocity acquired in their descent, had actually rolled nearly half way up the opposite side.

PRECIPICE OF THE TABLE MOUNTAIN, SOUTH CAROLINA.

The Table Mountain, situated in Pendleton District, in South Carolina, presents an awful precipice of nine hundred feet. Few persons, who have once cast a glimpse into the almost boundless abyss beneath, can again exercise sufficient fortitude to approach the margin of the chasm. Almost every one, on looking over, involuntarily falls to the ground, senseless, nerveless, and helpless; and would inevitably be precipitated, and dashed to atoms, were it not for measures of caution and security, that have always been deemed indispensable to a safe indulgence of the curiosity of the visitor or spectator. Every one, on proceeding to the spot, whence it is usual to gaze over the wonderful deep, has, in his imagination, a limit or bound, graduated by a reference to distances with which his eye has been familiar. But in a moment, eternity, as it were, is presented to his astonished senses; and he is instantly overwhelmed: his whole system is no longer subject to his volition or his reason, and he falls like a mass of lead, obedient only to the common laws of mere matter. He then revives, and in wild delirium, surveys a scene which, for a while, he is unable to define by description or limitation.

GEOLOGICAL CHANGES OF THE EARTH.

There are more things in heaven and earth  
Than are dreamt of in our philosophy.

SHAKESPEARE.

THE variety of fossil substances, many of them marine productions, which are found in mountains remote from the sea, are undeniable proofs that the earth's surface has undergone considerable changes, some of which indicate an alteration of climate not easily to be explained. The remains of animals inhabiting hot countries, and the marine productions of hot climates, which are frequently found in high northern latitudes, lead to a suspicion that the earth's axis, was at a very remote period, differently inclined to what it is at present. The tropics now extend twenty-three degrees and a half on each side of the equator; but if they were extended to forty-five degrees, then the arctic circle and the tropics would coincide, and thence would arise inconceivable variations in the productions and phenomena of the earth. All this would form an amusing speculation to a person possessed of a terrestrial globe, who might tie a thread around it to represent the tropics at forty-five degrees of elevation.

By the gradual operation of the sea, and of rivers, the face of the globe has, in the course of ages, undergone very material changes. The former has encroached in particular parts, and retired from others; and the mouths of large rivers, running through low countries, have often been variously modified, by a deposition and transfer of the matter washed down from the land. At Havre, the sea undermines the steep coast; while it recedes at Dunkirk, where the shore is flat. In Holland, the Zuyder Zee was probably formed, in the middle ages, by continual irruptions of the sea, where only the small lake Flevo had before existed. The mouths of the Rhine have been considerably altered, as well in their dimensions as in their directions. The mud, as it is deposited by large rivers, generally causes a *delta*, or a triangular piece of land, to grow out into the sea. Thus the mouth of the Mississippi is said to have advanced above fifty miles since the discovery of America. The island called Sandy Hook, at the entrance of the river of New-York, was about forty years ago, a peninsula, attached to the high land. The sea, within the space of forty years, has retired more than a mile from Rosetta, in Egypt; and the mouths of the Arno, and of the Rhone, consist in a great measure of new land.

The Javanese have a tradition, that in former times the Islands of Sumatra, Java, Bali, and Sumbawa, were united, and afterwards separated into nine different parts. They add, that when three thousand rainy seasons shall have passed away, they will be united. In the Mediterranean, geological phenomena evince, that the Island of Malta, and that of Gozo, its dependency, now separated by a wide channel, and an intermediate small Island of Cumino, formed, together with the latter, a single island. By the encroachments of the sea, and the subsidence of some parts of the land, the islands of Sicily, the aboriginal inhabitants of which, carried on a considerable trade in tin with the Phœnicians, Greeks, and Romans, are now little more than barren rocks, with small patches of earth interspersed in the hollows. Strabo describes the Phœnicians as having been so jealous of their lucrative traffic with these islands, that they ran a vessel purposely on shore, and risked the lives of the crew, rather than have it made known to the Romans. The land, within which these tin-mines were worked, must now be sunk, and buried beneath the sea. On the shifting of the sands between the islands, walls and ruins are frequently seen; the difference of level, since these walls, or fences, were made, to prevent the encroachments of the sea, being estimated at sixteen feet. There is little doubt but that there must have been a sub-

dence of the land, followed by a sudden inundation. This, indeed, seems to be confirmed by tradition, there being a strong persuasion in the western parts of Cornwall, that there formerly existed a large country between the Land's-End and the islands of Scilly, now laid many fathoms under water. Although there are not any positive evidences of such an ancient connexion between the main land and these islands, still it is extremely probable, that the cause of the inundation which destroyed the greater part of them, may have reached the Cornish shores, there being several proofs of a subsidence of the land in Mount's Bay. The principal anchoring place, which was called a lake, is now a haven, or open harbour; and the mount, from its Cornish name, signifying *the grey rock in a wood*, must have formerly stood in a wood, but is now at full tide half a mile in the sea.

Examples of a similar kind, relative to every known country, might be multiplied. One of the most considerable inundations to be met with in history, is that which happened in the reign of Henry I. and which overflowed the estates of Earl Goodwin, forming the banks called the Goodwin Sands. In the year 1346, a similar irruption of the sea destroyed a hundred thousand persons in the territory of Dort, in the United Provinces; and a still greater number round Dollart. In Friesland and Zealand more than three hundred villages were overwhelmed; and their remains are still visible, on a clear day, at the bottom of the water. The Baltic Sea has, by slow degrees, covered a large part of Pomerania; and, among others, overwhelmed the famous port of Vineta. The Norwegian Sea has formed several little islands from the main land, and still daily advances on the continent. The German Sea has advanced on the shores of Holland, near Catt, to such a degree, that the ruins of an ancient citadel of the Romans, formerly built on that coast, are now under water. The country surrounding the Isle of Ely was, in the time of Bede, about a thousand years ago, one of the most delightful and highly cultivated spots in Great Britain; it was overwhelmed, and remained for several centuries under water, until at length, the sea, by a caprice similar to the one which had prompted its invasions, abandoned the earth, but without the latter being able to recover its primitive state, that of one of the most fertile valleys in the world.

On the other hand, the sea has, in many instances, deserted the land; and by the deposition of its sediment in some places, and the accumulation of its sands in others, has also formed new lands. In this manner the Isle of Oxney, near Romney Marsh, was produced. In France, the town of Aigues Mor-



tes, which was a sea-port in the time of St. Louis, is now removed more than four miles from the sea. Psalmodi, also in that kingdom, was an island in the year 815, and is now upwards of six miles within the land. In Italy, a considerable portion of land has been gained at the mouth of the river Arno; and Ravenna, which once stood by the sea-side, is now considerably removed from it. Every part of Holland seems to be a conquest from the sea, and to have been rescued, in a manner, from its bosom. The industry of man, however, in the formation of dykes, is here to be brought into account; for the surface of the earth, in that country, is for the greater part, below the surface of the sea.

Three-fifths of the surface of the globe are covered by the sea, the average depth of which has been estimated at from five to ten miles. Demonstrative proofs exist in Great Britain, and in various parts of the world, that great changes have taken place in the relative positions of the present continents with the ocean, which, in former ages, rolled its waves over the summits of our present elevated mountains.

#### EXTRANEOUS FOSSILS.

The fossil remains of animals not now in existence, entombed and preserved in solid rocks, present us with durable monuments of the great changes which our planet has undergone in former ages. We are led to a period when the waters of the ocean covered the summits of our highest mountains, and are irresistibly compelled to admit one of two conclusions, either that the sea has retired, and sunk beneath its former level; or that some power operating from beneath, has lifted up the islands and continents, with all their hills and mountains, from the watery abyss, to their present elevation above its surface.

The calcareous, or limestone mountains in Derbyshire, and at Craven, in Yorkshire, having an elevation of about two thousand feet above the present level of the sea, contain, in a greater or less abundance, and throughout their whole extent, fossil remains of zoophites, shell-fish, and marine animals. Not any remains of vegetables have been found in the calcareous mountains of England; but, in the thick beds of shale and grit-stone lying upon them, are found various vegetable impressions, and above these, regular beds of coal, with strata, containing shells of fresh-water muscles. In the earthy limestone of the upper strata, are sometimes found fossil flat-fish, with the impression of the scales and bones quite distinct. The mountains of the Pyrenees are covered in the highest part, at Mont Perdu, with calcareous rocks, containing impressions

of marine animals; and, even where the impressions are not visible in the lime-stone, it yields a foetid cadaverous odour, when dissolved in acids, owing, in all probability, to the animal matters it contains. Mont Perdu, which rises ten thousand five hundred feet, nearly two miles above the level of the sea, is the highest situation in which any marine remains have been found in Europe. In the Andes, they have been observed by Humboldt at the height of fourteen thousand feet, more than two miles and a half. Lastly, in southern countries, in and under beds of clay-covering chalk, the bones of the elephant, and of the rhinoceros are frequently found.

These bones, as they have been brought from different parts of the world, have been examined with the utmost attention by the sagacious naturalist, Cuvier. He has observed characteristic variations of structure, which prove that they belong to animals not now existing on our globe: nor have many of the various zoophites and shell-fish, found in calcareous rocks, been discovered in our present seas. From these very curious facts he makes the following deductions.

“ These bones are buried, almost every where, in nearly similar beds: they are often blended with some other animals resembling those of the present day. The beds are generally loose, either sandy or marly; and always neighbouring, more or less, to the surface. It is then probable that these bones have been enveloped by the last, or by one of the last, catastrophes of this globe. In a great number of places they are accompanied by the accumulated remains of marine animals; but in some places, which are less numerous, there are none of these remains: sometimes the sand or marl, which covers them, contains only fresh water shells. No well authenticated account proves that they have been covered by regular beds of stone, filled with sea-shells; and, consequently, that the sea has remained on them undisturbed, for a long period. The catastrophe which covered them was, therefore, a great, but transient, inundation of the sea. This inundation did not rise above the high mountains; for we find no analogous deposits covering the bones, nor are the bones themselves there met with, not even in the high vallies, unless in some of the warmer parts of America. These bones are neither rolled nor joined in a skeleton, but scattered, and in part fractured. They have not, then, been brought from afar by inundation, but found by it in places where it has covered them, as might be expected, if the animals to which they belonged had dwelt in these places, and had there successively died. Before *this catastrophe*, these animals lived, therefore, in the *climates in which we now dig up their bones*; it was *this catastrophe which destroyed them there*; and, as we no longer

find them, it is evident, that it has annihilated those species. The northern parts of the globe, therefore, nourished formerly, species belonging to the genus *elephant*, *hippopotamus*, *rhinoceros*, and *tapir*, as well as the *mastodon*, genera, of which the four first have no longer any species existing, except in the torrid zone; and of the last, none in any part."

That every part of the dry land was once covered by the ocean, is a fact on which all geologists agree; and the discovery, noticed above, of the fossil remains of many genera of quadrupeds, once existing, but which have now disappeared from the earth, leads to another fact, not less interesting, and which is at the same time coincident with the oldest records or traditions of the human race, namely, that at the period when these great changes took place, man was not an inhabitant of this planet. These fossil remains, now about to be particularized, are among the most surprising of nature's phenomena, and irresistibly lead to awful speculations respecting the past and future condition of the terrestrial globe.

#### LARGE FOSSIL ANIMAL OF MAESTRICHT.

The large animal, whose fossil remains are found in the quarries of Maestricht, has been deservedly a frequent object of admiration; and the beautiful appearance which its remains possess, in consequence of their excellent state of preservation, in a matrix which admits of their fair display, has occasioned every specimen of this fossil to be highly valued. The lower jaw of this animal, with some other specimens, which were presented by Dr. Peter Camper to the Royal Society, and which are now in the British Museum, are among the most splendid and interesting fossils in existence.

In 1770, the workmen, having discovered part of an enormous head of an animal imbedded in the solid stone, in one of the subterraneous passages of the mountain, gave information to M. Hoffman, who, with the most zealous assiduity, laboured until he had disengaged this astonishing fossil from its matrix. But when this was done, the fruits of his labours were wrested from him by an ecclesiastic, who claimed it as being proprietor of the land over the spot on which it was found. Hoffman defended his right in a court of justice; but the influence of the Chapter was employed against him, and he was doomed not only to the loss of this inestimable fossil, but to the payment of heavy law expenses. But in time, justice, M. Faujas says, though tardy, at last arrived—the troops of the French Republic secured this treasure, which was conveyed to the National Museum.

The length of the cervical, dorsal, and lumbar vertebrae.

appears to have been about nine feet five inches, and that of the vertebræ of the tail about ten feet; adding to which the length of the head, which may be reckoned, considering the loss of the intermaxillary bones, at least at four feet, we may safely conclude the whole length of the skeleton of the animal to have approached very nearly to twenty-four feet.

The head is a sixth of the whole length of the animal; a proportion approaching very near to that of the crocodile, but differing much from that of the monitor, the head of which animal forms hardly a twelfth part of the whole length.

The tail must have been very strong, and its width, at its extremity, must have rendered it a most powerful oar, and have enabled the animal to have opposed the most agitated waters, as has been well remarked by M. Adrien Camper. From this circumstance, and from the other remains which accompany those of this animal, there can be no doubt of its having been an inhabitant of the ocean.

Taking all these circumstances into consideration, M. Cuvier concludes, and certainly on fair, if not indisputable, grounds, that this animal must have formed an intermediate genus between those animals of the lizard tribe, which have an extensive and forked tongue, which include the monitors and the common lizards, and those which have a short tongue, and the palate armed with teeth, which comprise the iguanas, marbres, and anolis. This genus, he thinks, could only have been allied to the crocodile by the general characters of the lizards.

## FOSSIL REMAINS OF RUMINANTIA.

Among the fossils of the British Empire, none are more calculated to excite astonishment than the enormous stags' horns which have been dug up in different parts of Ireland. Their dimensions, Dr. Molyneux informs us, were as follows;—

	Ft.	In.
From the extreme tip of each horn, - -	10	10
From the tip of the right horn to its root, -	5	2
From the tip of one of the inner branches to the tip of the opposite branch, - - -	3	7 1-2
The length of one of the palms, within the branches, - - - - -	2	5
The breadth of the same palm within the branches, - - - - -	1	10 1-2
The length of the right brow antler, - - -	1	2

A similar pair, found ten feet under ground, in the county of Clare, was presented to Charles II. and placed in the horn-

gallery, Hampton-Court; but was afterwards removed into the guard-room of the same palace.

At Ballyward, near Ballyshannon; at Turvey, eight miles from Dublin; and at Portumery, near the river Shannon, in the county of Galway; similar horns have been found. In the common hall of the Bishop of Armagh's house, in Dublin, was a forehead, with two amazingly large beams of a pair of this kind of horns, which, from the magnitude of the beams, must have much exceeded in size those of which the dimensions are given above. Dr. Molyneux states, that in the last twenty years, thirty pair of these horns had been dug up by accident in this country; the observations also, of several other persons, prove the great frequency with which these remains have been found in Ireland.

Various opinions have been entertained respecting this animal and its existing prototype. This, however, does not appear to have been yet discovered; and these remains may, therefore, be regarded as having belonged to an animal now extinct.

#### FOSSIL REMAINS OF THE MASTODON.

We now come to the examination of one of the most stupendous animals known, either in a recent or a fossil state; and which, whether we contemplate its original mode of existence, or the period at which it lived, cannot but fill our minds with astonishment.

The first traces of this animal are sketched in a letter from Dr. Mather, of Boston, to Dr. Woodward, in 1712, and are transcribed from a work in manuscript, entitled *Biblia Americana*. In this work, teeth and bones of prodigious size, supposed to be human, are said to have been found in Albany, in New-England. About the year 1740, numerous similar bones were found in Kentucky, on the Ohio, and dispersed among the European virtuosi.

Many bones of this animal, were found in 1799, in the State of New-York, in a large plain, bounded on every side by immense mountains, in the vicinity of Newburgh, situated on the Hudson, or North River. These remains are also found on the side of the three great chains of mountains, the Alleghanies, the North Mountains, and the Blue Mountains; in the interior parts of Pennsylvania and Carolina; and in New-Jersey, a few miles from Philadelphia.

From a careful attendance to every circumstance, M. Cuvier conceives we have a right to conclude, that this great *mastodon*, or animal of the Ohio, did not surpass the elephant in height, but was a little longer in proportion; its limbs rather

thicker ; and its belly smaller. It seems to have very much resembled the elephant in its tusks, and, indeed, in the whole of its osteology ; and it also appears to have had a trunk. But, notwithstanding its resemblance to the elephant, in so many particulars, the form and structure of the grinders are sufficiently different from those of the elephant, to demand its being placed in a distinct genus. From the later discoveries respecting this animal, M. Cuvier is also inclined to suppose that its food must have been similar to that of the hippopotamus and the boar, but preferring the roots and fleshy parts of vegetables ; in the search of which species of food it would, of course, be led to such soft and marshy spots as it appears to have inhabited. It does not, however, appear to have been at all formed for swimming, or for living much in the waters, like the hippopotamus, but rather seems to have been entirely a terrestrial animal.

#### FOSSIL REMAINS OF THE RHINOCEROS.

There appear to be three living species of rhinoceros : 1. That of India, a unicorn, with a rugose coat, and with incisors, separated, by a space, from the grinders. 2. That of the Cape, a bicorn, the skin without rugæ, and having twenty-eight grinders, and no incisors. 3. That of Sumatra, a bicorn, the skin but slightly rugose, thus far resembling that of the Cape, but having incisive teeth, like that of India.

The fossil remains of the rhinoceros have been generally found in the same countries where the remains of elephants have been found ; but they do not appear to have so generally excited attention ; and, perhaps, but few of those who discovered them, were able to determine to what animal they belonged. Thus a tooth of this animal is described by Grew merely as the tooth of a terrestrial animal ; and the remains of this animal, found in the neighbourhood of Canterbury, were supposed to have belonged to the hippopotamus.

In Hartzberg, in the principality of Grubenhagen ; Quedlimburg, Darmstadt, the borders of the Rhine, Mentz, Strasbourg, the neighbourhood of Cologne, Westphalia, numerous parts of France, and in several parts of Great Britain, the remains of the rhinoceros have been found. In Siberia, these remains have been met with in considerable quantities. Pallas, whose researches have been particularly directed to this part of the world, made the astonishing discovery of a complete rhinoceros, still covered by its skin, and buried in the sand on the borders of the river Wiluji.

## FOSSIL REMAINS OF THE SIBERIAN MAMMOTH.

It has been demonstrated by Cuvier, that this animal was of a different species from the mastodon, or American mammoth. Its bones have been found in the alluvial soil near London, Northampton, Gloucester, Harwich, Norwich, in Salisbury plain, and in other places in England; they also occur in the north of Ireland; and in Sweden, Iceland, Russia, Poland, Germany, France, Holland, and Hungary, the bones and teeth have been met with in abundance. Its teeth have also been found in North and South America, and abundantly in Asiatic Russia. Pallas says, that from the Don to the Tchutskoiness, there is scarcely a river that does not afford the remains of the mammoth, and that they are frequently imbedded in *alluvial soil, containing marine productions*. The skeletons are seldom complete; but the following interesting narrative will show, that in one instance, the animal has been found in an entire state.

In the year 1799, a Tungusian fisherman observed a strange shapeless mass projecting from an ice-bank, near the mouth of a river in the north of Siberia, the nature of which he did not understand, and which was so high in the bank as to be beyond his reach. He next year observed the same object, which was then rather more disengaged from among the ice; but was still unable to conceive what it was. Towards the end of the following summer, 1801, he could distinctly see that it was the frozen carcase of an enormous animal, the entire flank of which, and one of its tusks, had become disengaged from the ice. In consequence of the ice beginning to melt earlier, and to a greater degree than usual, in 1803, the fifth year of this discovery, the enormous carcase became entirely disengaged, and fell down from the ice-crag on a sand bank forming part of the coast of the Arctic Ocean. In the month of March of that year, the Tungusian carried away the two tusks, which he sold for fifty rubles, about fifteen pounds sterling.

Two years afterwards, this animal still remained on the sand bank, where it had fallen from the ice; but its body was then greatly mutilated. The peasants had taken away considerable quantities of its flesh to feed their dogs; and the wild animals, particularly the white bears, had also feasted on the carcase; yet the skeleton remained quite entire, except that one of the fore legs was gone. The entire spine, the pelvis, *one shoulder blade*, and three legs, were still held together by *their ligaments*, and by some remains of the skin; and the *other shoulder blade* was found at a short distance. *The head*

remained, covered by the dried skin, and the pupil of the eyes was still distinguishable. The brain also remained within the skull, but a good deal shrunk and dried up; and one of the ears was in excellent preservation, still retaining a tuft of strong bristly hair. The upper lip was a good deal eaten away, and the under lip was entirely gone, so that the teeth were distinctly seen. The animal was a male, and had a long mane on its neck.

The skin was extremely thick and heavy, and as much of it remained as required the exertions of ten men to carry away, which they did with considerable difficulty. More than thirty pounds weight of the hair and bristles of this animal were gathered from the wet sand bank, having been trampled into the mud by the white bears, while devouring the carcase. The hair was of three distinct kinds; one consisting of stiff black bristles, a foot or more in length; another of thinner bristles, or coarse flexible hair, of a reddish brown colour; and the third of coarse reddish brown wool, which grew among the roots of the hair. These afford an undeniable proof that this animal had belonged to a race of elephants inhabiting a cold region, with which we are unacquainted, and by no means fitted to dwell in the torrid zone. It is also evident that this enormous animal must have been frozen up by the ice at the moment of its death.

#### CORAL REEFS AND ISLANDS.

Coral belongs to the class of those surprising productions of nature, which are named *zoophytes*, or plant-animals, on account of their filling up the intermediate space between the animal and vegetable kingdoms; and in treating of them, this curious substance will be distinctly considered. In the mean time, the production of coral reefs and islands presents one of those geological changes, by which the earth's surface has been modified, and has received a new accession from the sea.

The common foundation of the clusters of islands discovered by modern navigators in the Pacific ocean, as well as of those belonging to New South Wales, is evidently of coral structure, immense reefs of which shoot out in all directions. There is every reason to believe that the islands which are occasionally raised by the tremendous agency of subterraneous volcanoes, do not bear any proportion to those which are perpetually forming, by the silent but persevering efforts of the sea worms, by which coral is produced. Banks of coral are found at all depths, and at all distances from the shore, entirely unconnected with the land, and detached from each other. By a quick progression, they grow up towards the surface;



while the winds, heaping up the coral from deeper water, chiefly accelerate the formation of these banks into shoals and islands. They become gradually shallower; and when once the sea meets with resistance, the coral is quickly thrown up by the force of the waves breaking against the bank. These coral banks have been seen in all their stages—some in deep water—others with a few rocks appearing above the surface, just formed into islands without the least appearance of vegetation; and, lastly, others covered with soil and weeds.

The loose corals, rolled inward by the billows in large pieces, ground, and, the reflux being unable to carry them away, become a bar to the coagulated sand with which they are always intermixed. This sand, being easiest raised, is lodged at top; and when its accumulated mass is elevated by violent storms, and no longer within the reach of common waves, it becomes a resting place to birds whom the search of prey draws thither. Their dung, feathers, &c. augment the soil, and prepare it for the reception of accidental roots, branches, and seeds, cast up by the waves, or brought thither by birds. Thus islands are formed: the leaves and rotten branches, intermixing with the sand, produce in time a light black mould, in which trees and shrubs vegetate and thrive. Cocoa nuts, which continue long in the sea without losing their vegetative powers, having been thrown on such islands, produce trees which are particularly adapted to all soils, whether sandy, rich, or rocky.

The violence of the waves, within the tropics, must generally be directed to two points, according to the monsoons. Hence the islands formed from coral banks must be long and narrow, and lie nearly in a meridional direction. Even supposing the banks to be round, as they seldom are when large, the sea meeting most resistance in the middle, must heave up the matter in greater quantities there, than towards the extremities; and, by the same rule, the ends will generally be open, or at least, lowest. They will also commonly have soundings there, as the remains of the banks, not accumulated, will be under water. Where the coral banks are not exposed to the common monsoon, they will alter their direction, and become, either round, or extended in the parallel, or of irregular forms, according to accidental circumstances.

Captain Flinders, in his voyage to Terra Australis, gives a lively and interesting description of a coral reef on the southern coast of New South Wales. On this reef he landed, and the water being very clear round the edges, a new creation, as *it were*, but imitative of the old, was presented to the view. *Wheat sheaves, mushrooms, stag's horns, cabbage leaves, and a variety of other forms, were glowing under water with vivid*

ints of every shade betwixt green, purple, brown, and white; qualling in beauty, and excelling in grandeur the most favourite *parterre* of the curious florist. These were different species of coral and fungus, growing, as it were, out of the solid rock, and each had its peculiar form and shade of colouring; but, whilst contemplating the richness of the scene, the destruction with which it was pregnant could not be forgotten.

Different corals in a dead state, concreted into a solid mass of dull white colour, composed the stone of the reef. The negro heads were lumps which stood higher than the rest; and being generally dry, were blackened by the weather; but even in these, the forms of the different corals and some shells were distinguishable. The edges of the reef, but particularly on the outside where the sea broke, were the lightest parts; within these were pools and holes containing live corals, sponges, sea-eggs, and cucumbers; and many enormous cockles were cattered upon different parts of the reef. At low water, these cockles seem most commonly to lie half open; but frequently close with much noise—and the water within the shells then pouts up in a stream, three or four feet high; it is from this noise, and the spouting of the water, that they are discovered, or, in other respects, they are scarcely to be distinguished from the coral rock.

His description of a coral island which he afterwards visited on the same coast, is truly philosophical and throws great light on these surprising productions of nature.

“ This little island, or rather the surrounding reef, which is three or four miles long, affords shelter from the southeast winds. It is scarcely more than a mile in circumference, but appears to be increasing both in elevation and extent. At no very distant period of time, it was one of those banks produced by the washing up of sand and broken coral, of which most reefs afford instances, and those of Torres’ Strait a great many. These banks are in different stages of progress; some, like this, are become islands, but not yet habitable; some are above high water mark, but destitute of vegetation; whilst others are overflowed with every returning tide.

“ It seems to me, that when the animalcules which form the corals at the bottom of the ocean, cease to live, their structures adhere to each other, by virtue either of the glutinous remains within, or of some property in salt water; and the interstices being gradually filled up with sand and broken pieces of coral washed by the sea, which also adhere, a mass of rock is at length formed. Future races of these animalcules erect their habitations upon the rising bank, and die in their turn, to increase, but principally to elevate, this monu-

ment of their wonderful labours. The care taken to work perpendicularly in the early stages, would mark a surprising instinct in these diminutive creatures. Their wall of coral for the most part, in situations where the winds are constant, being arrived at the surface, affords a shelter, to leeward of which, their infant colonies may be safely sent forth, and to this their instinctive foresight it seems to be owing, that the windward side of a reef exposed to the open sea, is generally, if not always, the highest part, and rises almost perpendicular, sometimes from the depth of 200, and perhaps many more fathoms. To be constantly covered with water, seems necessary to the existence of the animalcules, for they do not work, except in holes upon the reef, beyond low water mark; but the coral sand, and other broken remnants thrown up by the sea, adhere to the rock, and form a solid mass with it, as high as the common tides reach. That elevation surpassed, the future remnants, being rarely covered, lose their adhesive property; and remaining in a loose state, form what is usually called a key upon the tops of the reef. The new bank is not long in being visited by sea birds; salt plants take root upon it, and a soil begins to be formed; a cocoa nut is thrown on shore; land birds visit it and deposit the seeds of shrubs and trees; every high tide, and still more every gale, adds something to the bank; the form of an island is gradually assumed—and last of all, comes man to take possession.

“This island is well advanced in the above progressive state; having been many years, probably some ages, above the reach of the highest spring tides, or the wash of the surf in the heaviest gales. I distinguished, however, in the rock which forms its basis, the sand, coral, and shells formerly thrown up, in a more or less perfect state of cohesion; small pieces of wood, pumice stone, and other extraneous bodies, which chance had mixed with the calcareous substances when the cohesion began, were inclosed in the rock; and, in some cases, were still separable from it without much force. The upper part of the island is a mixture of the same substances in a loose state, with a little vegetable soil; and is covered with the *casuarina* and a variety of other trees and shrubs, which give food to parquets, pigeons, and some other birds; to whose ancestors it is probable the island was originally indebted for this vegetation.”

## AFRICAN DESERTS.

The most striking feature of AFRICA consists of the immense deserts which pervade its surface, and which are supposed to comprise the one half of its whole extent. The

chief of these is, by way of eminence, called SAHARA, or the Desert. It stretches from the shores of the Atlantic, with few interruptions, to the confines of Egypt, a space of more than forty-five degrees, or 2700 geographical miles, by a breadth of twelve degrees, or 720 geographical miles. It is one prodigious expanse of red sand, and sand-stone rock, of the granulations of which, the red sand consists. It is, in truth, an empire of sand, which seems to defy every exertion of human power or industry, although it is interspersed with various islands, and fertile and cultivated spots of different sizes, of which Fessan is the chief of those which have been hitherto explored.

Nearly in the centre of this sandy ocean, and nearly midway between the Mediterranean Sea and the coast of Guinea, rise the walls of Tombuctoo, the capital of the very interesting empire of Bembarra—a city which constitutes the great mart for the commerce of all the interior of Africa. To maintain this commerce is the laborious work of the *akkabaars*, or caravans, which cross this enormous desert from almost every part of the African coast. The mode in which it is traversed is highly curious.

The caravans consist of several hundred loaded camels, accompanied by the Arabs who let them out to the merchants for the transport of their goods. During their route, they are often exposed to the attacks of the roving Arabs of Sahara, who generally commit their depredations on the approach to the confines of the desert. In this tiresome journey, the caravans do not proceed to the place of their destination, in a direct line across the trackless desert, but turn occasionally eastward or westward, according to the situation of certain fertile, inhabited, and cultivated spots, called *oases*, interspersed in various parts of the Sahara, like islands in the ocean. These serve as watering places to the men, as well as to feed, refresh, and replenish, the hardy and patient camel. At each of these cultivated spots, the caravan sojourns about seven days, and then proceeds on its journey, until it reaches another spot of the same description. In the intermediate journeys, the hot winds, denominated *shume*, or *simoom*, are often so violent, as considerably, if not entirely, to exhale the water carried in skins by the camels, for the use of the passengers and drivers. On these occasions, it is affirmed by the Arabs, that five hundred dollars have been frequently given for a draught of water, and that ten or twenty dollars are commonly paid, when a partial exhalation has occurred. These scorching winds will be particularly described, in treating of atmospherical phenomena.

In 1805, a caravan proceeding from Tombuctoo to Taflet,

was disappointed in not finding water at one of the usual watering places, when, horrible to relate, the whole of the persons belonging to it, two thousand in number, besides one thousand eight hundred camels, perished of thirst! Accidents of this nature, account for the vast quantities of human and other bones, which are found heaped together in various parts of the desert.

The following is the general route of the caravans, in crossing the desert. Having left the city of Fez, the capital of Morocco, they proceed at the rate of three miles and a half an hour, and travel seven hours each day. In the space of eighteen days, they reach Akka, where they remain a month, as this is the place of rendezvous at which they are formed into one grand accumulated caravan. In proceeding from Akka to Tagassa, sixteen days are employed; and here again, the caravan sojourns fifteen days to refresh the camels. It then directs its course to the *oasis* and well of Taudeny, which is reached in seven days; and, after another stay of fifteen days, proceed to Arawan, a watering place, situated at a like distance. After having sojourned there fifteen days, it sets out, and reaches Tombuctoo on the sixth day, after having performed a journey of fifty-four days of actual travelling, and seventy-five of repose, making, altogether, from Fez to Tombuctoo, one hundred and twenty-nine days, or four-lunar months and nine days.

Another caravan sets out from Wedinoon and Sok Assa, traversing the desert between the black mountains of Cape Bojador and Gualata: it touches at Tagassa and El Garbie, or West Tagassa, where having staid to collect salt, it proceeds to Tombuctoo. The time occupied by this caravan is five or six months, as it proceeds as far as Gibbel-bied, or the white mountains, near Cape Blanco, through the deserts of Mograffa and Woled Abusebah, to a place named Agadeen, where it sojourns twenty days.

The caravans which cross the desert, may be compared to fleets of merchant vessels under convoy, the *stata*, or convoy of the desert, consisting of a certain number of Arabs, belonging to the tribe through whose territory the caravan passes. Thus in crossing the territory of Woled Abusebah, it is accompanied by Sebayhees, or people of that country, who on reaching the confines of the territory of Woled Deleim, deliver their charge to the protection of the chiefs of that country. These again conduct it to the confines of the territory of the Mograffa Arabs, under whose care it at length reaches Tombuctoo. Any assault on the caravan during this journey, is considered as an insult to the whole tribe to which the convoy belongs, and for such an outrage they never fail to take ample revenge.

Besides these grand caravans, others cross the desert on an emergency, without a convoy, or guard. This is, however, a perilous expedition—as they are too often plundered near the northern confines of the desert, by two notorious tribes, named *Dikna* and *Emjot*. In the year 1798, a caravan consisting of two thousand camels, laden with the produce of the *Souham* territory, together with seven hundred slaves, was plundered and dispersed, with great slaughter. These desperate attacks are conducted in the following manner. The tribe being assembled, the horses are picketed at the entrance of the tents, and scouts sent out, to give notice when a caravan is likely to pass. These scouts being mounted on the *heirie*, or fleet horses of the desert, quickly communicate the intelligence, and the whole tribe mount their horses, taking with them a sufficient number of female camels, on whose milk they entirely subsist. Having placed themselves in ambush near an oasis, or watering place, they issue thence on the arrival of the caravan, which they plunder without mercy, leaving the unfortunate merchants entirely destitute.

The food, dress, and accommodations of the people who compose the caravans, are simple and natural. Being prohibited by their religion the use of wine and intoxicating liquors, and exhorted by its principles to temperance in all things, they are commonly satisfied with a few nourishing dates, and a draught of water, travelling for weeks successively without any other food. At other times, when they undertake a journey of a few weeks across the desert, a little barley meal, mixed with water, constitutes their only nourishment. In following up this abstemious mode of life, they never complain, but solace themselves with the hope of reaching their native country, singing occasionally during the journey, whenever they approach a habitation, or when the camels are fatigued. Their songs are usually sung *in trio*; and those of the camel-drivers who have musical voices, join in the chorus. These songs have a surprising effect in renovating the camels; while the symphony and time maintained by the singers, surpass what any one would conceive who has not heard them.—The day's journey is terminated early in the afternoon, when the tents are pitched, prayers said, and the supper prepared by sunset. The guests now arrange themselves in a circle, and the sober meal being terminated, converse till they are overcome by sleep. At day-break next morning, they again proceed on their journey.

## PILGRIMAGE ACROSS THE DESERTS.

*The following very lively description of a pilgrimage across the desert is given by Ali Bey, in his travels in Morocco, Tri-*

poli, &c. It is an animated picture, which portrays in the strongest colours the perils and sufferings encountered in these enterprises.

"We continued marching on in great haste, for fear of being overtaken by the four hundred Arabs whom we wished to avoid. For this reason we never kept the common road, but passed through the middle of the desert, marching through stony places, over easy hills. This country is entirely without water; not a tree is to be seen in it, not a rock which can afford a shelter or shade. A transparent atmosphere, an intense sun, darting its beams upon our heads, a ground almost white, and commonly of a concave form, like a burning glass; slight breezes, scorching like a flame. Such is a faithful picture of this district, through which we were passing.

"Every man we meet in this desert, is looked upon as an enemy. Having discovered, about noon, a man in arms, on horseback, who kept at a certain distance, my thirteen beduins united, the moment they perceived him, darted like an arrow to overtake him, uttering loud cries, which they interrupted by expressions of contempt and derision; as, '*What are you seeking, my brother?*' '*Where are you going, my son?*' As they made these exclamations, they kept playing with their guns over their heads. The discovered beduin profited of his advantage, and fled into the mountains, where it was impossible to follow him.—We met no one else.

"We had now neither eaten nor drank since the preceding day; our horses and other beasts were equally destitute; though ever since nine in the evening we had been travelling rapidly. Shortly after noon, we had not a drop of water remaining, and the men, as well as the poor animals, were worn out with fatigue. The mules, stumbling every moment, required assistance to lift them up again, and to support their burden till they rose. This terrible exertion exhausted the little strength we had left.

"At two o'clock in the afternoon, a man dropped down stiff, and as if dead, from great fatigue and thirst. I stop with three or four of my people to assist him. The little wet which was left in one of the leathern budgets, was squeezed out of it, and some drops of water poured into the poor man's mouth, but without any effect. I now felt that my own strength was beginning to forsake me; and becoming very weak, I determined to mount on horseback, leaving the poor fellow behind. From this moment, others of my caravan began to drop successively, and there was no possibility of giving them any assistance; they were abandoned to their unhappy destiny, as every one thought only of saving himself. Several mules with

their burdens were left behind, and I found on my way two of my trunks on the ground, without knowing what was become of the mules which had been carrying them, the drivers having forsaken them, as well as the care of my effects and of my instruments.

“ I looked upon this loss with the greatest indifference, as if they had not belonged to me, and pushed on. But my horse began now to tremble under me, and yet he was the strongest of the whole caravan. We proceeded in silent despair. When I endeavoured to encourage any of the party, to increase his pace, he answered me by looking steadily at me, and by putting his fore-finger to his mouth, to indicate the great thirst by which he was affected. As I was reproaching our conducting officers for their inattention, which had occasioned this want of water, they excused themselves by alleging the mutiny of the oudaias; and besides, added they, ‘ Do we not suffer like the rest?’ Our fate was the more shocking, as every one of us was sensible of the impossibility of supporting the fatigue to the place, where we were to meet with water again. At last, at about four in the evening, I had my turn, and fell down with thirst and fatigue.

“ Extended without consciousness on the ground, in the middle of the desert, left only with four or five men, one of whom had dropped at the same moment with myself, and all without any means of assisting me, because they knew not where to find water, and, if they had known it, had not strength to fetch it, I should have perished with them on the spot, if Providence, by a kind of miracle, had not preserved us.

“ Half an hour had already elapsed since I had fallen senseless to the ground, (as I have since been told,) when, at some distance, a considerable caravan, of more than two thousand souls, were seen advancing. It was under the direction of a marebout or saint called Sidi Alarbi, who was sent by the Sultan to Ttensen or Tremecen. Seeing us in this distressed situation, he ordered some skins of water to be thrown over us. After I had received several of them over my face and hands, I recovered my senses, opened my eyes, and looked around me, without being able to discern any body. At last, however, I distinguished seven or eight sheriffs and fakeers, who gave me their assistance, and showed me much kindness. I endeavoured to speak to them, but an invincible knot in my throat seemed to hinder me; I could only make myself understood by signs, and by pointing to my mouth with my finger.

“ They continued pouring water over my face, arms, and hands, and at last, I was able to swallow small mouthfuls. This



enabled me to ask, '*Who are you?*' When they heard me speak, they expressed their joy, and answered me, '*Fear nothing; far from being robbers, we are your friends,*' and every one mentioned his name. I began by degrees to recollect their faces, but was not able to remember their names. They poured again over me a still greater quantity of water, gave me some to drink, filled some of my leather bags, and left me in haste, as every minute spent in this place was precious to them, and could not be repaired.

"This attack of thirst is perceived all of a sudden by an extreme aridity of the skin; the eyes appear to be bloody, the tongue and mouth both inside and outside are covered with a crust of the thickness of a crown piece; this crust is of a dark yellow colour, of an insipid taste, and of a consistence like the soft wax from a beehive. A faintness or languor takes away the power to move; a kind of knot in the throat and diaphragm, attended with great pain, interrupts respiration. Some wandering tears escape from the eyes, and at last, the sufferer drops down to the earth, and in a few moments loses all consciousness. These are the symptoms which I remarked in my unfortunate fellow-travellers, and which I experienced myself.

"I got with difficulty on my horse again, and we proceeded on our journey. My Beduins and my faithful Salem were gone in different directions, to find out some water, and two hours afterwards, they returned one after another, carrying along with them some good or bad water, as they had been able to find it; every one presented to me part of what he had brought; I was obliged to taste it, and I drank twenty times, but as soon as I swallowed it, my mouth became as dry as before; at last I was not able either to spit or to speak.

"The greatest part of the soil of the desert consists of pure clay, except some small traces of a calcareous nature. The whole surface is covered with a bed of chalky calcareous stone of a whitish colour, smooth, round, and loose, and of the size of the fist; they are almost all of the same dimension, and their surface is carious like pieces of old mortar; I look upon this to be a true volcanic production. This bed is extended with such perfect regularity, that the whole desert is covered with it; a circumstance which makes pacing over it very fatiguing to the traveller.

"Not any animal is to be seen in this desert, neither quadrupeds, birds, reptiles, nor insects, nor any plant whatever; and the traveller who is obliged to pass through it, is surrounded by the silence of death. It was not till four in the evening that we began to distinguish some small plants burnt with the sun, and a tree of a thorny nature, without blossom or fruit."

## SANDS OF THE DESERT.

In the pathless desert, high mounds of sand, shifting with every change of wind, surround the traveller on every side, and conceal from his view all other objects. There the wind is of a surprising rapidity, and the sand so extremely fine, that it forms on the ground waves, which resemble those of the sea. These waves rise up so fast, that in a very few hours a hill of from twenty to thirty feet high is transported from one place to another. The shifting of these hills, however, does not take place on a sudden, as is generally believed, and is not, by any means, capable of surprising and burying a caravan while on the march. The mode in which the transposition of the hills takes place, is not difficult of explanation. The wind sweeping the sand from the surface continually, and that with an astonishing rapidity, the ground lowers every moment: but the quantity of sand in the air increasing as quickly by successive waves, cannot support itself there, but falls in heaps, and forms a new hill, leaving the place it before occupied level, and with the appearance of having been swept.

It is necessary to guard the eyes and mouth against the quantity of sand which is always flying about in the air; and the traveller has to seek the right direction, to avoid being lost in the windings made in the middle of the hills of sand, which bound the sight, and which shift from one spot to another so often, as not to leave any thing to be seen besides the sky and sand, without any mark by which the position can be known. Even the deepest footstep in the sand of either man or horse, disappears the moment the foot is raised.

The immensity, the swiftness, and the everlasting motion of these waves, disturb the sight both of men and beasts, so that they are almost continually marching as if in the dark. The camel gives here a proof of his great superiority; his long neck, perpendicularly erected, removes his head from the ground, and from the thick part of the waves; his eyes are well defended by thick eye-lids, largely provided with hair, and which he keeps half shut; the construction of his feet, broad and cushion-like, prevents his treading deep into the sand; his long legs enable him to pass the same space with only half the number of steps of any other animal, and, therefore, with less fatigue. These advantages give him a solid and easy gait, on a ground where all other animals walk with slow, short, and uncertain steps, and in a tottering manner. Hence the camel, intended by nature for these journeys, affords a new motive of praise to the Creator, who, in his wisdom, has given the camel to the African, as he has bestowed the rein-deer on the Laplander.

Lieutenant Pottinger, in his travels in Beloochistan, a province of India, gives the following interesting account of those curious phenomena. He had to pass over a desert of red sand, the particles of which were so light, that when taken in the hand they were scarcely more than palpable, the whole being thrown by the winds into an irregular mass of waves, principally running east and west, and varying in height from ten to twenty feet. The greater part of them rose perpendicularly on the opposite side to that, from which the prevailing north west wind blew, and might readily have been fancied, at a distance, to resemble a new brick wall. The side facing the wind, sloped off with a gradual declivity towards the base of the next windward wave, again ascending in a straight line, in the same extraordinary manner as above described, so as to form a hollow or path between them. Our traveller kept as much in these paths as the direction he had to take would allow; but it was not without great difficulty and fatigue that the camels were urged over the waves, when it was requisite to do so, and more particularly when they had to clamber up the leeward or perpendicular face of them, in attempting which, they were often defeated. On the oblique, or shelving side, they ascended pretty well, their broad feet saving them from sinking deeper than did the travellers themselves; and the instant they found the top of the wave giving way from their weight, they most expertly dropped on their knees, and in that posture gently slid down with the sand, which was luckily so unconnected, that the leading camel usually caused a sufficient breach for the others to follow on foot. The night was spent under shelter of one of these sand waves, the surrounding atmosphere being uncommonly hot and close.

On the following day, in crossing a desert of the same description, the like impediments occurred; but these were trifling compared with the distress suffered, not only by our traveller and his people, but also by the camels, from the floating particles of sand—a phenomenon for which he confesses himself at a loss to account. When he first observed it, in the morning, the desert appeared to have, at the distance of half a mile or less, an elevated and flat surface from six to twelve inches higher than the summits of the sand waves. This vapour appeared to recede as he advanced, and once or twice completely encircled his party, limiting the horizon to a very confined space, and conveying a most gloomy and unnatural sensation to the mind of the beholders, who were at the same *moment* imperceptibly covered with innumerable atoms of *small sand*, which getting into the eyes, mouth, and nostrils, *caused excessive irritation, attended by an extreme thirst,*

which was increased in no small degree by the intense heat of the sun. This annoyance is supposed by the natives to originate in the solar beams causing the dust of the desert, as they emphatically call it, to rise and float through the air—a notion which appears to be in a great measure correct, this sandy ocean being only visible during the hottest part of the day. The following simple theory of these moving sands is submitted by the author. When the violent whirlwinds which prevail in the desert, terminate in gusts of wind, they usually expand over several square miles of surface, raging with irresistible force, and bearing upwards an immense body of sand, which descends as the current of air that gave it action dies away, thus creating the extraordinary appearance in question. If it should be asked what prevents the sand from subsiding altogether, when it has so far accomplished this as to rest apparently on the waves, the answer is, that all the grosser particles do settle, but that the more minute ones become rarified to such a degree by the heat produced by the burning sand on the red soil, that they remain, as it were, in an undecided and undulating state, until the returning temperature restores their specific gravity, when by an undeviating law of nature, they sink to the earth. This, in some measure, coincides with the opinion of the native Brahoes; but, conformably to their notion, it is evident, that the floating sands would be apparent at all periods of excessive solar influence, which not being the case, it becomes necessary to find a primary cause for the phenomenon. To remove any suspicion of his having been deceived in the reality of this floating vapour of sand, he adds, that he has seen this phenomenon, and the Shurab, or watery illusion so frequent in deserts, called by the French *mirage*, in opposite quarters at the same moment, each of them being to his sight perfectly distinct. While the former had a cloudy and dim aspect, the latter was luminous, and could not be mistaken for water. To corroborate what he has here advanced, he states, that he was afterwards joined by a fokeer from Kaboul, who informed him that he had witnessed the moving sands, in passing through the desert from Seistan, to a much greater degree than has been described; and, what is scarcely credible, he spoke of having been forced to sit down in consequence of the density of the cloud in which he was enveloped.

Our traveller next proceeds to a curious description of the pillars or columns of sand formed in the deserts. He experienced a violent tornado, or gust of wind, which came on so suddenly, that, if he had not been apprized of its strength by the guide, it might have been disastrous to his party, in whom *it would have been an act of temerity to have endeavoured to*

sit on the camels during its impetuous fury. Before it began, the sky was clear, save a few small clouds in the northwest quarter; and the only warnings it afforded, were the oppressive sultriness of the air, and a vast number of whirlwinds springing up on all sides. These whirlwinds, he observes, might perhaps be more correctly expressed by some other name; but as the wind issued from them he adopts the term. They are vast columns of sand, which begin by a trifling agitation, with a revolving motion on the surface of the desert, and gradually ascend and expand, until their tops are lost to the view. In this manner they move about with every breath of wind, and are observed, thirty or forty of them at the same time, of different dimensions, apparently from one to twenty yards in diameter. Those who have seen a water spout at sea, may exactly conceive the same formed of sand on shore. The moment the guide saw the whirlwinds disperse, which they did as if by magic, and a cloud of dust approaching, he advised the party to dismount, which they had hardly time to do, and lodge themselves snugly behind the camels, when a storm burst upon them with a furious blast of wind, the rain falling in huge drops, and the air being so completely darkened, that they were unable to discern any object at the distance of even five yards.

## DIAMOND MINES.

The high value attached to diamonds does not depend so much on their beauty and hardness, as on their great scarcity, and the labour and expense necessary in procuring them. Hitherto they have been observed in the torrid zone alone; and Brazil is the only part of the Americas in which they have been found. The historical account of their discovery in that country is as follows. Near the capital of the territory of Serro do Frio flows the river Milho Verde, where it was the custom to dig for gold, or rather to extract it from the alluvial soil. The miners, during their search for gold, found several diamonds, which they were induced to lay aside in consequence of their particular shape and great beauty, although they were ignorant of their intrinsic value.

The diamond works on the river Jigitonhonha are described by Mr. Mawe as the most important in the Brazilian territory. The river, in depth from three to nine feet, is intersected by a canal, beneath the head of which, it is stopped by an embankment of several thousand bogs of sand, its deeper parts being laid dry by chain-pumps. The mud is now washed away, and the *cascalhao*, or earth which contains the diamonds, dug up, and removed to a convenient place for washing. The

process is as follows. A shed, consisting of upright posts, which support a thatched roof, is erected in the form of a parallelogram, in length about ninety feet, and in width forty-five. Down the middle of its area, a current of water is conveyed through a canal covered with strong planks, on which the earth is laid to the thickness of two or three feet. On the other side of the area, is a flooring of planks, from twelve to fifteen feet in length, imbedded in clay, extending the whole length of the shed, and having a gentle slope from the canal. This flooring is divided into about twenty compartments, or troughs, each about three feet wide, by means of planks placed on their edges; and the upper end of these troughs communicate with the canal, being so formed, that water is admitted into them between two planks about an inch separate from each other. Through this opening, the current falls about six inches into the trough, and may be directed to any part of it, or stopped at pleasure, by means of a small quantity of clay. Along the lower ends of the troughs, a small channel is dug, to carry off the water.

On the heap of earth, at equal distances, three high chairs are placed for the overseers, who are no sooner seated, than the negroes enter the troughs, each provided with a rake of a peculiar form, and having a short handle, with which he rakes into the trough from fifty to eighty pounds weight of the earth. The water being then allowed to pass in by degrees, the earth is spread abroad, and continually raked up to the head of the trough, so as to be kept in constant motion. This operation is continued for a quarter of an hour, when the water begins to run clearer: and, the earthy particles having been washed away, the gravel-like matter is raked up to the end of the trough. At length, the current flowing quite clear, the largest stones are thrown out, and afterwards those of an inferior size: the whole is then examined with great care for diamonds. When a negro finds one, he immediately stands upright, and claps his hands: he then extends them, holding the gem between the fore finger and the thumb. An overseer receives it from him, and deposits it in a bowl, suspended from the centre of the structure, and half filled with water. In this vessel, all the diamonds found in the course of the day are deposited, and at the close of the work, are taken out and delivered to the principal overseer, who, after they have been weighed, registers the particulars in a book kept for that purpose.

When a negro is so fortunate as to find a diamond of the weight of seventeen carats and a half, the following ceremony takes place: he is crowned with a wreath of flowers, and

carried in procession to the administrator, who gives him his freedom by paying his owner for it. He also receives a present of new clothes, and is permitted to work on his own account. For small stones, proportionate premiums are given; while many precautions are taken to prevent the negroes from stealing the diamonds, with which view they are frequently changed by the overseers, lest these precious gems should be concealed in the corners of the troughs. When a negro is suspected of swallowing a diamond, he is confined in a solitary apartment, and means taken to bring the gem to light.

In the EAST-INDIES, THE KINGDOM OF GOLCONDA, extending two hundred and sixty miles along the bay of Bengal, and having a breadth of two hundred miles from east to west, abounds in DIAMOND MINES. They are chiefly in the vicinity of the rocky hills and mountains which intersect the country, and in the whole of which, diamonds are supposed to be contained. In several of the mines, they are found scattered in the earth, within two or three fathoms of the surface, and in others, are met with in a mineral substance in the body of the rocks, forty or fifty fathoms deep. The labourers having dug five or six feet into the rock, soften the stone by fire, and proceed till they find the vein, which often runs two or three furlongs under the rock. The earth being brought out, and carefully searched, affords stones of various shapes, and of a good water. This earth is of a yellowish, and sometimes of a reddish colour, frequently adhering to the diamond with so strong a crust, that the separation becomes difficult.

To find the diamonds, the workmen form a cistern of a kind of clay, with a small vent on one side, a little above the bottom; in this vent, they place a plug, and throwing into the cistern the earth they have dug, pour in water to dissolve it. They then break the clods, and stir the wet earth in the cistern, allowing the lighter part to be carried off in the form of mud, when the vent hole is opened to let out the water. They thus continue washing until what remains in the cistern is pretty clean; and then, in the middle of the day, when the sun shines bright, carefully look over all the sand, at which practice they are so expert, that the smallest stone cannot escape them. The brightness of the sun being reflected by the diamonds, aids them in their research, which would be foiled if a cloud were to intervene.

The specific gravity of the diamond is to that of water, in the proportion of somewhat more than three and a half to one. It is the hardest of all precious stones, and can only be cut and ground by itself and its own substance. To bring it to the perfection by which its price is so greatly augmented, the best

dary begins by rubbing several of these stones against each other, while rough, having first glued them to the ends of two wooden blocks, thick enough to be held in the hand. The powder thus rubbed off the stones, and received in a small box for the purpose, serves to grind and polish them.

The greatest known diamond was found in Brazil, and belongs to the King of Portugal. It weighs 1680 carats; and, although uncut, is estimated by Rome de l'Isle at the enormous sum of two hundred and twenty-four millions sterling, which gives an estimate of nearly eighty pounds sterling for each carat, the multiplicand of the square of its whole weight being taken. The one next in magnitude and value is that purchased in 1772 by the late Empress of Russia: it weighs seven hundred and seventy-nine carats, and has been estimated at nearly five millions sterling. It ought, however, to be observed, that these estimates, founded on the magnitude and brilliancy of the gems, are very different from the prices which the most princely fortunes can afford to pay for them. The diamond in question, cost about one hundred and thirty-five thousand pounds sterling; and the one called the *PITT OF REGENT*, although it weighed one hundred and thirty-six carats only, was, on account of its greater brilliancy, purchased of a Greek merchant for one hundred thousand pounds sterling. Several other large diamonds are preserved in the cabinets of the Sovereigns and Princes of Europe.

The reader will not fail to be gratified by some curious particulars relative to these and the other precious gems, drawn from the valuable treatise of Mr. Mawe, on this interesting subject.

In the history of the human race, there are few things which at first sight appear so remarkable, as the prodigious value which, by common consent, in all ages, and in all civilized countries, has been attached to the diamond. That a house with a large estate, the means of living, not only at ease but in splendour, should be set in competition with, and even be deemed inadequate to the purchase of a transparent crystalized stone, not half the size of a hen's egg, seems almost a kind of insanity. It would, indeed, truly deserve this name, if the purchaser were to part with what the seller would acquire by such a transfer. If, for the consciousness of possessing a diamond of nearly three-quarters of an ounce weight, a country gentleman were to pay ninety thousand pounds in ready money, and an annuity of four thousand pounds besides, he would very deservedly incur some risk of a statute of lunacy; yet, not only the above sum was given, but a patent of nobility into the bargain, by the Empress Catharine of Russia, for the fa-



mous diamond of Nadir Shah. In this case, however, although the seller acquired much, the purchaser did not undergo any personal privation; and, in reality, notwithstanding the costliness and high estimation of diamonds, they are not put in competition with the substantial comforts and conveniences of life. Among ornaments and luxuries, they, however, unquestionably occupy, and have ever occupied, the highest rank. Even fashion, proverbially capricious as she is, has remained steady in this, one of her earliest attachments, during, probably, three or four thousand years. There must be, therefore, in the nature of things, some adequate reason for this universal consent, which becomes a curious object of inquiry.

The utility of the diamond, great as it is in some respects, enters for little or nothing into the calculation of its price; at least all that portion of its value which constitutes the difference between the cost of an entire diamond and an equal weight of diamond powder, must be attributed to other causes.

The beauty of this gem, depending on its unrivalled lustre, is, no doubt, the circumstance which originally brought it into notice, and still continues to uphold it in the public estimation; and certainly, notwithstanding the smallness of its bulk, there is not any substance, natural or artificial, which can sustain any comparison with it in this respect. The vivid and various refractions of the opal, the refreshing tints of the emerald, the singular and beautiful light which streams from the six-rayed star of the girasol, the various colours, combined with high lustre, which distinguish the ruby, the sapphire, and the topaz, beautiful as they are on a near inspection, are almost entirely lost to a distant beholder; whereas, the diamond, without any essential colour of its own, imbibes the pure solar ray, and then reflects it, either with undiminished intensity, too white and too vivid to be sustained for more than an instant by the most insensible eye, or decomposed by refraction into those prismatic colours which paint the rainbow, and the morning and evening clouds, combined with a brilliancy which yields, and hardly yields, to that of the meridian sun. Other gems, inserted into rings and bracelets, are best seen by the wearer; and, if they attract the notice of the bystanders, divide their attention, and withdraw those regards which ought to be concentrated on the person, to the merely accessory ornaments. The diamond, on the contrary, whether blazing on the crown of state, or diffusing its starry radiance from the breast of titled merit, or "in courts of feasts and high solemnities," wreathing itself with the hair, illustrating the shape and colour of the neck, and entering ambitiously into contest with the lire!

lustre of those eyes that "rain influence" on all beholders, blends harmoniously with the general effect, and proclaims to the most distant ring of the surrounding crowd, the person of the monarch, of the knight, or of the beauty.

Another circumstance tending to enhance the value of the diamond is, that although small stones are sufficiently abundant to be within the reach of moderate expenditure, and therefore afford, to all those who are in easy circumstances, an opportunity to acquire a taste for diamonds, yet those of a larger size are, and ever have been, rather rare; and of those which are celebrated for their size and beauty, the whole number, at least in Europe, scarcely amounts to half a dozen, all of them being in the possession of sovereign princes. Hence the acquisition even of a moderately large diamond, is what mere money cannot always command; and many are the favours, both political and of other kinds, for which a diamond of a large size, or of uncommon beauty, may be offered as a compensation, where its commercial price, in money, neither can be tendered, nor would be received. In many circumstances also, it is a matter of no small importance for a person to have a considerable part of his property in the most portable form possible; and in this respect, what is there that can be compared to diamonds, which possess the portability, without the risk of bills of exchange? It may further be remarked, in favour of this species of property, that it is but little liable to fluctuation, and has gone on pretty regularly increasing in value, insomuch that the price of stones of good quality is considerably higher than it was some years ago.

**THE ART OF CUTTING AND POLISHING DIAMONDS** has a twofold object; first, to divide the natural surface of the stone in a symmetrical manner, by means of highly polished polygonal planes, and thus to bring out, to the best advantage, the wonderful refulgence of this beautiful gem; and, secondly, by cutting out such flaws as may happen to be near the surface, to remove those blemishes which materially detract from its beauty, and consequently from its value.

The removal of flaws is a matter of great importance, for, owing to the form in which the diamond is cut, and its high degree of refrangibility, the smallest fault is magnified, and becomes obtrusively visible in every face. For this reason also, it is by no means an easy matter, at all times, to ascertain whether a flaw is, or is not, superficial; and a person with a correct and well practised eye, may often purchase to great advantage, stones which appear to be flawed quite through, but are, *in fact, only superficially blemished.*

*The most esteemed, and, at the same time, nearest to the co-*

lour of the **ORIENTAL RUBY**, is pure carmine, or blood red, of considerable intensity, forming, when well polished, a blaze of the most exquisite and unrivalled tint. It is, however, more or less pale, and mixed with blue in various proportions: hence it occurs, rose-red and reddish-white, crimson, peach blossom-red, and lilac-blue, the latter variety being named **ORIENTAL AMETHYST**. It is a native of Pegu, and is said to be found in the sand of certain streams near the town of Sirian, the capital of that country: it also occurs, with sapphire, in the sands of the rivers of Ceylon. A ruby, perfect both in colour and transparency, is much less common than a good diamond, and when of the weight of three or four carats, is even more valuable than that gem. The king of Pegu, and the monarchs of Ava and Siam, monopolize the finest rubies, in the same way as the sovereigns of India make a monopoly of diamonds. The finest ruby in the world is in possession of the first of these kings; its purity has passed into a proverb, and its worth, when compared with gold, is inestimable. The Subah of the Decan, also, is in possession of a prodigiously fine one, a full inch in diameter. The princes of Europe cannot boast of any of a first rate magnitude.

The **ORIENTAL SAPPHIRE** ranks next in value to the ruby: when perfect, its colour is a clear and bright Prussian blue, united to a high degree of transparency. The **ASTERIAS**, or **STAR-STONE**, is a remarkable variety of this beautiful gem: it is semi-transparent, with a reddish purple tinge.

#### GOLD AND SILVER MINES.

The mines of **LA PLATA**, so denominated on account of the abundance of silver they contain, are chiefly situated in the provinces which were strictly considered as Peruvian, before the new partition of territory in 1778; Charcas, Tucuman, and even Buenos Ayres, being then considered as dependencies of Peru. With the exception of New Spain, the upper part of the viceroyalty of La Plata is the richest country in silver which has yet been discovered, and contains innumerable mines both of that metal and of gold. All its northern provinces teem with mineral opulence; and those of Laricaja and Carabaya are distinguished by the production of the latter, and still nobler metal, in its virgin state.

The mountain of Potosi alone produces weekly about five thousand marks of silver, that is, from thirty to forty thousand dollars—a surprising produce, when it is considered that it has *been wrought* since 1545, at which time it was *accidentally discovered* by an Indian. At the commencement, it was *still more abundant*, and the metal was dug up in a purer state;

is still considered as the most sure and permanent mine. Silver is often found in shoots imbedded in the earth. Six hundred Indians are sent every eighteen months, from the provinces of the viceroyalty, to work this mine. The expeditions called *mita*; and these Indians, having been enrolled and divided into parties, are distributed by the governor of Potosi, to receive a small daily stipend, (equal to about eighteen English,) until the period of their labour is completed. They are thus condemned to a forced service, which is nothing more than slavery, so long as it lasts, and which the Spaniards endeavour to justify by the plea that labourers could not otherwise be procured. The *mita* having thus, according to them, rendered indispensable, they observe that it is conducted with all possible humanity; which those may believe, who have never heard of the cruelties they have exercised, it may be said habitually, on the wretched Indians, since the con-

centrifuges of pure gold and silver, called *papas*, from their resemblance to the potatoe, are often found in the sands. The Indians likewise occupy themselves in *lavederos*, or in washing the sands of the rivers and rivulets, in order to find particles of precious metals.

They compensate for the mines which are rendered useless by the eruption of water, or other accidents, rich and new ones are daily discovered. They are all found in the chains of mountains, commonly in dry and barren spots, and sometimes on the sides of the *quebreñas*, or astonishing precipitous breaks and ridges. However certain this rule may be in the vicereignty of Buenos Ayres, it is contradicted in that of Lima, where, at three leagues distance from the Pacific Ocean, not far from Tagna, in the province of Africa, there was discovered many years ago, the famous mine of Huantajaya, in a plain at a distance from the mountains, of such exuberant wealth, that the pure metal was cut out with a chisel. In this mine a large specimen of virgin silver is preserved in the royal cabinet of natural history at Madrid. It attracted a considerable population, although neither water nor the conveniences for labour could be found on the spot, nor were there any pasturage for the cattle.

The mint of Potosi, about six millions of dollars are coined; and the mines of the viceroyalty of La Plata, collectively, are reckoned to yield about sixteen millions.

The new viceroyalty of Buenos Ayres contains thirty-nine, twenty-seven silver mines, and sixteen of other

*mines of MEXICO, OF NEW SPAIN, HAVE BEEN MORE CE-*

lebrated for their riches than those of La Plata, notwithstanding which, they are remarkable for the poverty of the mineral they contain. A quintal, or one thousand six hundred ounces of silver ore, affords, at a medium, not more than three or four ounces of pure silver, about one third of what is yielded by the same quantity of mineral in Saxony. It is not, therefore, owing to the richness of the ore, but to its abundance, and the facility of working it, that the mines of New Spain are so much superior to those of Europe.

The fact of the small number of persons employed in working them, is not less contrary to the commonly received opinion on this subject. The mines of Guanaxato, infinitely richer than those of Potosi ever were, afforded from 1796 to 1803, nearly forty millions of dollars in gold and silver, or very nearly five millions of dollars annually, being somewhat less than one fourth of the whole quantity of gold and silver from New Spain; notwithstanding which, these mines, productive as they were, did not employ more than five thousand workmen of every description. In Mexico, the labour of the mines is perfectly free, and better paid than any other kind of industry, a miner earning from five to five dollars and a half weekly, while the wages of the common labourer do not exceed a dollar and a half. The *tenateros*, or persons who carry the ore on their backs, from the spot where it is dug out of the mine, to that where it is collected in heaps, receive a sum equal to five English shillings for a day's work of six hours. Neither slaves, criminals, nor forced labourers, are employed in the Mexican Mines.

In consequence of the clumsy, imperfect, and expensive mode of clearing them from water, several of the richest of these mines have been overflowed and abandoned; while the want of method in the arrangement of the galleries, and the absence of lateral communications, add to the uncertainty, and greatly increase the expense of working them. Labour is not, as in the working of the European mines, abridged, nor the transport of materials facilitated. When new works are undertaken, a due consideration is not bestowed on the preliminary arrangements; and they are always conducted on too large and expensive a scale.

More than three-fourths of the silver obtained from America is extricated from the ore by the means of quicksilver, the loss of which, in the process of amalgamation, is immense. The quantity consumed annually in New Spain alone, is about sixteen thousand quintals; and, in the whole of America, about twenty-five thousand quintals are annually expended, the cost of which, in the colonies, has been estimated at out-fourth of

a million sterling. The greater part of this quicksilver has been lately furnished by the mine of Almaden in Spain, and that of Istria in Carniola, the celebrated quicksilver mine of Huancavelica, in Peru, having greatly fallen off in its produce, since the sixteenth century, when it was highly flourishing. The prosperity of the silver mines, both in Mexico and Peru, therefore, greatly depends on the supplies of quicksilver from Spain, Germany, and Italy; for such is the abundance of the ore in those kingdoms, that the only limit to the quantity of silver obtained there, is the want of mercury for amalgamation.

In taking a general view of the riches of the other provinces of America, Mr. Humboldt, who has supplied these details, remarks, that in Peru, silver ore exists in as great abundance as in Mexico, the mines of Lauricocha being capable of yielding as great a produce as those of Guanaxato; but that the art of mining, and the methods of separating the silver from its ore, are still more defective than in New Spain. Notwithstanding this imperfect system, the total amount of the precious metals annually furnished by America, is estimated at upwards of nine millions and a half sterling—the gold being in proportion to the silver as one to forty-six. From 1492 to 1803, the quantity of gold and silver extracted from the American mines has been equal in value to 5,706,700,000 dollars; of which immense sum, the portion brought into Europe, including the booty made by the conquerors of America, is estimated at 5,445,000,000, giving an average of seventeen million and a half of dollars yearly. The annual importation being divided into six periods, appears to have been constantly augmenting, and in the following progressive ratio. From 1492 to 1500, it did not exceed 250,000 dollars. From 1500 to 1545, it amounted to three millions of dollars. From 1545 to 1600, to eleven millions. From 1600 to 1700, to sixteen millions. From 1700 to 1750, to twenty-two millions and a half. And, lastly, from 1750 to 1803, to the prodigious sum of thirty-five millions three hundred thousand dollars, nearly equal to eight millions sterling.

The first period was that of exchange with the natives, or of mere rapine. The second was distinguished by the conquest and plunder of Mexico, Peru, and New Granada, and by the opening of the first mines. The third began with the discovery of the rich mines of Potosi; and in the course of it, the conquest of Chili was completed, and various mines opened in New Spain. At the commencement of the fourth period, the mines of Potosi began to be exhausted; but those of Lauricocha were discovered, and the produce of New Spain rose from two millions to five millions of dollars annually. The fifth

period began with the discovery of gold in Brazil; and the sixth is distinguished by the prodigious increase of the mines of New Spain, while those of every other part of America, with the exception of the Brazils, have been constantly improving.

The GOLD MINES of BRAZIL are very productive. Those called GENERAL, are distant about seventy-five leagues from Rio Janeiro, which is the staple and principal outlet of the riches of the Brazilian territory. They yield to the king, annually, for his right of fifths, at least one hundred and twelve arrobas, (weighing twenty-five pounds each,) of gold. Their yearly produce, may, therefore, be estimated at upwards of eight hundred thousand pounds sterling; and that of the more distant mines, at about one third the sum.

The gold drawn from them cannot be carried to Rio Janeiro, without being first brought to the smelting houses established in each district, where the right of the crown is received. What belongs to private persons is remitted in bars, with their weight, number, and an impression of the royal arms. The gold is then assayed, and its standard imprinted on each bar. When these bars are carried to the mint, their value is paid to the possessor in coin, commonly in half doubloons, each worth eight Spanish dollars. Upon each of these half doubloons the king gains a dollar, by the alloy and right of coinage. The mint of Rio Janeiro is one of the most beautiful in existence, and is furnished with every convenience for working with the greatest celerity. As the gold arrives from the mines at the same time that the fleets arrive from Portugal, it is necessary to accelerate the operations of the mint, and the coinage proceeds with surprising quickness.

In AFRICA, the kingdom of MOZAMBIK abounds in gold, which is washed down by the rivers, and forms a chief part of the commerce of the country. The kingdoms of MONOMOTAPA and SOFALA likewise furnish considerable quantities of gold; and the Portuguese who reside in the latter territory, report that it yields annually two millions of *metigals*, equal to somewhat more than a million sterling. The merchants export from Mecca, and other parts, about the same quantity of gold. The soldiers are paid in gold dust, in the state in which it is collected; and this is so pure, and of so fine a yellow, as not to be exceeded, when wrought, by any other gold beside that of Japan. Gold is likewise found on the island of Madagascar. The gold coast is so denominated from the abundance of gold found among the sands: it is not, however, so productive as has been generally supposed, owing to the intense heats, which, in a great measure, prevent the natives from prosecuting their researches.

IN ASIA, the ISLAND OF JAPAN is most productive of gold, which is found in several of its provinces, and is, in by far the greater proportion, melted from its ore. It is likewise procured by washing the sands, and a small quantity is likewise found in the ore of copper. The emperor claims a supreme jurisdiction, not only over the gold mines but over all the mines of the empire, which are not allowed to be worked without a license from him. Two thirds of their produce belong to him, and the other third is left to the governor of the province in which the mines are situated. But the richest gold ore, and that which yields the finest gold, is dug in one of the northern provinces of the island of Nippon, a dependency of Japan, where the gold mines have been highly productive until latterly, though they have much fallen off. In the Japanese province of Tschungo, a rich gold mine, having been filled with water, was no longer worked: as it was, however, so situated, that, by cutting the rock, and making an opening beneath the mine, the water could be easily drawn off, this was attempted. At the moment of commencing the operation, so violent a storm of thunder and lightning arose, that the workmen were obliged to seek shelter elsewhere; and these superstitious people imagining that the tutelary god and protector of the spot, unwilling to have the bowels of the earth thus rifled, had raised the storm to make them sensible of his great displeasure at such an undertaking, desisted from all further attempts, through the fear of incurring his displeasure.

THIBET, a mountainous country of India, contains a great abundance of gold, which is traced in the rivers flowing from that territory into the Ganges. In Hindostan, there are not any mines of gold; but in the Irnada district, gold is collected in the river which passes Nelambur in the Mangery Talui, a Nair having the exclusive privilege of this collection, for which he pays a small annual tribute. Silver is in general, rare throughout the oriental regions, and there is not any indication of this metal in India; but in Japan there are several silver mines, more particularly, in the northern provinces, and the metal extracted from them is very pure and fine.

Turning to EUROPE, DALMATIA is said in ancient times to have produced an abundance of gold. Pliny reports, that in the reign of the emperor Nero, fifty pounds of this precious metal were daily taken from the mines of that province; and that it was found on the surface of the ground. It is added, that Vibius, who was sent by Augustus to subdue the Dalmatians, obliged that hardy and warlike people to work in the mines, and to separate the gold from the ore.

*BOSSINA, in SCLAVONIA, contains many mineral mountains,*



and has rich mines of gold and silver. The district in which the latter are found is named the *Srebrarniza*, being derived from the word *srebr*, which signifies silver in all the Slavonian dialects. Their produce resembles the native silver of Potosi, and is found, combined with pure quartz, in small, thin leaves, resembling moss.

The kingdom of NORWAY formerly produced gold; but the expense of working the mines, and procuring the pure ore, being greater than the profit, these have been neglected. There are, however, silver mines, which are extremely valuable, and give employment to several thousands of persons. The principal of these is at Konigsberg, and was discovered in 1623, when the town was immediately built, and peopled with German miners. In 1751, forty-one shafts, and twelve veins, were wrought in this mine, and gave employment to three thousand five hundred officers, artificers, and labourers.

The silver ore is not, as was at first imagined, confined to the mountain between Konigsberg and the river Jordal, but extends its veins for several miles throughout the adjacent districts, in consequence of which, new mines have been undertaken in several places, and prosperously carried on. One of the richest and most ancient of the mines, named "Old God's blessing," has sometimes, in the space of a week, yielded several hundred pounds weight of rich ore. The astonishing depth of this mine, which is not less than a hundred and eighty fathoms perpendicular, fills the mind of the beholder with amazement; and the circumference at the bottom forms a clear space of several hundreds of fathoms. Here the sight of thirty or forty piles burning on all sides in this gloomy cavern, and continually fed to soften the stone in the prosecution of the labours, seems, according to the notions commonly entertained, an apt image of hell; and the swarms of miners, covered with soot, and bustling about in habits according to their several employments, may well pass for so many infernal spirits; more especially, when, at a given signal, when the mine is to be sprung in this or that direction, they exclaim aloud: "Berg-livet, berg-livet!" Take care of your lives.

The gold mines of CREMNITZ lie forty miles south of the Carpathian hills; and twenty miles farther to the south, are the silver mines of SHEMNITZ. These are called mining towns; and the former is the principal, its rich ores being found in what is styled metallic rock. Its mines also produce a certain proportion of silver. Hungary is besides enriched by a mineral peculiar to itself, or one, at least, which has not hitherto been discovered elsewhere, namely, the opal—a gem preferred to all others by the oriental nations. The opal mines are

situated at Ozerwiniza, where they are found in a hill consisting of decomposed porphyry, a few fathoms beneath the surface. Their produce is of various qualities, from the opaque-white, or semi-opal, to the utmost refulgence of the lively colours by which this noble gem is distinguished.

TRANSYLVANIA and THE BANNET contain numerous and valuable mines, consisting chiefly of grey gold ore, and white gold ore. The finest gold is found at Olapian, not far from Zalathna, intermixed with gravel and sand. The sands of the Rhine, on the shores near Germersheim and Sels, also contain gold.

The mountains of SPAIN were, according to the ancient writers, very rich in gold and silver; and accordingly Gibbon calls that kingdom "the Peru and Mexico of the old world." He adds, that "the discovery of the rich western continent by the Phœnicians, and the oppression of the simple natives, who were compelled to labour in their own mines for the benefit of strangers, form an exact type of the more recent history of Spanish America." The Phœnicians were simply acquainted with the sea-coasts of Spain; but avarice as well as ambition carried the arms of Rome and Carthage into the heart of the country, and almost every part of the soil was found pregnant with gold, silver, and copper. A mine near Carthage is said to have yielded daily twenty-five thousand drachms of silver, or three hundred thousand pounds sterling a year. The provinces of Asturia, Galicia, and Lusitania, yielded twenty thousand pounds weight of gold annually: the modern Spaniards have, however, chosen rather to import the precious metals from America, than to seek them at home.

PORTUGAL is in many parts mountainous, and these mountains contain, beside others, rich ores of silver; but the Portuguese, like the Spaniards, being supplied with metals from their transatlantic possessions, and particularly with an abundance of gold and silver from Brazil, do not work the mines in their own country. Gems of all kinds, as turquoises and hyacinths, are also found in the above mountains, together with a beautifully variegated marble, and many curious fossils.

#### QUICKSILVER MINES.

The quicksilver mines of IDRIA are the most interesting of these, and demand a particular description, as they have been celebrated in natural history, poetry, and romance. The ban of Idria is a district immediately subject to the Chamber of Inner Austria, and lies westward of Carniola. The town, which is small, is seated in a deep valley, amid high mountains, *on the river of the same name*, and at the bottom of so

steep a descent, that its approach is a task of great difficulty, and sometimes of danger.

The mines were discovered in 1497, before which time, that part of the country was inhabited by a few coopers only, and other artificers in wood, with which the territory abounds. One evening, a cooper having placed a new tub under a dropping spring, to try if it would hold water, on returning next morning, found it so heavy that he could scarcely move it. He at first was led by his superstition to suspect that the tub was bewitched; but perceiving at length a shining fluid at the bottom, with the nature of which he was unacquainted, he collected it, and proceeded to an apothecary at Laubach, who, being an artful man, dismissed him with a small recompense, requesting that he would not fail to bring him further supplies.

The subterraneous passages of the great mine are so extensive, that it would require several hours to pass through them. The greatest perpendicular depth, computing from the entrance of the shaft, is 840 feet; but as these passages advance horizontally, under a high mountain, the depth would be much greater, if the measure were taken from the surface. One mode of descending the shaft is by a bucket; but as the entrance is narrow, the bucket is liable to strike against the sides, or to be stopped by some obstacle, so that it may be readily overset. A second mode of descending is safer, by the means of a great number of ladders, placed obliquely, in a kind of a zig-zag: as the ladders, however, are wet and narrow, a person must be very cautious how he steps, to prevent his falling. In the course of the descent, there are several resting places, which are extremely welcome to the wearied traveller. In some of the subterraneous passages the heat is so intense, as to occasion a profuse sweat; and in several of the shafts the air was formerly so confined, that several miners were suffocated by an igneous vapour, or gaseous exhalation, called the fire-damp. This has been prevented by sinking the main shaft deeper. Near to it is a large wheel, and an hydraulic machine, by which the mine is cleared of water.

To these pernicious and deadly caverns criminals are occasionally banished by the Austrian government; and it has sometimes happened, that this punishment has been allotted to persons of considerable rank and family. An incident of this nature, in the person of Count Alberti, laid the foundation of Mr. Sargent's elegant dramatic poem, entitled "THE MINE."

The Count having fought a duel with an Austrian general, against the Emperor's command, and having left him for dead, was obliged to seek refuge in one of the forests of Latria, where

he was apprehended, and afterwards rescued by a band of robbers who had long infested that quarter. With these banditti, he spent nine months, until, by a close investiture of the place in which they were concealed, and after a very obstinate resistance, in which the greater part of them were killed, he was taken and carried to Vienna, to be broken alive on the wheel. This punishment was, by the intercession of his friends, changed into that of perpetual confinement and labour in the mines of Idria—a sentence which, to a noble mind, was worse than death. To these mines he was accompanied by the Countess, his lady, who belonged to one of the first families in Germany, and who, having tried every means to procure her husband's pardon without effect, resolved at length to share his miseries, as she could not relieve them. They were terminated, however, by his pardon being procured by the general with whom he had fought the duel, on the latter being recovered from his wounds; and this nobleman, on his return to Vienna, was again taken into favour, and restored to his fortune and rank.

## IRON MINES.

Native iron, the existence of which was formerly questioned, has been found in several places: it is, however, far from being common, and occurs in several mines. A mass of this description of iron was discovered in the district of Santiago del Estero, in South America, by a party of Indians, in the midst of a wide extended plain. It projected about a foot above the ground, nearly the whole of its upper surface being visible; and the news of its having been found in a country where there are not any mountains, nor even the smallest stone, within the circumference of a hundred leagues, was considered as truly surprising. Although the journey was attended with great danger, on account of the want of water, and abundance of wild beasts in these deserts, several individuals, in the hope of gain, undertook to visit this mass; and, having accomplished their journey, sent a specimen of the metal to Lima and Madrid, where it was found to be very pure soft iron.

As it was reported that this mass was the extremity of an immense vein of the metal, a metallurgist was sent to examine the spot, and by him it was found buried in pure clay and ashes. Externally, it had the appearance of very compact iron, but was internally full of cavities, as if the whole had been formerly in a liquid state. This idea was confirmed by its having, on its surface, the impression of human feet and hands of a large size, as well as that of the feet of a description of large birds, very common in South America. Although these impressions *seemed very perfect*, it was concluded, either that they were

*lusus naturæ*, or that impressions of this kind were previously on the ground, and that the liquid mass of iron, in falling on it, received them. It had the greatest resemblance to a mass of dough; which, having been stamped with impressions of hands and feet, and marked with a finger, had afterwards been converted into iron.

On digging round the mass, the under surface was found covered with a coat of scorise from four to six inches thick, undoubtedly occasioned by the moisture of the earth, the upper surface being clean. No appearance of generation was observed in the earth below or round it for a great distance. About two leagues to the eastward, was a brackish mineral spring, and a very gentle ascent of from four to six feet in height, running from north to south; with this exception, the adjacent territory was a perfect level. About the spring, as well as near the mass, the earth was very light, loose, and greatly resembling ashes, even in colour. The grass in the vicinity, was very short, small, and extremely unpalatable to the cattle; but that at a distance, was long, and extremely grateful to them. From these concurrent circumstances it was concluded, that this mass of native iron, which was estimated to weigh about three hundred quintals, was produced by a volcanic explosion. It is stated as an undoubted fact, that in one of the forests of the above district of Santiago del Estero, there exists a mass of pure native iron, in the shape of a tree with its branches. At a little depth in the earth are found stones of quartz of a beautiful red colour, which the honey-gatherers, the only persons who frequent this rude territory, employ as flints to light their fires. Several of these were selected on account of their peculiar beauty, they being spotted and studded, as it were, with gold: one of them, weighing about an ounce, was ground by the governor of the district, who extracted from it a drachm of gold.

A fibrous kind of native iron has been found at Ebenstock, in Saxony, and also in Siberia, where one particular mass weighed 1600 pounds. It resembled forged iron in its composition, and was malleable when cold, but brittle when red hot. In Senegal, where it is most common, it is of a cubical form, and is employed by the natives in the manufacture of different kinds of vessels.

Iron, although one of the imperfect metals, is susceptible of a very high polish, and more capable than any other metal of having its hardness increased or diminished by certain chemical processes. It is often manufactured in such a way as to be *one hundred and fifty times*, and, as will now be seen, even above *six hundred and thirty times*, more valuable than gold. On weighing several common watch-pendulum

springs, such as are sold, for ordinary work, by the London artists, at half a crown, ten of them were found to weigh but one single grain. Hence, one pound avoirdupois, equal to seven thousand grains, contains ten times that number of these springs, which amount, at half a crown each, to 8750 pounds sterling. Reckoning the troy ounce of gold at four pounds sterling, and the pound, equal to 5760 grains, at 48 pounds sterling, the value of an avoirdupois pound of gold is 58,33, or 58l. 6s. 7d. The above amount of the value of the watch springs weighing an avoirdupois pound, being divided by that sum, will give a ratio of somewhat more than 150 to 1. But the pendulum-springs of the best kind of watches sell at half a guinea each; and at this price, the abovementioned value is increased in the ratio of four and one fifth to one; which gives an amount of 36,750l. sterling. This sum being divided by the value of the avoirdupois pound of gold, gives a quotient of more than 630 to 1.

It is the valuable property of iron, after it is reduced into the state of steel, that, although it is sufficiently soft when hot, or when gradually cooled, to be formed without difficulty into various tools and utensils, still it may be afterwards rendered more or less hard, even to an extreme degree, by simply plunging it, when red hot, into cold water. This is called *tempering*, the hardness produced, being greater in proportion as the steel is hotter, and the water colder. Hence arises the superiority of this metal for making mechanics' instruments or tools, by which all other metals, and even itself, are filed, drilled, and cut. The various degrees of hardness given to iron, depend on the quantity of ignition it possesses at the moment of being tempered, which is manifested by the succession of colour exhibited on the surface of the metal, in the progress of its receiving the increasing heat. These are, the yellowish white, yellow, gold colour, purple, violet, and deep blue;—after the exhibition of which, the complete ignition takes place. These colours proceed from a kind of scorification on the surface of the heated metal.

The largest iron works in England are carried on in COLLEBROOK DALE, in Shropshire. This spot, which is situated between two towering and variegated hills, covered with wood, possesses peculiar advantages, the ore being obtained from the adjacent hills, the coals from the vale, and abundance of limestone from the quarries in the vicinity. The romantic scenery which nature here exhibits, and the works which are carrying on, seem to realize the ancient fable of the Cyclops. "The noise of the forges, mills, &c." Mr. Young observes, "with all their vast machinery, the flames bursting from the

furnaces, with the burning coal, and the smoke of the lime kilns, are altogether horribly sublime." To complete the peculiarities of this spot, a bridge, entirely constructed of iron, is here thrown over the Severn. In one place it has parted, and a chasm is formed; but such is its firm basis, that the fissure has neither injured its strength nor utility.

The great superiority of Swedish iron over that of all other countries, for the manufacture of steel, is well known, and is ascribed to the great purity of the ore from which the iron is smelted. Hitherto the British steel makers have not been able to employ British iron in their processes, it having been found too brittle to bear cementation; but attempts are now making by some very spirited steel makers at Sheffield; and from the products already obtained, great hopes are entertained of ultimate success. One of the most remarkable of the Swedish mines, if the name can with propriety be applied to it, is Tabern, a mountain of a considerable size, composed entirely of pure iron ore, and occurring in a large tract of sand over which it seems to have been deposited. This mountain has been wrought for nearly three centuries, notwithstanding which, its size is scarcely diminished.

But the richest iron mine of Sweden is that of Danmora, in the province of Upland. It is in depth eighty fathoms; occupies a considerable extent of territory; and its ore is conveyed to the surface of the earth, through several pits or openings made for that purpose, by means of casks fixed to large cables, which are put in motion by horses. The workmen standing on the edges of these casks, and having their arms clasped round the cable, descend and ascend with the utmost composure. The water is drawn from the bottom by a wheel sixty-six feet in diameter, and is afterwards conveyed along an aqueduct, nearly a mile and a half in length. At certain distances from Danmora, are several furnaces, with large and populous villages, exclusively inhabited by the miners.

In Wrazall's tour through the north of Europe, the mine of Danmora is described as yielding the finest iron ore in Europe, its produce being exported to every country, and constituting one of the most important sources of national wealth and royal revenue. The ore is not dug, as is usual in other mines, but is torn up by the force of gunpowder—an operation which is performed every day at noon, and is one of the most awful and tremendous that can possibly be conceived. "We arrived," observes the tourist, "at the mouth of the great mine, *which is nearly half an English mile in circumference, in time to be present at it.* Soon after twelve, the first explosion took place, and could not be so aptly compared to any thing as to

subterraneous thunder, or rather volleys of artillery discharged under ground. The stones were thrown up, by the violence of the gunpowder, to a vast height above the surface of the ground, and the concussion was so great, as to shake the surrounding earth or rock on every side.

“ As soon as the explosion had ceased, I determined to descend into the mine, to effect which, I had to seat myself in a large deep bucket, capable of containing three persons, and fastened by chains to a rope. When I found myself thus suspended between heaven and earth by a rope, and looked down into the dark and deep abyss beneath me, to which I could see no termination, I shuddered with apprehension, and half repented my curiosity. This was, however, only a momentary sensation, and before I had descended a hundred feet, I looked round on the scene with very tolerable composure. It was nearly nine minutes before I reached the bottom; and when I set my foot on the earth, the view of the mine was awful and sublime in the highest degree. Whether, as I surveyed it, terror or pleasure formed the predominant feeling, is hard to say. The light of the day was very faintly admitted into these subterraneous caverns: in many places, it was absolutely lost, and flambeaux were kindled in its stead. Beams of wood were laid across some parts, from one side of the rock to the other; and on these the miners sat, employed in boring holes for the admission of gunpowder, with the most perfect unconcern, although the least dizziness, or even a failure in preserving their equilibrium, must have made them lose their seat, and have dashed them against the rugged surface of the rock beneath. The fragments torn up by the explosion, previously to my descent, lay in vast heaps on all sides, and the whole scene was calculated to inspire a gloomy admiration.

“ I remained three quarters of an hour in these frightful and gloomy caverns, which find employment for not less than one thousand three hundred workmen, and traversed every part of them which was accessible, conducted by my guides. The weather above was very warm, but here the ice covered the whole surface of the ground, and I found myself surrounded with the colds of the most rigorous winter, amid darkness and caves of iron. In one of these, which ran a considerable way beneath the rock, were eight wretched beings warming themselves round a charcoal fire, and eating the little scanty subsistence arising from their miserable occupation. They rose with surprise at seeing so unexpected a guest among them, and I was not a little pleased to dry my feet, which were wet with treading on the melted ice, at their fire.



“ Having gratified my curiosity with a view of these subterraneous apartments, I made the signal for being drawn up, and felt so little terror while re-ascending, compared with that of being let down, that I am convinced, after five or six repetitions, I should have been perfectly indifferent to the undertaking. So strong is the effect of custom on the human mind, and so contemptible does danger or horror become, when familiarized by continual trials!”

Throughout the whole extent of Sweden, the iron mines at present wrought, employ upwards of twenty-five thousand persons, and yield annually upwards of fifty-seven thousand tons of metal. It has been calculated that the furnaces and forges, which give to the iron the degree of perfection requisite before it can be used, consume annually two millions four hundred thousand loads of charcoal.

#### MINES OF COPPER, TIN, LEAD, &c.

The purest copper obtained in Europe is the produce of the mines of the Swedish province of Dalecarlia. The following is a brief description of the principal of these immense and gloomy caverns, all of which boast a high antiquity.

The traveller's curiosity is first attracted by the hydraulic machines which are destined to convey the water to the different quarters, and the power of which is such, that one of the wheels has a diameter of not less than forty-four feet. Another wheel, of proportionate magnitude, is employed to raise the ore from the mine to the surface of the earth, and is admirably constructed. Regular circles are placed on each side, and round these the chain rises, taking a larger or smaller circumference, in proportion to the necessary circle to be made, so as to counterbalance the weight, and consequently the increased motion of the bucket.

Exteriorly, a vast chasm of a tremendous depth presents itself to the view. This being the part of the mine which was first opened, either through the ignorance or neglect of those who had then the management of the works, the excavations so weakened the foundations of the hill, that the whole fell in, leaving a most chaotic scene of precipitated rocks, and a gaping gulf resembling the mouth of a volcano. Great care has been since taken that no such disaster should again occur. Plans and sections are drawn of all the galleries, &c.; and, where the prosecution of the works, in the same direction, might be dangerous, orders are issued for the miners to stop, *and AN IRON CROWN* is fixed on the spot, as a prohibition ever *to proceed further*. The workmen then explore in a *different direction*, while every subterraneous excavation is *nicely watched*.

The traveller passes into the great chasm by a range of wooden steps, which cross, in a variety of directions, the rough masses of fallen rocks, of gravel, and of the ancient machinery. Ere he reaches the entrance of the cavern, he has to descend thirty toises; and this being accomplished, proceeds horizontally to a considerable distance within. He now loses the pure air of day, and gradually breathes an oppressive vapour, which rolls towards him, in volumes from the mouths of a hundred caves leading into the main passage. He now feels as if he were inhaling the atmosphere of Tartarus. The Swedish iron mines which are described above, are mere purgatories when compared with this Satanic dwelling. The descent is performed entirely by steps laid in the winding rock; and, in following the subterraneous declivity, the traveller reaches the tremendous depths of these truly Stygian dominions.

The pestilential vapours which environ him with increasing clouds, and the style of the entrance, remind him of Virgil's description of the descent of Æneas to the infernal regions. Here are to be seen the same caverned portico, the rocky, rough descent, the steaming sulphur, and all the deadly stenches of Avernus. The wretched inmates of this gloomy cavern appear to him like so many spectres, as poetic fiction has described them: and he is induced, by the length of the way, joined to the excessive heat and its suffocating quality, to fancy that he will be made to pay dearly for his curiosity. In one part, the steam is so excessively hot as to scorch at the distance of twelve paces, at the same time that the sulphurous smell is intolerable. Near this spot, a volcanic fire broke out some years ago, in consequence of which, strong walls were constructed, as barriers to its powers, and several contiguous passages, which, had it spread, would have proved dangerous to the mine, closed up.

The visitor has now to traverse many long and winding galleries, as well as large vaulted caverns, where the workmen are dispersed on all sides, employed in hewing vast masses of the rock, and preparing other parts for explosion. Others wheel the brazen ore towards the black abyss where the suspended buckets hang ready to draw it upward. From the effect of such violent exercise, combined with the heat, they are obliged to work almost naked. Their groups, occupations, and primitive appearance, scantily lighted by the trembling rays of torches, form a curious and interesting scene.

The depth of the mine being at least twelve hundred feet, a full hour is required to reach to the bottom. The mass of copper lies in the form of an inverted cone. Five hundred

men are employed daily ; but females are not admitted, on account of the deleterious quality of the vapours.

This mine was anciently a State prison, in which criminals, slaves, and prisoners of war toiled out their wretched existence. Near the bottom is a rocky saloon, furnished with benches. It is called the HALL OF THE SENATE, on account of its having been the resting place of several Swedish Kings, who came, attended by the senators, to examine the works, and here took refreshments. It was in this mine that the immortal GUSTAVUS VASA, disguised as a peasant, laboured for his bread, in the course of a long concealment, after having been robbed by the peasant who served him as a guide.

In the year 1751, a very rich copper mine was wrought in the county of WICKLOW, IRELAND. From this mine, ran a stream of blue-coloured water, of so deleterious a nature as to destroy all the fish in the river Arklow, into which it flowed. One of the workmen, having left an iron-shovel in this stream, found it some days after, encrusted with copper. This led one of the proprietors of the mine to institute a set of experiments, from which he concluded that the blue water contained an acid holding copper in solution ; that iron had a stronger affinity for the acid than copper ; and that the consequence of this affinity was the precipitation of the copper, and the solution of the iron, when pieces of that metal were thrown into the blue water. These ideas induced the miners to dig several pits for the reception of this water, and to put bars of iron into them. The result was, that they obtained an abundance of copper, much purer and more valuable than that which they procured from the ore itself by smelting.

On the island of ANGLESEA, near Dulas bay, on the north coast, is PARYS MOUNTAIN, which contains the most considerable quantity of copper ore perhaps ever known. The external aspect of the hill is extremely rude, and it is surrounded by enormous rocks of coarse white quartz. The ore is lodged in a basin, or hollow, and has on one side, a small lake, over the waves of which, as over those of Avernus, fatal to the feathered tribe, birds are never known to pass. The effect of the mineral operations has been, that the whole of this tract has assumed a most savage appearance. Suffocating fumes of the burning heaps of copper arise in all parts, and extend their baneful influence for miles around. That the ore was worked in a very remote period, appears by vestiges of the ancient operations, which were carried on by trenching, and by heating the rocks intensely, when water was suddenly poured on them, so as to cause them to crack or scale. In the year 1768, after a long search, which was so little profitable that it was

on the eve of being abandoned, a large body of copper ore was found; and this has ever since been worked to great advantage, still promising a vast supply. The water lodged in the bottom of the bed of ore, being strongly impregnated with the metal, is drawn up, and distributed in pits, where the same process is employed as in the Wicklow mine. The copper thus procured, differs little from native copper, and is very highly prized.

CORNWALL has been in all ages, famous for its numerous mines of tin, which are, in general, very large, and rich in ore. The tin-works are of different kinds, dependent on the various forms in which the metal appears. In many places, its ore so nearly resembles common stones, that it can only be distinguished from them by its superior weight. In other parts, the ore is a compound of tin and earth, concentered into a substance almost as hard as stone, of a bluish or grayish colour, and to which the mundic, impregnated with copper, frequently gives a yellowish cast. This ore is always found in a continued stratum, which the miners call *load*; and this, for the greater part, is found running through the solid substance of the hardest rocks, beginning in small veins near the surface, perhaps not above half an inch or an inch wide, and increasing, as they proceed, into large dimensions, branching out into several ramifications, and bending downward in a direction, which is generally, nearly east and west. These loads, or veins, are sometimes white, very wide, and so thick, that large lumps of the ore are frequently drawn up of more than twenty pounds weight. The loads of tin ore are not always contiguous, but sometimes break off so entirely, that they seem to terminate; but the sagacious miner knows by experience, that, by digging at a small distance on one side, he shall meet with a separated part of the load, apparently tallying with the other end, so nicely as if it had been broken off by some sudden shock of the rock.

The miners of Cornwall follow the load, or vein, in all its rich and meandering curves, through the bowels of the flinty earth. The waters are sometimes drained from the mines, by subterraneous passages, formed from the body of the mountain to the level country. These passages are called *adits*, and require occasionally the labour of many years; but when effected, they save the constant expense of large water-works and fire-engines. From the surface of the earth the workmen sink a passage to the mine, which they call a shaft, and place over it a large winch, or, in works of greater magnitude, a wheel and axle, by which means, they draw up large quantities of ore at a time, in vessels called *kibbuls*. This ore is thrown into

heaps, which great numbers of poor people are employed in breaking to pieces, and fitting the ore for the stamping mills.

A third form in which tin appears, is that of crystals; for this metal will, under proper circumstances, readily crystallise. Hence, in many parts of the mineral rocks, are found the most perfectly transparent and beautiful crystals of pure tin. Beside these crystals, in many of the cavernous parts of the rocks, are found those transparent crystals, called **CORNISH DIAMONDS**, they being extremely brilliant when well polished. The form is that of a six-sided prism pointed on the top, and they are sometimes four or five inches in length.

Among the most remarkable **LEAD MINES**, may be cited those of **UPPER LOUISIANA**, in **NORTH AMERICA**, which have for many years been highly productive. That called **Burton's mine** is so extensive, that the mineral is calculated to cover two thousand acres of land. It is of two kinds, the gravel and fossil. The gravel mineral is found immediately under the soil, intermixed with gravel, in pieces of solid mineral, weighing from one to fifty pounds. Beneath the gravel is a sand rock, which being broken, crumbles to a fine sand, and contains mineral nearly of the same quality as that of the gravel. But the mineral of the first quality is found in a bed of red clay, under the sand rock, in pieces of from ten to five hundred pounds weight, on the outside of which, is a spar, or fossil, of a bright glittering appearance, resembling spangles of gold and silver, as solid as the mineral itself, and of a greater specific gravity. This being taken off, the mineral is solid, unconnected with any other substance, of a broad grain, and what mineralogists call **potters' ore**.

In other mines, in the vicinity of the above, the lead is found in regular veins, from two to four feet in thickness, containing about fifty ounces of silver in a ton; but at the depth of twenty-five feet, the operations are impeded by water. The whole of this mineral tract is very rich and extensive.

In **GREAT BRITAIN** there are numerous lead mines, among which, may be cited that of **Arkingdale**, in **Yorkshire**, and those with which **Shropshire** abounds. In the south of **Lanarkshire**, and in the vicinity of **Wanlock-head**, **Scotland**, are two celebrated lead mines, which yield annually above two thousand tons of metal. The **Susannah-vein Lead-hills**, has been worked for many years, and has been productive of great wealth. The above are considered as the richest lead mines of Europe.

Several of the Irish lead mines have yielded a considerable proportion of silver; and mention is made of one, in the county of **Antrim**, which afforded, in thirty pounds of lead,

of that metal. Another, less productive of silver, was at Ballysadare, near the harbour of Sligo, in Connaught; and in the county of Tipperary, thirty miles from Limerick.

The ores of this last were of two kinds, most usually of a reddish colour, hard and glittering; the other, which is the richest in silver, resembled a blue marl. The works destroyed in the Irish insurrections in the reign of Charles II. at the mine, however, is still wrought on account of the lead which it produces.

The following is the enumeration of the different substances in which the metals are found. In granitic mountains, tin, lead, iron, bismuth, cobalt; and in gneis, or schistose granite, copper, lead, tin, and zinc. In micaceous schist, are copper, tin, lead, and antimony. In hornblende slate, iron, copper, and zinc; and under argillate, or common slate, silver, copper, lead, and zinc. In steatite, sulphureous pyrites, and magnesian primitive limestone, copper, lead, and zinc appear; and in a strata of coal, native silver, galena, and manganese have been discovered.

## COAL MINES.

Coal is scattered, with a more or less sparing hand, over the whole continent, and almost over every kingdom of the globe; and there is not any country where coal mines are so rich and so plentiful as in Great Britain, the opulence of which has been almost wholly ascribed to this valuable mineral.

In truth, the very soul of her manufactures, and, consequently, of her commerce, every manufacturing town being situated in the midst of a coal country. Of this, striking instances are afforded by Bristol, Birmingham, Wolverhampton, Manchester, Newcastle, and Glasgow.

The coals of Whitehaven and Wigan are esteemed the best; and the cannel and peacock coals of Lancashire are so valuable, that they are suspected by some to have constituted the *gates*, or jet, which the ancients ascribed to Great Britain. In Somersetshire, the Mendip coal mines are distinguished by their productiveness; they occur there, as indeed by every other part, in the low country, and are not to be found in the hills. The beds of coal are not horizontal, but sloping, and to the southeast at the rate of about twenty-two inches in the hundred. Hence they would speedily sink so deep that it would not be possible to work them, were it not that they are intersected at intervals by perpendicular dykes or veins, of a different kind of mineral, on the other side of which, these beds are considerably raised up. They are seven in number, lying at regular distances beneath each other, and separated

rated by beds of a different kind of substance, the deepest being placed more than two hundred feet beneath the surface of the earth.

The town of Newcastle, in Northumberland, has been celebrated during several centuries for its very extensive trade in coals. It was first made a borough by William the Conqueror, and the earliest charter for digging coals, granted to the inhabitants, was in the reign of Henry III. in 1239; but in 1306, the use of coal for fuel was prohibited in London, by royal proclamation, chiefly because it injured the sale of wood, with which the environs of the Capital were then overspread. This interdict did not, however, continue long in force; and coals may be considered as having been dug for exportation at Newcastle for more than four centuries. It has been estimated, that there are twenty-four considerable collieries lying at different distances from the river, from five to eighteen miles; and that they produced, for an average of six years, up to the close of 1776, an annual consumption of three hundred and eighty thousand chaldrons, Newcastle measure, (equal to seven hundred and seventeen thousand six hundred and fifteen chaldrons, London measure,) of which about thirty thousand chaldrons were exported to foreign parts. The boats employed in the colliery are called keels, and are described as strong, clumsy, and oval, each carrying about twenty tons; and of these, four hundred and fifty are kept constantly employed. In the year 1776, an estimate was made of the shipping employed in the Newcastle coal trade; and from this estimate it appears, that three thousand five hundred and eighty-five ships, were, during that year, engaged in the coasting trade, and three hundred and sixty-three in the trade to foreign ports, their joint tonnage amounting to seven hundred and thirty-eight thousand two hundred and fourteen tons.

It is a common opinion among geologists, that pit coal is of vegetable origin, and that it has been brought to its present state by the means of some chemical process, not at this time understood. However extravagant this opinion may at first sight appear, it is supported by the existence of vast depositions of matter, half-way, as it were, between perfect wood and perfect pit coal; which, while it obviously betrays its vegetable nature, has, in several respects, so near an approximation to pit coal, as to have been generally distinguished by the name of coal. One of the most remarkable of these depositions exists in Devonshire, about thirteen miles southwest of Exeter, and is well known under the name of Bovey coal. Its vegetable nature has been ascertained by Mr. Hatchet, in a set of experiments, in which he found both extractive matter and resin—substances which belong to the vegetable kingdom.

The beds of this coal are seventy feet in thickness, and are interspersed by beds of clay. On the north side, they lie within a foot of the surface, and dip south at the rate of about twenty inches per fathom. The deepest beds are the blackest and heaviest, and have the closest resemblance to pit coal, while the upper ones strongly resemble wood, and are considered as such by those who dig them. They are brown, and become extremely friable when dry, burning with a flame similar to that of wood, and assuming the appearance of wood which has been rendered soft by some unknown cause, and, while in that state, has been crushed flat by the weight of the incumbent earth. This is the case, not only with the Bovey coal, but also with all the beds of wood coal which have been hitherto examined in different parts of Europe.

The coal mines of Whitehaven may be considered as the most extraordinary in the known world. They are excavations which have, in their structure, a considerable resemblance to the gypsum quarries of Paris, and are of such a magnitude and extent, that in one of them alone, a sum exceeding half a million sterling, was, in the course of a century, expended by the proprietors. Their principal entrance is by an opening at the bottom of a hill, through a long passage, hewn in the rock, leading to the lowest vein of coal. The greater part of this descent is through spacious galleries, which continually intersect other galleries, all the coal being cut away, with the exception of large pillars, which, where the mine runs to a considerable depth, are nine feet in height, and about thirty-six feet square at the base. Such is the strength there required to support the ponderous roof.

The mines are sunk to the depth of one hundred and thirty fathoms, and are extended under the sea to places where there is, above them, sufficient depth of water for ships of large burden. These are the deepest coal mines which have hitherto been wrought; and perhaps the miners have not, in any other part of the globe, penetrated to so great a depth beneath the surface of the sea, the very deep mines in Hungary, Peru, and elsewhere, being situated in mountainous countries, where the surface of the earth is elevated to a great height above the level of the ocean.

In these mines there are three strata of coal, which lie at a considerable distance one above the other, and are made to communicate by pits; but the vein is not always continued in the same regularly inclined plane, the miners frequently meeting with hard rock, by which their further progress is interrupted. At such places there seem to have been breaks in the earth, from the surface downward, one portion appearing to



have sunk down, while the adjoining part has preserved its ancient situation. In some of these places, the earth has sunk ten, twenty fathoms, and even more : while in others, the depression has been less than one fathom. These breaks the miners call dykes ; and when they reach one of them, their first care is to discover whether the strata in the adjoining part are higher or lower than in the part where they had been working : or, according to their own phrase, whether the coal be cast down or up. In the former case they sink a pit ; but if it be cast up to any considerable height, they are frequently obliged, with great labour and expense, to carry forward a level, or long gallery, through the rock, until they again reach the stratum of coal.

Coal, the chief mineral of Scotland, has been there worked for a succession of ages. Pope Pius II. in his description of Europe, written about 1450, mentions that he beheld with wonder black stones given as alms to the poor of Scotland. This mineral may, however, be traced to the twelfth century ; and a very early account of the Scottish coal mines, explains with great precision, the manner of working the coal, not neglecting to mention the subterraneous walls of whin, which intersect the strata, particularly a remarkable one, visible from the river Tyne, where it forms a cataract, and passes by Prestonpans, to the shore of Fife. The Lothians and Fifeshire, particularly abound with this useful mineral, which also extends into Ayrshire ; and near Irwin is found a curious variety, named ribbon coal. A singular coal, in veins of mineral, has been found at Castle Leod, in the east of Rosshire ; and it is conjectured that the largest untouched field of coal in Europe exists in a barren tract of country in Lanerkshire.

In North America, coal has been discovered in great abundance on both sides of James river, and is said to have been first discovered by a boy in pursuit of cray fish. This valuable mineral also abounds towards the Mississippi and the Ohio, that of Pittsburgh being of a superior quality ; but it is chiefly worked in Virginia, where the beds are very extensive. One of these beds, about twenty-four feet in thickness, was found to repose on granite, and is cited as a great singularity. In the territory south of the Ohio, what is called stone coal is found in the Cumberland mountains ; and in 1804, a coal mine was discovered on the river Juniata, in the vicinity of the Appalachian mountains. The bed is horizontal, on which account it is wrought with considerable advantage, and the mineral is upwards of ten feet in thickness. Notwithstanding these supplies at particular points of the extensive territory of the United States, coals are imported from Great Britain in

very considerable quantities. In the space of one year, reckoning from the first of October, 1801, the importation amounted to not less than 18,473 chaldrons.

The process of mining is a combination of boring and digging. Shafts are sunk, levels are driven, and drains are carried off, by the help of picks or pick-axes, wedges, and hammers, the rocks being also sometimes loosened by blasting with gunpowder. In searching for coal, a shaft is sunk through the uppermost soft stratum, and the rock is then bored, by striking it continually with an iron borer, terminating in an edge of steel, which is in the mean time, turned partly round; and, at proper intervals, a scoop is let down to draw up the loose fragments. In this manner, a perforation is sometimes made for more than an hundred fathoms, the borer being lengthened by pieces screwed on; it is then partly supported by a counterpoise, and worked by machinery. Should it happen to break, the piece is raised by a rod furnished with a hollow cone, as an extinguisher, which is driven down on it. The borer is sometimes furnished with knives, which are made to act on any part at pleasure, and to scrape off a portion of the surrounding substance, which is collected in a proper receptacle.

Those who have the direction of deep and extensive coal mines, are obliged, with great art and care, to keep them ventilated with perpetual currents of fresh air, which afford the miners a constant supply of that vital fluid, and expel from the mines damps and other noxious exhalations, together with such other burnt and foul air, as is become deleterious, and unfit for respiration. In the deserted mines, which are not thus ventilated with currents of fresh air, large quantities of these damps are frequently collected; and in such works, they often remain for a long time without doing any mischief. But when, by some accident, they are set on fire, they then produce dreadful explosions, and, bursting out of the pits with great impetuosity, like the fiery eruptions from burning mountains, force along with them ponderous bodies to a great height in the air.

Various instances have occurred, in which the coal has been set on fire by the fulminating damp, and has continued burning for several months, until large streams of water were conducted into the mine, so as to inundate the parts where the conflagration existed. By such fires, several collieries have been entirely destroyed, in the vicinity of Newcastle, and in other parts of England, as well as in Fifeshire, in Scotland. In some of these places, the fire has continued to burn for ages. To prevent, therefore, as much as possible, the collieries from being filled with these pernicious damps, it has been found *necessary*, carefully to search for the crevices in

the coal whence they issue, and at those places, to confine them within a narrow space, conducting them through large pipes into the open air, where, being set on fire, they consume in perpetual flame, as they continually arise out of the earth.

The late Mr. Spelling, engineer of the Whitehaven coal mines, having observed that the fulminating damp could only be kindled by flame, and that it was not liable to be set on fire by red hot iron, nor by the sparks produced by the collision of flint and steel, invented a machine called a steel-mill, in which a wheel of that metal is turned round with a very rapid motion, and, by the application of flints, great plenty of sparks are emitted, which afford the miners such a light as enables them to carry on their work in close places, where the flames of a candle, or of a lamp, would, as has already happened in various instances, occasion violent explosions. In that dreadful catastrophe, the explosion of the Felling Colliery, the particulars of which will be hereafter detailed, it will be seen that mills of this description were employed, in searching for the remains of the sad victims of the disaster; but this event happened before the invention of Sir Humphrey Davy's safety lamp, a discovery which, while it affords a more certain light, holds out every security to the miner against accidents which, without such a resource, might still be superadded to those already recorded, as arising from the flame of a candle or lamp.

A greater number of mines have, however, been ruined by inundations than by fires; and here that noble invention the fire-engine displays its beneficial effects. It appears, from nice calculations, that it would require about 550 men, or a power equal to that of 110 horses, to work the pumps of one of the largest fire-engines, having a cylinder of seventy inches diameter, now in use, and thrice that number of men to keep an engine of that size constantly at work. It also appears, that as much water may be raised by such an engine, as can be drawn, within the same space of time, by 2520 men with rollers and buckets, after the manner now daily practised in many mines; or as much as can be borne on the shoulders of twice that number of men, as is said to be done in several of the mines of Peru. So great is the power of the elastic steam of the boiling water in those engines, and of the outward atmosphere, which, by their alternate actions, give force and motion to the beam, and, through it, to the pump rods which elevate the water through tubes, and discharge it from the mine!

*There are four fire-engines belonging to the Whitehaven*

colliery, which, when all at work, discharge from it about 1228 gallons of water every minute, at thirteen strokes; and, at the same rate, 1,768,320 gallons, upwards of 7000 tons, every twenty-four hours. By these engines, nearly twice the above-mentioned quantity of water might be discharged from mines which are not above sixty or seventy fathoms deep, which depth is rarely exceeded in the Newcastle collieries, or in any other English collieries, with the exception of the above.

Coal pits have sometimes taken fire by accident, and have continued to burn for a considerable length of time. About the year 1648, a coal mine at Benwell, a village near Newcastle-upon-Tyne, was accidentally kindled by a candle: at first, the fire was so feeble, that a reward of half a crown, which was asked by a person who offered to extinguish it, was refused. It gradually increased, however, and had continued burning for thirty years, when the account was drawn up and published in the Philosophical Transactions: it was not finally extinguished until all the fuel was consumed. Examples of a similar kind have happened in Scotland and in Germany.

## FELLING COLLIERY.

But of all the recorded accidents relative to coal mines, that of Felling Colliery, near Sunderland, a concise narrative of which here follows, was the most disastrous.

FELLING is a manor about a mile and a half east of Gateshead. It contains several strata of coal, the uppermost of which were extensively wrought in the beginning of the last century. The stratum called the High-main, was won in 1779, and continued to be wrought till the 19th January, 1811, when it was entirely excavated. The present colliery is in the seam called the Low-main. It commenced in October, 1810, and was at full work in May, 1812. This mine was considered by the workmen, as a model of perfection in the purity of its air, and orderly arrangements—its inclined plane was saving the daily expense of at least 13 horses—the concern wore the features of the greatest possible prosperity, and no accident, except a trifling explosion of fire-damp, slightly burning two or three workmen, had occurred. Two *shifts* or sets of men were constantly employed, except on Sundays. Twenty-five acres of coal had been excavated. The first shift entered the mine at four o'clock, A. M., and were relieved at their working posts by the next, at 11 o'clock in the morning. The establishment it employed under ground, consisted of about 128 persons, who, from the 11th to the 25th of May, 1812, wrought 624 scores of coal, equal to 1300 Newcastle chaldrons, or 2455 London chaldrons.

About half past 11 o'clock on the morning of the 25th of May, 1812, the neighbouring villages were alarmed by a tremendous explosion in this colliery. The subterraneous fire broke forth with two heavy discharges from the Low-main, which were almost instantaneously followed by one from the High-main. A slight trembling, as from an earthquake, was felt for about half a mile around the workings; and the noise of the explosion, though dull, was heard to three or four miles distance, and much resembled an unsteady fire of infantry.

Immense quantities of dust and small coal accompanied these blasts, and rose high into the air, in the form of an inverted cone. The heaviest part of the ejected matter, such as corves, pieces of wood, and small coal, fell near the pits; but the dust, borne away by a strong west wind, fell in a continued shower from the pit to the distance of a mile and a half. As soon as the explosion was heard, the wives and children of the workmen ran to the pit; the scene was distressing beyond the power of description.

Of one hundred and twenty-eight persons in the mine at the time of the explosion, only thirty-two were brought to daylight, twenty-nine survived the fatal combustion, the rest were destroyed. Nor from the time of the explosion till the 8th of July, could any person descend. But after many unsuccessful attempts to explore the burning mine, it was re-closed, to prevent the atmospheric air from entering it; this being done, no attempt was afterwards made to explore it, till the morning of the last mentioned day; from which time to the 19th of September, the heart-rending scene of mothers and widows examining the putrid bodies of their sons and husbands, for marks by which to identify them, was almost daily renewed; but very few of them were known by any personal mark, they were too much mangled and scorched to retain any of their features. Their clothes, tobacco-boxes, shoes, &c. were, therefore, the only indexes by which they could be recognized.

At the crane, twenty-one bodies lay in ghastly confusion; some like mummies, scorched as dry as if they were baked. One wanted its head, another an arm. The scene was truly frightful. The power of fire was visible upon them all; but its effects were extremely variable: while some were almost torn to pieces, there were others who appeared as if they had sunk down overpowered by sleep.

The ventilation concluded on Saturday the 19th of September, when the ninety-first body was dug from under a heap of stones. At six o'clock in the morning, the pit was visited by candle-light, which had not been used in it for the space of one

hundred and seventeen days ; and at 11 o'clock in the morning the tube furnace was lighted. From this time the colliery has been regularly at work : but the ninety-second body has never yet been found. All these persons, except four, who were buried in single graves, were interred in Heworth Chapel-yard, in a trench, side by side, two coffins deep, with a partition of brick and lime between every four coffins.

## MISCELLANEOUS SUBJECTS CONNECTED WITH MINERALOGY.

### CLIFTON HOT-WELL.

The warm spring, or fountain, called **THE HOT-WELL**, in the parish of Clifton, is said to be so copious as to discharge sixty gallons of water in a minute. It rises forcibly from an aperture in the solid rock, at about twenty-six feet below high water mark, and ten feet above low water. On its immediate influx from the rock, the water is much warmer than when it is pumped up for drinking ; and it also feels and tastes warmer in winter than in summer, and, in very cold days, heats the glass into which it falls from the cock. In 1695, this celebrated spring, after having fallen into neglect, was recovered, and the Hot-well-house erected, proper foundations being made for the pumps, by which the water is raised to the height of thirty feet : pipes are contrived, through which the waste water runs into the river ; and in these pipes are valves, which open to let out the water, but shut when the tide is rising.

With respect to the qualities of this mineral water, it is natural to suppose, that in its subterraneous passage through the rocks, over different strata, and among such variety of mineral and other substances, it must be impregnated with their several virtues. In the common spring water of the neighbouring rock-house, on a trial being made, the mercury in Fahrenheit's thermometer stood at fifty degrees, while that of the Hot-well, taken immediately from the pump, raised it to seventy-six degrees ; and, as the heat of a person in health seldom exceeds the ninety-sixth degree, it follows, that the Bristol water possesses somewhat more than three-fourths of the human heat.

Below the Hot-well-house, rises a magnificent range of rocks, which are not more remarkable for their height, than for their being equally so on both sides of the river, the strata in some places answering on each side for about a mile and a half in a serpentine course. These constitute one of the greatest natural curiosities in England. The rock beyond the Hot-well, and on the same side, is named **St. VINCENT'S**, a chapel dedicated to *that saint having been formerly built on its summit. It is in*

height three hundred feet, and has a majestic appearance. It supplies the naturalist with many curious fossils; the botanist with a variety of scarce plants; the antiquary with the remains of a Roman camp; and the less curious inquirer with a view of a most dreadful and surprising precipice.

The rocks in general, when broken up, are of a dusky red, brown, or chocolate colour marble, very hard and close grained, and which, on being struck with a hammer, emit a strong sulphureous smell. It will bear a polish equal to any foreign marble; and, when sawed into slabs and polished, appears beautifully variegated with veins of white, bluish gray, or yellow. It is often employed for chimney-pieces; but is principally used for making lime, for which purpose, there is not any stone in England so well calculated, nor is there any lime so strong, fine, and white, which excellent qualities occasion great demand for foreign consumption.

Here, and in the vicinity, labourers are daily employed in blowing up the rocks with gunpowder, by which process vast fragments are frequently thrown down, and repeatedly strike the precipice with a dreadful crash, which, combined with the loud report of the explosion, re-echoed from side to side by the lofty cliffs, makes a grand and awful noise, resembling thunder, for which it is frequently mistaken by strangers. It is the opinion of the greater part of those who have viewed these rocks, that they were once united, and were separated by some terrible convulsion of nature. A bridge of one arch, from rock to rock, over the Avon, has long been in contemplation; but if the blowing up of these rocks should still be persisted in, the design will be rendered impracticable. This is the more to be regretted, because stone of the same quality is to be procured in Durham-down, or lower down the river.

In the fissures and cavities of these rocks, are found those fine crystals, called BRISTOL STONES, OR DIAMONDS, some of which are so hard as to cut glass, and are exceedingly clear, colourless, and brilliant. When set in rings, in their natural state, these have appeared of as high a polish and lustre as if they had been wrought by the most skilful lapidary.

Bristol is surrounded by coal pits, those of Gloucestershire being at Kingswood, and those of Somerset at Bedminster, Ashton, Nailsea, and Brislington. But the most copious supply is from Kingswood, where there are a great number of pits and colliers' houses, which last are so frequent, that Kingswood, viewed from the neighbouring hills, has the appearance of being one vast rural suburb of Bristol.

## SALT MINES.

Culinary salt, or, as it is termed in chemistry, muriat of soda, exists abundantly in a native state, both in a solid form, and dissolved in water. It occurs, in solution, not only throughout the wide range of the ocean, but in various springs, rivers, and lakes; and is known, in its solid form, as a peculiar mineral, under the names of *rock salt*, *fossil salt*, and *salt gem*. Its beds are mostly beneath the surface of the ground, but sometimes rise into hills of considerable elevation. At Cordova, in Spain, a hill, between four and five hundred feet in height, is nearly composed of this mineral. But the most celebrated salt mines are those of Wielicza, in Gallicia, commonly called the salt mines of Cracow, those of Tyrol, of Poland, of Castile, in Spain, and of Cheshire, in England. In the province of Lahor, in Hindostan, is a hill of rock salt, of equal magnitude with that near Cordova. The mines of Iletski, in Russia, yield vast quantities of this substance. It is so plentiful in the desert of Caramania, and the air so dry, that it is there used as a material for building. It forms the surface of a large part of the northern desert of Lybia; and is found in great abundance in the mountains of Peru. It has a pure saline taste, without any mixture of bitterness; and crystalizes in cubes when obtained by slow evaporation from its solution. In Germany the mines of this kind are numerous: one of the largest is that of Hallein, near Saltsburg, in which the salt is hewn out from subterraneous caverns of a considerable range, and exhibits almost every diversity of colour, as yellow, red, blue, and white; in consequence of which, it is dissolved in water, to be liberated from its impurities, and afterwards re-crystalized. The salt mines of Cracow, and those of Cheshire, merit a particular description.

## SALT MINES OF CRACOW.

These celebrated excavations are about five miles distant from the city of Cracow, in a small town named Wielicza, which is entirely undermined, the cavities reaching to a considerable extent beyond its limits. The length of the great mine, from east to west, is six thousand feet; its breadth, from north to south, two thousand; and its greatest depth eight hundred; but the veins of salt are not limited to this extent, the depth and length of them, from east to west, being yet unknown, and their breadth only hitherto determined. There are at present ten shafts, but not a single spring has been discovered throughout the extent of the mine.

In descending to the bottom, the visitor is surprised to find a



kind of subterraneous commonwealth, consisting of many families, who have their peculiar laws and polity. Here are likewise public roads and carriages, horses being employed to draw the salt to the mouths of the mine, where it is taken up by engines. These horses, when once arrived at their destination, never more see the light of the sun; and many of the people seemed buried alive in this strange abyss, having been born there, and never stirring out; while others are not denied frequent opportunities of breathing the fresh air in the fields, and enjoying the surrounding prospects. The subterraneous passages, or galleries, are very spacious, and in many of them chapels are hewn out of the rock salt. In these passages crucifixes are set up, together with the images of saints, before which a light is kept constantly burning. The places where the salt is hewn out, and the empty cavities whence it has been removed, are called chambers, in several of which, where the water has stagnated, the bottoms and sides are covered with very thick incrustations of thousands of salt crystals, lying one on the other, and many of them weighing half a pound and upwards. When candles are placed before them, the numerous rays of light reflected by these crystals emit a surprising lustre.

In several parts of the mine, huge columns of salt are left standing, to support the rock; and these are very fancifully ornamented. But the most curious object in the inhabited part, or subterraneous town, is a statue which is considered by the immured inhabitants as the actual transmutation of Lot's wife into a pillar of salt; and in proportion as this statue appears either dry or moist, the state of the weather above ground is inferred. The windings in this mine are so numerous and intricate, that the workmen have frequently lost their way; and several, whose lights have been extinguished, have thus perished. The number of miners to whom it gives employment, is computed at between four or five hundred; but the whole amount of the men employed in it, is about seven hundred.

The salt lies near the surface, in large shapeless masses, out of which blocks of sixty, eighty, or a hundred feet square, may be hewn; but at a considerable depth it is found in smaller lumps. About six hundred thousand quintals of salt are dug annually out of the mines of Cracow. The worst and cheapest is called green salt, from its greenish colour, occasioned by an heterogeneous mixture of a grayish mineral, or clay, and entirely consists of salt crystals of different dimensions. A finer sort is dug out in large blocks; and the third kind is the *sal gemmæ*, or crystal salt, which is found in small pieces interspersed in the rock, and when detached from it, breaks into cubes of rectangular prisms. This is usually sold unprepared. The colour of the salt stone is a dark gray mixed with yellow.

## SALT MINES AND SALT SPRINGS OF CHESHIRE.

The Cheshire rock salt, with very few exceptions, has hitherto been ascertained to exist only in the valleys bordering on the river Weaver, and its tributary streams; in some places manifesting its presence by springs impregnated with salt, and in others, being known by mines actually carried down into the substance of the salt strata. Between the source of the Weaver and Nantwich, many brine springs make their appearance; and occur again at several places, in proceeding down the stream. At Moulton, a mine has been sunk into the body of rock salt, and a similar mine is wrought near Middlewich. At Northwich, brine springs are very abundant; and there also many mines have been sunk for the purpose of working out the fossil salt. In that vicinity, a body of rock salt has been met with, in searching for coal.

The brines in this district are formed by the penetration of spring or rain waters to the upper surface of the rock salt, in passing over which, they acquire such a degree of strength, that one hundred parts have yielded twenty-seven of pure salt, thus nearly approaching to the perfect saturation of brine. Their strength is, therefore, much greater than that of the salt springs met with in Hungary, Germany, and France. The brine having been pumped out of the pits, is first conveyed into large reservoirs, and afterwards drawn off as it is needed, into pans made of wrought iron. Here heat is applied in a degree determined by the nature of the salt to be manufactured, and various additions are made to the brine, with a view either to assist the crystalization of the salt, or to promote the separation of the earthy particles, which exist in a very small proportion. The importance of the manufacture of Cheshire salt will be sufficiently obvious from the statement, that, besides the salt made for home consumption, the annual amount of which, exceeds 16,000 tons, the average of the quantity sent yearly to Liverpool for exportation, has not been less than 140,000 tons.

The mine of rock salt first worked, was discovered by accident at Marbury, near Northwich, about a century and a half ago; and this bed had been wrought for more than a century, when, in the same neighbourhood, a second and inferior stratum was fallen in with, separated from the former by a bed of indurated clay. This lower stratum was ascertained to possess a very great degree of purity, and freedom from earthy admixture; on which account, and from the local advantages of Northwich for exportation, the fossil salt is worked in the vicinity of that place only. It occurs in two great strata or

beds, lying nearly horizontally, and separated, the superincumbent from the subjacent stratum, by several layers of indurated clay, or argillaceous stone. These intervening beds possess in conjunction a very uniform thickness of from thirty to thirty-five feet, and are irregularly penetrated by veins of fossil salt. There is every reason to believe, that the beds of rock salt at Northwich, are perfectly distinct from any others in the salt district, and form what are termed by mineralogists *incumbent bodies* or *masses of mineral*.

These enormous masses stretch a mile and a half in a longitudinal direction from northeast to southwest; but their transverse extent, as measured by a line at right angles from the former, does not exceed 4,200 feet, somewhat more than three quarters of a mile. Without this area, the brine which is met with, is of a very weak and inferior quality, and at a short distance, disappears altogether. The thickness of the upper bed varies from sixty to ninety feet; and a general estimate made from its level, shows, that its upper surface, which is ninety feet beneath that of the earth, is at least thirty-six feet beneath the low water mark of the sea at Liverpool—a fact not unimportant in determining the nature of the formation of this mineral. The thickness of the lower bed has not hitherto been ascertained; but the workings are usually begun at the depth of from sixty to seventy-five feet, and are carried down for the space of fifteen or eighteen feet, through what forms the purest portion of the bed. In one of the mines, a shaft has been sunk to a level of forty-two feet still lower, without passing through the body of rock salt. There is thus an ascertained thickness of this bed of about a hundred and twenty feet, and without any direct evidence that it may not extend to a considerably greater depth.

Although two distinct beds only of fossil salt have been met with at Northwich, it has been ascertained that the same limitations do not exist throughout the whole of the salt district. At Lawton, near the source of the river Wheelock, three distinct beds have been found, separated by strata of indurated clay; one at the depth of 126 feet, four feet in thickness; a second, thirty feet lower, twelve feet in thickness; and a third, forty-five feet farther down, which was sunk into seventy-two feet, without passing through its substance. The intervening clay, the structure of which is very peculiar, is called the *SHAGGY METAL*, and the fresh water which passes through its pores, has the expressive appellation of *ROARING MEG*. This epithet will not appear too strong, when it is mentioned that in a mine in which the section of strata was taken, and where the *shaggy metal* was found at the depth of about eighty feet, the

quantity of water ascertained to issue from its pores in one minute, was not less than three hundred and sixty gallons; a circumstance which greatly enhances the difficulty of passing a shaft down to the body of rock salt.

In many of these beds of argillaceous stone, a portion of salt, sufficiently strong to affect the taste, is found to exist; and this saltiness increases, as might be expected, in proportion as the body of rock salt is approached: in the strata or layers immediately above the rock, which in all the mines are perfectly uniform in their appearance and structure, it is particularly remarkable, notwithstanding there are not, in these strata, any veins of rock salt connected with the great mass below. On the contrary, the line between the clay and rock salt is drawn with great distinctness in every instance, without presenting any of those inequalities which would arise from a mutual penetration of the strata. Not any marine exuviae, or organic remains, are found in the strata above the rock salt; and the almost universal occurrence of gypsum, in connexion with beds of fossil salt, is a fact still more deserving of observation, because it appears, not only in these mines, but also in the salt mines of Hungary, Poland, and Transylvania, on which account, Werner, in his geognostic system, assigns to the rock salt and floetz gypsum a conjunct situation.

The fossil salt extracted from the Northwich mines is of different degrees of purity, and more or less blended with earthy and metallic substances. The purer portion of the lower bed yields a rock salt, which, being principally exported to the Baltic, obtains the name of Prussian rock. The extent of the cavity formed by the workings, varies in different mines, the average depth being about sixteen feet. In some of the pits, where pillars from eighteen to twenty-four feet square form the supports of the mine, the appearance of the cavity is singularly striking, and the brilliancy of the effect is greatly increased when the mine is illuminated by candles fixed to the sides of the rock. The scene thus formed, almost appears to realize the magic palaces of eastern poets. Some of the pits are worked in aisles or streets, but the choice here is wholly arbitrary. Among the methods employed in working out the rock salt, the operation of blasting is applied to the separation of large masses from the body of the rock, and these are afterwards broken down by the mechanical implements in common use. The present number of mines is eleven or twelve, from which there are raised, on an annual average, fifty or sixty thousand tons of rock salt. The greater part of this quantity is exported to Ireland and the Baltic, the remainder being employed in

the Cheshire district, in the manufacture of white salt by solution and subsequent evaporation.

The general situation occupied by the rock salt in Cheshire is very similar to that of the Transylvanian and Polish mines, the beds of this mineral being disposed in small plains, bounded by hills of inconsiderable height, forming a kind of basin or hollow, from which there is usually only a narrow egress for the waters. The situation of the Austrian salt mines near Salzburg is, however, very different. The mineral there appears to be disposed in beds of great thickness, which occur near the summits of limestone hills, at a great elevation above the adjoining country. This is a singular fact; and if the hypothesis be allowed that rock salt is formed from the waters of the sea, it is necessary to suppose the occurrence on this spot of the most vast and surprising changes!

The theory of the formation of rock salt presents some difficulties, at the same time that little doubt can exist of the general fact, that the beds of this mineral have been formed of deposition from the waters of the sea. Such an opinion acquires much probability from the situation in which these beds usually occur; occupying the vallies and lower parts of the plains which are so surrounded by hills of secondary formation, as to leave only a narrow egress for the waters collected on their surface. The structure of the plain which constitutes the salt district of Cheshire, regarded in its general character, leads strongly to the conclusion that the waters of the sea must, at some former period, have occupied the lower parts at least, of the basin thus formed, which, at that time, had a level lower by two hundred and fifty or three hundred feet than the one now appearing. To account for the great depositions of salt in the lower part of this basin, it is necessary to suppose that some barrier must have been afterwards interposed to prevent the free communication of the waters of the sea with those thus collected; and the general course of the streams, the position of the beds of rock salt, and the contractions in the valley of the Weaver, which appear below Northwich at Anderton and Frodsham, point out with some distinctness the place where these obstructions may probably have occurred.

The principal objection to this theory undoubtedly is, the non-existence of marine exuviae, either in the rock salt, or in the adjacent strata of clay; a fact very difficult to connect with the idea of a deposition from the waters of the sea. Other objections, though perhaps of less moment, arise from the appearance of the earthy salts in smaller proportion in the rock salt than in sea water; from the apparently partial depositions of the beds; and from the difficulty of explaining the formation

of certain figured appearances which occur in the substance of the rock. These circumstances, however, by no means authorize the rejection of the general idea which has been given of the origin of this mineral, strengthened as it is by the situation and appearances observed in the foreign salt mines, where the proofs of marine deposition are still stronger than those presented in the Cheshire district.

### PHENOMENA OF THE OCEAN.

*They that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and his wonders in the deep.—PSALMS.*

#### SALTNESS OF THE SEA.

Of the various phenomena of the sea, that of its saltness is one of the most obvious. No questions concerning the natural history of our globe have been discussed with more attention, or decided with less satisfaction, than that concerning its primary cause, which had perplexed the philosophers before the time of Aristotle, and surpassed even the great genius of that profound inquirer into natural causes. Father Kircher, after having consulted not less than thirty-three authors on this subject, could not help remarking, that the fluctuations of the ocean itself, were scarcely more various, than the opinions concerning the origin of its saline impregnation.

This question does not seem capable of admitting an illustration from experiment; at least, not any experiments have been hitherto made for that purpose: it is, therefore, not surprising, that it remains nearly as problematical in the present age, as it has been in any of the preceding. Had observations been made three or four centuries ago, to ascertain the then saltness of the sea, at any particular time and place, we might now, by making similar observations at the same place, in the same season, have been able to know, whether the saltness, at that particular place, was an increasing, or a decreasing, or an invariable quantity. This kind and degree of knowledge would have served as a clue to direct us to a full investigation of this matter in general. It is to be regretted, however, that observations of this nature, have not, until very lately, been made with any degree of precision.

One of the principal opinions maintained on this subject by modern philosophers, and more particularly supported by Doctor Halley, is, that since river water, in almost every part of the globe, is impregnated, in a greater or less degree, by sea salt, *the sea must have gradually acquired its present quantity*

of salt from the long continued influx of rivers. The water which is carried into the sea by these rivers, is again separated from it by evaporation, and being dispersed over the atmosphere by winds, soon descends in rain or vapour upon the surface of the earth, whence it hastens to pour into the bosom of the ocean the fresh tribute of salt it has collected in its inland progress. Thus the salt conveyed into the sea not being a volatile substance, nor performing an incessant circulation, must be a perpetually increasing quantity; and sufficient time, it is contended, has elapsed, since the creation, for the sea to acquire from this source its present quantity of salt.

This opinion has been successfully combatted; and it is denied that fresh water rivers can, in the course of many thousand years, have produced saltness in the sea. If this were the case, every sea, or great body of water, which receives rivers, must have been salt, and have possessed a degree of saltness in proportion to the quantity of water which these rivers discharge. But so far is this from being true, that the Palus Mæotis, and the great American lakes, do not contain salt water, but fresh. It may indeed be objected, that the quantity of salt which rivers carry along with them, and deposit in the sea, must depend on the nature of the soil through which they flow, which may in some places not contain any salt; and that this is the reason why the great lakes in America, and the Palus Mæotis are fresh. But to this opinion, which is merely hypothetical, there are insurmountable objections. It is a curious fact, that the saltness of the sea is greatest under the line, and diminishes gradually towards the poles; but it cannot, therefore, be assumed, that the earth contains more salt in the tropical regions than in the temperate zones, and more in these again, than in the frigid zones. On the other hand, if it be allowed, that the sea receives its saltness from the rivers, it must be equally salt, or nearly so, in every part of the earth; since, according to a simple and well known principle in chemistry, *when any substance is dissolved in water with the assistance of agitation, at whatever part of the water it is introduced, it will be equally diffused through the whole liquid.* Now, though it were true, that a greater quantity of salt should have been introduced into the sea under the line, than towards the poles, from the constant agitation occasioned by the wind and tide, the salt must have soon pervaded the whole mass of water. Neither is this greater proportion of saltness owing to a superior degree of heat, since it is an established principle in chemistry, that cold water and hot water dissolve nearly the same proportion of salt.

The saltness of the sea has also been ascribed to the solu-

tion of subterraneous mines of salt, that are supposed to abound in the bottom of the sea, and along its shores. But this hypothesis cannot be supported. If the sea were constantly dissolving salt, it would soon become saturated; for it cannot be said that it is deprived of any portion of its salt by evaporation, since rain water is fresh. If the sea were to become saturated, neither fishes nor vegetables could live in it. It may hence be inferred, that the saltness of the sea cannot be accounted for by secondary causes, and that it has been salt since the beginning of time. It is, indeed, impossible to suppose, that the waters of the sea were at any time fresh since the formation of fishes and sea-plants; neither will they live in water which is fresh. It may hence be concluded that the saltness of the sea has, with some few exceptions, perhaps arising from mines of rock salt dispersed near its shores, been nearly the same in all ages. This hypothesis, which is the simplest, and is involved in the fewest difficulties, best explains the various phenomena dependent on the saltness of the sea.

Although this saline property may be one of the causes by which the waters of the sea are preserved from putridity, still it cannot be considered as the principal cause. The ocean has, like rivers, its currents, by which its contents are circulated round the globe; and these may be said to be the great agents which keep it sweet and wholesome. A very enlightened navigator, Sir John Hawkins, speaks of a calm in which the sea, having continued for some time without motion, assumed a very formidable aspect. "Were it not," he observes, "for the moving of the sea, by the force of winds, tides, and currents, it would corrupt all the world. The experiment of this, I saw in the year 1590, lying with a fleet about the Islands of Azores, almost six months, the greater part of which time we were becalmed. Upon which all the sea became so replenished with various sorts of gellies, and forms of serpents, adders, and snakes, as seemed wonderful; some green, some black, some yellow, some white, some of divers colours, and many of them had life; and some there were a yard and a half, and two yards long; which, had I not seen, I could hardly have believed. And hereof are witnesses all the companies of the ships which were then present; so that hardly a man could draw a bucket of water clear of some corruption. In which voyage, toward the end thereof, many of every ship fell sick, and began to die apace. But the speedy passage into our country, was a remedy to the crazed, and a preservative to those who were not touched."



## ICE ISLANDS.

This name is bestowed by seamen on the huge solid masses of ice which float on the sea near or within the Polar circles. Many of these fluctuating islands are met with on the coasts of Spitzbergen, to the great danger of the vessels employed in the Greenland fishery. In the midst of these tremendous masses, navigators have been arrested and frozen to death. In this manner, the brave Sir Hugh Willoughby perished with all his crew in 1553; and in the year 1773, Lord Mulgrave, after every effort which the most accomplished seaman could make, to reach the termination of his voyage, was caught in the ice, and nearly experienced the same unhappy fate. The scene he describes, divested of the horrors attendant on the eventful expectation of change, was most beautiful and picturesque. Two large ships becalmed in a vast bason, surrounded on all sides by ice islands of various forms; the weather clear; the sun gilding the circumambient ice, which was smooth, low, even, and covered with snow, except where pools of water, on a portion of the surface, shot forth new icy crystals; and the smooth surface of the comparatively small space of sea in which they were hemmed. Such is the picture drawn by our navigator, amid the perils by which he was surrounded.

After fruitless attempts to force their way through the fields of ice, the limits of these became at length so contracted, the ships were immoveably fixed. The smooth extent of surface was soon lost: the pressure of the pieces of ice, by the violence of the swell, caused them to pack; and fragment rose upon fragment, until they were in many places higher than the main yard. The movements of the ships were tremendous and involuntary, in conjunction with the surrounding ice, actuated by the currents. The water having shoaled to fourteen fathoms, great apprehensions were entertained, as the grounding of the ice, or of the ships, would have been equally fatal: the force of the ice might have crushed them to atoms, or have lifted them out of the water, and have overset them; or, again, have left them suspended on the summits of the pieces of ice at a tremendous height, exposed to the fury of the winds, or to the risk of being dashed to pieces by the failure of their frozen dock. An attempt was made to cut a passage through the ice; but after a perseverance truly worthy of Britons, it proved ineffectual. The commander, who was at all times master of himself, directed the boats to be made ready to be hauled over the ice, till they should reach navigable water, proposing in them to make the voyage to England; but after they had

thus been drawn over the ice, for three progressive days, a wind having sprung up, the ice separated sufficiently to yield to the pressure of the ships in full sail. After having laboured against the resisting fields of ice, they at length reached the harbour of Smeeringberg, at the west end of Spitzbergen.

The vast islands of floating ice which abound in the high southern latitudes, are a proof that they are visited by a much severer degree of cold than equal latitudes towards the north pole. Captain Cook, in his second voyage, fell in with one of these islands in latitude  $50^{\circ} 40'$  south. It was about fifty feet high, and half a mile in circuit, being flat on the top, while its sides, against which the sea broke exceedingly high, rose in a perpendicular direction. In the afternoon of the same day, the 10th of December, 1773, he fell in with another large cubical mass of ice, about two thousand feet in length, four hundred feet in breadth, and in height two hundred feet. Mr. Foster, the naturalist of the voyage, remarks, that according to the experiments of Boyle and Marian, the volume of ice is to that of sea water as 10 to 9: consequently by the known rules of hydrostatics, the volume of ice which rises above the surface of the water, is to that which sinks below it as 1 to 9. Supposing, therefore, this mass of ice to have been of a regular figure, its depth under water must have been 1800 feet, and its whole height 2000 feet: estimating its length as above, at 2000 feet, and its breadth at 400 feet, the entire mass must have contained 1600 millions of cubic feet of ice.

Two days after, several other ice islands were seen, some of them nearly two miles in circuit, and 600 feet high; and yet such was the force of the waves, that the sea broke quite over them. They exhibited for a few moments a view very pleasing to the eye; but a sense of danger soon filled the mind with horror: for had the ship struck against the weather side of one of these islands, when the sea ran high, she must in an instant have been dashed to pieces. The route to the southward was afterwards impeded by an immense field of low ice, the termination of which could not be seen, either to the east, west, or south. In different parts of this field were islands, or hills of ice, like those which had before been found floating in the sea.

At length, these ice islands became as familiar to those on board as the clouds and the sea. Whenever a strong reflection of white was seen on the skirts of the sky, near the horizon, then ice was sure to be encountered; notwithstanding which, that substance itself was not entirely white, but often tinged, especially near the surface of the sea, with a most beautiful sapphire, or rather berylline blue, evidently re-

flected from the water. This blue colour sometimes appeared twenty or thirty feet above the surface, and was probably produced by particles of sea water which had been dashed against the mass in tempestuous weather, and had penetrated into its interstices. In the evening, the sun setting just behind one of these masses, tinged its edges with gold, and reflected on the entire mass a beautiful suffusion of purple. In the larger masses were frequently observed shades or casts of white, lying above each other in strata, sometimes of six inches, and at other times of a foot in height. This appearance seemed to confirm the opinion entertained relative to the increase and accumulation of such huge masses of ice, by heavy falls of snow at different intervals: for snow being of various kinds, small grained, large grained, in light feathery locks, &c.; the various degrees of its compactness may account for the different colours of the strata.

The approximation of several fields of ice of different magnitudes produces a very singular phenomenon. The smaller of these masses are forced out of the water, and thrown on the larger ones, until at length an aggregate is formed of a tremendous height. These accumulated bodies of ice float in the sea like so many rugged mountains, and are continually increased in height by the freezing of the spray of the sea, and the melting of the snow which falls on them. While their growth is thus augmented, the smaller fields, of a less elevation, are the meadows of the seals, on which these animals at times frolic by hundreds.

The collision of great fields of ice, in high latitudes, is often attended by a noise, which, for a time, takes away the sense of hearing any thing beside; and that of the smaller fields with a grinding of unspeakable horror. The water which dashes against the mountainous ice, freezes into an infinite variety of forms, and presents to the admiring view of the voyager, ideal towns, streets, churches, steeples, and almost every form which imagination can picture to itself.

#### ICEBERGS.

Analogous to the ice-fields described above, are those large bodies of ice, named ICEBERGS, which fill the valleys between the high mountains in northern latitudes. Among the most remarkable are those of the east coast of Spitzbergen. They are seven in number, and lie at considerable distances from each other, extending through tracts unknown, in a region totally inaccessible in the internal parts. The most distant of them exhibits over the sea a front three hundred feet in height, emulating the colour of the emerald: cataracts of melted

snow fall down in various parts ; and black spiral mountains, streaked with white, bound the sides, rising crag above crag, as far as the eye can reach in the back ground. At times, immense fragments break off, and precipitate themselves into the water with a most alarming dashing. A portion of this vivid green substance was seen by Lord Mulgrave, in the voyage above referred to, to fall into the sea ; and, notwithstanding it grounded in twenty-four fathoms water, it spired above the surface fifty feet. Similar icebergs are frequent in all the arctic regions ; and to their lapse is owing the solid mountainous ice which infests those seas.

The frost sports wonderfully with these icebergs, and gives them majestic, as well as other most singular forms. Masses have been seen to assume the shape of a gothic church, with arches, windows, and doors, and all the rich drapery of that style of architecture, composed of what the writer of an Arabian tale would scarcely have ventured to introduce among the marvellous suggestions of his fancy—*crystals of the richest sapphire blue*. Tables with one or more feet ; and often immense flat-roofed temples, like those of Luxor on the bank of the Nile, supported by round transparent columns of cerulean hue, float by the astonished spectator. These icebergs are the creation of ages, and acquire annually additional height by falls of snow and rain, which latter often freezes instantly, and more than repairs the loss occasioned by the influence of the sun's heat.

## LUMINOUS POINTS IN THE SEA.

Among the phenomena which have long exercised the sagacity of philosophers, that of the luminous appearance of the surface of the sea, during the obscurity of the night, is highly curious. A variety of experiments were made by a French naturalist at Cayenne, at different seasons, to ascertain its true cause ; and to him it appeared that these luminous points were produced by motion and friction alone, as he could not, with the help of the best glasses, perceive any insects floating in the water. But it would seem, from the experiments and observations of many learned men, that this phenomenon is produced by various causes, both jointly and separately. It has been proved by one set of experiments, that the putrefaction of animal substances produces light and scintillation in the sea. A little white fish placed in sea-water, rendered it luminous in the space of twenty-eight hours. On another hand, it is certain that there is in the sea a prodigious quantity of shining insects or animalcules, which contribute to this phenomenon. A French astronomer, M. Dangelet, who return-

ed from Terra Australis in 1774, brought with him several kinds of worms which shine in water, when it is set in motion; and M. Rigaud affirms, that the luminous surface of the sea, from Brest to the Antilles, contains an immense quantity of little, round, shining polypi, of about a quarter of a line in diameter. Other learned men, who acknowledge the existence of these luminous animals, cannot, however, be persuaded to consider them as the cause of all that light and scintillation which appear on the surface of the ocean. They imagine that some substance of a phosphoric nature, arising from putrefaction, must be admitted as one of the causes of this phenomenon. By other naturalists, it has been ascribed to the oily and greasy substances with which the sea is impregnated; in proof of which, a kind of fish, resembling the tunny, is cited, as being provided with an oil which shines with considerable lustre.

The Abbe Nollet was convinced, by a series of experiments, that this phenomenon is caused by small animals, either by their luminous aspect, or by some liquor or effluvia which they emit. He did not, however, exclude other causes; and among these, the spawn or fry of fishes is deserving of attention. M. Dangelet, in sailing into the bay of Antongil, in the island of Madagascar, observed a prodigious quantity of fry, which covered the surface of the sea for the extent of more than a mile, and which he, at first, on account of its colour, mistook for a bank of sand. This immense accumulation of spawn or fry exhaled a disagreeable odour; and it should be remarked that the sea, had, for some days before, appeared with uncommon splendour. The same accurate observer, perceiving the sea remarkably luminous in the road of the Cape of Good Hope, during a perfect calm, remarked that the oars of the canoes produced a whitish and pearly kind of lustre: when he took in his hand the water, which contained phosphorus, he discerned in it, for some minutes, globules of light as large as the heads of pins. On pressing these globules, they appeared to his touch like a soft and thin pulp; and some days after the sea was covered with entire banks of small fishes, in innumerable multitudes.

From all these facts it may be deduced, that various causes contribute to the light and scintillation of the sea; and that the light which the Cayenne naturalist attributed to agitation and friction, differs from that which is extended far and near, seeming to cover the whole surface of the ocean, and producing a very beautiful and striking appearance, particularly in the torrid zone, and in the summer season.

## TIDES AND CURRENTS.

Alternate tides in sacred order run.

BLACKMORE.

Among the most wonderful phenomena of nature may be reckoned the tides of the sea. They were but little understood by the ancients, although Pliny, Ptolemy, and Macrobius, were of opinion that they were influenced by the sun and moon. The former expressly says, that the cause of the ebb and flow is in the sun, which attracts the waters of the ocean; and he adds, that the waters rise in proportion to the proximity of the moon to the earth.

Among the phenomena of the tides, one of the most singular is the **BORE**, peculiar to several rivers: it is ascribed to the waters, which were before expansive, being suddenly pent up, and confined within a narrow space. This bore, or impetuous rush of waters, accompanies the first flowing of the tide in the Perret, in Somersetshire, and in the Seine, in France. It is also one of the peculiarities of the Severn, the most rapid river in England.

One of the greatest known tides is that of the Bristol Channel, which sometimes flows upwards of forty feet. At the mouth of the river Indus, the water rises thirty feet. The tides are also remarkably high on the coasts of Malay, in the straits of Sunda, in the Red Sea, at the mouth of the river St. Lawrence, along the coasts of China and Japan, at Panama, and in the gulf of Bengal. The most remarkable tides, however, are those at Batsha, in the kingdom of Tonquin, in  $20^{\circ} 50'$  north latitude. In that port, the sea ebbs and flows once only in twenty-four hours, while, in all other places, there are two tides within that space. What is still more extraordinary, twice in each month, when the moon is near the equinoctial, there is not any tide, the water being for some time quite stagnant. These, with other anomalies of the tides there, Sir Isaac Newton, with peculiar sagacity, ascertained to arise from the concurrence of two tides, one from the South Sea, and the other from the Indian Ocean. Of each of these two tides, there come successively two every day; two at one time greater, and two at another which are less. The time between the arrival of the two greater, was considered by him as high tide; that between the two less, as ebb. In short, with these simple facts in his possession, that great mathematician solved every appearance, and so established his theory as to silence every opposer.

Besides the common and periodical tides, a variety of **LOCAL CURRENTS** are met with in different seas, on different parts of

the ocean, and for the greater part at an inconsiderable distance from land. They have been usually ascribed to particular winds; but their origin is not easy to trace, as they have been occasionally found beneath the surface of the water running in a contrary direction to the stratum above, and cannot, therefore, have been owing to winds or monsoons. These particular currents have been ascribed to the immense masses of polar ice, which produce a greater degree of cold in the under than in the upper stratum of waters; and it has been suspected, that there is an under current of cold water flowing perpetually from the poles towards the equator, even where the water above flows towards the poles. The great inferiority of temperature, which is frequently found in deep and superficial soundings of the same space of water, is thus accounted for.

The most extraordinary current is that of the gulf of Florida, usually called the *GULF-STREAM*, which sets along the coast of North America to the northward and eastward, and flows with an uninterrupted rapidity. It is ascribed to the Trade winds, which, blowing from the eastern quarter into the great Mexican gulf, cause there an accumulation above the common level of the sea. The water, therefore, constantly runs out by the channel where it finds least resistance, that is, through the gulf of Florida, with such force as to continue a distinct stream to a very great distance. A proof of its having thus originated is, that the water in the gulf-stream has been found to have retained a great portion of the heat it had acquired in the torrid zone.

A very singular upper current often prevails to the westward of Scilly, and is highly dangerous to ships which approach the British Channel. Currents of this description, are, however, more frequently met with about the Straits of Gibraltar, and near the West-India islands, the coasts of which are so subject to counter-tides, or extraordinary currents, that it is often dangerous for boats to land. They proceed to the westward, along the coasts of Jucatan and Mexico, and, running round into the gulf, return into the great ocean, by the straits of Bahama, along the coasts of Florida, in order to pursue, in the north, the course ordained them by the great Author of nature. In this course the waters run with an extraordinary rapidity, passing between the great and small American islands in the great deeps, by an almost even and imperceptible motion. Against the shores and coasts of these islands, which form an Archipelago, they are, however, very sensible and dangerous, interrupting the navigation, and rendering it scarcely possible to stem them in proceeding to the eastward.

Besides these regular currents, there are others, called **COUNTER-TIDES**, which are observable on the sea coasts and shores. In places where these flow, the sea rises in an extraordinary manner, becoming very furious without any apparent cause, and without being moved by any wind. The waves rise and open very high, breaking on the shore with such violence, that it is impossible for vessels to land. These counter-tides are chiefly ascribed to the pressure of the heavy black clouds which are occasionally seen to hang over an island, or over the sea.

### PRINCIPAL RIVERS.

Not to mention the great variety of known benefits a river bestows on the country through which it flows, its winding course becomes a delightful ornament, and renders the most beautiful landscape still more exquisitely enchanting. At its fountain head, it is nothing more than a small vein of water, oozing from a hill on a bed of sand or clay, on which account it has been supposed to originate in waters brought from the sea by subterraneous ducts, and having lost their saltness by percolation in their passage through the earth. If this be conceded, it is not so easy to explain by what power the water rises above the level of the sea to the summits of mountains, where springs generally abound; it being contrary to the laws of hydrostatics, that a fluid should rise in a tube above the level of its surface. Doctor Halley has on this subject ventured an hypothesis, which has been most generally received. He attributes the origin of springs to vapours raised by the action of the sun, as well as by the agitation of the winds, from seas, lakes, &c. He made several experiments to show that vapour is a sufficient fund to supply all our rivers, springs, &c. To find the quantity of water which the Mediterranean receives, he allows the most considerable rivers which run into it, such as the Iber, Rhone, Tyber, Po, Danube, Neister, Boristhenes, Tanais, and Nile, each to furnish ten times as much water as the Thames, including in this estimate the water which flows into that sea from small rivulets. Now the Thames is found by calculation to evacuate two hundred and three millions of tons of water daily. The above nine rivers, will, therefore, evacuate little more than eighteen hundred millions of tons in a day, and this scarcely exceeds a third of what he had, by preceding experiments, demonstrated to be raised in that time in the form of vapour. He has thus discovered a source abundantly sufficient for the supply of fountains.

To explain *this theory* on the principles of evaporation, the Doctor considers, that if an atom of water were to be ex-



panded into a bubble, so as to be ten times as large in diameter as when it was in its condensed state of water, that atom would become specifically lighter than the air, and would, therefore, rise so long as the warmth which first separated it from the surface of the water should continue to distend it in the same degree; and, consequently, that vapours may be raised from the sea in that manner, till they arrive at a certain height in the atmosphere, in which they find air of equal specific gravity with themselves. Here they will float, till, being condensed by cold, they become specifically heavier than the air, and fall down in dew; or, being driven by the winds against the sides of mountains, many of which far exceed the usual height to which vapours would of themselves ascend, are compelled by the stream of air to mount up with it to their summits. Being there condensed into water, they presently precipitate, and, oozing down by the crannies of the stones, enter, in part, the crevices of the hills. These being once filled, all the overplus of water which comes thither, runs over by the lowest place, and breaking out by the sides of the hills, forms single springs. Many of these, running down by the vallies, between the ridges of the hills, and uniting, form little rivulets or brooks. Many of these again meeting in one common valley, and, by gaining the plain ground, having grown less rapid, become a river; and many of these uniting, form such prodigious streams of water as the Wolga, the Danube, and the Rhone.

Thus, one part of the vapours, which is blown on the land, is returned, by the rivers, to the sea, whence it came. Another part falls into the sea before it can reach the land, which is the reason why the rivers do not return so much water into the Mediterranean as is raised by vapour. A third part falls on the low ground, and furnishes the pabulum, or nutriment of plants. But the circulation does not end even here; for it is again exhaled into vapour by the action of the sun, and returned to the great world of waters whence it first arose.

To this theory, beautiful as it appears, it has been objected, that it does not account for the origin of hot and salt springs, and that many springs, among which is a remarkable one at Upminster, in Essex, are not only perpetual, but yield the same quantity of water, whatever proportion of rain or vapour may be afforded. Amid these uncertainties, the exclamation of the apostle Paul may be aptly cited: "*O the depth of the riches both of the wisdom and knowledge of God! How unsearchable are his judgments, and his ways past finding out!*"

## AMERICAN RIVERS.

## RIVER OF THE AMAZONS.

This prince of rivers, as it is emphatically styled by Ulloa, is likewise called the Marañon, and was first navigated by Francisco Orellana, shortly after the discovery of Peru, on which account it has occasionally received the name of Orellana. As it is the largest of all known rivers, so it has its source among the Andes mountains, which, with the exception of a portion of the great Himalaya chain of Asiatic mountains recently discovered, have the greatest elevation. It forms the northern boundary of Brazil, taking its rise at an inconsiderable distance from the Pacific Ocean, and flowing in an eastern course more than twelve hundred leagues, in which progress it receives upwards of sixty considerable rivers. In some parts it divides into several branches, encompassing a multitude of islands, and at length discharges itself into the Atlantic Ocean, directly under the equatorial line, by a channel one hundred and fifty miles in breadth.

As, among the great number of roots by which nourishment is conveyed to a stately tree, it is difficult, from the length of some, and the magnitude of others, to determine precisely from which the product is derived: so has an equal perplexity occurred in discovering the spring of this transcendent river. All the provinces of Peru may be said to emulate each other in sending forth supplies for its increase; and these, together with the many torrents which precipitate themselves from the Cordilleras, or chains of the Andes, augmented by the snow and ice, join to form a kind of sea of what at first scarcely deserved the name of a river.

The sources, by which this river is increased, are so numerous, that every one which issues from the eastern Cordillera, beginning with the government of Popayan, where the river Caqueta, or Upura, originates, to the province of Huanico, within thirty leagues of Lima, the capital, may be strictly reckoned among the number. For, be it observed, all the streams which run westward from this immense chain of mountains, widening as they advance from their source by the conflux of others, form those mighty rivers which afterwards unite in that of the Amazons; and, although some traverse a larger distance from their source, still, others which rise nearer, by receiving, in their short course, a great number of brooks, and by consequently discharging a proportionate quantity of water, may be considered as having an equal claim to be called the principal source. The authors of the *Peruvian Mercury*,

whose profound inquiries on this subject have been given in the work entitled "The present state of Peru," regard, however, the Ucayali as its real trunk, observing, among other cogent reasons, that it does not yield to this river in the quantity of its waters; but, on the contrary, presents itself at the confluence with a greater breadth, and with a superiority which obliges it to change its course.

The Marañon, or river of the Amazons, issues from the lake of Lauricocha, near the city of Huanico, in the jurisdiction of Tarma, in eleven degrees of south latitude, whence it takes a southern course almost to the twelfth degree, through the country belonging to that jurisdiction, and, forming insensibly a circuit, flows eastward through the country of Juaxa. After being precipitated from the eastern side of the Cordillera, or chain, of the Andes, it proceeds northward; and, leaving the jurisdictions of Mayabamba and Chaca-poyas, continues its course to the city of Jaen, in the latitude of five degrees, twenty-one minutes. Thence, by a second circuit, it flows towards the east in a continued direction, till at length it falls into the ocean, where its mouth is of such an enormous breadth, that it reaches from the equinoctial to beyond the first degree of north latitude. Its distance from the lake of Lauricocha to Jaen, including its windings, is about two hundred leagues; and that city being thirty degrees to the west of its mouth, gives a further extent of six hundred leagues, which may, including the several circuits and windings, be moderately computed at one thousand. Thus, the whole course of this transcendent river, from Lauricocha to its influx into the ocean, is at least twelve hundred leagues.

#### RIO DE LA PLATA.

This vast river, like those already described, rises among the stupendous mountains on the western side of South America. During its course, which is said to exceed eight hundred leagues, it receives upwards of fifty rivers, and at length discharges itself into the Atlantic ocean by a very extensive mouth, its northern coast being in thirty-five degrees, and its southern in thirty-six degrees, twenty minutes, of south latitude. It was discovered, in 1515, by Don Diaz de Solis, a very skilful Spanish navigator, who had been sent to open a communication with the Moluccas, or Spice Islands, lying to the west. Having entered a river which he called Rio Janeiro, and which has since given a name to the Brazilian capital, he proceeded thence to a spacious bay, which he supposed to be the entrance of a strait communicating with the Indian ocean. On advancing fur-

ther, however, he found it to be the mouth of this river; and, being anxious to prosecute his discovery, was cut off, with several of his crew, by the natives. Being thus disheartened, the survivors returned to Europe, without having made any further attempt to explore the territory.

P. Cataneo, a Modenese jesuit, who landed at Buenos Ayres in 1749, expresses his astonishment at viewing this vast body of water. "When," he observes, "I resided in Europe, and read in books of history or geography, that the mouth of the Rio de la Plata was a hundred and fifty miles in breadth, I considered it as an exaggeration, because in this hemisphere we have not any example of such vast rivers. When I approached its mouth, I had the most vehement desire to ascertain the truth with my own eyes; and I have found the matter to be exactly as it was represented. This I deduce particularly from one circumstance. When we took our departure from Monte Video, a fort situated more than a hundred miles from the mouth of the river, and where its breadth is considerably diminished, we sailed an entire day before we discovered the land on the opposite bank of the river; and when we were in the middle of the channel, we could not discern land on either side, and saw nothing but the sky and water, as if we had been in some great ocean. Indeed, we should have taken it to be the sea; if the freshness of its water, which was turbid like that of the Po, had not satisfied us that it was a river. Moreover, at Buenos Ayres, another hundred miles up the river, and where it is still much narrower, it is not only impossible to discern the opposite coast, which is indeed very low and flat, but one cannot perceive the houses, or the tops of the steeples, in the Portuguese settlement at Colonia, on the other side of the river."

It has been asserted that most of the rivers of Peru and Chili have scarcely any motion by night, while on the appearance of the morning sun, they resume their former rapidity. This would appear to proceed from the mountain snows, which, being melted by the powerful heats, increase the stream, and continue to drive on the current, while the sun is engaged in dissolving them. Thus are formed these wonderful masses of water!

In concluding this account of the rivers of South America, the prodigious multitudes and variety of the fishes, with which they abound, ought not to be passed over unnoticed.

In the river of the Amazons, agreeable to the testimony of the Jesuit Acugna, they are so abundant, that, without any art, they may be readily taken with the hands. "In the Oroonoko," observes another Jesuit, Gumilla, "beside an infinite variety of other fishes, turtles abound in such numbers as words

cannot be found to express. I doubt not but that such as read my account will accuse me of exaggeration : but I can affirm, that it would be as difficult to count them, as to count the sands on the banks of that river. Their multitude may be estimated by the surprising consumption of them ; for all the nations contiguous to the river, and even many, dwelling at a distance, flock thither at the breeding season, and not only find sustenance during that time, but carry off great numbers both of the turtles, their eggs, &c."

#### THE MISSISSIPPI.

Proceeding to North America, this vast river claims the principal attention. It runs chiefly from North to South, receiving in its course many large rivers, scarcely inferior to the Rhine or the Danube, navigable almost from their sources, and laying open the inmost recesses of this part of the great American continent. Near the heads of these, are extensive lakes, having a communication with each other, and with the great river St. Lawrence.

The Mississippi is supposed to take its rise from three or four springs, which unite at about forty-six degrees of north latitude, and ninety-eight of west longitude. It has been ascended as high as forty-five degrees North, about one hundred and fifty miles above the FALLS OF ST. ANTHONY. Its course extends above two thousand miles, comprising its continual flexions. In a southeast direction, it proceeds till it reaches about thirty-eight degrees of north latitude ; and then takes a course almost due south, till it arrives at West Florida, where it again runs to the southeast. On the westward, near the falls of St. Anthony, it receives the river St. Pierre or St. Peter ; and in the same direction, in about forty-one degrees of north latitude, the Moingona ; receiving from the eastward the Fox river, and the Illinois, below forty degrees. A little lower, the noble Missouri runs into it from the westward, the Ohio joining it from the eastward. At thirty-three degrees, the White River and the Paniassas first join, and then pour their united streams into this grand receptacle of waters, which discharges itself into the sea by many openings.

This grand river, after being joined by the Missouri, is about six miles in width, and continues its course southerly, not any considerable stream falling into it, after the above, for between two and three hundred miles, when it is joined by the Ohio. The country on each side the Mississippi to this part, is exceedingly fine, and the climate warm and agreeable.

The navigation of the Mississippi is very tedious, even in descending, as it is not deemed safe to sail down it during the

night, the channel being constantly encumbered by floating trees, which the winds tear from its banks, and precipitate into the water. The ascent is still more difficult and tedious. Proceeding northward from its mouth, the adjacent country is one continued level spot, covered with vast forests, which so entirely intercept the winds as to cause a dead calm constantly to prevail, insomuch that, in this part it usually requires a month to navigate twenty leagues only. When these forests cease, the remainder of the navigation is obstructed by strong currents, so that boats seldom advance farther than five or six leagues in the course of the day and night. This river bounds Louisiana to the eastward; and at its mouth is the isle of Orleans, a very beautiful and fertile spot. The city of New Orleans, the capital, owed its rise to the delusions which were practised on the French nation by the celebrated projector Law. The immense wealth which was supposed to be contained in the mines of St. Barbe, in Louisiana, caused a company to be formed in France; and the national phrensy, which was long prevalent, led vast numbers to embark, for the purpose of settling on the banks of the Mississippi. Being landed in West Florida, the greater part perished through want; and the survivors were removed to this island, where the city of New Orleans was built for their accommodation.

The drift wood of the Mississippi, to which an allusion has already been made, is worthy of particular observation.

Before I speak of that immense valley, which covers an area of upwards of thirty-five thousand miles, of which one-third belongs to the territory of Missouri, I must remark that, by what has been exposed of the Mississippi river, it is evident, that whatever once escaped from its banks, never returns to them again; hence, we could form an idea of the enormous beds of timber, leaves, and other substances, which are assembled below the surface of the valley mentioned above, provided we could know how long the Mississippi has been floating them into the lower country. This inference we might found upon the quantity that we see going, without interruption, into the Achafalaya, where several hundred miles are converted into solid rafts of wood. These rafts of wood, in the course of every two or three years, disappear under the sand and leaves. This operation alternately removes the bed of the Achafalaya sometimes four or five miles to the east, or two or three to the west, but more commonly towards the east. On this side, it has gained more than 10 miles already since it has become an outlet of the Mississippi; indeed, in its length, it will soon fall into this river, and bring its mouth lower down;

for it is evident, that the Achafalaya was formerly the outlet of Red river, whose actual confluence with the Mississippi is two and three quarters of a mile from the mouth of the Achafalaya. When this was joined to the Red river, it formed a separate stream, running parallel to the Mississippi, without any communication. This communication has, however, taken place in consequence of the encroachment of the Mississippi, whose bed constantly gains on one bank or the other, substituting, on the opposite side, glarle and sand, (what is called sand beach,) and thus forming bars, some of which are one mile broad, and from three to five miles long.

I will now return to the drift wood accumulated in the Achafalaya. Lest any one should hear with incredulity of the enormous quantity of wood spread over the country, which that river every year inundates, I will give an abstract of my observations, made in 1812. Having landed at the mouth of this river, when it was at its fullest, I was surprised at the quantity of wood leaping perpetually into the shoot. I then counted the large trees entering the river, in a given time, which I found to produce more than eight thousand cubic feet per minute. The estimation, I am satisfied, was rather below than above the fact; but if we even reduce this estimate to less than one half, we shall be astonished to find what a surface of country such an accumulation of timber will cover in twenty-four hours, particularly, when we consider how much space large trees will occupy, with their limbs and roots. The reader will observe, that I have omitted to estimate the leaves, bark, reeds, &c. whose united quantity is, probably, equal to that of the wood; neither have I included the sediment of the muddy water, as discharged from the mouth of the Mississippi river, which proved, according to several elaborate experiments which I formerly made, to be equal to thirty-six cubic miles annually.

I will give a few more examples of this kind, before I change the subject; for I consider it to be of great importance. I will leave, for the observation of the Mississippi navigators, the beds of drift wood collected on the heads of the Islands, which they pass in coming down the Ohio, and more particularly the Mississippi. I will, therefore, advert to the large raft of the Red river, which is sixty miles in length, and, in many places, fifteen in breadth. On this, in some places, cedars are heaped by themselves, and in others, pines. At the foot of a hill, where nothing else grows, the flood sweeps them into a pile, where they are matted together, with their leaves and with the pods or capsules of their seeds, forming the most compact kind of rafts. If these leaves ever enter into fermentation, or any

other decomposition, this must certainly produce bituminous substances in great quantity; whilst the other kinds of wood mixed likewise, by the same cause, with a very large proportion of minute vegetables, may produce other bituminous bodies in smaller quantity; but I conceive that mineral coal would be formed in the greatest abundance, as the rafts of mixed wood are inexhaustible.

In this raft of the Red river, numerous small streams are seen to disappear under the raft, and show themselves again, after having passed several miles under the surface, and under the sand banks, which are, probably, part of the raft buried under the sand.

## ASIATIC RIVERS.

### THE GANGES.

Both in magnitude and extent, the Ganges is a most noble and majestic river. It rises in the kingdom of Thibet; entering Hindostan about the thirtieth degree of latitude, and runs first southeastward by the cities of Bikaner, Minapor, Halabes, Benares, and Patna, to Rajah Mahl, where it divides into two branches. The eastern having passed by Dakka, the capital of Bengal, enters the gulf of that name about Chatigan. The western, descending by Kossum-bazar and Hughly, falls into the gulf below Chandernagor towards Pipeli. Many of the Jews, and ancient Christians believed this river to be the Pison, one of the four mentioned in Scripture as the boundaries of the terrestrial paradise.

The length of the Ganges exceeds fourteen hundred miles. The Burrampooter, its proudest auxiliary, is nearly of the same length; and the opinion generally entertained, is, that the sources of these mighty rivers are not far distant from each other. Each of them runs, however, nearly a thousand miles, before they unite and constitute one common stream, falling into the bay of Bengal by several mouths. Ganga is, in the Hindostan language, a general term for a river; but it is particularly applied to this one on account of its unrivalled magnificence. The Hindoos have a superstitious veneration for all the great rivers which fertilize their country; but the waters of the Ganges are to them peculiarly sacred. In its impetuous course it opens a passage through Mount Himmeleh, and again appears, amidst impending rocks, which resembling, on an immense scale, the head of a cow, an animal equally esteemed by the Hindoos, as was the apis, or sacred ox, among the Egyptians, their religious awe for the Ganges, is, on that account, enhanced. Not any river in the world imparts great-



er benefits to the countries through which it passes ; for, by annually overflowing its banks like the Nile, it waters and manures the country to an extent of an hundred miles in breadth. The Hindoos, having deified this river, make it an act of their religion to perform a pilgrimage to it, supposing its waters to purify from defilement such as bathe in them. On its slimy shore they bury their dead, and also remove those who are at the point of death to its banks, or to those of some one of the creeks which run into it.

On certain festivals, a concourse of upwards of a hundred thousand persons assemble to bathe in the Ganges, on the banks of which, are a great number of superb and immensely rich pagodas. But what principally distinguishes this river, besides its greatness and rapidity, is the gold it brings down in its sands, and throws on its banks ; and the precious stones and pearls it produces, not only in itself, but in the Gulf of Bengal, into which it discharges its waters, and which abounds with them. The Chun, or Jemma, the Guderasu, the Perilis, Lakia, and several other rivers, discharge themselves into it during its course.

#### THE INDUS.

This river is by the natives called Sinde or Sindet, and in the Sancrit language Seendho. It is likewise denominated Nilab, or the blue river. Its source has not been accurately traced ; but it is generally supposed to originate in the mountains of Mus Tag, running from east to west, and forming a chain to the south of Little Bucharia. Having flowed for an extent of upwards of a thousand miles, it forms a Delta in the province of Sinde, and enters the Indian Sea by numerous mouths.

The tributary streams of the Indus chiefly join it in the northern part of its course, where they form the Panja, or country of five rivers. From the west, the Kamet, with its auxiliary streams, and the Comul, flow into it ; from the east, the Bahut, or Hydaspes ; the Chunab, or Acesinas ; the Kauvee, or Hydraotes ; and the Setleg, or Hesudrus. The whole of this part of Hindostan is at present but little known : much is, however, expected from the indefatigable researches of the members of the Asiatic Society. It is even uncertain whether the Caggan, a considerable and distant river to the east, joins the Indus, or falls into the gulf of Cutch.

Mr. Elphinstone, in his account of the kingdom of Caubul, introduces the following interesting account of the Indus :—

“ We were anxious and happy as we approached the river, and were not a little gratified when at last we found ourselves

upon its banks. The Indus, besides its great name, and the interest it excites as the boundary of India, is rendered a noble object by its own extent, and by the lofty hills which form the back ground of the view.—We were, however, a little disappointed in its appearance, owing to an island, which divided it, and impaired the effect of its stream. There were other islands and sand banks in the river; but near the side where we stood, it came up to the edge, and seemed deep and rapid. While on the banks of the river, we met a native, to whose conversation, and that of the guide, we listened with great interest and curiosity. The plains on the opposite shore we found were inhabited by Beloches, and the mountains by the Sheeraunees, a fierce and turbulent tribe. On the other side of the range were tribes and places, of which we had never heard the names; while those we had learned from our maps, were equally new to our informants. All we could learn was, that beyond the hills was something wild, strange, and new, which we might hope one day to explore.

“From Oodoo da Kote, near which we first saw the Indus, to the ferry of Kaheree, where we crossed it, is about seventy-five miles. It is a narrow tract contested between the river and the desert. If, in hunting, we were led many miles to the west of the road, we got into branches of the river, and troublesome quicksands, among thickets of tamarisk or of reeds; and, if we went as far to the right, the appearance of sand, and even in some places of sand hills, admonished us of the neighbourhood of the desert. Many parts, however, were cultivated with great pains and method, and produced good crops of wheat, barley, turnips, and cotton. The fields were always enclosed, either with hedges of dry thorn, with hurdles of willow, or with fences, made of stiff mats of reeds supported by stakes. Some of the houses near the river attracted our attention, being raised on platforms, supported by strong posts, twelve or fifteen feet high. We were told they were meant to take refuge in, during the inundation, when the country for ten or twelve coss, (twenty or twenty-four miles,) from the banks, was under water.”

Besides the above majestic rivers, those principally deserving of notice in the Asiatic territory are the following.

The EUPHRATES, which has two sources; one of these is about seventy miles from the shores of the Euxine or Black Sea, and, taking a circuitous course of five hundred leagues, first to the southwest, and then to the southeast, discharges itself into the Persian gulf. About a hundred miles to the northwest of Bassora, it is joined by the TIGRIS, which, rising in its vicinity, proceeds in a nearly straight course through Ar-

menia Major, or Turcomania, until it forms its junction. On this river, the ancient city of Nineveh is supposed to have stood. The KISTNA, a stream peculiarly sacred, rises at Bailsur, not far to the south of Poonah, and is equally celebrated for the fertility it diffuses, and for the rich diamond mines near which it flows, particularly those of Visiapour and Golconda. The CAVERY passes by Seringapatam, the capital of Mysore, forming an immensely wide Delta, or triangle, and entering the sea after a course of about three hundred miles.

In the enormous extent of the Chinese Empire there are two rivers which are rendered particularly interesting by their great length and majestic breadth. These are the Hoang-ho, or Yellow River, and the Kian-ku.

### AFRICAN RIVERS.

#### THE NILE.

————— with annual pomp,  
Rich king of floods! o'erflows the swelling Nile.

THOMSON.

This celebrated river is likewise called Abanchi, signifying in the Abyssinian tongue, "the father of rivers," and is named by the Africans Neel Shem, the Egyptian river. It divides Egypt into two parts; and its extent, from its source, is supposed to exceed two thousand miles. It arises from amidst the mountains of the moon, in Upper Ethiopia, and flows into the Mediterranean Sea by seven channels, two only of which are at present navigable. The ancients were entirely ignorant of the source of this river, although many endeavours were made by them to explore it; but it is now well known to lie in about the twelfth degree of north latitude. It enters the lake of Dambia, in Abyssinia, crossing one of its extremities with such extreme rapidity, that its waters may be distinguished through a progress of six leagues within this lake. Here its magnificence commences: after a further progress of about fifteen miles, it rushes precipitately from the summit of a high rock, forming one of the most beautiful water-falls known. It now again collects its scattered streams among the rocks, which seem to be disjointed in that part merely to afford it a passage. They are so close to each other, that a bridge of beams was once laid over them to afford a passage to an army; and Sultan Segued built over them a bridge of one arch, to construct which, he procured masons from India.

The greater part of Lower Egypt is contained in a triangular island, formed by the Mediterranean Sea, and the two great branches of the Nile—which dividing itself five or six

miles from Old Cairo, flows on the one side to the northeast, falling into the sea at Damietta; while the other branch runs to the northwest, and enters the sea at Rosetta. What is called the Delta, resembling the Greek letter of that name, and constituting a triangle, is thus formed.

The water of the Nile is thick and muddy, more particularly when the river is swollen by the heavy rains, which constantly fall within the tropics in the beginning of the summer-season, and which are doubtless the principal cause of its overflowing the low lands of Egypt. A similar phenomenon in the Ganges has been noticed above; and it is the same with all the rivers, which have either their rise or course within the tropics; they annually break their bounds, and cover the lands for many miles on each side, before they reach the sea. They likewise leave prolific mud, which, like that of the Nile, fertilizes the land; beside which, the north winds prevailing about the latter end of May, drive in the waters from the sea, and keep back those of the river, in such a manner as considerably to assist the swell.

The Egyptians, and the Copts more especially, are persuaded that the Nile always begins to rise on the same day of the year; as, indeed, it generally commences on the 18th or 19th of June. Its rise was observed for three successive years by Dr. Pococke, who found it to ascend during the first five days from five to ten inches; and it thus continued rising till it had attained the height of nine feet, when the canal of Cairo was cut. It then rose from three to five inches only in the day; for, having spread over the land, and entered the canal, although more water might have descended than before, its rise was less considerable. The other canals were now laid open at stated times, and those which water the lower grounds, the last. These canals are carried along the highest parts of the country, to the end that the water may be conveyed to the valleys.

The Nile has one peculiar characteristic. Other rivers being supplied by rivulets, the ground is lowest near their banks; but as not any water flows into the Nile in its passage throughout Egypt, and as it is necessary that this river should overflow the land, the country is generally lower at a distance from, than near to it; and, in most parts, the land has a gradual descent from the river to the foot of the hills, which terminate the sandy plains most benefitted by the irrigation.

Among other remarkable appearances, the celebrated Bruce notices a very singular one attendant on the inundation of the Nile. In Abyssinia, the early part of the morning is constantly clear in that season, with a fine sunshine. About nine, a

## LAKES.

## AMERICAN LAKES.

The northern parts of this division of the globe are distinguished by their numerous and immense lakes, the five principal of which lie either wholly, or chiefly, in the two Canadian provinces: these are the lakes SUPERIOR, HURON, ONTARIO, ERIE, and MICHIGAN. These vast assemblages of fresh water, which are neither put in motion, nor alternately raised and sunk, by tides, are supposed to contribute very considerably to the greater degree of cold felt in the northern parts of America, than in the same parallels of latitude in Europe. They are situated within about seven degrees of latitude, and fourteen of longitude, or from  $41^{\circ} 35'$  to  $49^{\circ}$  north, and from  $75^{\circ} 20'$  to  $92^{\circ}$  west.

## LAKE SUPERIOR.

This great North American Lake is justly entitled to the distinguished name it bears, not only because it is the largest expanse of fresh water in the known world, surpassing in magnitude the Asiatic salt water lake improperly denominated "the Caspian Sea," but because it has a much greater elevation than the other lakes of that country, the level of its waters being several hundred feet higher than the river St. Lawrence. Its circumference is estimated at about fifteen hundred miles; but it has been observed by an intelligent navigator, Carver, that, "if it were coasted round, and the utmost extent of each of the bays taken, it would exceed sixteen hundred!" He coasted nearly twelve hundred miles on the north and eastern shores. "When it was calm," he observes, "and the sun shone bright, I could sit in my canoe, where the depth was upwards of six fathoms, and could plainly see huge piles of stones at the bottom. The water at this time was pure and transparent as the air, and my canoe seemed as if it hung suspended in that element. It was impossible to look attentively, through this limpid medium, at the rocks beneath, for even a few minutes, without feeling the head swim, and the eyes no longer able to view the dazzling scene. This occurred in the month of July; and, although the surface of the water, from the heat of the atmosphere, was warm, still, on letting down to the depth of about a fathom, the water drawn thence was so excessively cold, that it had nearly the same effect as ice, when taken into the mouth.

Lake Superior is said to receive nearly forty rivers and streams of water; the two principal rivers are the Alanipegon, from the north, and the Michipicooton, from the west.

By the means of the latter, a communication is established with the lakes of Bourbon, Winnipeg, and Du Bois; and in this river the source of the St. Lawrence is said to have been traced. A small river on the west, before it enters the lake, has a perpendicular fall from the top of a mountain of more than six hundred feet, through a very narrow channel. In this lake, which has one passage only, St. Mary's strait, for the discharge of its waters, there are many islands, two of which are of great extent. The largest of them, Isle Royal, is nearly a hundred miles from east to west, and about forty miles from north to south. Miropau Isle is likewise of considerable extent; and, at the entrance of West Bay, is a cluster of small islands, called, "The twelve Apostles." On the south side of the lake, is a peninsula, which spreads into the lake sixty miles.

#### LAKE HURON.

This lake is next in magnitude to the one described above, being about a thousand miles in circumference. Its shape is nearly triangular; and on its north side, is an island nearly an hundred miles in extent from east to west, and about eight from north to south: it is called by the Indians, *Manataulin*, which signifies the abode of spirits. At the west point of the lake, are the straits of *Michillimackinac*, which unite with lake Michigan; and about fifty miles to the northeast of these straits, are those of St. Mary, by which lake Huron communicates with lake Superior. They are about forty miles in length, and have falls, which are not, however, perpendicular, like those of Niagara, but the waters of which pass along a sloping bottom, and are, on that account, named THE RAPIDS. These are about three quarters of a mile in length, but not so impetuous as entirely to obstruct the navigation downward. The southern point of lake Huron runs into a strait, which soon after enlarges into a small lake called St. Clair, from which runs another strait, named Detroit. The latter discharges itself into lake Erie, the distance between which and lake Huron is eighty miles.

#### ASIATIC LAKES.

##### LAKE ASPHALTITES.

This Lake is more usually known by the name of the **DEAD SEA**. It lies in Palestine, and is about fifty miles in length, and twelve or thirteen in breadth. It is surrounded by lofty mountains, and receives the river Jordan. It covers the ground, *in which stood the cities of Sodom and Gomorrah, buried, ac-*

Lago Maggiore, in the Duchy of Milan, is a most extraordinary lake, sixty miles in length, and six in its general breadth, with a depth of eight fathoms in the centre. It is surrounded on every side with hills covered with vineyards; and along its banks are rows of fine trees, and walls arched with vine branches. This enchanting prospect is heightened by several large natural cascades falling from the mountains. At the part where it widens into a bay, appear the two celebrated islands named Isola Bella, and Isola Madre, which have been compared to two pyramids of confectionary, adorned, with green festoons and flowers. At one extremity of the garden of Isola Bella, are ten terraces, the perpendicular height of which, taken collectively, is more than two hundred feet above the level of the water of the lake. These terraces decrease proportionably in their circuit, as they rise toward the top of the hill, where an oblong area, paved with fine stone, and surrounded with a balustrade, affords a most delightful prospect. Isola Madre has seven terraces, which are high, but sloping, and at a considerable distance from each other, on which account it appears to be lower than Isola Bella, although the terraces have been planned of an equal height. Nature was, perhaps, never so successfully aided by the decorations of art, as in the disposition of the gardens and ornaments with which these islands, so beautiful in themselves, are embellished.

## CATARACTS AND CASCADES.

### FALLS OF NIAGARA.

[See Plate, No. 12.]

The river Niagara, in Upper Canada, takes its rise in the eastern extremity of Lake Erie, and, after flowing for twelve leagues, empties itself into Lake Ontario. Its breadth is nine hundred feet, and its depth very considerable; but its current is so exceedingly strong and irregular, and its channel so frequently interspersed with rocks, that it is navigable for small boats only. Proceeding lower, the stream widens, and the rocks gradually recede from the view, and the current, though strong, is smooth and regular. At fort Chippeway, however, situated one league above the cataracts, the scene is again changed, and the river so agitated, that a boat would be inevitably dashed in pieces, were it permitted to pass Fort Niagara, situated on its bank. So impetuously do the waves break among the rocks, that the mere sight of them, from the adjacent shore, is sufficient to strike terror in the spectator. As it approaches the falls, the stream rushes along, with redoubled fury, until it reaches the edge of the stupendous precipice,

when it tumbles suddenly to the bottom, without meeting with any obstruction in its descent. Precisely at this place, the river strikes off to the right, and the line of cataracts winds obliquely across, instead of extending, in the shortest direction, from the one bank to the other. It ought to be observed, that the water does not precipitate itself down the vast abyss in one entire sheet, but, being separated by islands, forms three distinct collateral falls.

One of these is called **THE GREAT, or HORSE-SHOE FALL**, from the similarity of its form to that of a horse-shoe. It is situated on the northwest extremity of the river, and is most deserving of the attention of the spectator, as its grandeur is evidently superior to that of the adjacent cataracts, although its height may be considerably less. As the extent of this fall can be ascertained by the eye only, it is impossible precisely to describe its limits; but its circumference is generally computed at one thousand eight hundred feet, somewhat more than one third of a mile. Beyond the intervening island, the width of which may be equal to one thousand and fifty feet, is **THE SECOND FALL**, about fifteen feet wide; and at the distance of ninety feet, occupied by the second island, is situated **Fort Scloper fall**, so called from its proximity to that fort. The dimensions of this cataract, may be reckoned equal to those of the large island; so that the entire extent of the precipice, including the intermediate islands, is four thousand and five feet; a computation which certainly does not exceed the truth. The quantity of water precipitated from the falls is prodigious; and agreeably to a late estimate, amounts to *six hundred and seventy thousand, two hundred and fifty tons per minute.*

From the eminence entitled "the Table rock," the spectator has a fine prospect of the terrific **RAPIDS**, above the falls, and of the surrounding shores, embellished with lofty woods. He there sees to advantage the adjacent **HORSE-SHOE FALL**; and the dread abyss, into which he may look perpendicularly from the edge of the rock, if his courage be equal to his curiosity. The immensity of the various objects which here present themselves to the view, infallibly overwhelms a stranger with astonishment, and several minutes must elapse before he can possibly collect himself sufficiently to form any just conception of the awful and magnificent scene before him, which requires, that all its component parts should be separately examined, and which affords so truly surprising an exhibition, that persons who have resided in its vicinity for several years, and who have been constantly habituated to its sublimity, *ingenuously acknowledge, at their last visit, that they were never able before to discover its peculiar grandeur.*



From a cliff nearly opposite to one extremity of **FORT SCLOPER CATARACT**, the falls are seen in a very interesting point of view: the scenery there, it is true, is less magnificent, but is infinitely more beautiful than from any other station. For several miles beneath the precipice, the river is bounded, on either side, by steep and lofty cliffs, composed of earth and rocks, which in most parts are perpendicular. The descent to the bottom of the falls, is here accomplished by two ladders, formed of long pine trees, with notches on their sides, on which the traveller rests his feet, and passes down amidst a variety of huge misshapen rocks and pendant trees, which seem to threaten him with instantaneous destruction. The breadth of the river in this part is about two furlongs; and towards the right, on the opposite side, **FORT SCLOPER FALL** appears in a very advantageous point of view. About one half of the **HORSE-SHOE FALL** is concealed by the projecting cliff, but its partial prospect is extremely fine. The bottom of the former of these falls, is skirted with a beautiful white foam, which ascends from the rock in thick volumes, but does not rise into the air like a cloud of smoke, as is the case with that of the latter fall, although its spray is so considerable, as to descend like a shower of rain, near the second ladder, on the opposite side of the river. On its brink, and along the strand, to the **GREAT FALL**, are to be constantly seen shattered trees and bodies of animals, which have been carried away by the extreme violence of the current.

The colour of the water of the cataracts, as it descends perpendicularly on the rocks, is occasionally a dark green, and sometimes a foaming brilliant white, displaying a thousand elegant variations, according to the state of the atmosphere, the height of the sun, or the force of the wind. A portion of the spray, resulting from the falls, frequently towers above the height, and literally mingles with the clouds: while the remainder, broken in its descent by fragments of rocks, is in continual agitation. The noise, irregularity, and rapid descent of the stream, continue about eight miles farther; and the river is not sufficiently calm to admit of navigation, till it reaches **Queen's-town**, on the west side of the straits of **Niagara**, and nine miles distant from the falls.

To attempt an adequate description of them, would be a fruitless task. Their wondrous reality puts to flight the most sublime ideas of anticipating fancy, and overpowers the soul of an intelligent spectator, with such enthusiastic feelings as can never be rightly conceived, unless by those who have, on *some* occasion, contemplated a similar scene.

## FALLS OF THE MONTMORENCY.

The Montmorency empties itself at the distance of about eight miles northeast of Quebec, into the great river St. Lawrence, to the coast of which it gradually descends from the elevated mountain on which it has its source. At a station called La Motte, situated on the northern extremity of a sloping round, its waters diffuse themselves into shallow currents, interrupted by rocks which break them into foam, and accompanied by murmuring sounds, which enliven the solitude and solemn stillness prevailing throughout the surrounding forests and desolate hills. Farther down, its channel is bounded by precipitous rocks, its breadth becoming extremely contracted, and the rapidity of its current proportionably augmented. At a place called "the natural steps" there are several beautiful ascades of ten or twelve feet. These steps, which are extremely regular, have been gradually formed by the accession of waters the river receives in its progress, at the breaking up of winter, by the melting of the snows. From the middle of April to the end of May, its waters roll with increasing height and rapidity. Being powerfully impelled in their course, they insinuate themselves between the strata of the horizontal rock, vast fragments of which are detached by the rushing violence of the sweeping torrent.

On the eastern side, the bank, which is almost perpendicular, and fifty feet high, is surmounted by lofty trees. The outhwest bank rises beyond the steps, and terminates in a precipice. On the opposite side, the bank is regular, and of a singular shape, resembling the ruin of an elevated wall. The trees, by which the banks are enclosed, united with the effect produced by the foaming currents, and the scattered masses of stone, form a scene wild and picturesque. The stream now taking a southern direction, is augmented in its velocity, and forms a grand cascade interrupted by huge rocks. A quarter of a mile further down, a similar effect is produced. After exhibiting an agreeable variety through its course, the river is precipitated, in an almost perpendicular direction, over a rock two hundred and fifty feet in height. Wherever it touches the rock, it falls in white clouds of rolling foam; and beneath, where it is propelled with uninterrupted gravitation, it forms numerous flakes, like wool or cotton, which are gradually protracted in the descent, until they are received into the boiling profound abyss beneath.

The effect from the summit of the cliff is awfully grand, and truly sublime. The prodigious depth of the descent of the waters of this surprising fall; the brightness and volubility of their

course ; the swiftness of their movement through the air ; and the loud and hollow noise emitted from the basin, swelling with incessant agitation from the weight of the dashing waters, forcibly combine to attract the attention, and to impress the mind of the spectator with sentiments of grandeur and elevation. The clouds of rising vapour, which assume the prismatic colours, contribute to enliven the scene. They fly off from the fall in the form of a revolving sphere, emitting with velocity pointed flakes of spray, which spread in receding, until they are interrupted by the neighbouring banks, or dissolved in the atmosphere.

The breadth of the fall is one hundred feet ; and the basin, which is bounded by steep cliffs, forms an angle of forty-five degrees. When viewed from the beach, the cataract is seen, with resplendent beauty, to flow down the gloomy precipice, the summit of which is crowded with woods. The diffusion of the stream, to the breadth of fifteen hundred feet, and the various small cascades produced by the inequalities of its rocky bed, on its way to the river St. Lawrence, display a very singular and pleasing combination.

#### THE TUCCOA FALL.

This fall, in Franklin county, Georgia, is as yet scarcely known to the best informed of our geographers, and is, notwithstanding, one of the most beautiful that can be conceived. It is much higher than the great fall of Niagara ; and the water is charmingly propelled over a perpendicular rock. When the stream is full, it passes down the steep in one expansive sheet, magnificent to behold.

#### FALLS OF THE MISSOURI.

The most prominent features of this great American river, which is fed by so many streams, having their sources in a great variety of soils and climates, are its wonderful falls, rapids, and cascades, the following connected view of which, is abstracted from the very accurate draught and survey made by Captain Clarke.

This river is nine hundred feet wide at the point where it receives the waters of Medicine river, which is four hundred and one feet in width. The united current continues five thousand four hundred and twelve feet, somewhat more than a mile, to a small rapid on the north side, from which it gradually widens to four thousand two hundred feet, and at the distance of nine thousand and forty-two feet, (nearly a mile and three-fourths,) reaches the head of the Rapids, narrowing as it approaches them. Here the hills on the north, which had

withdrawn from the bank, closely border the river, which, for the space of a mile, makes its way over the rocks with a descent of thirty feet : in this course, the current is contracted to sixteen hundred and forty feet, and, after throwing itself over a small pitch of five feet, forms a beautiful cascade of twenty-six feet five inches ; this does not, however, fall immediately perpendicular, being stopped by a part of the rock, which projects at about one-third of the distance. After descending this fall, and passing the Cotton-wood island, on which the eagle has fixed its nest, the river goes on for eight thousand seven hundred and seventy-eight feet (more than a mile and a half) over rapids and little falls, the estimated descent of which is thirteen feet six inches, till it is joined by a large fountain boiling up underneath the rocks near the edge of the river, into which it falls with a cascade of eight feet. It is of the most perfect clearness, and rather of a bluish cast ; and even after falling into the Missouri, it preserves its colour for half a mile. From this fountain the river descends with increased rapidity for the distance of three thousand five hundred and thirty-one feet, during which the estimated descent is five feet : from this, for a distance of two thousand two hundred and twenty-seven feet, the river descends fourteen feet seven inches, including a perpendicular fall of six feet seven inches. The river has now become pressed into a space of one thousand four hundred and nineteen feet, and here forms a grand cataract, by falling over a plain rock, the whole distance across the river, to the depth of forty-seven feet eight inches : after recovering itself, the Missouri then proceeds with an estimated descent of three feet, till, at the distance of sixteen hundred and eighty-three feet, it again is precipitated down the crooked falls of nineteen feet perpendicular ; below this, at the mouth of a deep ravine, is a fall of five feet, after which, for the distance of sixteen thousand and five feet, (upwards of three miles,) the descent is much more gradual, not being more than ten feet, and then succeeds a handsome level plain for the space of two thousand nine hundred and thirty-seven feet, (more than half a mile,) with a computed descent of three feet, making a bend towards the north. Thence it descends, during seven thousand nine hundred and twenty feet, about eighteen feet and a half, when it makes a perpendicular fall of two feet, which is fourteen hundred and eighty-five feet beyond the great cataract, in approaching which it descends thirteen feet, within a distance of about six hundred feet, and gathering strength from its confined channel, which is only eight hundred and forty feet wide, rushes over the fall to the depth of eighty-seven feet and three quarters of an inch. After *raging among the rocks*, and losing itself in foam, it is compress-

ed immediately into a bed of two hundred and seventy-nine feet in width ; it continues for five thousand six hundred and ten feet to the entrance of a run or deep ravine, where there is a fall of three feet, which, joined to the decline of the river during that course, makes the descent six feet. As it goes on, the descent, within the next three thousand nine hundred and sixty feet, is only four feet ; from this, passing a run or deep ravine, the descent for one thousand six hundred feet is thirteen feet ; within three thousand nine hundred and sixty feet, is a second descent of eighteen feet ; thence two thousand six hundred and forty feet further, is a descent of six feet ; after which, to the mouth of Portage creek, a distance of four thousand six hundred and twenty feet, the descent is ten feet.—From this survey and estimate, it results, that the river experiences a descent of three hundred and fifty-two feet in the course of two or three quarter miles, from the commencement of the rapids, to the mouth of Portage creek, exclusive of almost impassable rapids which extend for a mile below its entrance.

#### CATARACTS OF THE NILE.

This celebrated river, through its long and fertile range of about two thousand British miles, in winding through abrupt and precipitous countries, exhibits very considerable cataracts, ten or twelve of which, having a descent of more than twenty feet, occur, before it reaches the level of Egypt. The one, which, by way of eminence, is called the CATARACT OF THE NILE, was visited by Mr. Bruce, from whose relation the following particulars are extracted.

At the distance of half a mile beneath the cataract, the river is confined between two rocks, over which a strong bridge of a single arch has been thrown, and runs into a deep trough, with great roaring, and an impetuous velocity. On ascending, the cataract presents itself amid groves of beautiful trees, and exhibits a most magnificent and stupendous sight, such, as Mr. Bruce observes, ages, added to the greatest length of human life, could not efface, or eradicate from his memory. It struck him with a kind of stupor, and total oblivion of where he was, as well as of every sublunary concern. At the time of his visit, the river had been considerably increased by rains, and fell in one sheet of water, above half an English mile in breadth, and to the depth of at least forty feet, with a force and noise which were truly terrific, and which, for a time, stunned him, and made him giddy. A thick fume, or haze, covered the fall in every part, and hung over the course of the stream both above and below, marking its track, although the waters were not seen. The river, although much swollen, preserved its

tural clearness, and fell, partly into a deep pool, or basin, in the solid rock, and partly in twenty different eddies to the very bottom of the precipice. In falling, a portion of the stream appeared to run back with great fury on the rock, as well as forward in the line of its course, raising waves, or violent ebullitions, which chafed against each other.

## CATARACT OF THE MENDER.

The cataract which constitutes the source of this river, the remainder of the ancients, is thus beautifully described by Victor Clarke. "Our ascent, as we drew near to the source of the river; became steep and rocky. Lofty summits towered above us, in the greatest style of Alpine grandeur; the torrent, in its rugged bed below, all the while foaming on our left. Presently we entered one of the sublimest natural amphitheatres the eye ever beheld; and here the guides desired us to halt. The noise of waters silenced every other sound. Huge jagged rocks rose perpendicularly, to an immense height; whose sides and fissures, to the very clouds, concealing their tops, were covered with pines. These grew in every possible position, among a variety of evergreen shrubs; and enormous pine-trees waved their vast branches above the torrent. As we approached its deep gulf, we beheld several cascades, all in foam, pouring impetuously from chasms in the naked face of a perpendicular rock. It is said the same magnificent cataract continues all seasons of the year, wholly unaffected by casualties of rain or melting snow. Having reached the chasms whence the torrent issues, we found, in their front, a beautiful natural basin, six or eight feet in depth, serving as a reservoir for the water during the first moments of its emission. It was so clear that the minutest object might be discerned at the bottom. The copious overflowing of this reservoir causes its appearance, to a spectator below, of different cascades, falling to the depth of about forty feet, but there is only one source. Behind are the chasms whence the water issues. We entered one of these, and passed into a cavern. Here the water appeared, rushing with great force, beneath the rock, towards the basin on the outside. The whole of the rock about the source was covered with moss; close to the basin grew hazel and plane-trees; above were oaks and pines; and all beyond naked and fearful precipice."

## CATARACT OF SAVOY.

In SAVOY, the Arvo flows many miles between high, craggy, and inaccessible rocks, which appear to have been purposely cleft to give its waters a free passage. The surprising

echoes and continual sounds occasioned by its stream, the trampling of the horses and mules, the hallooing of passengers, &c.—are, in these places, reverberated three, four, and even in some parts, six or seven times, with a noise so deep and wild, as to strike with terror the traveller who is unaccustomed to them; and the firing of a gun or pistol, is there more terrible than the loudest claps of thunder. A steep precipice, with monstrous impending rocks, which seem ready to fall, joined to the roaring of the river, add largely to the general sublimity. The cataracts of this river are more or less loud and terrible, in proportion as the waters are more or less swollen by the melting snows, with which the tops of the mountains are covered. One in particular, called the *NUN OF ARPENA*, falls from a prodigiously high rock with great noise and violence: its descent is said to exceed eleven hundred feet.

#### CATARACT IN DALMATIA.

In DALMATIA, the river Cettina forms a magnificent cascade, called by the inhabitants *VELICA GUBAVISA*, to distinguish it from a less fall a little below. The waters precipitate themselves from a height of above one hundred and fifty feet, forming a deep majestic sound, which is by the echo resounding between the steep and naked marble banks. Many broken fragments of rocks, which impede the course of the river after its fall, break the waves, and render them still more lofty and sonorous. By the violence of the re-percussion, their froth flies off in small white particles, and is raised in successive clouds, which are scattered, by the agitation of the air, over the valley. When these clouds ascend directly upward, the inhabitants expect the noxious southeast wind called the *si-rocco*.

The fall of the *Staub-Bach*, in the valley of *Lauterbrannen*, is estimated at nine hundred feet of perpendicular height; and about a league from *Scaffhausen*, at the village of *Lauffen*, in Switzerland, is a tremendous cataract of the Rhine, where that river precipitates itself from a rock said to be seventy feet in height, and not less than four hundred and fifty feet in breadth.

In Sweden, Near *Gottenburgh*, the river *Gotha* rushes down from a prodigiously high precipice into a deep pit, with a dreadful noise, and with such amazing force, that the trees designed for the masts of ships, which are floated down the river, are usually turned upside down in their fall, and shattered in pieces. They frequently sink so far under water, as to disappear for a quarter of an hour, half an hour, and sometimes for three quarters of an hour. The pit into which the torrent

precipitates them, is of a depth not to be ascertained, having been sounded with a line of several hundred fathoms without the bottom being found.

## PASSAICK FALLS.

[See Plate, No. 13.]

In addition to the stupendous North American cataracts already described, may be noticed the one formed by the river Passaick, which discharges itself into the sea at the northern extremity of the State of New Jersey. About twenty miles from the mouth of this river, where it has a breadth of about a hundred and twenty feet, and runs with a very swift current, it reaches a deep chasm or cleft, which crosses its channel, and falls about seventy feet perpendicular in one entire sheet. One end of the cliff is closed up, and the water rushes out of the other with incredible rapidity, in an acute angle to its former direction, and is received into a large basin. It thence takes a winding course through the rocks, and spreads again into a very considerable channel. The cleft is from four to twelve feet in breadth, and is supposed to have been produced by an earthquake. When this cataract was visited by a late British traveller, the spray formed two beautiful rainbows, primary and secondary, which greatly assisted in producing as fine a scene as the imagination can conceive. It was heightened by another fall, though of less magnificence, about ninety feet above. The falls of St. Anthony, on the river Mississippi, descend from a perpendicular height of thirty feet, and are nearly eight hundred feet in width, while the shore on each side is a level flat, without any intervening rock or precipice.

## SPRINGS AND WELLS.

## SAINT WINIFRED'S WELL.

HOLYWELL, in Flintshire, is famous for ST. WINIFRED'S Well, one of the finest springs in the world. On account of the sanctity in which it was holden, it gave name to the town. This well pours out, each minute, *twenty one tons of water*, which, running to the middle of the town, down the side of a hill, is made use of by every house as it passes, after which it turns several mills, and is employed in various manufactures, which greatly increase the population of the place, and its neighbourhood. Over the spring, where a handsome bath has been erected, is a neat chapel, supported by pillars, and on the windows are painted the chief events of St. Winifred's, or, as *was anciently written*, Wenefrede's life. About the well



grows moss, which the ignorant and superstitious devotees most stupidly imagine to be St. Winifred's hair. This saint is reported to have been a virgin Martyr, who lived in the seventh century, and, as the legend says, was ravished and beheaded in this place by a pagan tyrant; the spring having miraculously risen from her blood. Hence this bath was much frequented by Popish pilgrims out of devotion, as well as by those who came to bathe in it for medicinal purposes. Mr. Pennant says, "the custom of visiting this well in pilgrimage, and offering up devotions there, is not yet entirely laid aside: in the summer, a few are to be seen in the water, in deep devotion, up to their chins for hours, sending up their prayers, or performing a number of evolutions round the polygonal well."

It might have been supposed, that the present enlightened age would have been secure against a repetition of impostures of this kind; but Doctor Milner, a Catholic Bishop, of Wolverhampton, has taken much pains to persuade the world that an ignorant proselyte, of the name of Winefrid White was there cured of various chronic diseases, so late as the year 1804, by a miracle. Sir Richard Phillips, having, in the Monthly Magazine, referred this pretended miracle to the known effect of strong faith on ignorant minds, in any proposed means of cure, has been attacked by the catholic clergy for his incredulity; but in number 302 of the Monthly Magazine, he replies in the following words.

"We have no doubt whatever that Winefrid White was cured by her journey to Holywell, and by bathing in the wonderful natural spring at that place; but we are not credulous enough to believe that her cure was effected by any antagonist properties of the water to the cause of her disease—not impious enough so to sport with ETERNAL OMNIPOTENCE as to assert that a capricious suspension of the laws of Nature took place for this purpose. On the contrary, we believe that the poor woman was cured by causes well known to every medical practitioner, and proved in hundreds of recorded instances; that is to say, by her faith in the means proposed for her cure, wrought to the highest pitch by her religion, and by the assurances of those to whom she was accustomed to defer. We think, nevertheless, that the publication of this '*Case of Winefrid White*,' savours strongly of religious empiricism, and is exactly analogous to the '*cases of cure*' which we every day see advertised in all the newspapers. We refrain from treating the subject theologically, yet it appears to us that *Matthew, chap. 24, verse 24*, proves that '*signs and wonders*' are not only no evidence of divine interposition, but may be used

'false prophets, so as to deceive the very elect.' The absence of miraculous powers will be found, we suspect, and on other circumstances than the date of the year. It disappears wherever the printing-press begins to be free, and, by its agency, fixes all the circumstances that attend; and they still continue to flourish wherever the existence of the circumstances depends, for any period, on tradition. Miracles are, therefore, performed in abundance in our days, among the Negroes, the Hottentots, the Indians, the Tartars, the South Sea Islanders, and the Inhabitants of the two Americas. The last we believe on record is to be found in the Hon. M. Elphinstone's published *Embauchery to Caubul*, in 1808: he states that the sick were carried on many days' journey; and, at page 28, he says, 'some of us could raise the dead; and there was a story current that we had made and animated a wooden ram at Moolat that we had sold him as a ram; and that it was not till the chaser began to eat him, that the material of which he was made was discovered.'—We forbear," says Sir Richard, to discuss the subject further."

## WIGAN WELL.

At a mile from Wigan in Lancashire, is a spring, the water of which burns like oil. On applying a lighted candle to the surface, a large flame is suddenly produced, and burns vigorously. A dish full of water having been taken up at the place, the flame issues, and a lighted candle held to it, goes out; notwithstanding which, the water in this dish rises up like water in a pot on the fire, but does not grow warm on introducing the hand. What is still more extraordinary, on making a dam, and preventing the flowing of water to the ignited part, that which was already there has been drained away, a burning candle being applied to the surface of the dry earth at the same point where the water was burned, the fumes take fire, and burn with a resplendent light, the cone of the flame ascending a foot and a half from the surface of the earth. It is not discoloured like that of sulphur bodies, neither has it any manifest smell, nor do the fumes in their ascent, betray any sensible heat. The latter probably consist of inflammable air, or hydrogen gas; it ought to be observed, that the whole of the country round Wigan, for the compass of several miles, is underlaid with coal. This phenomenon may therefore be referred to the same cause which occasioned the dreadful explosion of the *Colliery*; but in the present case, this destructive gas, instead of being pent up in the bowels of the earth, accompanies the water in its passage to the surface.

## BROSELEY SPRING.

This celebrated boiling spring, or well, at Broseley, in Shropshire, was discovered in the month of June, 1711. It was first announced by a terrible noise in the night, there having been a remarkable thunder-storm. Several persons who resided in the vicinity, having been awakened in their beds by this loud and rumbling noise, arose, and proceeding to a bog under a small hill, about two hundred yards from the river Severa, perceived a surprising commotion and shaking of the earth, and a little boiling up of water through the grass. They took a spade, and digging up a portion of the earth, the water immediately flew up to a great height, and was set on fire by a candle which was presented to it. To prevent the spring from being destroyed, an iron cistern has been placed over it, provided with a cover and a hole in the centre, through which the water may be viewed. If a lighted candle, or any burning substance, be presented to this aperture, the water instantly takes fire, and burns like spirit of wine, continuing to do so as long as the air is kept from it; but on removing the cover of the cistern it quickly goes out. The apparent boiling and ascent of the water of this spring, are still more obviously the result of hydrogen gas, or inflammable air, than in the preceding instance of Wigan well.

## RECIPROCATING FOUNTAINS, OR SPRINGS,

May be cited among the most curious phenomena of nature. An irregularity of flow is not uncommon in boiling springs; but there are other springs which evince a periodical influx and reflux, almost as regular as the tides of the ocean.—These changes, it will be seen, frequently occur several times in a day, or even in an hour. They are ascribed to various causes, either subterraneous, or superficial, but in general, springs and lakes of this description have been ascertained to communicate with others beneath, through pores or apertures of various diameters, which serve equally to carry off the waters, and to supply them afresh. In such cases, the flux and reflux of the upper head of water, must necessarily, depend on the state of that beneath; and the causes which alternately augment and diminish the latter, must produce a similar effect on the former.

PADERBORN SPRING, in Westphalia, disappears twice in twenty-four hours, returning constantly, after a lapse of six hours, with a great noise, and so forcibly as to drive three mills at a short distance from its source. The inhabitants call it *the boisterborn*, that is, the boisterous spring. LAY-WELL spring, near Torbay, is about six feet in length, five in breadth, and nearly

six inches deep. The flux and reflux, which are very visible, are performed in about two minutes; when the spring remains at its lowest ebb for the space of about three minutes. In this way it ebbs and flows twenty times within the hour. As soon as the water begins to rise, many bubbles ascend from the bottom; but on its falling, the bubbling instantly ceases.—GIGGLESWICK SPRING, in the West Riding of Yorkshire, lies at the foot of a hill of limestone named Giggleswick Scar. Its reciprocations are irregular, both with respect to duration and magnitude, the interval of time between any two succeeding flows being sometimes greater, and at other times less, insomuch that a just standard of comparison cannot be formed. The rise of the water, in the stone trough, or cistern, which receives it, during the time of the well's flowing, is equally uncertain, varying from one inch to nine or ten inches, in the course of a few reciprocations. This spring, like the preceding one, discharges bubbles of air at the time of its flowing.—Near the LAKE OF BOURGET, in Savoy, is a reciprocating spring which rises and falls with a great noise, but not at stated and regular times. After Easter, its ebbings and flowings are frequently perceived six times in an hour; but in dry seasons not more than once or twice. It issues from a rock, and is called *la Fontaine de Merveille*, the marvellous fountain.

## BITUMINOUS AND OTHER LAKES.

### PITCH LAKE OF TRINIDAD.

Near Point LA BRAYE, TAR POINT, the name assigned to it on account of its characteristic feature in the Island of Trinidad, is a lake which at the first view appears to be an expanse of still water, but which, on a nearer approach, is found to be an extensive plain of mineral pitch, with frequent crevices and chasms filled with water.—On its being visited in the autumnal season, the singularity of the scene was so great, that it required some time for the spectators to recover themselves from their surprise, so as to examine it minutely. The surface of the lake was of an ash colour, and not polished or smooth, so as to be slippery, but of such a consistence as to bear any weight. It was not adhesive, although it received in part the impression of the foot, and could be trodden without any tremulous motion, several head of cattle browsing on it in perfect security. In the summer season, however, the surface is much more yielding, and in a state approaching to fluidity, as is evidenced by pieces of wood and other substances recently thrown in, having been found enveloped in it. Even large branches of trees, which were a foot above the level, had, in some way,

become enveloped in the bituminous matter. The interstices, or chasms, are very numerous, ramifying and joining in every direction; and being filled with water in the wet season, present the only obstacle to walking over the surface. These cavities are in general deep in proportion to their width, and many of them unfathomable: the water they contain is uncontaminated by the pitch, and is the abode of a variety of fishes. The arrangement of the chasms is very singular, the sides invariably shelving from the surface, so as nearly to meet at the bottom, and then bulging out towards each other with a considerable degree of convexity. Several of them have been known to close up entirely, without leaving any mark or seam.

The pitch lake of Trinidad contains many islets covered with grass and shrubs, which are the haunts of birds of the most exquisite plumage. Its precise extent cannot, any more than its depth, be readily ascertained, the line between it and the neighbouring soil not being well defined; but its main body may be estimated at three miles in circumference. It is bounded on the north and west sides by the sea, on the south by a rocky eminence, and on the east by the usual argillaceous soil of the country.

#### MUD LAKE OF JAVA.

The following details relative to the volcanic springs of boiling mud in Java, are extracted from the Penang Gazette.

“Having received an extraordinary account of a natural phenomenon in the plains of Grobogna, fifty paals northeast of Solo; a party set off from *Solo* the 25th Sept. 1814, to examine it.—On approaching the dass or village of Kuhoo, they saw between two topes of trees in a plain, an appearance like the surf breaking over rocks with a strong spray falling to leeward. Alighting, they went to the ‘Bluddugs,’ as the Javanese call them. They are situated in the village of Kuhoo, and by Europeans are called by that name. “We found them,” says the narrator, “to be an elevated plain of mud about two miles in circumference, in the centre of which, immense bodies of soft mud were thrown up to the height of ten to fifteen feet, in the form of large bubbles, which, bursting, emitted great volumes of dense white smoke. These large bubbles, of which there were two, continued throwing up and bursting seven or eight times in a minute; at times, they threw up two or three tons of mud. The party got to the leeward of the smoke, and found it to stink like the washings of a gun-barrel.—As the bubbles burst, they threw the mud out from the centre, with a pretty loud noise, occasioned by the falling

of the mud on that which surrounded it, and of which the plain composed. It was difficult and dangerous to approach the large bubbles, as the ground was all a quagmire, except where the surface of the mud had become hardened by the sun;—upon this, we approached cautiously to within fifty yards of one of the largest bubbles, or mud-pudding, as it might properly be called, for it was of the consistency of custard-pudding, and was about a hundred yards in diameter:—here and there, where the foot accidentally rested on a spot not sufficiently hardened to bear, it sunk—to the no small distress of the walker.

“ We also got close to a small bubble, (the plain was full of them, of different sizes,) and observed it attentively for some time. It appeared to heave and swell, and when the internal air had raised it to some height, it burst, and the mud fell down in concentric circles; in which state it remained quiet until a sufficient quantity of air is again formed internally to raise and burst another bubble, and this continued at intervals of from about half a minute to two minutes.

“ From various other parts of the pudding round the large bubbles, there were occasionally small quantities of sand shot up like rockets to the height of twenty or thirty feet, unaccompanied by smoke:—this was in parts where the mud was of so stiff a consistency to rise in bubbles. The mud at all places we came near was cold.

“ The water which drains from the mud is collected by the Javanese, and, being exposed in the hollows of split bamboos to the rays of the sun, deposits crystals of salt. The salt thus made is reserved exclusively for the use of the Emperor of Solor; in dry weather it yields thirty pudgins of 100 catties each, every month, but, in wet or cloudy weather, less.

“ Next morning we rode two and a half paals, to a place in a forest called Ram-am, to view a salt lake, a mud hillock, and various boiling pools.

“ The lake was about half a mile in circumference, of a dirty looking water, boiling up all over in gurgling eddies, but more particularly in the centre, which appeared like a strong spring. The water was quite cold, and tasted bitter, salt, and sour, and had an offensive smell.

“ About thirty yards from the lake stood the mud-hillock, which was about fifteen feet high from the level of the earth. The diameter of its base was about twenty-five yards, and its top about eight feet—and in form an exact cone. The top is open, and the interior keeps constantly boiling and heaving up like the bluddugs. The hillock is entirely formed of mud which has flowed out of the top. Every rise of the mud was accom-

panied by a rumbling noise from the bottom of the hillock, which was distinctly heard for some seconds before the bubble burst ;—the outside of the hillock was quite firm. We stood on the edge of the opening and sounded it, and found it to be eleven fathoms deep. The mud was more liquid than at the bluddugs, and no smoke was emitted either from the lake, hillock, or pools.

“ Close to the foot of the hillock was a small pool of the same water as the lake, which appeared exactly like a pot of water boiling violently ;—it was shallow, except in the centre, into which we thrust a stick twelve feet long, but found no bottom. The hole not being perpendicular, we could not sound it without a line.

“ About 200 yards from the lake were two very large pools or springs, eight and twelve feet in diameter; they were like the small pool, but boiled more violently and stunk excessively. We could not sound them for the same reason which prevented our sounding the small pool.

“ We heard the boiling thirty yards before we came to the pools, resembling the noise of a waterfall. These pools did not overflow—of course the bubbling was occasioned by the rising of air alone. The water of the bluddugs and of the lake is used medicinally by the Javanese.”

## MISCELLANEOUS CURIOSITIES OF NATURE.

### THE GREAT SERPENT, CALLED THE BOA CONSTRICTOR.

Among serpents, the genus BOA is distinguished by its vast, and, indeed, almost unlimited size, as well as by its prodigious strength, which enables it to destroy cattle, deer, &c. by twisting around them in such a manner as to crush them to death by continual pressure. It also claims a superiority over other serpents by the beauty of its colours, and the peculiar disposition of its variegations. The entire ground colour of this animal, in the younger specimens, is a yellowish gray, and sometimes a bright yellow, on which is disposed, along the whole length of the back, a series of large, chain-like, reddish brown, and sometimes perfectly red variegations, leaving large open spaces of the ground colour at regular intervals. The largest, or principal marks, composing the above chain-like pattern, are of a squarish form, accompanied on their exterior sides by large triangular spots, with their points directed downward. Between these larger marks are disposed many smaller ones of uncertain forms, and more or less numerous in different

parts. The ground colour itself is also scattered over by many small specks of the same colour with the variegations. The exterior edges of all the larger spots and markings are commonly blackish, or of a much deeper cast than the middle part, and the ground colour immediately accompanying the outward edges of the spots, is, on the contrary, lighter than on the other parts, or even whitish, thus constituting a general richness of pattern, of which nothing but an actual view of a highly-coloured specimen of the animal itself can convey a complete idea. In larger specimens, the yellow tinge is often lost in an uniform gray cast, and the red tinge of the variegations sinks into a deep chesnut: in some instances, the general regularity of the pattern, as above described, is disturbed by a kind of confluent appearance. The head is invariably marked above by a large longitudinal dark band, and by a narrower lateral band passing across the eyes towards the neck.

It was, in all probability, an enormous specimen of this very serpent which once threw a whole Roman army into dismay. The fact is recorded by Valerius Maximus, who quotes it from one of the lost books of Livy, where it was detailed at a greater length. He relates, that near the river Bagrada, in Africa, a snake was seen of so enormous a magnitude as to prevent the army of Attilius Regulus from the use of the river; and which, after having snatched up several soldiers with its enormous mouth, and killed several others by striking and squeezing them with the spires of its tail, was at length destroyed by assailing it with all the force of military engines and showers of stones, after it had withstood the attack of their spears and darts. It was regarded by the whole army as a more formidable enemy than even Carthage itself. The whole adjacent region was tainted with the pestilential effluvia proceeding from its remains, as were the waters with its blood, so as to oblige the Roman army to shift its station. The skin of this monster, measuring in length *one hundred and twenty feet*, was sent to Rome as a trophy, and was there suspended in a temple, where it remained till the time of the Numidian war.

In the narrative of Mr. McLeod, surgeon of the *Alceste* frigate, which conveyed the late embassy to China, and was wrecked in the Straits of Gaspar, is an account of a BOA CONSTRICTOR having been embarked on board the *Cæsar*, the vessel which brought home the officers and crew of the shipwrecked frigate. The details are of great interest; but the mode in which this prodigy of nature was, during the passage, supplied with its food, causes humanity to shudder. Well may Sir Richard Phillips have remarked in the supplementary number of the *Monthly Magazine*, [No. 307, p. 646.] that the parties



guilty of the atrocious act about to be described, ought themselves to have been made to exchange places with the helpless goat!

The BOA CONSTRICTOR was a native of Borneo, and had been sent to Batavia, where he was embarked. "He was brought on board shut up in a wooden crib or cage, the bars of which were sufficiently close to prevent his escape; and it had a sliding door, for the purpose of admitting the articles on which he was to subsist; the dimensions of the crib were about four feet high, and about five feet square, a space sufficiently large to allow him to coil himself round with ease. The live stock for his use during the passage, consisting of six goats of the ordinary size, were sent with him on board, five being considered as a fair allowance for as many months. At an early period of the voyage we had an exhibition of his talent in the way of eating, which was publicly performed on the quarter-deck, upon which he was brought. The sliding door being opened, one of the goats was thrust in, and the door of the cage shut. The poor goat, as if instantly aware of all the horrors of its perilous situation, immediately began to utter the most piercing and distressing cries, butting instinctively, at the same time, with its head towards the serpent, in self-defence.

"The snake, which at first appeared scarcely to notice the poor animal, soon began to stir a little, and, turning his head in the direction of the goat, it at length fixed a deadly and malignant eye on the trembling victim, whose agony and terror seemed to increase; for, previous to the snake seizing its prey, it shook in every limb, but still continuing its unavailing show of attack, by butting at the serpent, who now became sufficiently animated to prepare for the banquet. The first operation was that of darting out his forked tongue, and at the same time rearing a little his head; then suddenly seizing the goat by the fore-leg with his mouth, and throwing him down, he was encircled in an instant in its horrid folds. So quick, indeed, and so instantaneous was the act, that it was impossible for the eye to follow the rapid convolution of his elongated body. It was not a regular screw-like turn that was formed, but resembling rather a knot, one part of the body overlaying the other, as if to add weight to the muscular pressure, the more effectually to crush his object. During this time, he continued to grasp with his mouth, though it appeared an unnecessary precaution, that part of the animal which he had first seized. The poor goat, in the meantime, continued its feeble and half stifled cries for some minutes, but they soon became more and more faint, and at last it expired. The snake, however, retained it for a considerable time in its grasp after it was appa-

rently motionless. He then began slowly and cautiously to unfold himself till the goat fell dead from his monstrous embrace, when he began to prepare himself for the feast. Placing his mouth in front of the head of the dead animal, he commenced by lubricating with his saliva that part of the goat; and then taking its muzzle into his mouth, which had, and indeed always has, the appearance of a raw lacerated wound, he sucked it in as far as the horns would allow. These protuberances opposed some little difficulty, not so much from their extent as from their points; however, they also, in a very short time, disappeared; that is to say, externally; but their progress was still to be traced very distinctly on the outside, threatening every moment to protrude through the skin. The victim had now descended as far as the shoulders; and it was an astonishing sight to observe the extraordinary action of the snake's muscles when stretched to such an unnatural extent—an extent which must have utterly destroyed all muscular power in any animal that was not, like itself, endowed with very peculiar faculties of expansion and action at the same time. When his head and neck had no other appearance than that of a serpent's skin, stuffed almost to bursting, still the workings of the muscles were evident; and his power of suction, as it is erroneously called, unabated; it was, in fact, the effect of a contractile muscular power, assisted by two rows of strong hooked teeth. With all this, he must be so formed as to be able to suspend, for a time, his respiration, for it is impossible to conceive, that the process of breathing could be carried on while the mouth and throat were so completely stuffed and expanded by the body of the goat, and the lungs themselves, (admitting the trachea to be ever so hard,) compressed as they must have been, by its passage downwards.

“The whole operation of completely gorging the goat, occupied about two hours and twenty minutes: at the end of which time, the tumefaction was confined to the middle part of the body, or stomach, the superior parts, which had been so much distended, having resumed their natural dimensions. He now coiled himself up again, and lay quietly in his usual torpid state for about three weeks or a month, when his last meal appearing to be completely digested and dissolved, he was presented with another goat, which he devoured with equal facility. It would appear, that almost all he swallows is converted into nutrition, for a small quantity of calcareous matter, (and that, perhaps, not a tenth part of the bones of the animal,) with occasionally some of the hairs, seemed to compose his general fæces;—and this may account for these animals being able to remain so long without a supply of food. He had more

difficulty in killing a fowl than a larger animal, the former being too small for his grasp.

“As we approached the Cape of Good Hope, this animal began to droop, as was then supposed, from the increasing coldness of the weather, (which may probably have had its influence,) and he refused to kill some fowls which were offered to him. Between the Cape and St. Helena he was found dead in his cage; and, on dissection, the coats of his stomach were discovered to be excoriated and perforated by worms. Nothing remained of the goat except one of the horns, every other part being dissolved.”

#### THE SEA SERPENT.

The existence of this Marine prodigy on the coast of North America, has been placed beyond a doubt by the multiplied evidences procured by the Linnæan Society of New England, established at Boston. The inquiries were founded on the rumours currently spread, on various authorities, that in the month of August, 1817, an animal of very singular appearance had been repeatedly seen in the harbour of Gloucester, Cape Ann, about thirty miles from Boston. It was said to resemble a serpent in its general form and motions, to be of immense size, and to move with wonderful rapidity; to appear on the surface of the water in calm and bright weather only; and to seem jointed, or like a number of buoys or casks following each other in a line. The following is a brief abstract of the evidences taken *on oath* in support of these rumours. The depositions were made before Lonson Nash, Esq. a magistrate of Gloucester, by whose own account of the animal, of which he had a distinct view, it may not be improper to preface the various evidences adduced.

Mr. Nash saw the serpent at the distance of about two hundred and fifty yards. It was so long, that the two extremes were not visible, *at one view*, with a telescope. He therefore judged it to be seventy, or perhaps a hundred feet in length. He perceived eight distinct portions or bunches, apparently caused by the vertical motion of the animal, which he conjectures to be straight. In this vertical motion, all the testimonies agree, as well as in the apparent bunches. The track made in the water was visible for half a mile, and the progress of the animal, when on its surface, a mile in four minutes; but when immersed, by the motion of the water, which could be often traced, he appeared to move a mile in two minutes, or in three minutes at the most. His body was of the size of a half barrel, apparently rough, and of a very dark colour, in which latter particular all the accounts coincide.

A ship-master, and two of his men, being in a boat, approached this monstrous animal to within the short distance of thirty feet. They describe it as being of the serpent form, its head resembling that of a land snake, and very large, of the size of a ten gallon keg. It darted out its tongue, the extremity of which resembled a fisherman's harpoon, to the extent of two feet, raising it perpendicularly, and again letting it fall. Over each of the eyes, which were very bright, was a bunch. Its body was apparently about two feet and a half in circumference. Its motion was at the rate of twelve or fourteen miles in an hour, much swifter than that of a whale, or any other fish, and vertical, but steady.

Another ship-master attests, that he saw the serpent three times, twenty or thirty persons being present, at the distance of about 150 yards. Its apparent length was 80 or 90 feet, and its size that of a half barrel. It had joints, or bunches, from head to tail; its head, which was raised two feet above the water, resembling that of a rattlesnake, and of the size of a horse's head. Its mouth was open about ten inches. Its body was of a dark chocolate colour, and rough and scaly. In turning short and quick, the first part of the curve it made resembled the link of a chain; but when the head came parallel with the tail, they appeared near together; when on the surface of the water, its motion was slow, the animal at times playing about in circles, and at others, moving nearly straight forward. In disappearing, it apparently sunk directly down.

The other depositions were seven in number, three by merchants, one by a ship-master, one by a ship-carpenter, and two by mariners. One of them describes the tongue of the animal as resembling a prong, or spear, elevated about twelve inches, six inches in circumference, and terminating in a small point. The body appeared to be jointed, round, and about the size of that of a man. The other accounts agree in the foregoing particulars, all testifying the enormous length of the animal, which in some instances they estimate at 70 feet; and the extreme rapidity of its motion through the water. This motion was vertical, like that of the caterpillar. The ship-carpenter, Matthew Gaffney, being in a boat on the 14th of August, and within thirty feet of the animal, discharged his piece, carrying a large ball, at its head, which he thought he struck. The creature turned immediately towards the boat, as if to approach it; but sunk down, and went directly under it, again making its appearance at about one hundred yards distance. *It did not turn down like a fish, but appeared to settle directly down like a rock.*

*The society having been informed that an animal resem-*

bling the above had been seen at Plymouth, a sea-port belonging to the United States, two or three years before, procured the following testimony on oath from a ship-master residing there.

On the 20th of June, 1815, this deponent, Elkanah Finney, was suddenly called to witness a strange appearance in the cove next his house. By the aid of his glass, he was satisfied in a moment that it was some aquatic animal, with the form, motion, and appearance of which he had been hitherto unacquainted. It moved, at the distance of a quarter of a mile from the shore, with great rapidity towards the north, being then apparently about thirty feet in length; but in again making towards the cove, it displayed a much greater length, not less, in the deponent's opinion, than a hundred feet. It approached him in a southerly direction, very rapidly, until it came in a line with him, when it stopped, and lay entirely still on the surface of the water. "I had then," observes the deponent, "a good view of the animal through my glass, at the distance of a quarter of a mile. His appearance in this situation was like a string of buoys. I saw perhaps thirty or forty of these protuberances or bunches, which were about the size of a barrel. The head, which tapered off to the size of a horse's head, appeared to be about six or eight feet long, and where it was connected with the body was a little larger than the latter. I could not discern any mouth; but what I supposed to be his under jaw had a white stripe extending the whole length of the head just above the water. While he lay in this situation, he appeared to be about a hundred or a hundred and twenty feet long. The body appeared to be of an uniform size. I saw no part of the animal which I supposed to be a tail, and thought therefore that he did not discover to me his whole length. His colour was a deep brown or black. I could not discover any eyes, mane, gills, or breathing holes. I did not see any fins or legs. The animal did not utter any sound, and did not appear to notice any thing, but remained still and motionless for five minutes or more. The wind was light, with a clear sky, and the water quite smooth. He then moved to the southward, but not with as rapid a motion as before. The next morning, at eight o'clock, it being quite calm, I again saw the animal about a mile to the northward of my house, down the beach: he did not display so great a length as the night before, perhaps not more than twenty or thirty feet. He often disappeared, and was gone five or ten minutes under water. I thought he was diving or fishing for his food.—He remained nearly in the same situation, and thus employed, for nearly two hours. I then saw him moving off, in a nor-

thern direction, towards the light-house. I could not determine whether his motion was up and down, or to the right and left; but his quickest motion was very rapid; I should suppose at the rate of fifteen or twenty miles an hour. Mackarel, herrings, and other bait fish, abound in the cove where the animal was seen."

This deposition is considered as impartial and unbiassed, it agreeing uniformly with the deponent's first declarations in 1815. When made, he had not perused the testimonials procured at Cape Ann; and having been engaged from his youth in foreign voyages, and frequently seen whales, and almost every species of fish, his testimony must be allowed to have great weight.

In corroboration of the existence of the Sea Serpent on the coast of North America, the testimony of the Rev. Mr. Cummings, a clergyman employed in the Missions of the district of Maine, is adduced by the Society. His relation, made in the month of June, 1809, was taken down in writing by a friend. It states, that in Penobscot bay, a Sea Serpent, supposed to be about sixty feet in length, and of the size of a sloop's mast, had been occasionally seen within the last thirty years. Mr. Cummings being with a party, in a boat twenty-three feet in length, the animal approached to within fifteen rods, and was judged to be about three times that length. He held his head, which resembled that of a common snake, flattened, and about the size of a pail, five feet out of the water. About the head and neck, the colour was a bluish green; but the tint of the body could not be determined, on account of the rippling of the water. The British, Mr. Cummings observed, saw him in their expedition to Bagaduse, and estimated his length at 300 feet, which he thought an exaggeration. He added, that this animal had been frequently seen by the inhabitants of Fox and Long Islands, Mount Desert, &c.

In the communication to the Society from which the above extract is made, there are two other testimonies, that of a Captain Lillis, who observed, that he had seen off the coast, in 1809, a very singular fish, about forty feet long, which appeared more like an ordinary serpent than a fish, holding his head erect, without a mane;—and that of a resident of one of the islands in the Bay of Penobscot, who declared that he had often seen a marine monster of this description, which was as large as a sloop's boom, and about sixty or seventy feet long. He asserted, that about the year 1780, as a schooner was lying at the mouth of the river, or in the bay, one of these enormous creatures leaped over it between the masts: the men ran into the hold for fright, and the weight of the serpent sunk

the vessel, which was of eighteen tons burthen, 'one streak,' or plank.

Extracts are given by the Society from the Natural History of Norway, by Pontoppidan, Bishop of Bergen, to show how much his account of the Sea Serpent on the Norwegian coast, agrees with the above depositions and statements. The following passage will suffice to evince this, with the difference, however, that the Norwegian Serpent is represented as much longer, and of a proportionate bulk. "Though one cannot," says the Bishop, "have an opportunity of taking the exact dimensions of this creature, yet all who have seen it are unanimous in affirming, as far as they can judge at a distance, that it appears to be the length of a cable, i. e. one hundred fathoms, or six hundred English feet; that it lies on the surface of the water, when it is very calm, in many folds; and that there are, in a line with the head, some small parts of the back to be seen above the surface of the water, when it moves or bends. These, at a distance, appear like so many casks or hogsheads floating in a line, with a considerable distance between them. Mr. Tuchsén, of Heroe, is the only one of the many correspondents I have, who informs me that he has observed the difference between the body and the tail of this creature, as to thickness. It appears that it does not, like the eel or land snake, taper gradually to a point, but that the body, which looks to be as big as two hogsheads, grows remarkably small at once where the tail begins. The head in all the kinds has a high and broad forehead, but in some a pointed snout, though in others that is flat, like that of a cow or horse, with large nostrils, and several stiff hairs standing out on each side, like whiskers. The accounts add, that the eyes of this creature are very large, of a blue colour, and look like a couple of bright pewter plates. The whole animal is of a dark brown colour, but speckled and variegated with light streaks or spots, which shine like tortoise shell. Some say it sheds its skin like the land snake. The wind is so destructive to this creature, that it is never seen on the surface of the water but in the greatest calm; and the least gust of wind drives it immediately to the bottom again. It shoots through the water like an arrow from the bow, seeking constantly the coldest places. I have been informed by some of our sea-faring men, that a cable would not be long enough to measure the length of some of them, when they are observed on the surface of the water in an even line. They say those round humps or folds sometimes lie one after another as far as a man can see."

The report of the Committee of the Linnæan Society adds:

“ We have seen and heard sundry other statements, of various authority, relating to similar animals, said to have been seen at sea by different persons ; but do not insert them in our report, because we consider the foregoing testimony sufficient to place the existence of the animal beyond a doubt ; and because they do not appear so minute and so well authenticated as the preceding documents.”

About four weeks after the depositions, the substance of which has been given above, had been received, a young serpent of a remarkable appearance was brought from Gloucester to Boston, and exhibited as the progeny of the Great Sea Serpent. It had been killed in a meadow, situated on the eastern shore of Cape Ann, within 150 paces of high water mark, by a planter, who, with a pitchfork, confined the animal against some loose rocks. He exhibited the most violent rage, biting himself twice, holding on, and shaking (to use the planter's expression) as one dog shakes another in fighting. His tail seemed likewise a weapon of defence ; for he struck the end of it against the handle of the fork several times. His progressive movement was vertical, but slow, and was produced, first by contracting, and then by extending the body. When contracted, the animal was not more than a foot and a half in length ; and the protuberances on his back were then at least three times as large as when he was extended.

The Committee of the Linnæan Society having inspected both the external and internal structure of this animal, which they name the *SCOLIOPHIS ATLANTICUS*, or *FLEXUOUS SERPENT OF THE ATLANTIC*, proceed to remark that it has the general form and external characters of a serpent, but is remarkably distinguished from all others of that class by a row of protuberances along the back, apparently formed by undulations of the spine. These protuberances are forty in number, and their size is proportioned to that of the body, at the places where they are respectively situated. Thus the body can be bent with facility upward and downward, a circumstance not common to other serpents. The whole length of the animal is 2 feet 11 1-2 inches.

After a minute anatomical description of the *SCOLIOPHIS ATLANTICUS*, (the young serpent,) the Committee discuss the question whether it is to be so identified with the Great Sea Serpent, as to be considered of the same species. The appearance, they remark, at nearly the same time and place, of two creatures agreeing with each other in certain important and conspicuous particulars, disagreeing in the most remarkable of these particulars with other animals of their class, and between whom, *no difference*, but that of size, has been discovered, *must naturally lead to a conjecture that they are of*



the same species. The appearances noticed in the depositions, relative to the great serpent, bating a few exceptions, agree with, and are accounted for, by a structure like that of the *Scoliophis*. The protuberances seen above the water might have been produced in two ways: by bunches on the back projecting out of the water; or by vertical undulations of the body when in motion. The supposition that both these appearances have been presented at different times, is the most satisfactory mode of accounting for the variety of testimony with regard to the number, size, and distance of these protuberances. The other facts stated in relation to the form and general arrangement of colours in the large serpent, apply sufficiently well to the *Scoliophis*. The shape of the head and proportion of the eye—the protuberance on the side of the head, just above the eye—the form of the mouth—the distance from the head to the commencement of the protuberances—the brown colour of the body and the whitish colour of the under part of the head and neck—the disappearance of bunches from what was supposed to be the navel toward the tail—the tapering of the body toward the tail—its roundness, and great flexibility, are all points of the closest resemblance. These coincidences cannot be the effect of design, since all the depositions from Gloucester, relative to the Great Serpent, were in the hands of the Committee before the *Scoliophis* was discovered.

The prong or spear seen near the head of the former, when in motion, was probably the tongue. The shape of a harpoon, ascribed to that organ, was doubtless an optical illusion, occasioned by its rapid vibration; and this, it is well known, is not the first instance of such a deception. The structure of the *Scoliophis* is besides well suited to a residence in the water, being capable of various and complicated motions. It bends horizontally, as did the Great Serpent, in the act of turning; it bends vertically, as that animal is supposed to do in the act of swimming; and it might assume any compound and intermediate motion, that would be most effectual in propelling it through the water.

Supposing, therefore, the species of the two serpents to be the same, it is not improbable that the one is the progeny of the other. The *Colubri* without fangs, the tribe most nearly resembling the *Scoliophis*, are said by naturalists to be generally, if not always, oviparous; to deposit their eggs in the sand in the spring, or in the end of summer; and to abandon them. These eggs are hatched by the heat of the sun often in less than a month. It should be remarked that the large serpents described in the accounts and depositions, were seen near the shore, and, with one exception, in the month of August only.

In reply to the three principal objections which may be made against the specific identity of the two animals; and, first, their disproportionate size. This is not apparently greater than is found between the young and full grown individuals of some other animals, among which may be cited the Boa CONSTRUCTOR. Secondly, that the one was seen only in the water, and the other on land. This objection is lessened when it is recollected that the eggs of amphibious animals are deposited on land. The large serpent may have visited the shore in the night, or at other times. That it was an amphibious animal, dependent on respiration, is rendered probable by its general structure, and by its frequenting the surface of the water, often with its head elevated above it. The small serpent was found near the salt water, in a place over which the sea breaks in stormy weather. Supposing it a young animal, it might have remained in the place where it was hatched, or it might have occasionally resorted to the shore from the water. It could not be expected to venture far from the shore, until its increased size should afford it some security from becoming a prey to larger animals of the ocean. Lastly, the circumstance that not any evidences of immaturity were observed in the colliophis, might be considered as a source of a third objection, if it were not well known that, as serpents generally abandon their eggs, the young are perfect in all their parts, and capable of providing for their own subsistence, immediately on their being hatched.

On the whole, the Committee observe, as these two animals agree in so many conspicuous, important, and peculiar characters, and as no material difference has been yet clearly pointed out, excepting that of size, the Society will probably feel justified in considering them individuals of the same species and entitled to the same name, until a more close examination of the Great Serpent shall have disclosed some difference of structure, important enough to constitute a specific distinction.

A postscript contains a communication from Long Island, stating, that on the 5th of October, 1817, the Sea Serpent had been seen in the Sound. At the distance of half a mile from the shore, a long, rough, dark looking body was observed, making a rapid progress towards New-York, against a brisk breeze and a strong ebb tide. The observers were soon convinced that it was a living animal. His head did not at first appear more elevated above the water than the ridges or humps on his back; but when he was afterwards seen, nearly in the middle of the Sound, his body, owing to the increased velocity with which he moved, became more depressed, and his head greatly elevated. He was distinctly seen for about ten mi-

minutes, during which short space, it was estimated that his progress was not less than six or seven miles. His back, 40 or 50 feet of which appeared above the surface of the water, was irregular, uneven, and deeply indented. The general description of the animal, in this statement, agrees with those already given; but it is said that the extreme rapidity with which he moved, created a swell not unlike that of a boat towed rapidly at the stern of a vessel.

#### THE COBRA DE CAPELLO.

The following interesting account of this very curious snake, a native of India, is extracted from Forbes' Oriental Memoirs, a work, the merits of which cannot be sufficiently praised.

“The Cobra de Capello, or hooded-snake, (*coluber naja*), called by the Indians the naag, or nagao, is a large and beautiful serpent; but one of the most venomous of all the coluber class; its bite generally proves mortal in less than an hour. It is called the hooded-snake, from having a curious hood near the head, which it contracts or enlarges at pleasure; the centre of this hood is marked in black and white like a pair of spectacles, whence it is also named the spectacle snake.

“Of this genus are the dancing-snakes, which are carried in baskets throughout Hindostan, and procure a maintenance for a set of people, who play a few simple notes on the flute, with which the snakes seem much delighted, and keep time by a graceful motion of the head, erecting about half their length from the ground, and following the music with gentle curves, like the undulating lines of a swan's neck. It is a well attested fact, that when a house is infested with these snakes, and some other of the coluber genus, which destroy poultry and small domestic animals, as also by the larger serpents of the boa tribe, the musicians are sent for; who, by playing on a flagelet, find out their hiding-places, and charm them to destruction: for no sooner do the snakes hear the music than they come softly from their retreat, and are easily taken. I imagine these musical snakes were known in Palestine, from the Psalmist comparing the ungodly to the deaf adder, which stoppeth her ears, and refuseth to hear the voice of the charmer, charm he never so wisely.

“When the music ceases, the snakes appear motionless; but if not immediately covered up in the basket, the spectators are liable to fatal accidents. Among my drawings is that of a Cobra de Capello, which danced for an hour on the table while I painted it; during which, I frequently handled it, to observe the beauty of the spots, and especially the spectacles

on the hood, not doubting but that its venomous fangs had been previously extracted. But the next morning my upper servant, who was a zealous Mussulman, came to me in great haste, and desired I would instantly retire, and praise the Almighty for my good fortune; not understanding his meaning, I told him that I had already performed my devotions, and had not so many stated prayers as the followers of his prophet. Mahomed then informed me, that while purchasing some fruit in the bazar, he observed the man who had been with me the preceding evening, entertaining the country people with his dancing snakes; they, according to their usual custom, sat on the ground around him; when, either from the music stopping too suddenly, or from some other cause irritating the vicious reptile which I had so often handled, it darted at the throat of a young woman, and inflicted a wound of which she died in about half an hour. Mahomed once more repeated his advice for praise and thanksgiving to Alla, and recorded me in his calendar as a lucky man."

## THE CERASTES, OR HORNED SNAKE.

This curious species is a native of many parts of Africa, and is also frequent in Egypt, Syria, and Arabia. It is about two feet in length, and is distinguished by a pair of horns, of curved processes, situated above the eyes, and pointing forwards: these horns have not any thing analogous in their structure to the horns of quadrupeds, and are by no means to be considered in the light of offensive or defensive weapons: they increase, however, the natural antipathy so generally felt against the serpent tribe, and give the animal a more than ordinary appearance of malignity. Its bite is much to be dreaded, since, exclusive of the general danger of treading accidentally on this reptile, and thus irritating it unawares, it possesses a propensity to spring suddenly to a considerable distance, and assail without provocation those who happen to approach it. "When," Mr. Bruce observes, "he inclines to surprise any one, the Cerastes creeps with his side towards the person, and his head averted, till judging his distance, he turns round, springs upon him, and fastens on the part next to him."

On the subject of the incantation of serpents, this celebrated traveller remarks as follows: "There is not any doubt of its reality: the Scriptures are full of it; and those who have been in Egypt, have seen as many different instances as they chose. Some have suspected that it was a trick, and that the animals so handled had been first trained, and then disarmed of the power of hurting; and, fond of the discovery, have rested themselves upon it, without experiment, in the face of all antiquity. But

I will not hesitate to aver, that I have seen at Cairo, (and this may be seen daily, without trouble or expense,) a man who came from above the catacombs, where the pits of the mummy birds are kept, who has taken a Cerastes with his naked hand, from a number of others lying at the bottom of a tub, has put it upon his bare head, covered it with the common red cap he wears, then taken it out, put it on his breast, and tied it about his neck like a necklace; after which, it has been applied to a hen, and bit it, which has died in a few minutes; and, to complete the experiment, the man has taken it by the neck, and, beginning at the tail, has eaten it, as one would do a carrot, or a stock of celery.

“However lively the snake may have been before, when he is seized by any of these barbarians, he seems as if taken with sickness and feebleness, frequently shuts his eyes, and never turns his mouth towards the arm of the person who holds him. On their being questioned how they are exempted from its attack, the gravest and most respectable among the Egyptians reply that they were born so; while the lower sort talk of enchantments by words and by writing. They all pretend to prepare any person by remedies, that is, by decoctions of herbs and roots. Be this as it may, the records of history attest, that where any country has been remarkably infested by serpents, there the people have been screened by a secret of some kind. Thus it was with the Psylli and Maronides of old.”

“Tame at whose spell the charm'd Cerastes lay.”

#### GREAT VIPER OF MARTINIQUE.

This formidable reptile is peculiar to the islands of Martinique, St. Lucie, and Beconia, and has never been traced to the American continent. On account of its triangular head, resembling that of a spear, it has been named by the French naturalist TRIGONOCEPHALUS: when full grown, it is nearly eight feet in length, and its bite is highly dangerous. Its agility is, as well as its mode of darting, very remarkable: it rolls the body in four circles, one upon another, the circumvolutions of which incline all at once at the will of the animal, so as to throw the whole mass forward five or six feet. After the manner of the crested or hooded snake, it can raise itself upright on its tail, and thus attain the height of a man; at the same time that, by means of large scales, laid over each other, with which the belly is covered, this serpent, like the adder, can climb large trees, and creep among the branches, in order to reach the birds' nests, whose young he devours, and in which he has often been found coiled up.

## FASCINATING POWER OF SNAKES.

A remarkable instance of the fascinating power of snakes is given in Lichtenstein's travels in Southern Africa. In rambling in the fields near Cape Town, he saw, at the brink of a ditch, a large snake in pursuit of a field mouse. The poor animal was just at its hole, when it seemed in a moment to stop, as if unable to proceed, and without being touched by the snake, to be palsied with terror. The snake had raised its head over him and opened its mouth, and seemed to fix its eyes steadfastly upon him. Both remained still awhile; but as soon as the mouse made a motion, as if to flee, the head of the snake instantly followed the movement, as if to stop his way. This sport lasted four or five minutes, till the author's approach put an end to it: the snake then snapped up his prey hastily, and glided away with it to a neighbouring bush. "As I had," he observes, "heard a great deal of this magic power in the snake over smaller animals, it was very interesting to me to see a specimen of it. I think it may be made a question, however, whether the poisonous breath of the reptile might not really have had the effect of paralysing the limbs of the mouse, rather than that its inability to move proceeded either from the fixed eye of the snake, or the apprehension of inevitable death. It is remarkable, and very certain, that serpents will sport with their prey, as cats do, before they kill it."

This author notices several peculiarities of the snakes of South Africa. A very rare description of serpent is there called the SPURTING SNAKE. It is from three to four feet long, of a black colour, and has the singular property, as the colonists assert, that when it is attacked, it spurts out its venom, and knows how to give it such a direction as to hit the eyes of the person making the attack. This is followed by violent pain, and by so great an inflammation, that it frequently occasions the entire loss of the sight. The POF-ADDER, one of the most poisonous species, is distinguishable by a disproportionate thickness, and by a body handsomely spotted with black and white spots on a brownish ground. It has this peculiarity, that, when it is enraged, it swells out its neck to a very great size. One which was caught, measured in length about an ell and a half, and was about six inches round in its greatest circumference.—One of the species, called the TREE SNAKE, was caught while in the act of climbing up the wall of a farm-house, to take the swallows which had their nests under the roof. This snake is extremely adroit at climbing, and is, therefore, a terrible enemy to small birds. Its bite is extremely venomous, and is considered as mortal. The one here noticed, mea-

sured six feet in length, with a black back, and grayish belly. In the belly were found six half digested young swallows. The LEMON SNAKE measures about five feet in length, and has a skin of a fine lemon-colour, regularly spotted with black.

#### THE ELEPHANT.

How instinct varies in the grov'ling swine,  
Compar'd, half reasoning elephant, with thine !  
'Twith that, and reason, what a nice barrier !  
For ever separate, yet for ever near !

POPE.

The largest elephants are from ten to eleven feet in height: some are said to exceed it: but the average is eight or nine feet. They are fifty or sixty years before they arrive at their full growth: and their natural life is about one hundred and twenty years. Their price increases with their merit during a course of education. Some, for their extraordinary qualities, become in a manner invaluable; when these are purchased, no compensation induces a wealthy owner to part with them.

The skin of the elephant is generally a dark gray, sometimes almost black; the face frequently painted with a variety of colours; and the abundance and splendour of his trappings add much to his consequence. In India, the Mogul princes allow five men and a boy to take care of each elephant; the chief of them, called the mahawut, rides upon his neck to guide him; another sits upon the rump, and assists in battle; the rest supply him with food and water, and perform the necessary services. Elephants bred to war, and well disciplined, will stand firm against a volley of musketry, and never give way unless severely wounded. One of these animals has been seen with upwards of thirty bullets in the fleshy parts of his body, perfectly recovered from his wounds. All are not equally docile, and when an enraged elephant retreats from battle, nothing can withstand his fury: the driver having no longer a command, friends and foes are involved in undistinguished ruin.

The elephants in the army of Antiochus were provoked to fight by showing them the blood of grapes and mulberries. The history of the Maccabees informs us, that "to every elephant they appointed a thousand men, armed with coats of mail, and five hundred horsemen of the best; these were ready at every occasion; wherever the beast was, and whithersoever he went, they went also; and upon the elephants were strong towers of wood, filled with armed men, besides the Indian that ruled them."

Elephants in peace and war know their duty, and are more

obedient to the word of command than many rational beings. It is said they can travel, on an emergency, two hundred miles in forty-eight hours; but will hold out for a month, at the rate of forty or fifty miles a day, with cheerfulness and alacrity. "I performed," observes Forbes in his Oriental Memoirs, "many long journeys upon an elephant: nothing could exceed the sagacity, docility, and affection of this noble quadruped. If I stopped to enjoy a prospect, he remained immovable until my sketch was finished; if I wished for ripe mangoes growing out of the common reach, he selected the most fruitful branch, and breaking it off with his trunk, offered it to the driver for the company in the houdah, accepting of any part given to himself with a respectful salem, by raising his trunk three times above his head, in the manner of the oriental obeisance, and as often did he express his thanks by a murmuring noise. When a bough obstructed the houdah, he twisted his trunk around it, and, though of considerable magnitude, broke it off with ease, and often gathered a leafy branch, either to keep off the flies, or as a fan to agitate the air around him, by waving it with his trunk; he generally paid a visit at the tent-door during breakfast, to procure sugar-candy or fruit, and he cheered by the encomiums and caresses he deservedly met with: no spaniel could be more innocently playful, nor fonder of those who noticed him, than this docile animal, which, on particular occasions, appeared conscious of his exaltation above the brute creation."

However surprising may be the docility of this noble animal, when tamed, its sagacity, in a savage state even, is a subject of still greater wonder, as is evidenced by the following narrative extracted from Lichtenstein's travels in South Africa. Two individuals, named Muller and Prince, being engaged in the Caffre territory, where these animals abound, in an elephant hunt, discovered the footsteps of a very large elephant, and soon espied the animal himself on the declivity of a naked and widely outstretched hill. It is a rule when an elephant is thus found, to endeavour to get above him on the hill, to the end that, in case of necessity, the hunter may flee to the summit, whither the animal, on account of the unwieldiness of its body, cannot follow him fast. This precaution was neglected by Prince, who shot too soon, while they were yet at too great a distance, and the elephant on higher ground than himself and his companion. The wounded animal rushed down towards them, while they endeavoured to push their horses on, and gain the brow of the hill. Being able, on favourable ground, to run as fast as a horse, he soon came up with them, and struck with his tusk at Muller's thigh, he being the nearest of



the two fugitives. Muller now considered his fate as inevitable, as he endeavoured in vain to set his almost exhausted horse into a gallop, and saw the animal, after giving a violent snort, raise his powerful trunk above his head. It was not, however, on himself, but on his companion, that the stroke fell; and in an instant he saw him snatched from his horse, and thrown up into the air. Scarcely in his senses, he continued his flight, and only in some degree recovered himself by finding Prince's horse running by his side without a rider: then looking back, he saw his unfortunate friend on the ground, and the elephant stamping upon him with the utmost fury. He was now convinced, not without the greatest astonishment, that the sagacious animal had distinguished which of the two it was who wounded him, and wreaked his whole vengeance upon him alone. Muller, on this, went in search of the rest of the party, that they might collect the mangled remains of their companion, and bury them; but they were soon put to flight by the elephant rushing again from a neighbouring thicket, to vent his wrath once more upon the corpse, already so dreadfully mangled. While he was busied in doing this, however, he was attacked by the dispersed hunters, and sacrificed to the manes of his unfortunate victim.

The contrivances for taking elephants are various; but the most curious are those employed by the natives of Ceylon, where the finest race of these animals is found. They sometimes surround the woods in bands, and drive with lighted torches, amid the clamour of trumpets, the discharge of fire-arms, and noises of every description, the elephants which inhabit them, till they are at length entrapped into a particular spot surrounded with palisades, so as to prevent all escape. At other times a kind of decoy, or female elephant, is sent out in order to induce some of the males to pursue her, who are by that means secured. When a wild elephant is taken, it still remains to reduce it to a quiet state, and to tame it, in order to its being made useful; this is effected by throwing ropes round the legs and body, which are well secured; and two tame elephants, properly instructed, are placed on each side. The captive animal finds himself gradually so fatigued by his ineffectual struggles, and so much soothed by the caresses occasionally given by the trunks of the tame elephants, by the food from time to time presented to him, and the water with which he is refreshed by its being poured over him, that in the space of a few days, unless more than unusually untractable in his nature, he becomes completely tame, and is placed with the rest of the domesticated troop. Sometimes, in order more effectually to subdue them, the elephants are deprived of sleep for a considerable time.

The anecdotes recording the sagacity, and also the amiable qualities of the elephant, are numerous. Of these the following are selected as highly interesting. In Delhi, an elephant passing along the streets, put his trunk into a tailor's shop, where several persons were at work. One of them pricked the end of his trunk with his needle; the beast passed on; but at the next dirty puddle filled his trunk with water, returned to the shop, and spurting it among those who had offended him, spoiled their work.—At Adsmeer, an elephant which often passed through the bazar, or market, as he went by a certain herb-woman, always received from her a mouthful of greens: at length he was seized with one of his periodical fits of rage, broke his fetters, and, running through the market, put the crowd to flight, and, among others, this woman, who, in her haste, forgot a little child she had brought with her. The animal recollecting the spot where his benefactress was wont to sit, took up the infant gently on his trunk, and placed it in safety on a stall before a neighbouring house.—At the same place, another elephant in his madness killed his *cornac*, or governor: the wife, witnessing the misfortune, took her two children, and flung them before the elephant, saying, "now you have destroyed their father, you may as well put an end to their lives and mine." It instantly stopped, relented, took the eldest of the boys, placed him on his neck, adopted him for his governor, and never afterwards would permit any other person to mount him.—A painter was desirous of drawing the elephant kept in the menagerie at Versailles, in an uncommon attitude, namely, that of holding his trunk raised up in the air, with his mouth open. The painter's boy, in order to keep the animal in this posture, threw fruit into his mouth; but as the lad frequently deceived him and made an offer only of throwing the fruit, he grew angry; and, as if he had known that the painter's intention of drawing him was the cause of the affront thus offered, instead of avenging himself on the lad, he turned his resentment on the master, and taking up a quantity of water in his trunk, threw it on the paper on which the painter was drawing, and spoiled it.

## THE ORANG OUTANG.

This singular animal, likewise called the satyr, great ape, or man of the woods, which has, on account of its near approximation to the human species, so strongly excited the attention of naturalists, is a native of the warmer parts of Africa and India, where it resides principally in woods, on the fruits of which it feeds, like the other species of the *simia* race. Such of these animals as have been imported into Europe, have rarely exceeded the height of two or three feet, and have therefore been

supposed to be young; those full grown being said to be at least six feet in height. The general colour of the orang outang is a dusky brown; the face is bare; the ears, hands, and feet nearly similar to the human; and the whole appearance such as to exhibit the most striking approach to the human figure. The likeness, however, is only a general one, and the structure of the hands and feet, when examined with an anatomical precision, seems to prove that the animal was principally designed by nature for the quadruped mode of walking, and not for an upright posture, which is only occasionally assumed, and which, in those exhibited to the public, is perhaps, rather owing to instruction than truly natural. Buffon, indeed, makes it one of the distinctive characters of the real or proper apes, of which the orang outang is the chief, to walk erect on two legs only; and it must be granted that these animals support an upright posture much more easily and readily than most other quadrupeds, and may probably be often seen in this attitude even in a state of nature.

The manners of the orang outang, when in captivity, are gentle, and perfectly devoid of that disgusting ferocity so conspicuous in some of the larger baboons and monkeys. It is mild and docile, and may be taught to perform, with dexterity, a variety of actions in domestic life. Thus it has been seen to sit at table, and, in its manner of feeding and general behaviour, to imitate the company in which it was placed: to pour out tea, and drink it without awkwardness or restraint; to prepare its bed with exactness, and compose itself to sleep in a proper manner. Such are the actions recorded of one which was in London, in 1738.

The orang outang described by Buffon was mild, affectionate, and good natured. His air was melancholy, his gait grave, his movements measured, his disposition gentle, and very different from those of other apes. He had neither the impatience of the Barbary ape, the maliciousness of the baboon, nor the extravagance of the monkey tribe. It may be alleged, observes this writer, that he had had the benefit of instruction; but the other apes I shall compare with him were educated in the same manner. Signs and words alone were sufficient to make our orang outang act; but the baboon required a cudgel, and the other apes a whip; for none of them would obey without blows. I have seen this animal present his hand to conduct the persons who came to visit him, and walk as gravely along with them as if he had formed a part of the company. I have seen him sit down at table, unfold his napkin, wipe his lips, use a spoon or fork to carry the victuals to his mouth, pour his liquor into a glass, and make it touch that of a person who drank along

with him. When invited to take tea, he brought a cup and a saucer, placed them on the table, put in sugar, poured out the tea, and allowed it to cool before he drank it. All these actions he performed without any other instigation than the signs or verbal orders of his master, and often of his own accord. Far from doing an injury to any one, he even approached company with circumspection, and presented himself as if he wished to be caressed.

Doctor Tyson, who, about the close of the seventeenth century, gave a very exact description of a young orang outang, then exhibited in the metropolis, observes that, in many of its actions, it seemed to display a very high degree of sagacity, and was the most gentle and affectionate creature imaginable. Those whom it had known on shipboard it embraced with the greatest tenderness, opening their bosoms, and clapping its hands around them; and although several monkeys had been embarked, still it was observed that, during the passage to England, it would never associate with them, and, as if nothing akin to them, would carefully avoid their company.

But however docile and gentle the ourang outang may be when taken young, and instructed, it is said to be possessed of great ferocity in its native state, and is considered as a dangerous animal, capable of readily overpowering the strongest man. Its swiftness is equal to its strength, and for this reason it is but rarely to be obtained in its full grown state, the young alone being taken.

The orang outang now exhibiting at Exeter Change, is a native of Borneo, and is remarkable not only on account of its extreme rarity, but as possessing, in many respects, a strong resemblance to man. What is technically denominated the cranium, is perfectly human in its appearance; the shape of the upper part of the head, the forehead, the eyes, (which are dark and full,) the eye-lashes, and, indeed, every thing relating to the eyes and ears, differing in no respect from man. The hair of his head, however, is merely the same which covers his body generally. The nose is very flat,—the distance between it and the mouth considerable; the chin, and, in fact, the whole of the lower jaw, is very large, and his teeth, twenty-six in number, are strong. The lower part of his face is what may be termed an ugly, or caricature likeness of the human countenance. The position of the scapulæ, or shoulder-blades, the general form of the shoulders and breasts, as well as the figure of the arms, the elbow joint especially, and the hands, strongly continue the resemblance. The metacarpal, or that part of the hand immediately above the fingers, is somewhat elongated; and, by the thumb being thrown a little higher up, nature

seems to have adapted his hand to his mode of life, and given him the power of grasping more effectually the branches of trees. The fingers, both of the hands and feet, have nails exactly like those of the human race, with the exception of the thumb of the foot, which is without a nail.

He is corpulent about the abdomen, or, to employ the common phrase, rather pot-bellied, looking like one of those figures of Bacchus often seen riding on casks : but whether this is his natural appearance when wild, or acquired since his introduction into new society, and by indulging in a high style of living, it is difficult to determine.

His thighs and legs are short and bandy, the ankle and heel like the human ; but the fore part of the foot is composed of toes, as long and as pliable as his fingers, with a thumb a little situated before the inner ankle ; this conformation enabling him to hold equally fast with his feet as with his hands. When he stands erect, he is about three feet high, and he can walk, when led, like a child ; but his natural locomotion, when on a plain surface, is supporting himself along at every step, by placing the knuckles of his hands upon the ground.

His natural food seems to be all kinds of fruits and nuts ; but when he was embarked on board the *Cæsar*, the vessel which brought him to England, Mr. McLeod observes in his narrative already cited, he ate biscuit, or any other sort of bread, and sometimes animal food. He drank grog, and even spirits, if given to him ; and has been known repeatedly to help himself in this way : he was also taught to sip his tea or coffee : and since his arrival in England, has discovered a taste for a pot of porter. His usual conduct while on board was not mischievous, and chattering like that of monkeys in general : but he had rather a grave and sedate character, and was much inclined to be social, and on good terms with every body. He made no difficulty, however, when cold or inclined to sleep, in supplying himself with any jacket he found hanging about, or in stealing a pillow from a hammock, in order to lie more soft and comfortably.

Sometimes, when teased by showing him something to eat, he would display, in a very strong manner, the human passions, following the person, whining and crying, throwing himself off on his back, and rolling about apparently in a great rage, attempting to bite those near him, and frequently lowering himself by a rope over the ship's side, as if pretending to drown himself ; but when he came near the water's edge, he always re-considered the matter, and came on board again. He would often rifle and examine the pockets of his friends in quest of nuts and biscuits, which they sometimes carried for him. He

and a great antipathy to the smaller tribe of monkeys, and would throw them overboard if he could; but in his general habits and dispositions there was much docility and good nature, and, when not annoyed, he was extremely inoffensive.

## THE CHAMELEON.

No numbers can the varying robe express,  
While each new day presents a different dress.

Few animals have been more celebrated by naturalists than the CHAMELEON, which is said to possess the power of changing its colour at pleasure, and of assimilating it to that of any particular object or situation. This, however, is to be received with certain limitations, the change of colour it takes varying in degree, according to circumstances of health, temperature of weather, and other causes. It is a native of Africa and India, and has likewise been seen in the southern parts of Europe. It is harmless in its nature, and supports itself by feeding on insects, for which purpose the structure of the tongue is admirably adapted. It consists of a long missile body, furnished with a dilated, and somewhat tubular tip, by means of which the animal seizes insects with great ease, darting out his tongue in the manner of a wood-pecker, and retracting it instantaneously with the prey on its tip. It can also support a long fastenence, and hence arose the popular idea of the chameleon being nourished by air alone.

A very interesting account of the chameleon is given by Pliney in his Oriental Memoirs. This great curiosity, he remarks, is so common in India, that it is found in every thicket. He describes with great accuracy, and in the following terms, one which he kept for several weeks.

“The chameleon of the Concan, including the tail, is about nine inches long; the body only half that length, varying in circumference, as it is more or less inflated; the head, like that of a fish, is immoveably fixed to the shoulders; but every inconvenience is removed by the structure of the eyes, which, like spheres rolling on an invisible axis, are placed in deep cavities, projecting from the head: through a small perforation in the exterior convexity, appears a bright pupil, surrounded by a yellow iris, which, by the singular formation and motion of the eye, enables the animal to see what passes before, behind, or on either side; and it can give one eye all these motions, while the other remains perfectly still: a hard rising protects these delicate organs; another extends from the forehead to the nostrils: the mouth is large, and furnished with teeth, with a tongue half the length of the body, and hollow like an elephant's trunk; it darts nimbly at flies and other insects, which

it seems to prefer to the aerial food generally supposed to be its sustenance. The legs are longer than usual in the lacerta genus; on the fore-feet are three toes nearest the body, and two without; the hinder exactly the reverse; with these claws it clings fast to the branches, to which it sometimes entwines itself by the tail, and remains suspended: the skin is granulated like shagreen, except a range of hard excrescences, or denticulations, on the ridge of the back, which are always of the same colour as the body; whereas a row of similar projections beneath, continue perfectly white, notwithstanding any metamorphosis of the animal.

“The general colour of the chameleon, so long in my possession, was a pleasant green, spotted with pale blue; from this it changed to a bright yellow, dark olive, and a dull green; but never appeared to such advantage as when irritated, or a dog approached it; the body was then considerably inflated, and the skin clouded like tortoise shell, in shades of yellow, orange, green, and black. A black object always caused an almost instantaneous transformation; the room appropriated for its accommodation was skirted by a board painted black; this the chameleon carefully avoided; but if he accidentally drew near it, or if we placed a black hat in his way, he was reduced to a hideous skeleton, and from the most lively tints became black as jet; on removing the cause, the effect as suddenly ceased; the sable hue was succeeded by a brilliant colouring, and the body was again inflated.”

#### THE BOTTLE-NESTED SPARROW.

The BAYA, or BOTTLE-NESTED SPARROW, is remarkable for its pendent nest, brilliant plumage, and uncommon sagacity. These birds are found in most parts of Hindostan; in shape they resemble the sparrow, as also in the brown feathers of the back and wings; the head and breast are of a bright yellow, and in the rays of a tropical sun have a splendid appearance, when flying by thousands in the same grove; they make a chirping noise, but have no song: they associate in large communities, and cover extensive clumps of palmyras, acacias, and date trees, with their nests. These are formed in a very ingenious manner, by long grass woven together in the shape of a bottle, with the neck hanging downwards, and suspended by the other end to the extremity of a flexible branch, the more effectually to secure the eggs and young brood from serpents, monkeys, squirrels, and birds of prey. These nests contain several apartments, appropriated to different purposes: in one, the hen performs the office of incubation; another, consisting of a little thatched roof, and covering a perch,

without a bottom, is occupied by the male, who, with his chirping note, cheers the female during her maternal duties. The Hindoos are very fond of these birds, for their docility and sagacity: when young, they teach them to fetch and carry; and at the time the young women resort to the public fountains, their lovers instruct the baya to pluck the tica, or golden ornament, from the forehead of their favourite, and bring it to their expecting master.

## THE HUMMING BIRD.

There are not less than sixty-five species of this very curious bird, all of them remarkable for the beauty of their colours. Of these, the MINIMUS, FLY-BIRD, or LEAST HUMMING BIRD, the most diminutive of the feathered tribe, may be cited as among the most interesting of the minute wonders of nature. It is exceeded, both in weight and dimensions, by several species of bees. Its total length is one inch and a quarter; and, when killed, it does not weigh more than about twenty grains. The bill is straight and black, three lines and a half in length: the upper parts of the body are of a greenish brown, in some lights appearing reddish: the under parts are grayish white; the wings are violet brown; the tail of a bluish black, with a gloss of polished metal; but the outer feathers, except one on each side, are gray from the middle to the tip, and the outer one wholly gray: the legs and claws are brown. The female is still less than the male.

These birds, which are natives of the Brazils, of various parts of South America, and of the adjacent islands, subsist on the nectar or sweet juice of flowers, frequenting those most which have a long tube. They never settle on the flower during the act of extracting the juice, but flutter continually like bees, moving their wings very briskly, and making a humming noise, whence they have received their names. They are not shy; but when very nearly approached, fly off like an arrow from a bow. They often meet and fight for the right to a flower, and this all on the wing: in this state, they often enter an apartment, the windows of which are open, fight a little, and go out again. When they come to a flower which is juiceless, or on the point of withering, they pluck it off as it were in anger, by which means, the ground is often strewn with flowers. In flying against each other, they have, besides the humming, a chirping note resembling that of the sparrow.—They do not feed either on insects or fruits; but have been kept alive in cages for several weeks, by feeding them with sugared water.

*The humming bird builds most frequently in the middle*



of a branch of a tree, the nest being so small, that it cannot be seen by one standing on the ground beneath. It is round; is composed externally of fine green moss; and has its inside lined with soft down, collected either from the leaves of the great mullein, or from silk grass. The eggs, of which the female lays two, are white, and of the size of a pea.

During his stay at the Brazils, Mr. Forbes visited, almost daily, a lovely valley in the neighbourhood of St. Sebastian. "There," he observes, "thousands of nature's choristers, arrayed in all the brilliancy of tropical plumage, enlivened the extensive orange groves; and the humming bird, the smallest and most lovely of the feathered race, buzzed like the bee, while sipping the nectareous dew from the blossoms of the flowers. Nothing can exceed the delicacy of these little beauties; especially of that which, from its minuteness, is called the fly-bird; its bill and legs are not thicker than a pin; its head, tufted with glossy jet, varies with every motion into shades of green and purple; the breast is of a bright flame colour; every feather, when viewed through a microscope, appears as if fringed with silver, and spotted with gold."

#### EDIBLE BIRDS' NESTS.

Among the interesting subjects which still remain open for research, are the habits and constitution of the *HIRUNDO ESCULENTA*, the small swallow which forms the edible nests, annually exported in large quantities from Java and the eastern islands for the Chinese market. These birds, Governor Raffles observes, in his history of Java, not only abound among the cliffs and caverns of the south coast of that island, but inhabit the fissures and caverns of several of the mountains and hills in the interior of the country. From every observation which has been made in Java, it has been inferred, that the mucilaginous substance of which the nests are formed, is not, as has been generally supposed, obtained from the ocean. The birds, it is true, generally inhabit the caverns in the vicinity of the sea, as agreeing best with their habits, and affording them the most convenient retreats to which to attach their nests; but several caverns are found inland, at a distance of forty or fifty miles from the sea, containing nests similar to those on the shore. From many of their retreats along the southern coast, they have been observed to take their flight in an inland direction, towards the pools, lakes, and extensive marshes, covered with stagnant water, as affording them abundance of their food, which consists of flies, musquitoes, gnats, and small insects of every description. The sea, which washes the foot of the cliffs, where they most abound, is almost al-

ways in a state of the most violent agitation; and affords none of those substances which have been supposed to constitute the food of the esculent swallow. Another species of swallow in the island of Java, forms a nest, in which grass, moss, &c. are merely agglutinated by a substance exactly similar to that of which exclusively the edible nests consist. This substance, from whatever part of those regions the nests be derived, is essentially uniform, differing only in the colour, according to the relative age of the nests. It exhibits none of those diversities which might be expected, if, like the mud employed by the martin, and the materials commonly used in nest-making, it were collected casually, and applied to the rocks. Were it to consist of the substances usually supposed, it would be putrescent and diversified.

## THE TERMITES, OR WHITE ANTS.

[See Plate, No. 14.]

Of these very surprising insects naturalists describe four species, the largest of which is the **TERMES BELLICOSUS**, or **BELLIGERENT TERMITE**. The nests of these insects are large handsome pyramids, ten or twelve feet and upwards above the surface of the earth, and as many beneath it. The second species is named the **FATAL TERMITE**, the nests of which are likewise of a pyramidal form, but neither so lofty nor extensive as the former. Its ravages, however, are more fatal, and its punctures more painful and dangerous. The **BITING TERMITE** forms the third species, and constructs its nest in the form of a cylindrical turret, four feet high, and one in diameter. The turret is covered with a conical roof, which projects some inches over, and beyond the building, doubtless to prevent it from being injured by the rain. The **DESTROYING TERMITE** constitutes the fourth species, and constructs spherical nests round the branch of a tree, which passes entirely through them.

The **TERMES BELLICOSUS**, according to Mr. Smeathman, whose account has appeared in the *Philosophical Transactions*, constructs works which surpass those of the bees, wasps, beavers, and other animals, as much at least, as those of the most polished European nations excel those of the least cultivated savages. Even with regard to man, his greatest works, the boasted pyramids, fall comparatively far short, even in size alone, of the structures raised by these insects. The labourers among them employed in this service, are not a quarter of an inch in length; but the structures which they erect, rise, as has already been observed, to the height of ten or twelve feet and upwards, above the surface of the earth. Supposing the *height of a man to be six feet*, this author calculates, that the

buildings of these insects may be considered, relatively to their size, and that of a man, as being raised to nearly five times the height of the greatest of the Egyptian pyramids ; that is, corresponding with considerably more than half a mile. It may be added, that, with respect to the interior construction, and the various members and dispositions of the parts of the buildings, they appear greatly to exceed that, or any other work of human construction.

The most striking parts of these structures are the royal apartments, the nurseries, magazines of provisions, arched chambers and galleries, with their various communications ; the ranges of the gothic-shaped arches, projected, and not formed by mere excavation, some of which are two or three feet high, but which diminish rapidly, like the arches of aisles in perspectives ; the various roads, sloping staircases, and bridges, consisting of one vast arch, and constructed to shorten the distance between the several parts of the building, which would otherwise communicate only by winding passages. In the plate, a section is given of one of these surprising mounds or ant hills ; and likewise the section of a pyramid surmounted by its conical roof. In some parts near Senegal, the number, magnitude, and closeness of these structures, make them appear like the villages of the natives.

The economy of these industrious insects is equally curious with the plan and arrangement of the interior of their buildings. There are three distinct ranks or orders among them, constituting a well regulated community. These are, first, the *labourers*, or working insects ; next, the *soldiers*, or fighting order, who abstain from all labour, and are about twice as long as the former, and equal in bulk to about fifteen of them ; and, lastly, the winged, or perfect insects, which may be styled the *nobility*, or *gentry*, of the state ; for they neither labour nor fight, being scarcely capable even of self-defence. These alone are capable of being elected *kings* or *queens* ; and it has been so ordained by nature, that they emigrate within a few weeks after they are elevated to this state, and either establish new kingdoms or perish in the space of one or two days.

The first order, the working insects, are most numerous, being in the proportion of one hundred to one of the soldiers. In this state, they are about a quarter of an inch long, and twenty-five of them weigh about a grain, so that they are not so large as some of the ants of Europe.

The second order, or soldiers, have a very different form from the labourers, and have been by some authors supposed to be the males, and the former the neuters ; but they are, in

really, the same insects as the foregoing, only that they have undergone a change of form, and approached one degree nearer to the perfect state.

The third order, or the insect in its perfect state, varies its form still more than ever, differing in every essential part from the labourers and soldiers; besides which, it is now furnished with four fine, large, brownish, transparent wings, with which it is, at the time of emigration, to wing its way in search of a new settlement. The difference is, indeed, so great, that these perfect insects have not, until recently, been supposed to belong to the same community with the others, and are not to be discovered in the nest, until just before the commencement of the rainy season, when they undergo the last change, which is preparative to the formation of new colonies. They are equal in bulk to two soldiers and about thirty labourers; and, with the aid of their wings, roam about for a few hours, when their wings fall off, and they become the prey of innumerable birds, reptiles, and insects. Hence it happens, that scarcely a pair of the many millions of this unhappy race, find a place of safety, to fulfil the first law of nature, and lay the foundation of a new community. In this state, many fall into the neighbouring waters, and are eaten with avidity by the Africans, who roast them in the manner of coffee, and find them delicate, nourishing, and wholesome.

The few fortunate pairs who survive this annual massacre and destruction, being casually found by some of the labourers, who are constantly running about on the surface of the ground, are elected kings and queens of new states. Those who are not so elected and preserved, certainly perish, and most probably in the course of the following day. By these industrious creatures, the king and queen elect are immediately protected from their innumerable enemies, by inclosing them in a chamber of clay, where the propagation of the species soon commences. Their voluntary subjects then busy themselves in constructing wooden nurseries, or apartments, solely composed of wooden materials, seemingly joined together with gums. Into these, they afterwards carry the eggs produced by the queen, lodging them as fast as they can obtain them from her. Plausible reasons are given by Mr. Smeathman for the belief he entertains, that they here form a kind of garden for the cultivation of a species of microscopical mushroom; and in this belief he is supported by Mr. Konig, in his essay on the East-Indian termites, by whom also this is conjectured to be the food of the young insects. But perhaps the most wonderful, at the same time, best authenticated, part of the

history of these curious insects, is that which relates to the queen, or mother of the community in her pregnancy.

After impregnation, a very extraordinary change begins to take place in her person, or rather in her abdomen only. It gradually increases in bulk, and at length becomes of such an enormous size as to exceed the bulk of the rest of her body 1500 or 2000 times. She becomes 2000 times heavier than her consort, and exceeds 20,000 or 30,000 times the bulk of one of the labourers. In this state 80,000 eggs (for they have been counted) are protruded in twenty-four hours. They are instantly taken from her body by the attendants, a sufficient number of whom are constantly in waiting in the royal chambers, and adjacent galleries, and carried to the nurseries, which are sometimes four or five feet distant in a straight line. Here, after they are hatched, the young are attended and provided with every thing necessary, until they are able to shift for themselves, and take their share in the labours of the community.

Many curious and striking particulars are related of the great devastations committed by this powerful community, which construct roads, or rather covered ways, diverging in all directions from the nest, and leading to every object of plunder within their reach. Though the mischiefs they commit are very great, such is the economy of nature, that they are probably counterbalanced by the good produced by them, in quickly destroying dead trees and other substances, which would otherwise, by a tedious decay, serve only to encumber the face of the earth. Such is their alacrity and dispatch in this office, that the total destruction of deserted towns is accomplished in two or three years, and their space filled by a thick wood, not the least vestige of a house remaining.

At Bombay, Mr. Forbes observes in his memoirs, they are so numerous and destructive that it is difficult to guard against their depredations: in a few hours they will demolish a large chest of books, papers, silk, or clothes, perforating them with a thousand holes; the inhabitants dare not leave a box on the floor without placing it on glass bottles, which, if kept free from dust, they cannot ascend: this is trifling, when compared with the serious mischief they sometimes occasion, penetrating the beams of a house, or destroying the timbers in a ship.

These destructive animals advance by myriads to their work, under an arched incrustation of fine sand, tempered with a moisture from their body, which renders the covered-way as hard as burnt clay, and effectually conceals them in their industrious employment.

Mr. Forbes, on his departure from his residence at Anjengo, to pass a few weeks at a country retirement, locked up a room containing books, drawings, and a few valuables ; as he took the key with him, the servant could not enter to clean the furniture ; the walls of the room were white-washed, and adorned with prints and drawings, in English frames and glasses : returning home in the evening, and taking a cursory view of his cottage by candle light, he found every thing apparently in the same order as he left it ; but on a nearer inspection the next morning, he observed a number of advanced works, in various directions, towards his pictures ; the glasses appeared to be uncommonly dull, and the frames covered with dust : on attempting to wipe it off, he was astonished to find the glasses fixed to the wall, not suspended in frames as he left them, but completely surrounded by an incrustation cemented by the white ants, who had actually eaten up the deal frames and backboards, and the greater part of the paper, and left the glasses upheld by the incrustation, or covered-way, which they had formed during their depredation. From the flat Dutch bottles, on which the drawers and boxes were placed, not having been wiped during his absence, the ants had ascended the bottles by means of the dust, eaten through the bottom of a chest, and made some progress in perforating the books and linen.

The different functions of the labourers and soldiers, or the civil and military establishments, in a community of white ants, are illustrated by Mr. Smeathman, in an attempt to examine their nest or city. On making a breach in any part of this structure with a hoe or pick-axe, a soldier immediately appears, and walks about the breach, as if to see whether the enemy is gone, or to examine whence the attack proceeds. In a short time, he is followed by two or three others, and soon afterwards by a numerous body, who rush out as fast as the breach will permit them, their numbers increasing as long as any one continues to batter the building. During this time, they are in the most violent bustle and agitation ; some being employed in beating with their forceps upon the building, so as to make a noise which may be heard at three or four feet distance. On ceasing to disturb them, the soldiers retire, and are succeeded by the labourers who hasten in various directions towards the breach, each with a burden of mortar in his mouth, ready tempered. Though there are millions of them, they never stop or embarrass each other ; and a wall gradually arises to fill up the chasm. A soldier attends every 600 or 1000 of the labourers, seemingly as a director of the works ; for he never touches the mortar, either to lift or to carry it. One in particular, places himself close to the wall under repair, and fre-

quently makes the abovementioned noise, which is constantly answered by a loud hiss from all the labourers within the dome: and at every such signal, they evidently redouble their pace, and work as fast again.

The work being completed, a renewal of the attack constantly produces the same effects. The soldiers again rush out, and then retreat, and are followed by the labourers loaded with mortar, and as active and as diligent as before. Thus the pleasure of seeing them come out to fight or work alternately, Mr. Smeathman observes, may be obtained as often as curiosity excites, or time permits; and it will certainly be found that the one order never attempts to fight, nor the other to work, let the emergency be ever so great. The obstinacy of the soldiers is remarkable: they fight to the very last, disputing every inch of ground so well as often to drive away the negroes, who are without shoes, and make white people bleed plentifully through their stockings.

Such is the strength of the buildings erected by these pony insects, that when they have been raised to little more than half their height, it is the constant practice of the African wild bulls to stand as centinels upon them, while the rest of the herd are ruminating below. When at their full height of ten or twelve feet, they are used by Europeans as look-out stations whence they can see over the grass, which in Africa is, on an average, of the height of thirteen feet. Four or five persons may stand on the top of one of these buildings to look out for a vessel, the approach of which is expected.

#### TRANSFORMATION OF INSECTS.

All winged insects, without exception, and many of those which are destitute of wings, have to pass through several changes before they arrive at the perfection of their natures. The appearance, the structure, and the organs of a caterpillar, a chrysalis, and a fly, are so different, that, to a person unacquainted with their transformations, an identical animal would be considered as three distinct species. Without the aid of experience, who could believe that a butterfly, adorned with four beautiful wings, furnished with a long spiral proboscis, instead of a mouth, and with six legs, proceeded from a disgusting caterpillar, provided with jaws and teeth, and fourteen feet? Without experience, who could imagine that a long, white, smooth, soft worm, hid under the earth, should be transformed into a black crustaceous beetle, having wings covered with horny cases?

Besides their final metamorphosis into flies, caterpillars undergo several intermediate changes. All caterpillars cast a

change their skins more or less frequently according to the species. The silkworm, previous to its chrysalis state, casts its skin four times. The first skin is cast on the 10th, 11th, or 12th day, according to the nature of the season; the second, in five or six days after; the third, in five or six days more: and the fourth and last, in six or seven days after the third. This changing of skin is not only common to all caterpillars, but to every insect whatever. Not one of them arrives at perfection without casting its skin at least once or twice. The skin, after it is cast, preserves so entirely the figure of the caterpillar in its head, teeth, legs, colour, hair, &c. that it is often mistaken for the animal itself. A day or two before this change happens, caterpillars take no food; they lose their former activity, attach themselves to a particular place, and bend their bodies in various directions, till, at last, they escape from the old skin, and leave it behind them. The intestinal canal of caterpillars is composed of two principal tubes, the one inserted in the other: the external tube is compact and fleshy; but the internal one is thin and transparent. Some days before caterpillars change into the chrysalis state, they void, along with their excrement, the inner tube which lined their stomach and intestines. When about to pass over into the chrysalis state, which is a state of imbecility, they select the most proper places and modes of concealing themselves from their enemies. Some, as the silkworm and many others, spin silken webs or cords round their bodies, which completely disguise the animal form. Others, leave the plants upon which they formerly fed, and hide themselves in little cells which they make in the earth. The rat-tailed worm abandons the water upon the approach of its metamorphosis, retires under the earth, where it is changed into a chrysalis, and, after a certain time, bursts from its seemingly inanimate condition, and appears in the form of a winged insect. Thus the same animals pass the first and longest period of their existence in the water, another under the earth, and the third and last in the air. Some caterpillars, when about to change into a chrysalis state, cover their bodies with a mixture of earth and of silk, and conceal themselves in the loose soil. Others incrust themselves with a silky or glutinous matter, which they push out from their mouths, without spinning it into threads. Others retire into the holes of walls or decayed trees. Others suspend themselves to the twigs of trees, or to other elevated bodies, with their heads undermost. Some attach themselves to walls, with their heads higher than their bodies, but in various inclinations: and others choose a *horizontal position*. Some fix themselves by a gluten, and



spin a rope round their middle to prevent them from falling. Those which feed upon trees attach themselves to the branches, instead of the leaves, which are less durable, and subject to a variety of accidents. The colours of the caterpillar give no idea of those of the future flies.

The metamorphosis of insects has been regarded as a sudden operation, because they often burst their shell or silky covering quickly, and immediately appear furnished with wings. But by more attentive observation, it has been discovered, that the transformation of caterpillars is a gradual process from the moment the animals are hatched till they arrive at a state of perfection. Why, it may be asked, do caterpillars so frequently cast their skins? The new skin, and other organs, were lodged under their old ones, as, in many tubes or cases, and the animal retires from these cases, because they have become too strait. The reality of these encasements has been demonstrated by a simple experiment. When about to molt or cast its skin, if the foremost legs of a caterpillar are cut off, the animal comes out of the old skin deprived of these legs. From this fact, Reaumur conjectured, that the chrysalis might be thus encased, and concealed under the last skin of the caterpillar. He discovered that the chrysalis, or rather the butterfly itself, was inclosed in the body of the caterpillar. The proboscis, the antennæ, the limbs, and the wings of the fly, are so nicely folded up, that they occupy a small space only under the first two rings of the caterpillar. In the first six limbs of the caterpillar, are encased the six limbs of the butterfly. Even the eggs of the butterfly have been discovered in the caterpillar long before its transformation.

From these facts it appears, that the transformation of insects is only the throwing off external and temporary coverings, and not an alteration of the original form. Caterpillars may be considered as analogous to the fetuses of men and of quadrupeds. They live and receive nourishment in envelopes till they acquire such a degree of perfection, as enables them to support the situation to which they are ultimately destined by Nature.

#### ZOOPTHITES, OR PLANT-ANIMALS.

These wonderful productions are so denominated on account of their existing in the shape of plants. They are very numerous, and the greater part of them have so great a resemblance to vegetables, that they have generally been considered as such, although the horny and stony appearance of several of the tribe, declares them, at first view, to be of a widely different nature from the generality of plants. In others, how-

ever, the softness of their substance, and the ramified mode of their growth, would lead any one not acquainted with their real nature to suppose them vegetables. The hard, horny, or stony zoophytes are in general known by the name of corals; and of these, several distinctions are formed, either from the structure and appearance of the coral or hard part, or from the affinity which the softer, or animal part, bears to some other genus among soft-bodied animals, or *mollusca*. The zoophytes may be therefore said to unite the animal and vegetable kingdoms, so as to fill up the intermediate space.

Belonging to the class of zoophitic-worms, the fresh-water polypes are infinitely curious. These animals may be found in small streams, and in stagnant waters, adhering to the stems of aquatic plants, or to the under surface of the leaves, and other objects. If a polype be cut in two parts, the superior part will produce a new tail, and the inferior part a new head and arms; and this, in warm weather, in the course of a very few days. If cut into three pieces, the middle portion will produce both the head and tail; and in short, polypes may be cut in all directions, and will still re-produce the deficient organs. The natural mode of propagation in this animal, is by shoots or offsets, in the manner of a plant: one or more branches or shoots proceed from the parent stem, dropping off when complete; and it often happens that these young branches produce others before they themselves drop off from the parent; so that a polype may be found with several of its descendants still adhering to its stem, thus constituting a real genealogical tree. The polype likewise, during the autumnal season, deposits eggs, which evolve themselves afterwards into distinct animals; and thus possesses two modes of multiplication. It seems paradoxical that a polype should be able to swallow a worm three or four times as large as itself, which is frequently observed to happen; but it must be considered that the body of the animal is extremely extensile, and that it possesses, in an extraordinary degree, the power of stretching itself according to the size of the substance it has to swallow. It seizes its prey with great eagerness, but swallows it slowly, in the same manner as a snake swallows any small quadruped. The arms of a polype, when microscopically examined, are found to be furnished with a vast number of small organs, apparently acting like so many suckers, by the means of which, the animal can hold a worm, even though but slightly in contact with one of its arms; but when on the point of swallowing its prey, it then makes use of all its arms at once, in order to absorb it the more readily.

*Corals, on being gathered perfectly fresh, and placed in sea*

water, appear to put forth small flowers from all the minute cavities, or hollow points on the surface. These supposed flowers, (for such an idea has been entertained,) are real animals; and consequently corals are to be considered as aggregates of animals, either forming, or at least inhabiting, the calcareous substance of the coral in which they appear. The smaller corals, commonly known by the name of corallines, or sea-mosses, are so many ramified sea-polypes, covered with a kind of strong, horny case to defend them from the injuries to which they would be liable, in the boisterous element destined for their abode. The harder, or stony corals are equally of an animal nature; the entire coral continuing to grow as an animal, and to form, by secretion, the stronger or horny exterior, which may at once be considered as its bone, and the habitation in which it has constantly to dwell. A coral of this kind is, therefore, a large compound zoophite, springing up from the rock, in which it seems to have taken root, and shooting out into branches like a vegetable production.

Sponges afford another curious instance of zoophitic life. There are forty-nine species of this zoophite, each of which is characterized in the Linnæan system as a fixed animal, flexible, torpid, of various forms, composed either of reticulate fibres, or masses of small spines interwoven together, and clothed with a gelatinous flesh, full of small mouths on its surface, by which it absorbs and rejects water. The existence of the animal inhabitant within its cell has been satisfactorily ascertained by the observations and experiments of Ellis on the *spongia tomentosa*. He remarked its contraction when exposed to pain or injury, as well as the expiration and inspiration of water through its tubes. He thus established the position that sponge is an animal, and that the ends or openings of the branched tubes are the mouths by which it receives its nourishment and discharges its excrementitious matter. This position chemistry has since abundantly supported, by proving the ammoniacal property of the cellular substance of sponge.

#### THE BANIAN TREE.

Proceeding to the vegetable kingdom, the BANIAN, or BURN TREE, the *ficus indica* of Linnæus, claims a particular attention. It is considered as one of the most curious and beautiful of nature's productions in the genial climate of India, where she sports with the greatest profusion and variety. Each tree is in itself a grove, and some of them are of an amazing size, as they are continually increasing, and, contrary to most other animal and vegetable productions, seem to be exempted from decay: for every branch from the main body throws out its own roots.

it in small tender fibres, several yards from the ground, continually grow thicker; until by a gradual descent, reach its surface; where, striking in, they increase to a trunk, and become a parent tree, throwing out new ones from the top. These in time suspend their roots, receiving nourishment from the earth, swell into trunks, shoot forth other branches; thus continuing in a state of emission so long as the first parent of them all supplies her place.

The banian tree with many trunks, forms the most beautiful shade, vistas, and cool recesses, that can be imagined. The leaves are large, soft, and of a lively green; the fruit is a small when ripe of a bright scarlet; affording sustenance to monkeys, squirrels, peacocks, and birds of various kinds, which frequent among the branches.

The Hindoos are peculiarly fond of this tree; they consider its long duration, its out-stretching arms, and over shadowing largeness, as emblems of the Deity, and almost pay it divine honors. The Brahmins, who thus "find a fan in every savanna," spend much of their time in religious solitude under the shade of the banian tree; they plant it near the dewals, and in the Hindoo temples, improperly called pagodas; and in those places where there is not any structure for public worship, they place an image under one of these trees, and there perform a morning and evening sacrifice.

These are the trees under which a sect of naked philosophers, called Gymnosophists, assembled in Arrian's days; and the historian of ancient Greece, it is observed by Forbes, in his Oriental Memoirs, affords a true picture of the modern Hin-

"In winter the Gymnosophists enjoy the benefit of the sun's rays in the open air; and in summer, when the heat becomes excessive, they pass their time in cool and moist places, under the shade of large trees; which, according to the accounts of Nearchus, cover a circumference of five acres, and extend their branches so far, that ten thousand men may easily find shelter under them."

On the banks of the Narbudda, in the province of Guzzerat, stands a banian tree, supposed by some persons to be the one described by Nearchus, and certainly not inferior to it. It is distinguished by the name of the Cubbeer Burr, which was given to it in honour of a famous saint. High floods have, at various times, swept away a considerable part of this extraordinary tree; but what still remains is nearly two thousand feet in circumference, measured round the principal stems; the hanging branches, not yet struck down, cover a much larger space; and under it grow a number of custard apple,

and other fruit trees. The large trunks of this single tree amount to *three hundred and fifty*, and the smaller ones *exceed three thousand*: each of these is constantly sending forth branches and hanging roots, to form other trunks, and become the parents of a future progeny.

The CUBBEER BURR is famed throughout Hindostan, not only on account of its great extent, but also of its surpassing beauty. The Indian armies generally encamp around it; and, at stated seasons, solemn jatarras, or Hindoo festivals, to which thousands of votaries repair from every part of the Mogul empire, are there celebrated. It is said that 7000 people find ample room to repose under its shade. It has long been the custom of the British residents in India, on their hunting and shooting parties, to form extensive encampments, and spend weeks together under this magnificent pavilion, which affords a shelter to all travellers, particularly to the religious tribes of the Hindoos. It is generally filled with a variety of birds, snakes, and monkeys, the latter of which both divert the spectator by their antic tricks, and interest him by the parental affection they display to their young offspring, in teaching them to select their food, to exert themselves in jumping from bough to bough, and in taking, as they acquire strength, still more extensive leaps from tree to tree. In these efforts, they encourage them by caresses, when timorous, and menace, and even beat them, when refractory.

#### THE WEDDED BANIAN TREE.

Among the varieties of the Banian, or Burr trees, is the PEIPAL, or *ficus religiosa*, which is not uncommon in Guzerat, and causes a singular variety of vegetation. It may be considered as belonging to the order of creepers, and often springs round different trees, particularly the palmyra, or palm. The latter growing through the centre of a banian tree, looks extremely grand. The peipal frequently shoots from old walls, and runs along them, so as to cause a singular phenomenon of vegetation. In the province of Bahar, one of these trees was seen by an English traveller, on the inside of a large brick well, the whole circumference of the internal space of which it lined, and thus actually became a tree turned inside out. A banian tree thus inverted is uncommon; but the general usefulness and beauty of this variety, especially in overshadowing the public wells and village markets, can only be known by those who live in a sultry climate.

## THE COCOA-NUT TREE.

Of all the gifts which Providence has bestowed on the oriental world, the cocoa-nut tree is the one most deserving of notice. The blessings which are conveyed to man, by this single production of nature, are incalculable. It grows in a stately column, from thirty to fifty feet in height, crowned by a verdant capital of waving branches, covered with long spiral leaves: under this foliage, bunches of blossoms, clusters of green fruit, and others arrived at maturity, appear in mingled beauty. The trunk, though porous, furnishes beams and rafters for habitations; and the leaves, when platted together, make an excellent thatch, as well as common umbrellas, coarse mats for the floor, and brooms; while their finest fibres are woven into very beautiful mats for the rich. The covering of the young fruit is extremely curious, resembling a piece of thick cloth, in a conical form, as close and firm as if it came from the loom; it expands after the fruit has burst through its inclosure, and then appears of a coarser texture. The nuts contain a delicious milk, and a kernel sweet as the almond: this, when dried, affords abundance of oil; and when that is expressed, he remains feed cattle and poultry, and make a good manure. The shell of the nut furnishes cups, ladles, and other domestic utensils, while the husk which encloses it is of the utmost importance: it is manufactured into ropes, and cordage of every kind, from the smallest twine to the largest cables, which are far more durable than those of hemp. In the Nicobar islands, the natives build their vessels, make the sails and cordage, supply them with provisions and necessaries, and provide a cargo of arrack, vinegar, oil, jaggree or coarse sugar, cocoa-nuts, coir, cordage, black paint, and several inferior articles, for foreign markets, entirely from this tree.

Many of the trees are not permitted to bear fruit; but the embryo bud, from which the blossoms and nuts would spring, is tied up to prevent its expansion; and a small incision being then made at the end, a cool pleasant liquor, called Tarce, or Toddy, the palm-wine of the poets, oozes out in gentle drops.

## THE UPAS, OR POISON TREE.

Although a serious refutation of the gross imposition practised on the people of Europe, by the romance of Foersch on the subject of the UPAS, or celebrated poison tree of Java, may at this time be in a great measure superfluous, as the world has long ceased to be the dupe of his story, and as regular series of experiments have been instituted both in England and in France, to ascertain the nature and potency of the poison; yet

an authentic account of this poison, as drawn out by Dr. Horsfield, and published in the seventh volume of the Batavian transactions, cannot fail to be interesting. Almost every one has heard of the fabulous history, which, from its extravagant nature, its susceptibility of poetical ornaments, its alliance with the cruelties of a despotic government, and the sparkling genius of Darwin, whose purpose it answered to adopt and personify it as a malignant spirit, (in his *Loves of the Plants*,) has obtained almost equal currency with the wonders of the Lernæan hydra, or any other of the classic fictions of antiquity.

Although, the Doctor observes, the account published by Foersch, so far as relates to the situation of the poison tree, to its effects on the surrounding country, and to the application said to have been made of the upas on criminals in different parts of the island, has, as well as the description of the poisonous substance itself, and its mode of collection, been demonstrated to be an extravagant forgery; the existence of a tree on Java, from the sap of which a poison is prepared, equal in fatality, when thrown into the circulation, to the strongest animal poisons hitherto known, is a fact which it is his object to establish and illustrate. The tree which produces this poison is the anchar, and grows in the eastern extremity of the island. The work of Rhumphius contains a long account of the upas, under the denomination of *arbor toxicaria*. The tree does not grow on Ambonia, and his description was made from the information he obtained from Makasar. His figure was drawn from a branch of what is called the male-tree, sent to him from the same place, and establishes the identity of the poison tree of Makasar, and the other eastern Islands, with the anchar of Java. The simple sap of the *arbor toxicaria*, (according to Rhumphius,) is harmless, and requires the addition of several substances of the affinity of ginger, to render it active and mortal. In so far it agrees with the anchar, which, in its simple state, is supposed to be inert, and, before being employed as a poison, is subjected to a particular preparation. Besides the true poison tree, the upas of the Eastern Islands, and the anchar of the Javans, this island produces a shrub, which, as far as observations have hitherto been made, is peculiar to the same, and by a different mode of preparation, furnishes a poison far exceeding the upas in violence. Its name is *chetik*; but the genus to which it belongs has not yet been discovered or described.

The anchar is one of the largest trees in the forests of Java. The stem is cylindrical, perpendicular, and rises completely naked to the height of sixty, seventy, or eighty feet. It is covered with a whitish bark, slightly bursting in longitudinal fur-

rows. Near the ground, this bark is, in old trees, more than half an inch thick, and upon being wounded, yields plentifully the milky juice from which the celebrated poison is prepared. A puncture or incision being made into the tree, the juice or sap appears oozing out, of a yellowish colour (somewhat frothy) from old; paler, or nearly white, from young ones; exposed to the air, its surface becomes brown. The consistence very much resembles milk; but it is more thick and viscid. This sap is contained in the true bark (or cortex,) which, when punctured, yields a considerable quantity, so that in a short time a cup full may be collected from a large tree. The inner bark, (or liber,) is of a close-fibrous texture, like that of the *morus papyrifera*, and when separated from the other bark, and cleansed from the adhering particles, resembles a coarse piece of linen. It has been worked into ropes, which are very strong; and the poorer class of people employ the inner bark of the younger trees, which is more easily prepared, for the purpose of making a coarse stuff which they wear in working in the fields. But it requires much bruising, washing, and a long immersion, before it can be used; and, when it appears completely purified, persons wearing this dress, being exposed to rain, are affected with an intolerable itching, which renders their flimsy covering insupportable. It appears from the account of the manner in which the poison is prepared, that the deleterious quality exists in the gum, a small portion of which still adhering, produces, when exposed to wet, this irritating effect; and it is singular that this property of the prepared bark is known to the Javans in all places where the tree grows, while the preparation of a poison from its juice, which produces a mortal effect when introduced into the body by pointed weapons, is an exclusive art of the inhabitants of the eastern extremity of the island.

## CURIOSITIES OF ART.

### EDIFICES.

#### ST. PETER'S OF ROME.

[See Plate, No. 15.]

The piazza of this masterpiece of architecture is altogether sublime. The double colonnade on each side, extending in a semi-circular sweep; the stupendous Egyptian obelisk; the two fountains; the portico; and the admirable facade of the church; form such an assemblage of magnificent objects, as cannot fail to impress the mind with awe and admiration.



The church appears in the back-ground, and on each side is a row of quadruple arches, resting on two hundred and eighty-four pillars, and eighty-eight pilasters; the arches support one hundred and ninety-two statues, twelve feet in height. The two noble fountains throw a mass of water to the height of nine feet, from which it falls in a very picturesque manner, and adds greatly to the beauty of the scene. In the centre is the fine obelisk.

At the first entrance into St Peter's, the effect is not so striking as might be expected: it enlarges itself, however, insensibly on all sides, and mends on the eye every moment. The proportions are so accurately observed, that each of the parts is seen to an equal advantage, without distinguishing itself above the rest. It appears neither extremely high, nor long, nor broad, because a just equality is preserved throughout. Although every object in this church is admirable, the most astonishing part of it is the cupola. On ascending to it, the spectator is surprised to find, that the dome which he sees in the church, is not the same with the one he had examined without doors, the latter being a kind of case to the other, and the stairs by which he ascends into the ball, lying between the two. Had there been the outward dome only, it would not have been seen to advantage by those who are within the church; or had there been the inward one only, it would scarcely have been seen by those who are without; and had both been one solid dome of so great a thickness, the pillars would have been too weak to have supported it.

It is not easy to conceive a more glorious architectural display than the one, which presents itself to the spectator who stands beneath the dome. If he looks upward, he is astonished at the spacious hollow of the cupola, and has a vault on every side of him, which makes one of the most beautiful vistas the eye can possibly have to penetrate. To convey an idea of its magnitude, it will suffice to say, that the height of the body of the church, from the ground to the upper part of its ceiling, is four hundred and thirty-two feet, and that sixteen persons may place themselves, without inconvenience, in the globular top over the dome, which is annually lighted, on the 29th of June, by four thousand lamps and two thousand fire-pots, presenting a most delightful spectacle.

The vestibule of St. Peter's is grand and beautiful. Over the second entrance is a fine mosaic from Giotto, executed in the year 1303; and at the corners, to the right and left, are the equestrian statues of Constantine and Charlemagne. Of the five doors leading to the church itself, one, called the holy

door, is generally shut up by brick-work, and is only opened at a time of the Jubilee. The middle gate is of bronze, with *s-reliefs*.

Of the one hundred and thirty statues with which this church is adorned, that of St. Peter is the most conspicuous: it is said to have been recast from a bronze statue of Jupiter Capitolinus. One hundred and twelve lamps are constantly burning round the tomb of this Saint; and the high altar close to it, on which the Pope alone reads mass, is overshadowed by a ceiling, which exceeds in loftiness that of any palace of Rome. The splendid sacristy was built by Pius VI. But by far the greatest ornaments of the interior are the excellent works in mosaic, all copied from the most celebrated pictures, which are thus guarded from oblivion.

The great and truly awful dome of St. Peter's, is only two feet less in diameter than that of the Pantheon, being one hundred and thirty-seven feet; but it exceeds the latter in height by twenty feet, being one hundred and fifty-nine feet, besides the lantern, the basis pedestal of the top, the globular top itself, and the cross above it, which, collectively, measure one hundred and twenty feet. The roof of the church is ascended by easy steps; and here the visitor seems to have entered a small town, for he suddenly finds himself among a number of houses, which either serve as repositories of implements and materials for repairing the church, or are inhabited by the workmen. The dome, at the foot of which he now arrives, appears to be the parish church of this town; and the inferior rooms seem as if intended only for ornaments to fill up the vacancies. Add to this, that he cannot see the streets of Rome, the account of the surrounding high gallery, and its colossal statues: and the singularity of such a scene may be easily conceived. It is besides said, that a market is occasionally held here for the aerial inhabitants.

Although the adventurous stranger is now on the roof, he is still a great height to ascend before he reaches the summit of the dome. Previously to his engaging in this enterprise, he is conducted to the inside gallery of the dome. From this point the people within the body of the church appear like children. The higher he goes, the more uncomfortable he finds himself, on account of the oblique walls over the narrow staircase; and he is often compelled to lean with his whole body to one side. Several marble plates are affixed in these walls, containing the names of the distinguished personages who have had the courage to ascend to the dome, and even to climb up to the lantern, and the top. The Emperor Joseph is twice mentioned; and Paul I. as Grand Duke. In some

parts, where the stairs are too steep, more commodious steps of wood have been placed : by these the lantern can be reached with greater facility ; and the view which there waits the visitor, may be imagined without the aid of description ; it is AN IMMENSE PANORAMA, BOUNDED BY THE SEA.

ST. PAUL'S CHURCH IN LONDON.

[See Plate, No. 16.]

The chief ecclesiastical ornament of London is the Cathedral Church of St. Paul, which stands in the centre of the metropolis, on an eminence rising from the valley of the Fleet. The body of the church is in the form of a cross. Over the space where the lines of that figure intersect each other, rises a stately dome, from the top of which springs a lantern adorned with Corinthian columns, and surrounded at its base by a balcony ; on the lantern rests a gilded ball, and on that a cross, (gilt also,) crowning the ornaments of the edifice. The length of the church, including the portico, is 510 feet ; the breadth 282 ; the height to the top of the cross, 404 ; the exterior diameter of the dome, 145 ; and the entire circumference of the building, 2,292 feet. A dwarf stone wall supporting a balustrade of cast iron, surrounds the church, and separates a large area, which is properly the church-yard, from a spacious carriage and foot-way on the south side, and a foot pavement on the north.

The dimensions of this cathedral are great ; but the grandeur of the design, and the beauty and elegance of its proportions, more justly rank it among the noblest edifices of the modern world. It is adorned with three porticoes ; one at the principal entrance, facing the west, and running parallel with the opening of Ludgate-street ; and the other two facing the north and south, at the extremities of the cross aisle, and corresponding in their architecture. The western portico combines as much grace and magnificence as any specimen of the kind in the world. It consists of 12 lofty Corinthian columns below, and 8 composite above, supporting a grand pediment ; the whole resting on an elevated base, the ascent to which is by a flight of twenty-two square steps of black marble, running the entire length of the portico. The portico at the northern entrance, consists of a dome, supported by six Corinthian columns, with an ascent of twelve circular steps, of black marble. The southern portico is similar, except that the ascent consists of twenty-five steps, the ground on that side being lower.

The great dome is ornamented with thirty-two columns below, and a range of pilasters above. At the eastern extremity

ty of the church, is a circular projection, forming a recess within for the communion table. The walls are wrought in rustic, and strengthened and ornamented by two rows of coupled pilasters, one above the other, the lower being Corinthian, and the other composite. The northern and southern sides have an air of uncommon elegance. The corners of the western front are crowned with turrets of an airy and light form.

To relieve the heavy style of the interior, statues and monuments have been erected to the memory of great men. The statues are plain full-length figures, standing on marble pedestals, with appropriate inscriptions, in honour of Doctor Samuel Johnson, the benevolent Howard, and Sir William Jones, of Asiatic celebrity. Several of the monuments would disgrace the most barbarous age, and ought to be removed. The tomb of the great Nelson is beneath the pavement immediately under the dome.

The two turrets on the right and left of the west front, are each two hundred and eight feet in height. In one, on the southern side, is the great clock, the bell of which, weighing 11,474 pounds, and 10 feet in diameter, may be heard in the most distant part of London, when the wind blows towards that quarter. The entire pavement, up to the altar, is of marble, chiefly consisting of square slabs, alternately black and white, and is very justly admired. The floor round the communion table is of the same kind of marble, mingled with porphyry. The communion table has no other beauty; for, though it is ornamented with four fluted pilasters, which are very noble in their form, they are merely painted and veined with gold, in imitation of lapis lazuli. Eight Corinthian columns of blue and white marble, of exquisite beauty, support the organ gallery. The stalls in the choir are beautifully carved, and the other ornaments are of equal workmanship.

This Cathedral was built at the national expense, and cost £736,752. The iron balustrade on the wall surrounding the space that is properly the church-yard, which, with its seven iron gates, weigh 200 tons, cost £11,202. This immense edifice was reared in 35 years, the first stone being laid on the 21st of June, 1675, and the building completed in 1710, exclusive of some of the decorations, which were not finished till 1723. The highest stone of the lantern was laid on by Mr. Christopher Wren, son of the architect, in 1710. It was built by one architect, Sir *Christopher Wren*, by one mason, Mr. *Strong*; and while one prelate, Dr. *Henry Compton*, filled the see of London.

The dimensions of St. Paul's, from east to west, within the walls, are 510 feet; from north to south, within the doors of

the porticoes, 282; the breadth of the west entrance, 100; its circuit, 2292; its height within, from the centre of the floor to the cross, 340 feet. The circumference of the dome is 430 feet; the diameter of the ball, 6; from the ball to the top of the cross, 30; and the diameter of the columns of the porticoes, 4 feet. The height to the top of the west pediment, under the figure of St. Paul, is 120 feet; and that of the tower of the west front, 287.

From the bottom of the whispering gallery are 280 steps; including those to the golden gallery, 534, and to the ball, in all, 616 steps.—The weight of the ball is 5600 pounds.—The weight of the cross is 3360.—The extent of the ground whereon this Cathedral stands, is two acres, 16 perches. The length of the hour figures is 2 feet 2 1-2 inches; the circumference of the dial is 57 feet.

The *Whispering Gallery* is a very great curiosity.—It is 140 yards in circumference. A stone seat runs round the gallery along the foot of the wall. On the side directly opposite the door by which the visitor enters, several yards of the seat are covered with matting, on which the visitor being seated, the man who shows the gallery, whispers, with the mouth close to the wall, near the door, at the distance of 140 feet from the visitor, who hears his words in a loud voice, seemingly at his ear. The mere shutting of the door produces a sound to those on the opposite seat like violent claps of thunder. The effect is not so perfect, if the visitor sits down half way between the door and the matted seat, and still less so if he stands near the man who speaks, but on the other side of the door.

The marble pavement of the church is extremely beautiful, seen from this gallery. The paintings on the inner side of the dome, by Sir James Thornhill, are viewed with most advantage here. The ascent to the Ball is attended with some difficulty, and is encountered by few, yet both the Ball and passage to it well deserve the labour. The diameter of the interior of the Ball is six feet two inches, and twelve persons may sit within it.

The prospect from every part of the ascent to the top of St. Paul's, wherever an opening presents itself, is extremely curious. The effect is most complete from the gallery surrounding the foot of the lantern. The metropolis, from that spot, has a mimic appearance, like the objects in a *fantoccino*. The streets, the pavements, the carriages, and foot-passengers, have the appearance of fairy ground and fairy objects. The spectator, contemplating the bustle of the diminutive throng below, is moved a little out of the sphere of his usual symp-

with them, and, as if they were emmets, asks himself un-  
 tarily "about what are those little, inconsequential ani-  
 mals engaged?"

The form of the metropolis, and the adjacent country, is  
 perfectly seen from the gallery at the foot of the lantern,  
 a bright summer day. The ascent to this gallery is by  
 14 steps, of which 260, nearest the bottom, are extremely  
 easy; those above, difficult, and in some parts dark and un-  
 pleasant. In the ascent to this gallery, may be seen the brick  
 cone that supports the lantern, with its ball and cross; the  
 outer dome being turned on the outside of the cone, and the  
 inner dome turned on the inside. The entire contrivance to  
 produce the effect within the church, and on the outside, in-  
 ded by the architect, is extremely fine, even marvellous.  
 From the pavement of the church, the interior appears one  
 uninterrupted dome to the upper extremity; but it consists, in  
 fact, of two parts, the lower and principal dome having a large  
 circular aperture at its top, through which is seen a small  
 dome, that appears part of the great and lower dome, although  
 entirely separated from it, being turned also within the cone,  
 considerably above it.

#### WESTMINSTER ABBEY.

This interesting edifice derives its name of Westminster  
 Abbey from its situation in the western part of the metropo-  
 and its original destination as the church of a monastery.  
 The present church was built by Henry III. and his succes-  
 sors, with the exception of the two towers at the western en-  
 trance, which are the work of Sir Christopher Wren. The  
 length of the church is 360 feet; the breadth of the nave 72  
 feet; and the cross aisle 195 feet. The roof of the nave and  
 the cross aisle is supported by two rows of arches, one  
 above the other, each of the pillars of which, is a union of  
 a ponderous round pillar, and four of similar form, but ex-  
 tremely slender. These aisles being extremely lofty, and one  
 of the small pillars continued throughout, from the base to  
 the roof, produce an effect uncommonly grand and awful.  
 The choir is one of the most beautiful in Europe. It is di-  
 vided from the western part of the great aisle by a pair of iron  
 gates, and terminates at the east, by an elegant altar  
 of white marble. The altar is enclosed with a very fine bar-  
 rade, and in the centre of its floor, is a large square of cu-  
 pular *mosaic work*, of porphyry, and other stones of various  
 colours. In this choir, near the altar, is performed the cere-  
 mony of crowning the kings and queens of England.  
 At the southern extremity of the cross aisle, are erected

monuments to the memory of several of our most eminent poets. This interesting spot is called *Poet's Corner*; and never could place be named with more propriety; for here are to be found the names of Chaucer, Spenser, Shakespeare, Ben Jonson, Milton, Dryden, Butler, Thomson, Gay, Goldsmith, Addison, Johnson, &c.—Here also, as if this spot was dedicated to genius of the highest rank, are the tombs of Handel, Chambers, and Garrick.

The curiosities of Westminster Abbey consist chiefly of its highly interesting chapels, at the eastern end of the church, with their tombs. Immediately behind the altar stands a chapel dedicated to Edward the Confessor, upon an elevated floor, to which there is a flight of steps on the northern side. The shrine of the Confessor, which stands in the centre, was erected by Henry III. and was curiously ornamented with mosaic work of coloured stones, which have been picked away on every part within reach. Within the shrine is a chest, containing the ashes of the Confessor. The frieze representing his history from his birth to his death, put up in the time of Henry III. is highly curious, and deserves the study and attention of every lover of antiquity. The tomb of Henry III. is in this chapel; it has been extremely splendid, but is now mutilated. The table on which lies the king's effigy in brass, is supported by four twisted pillars, enamelled with gilt. This tomb, which is a fine specimen of its kind, is almost entire on the side next the area. It likewise contains the tombs of Edward I. and his Queen Eleanor; of Edward III. and Queen Philippa; of Richard II. and his Queen; of Margaret, daughter of King Edward IV.; of King Henry V.; and of Elizabeth, daughter of King Henry VII.

The grand monument of Henry V. is inclosed by an iron gate. The great arch over the tomb is full of ribs and pannels, and the headless figure of Henry still remains; the head was of solid silver, and was stolen during the civil wars. There was a chantry directly over the tomb, which had an altar-piece of fine carved work. The armour of Henry was once round his chantry; his helmet yet remains on the bar, and the very saddle which he rode at the battle of Agincourt, stripped of every thing which composed it, except the wood and iron, hangs on the right.

Contiguous to the eastern extremity of the church, and opening into it, stands the famous chapel of Henry VII. dedicated to the Virgin Mary, *one of the finest and most highly finished pieces of Gothic architecture in the world.* On its site, formerly stood a chapel, dedicated to the Virgin Mary, and also a tavern, distinguished by the sign of the White Rose.

Henry, resolving to erect a superb mausoleum for himself and his family, pulled down the old chapel and tavern; and on the 11th of February, 1503, the first stone of the present edifice was laid by Abbot Islip, at the command of the king. It cost £14,000, a prodigious sum for that period, (equal to £280,000 of our money;) and still more so, considering the parsimonious temper of the king. The labour merely of working the materials, will, at a glance, be seen to be immense, and almost incredible; and the genius employed both in this structure and Henry's tomb, must be mentioned with admiration.

The exterior of this chapel is remarkable for the richness and variety of its form, occasioned chiefly by fourteen towers, in an elegant proportion to the body of the edifice, and projecting in different angles from the outermost wall. It has lately been repaired and renewed with exquisite taste, and at great cost. The inside is approached by the area behind the chapels of Edward the Confessor and Henry V.

The floor is elevated above that of the area, and the ascent is by a flight of marble steps. The entrance is ornamented with a beautiful Gothic portico of stone, within which are three large gates of gilt brass, of most curious open workmanship, every pannel being adorned with a rose and a portcullis, alternately.

The chapel consists of the nave and two small aisles. The centre is 99 feet in length, 66 in breadth, and 54 in height, and terminates at the east in a curve, having five deep recesses of the same form. The entrance to these recesses being by open arches, they add greatly to the relief and beauty of the building. It is probable they were originally so many smaller chapels, destined to various uses. The side aisles are in a just proportion to the centre; with which they communicate by four arches, turned on Gothic pillars. Each of them is relieved by four recesses, a window running the whole height of each recess, and being most minute and curious in its divisions. The upper part of the nave has its four windows on each side, and ten at the eastern extremity, five above and five below. The entire roof of the chapel, including the side aisles, and the curve at the end, is of wrought stone, in the Gothic style and of most exquisite beauty.

An altar tomb, erected by HENRY, at the cost of £10,000, to receive his last remains, stands in the centre of the chapel. It is of basaltic stone, ornamented with gilt brass, and is surrounded with a magnificent railing of the same. This monument is by Pietro Torregiano, a Florentine sculptor, and possesses uncommon merit. Six devices in bas-relief, and four statues, all of gilt brass, adorn the tomb.



It is impossible to conceive Gothic beauty of a higher degree than the whole of the interior of Henry the Seventh's Chapel; and it is with regret that the antiquary sees the stalls of the knights reared against the pillars and arches of the nave, forming screens that separate the small aisles from the body of the chapel, and diminish the airiness, and interrupt the harmony of the plan.

The prospect from the top of one of the western towers, the ascent to which consists of 283 steps, is infinitely more beautiful, though less extensive, than that from St. Paul's. The many fine situations and open sites at the west end of the town, and its environs, occasion the difference. The Banqueting House at Whitehall, St. James' Park, with the Parade and Horse Guards, Carlton House, the Gardens of the Queen's Palace, the Green Park, the western end of Piccadilly, and Hyde Park, with its river, lie at once under the eye, and compose a most grand and delightful scene. The bridges of Westminster, Waterloo, and Blackfriars, with the broad expanse of water between them, the Adelphi and Somerset House on its banks, St. Paul's stupendous pile, and the light Gothic Steeple of St. Dunstan's in the east, are alike embraced with one glance, and happily contrast with the former prospect. From this tower, the exterior form of St. Paul's, when the sun falls upon it, is distinctly seen: and here its exquisite beauty will be more fully comprehended than in any part of the city, for a sufficient area to take in the entire outline is not there to be found.

#### MOSQUE OF OMAR.

DOCTOR CLARKE, on viewing this Mosque, observes, that "the sight was so grand, that he did not hesitate in pronouncing it the most magnificent piece of architecture in the Turkish empire; and, considered externally, far superior to the mosque of St. Sophia in Constantinople. By the sides of the spacious area in which it stands, are certain vaulted remains; these plainly denote the masonry of the ancients; and evidence may be adduced to prove, that they belonged to the foundations of Solomon's temple. He observed, also, that reticulated stucco, which is commonly considered as an evidence of Roman work. Phocas believed the whole space surrounding this building to be the ancient area of the temple; and Golius, in his notes upon the Astronomy of Alferganes, says the whole foundation of the original edifice remained. As to the mosque itself, there is no building at Jerusalem that can be compared with it, either in beauty or riches. The lofty Saracenic poop so nobly displayed in the style of the building; its numerous arcades; its

capacious dome, with all the stately decorations of the place; its extensive area, paved and variegated with the choicest marbles; the extreme neatness observed in every avenue towards it; and lastly, the sumptuous costume observable in the dresses of all the Eastern devotees, passing to and from the sanctuary, make it altogether one of the finest sights the Mahometans have to boast."

MOSQUE OF ST. SOPHIA AT CONSTANTINOPLE.

The dome of this celebrated structure is one hundred and thirteen feet in diameter, and is built on arches, sustained by vast pillars of marble. The pavement and staircase are also of marble. There are two rows of galleries supported by pillars of party-coloured marble, and the entire roof is of fine mosaic work. In this mosque, is the superb tomb of the Emperor Constantine, for which the Turks have the highest veneration.

Beside the above, two other mosques attract the particular notice of travellers who visit the Turkish capital. That of the Valide-Sultan, founded by the mother of Mahomed IV., is the largest, and is built entirely of marble. Its proportions are stupendous; and it boasts the finest symmetry. The mosque of Sultan Solyman is an exact square, with four fine towers in the angles: in the centre is a noble cupola, supported by beautiful marble pillars. Two smaller ones at the extremities, are supported in the same manner. The pavement and gallery surrounding the mosque are of marble; and under the great cupola is a fountain, adorned with such finely coloured pillars, that they can scarcely be deemed of natural marble. On one side is the pulpit, of white marble; and on the other, the little gallery for the grand Signior.—A fine staircase leads to it; and it is built up with gilt lattices. At the upper end is a kind of altar, on which the name of God is inscribed; and before it stand two candlesticks, six feet in height, with wax candles in proportion. The pavement is spread with fine carpets, and the mosque illuminated by a vast number of lamps. The court leading to it is very spacious, with galleries of marble, supported by green columns, and covered by 28 leaden cupolas on the sides, with a fine fountain in the centre.

The mosque of Sultan Selim I. at Adrianople, is another surprising monument of Turkish architecture. It is situated in the centre and most elevated part of the city, so as to make a very noble display. The first court has four gates, and the innermost, three; both being surrounded by cloisters, with marble pillars of the Ionic order, finely polished, and of very lively colours: the entire pavement is of white marble, and the

## THE TEMPLE OF MECCA.

roof of the cloisters is divided into several cupolas or domes, surmounted with gilt balls. In the midst of each court are fine fountains of white marble; and, before the grand entrance, is a portico, with green marble pillars, provided with five gates. The body of the mosque is one prodigious dome, adorned with lofty towers, whence the *imaams*, or priests, call the people to prayers. The ascent to these towers is very artfully contrived: there is but one door, which leads to three different staircases, going to three different stories of the tower, in such a manner, that three priests may ascend and descend, by a spiral progress without meeting each other.

The walls of the interior are inlaid with porcelain, ornamented with small flowers and other natural objects, in very lively colours. In the centre hangs a vast lamp of gilt silver, besides which, there are at least two thousand smaller ones: the whole, when lighted, have a very splendid effect.

## THE TEMPLE OF MECCA.

This magnificent temple, to which pilgrims resort from every quarter of the globe where the religion of Islamism is practised, is known by the Mussulmen under the name of *EL HARAM*, or the temple of excellence. It is situated nearly in the middle of the city, which is built in a valley, having a considerable slope from the north to the south. It is composed of the house of God, *Beit Allah*, or as it is called also, *La Kaaba*; of the Well of *Zemzem*, *Bir Zemzem*; of the *Cobba*, or place of Abraham, *Makham*, *Ibrahim*; of the places of the four orthodox rites, *Makam Hhaneffi*, *Makam Shaffi*, *Makam Maleki*, and *Makam Hhanbeli*: of two *Cobbas*, or *Chapels*, *El Cobbatain*; of an arch, called *Babes-selem* (in the same style as a triumphal arch,) near the place of Abraham; of *El Monbar* or the *Tribune* for the Priest; of the wooden staircase *Daureh*, which leads to the saloon of the house of God; of an immense court surrounded by a triple row of arches: of two smaller courts, surrounded with elegant piazzas; of nineteen doors; and of seven towers, or minarets, five of which adhere to the edifice, and the other two are placed between the neighbouring houses out of the inclosure.

*La Kaaba*, *Beit Allah*, or the house of God, is a quadrilateral tower, the sides and angles of which are unequal, so that its plan forms a true trapezium. The size of the edifice, and the black cloth which covers it, make this irregularity disappear, and give to it the figure of a perfect square.

The black stone, *Hhajera el Assouad*, or heavenly stone, which all true Mussulmen believe to have been brought thither by the angel *Gabriel*, is raised forty-two inches above the sur-

face, and is bordered all around with a large plate of silver, about a foot broad. The part of the stone, that is not covered by the silver at the angle, is almost a semi-circle, six inches in height, by eight inches six lines diameter at its base.

El Bir Zemzem, or the well of Zemzem, is situated fifty-one feet distant to the E. 10° N. of the black stone. It is about seven feet eight inches in diameter, and fifty six feet deep to the surface of the water. The brim is of fine white marble, five feet high. Tradition records that this well was miraculously opened by the angel of the Lord for Agar, when she was nearly perishing from thirst in the desert with her son Ismael, after having been sent from Abraham's house.

The Kaaba, and the stones of Ismael, are situated nearly in the centre of the temple, and occupy the middle of an oval or irregular elliptical surface, which forms a zone of thirty-nine feet wide round the edifice, upon which the pilgrims make their tours round the Kaabar. It is paved with fine marble, and is situated upon the lowest plane of the temple.

#### ROYAL PALACE OF ISPAHAN.

The palaces of the King are inclosed in a fort of lofty walls, which is estimated to have a circumference of three miles. The palace of the Chehel Sitoon, or 'forty pillars,' is situated in the middle of an immense square, which is intersected by various canals, and planted in different directions by the beautiful chengar tree. In front is an extensive square basin of water, from the farthest extremity of which, the palace is beautiful beyond either the power of language or the correctness of pencil to delineate. The first saloon is opened towards the garden, and is supported by eighteen pillars, all inlaid with mirrors, and, the glass being in a much greater proportion than the wood, appears at a distance to be formed of glass only. Each pillar has a marble base, which is carved into the figures of four lions placed in such attitudes, that the shaft seems to rest on their four united backs. The walls, which form its termination behind, are also covered with mirrors placed in such a variety of symmetrical positions, that the mass of the structure appears to be of glass, and, when new, must have glittered with most magnificent splendour. The ceiling is painted in gold flowers, which are still fresh and brilliant. Large curtains are suspended on the outside, which are occasionally lowered to lessen the heat of the sun.

#### THE TOWER OF LONDON.

The Tower of London was anciently a palace inhabited by various sovereigns of England, till the reign of Queen Eliza-

beth. Its extent within the wall is twelve acres and five roods. The exterior circuit of the ditch, which entirely surrounds it, is 3156 feet. The ditch on the side of Tower-hill, is broad and deep; on the side next to the river, it is narrower. A broad and handsome wharf, or gravel terrace, runs along the banks of the river parallel with the Tower, from which it is divided by the ditch.

Within the walls of the Tower are several streets, and a variety of buildings. The principal buildings are the Church, the White Tower, the Ordnance Office, the Record Office, the Jewel Office, the Horse Armory, the grand Store House, the small Armory, the Houses belonging to the Officers of the Tower, Barracks for the Garrison, and two Suttling Houses, commonly used by the soldiers of the Garrison.

The White Tower is a large square building, situated in the centre of the fortress. On the top are four watch-towers, one of which, at present, is used as an observatory. It consists within, of three lofty stories, beneath which are large commodious vaults. In the first story are two grand rooms, one of which is a small armory for the sea-service, and contains various sorts of arms, curiously laid up, which would serve upwards of ten thousand seamen. In the other rooms, in closets and presses, are abundance of warlike tools and instruments of death. In the upper stories, are arms and armourers' tools. The models of all new-invented engines of destruction, which have been presented to government, are preserved in this tower. On the top is a large cistern filled from the Thames by a water-engine, to supply the garrison with water.

The grand Store House, which stands north of the White Tower, is a plain building of brick and stone, 345 feet long, and 60 feet broad. The Jewel Office is a little to the east of the grand Store House. It is a dark and strong stone room. The Horse Armory is a brick building eastward of the White Tower. The Record Office is in the Wakefield Tower, opposite the platform. The rolls from the time of King John to the beginning of the reign of Richard III., are kept here in fifty-six wainscot presses. They contain the ancient tenures of land in England, the original laws and statutes, the rights of England to the dominion of the British seas, the forms of submission of the Scottish kings, and a variety of other records, &c.

The principal entrance to the Tower is on the west. It consists of two gates on the outside of the ditch; a stone bridge built over the ditch, and a gate within the ditch. On the right hand, at the west entrance, the lions and other wild beasts and birds are kept in a yard. The dens are very commodious, and

out twelve feet in their whole height, being divided into upper and lower apartment. In the former, the animals are shown in the day time; and in the latter, they are shown at night. They are in general, very healthy; and it is remarkable, that those which have been whelped in the Tower are more fierce than such as have been taken wild. They are inclosed in front by iron gratings: the greater part of the Tower have been recently rebuilt, and every precaution taken to prevent accidents.

THE SPANISH ARMORY contains the trophies of the famous victory of Queen Elizabeth over the Spanish Armada. Among the most remarkable are the *thumb-screws*, intended to be used to extort confession from the English, where their motives were hidden. In the same room are other curiosities; among which is the axe with which the unfortunate Anne was beheaded, to gratify the capricious passions of her husband, Henry VIII. A representation of Queen Elizabeth in armour, standing by a cream coloured horse, attended by a page, is also shown in this room. Her Majesty is dressed in the armour she wore, at the time she addressed her brave army at the camp of Tilbury, 1588, with a white silk petticoat, ornamented with pearls and spangles.

THE SMALL ARMORY is one of the finest rooms of its kind in the Tower. It is 345 feet in length, and in general, it contains complete stands of arms for no less than 100,000 men. They are disposed in a variety of figures, in a very elegant manner. A collection of ordnance from Egypt has been lately added, sixteen inches long, and seven inches and a half bore. There are several other curiosities, among which are arms taken at various times from rebels; the highland broad-sword deserves particular notice. In many respects, this room may be considered as one of the wonders of the modern world.

THE VOLUNTEER ARMORY is in the White Tower, and contains arms, piled in beautiful order, for 30,000 men, with pikes, muskets, &c. in immense numbers, arranged in stars and other figures. At the entrance of this room stands a fine figure of *les Brandon*, Duke of Suffolk, in bright armour, and having in his hand the very lance he used in his life-time, which is eighteen feet long.—The SEA ARMORY is also in this Tower, and contains arms for nearly 50,000 sailors and marines. In this room are several elegant pieces of brass cannon, presented by the City of London to the Earl of Leicester, and various similar curiosities.

THE ART of the ROYAL TRAIN OF ARTILLERY is kept on the second floor, under the small armory. The room is 380 feet long, 50 feet wide, and 24 in height. The artillery is ranged

on each side, a passage 10 feet in breadth being left in the centre. In this room are 20 pillars that support the small armory above, which are hung round with implements of war, and trophies taken from the enemy. There are many peculiarly fine pieces of cannon to be seen here: one (of brass) is said to have cost £200 in ornamenting. It was made for Prince Henry, eldest son of James I. Others are extremely curious for their antiquity. Among them is one of the first invented cannon. It is formed of bars of iron hammered together, and bound with iron-hoops. It has no carriage, but was moved by six rings, conveniently placed for that purpose.

The HORSE ARMORY is a noble room, crowded with curiosities. The armour of John of Gaunt, Duke of Lancaster, and son of Edward III. is seven feet in height. The sword and lance are of a proportionable size. A complete suit of armour, rough from the hammer, made for Henry VIII. when eighteen years old, is six feet high. The kings of England on Horseback, are shown in armour from the Conqueror to George II.

The JEWEL OFFICE contains, 1. *The imperial crown*, with which the kings of England are crowned. It is of gold, enriched with diamonds, rubies, emeralds, sapphires, and pearls; within is a cap of purple velvet, lined with white taffety, and turned up with three rows of ermine. This is never used but at coronations, and of course has never been produced since the year 1761.—2. *The golden globe*. This is put into the king's right hand before he is crowned; and when he is crowned, he bears it in his left hand, having the sceptre in his right.—3. *The golden sceptre*, and its cross, upon a large amethyst, decorated with table diamonds.—4. *The ancient sceptre*, covered with jewels and Gothic enamel work, and surmounted with an onyx dove. This sceptre is believed to be far the most ancient in the collection, and probably is a part of the original regalia. It was found by the present keeper in 1814, exactly at the time of the general peace. It is estimated at a very high value.—5. *St. Edward's staff*. It is four feet seven inches and a half long, and three inches and three quarters round, made of beaten gold. It is borne before the king in the coronation procession.—6. *The gold salt-cellar of state*. In make, it is the model of the square White Tower, and is of excellent workmanship. At the coronation, it is placed on the king's table.—7. *The sword of Mercy*. It has no point.—8. *A grand silver font*, used for christenings of the royal family.—9. *The crown of state*, which is worn by the king at his meeting of the parliament, and other state occasions. It is of extreme splendour and value, being covered with large sized pre-

cious stones, and on the top of its cross is a pearl, which Charles I. pledged to the Dutch Republic for eighteen thousand pounds. Under the cross is an emerald diamond, of a pale green colour, seven inches and a half in circumference, and valued at one hundred thousand pounds; and in the front is a rock ruby, unpolished, in its purely natural state, three inches long, and the value of which cannot be estimated.—10. *The golden eagle*, with which the king is anointed, and the *golden spur*.—11. *The diadem*, worn by the Queens, Anne and Mary.—And, 12. *The crown of Queen Mary*, *the cross of King William*, and several other valuable jewels.

In this Office, are all the crown jewels worn by the princes and princesses at coronations, and abundance of curious old plate. Independently of several of the jewels which are inestimable, the value of the precious stones and plate contained in this office, is not less than two millions sterling.

The CHAPEL, situated at the north end of the parade, is not otherwise attractive, than as it contains a few ancient tombs and monuments.

## THE LOUVRE.

This splendid palace, which was planned in the reign of Francis I. at the commencement of the sixteenth century, is a quadrangular edifice, having a court in the centre, and forming a square of 65 French toises, or 416 English feet. The front was built in the reign of Louis XIV., and is one of the most beautiful monuments of his reign. A spacious gallery, 227 toises, or 1450 English feet in length, connects this palace with that of the Thuilleries. Here was displayed, under the title of THE MUSEE NAPOLEON, that inestimable collection of paintings, one thousand and thirty in number, consisting of the *chefs-d'œuvres* of the great masters of antiquity, and constituting a treasury of human art and genius, far surpassing every other similar institution.

The anti-room, leading to the gallery, contained several exquisite paintings, the fruits of the triumphs of Bonaparte, or which had been presented to him by the sovereigns who had cultivated his alliance. This apartment was styled by the Parisians the NOSEGAY OF BONAPARTE: its most costly pictures were from the gallery of the Grand Duke of Tuscany; and to these were added a selection from those procured at Venice, Naples, Turin, and Bologna.

It would be impossible adequately to describe the first impressions made on the spectator on his entrance into THE GALLERY, where such a galaxy of genius and art was offered to his contemplation. It was lined by the finest productions of the



French, Flemish, and Italian schools, and divided by a curious double painting upon slate, placed on a pedestal in the middle of the room, representing the front and back views of the same figures.

From the Museum, the visitor descends into **THE SALLE DES ANTIQUES**, containing the finest treasures of Grecian and Roman statuary. His notice is instantly attracted by **THE BELVIDERE APOLLO**, a statue surpassing, in the opinion of connoisseurs, all others in the collection. This matchless statue is thus described by Sir John Carr, in his work entitled *The Stranger in France*. "All the divinity of a god beams through this unrivalled perfection of form. It is impossible to impart the impressions which it inspires: the rivetted beholder is ready to exclaim with Adam, when he first discerns the approach of Raphael:

"—————Behold what glorious shape  
Comes this way moving: seems another morn  
Risen on mid-noon; some great behest from heaven."

"The imagination cannot form such an union of grace and strength. One of its many transcendent beauties consists in its aerial appearance and exquisite expression of motion."

**THE MEDICEAN VENUS**, from the Palace Pitti, at Florence, also formed a part of this magnificent collection of statues. The classic Addison, in speaking of this statue, which he saw at Florence, observes, that it appeared to him much less than life, in consequence of its being in the company of others of a larger size; but that it is, notwithstanding, as large as the ordinary size of women, as he concluded from the measure of the wrist; since, *in a figure of such nice proportions*, from the size of any one part it is easy to guess at that of the others. The fine polish of the marble, communicating to the touch a sensation of fleshy softness, the delicacy of the shape, air, and posture, and the correctness of design, in this celebrated statue, are not to be expressed.

**THE PARIS MUSEUM**, and **SALLE DES ANTIQUES**, although deprived, at the termination of the contest with France, of so many *chefs-d'œuvres* of art, still contain others which render them highly interesting. The finest productions of Le Brun, several of them on an immense scale, still remain; as do likewise the matchless marine paintings by Vernet; the truly sublime works of Poussin, consisting of the chief of his masterpieces; together with many choice paintings by Rubens, Wouwermans, De Witte, &c. Many of the statues remaining in *the Hall of Antiques*, are likewise admirable specimens of sculpture.

In the gallery of the Louvre, a very curious collection of models, representing the fortresses of France and other countries, was once exhibited; but was removed to the end that the paintings might be seen with greater effect. These models, executed in the reign of Louis XIV. and amounting to upwards of one hundred and eighty, were wrought with the greatest accuracy, and so naturally, as to represent the several cities which they describe, with their streets, houses, squares, and churches, together with the works, moats, bridges, and rivers, not neglecting the adjacent territory, as consisting of plains, mountains, corn-lands, meadows, gardens, woods, &c. Several of these models were so contrived as to be taken in pieces, to the end that the curious observer might be better able to perceive their admirable construction.

## THE BRITISH MUSEUM.

This grand national collection of antiquities, books, and natural curiosities, is placed in the noble house formerly belonging to the Duke of Montagu, in Great Russel-street, Bloomsbury. It is a stately edifice, in the French style of the reign of Louis XIV., and on the plan of the Thuilleries. The celebrated French architect, Peter Paget, was sent over from Paris, by Ralph, first Duke of Montagu, expressly to construct this splendid mansion, which is, perhaps, better calculated for its present purpose than for a private residence.

The British Museum was established by act of parliament, in 1753, in consequence of the will of Sir Hans Sloane, who left his museum to the nation, which he declared in his testament, cost him upwards of fifty thousand pounds, on condition that parliament should pay twenty thousand pounds to his executors, and purchase a house sufficiently commodious for it. The parliament acted with great liberality on this occasion; several other valuable collections were united to this of Sir Hans Sloane, and the whole establishment completed for the sum of eighty-five thousand pounds, which was raised by the way of lottery. Parliament afterwards added, at various times, to the Sloane Museum, the Cottonian Library; that of Major Edwards; the Harleian Collection of Manuscripts; Sir William Hamilton's invaluable collection of Greek Vases; the Townleian collection of Antique Marbles; the Manuscripts of the late Marquis of Lansdown; and, lastly, the celebrated Elgin Marbles, which comprise what are considered as the finest specimens of ancient sculpture.

The whole of the important library of printed books and manuscripts, which had been gradually collected by the Kings of England from Henry VIII. to William III., was presented

to the Museum by George II. ; and George III. bestowed on it a numerous collection of valuable pamphlets, which had been published in the interval between 1640 and 1660. His Majesty likewise contributed the two finest mummies in Europe; the sum of £1,123, arising from lottery prizes, which had belonged to his royal predecessor; and, in 1772, a complete set of the Journals of the Lords and Commons. To these contributions, His Majesty has since added a collection of natural and artificial curiosities, sent to him, in 1796, by Mr. Menzies, from the Northwest coast of America, and several single books of great value and utility.

The trustees have lately added Greenwood's collection of stuffed birds; Hatchet's Minerals; Halhed's oriental manuscripts; Tyssen's collection of Saxon coins; Doctor Bentley's classics; and the Greville collection of minerals. To these may be added numerous donations from several of the Sovereigns of Europe, as well as from learned bodies, and private individuals.

On entering the gate of the Museum, a spacious quadrangle presents itself, with an Ionic colonnade on the south side, and on the north, the main building, which measures 216 feet in length, and 57 in height, to the top of the cornice. Several additional buildings have lately been added for the above collections.

The ground-floor consists of twelve rooms, and contains the library of printed books. The decorations of the staircase have lately been restored, and are worthy of admiration. The ceiling, which represents Phæton petitioning Apollo for permission to drive his chariot, was painted by Charles de la Fosse, who was reckoned one of the best colourists of the French school, and who painted the cupola of the dome of the Invalids at Paris. The landscape and decorations are by James Rousseau, an artist justly admired for his skill in perspective.

The first room on the upper story contains modern works of art from all parts of the world, arranged in cases. In the one in the centre, are several beautiful miniatures, among which are those of Sir Thomas More, King Charles I. and Oliver Cromwell, the latter having his watch placed by its side. Two curious portraits of King William III. and Queen Mary, are carved on two walnut-shells. In the presses are arranged, in geographical order, some fine specimens of China, and a variety of implements of war from different quarters of the globe. Here is to be seen the rich collection of curiosities from the South Pacific Ocean, brought by Captain Cooke. In the left corner, is the mourning dress of an Otahéitan lady,

in which taste and barbarity are singularly blended; and opposite, are the rich cloaks and helmets of feathers from the Sandwich Islands. Among these is one, which, in elegance of form, vies even with the Grecian helmets. In another case are the cava bowls, and above them batons and other weapons of war. The next objects of attention are the idols of the different islands, presenting in their hideous rudeness, a singular contrast with many of the works of art, formed by the same people; near these, are the drums and other instruments of music, and a breast-plate from the Friendly Islands. The ceiling of this room, or vestibule, represents the fall of Phæton.

The second room consists of similar objects. The third is devoted to the Lansdowne collection of manuscripts, which have been handsomely bound and lettered. In the fourth, are the Sloanean and Birchian collections of manuscripts. The fifth contains part of the Harleian library of manuscripts: and the sixth, the first part of the same, and additions made since the establishment of the Museum. The seventh is appropriated to the Royal and Cottonian library of manuscripts. On a table, in a glazed frame, is the original of the Magna Charta, belonging to the Cottonian library. Against the press, No. 21, of the Cottonian collection, is the original of the Articles preparatory to the signing of the Great Charter, perfect, with the seal.

The magnificent saloon is filled with the Greville collection of minerals, the finest in the world, admirably arranged, and luminously coloured. The dome of this saloon merits notice. It was painted by La Fosse, and has been described as the apotheosis of Iris, or birth of Minerva. In the middle of the window stands a table, composed of a variety of lavas from Mount Vesuvius, presented by the Earl of Exeter.

The eighth room contains a department of natural history, part of which is the valuable donation of Mr. Cracherode, disposed in two tables, nearly in the Linnæan order; and a much more extensive series, arranged according to the Wernerian system. The principal productions are very valuable, consisting of minerals from Derbyshire, Siberia, the South Seas, volcanic and rock stones from Germany. One very curious specimen of natural history is pointed out in the fifth division of the Cracherodean collection, an egg-shaped piece of calcedony, containing water, (enhydros,) which may be seen by gently shaking the vase. Here, also, in a glass case, is the famous fossil skeleton, from Guadaloupe, which has been the object of much *interesting controversy* among eminent naturalists in the *Monthly Magazine*. The ninth is appropriated to petrifications

and shells. In the first division of the cases in the middle of the room, is a valuable univalve shell, of the species called the paper nautilus, or argonaut shells, remarkable for the slighthness of its fabric, and the elegance of its shape. It is inhabited by an animal not unlike a cuttle-fish, which, by extending a pair of membranes, adhering to the top of its longest arms, has the power of sailing on the surface of the sea. Under the tables are deposited, in this, and the next room, a great number of volumes and parcels, containing collections of dried plants; which, from the fragile nature of their contents, are shown only on particular leave. The tenth room is entirely filled with vegetable productions, zoophites, sponges, &c. The contents of the eleventh room are birds, and arranged, as far as convenience would admit, according to the Linnæan system. Among the curious specimens of ornithology, is a humming-bird, scarcely larger than a bee; and another beautiful little creature, called the harlequin humming-bird, from the variety of its colours. In this room, there is a curious picture, executed many years ago in Holland, of that extremely rare and curious bird, the dodo, belonging to the tribe gallinæ. In the table in the middle, are preserved the nests of several birds, among the most curious of which are several hanging nests, chiefly formed by birds of the oriole tribe; nests of a substance resembling isinglass, which the Chinese make into a rich soup, scarce feathers, &c. In the second table are deposited a variety of eggs and nests: among the former may be noticed the eggs of the ostrich, the cassowary, the crocodile, &c. In the cases between the windows, are several of the rarer quadrupeds; among these the most curious are two orang-outangs, in a young state, a long-tailed macaoco, ermine, &c.; in cases under the tables are an armadillo, or porcupine, several young sloths, and a fine specimen of the two-toed ant-eater. The twelfth room contains a general and extensive arrangement of fishes, serpents, lizards, frogs, &c.

THE TOWNLEY MARBLES and EGYPTIAN ANTIQUITIES, are deposited in a very elegant suite of rooms, built purposely for them. The first room is devoted to a collection of bas-reliefs, in terra cotta, pronounced the finest in Europe. The second is a beautiful circular room, whence you have a fine view of the whole suite of apartments, bounded at the end by an exquisitely wrought *discobolon*, or ancient quoit-player. This room is devoted to Greek and Roman sculptures, among which may be pointed out a fine candelabrum, with several beautiful busts and statues. The third and fourth rooms are also filled with Greek and Roman sculptures: in the latter are several fine -reliefs. The fifth contains a collection of Roman sepul-

chral monuments, and a beautiful Mosaic pavement, recently discovered in digging the foundations for the new building at the bank of England. The sixth exhibits a miscellaneous collection of one hundred grand pieces of Roman and Greek sculpture. The seventh is devoted to Roman antiquities; and the eighth, on the left, to Egyptian antiquities, among which are the two mummies before mentioned, with their coffins; a manuscript, or papyrus, taken from a mummy, &c. Among the Egyptian sculptures in the ninth room, is the celebrated sarcophagus, commonly called the tomb of Alexander the Great, an engraving and dissertation on which appeared in the *Monthly Magazine* for February, 1809. The tenth contains Greek and Roman sculptures of singular beauty.

Thence returning, and proceeding up stairs, the visitor is conducted to the eleventh room, containing ancient and modern coins and medals, arranged in geographical order, those of each country being kept separate. It is not shown unless by the permission of the trustees, or of the principal librarian. Not more than two persons are admitted at one time, without the presence of the principal librarian, or of some other officer. The twelfth room contains the collection of the late Sir William Hamilton, which has been removed from the saloon. It principally consists of penates, or household gods, bronze vessels, utensils, &c., specimens of ancient glass, necklaces, pendants, fragments of relievos, and ancient armour, tripods, knives, patent lamps, seals, weights, sculpture in ivory, bracelets, bits, spurs, ancient paintings from Herculaneum, Babylonish bricks, and his unrivalled collection of Greek vases, the greater part of which were found in the sepulchres of Magna Grecia. The forms of the vases are much varied, and are equally simple and beautiful. In the thirteenth, is deposited the extensive and valuable collection of prints and drawings, the most important part of which was bequeathed by the Rev. William Cracherode. The contents of this room can be seen only by a few persons at a time, by particular permission.

## PORCELAIN TOWER AT NANKIN.

[See Plate, No. 17.]

This elegant and commodious building, (a very correct idea of which may be formed from the cut,) may be regarded as a fine specimen of oriental pagodas. The tower is about two hundred feet in height, and derives its name from its having a chain or porcelain coating. The Portuguese were the first to bestow on these superb edifices the title of pagodas, and to attribute them to devotional purposes. There can be little doubt, however, that in many instances they have been rather erected as

public memorials or ornaments, like the columns of the Greeks and Romans.

Mr. Ellis, in his *Journal of the late Embassy to China*, relates, that in the company of three gentlemen of the Embassy, he succeeded in passing completely through the uninhabited part of the city of Nankin, and in reaching the gateway visible from the Lion Hill. The object of the party was to have penetrated through the streets to the Porcelain Tower, apparently distant two miles. To this, however, the soldiers who accompanied them, and who, from their willingness in allowing them to proceed thus far, were entitled to consideration, made so many objections, that they were forced to desist, and to content themselves with proceeding to a temple on a neighbouring hill, from which they had a complete view of the city. From this station, the Porcelain Tower presented itself as a most magnificent object.

#### MAISON CARREE, AT NISMES.

If the Amphitheatre of Nimes strikes the spectator with an idea of greatness and sublimity, the Maison Carree enchants him with the most exquisite beauties of architecture and sculpture. This fine structure, as is evidenced by the inscription discovered on its front, was built by the inhabitants of Nimes, in honour of Caius Cæsar, and Lucius Cæsar, grand children of Augustus, by his daughter Julia, the wife of Agrippa. It stands upon a pediment 6 feet high, is 82 feet long, 35 broad, and 37 in height, without reckoning the pediment. The body of it is adorned with 20 columns engaged in the wall; and the peristyle, which is open, with 10 detached pillars that support the entablature. They all are of the Corinthian order, fluted and embellished with capitals of the most exquisite sculpture: the frieze and cornice are much admired, and the foliage is esteemed inimitable. The proportions of the building are so happily blended, as to give it an air of majesty and grandeur, which the most indifferent spectator cannot behold without emotion. To enjoy these beauties, it is not necessary to be a connoisseur in architecture: they are indeed so exquisite that they may be visited with a fresh appetite for years together. What renders them still more interesting is, that they are entire, and very little affected, either by the ravages of time, or the havoc of war. Cardinal Alberoni declared this elegant structure to be a jewel, which deserved a cover of gold to preserve it from external injuries. An Italian painter, perceiving a small part of the roof repaired by modern French masonry, tore his hair, and exclaimed in a rage, "Zounds! what do I see? Harlequin's on the head of Augustus!"

In its general architectural effect, as well as in all its details of sculpture and ornament, the Maison Carree of Nismes is ravishingly beautiful, and cannot be paralleled by any structure of ancient or modern times. That which most excites the astonishment of the admiring spectator, is to see it standing entire, like the effect of enchantment, after such a succession of ages, subjected as several of them were, to the ravages of the barbarians who overran the most interesting parts of Europe!

CAPITOL AT WASHINGTON.

There are, perhaps, no buildings in America that can in the grandeur of architecture or magnificence of structure generally, compare with the most splendid of the old world. If, however, any exception can be made to this remark, it must be in favour of the Capitol of the United States. This costly structure, erected for the accommodation of the American Congress, stands at the head of Pennsylvania Avenue, in the City of Washington, on an elevated site, commanding a rich and extensive view of the surrounding country. It is built of white free stone, and its dimensions are as follows :

Principal Building,	340 by 120	42000 ft.
East projection and steps,	170 „ 65	11050
West projection,	170 „ 83	14110
		<hr/>
		67160 ft.

The surrounding grounds included within iron palings, are 20 acres, 5937 feet. The cost of the whole building, when completed, is estimated at three millions of dollars. The north wing is occupied by the Senate, the south by the House of Representatives. Besides, there is a room appropriated for the Supreme Court of the United States, another for the National Library, &c. &c. The Representative Hall is undoubtedly the finest piece of architecture, (for the purpose intended,) in the world. A visitor of taste and judgment thus describes it. "I have never been more gratified by the examination of any specimen of art whatever. It is highly creditable to the great nation by which it has been erected, and to the architect and artist by whom it has been designed and executed." After so much, it will not perhaps be amiss to give a brief description of this chamber, for the information of those who may never have an opportunity of viewing it.

The room is semi-circular, and of considerable dimensions, both as to diameter and elevation; twenty-two massy columns, and four pilasters, of Brecia, or Potowmac marble, as it is



usually called, are erected on an elevated base of free stone, forming the area of the room. The capitals of those pillars are of Carrarian marble, were executed in Italy, and are very rich and beautiful. These support a large and magnificent dome, in the centre of which is placed an ornamental cupola, that admits the light into the Hall from above. In the front of the Speaker's chair, and over the entrance into the chamber, stands an allegorical figure, executed in Italian marble, by Messrs. Franconi and Zaccinania, representing History in the act of recording the proceedings of the nation. She stands in a winged car, which seems to roll over a section of the celestial globe, exhibiting, in bas-relievo, the signs of the zodiac. The wheel of the car is intended as the face of a clock, which is to be placed behind, and the front contains, in bas-relief, a figure of Fame, and a profile Bust of Washington. Above the Speaker's chair, is a colossal figure of Liberty, in plaster, pointing to the Hall below, and supported on the right by an American Eagle, and on her left by the Roman fasces, which are partially enveloped in the folds of a serpent. Immediately under this figure, on the frieze, is carved in alto relievo, another eagle, in the attitude of flying, executed by an artist of great eminence, now no more.

The ceiling of the dome is painted in a style of uncommon elegance, by Signior Bonani, a young Italian artist, and a pupil of the celebrated David of Paris.

The design is somewhat similar to that of the dome of the Pantheon of Rome. The cupola and bordering below, are splendidly ornamented, and contrasted with the rich and massy columns beneath, and the general finish and outline of the Hall, produce an effect at once grand and imposing. The Senate Chamber in the north wing, is a room of almost equal splendour and beauty with that of the House of Representatives.

#### UNITED STATES BANK AT PHILADELPHIA.

[See Plate, No. 18.]

In the design and proportions of this work, are displayed the leading features of that celebrated work of antiquity, the Parthenon at Athens. It is built of pure white marble, fronting north on Chesnut Street and south on Liberty Street. The design is of the Grecian Doric, having eight fluted columns, 4 feet 6 inches in diameter, embracing the whole front.

The columns rise from a basement 6 feet in elevation, supporting a plain entablature, extending along the sides of a parallelogram 86 by 160 feet, including the body of the building and porticoes that project ten feet six inches from each of the

1. The ascent to the porticoes from the street, is by a flight of steps to a terrace or platform, extending 16 feet on each side, and in front of the edifice.

It is on this terrace that the building is reared, and from it it derives a great portion of its effect.

The door of entrance opens into a spacious vestibule, leading to the banking room, which is placed immediately in the rear of the building. On the right and left of the vestibule, is an office and transfer office, which are entirely distinct from the rooms appropriated to banking purposes.

The banking room is a spacious parallelogram of 45 by 80 feet, adorned with twelve polished marble pillars, of the Ionic order, copied from the temple of Minerva Polias, at Priene. The pillars are placed at a distance of eight feet from the sides of the room, and support a vaulted paneled ceiling, across its greatest diameter. The president's and cashier's rooms on the right, together with the vaults and private stairways on the left, are adjacent to the sides of the banking room, and can be approached by doors of communication from that room. The stockholders, directors, and committee rooms, are situated along the southern front of the building, having passages of communication with each other and with the banking room.

The building is admirably calculated for the transaction of immense business, whilst in its structure, a due regard to the rules and beauties of architecture has been throughout fully maintained.

## PYRAMIDS, MONUMENTS, EXCAVATIONS, TOMBS, &c.

### PYRAMIDS OF EGYPT.

[See Plate, No. 19.]

The largest of these stupendous monuments, equally famous for the enormity of their size, and their remote antiquity, are those of Djiza, so called from a village of that name on the west bank of the Nile, distant from them about eleven miles. The pyramids, which most attract the attention of travellers, stand near the city of Cairo, on the west side of the river, almost opposite to the city of Cairo, and not far from the site of the ancient Memphis. When viewed from a distance peering above the horizon, they appear to be of a fine transparent hue they derive from the rarified atmosphere by which they are surrounded. M. Savary having approached within three leagues of them, in the night time, while the moon shone bright upon them, describes them as appearing to him, under his particular aspect, like two points of rock rising from the clouds. On a near approach, their sloping

and angular forms disguise their real height, and lessen it to the eye; independently of which, as whatever is regular is great or small by comparison, and as these masses of stone eclipse in magnitude every surrounding object, at the same time that they are inferior to a mountain, to which alone the imagination can successfully compare them, a degree of surprise is excited on finding the first impression produced by a distant view so much diminished in drawing near to them. On attempting, however, to measure any one of these gigantic works of art by some known and determinate scale, it resumes its immensity to the mind; since, on drawing near to the opening, the persons who stand beneath it, appear so small that they can scarcely be taken for men.

The base of the great pyramid of Cheops, or Cheospes, so named after a king of Egypt, is estimated by Denon at seven hundred and twenty feet, and its height at four hundred and forty-eight feet, calculating the base by the mean proportion of the length of the stones, and the height by the sum of that of each of the steps or stages. Its construction required so many years, and employed such a multitude of labourers, that the expenditure for garlic and onions alone, for their consumption, is said to have amounted to one thousand and sixty talents, upwards of one fourth of a million sterling. Its interior is thus accurately described by the above traveller.

“The entrance of the first gallery is concealed by the general outer covering which invests the whole of the pyramid. It is, however, probable, that the attention of the earlier searches was by some particular appearance directed to this spot. This gallery goes towards the centre of the edifice, in a direction sloping downward to the base: it is sixty paces in length; and at the further end are two large blocks of granite, an obstacle which caused some uncertainty in the digging. A horizontal passage has been made for some distance into the mass of stone; but this undertaking was afterwards abandoned.

“Returning to the extremity of the first gallery, and working upward by the side of the two granite blocks, you come to the beginning of the first sloping staircase, which proceeds in an oblique direction upward, for a hundred and twenty feet. You mount the steep and narrow gallery, helping your steps by notches cut in the ground, and by resting your hands against the sides. At the top of this gallery, which is formed of a calcareous stone cemented with mortar, you find a landing place about fifteen feet square, within which, to the right of the entrance, is a perpendicular opening called the well. This appears, from its irregularity, to have been the result of a fruit-

less attempt at a search, and has a diameter of about two feet by eighteen inches. There were no means of descending it; but by throwing down a stone, it was ascertained that its perpendicular direction could not be very considerable. On a level with the landing, is a horizontal gallery, a hundred and seventy feet in length, running directly towards the centre of the pyramid; and at the extremity of this gallery, is a small room, called the Queen's chamber. This is an oblong square of eighteen feet two inches, by fifteen feet eight inches; but the height is uncertain, the floor having been turned up by the avidity of the searchers. One of the side walls has also been worked into, and the rubbish left on the spot. The roof, which is formed of a fine calcareous stone, very nearly brought together, has the form of an angle nearly equilateral; but contains neither ornament, hieroglyphic, nor the smallest trace of a sarcophagus.—Whether it was intended to contain a body, is uncertain; but, in this case, the pyramid must have been built with a view of containing two bodies, and would not therefore have been closed at once. If the second tomb was really that of the queen, the two blocks of granite at the end of the first gallery, must have been finally reserved to close all the interior chambers of the pyramid.

“ Returning again from the Queen's chamber to the landing place, you ascend a few feet, and immediately find yourself at the bottom of a large and magnificent staircase, or rather inclined plane, one hundred and eighty feet in length, taking a direction upward, and still bearing towards the centre of the edifice. It is six feet six inches in breadth, in which are to be included two parapets, each nineteen inches in diameter, and pierced every three feet six inches, by oblong holes, twenty-two inches by three. The sarcophagus must have ascended this passage, and the series of holes must have been intended to receive a machine of some description, to assist in raising so heavy a mass as the sarcophagus up so steep an ascent.

“ The side walls of this ascending gallery rise perpendicularly for twelve feet, and then form a sloping roof of an excessively high pitch, not by a regular angle, but by eight successive projections, each of them six feet in height, rising above the other, and approaching nearer to a corresponding projection on the opposite side, till the roof is entirely shut in. The height of this singularly contrived vault, may be estimated at sixty feet from the part of the floor immediately beneath. The ascent of the staircase is facilitated by pretty regular but modern footings cut in the floor; and at the top is a small platform, in which is a thick block of granite, resembling an immense chest, imbedded in the solid building, and hollowed out

so as to leave alternate projections and retirings, into which are let blocks of the same material, with corresponding grooves and projections intended for ever to conceal and protect the entrance to the principal chamber which is behind them. I must have required immense labour to construct this part of the edifice, and not less to have broken an opening through so that the zeal of superstition has here been opposed to the eagerness of avarice, and the latter has prevailed. After mining through thirteen feet of solid granite, a door three feet three inches square, has been discovered, which is the entrance to the principal chamber. This is a long square, sixteen feet by thirty-two, and eighteen in height. The door is in the angle facing the gallery, corresponding to the door of the Queen's chamber below. When it is said that the tomb is a single piece of granite, half polished, and without cement, all that is remarkable in this strange monument, which exhibits such rigid simplicity in the midst of the utmost magnificence of human power, will have been described. The only broken part is an attempt at a search at one of the angles, and two small holes nearly round and breast high. Such is the interior of this immense edifice, in which the work of the hand of man appears to rival the gigantic forms of nature."

To the above account by the accurate Denon, we subjoin the following pleasing one by the celebrated Doctor Clarke. The impression made by these monuments, when viewed at a distance, can never, he observes, be obliterated from his mind

"By reflecting the sun's rays, they appeared as white as snow, and of such surprising magnitude, that nothing we had previously conceived in our imagination had prepared us for the spectacle we beheld. The sight instantly convinced us that no power of description, no delineation, can convey ideas adequate to the effect produced in viewing these stupendous monuments. The formality of their structure is lost in their prodigious magnitude: the mind, elevated by wonder, feels at once the force of an axiom, which, however disputed, experience confirms,—that in vastness, whatsoever be its nature, there dwells sublimity!

"Having arrived at the bottom of a sandy slope, leading up to the principal pyramid, a band of Bedouin Arabs, who had assembled to receive us upon our landing, were much amused by the eagerness excited in our whole party, to prove who should first set his foot upon the summit of this artificial mountain. As we drew near its base, the effect of its prodigious magnitude, and the amazement caused in viewing the enormous masses used in its construction, affected every one of us; but it was an impression of awe and fear rather than of the

sure. In the observations of travellers who had recently preceded us, we had heard the Pyramids described as huge objects which gave no satisfaction to the spectator, on account of their barbarous shape, and formal appearance: yet to us it appeared hardly possible that persons susceptible of any feeling of sublimity could behold them unmoved. With what amazement did we survey the vast surface that was presented to us, when we arrived at this stupendous monument, which seemed to reach the clouds? Here and there appeared some Arab guides upon the immense masses above us, like so many pigmies, waiting to show the way up to the summit. Now and then we thought we heard voices, and listened; but it was the wind in powerful gusts, sweeping the immense ranges of stone. Already some of our party had begun the ascent, and were pausing at the tremendous depth which they saw below. One of our military companions, after having surmounted the most difficult part of the undertaking, became giddy in consequence of looking down from the elevation he had attained; and being compelled to abandon the project, he hired an Arab to assist him in effecting his descent. The rest of us, more accustomed to the business of climbing heights, with many a halt for respiration, and many an exclamation of wonder, pursued our way towards the summit. The mode of ascent has been frequently described; and yet, from the questions which are often proposed to travellers, it does not appear to be generally understood. The reader may imagine himself to be upon a staircase, every step of which, to a man of middle stature, is nearly breast high; and the breadth of each step is equal to its height; consequently, the footing is secure; and although a retrospect, in going up, be sometimes fearful to persons unaccustomed to look down from any considerable elevation, yet there is little danger of falling. In some places, indeed, where the stones are decayed, caution may be required; and an Arab guide is always necessary to avoid a total interruption; but, upon the whole, the means of ascent are such that almost every one may accomplish it. Our progress was impeded by other causes. We carried with us a few instruments; such as our boat-compass, a thermometer, a telescope, &c.; these could not be trusted in the hands of Arabs, and they were liable to be broken every instant. At length, we reached the topmost tier, to the great delight and satisfaction of all the party. Here we found a platform, thirty-two feet square; consisting of nine large stones, each of which might weigh about a ton; although they are much inferior in size to some of the stones used in the construction of this pyramid.

*“The view from the summit of the pyramid amply fulfilled*

our expectations; nor do the accounts which have been given of it, as it appears at this season of the year, (in the month of August,) exaggerate the novelty and grandeur of the sight. All the region towards Cairo and the Delta, resembled a sea covered with innumerable islands. Forests of palm-trees were seen standing in the water; the inundation spreading over the land where they stood, so as to give them an appearance of growing in the flood. To the north, as far as the eye could reach, nothing could be discerned, but a watery surface thus diversified by plantations and by villages. To the south we saw the pyramids of Saccara; and, upon the east of these, smaller monuments of the same kind, nearer to the Nile. An appearance of ruins might indeed be traced the whole way from the Pyramids of Djiza to those of Saccara; as if they had been once connected, so as to constitute one vast cemetery. Beyond the pyramids of Saccara we could perceive the distant mountains of the Said; and upon an eminence near the Libyan side of the Nile appeared a monastery of considerable size. Towards the west and southwest, the eye ranged over the great Libyan Desert, extending to the utmost verge of the horizon, without a single object to interrupt the dreary horror of the landscape, except dark floating spots, caused by the shadows of passing clouds upon the sand.

“ The stones of the platform upon the top, as well as most of the others used in constructing the decreasing ranges from the base upwards, are of soft limestone. Those employed in the construction of the pyramids, are of the same nature as the calcareous rock on which they stand, and which was apparently cut away to form them. Herodotus says, however, that they were brought from the Arabian side of the Nile.

“ The French attempted to open the smallest of the three principal Pyramids; and having effected a very considerable chasm in one of its sides, have left this mark behind them, as an everlasting testimony of their curiosity and zeal. The landing of our army in Egypt put a stop to their labour. Had it not been for this circumstance, the interior of that mysterious monument would probably be now submitted to the inquiry which has long been an object among literary men.

“ Having collected our party upon a soft platform before the entrance of the passage leading to the interior, and lighted a number of tapers, we all descended into the dark mouth of the larger pyramid. The impression made upon every one of us, in viewing the entrance, was this: that no set of men whatever could thus have opened a passage, by uncovering precisely the part of the pyramid where the entrance was concealed, unless they had been previously acquainted with its

situation ; and for these reasons : First, because its position is almost in the centre of one of its planes, instead of being at the base. Secondly, that not a trace appears of those dilapidations which must have been the result of any search for a passage to the interior ; such as now distinguish the labours of the French upon the smaller pyramid, which they attempted to open. The persons who undertook the work, actually opened the pyramid in the only point, over all its vast surface, where, from the appearance of the stones inclined to each other above the mouth of the passage, any admission to the interior seems to have been originally intended. So marvelously concealed as this was, are we to credit the legendary story of an Arabian writer, who, discoursing of the wonders of Egypt, attributed the opening of this pyramid to *Almamon*, a Caliph of Babylon, about nine hundred and fifty years since ?

“ Proceeding down this passage, which may be compared to a chimney about a yard wide, we presently arrived at a very large mass of granite ; this seems to have been placed on purpose to choke up the passage ; but a way has been made round it, by which we were enabled to ascend into a second channel, sloping, in a contrary direction, towards the mouth of the first. Having ascended along this channel, to the distance of one hundred and ten feet, we came to a horizontal passage, leading to a chamber with an angular roof, in the interior of the pyramid. In this passage we found, upon our right hand, the mysterious well, which has been so often mentioned. Pliny makes the depth of it equal to one hundred and twenty-nine feet ; but Greaves, in sounding it with a line, found the plummet rest at the depth of twenty feet.

“ We threw down some stones, and observed that they rested at about the depth which Greaves has mentioned ; but being at length provided with a stone nearly as large as the mouth of the well, and about fifty pounds in weight, we let this fall, listening attentively to the result from the spot where the other stones rested : we were agreeably surprised, by hearing, after a length of time which must have equalled some seconds, a loud and distinct report, seeming to come from a spacious subterraneous apartment, accompanied by a splashing noise, as if the stone had been broken in pieces, and had fallen into a reservoir of water at an amazing depth. Thus does experience always tend to confirm the accounts left us by the ancients ; for this exactly answers to the description given us by Pliny of this well.

“ After once more regaining the passage whence these ducts diverge, we examined the chamber at the end of it, mentioned by all who have described the interior of this building. Its



roof is angular: that is to say, it is formed by the inclination of large masses of stone leaning towards each other, like the appearance presented by those masses which are above the entrance to the pyramid. Then quitting the passage altogether, we climbed the slippery and difficult ascent which leads to what is called the principal chamber. The workmanship, from its perfection, and its immense proportions, is truly astonishing. All about the spectator, as he proceeds, is full of majesty, and mystery, and wonder. Presently we entered that 'glorious room,' as it is justly called by Greaves, where, 'as within some consecrated oratory, art may seem to have contended with nature.' It stands 'in the very heart and centre of the pyramid, equidistant from all its sides, and almost in the midst between the basis and the top. The floor, the sides, the roof of it, are all made of vast and exquisite tables of Thebaick marble.' So nicely are these masses fitted to each other upon the sides of the chamber, that having no cement between them, it is really impossible to force the blade of a knife within the joints. This has been often related before; but we actually tried the experiment, and found it to be true. There are only six ranges of stone from the floor to the roof, which is twenty feet high; and the length of the chamber is about twelve yards. It is also about six yards wide. The roof or ceiling consists of only nine pieces, of stupendous size and length, traversing the room from side to side, and lying, like enormous beams across the top."

Mr. Salt, the traveller, having paid a recent visit to the principal pyramid, in company with a British officer, it has been ascertained that the short descending passage at its entrance, which afterwards ascends to the two chambers, is continued in a strait line through the base of the pyramid into the rock on which it stands. This new passage, after joining what was formerly called the well, is continued forward in a horizontal line, and terminates in a well, ten feet in depth, exactly beneath the apex of the pyramid, and at the depth of one hundred feet beneath its base.—Mr. Salt's companion has likewise discovered an apartment immediately above the king's chamber exactly of the same size, and of the same fine workmanship, but only four feet in height.

The base of the pyramid of Cephrenes, the next in magnitude, of the pyramids of Djiza, to that of Cheops, is estimated at 655 feet, and its height at 398. The pyramid of Miserinus has a base of 280 feet, and an elevation of 162.

The pyramids of Saccara, which are numerous, are interesting on account of the peculiarities of their structure. The largest of them is of an irregular form, the line of the terminat-

ing angle being sloped like a buttress reversed. Another, of a middling size, is composed of stages rising one above another. The smaller ones are greatly decayed; but the whole occupy an extent of two leagues. This multitude of pyramids scattered over the district of Saccara, Denon observes, prove that this territory was the *Necropolis* (city of the dead) to the south of Memphis, and that the village opposite to this, in which the pyramids of Djiza are situated, was another Necropolis, which formed the northern extremity of Memphis. The extent of that ancient city may thus be measured.

#### THE SPHINX.

At an inconsiderable distance from the great Egyptian pyramids, and by an almost imperceptible descent, the traveller arrives at the Sphinx, the enormous bulk of which instantly attracts his attention. It is cut out of the solid rock, and is said to have been the sepulchre of Amasis. The height of this figure is twenty-seven feet; and the beginning of the breast thirty-three feet in width. The nose has been shamefully mutilated. "Although," Denon remarks, "the proportions are colossal, the outline is pure and graceful; the expression is mild, gracious, and tranquil; the character is African; but the mouth, the lips of which are thick, has a softness and delicacy of execution truly admirable; it seems real life and flesh. Art must have been at a high pitch when this monument was executed; for, if the head is deficient in what is called *style*, that is, the straight and bold lines which give expression to the figures under which the Greeks have designated their deities, yet sufficient justice has been rendered to the fine simplicity and character of nature displayed in this figure."

#### PYRAMID OF CHOLULA.

[See Plate, No. 20.]

The city of Cholula, near which this Pyramid stands, is situated 80 miles east of Mexico. It contained, according to the account of Cortes, at the era of the Spanish conquest, 40,000 houses, independent of the adjoining villages, which were computed to contain as many more. When the Mexican empire was in its glory, this city was revered as the seat of religion. Its numerous temples, of which Cortes mentions that he counted more than 400, and more especially the great temple, erected on an artificial mountain, which still remains, attracted innumerable pilgrims from the most distant provinces to perform their devotions on this consecrated spot. We are informed by Humboldt, who examined this temple, that it has

four stories, all of equal height, and that it appears to have been constructed exactly in the direction of the four cardinal points. Its perpendicular height is 177 feet, and at the base, it measures on each side, 1450 feet. The platform on the top measures 16,000 square feet, and at the time of Cortez, was ascended by 120 flights of steps. On the platform it had an altar dedicated to the god of the air, but since it has fallen into the hands of the Spaniards, in its place a temple has been erected to the Virgin, in which mass is constantly performed. This temple is situated to the east of the city of Cholula, and is the most ancient and the most celebrated of all the Mexican religious monuments.

#### EGYPTIAN TEMPLES AND MONUMENTS.

The ruins of the TEMPLE OF HERMOPOLIS, or the great city of Mercury, afford a precise idea of the immense range and high perfection the arts had attained in Egypt. The stones have preserved their original destination, without having been altered or deformed by the works of modern times, and have remained untouched for four thousand years! They are of free-stone, of the finest of marble, and have neither cement, nor mode of union, besides the perfect fitting of the respective parts. The colossal proportions of this edifice evince the power the Egyptians possessed to raise enormous masses. The diameter of the columns, which are placed at equal intermediate distances, is 8 feet 10 inches; and the space between the two middle columns, within which the gate was included, twelve feet, which gives 120 feet for the portico: its height is 60 feet. Not any spring of an arch remains to throw light on the dimensions of the whole extent of the temple, or of the nave. The architecture is still richer than the doric order of the Greeks. The shafts of the pillars represent *fasciae*, or bundles: and the pedestal, the stem of the lotus. Under the roof, between the two middle columns, are winged globes; and all the roofs are ornamented with a wreath of painted stars, of aurora colour on a blue ground.

THE TEMPLE OF APOLLINOPOLIS MAGNA is described by Denon as surpassing in extent, majesty, magnificence, and high preservation, whatever he had seen in Egypt, or elsewhere. This building is a long suite of pyramidal gates, of courts decorated with galleries, of porticoes, and of covered naves, constructed, not with common stones, *but with entire rocks*. This superb edifice is situated on a rising ground, so as to overlook, not only its immediate vicinity, but the whole valley. On the *right* is the principal gate, placed between two huge mounds of buildings, on the walls of which are three orders of hieroglyphs.

phic figures increasing in their gigantic dimensions, insomuch that the last have a proportion of twenty-five feet. The inner court is decorated with a gallery of columns, bearing two terraces, which come out at two gates, through which is the passage to the stairs, leading to the platform of the mounds. Behind the inner portico are several apartments, and the sanctuary of the temple. A wall of circumvallation is decorated both within and without with innumerable hieroglyphics, executed in a very finished and laborious style. This magnificent temple appears to have been dedicated to the evil genius, the figure of Tryphon being represented in relief on the four sides of the plinth which surmounts each of the capitals. The entire frieze, and all the paintings within, are descriptive of Isis defending herself against the attacks of that monster.

The ruins of the ancient city of THEBES, which Homer has characterized by the single expression of THE CITY WITH A HUNDRED GATES, are of so immense an extent as to convince the spectator that fame has not magnified its size; for, the diameter of Egypt not being sufficient to contain it, its monuments rest on two chains of contiguous mountains, while its tombs occupy the vallies towards the west, far on into the desert. A large temple on the eastern side is more than two leagues and a half distant from Medinet-Abu, where the most western temple is situated. The modern village of Karnac is built on a small part of the site of a single temple, which requires half a mile to walk round. The remains of this temple are thus described by Denon.

“Of the hundred columns of the portico alone, the smallest are seven feet and a-half in diameter, and the largest twelve. The space occupied by the circumvallation of the temple, contains lakes and mountains. In short, to be enabled to form a competent idea of so much magnificence, the reader ought to fancy what is before him to be a dream, as he who views the objects themselves, rubs his eyes to know whether he is awake. The avenue leading from Karnac to Luxor, a space nearly half a league in extent, contains a constant succession of sphinxes and other chimerical figures to the right and left, together with fragments of stone walls, of small columns, and of statues.”

The village of Luxor is also built on the side of the ruins of a temple, not so large as that of Karnac, but in a better state of preservation, the masses not having as yet fallen through time, and by the pressure of their own weight. The most colossal parts consist of fourteen columns of nearly eleven feet in diameter, and of two statues in granite, at the outer gate, buried up to the middle of the arms, and having in front of

them the two largest and best preserved obelisks known. The French, when in Egypt, deemed their means insufficient, not to hew out, but merely to transport these two monuments, which are not more than a fragment of one of the numerous edifices of the astonishing city of Thebes. They are of rose-colour granite, are still seventy feet above the ground, and to judge by the depth to which the figures seem to be covered, about thirty feet more may be reckoned to be concealed from the eye, making in all one hundred for their height. The preservation is perfect; and the hieroglyphics with which they are covered being cut deep, and in relief at the bottom, show the bold hand of a master, and a beautiful finish. The gravers, which could touch such hard materials, must have been of an admirable temper; and the machines to drag such enormous blocks from the quarries, to transport them thither, and to set them upright, together with the time required for the labour, surpass all conception!

In speaking of the gate of the temple, which is now become that of the village of Luxor, Denon remarks as follows. "Nothing can be more grand, and at the same time more simple, than the small number of objects of which this entrance is composed. No city whatever makes so proud a display at its approach, as this wretched village, the population of which consists of two or three thousand souls, who have taken up their abode on the roofs and beneath the galleries of this temple, which has, nevertheless, the air of being in a manner uninhabited."

THE TOMBS OF THE KINGS OF THEBES, are grottoes consisting of a regular double gallery supported by pillars, behind which is a row of chambers, often double. In proportion as the height of these grottoes increases, they become more richly decorated; and the spectator is soon convinced, by the magnificence both of the paintings and sculptures, and of the subjects they represent, that he is among the tombs of great men or heroes. Those which appear to have belonged to the ancient kings, are only distinguished from the others by the magnificence of the sarcophagi, and the mysterious solitude of their situation; the others immediately overlooking the great buildings in the city. The sculpture in all is incomparably more laboured and higher finished than that of the temples, and displays a high perfection of the art. The lines of the hieroglyphics have been cut with a firmness of touch, and a precision, of which marbles offer but few examples; and the figures have a particular elegance and correctness of contour. Small subjects taken from nature are introduced; and in these, the groupes of persons are given in perspective; and cut in deep relief, in simple and natural attitudes. Several of these sub-

jects bear but little analogy to the spot in which they are immured ; for bas-reliefs are seen representing games, such as rope dancing, and asses taught to play tricks, and rear on their hind legs, sculptured with all the traits of genuine nature and simplicity.

The plan of these excavations is singular ; and many are so vast and complicated, that they might be mistaken for labyrinths, or subterraneous temples. After passing the elegant apartments described above, long and gloomy galleries present themselves, winding backwards and forwards in numerous angles, and seeming to occupy a great extent of ground. They are melancholy, repulsive, and without any decoration ; but open from time to time into other chambers covered with hieroglyphics, and branch out into narrow paths, leading to deep perpendicular pits. At the bottom of these pits are other adorned chambers ; and lower still, a new series of perpendicular pits and horizontal chambers, until at length, ascending a long flight of steps, the visitor reaches an open place on a level with the chambers he first entered.

#### CRYPTÆ, OR CATACOMBS OF ALEXANDRIA.

In the construction of these primeval sepulchres, a prodigious labour has been bestowed. They are situated about half a league along the shore, to the westward of the modern city of Alexandria. Their intricacy is such, that the guides will not enter them, without being provided with a clue of thread, to secure their retreat. Doctor Clarke has been very particular in his description of these subterraneous abodes of the dead ; and from his interesting narrative the following particulars are extracted.

“ The original entrance to them is now closed, and is externally concealed from observation. The only place by which admittance to the interior is practicable, is a small aperture made through the soft and sandy rock, barely large enough to admit a person upon his hands and knees. Here it is not unusual to encounter jackals, escaping from the interior, when alarmed by any person approaching : on this account, the guides recommend the practice of discharging a gun, or pistol, to prevent any sally of this kind. Having passed this aperture with lighted tapers, we arrived, by gradual descent, in a square chamber, almost filled with earth : to the right and left of this, are smaller apartments, chiseled in the rock ; each of these contains on either side of it, except that of the entrance, a Soros, for the reception of a mummy ; but, owing to the accumulation of sand in all of them, this part of the Catacombs cannot be examined without great difficulty. Leaving

the first chamber, we found a second of still larger dimensions, having four Cryptæ with Soroi, two on either side, and a fifth at its extremity towards the southeast. From hence, penetrating towards the west, we passed through another forced aperture, which conducted us into a square chamber, without any receptacles for dead bodies; thence pursuing a southwestern course, we persevered in effecting a passage, over heaps of sand, from one chamber to another, admiring every where the same extraordinary effects of labour and ingenuity, until we found ourselves bewildered with so many passages, that our clue of thread became of more importance than we at first believed it would prove to be. At last we reached the stately antichamber of the principal sepulchre, which had every appearance of being intended for a regal repository. It was of a circular form, surmounted by a beautiful dome, hewn out of the rock, with exquisite perfection, and the purest simplicity of workmanship. In a few of the chambers we observed pilasters, resembling in their style of architecture, the Doric, with architraves, as in some of the most ancient sepulchres near Jerusalem; but they were all integral parts of the solid rock. The dome covering the circular chamber was without ornament; the entrance to it being from the northwest. Opposite to this entrance was a handsome square Crypt with three Soroi; and to the right and left were other Cryptæ, similarly surrounded with places for the dead. Hereabouts we observed the remarkable symbol, sculptured in relief, of an orb with extended wings, evidently intended to represent the subterraneous Sun, or Sol Inferus, as mentioned by Macrobius. We endeavoured to penetrate farther towards the southwest and south, and found that another complete wing of the vast fabric extended in those directions, but the labour of the research was excessive.

“The cryptæ upon the southwest side corresponded with those which we have described towards the northeast. In the middle, between the two, a long range of chambers extended from the central and circular shrine towards the northwest; and in this direction appears to have been the principal and original entrance. Proceeding towards it, we came to a large room in the middle of the fabric, between the supposed Serapeum and the main outlet, or portal, towards the sea. Here the workmanship was very elaborate; and to the right and left were chambers, with receptacles ranged parallel to each other. Farther on, in the same direction, is a passage with galleries and spacious apartments on either side; probably the chambers for embalming the dead, or those belonging to the priests, who constantly officiated in the Serapeum. In the front is a kind

of vestibulum, or porch : but it is exceedingly difficult to ascertain precisely the nature of the excavation towards the main entrance, from the manner in which it is now choked with earth and rubbish. If this part were laid open, it is possible that something further would be known as to the design of the undertaking ; and, at all events, one of the most curious of the antiquities of Egypt would then be exposed to the investigation it merits. Having passed about six hours in exploring, to the best of our ability, these gloomy mansions, we regained, by means of our clue, the aperture by which we had entered, and quitted them for ever."

## CATACOMBS OF PARIS.

Having given you some account of the splendour and gaiety of this city, I must now request you to accompany me to the subterraneous part of it ; and although the scenery be less inviting, the visit may be attended with equal benefit.

I must first inform you that Paris has been principally built of stone taken out of the quarries, which are underneath the city, and the excavations thus made, as you will naturally suppose, are immense. Great anxiety was formerly felt on this account, for fear that many parts of the city might sink in consequence of not being sufficiently supported. So great was this uneasiness some years since, that the government, in 1776, appointed some of its most respectable citizens to examine these excavations, and report their situation.—The result of their examination was, that several churches, palaces, and many of the principal buildings and streets, in the south part of Paris, were considered in imminent danger of falling into the excavated gulph beneath them. It was therefore immediately determined to appoint a general administration for the superintendance of these quarries, with full authority to adopt such measures as they might deem proper.—This subterraneous government has been regularly continued ever since, with as much care as the police for the regulation of affairs above ground ; and under the superintendance of these inspectors, Paris has been regularly propped up by immense columns of stone, and the dreaded evil no longer gives alarm. To show that the public fears were not without cause, one house actually fell in, and was nearly buried, just as the above work was commenced.

In these subterraneous excavations, the Catacombs are to be seen ; and here have been deposited, by well grounded computation, since the year 1785, the bones and bodies of two millions and a half of the human race.

*These had been accumulating for centuries, in the different*



cemeteries, church-yards, &c. ; and these burying places, particularly that of L'Eglise des Innocens, finally became so offensive and injurious to the health of the inhabitants, that in 1785, it was ordered by the government that no more dead bodies should be buried within the city. At the same time orders were given to take down "L'Eglise des Innocens," remove the bodies from the burying ground adjoining it, and convert the place into a public Square. It was ascertained from the public records and calculations made thereon, that in the immense Charnel House of the Innocens, alone, there had been deposited, during the last seven centuries, one million two hundred thousand bodies, this having been for a long period of years the only place of deposit for the dead bodies of the whole city of Paris.

Many obstacles presented themselves, and numberless difficulties were thrown in the way, particularly by those who had friends buried there; but the plan was persevered in, and the immense and awful work begun. The first digging up of the bones, &c. commenced December 1st, 1785, and was regularly continued till May, 1786; when, in consequence of the warm weather, the work was stopped till a return of winter should make it safe to continue it. This work was regularly persisted in during the two following winters, and was completed in January, 1788.

All those bodies which had been recently interred, or which were not decayed, were re-buried out of the city, in some cases; in others were taken to the Catacombs, according to the wishes of surviving friends.

These bones and bodies were dug up in the day-time, and conveyed in covered waggons, about dusk, attended by priests, who performed religious ceremonies over them. They were then emptied into the Catacombs, through a shaft, or dry well, of about sixty feet in depth, and afterwards arranged by the labourers below, in the order in which they now are, and with the regularity and exactness of the most finished masonry.

In addition to the bones and bodies taken from the graveyard of the Innocens, there have since been taken up those of sixteen other public burying grounds. The second work was commenced in the year 1792, and continued in 1793, when, in consequence of the revolution in France, the work appears to have been suspended for ten years. In 1804, it re-commenced, and was continued at intervals till 1813, when the last disturbing of the bones appears to have taken place, by removing those found in the graveyard of the L'Hospital de la Trinite.

*I can give you hereafter the particulars of the removal of*

each of the seventeen grave-yards thus disturbed—at present must defer it.

Having furnished ourselves, the day previous, with a permit from the superintendent-general of the Catacombs, and also made our arrangement with the guide; my friend and myself attended at the time appointed, for the sake of making our gloomy visit. The place we descended is near the “Barrier D’Enfer,” and having each of us provided a lighted taper, we carefully followed our guide down a steep winding staircase of stone, of seventy-six steps, and through the different windings of the quarries. These correspond exactly with the different streets of that part of Paris near “La Rue et Barrier D’Enfer,” so that at any time our conductor could tell us under what particular part of the city we were. We proceeded in this manner, according to his account, about half a mile, when we came to a black closed door, over which we could read, by the light of our tapers, written in large capitals, these awful words, “*Arrete! c’est ici L’Empire de la Mort.*” Pause! this is the Empire of Death.

Our gloomy walk of itself was enough to impress us with serious and solemn thoughts, without the above charge. You will agree with me, however, that the inscription is most appropriate. On opening this door, which leads into “Le grand Ossuaire de la Tombe Isoire,” we found ourselves between walls and columns composed entirely of human bones and skulls, arranged with the most minute precision and regularity in the following manner; at the bottom a layer of one particular description of bones, thigh bones for instance, above these a layer of another description of bones, &c. to the height of about four feet; then a layer of skulls, afterwards layers of bones alternately, for four feet more: then another layer of skulls, &c. &c., to the top of these singular walls. The different bones of the human frame being alternately arranged, so as to keep up an exact uniformity of appearance. The rows of skulls throughout the whole being at equal distances apart. This uniformity is only kept up as to the exterior of these walls, making, in some cases, masses of four sides, in others, oval or oblong, with the corners rounded off. Within these walls, the bones are thrown loosely in, till the hollow space is entirely filled up.

These bones are perfectly dry and free from smell of every kind, and are, on the exterior of the different masses, cemented together by some glutinous substance, which keeps them in their proper places, and gives them a shining glossy appearance as if varnished. Through these gloomy walls our route now lay for about an hundred yards, and a fine opportunity

presented itself for reflecting on the vanity and insignificance of that creature called man. What a lesson for human pride was now before us. We saw no distinction here. The wise man and the idiot; the Christian and the infidel; the most delicate and amiable of the female sex, with the most abandoned; all lie here in one promiscuous heap. Part, perhaps only a single bone of one frame mixed with the bones of others, and perhaps two of the most deadly enemies during life, are thus mixed together. Here there is no distinction, no difference paid to rank or fortune. All are equal. To an observer, how little and contemptible appear the anxieties and disputes about precedence!—But you will say these reflections are common place, and they will naturally occur to you without my making them. I will therefore continue my description of our journey.

The bones taken from the different burying places are kept distinct from all others, and the friends and descendants of the deceased, if not able to designate the particular frames, have the poor satisfaction of knowing, that in such a particular mass of bones, are those of the friends in whom they feel interested. Those, for example, taken out of the burying ground of the Innocents, are in one mass; those from L'Église du St. Esprit in another; and those from "Le Convent des Blancs Manteaux," in another, &c.; and over each collection, an inscription describing from whence, and at what time they were taken up. Wise and absolutely necessary as was this plan, yet there is something very revolting to a person of feeling in this arrangement. For instance, the skull of any particular individual is separated at a great distance from any of the other bones belonging to him; and perhaps no two bones which formerly belonged to one frame are now near each other, but all ranks, sexes, and characters are mixed together in one promiscuous mass. Throughout the whole range of these remains of mortality, are inscriptions, some of which are very appropriate, the reading of which prolonged our stay more than otherwise would have been the case. Amongst them the following appear to claim particular notice. I give them to you in English, although the greater part of their beauty is lost by the translation, viz.—

Here, in the silence of peace, our ancestors repose,  
Beyond these bounds they rest,—waiting for another life.  
The tomb is the triumphal arch, through which we pass into eternity.

Other inscriptions represent the dead as addressing those who are viewing their bones:—

Death has stricken us ;  
 Fear ye also his strokes :  
 He is already at your sides ;—  
 Mortals ! be prepar'd !

Death pursues thee at every step, as the shadow follows thy body. Thinkest thou, that Death is at a distance?—At this very moment, perhaps, he is hovering about thee, and menacing thee with his fatal dart.

The different inscriptions are very numerous, but I will not trespass on your time by inserting any more.

In addition to the seventeen different collections of bones, our conductor pointed out to us several heaps of earth, in which bodies not decayed, were buried *en masse*.

One of these contained the bodies of those unfortunate people who were murdered on the 28th and 29th of August, 1788, by the mob, at la Place de Greve, l'Hotel de Brienne, &c.

Another contains the bodies of those who were killed by the mob, in their attack on the Chateau de Thuilleries, 10th of August, 1792.

Another, those massacred by the blood-thirsty Jacobins in the different prisons, on the 2d and 3d of September, 1792, including some of the most amiable and respectable of the Royalists, and some nearly connected with the Bourbon family.

Others contained those bodies which were taken out of the different grave-yards, before they had undergone a complete decay.

In one of those subterraneous apartments, are preserved such bones as had any thing particular in their appearance. We here saw many, which, during the lives of their owners, appeared to have been fractured, and could see in what manner the bones were knitted together ; also, those which appeared to have belonged to deformed persons, to persons of gigantic stature, &c. also many which our guide informed us had been selected by the physicians and surgeons of Paris, who, from their appearance, could tell of what disease, or by what means the owners came by their deaths. Several skulls were shown to us which appeared to have been perforated by musket or pistol balls, and several, which, from some peculiarity of form, were decided to have belonged to idiots, &c. In short, our guide pretended to speak with as much certainty on the subject, as if he had been acquainted with, or present at the deaths of the several persons whose bones we were examining. This curious kind of study occupied us a considerable time. In the midst of the different ranges of bones we came to a fountain called *La Fontaine de la Samaritaine*, the water of which is perfectly clear, and in which are several

gold fish. About two years since, our guide put these fish into this fountain, and although they are in the most profound darkness, except when an occasional taper shines upon them, yet they were very active and perfectly healthy.

Some years since, a poor Frenchman, who descended with a party into these dismal mansions, got somehow separated from his companions, and lost amidst the mazes of the Catacombs. He was sought for in vain, and his skeleton was discovered ten years afterwards at a considerable distance from the usual route. It was supposed that curiosity had kept him too far behind, or had led him to explore some of the avenues, or that his light became extinguished, and prevented him from retracing his steps. A party of English people, consisting of five, got also lost here the last year, and it was six hours before the guide could find them. These were amongst the agreeable stories told by our conductor, while exploring with him these labyrinths, which you may suppose were admirably calculated to keep up our spirits. In the present instance, we kept near to each other, and in spite of our utmost caution occasionally one of our tapers would get extinguished. When this occurred, immediate recourse was had to the light of our neighbour. Although entirely divested of any childish or superstitious fear, yet I could not help shuddering at the possibility of all three of our tapers being extinguished at the same time; but our guide assured us, that should this be the case, he was convinced that he could grope his way out, although he acknowledged that he had no great wish to volunteer the experiment.

It took us about two hours and a half to perform this subterraneous journey, and during the whole of it, we found the air perfectly sweet, and the walking and walls perfectly dry, except in one instance, when we passed under a canal: here there was a little dripping of water.

Having, according to our conductor's account, walked about a mile and a quarter, we came to the foot of a winding staircase, similar to the one by which we had descended. We here left these gloomy mansions, and although we had passed a most interesting time, yet, truly happy were we to find ourselves once more in the regions of sunshine and cheerfulness.

#### CATACOMBS OF ROME.

Next to the Egyptian Catacombs, the most extensive with which the moderns are acquainted, are those of Ancient Rome. Though their antiquity perhaps is not equal to that of some others dispersed throughout the world, an unusual interest is excited by their containing the remains of a people, who had

THE CATACOMBS OF ROME

rendered themselves so illustrious, and whose history is so familiar to our knowledge.

The Roman catacombs are of great extent. Some maintain, that, entering close to the city, they stretch several leagues beyond it; but the precise destination and limits of these, if they actually do exist, are not ascertained. Some others have for centuries been frequently explored; in the course of which, a zealous antiquarian, Anthony Bosio, who has amply elucidated this subject, ventured to pass entire days within them, had provisions carried there, and notwithstanding the danger of the enterprize, traversed their utmost extremities. Yet the hazard of this is great: persons have been known to lose their way; and the passages are of such intricacy, that it is unsafe to penetrate their recesses without a clue.

The catacombs of Rome, like those of most other places, are long, narrow, subterraneous galleries, crossing each other at right angles, or passing off obliquely. Chambers at each side occasionally appear, and a glimmering of light is admitted by openings above, distant by intervals of 300 yards or more. But in the interior, it is dark as night. The excavations are invariably under the earth, in the puzzolana, whereon the city is built: they are necessarily narrow to preserve the roof, and, in some parts, are vaulted. Nevertheless, the earth frequently detaches itself from above, and obstructs, or totally blocks up, the passages. There are cavities along each side, which have formerly been appropriated for the reception of lamps; and deep niches penetrate into the walls, wherein the bodies of the deceased were deposited. These niches are invariably in proportion to the size of the individual; those of women and children being smaller than the rest.

The bodies are regularly arranged in one tier of niches above another, along the sides of the galleries, each niche of sufficient capacity according to the number it was required to contain, and closed at the foot by a single brick. In general, the galleries can admit of a man traversing them with facility, and there two or three rows are seen: in some places they are more lofty; and Bosio relates, that one which he discovered was so high, as to receive eight or ten bodies above each other in the sides. Parts of the same gallery, however, were so low, that he had to advance bending downwards, or crawling on his breast, to the different streets or passages; probably the consequence of the superincumbent earth having given way. The cement by which the tombs are closed, unless where yielding from too great desiccation, is yet entire; and on removing the brick to inspect the interior, the skeletons of the deceased appear in good preservation. In elucidation of

this fact, let us quote the words of an adventurous explorer, who recently penetrated these gloomy mansions. "The brick obstructing the aperture of a catacomb being removed, a body, apparently that of a young woman, was discovered. Even yet all the teeth were preserved in her jaws. Her bones were perfectly covered with stalactites, exhibiting a most singular spectacle; for the light, reflected by the motion of the torches, seemed to animate the body, and the image of the spectator was multiplied a thousand fold, by the most entire portion of the skull."—"Another was opened, wherein a skeleton, turned towards the east, was seen. The hands were crossed on the breast, and but few teeth were in the jaws; it seemed to be that of an old man. When my guide stretched one arm to the head, and the other to the feet, designing to raise the skeleton, it immediately fell into a whitish humid dust. Nothing except the substance of the teeth, which were eleven in number, remained: the whole skeleton had vanished from view."

The catacombs of Rome, besides the tombs, contain edifices, which, in the days of the most prevalent superstitions, were churches, and where it is probable the mysteries of the earlier Christians were celebrated. Many inscriptions are still extant, and elegantly sculptured sarcophagi have been obtained from these catacombs. But above all, they abound with paintings in fresco, representing, like those of Egypt, an infinite variety of subjects; and sepulchral lamps, as also vases and lachrymatories, are frequently discovered in tombs which have escaped the pillage of the more barbarous ages.

With respect to the precise era when these cemeteries were constructed, and the persons for whose reception they were appropriated, we are opposed by many uncertainties. Some ascribe them to the ancient Romans, others bring them to a period about the birth of Christ; and there are not wanting intelligent antiquarians, by whom they are considered as almost solely for a secret deposit of those who suffered martyrdom, while the rage of persecution threatened the extermination of Christians. It is possible that all the three opinions are right.

Though cremation was general among the Romans, we do not learn that it was universally practised: children were not burnt, nor those in a state of servitude; and besides, if we may credit Pliny, this custom was introduced long after the building of the city. Inscriptions prove, that many who were not Christians were interred here; and numerous emblems, epitaphs, and histories show, that it was a sepulchre for Christians, among whom were martyrs. The academician of Cortona, saw a skull which he conjectured to have been violently separated from the vertebræ of the neck; and Bosio relates,

that in opening a tomb, he found a skull cleft by a hatchet, still sticking in it, and observed others apparently fractured by violence. In another part of the catacombs, there was found a horrible kind of pincers, with which the flesh was torn from the bones of martyrs; and also vessels full of concrete blood, which crumbled to earth, but on being wetted, immediately showed its crimson hue. Some of the Roman emperors were deposited in the catacombs of the Vatican. There the body of Honorius was discovered 1144 years subsequent to his decease, with many jewels and ornaments in his tomb, weighing forty pounds of solid gold.

#### MAUSOLEUM OF HYDER ALLY.

This splendid monument of oriental grandeur is situated at the western extremity of the great garden of Seringapatam, a city of Hindostan, and capital of the Mysore territory. It is surrounded by a grove of beautiful cypress trees, and was erected by Tippoo Saib in honour of the deceased sovereign, his father. Beneath tombs of black marble, elevated about eighteen inches from the ground, lie the bodies of Hyder Ally, his consort, and Tippoo Saib. They are covered with rich cloths, and have canopies over them. The whole of this sumptuous edifice is, together with its dome, supported by brilliantly polished black marble columns. It is surrounded by a magnificent area, within which the fakirs have cells allotted to them; and on an elevated platform are the tombs of several faithful servants. The mosque annexed to it is flanked by two towers. The Moulahs stationed there, are, through the liberality of the British government, still allowed two thousand pagodas per annum to read the Koran; and three pagodas are daily distributed in charity at the mausoleum.

#### THE TAJE MAHAL.

This grand mausoleum, which stands due north and south, on the southern bank of the river Jumna, was built by command of the Emperor Shah Jehan for the interment of his favourite sultana *Momtaz mehl*, or *Montazal Zumani*, the "*Precminent in the seraglio, or, Paragon of the age,*" and at his death, his remains were also here deposited, by order of his son Aurungzebe.

This building, in point of design and execution, is one of the most extensive, elegant, commodious, and perfect works ever undertaken and finished by one man. To this celebrated architect the Emperor Shah Jehan gave the title of *Zerreer elust*, or, *Jewel-handed*, to distinguish him from all other artists.

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This building, in point of design and execution, is one of the most extensive, elegant, commodious, and perfect works ever undertaken and finished by one man. To this celebrated architect the Emperor Shah Jehan gave the title of *Zerreer dust*, or, *Jewel-handed*, to distinguish him from all other artists.

It is built entirely of pure white marble, on an immense square

platform of the same material, having a lofty minaret of equal beauty at every corner. On each side and behind the imperial mausoleum, is a suite of elegant apartments, also of white marble, highly decorated with coloured stones. The tombs and other principal parts of this vast fabric, are inlaid with wreaths of flowers and foliage in their natural colours, entirely composed of cornelians, onyxes, verd-antique, lapis-lazuli, and a variety of agates, so admirably finished as to have rather the appearance of an ivory model set with jewels.

It was commenced in the fifth year of the reign of the Emperor Shah Jehan, and the whole completed in sixteen years, four months, and twenty-one days. It cost ninety eight lacs, or nine millions eight hundred and fifteen thousand rupees, equal to one million two hundred and twenty-five thousand pounds sterling : although the price of labour then was, and still continues to be, very reasonable in India.

#### THE SHOEMADOO AT PEGU.

The object in Pegu that most attracts and most merits notice, says Mr. Symes in his Embassy to Ava, is the noble edifice of Shoemadoo, or the Golden Supreme.—This extraordinary pile of buildings is erected on a double terrace, one raised upon another. The lower and greater terrace is about ten feet above the natural level of the ground, forming an exact parallelogram : the upper and lesser terrace is similar in shape, and rises about twenty feet above the lower terrace, or thirty above the level of the country. I judged a side of the lower terrace to be 1391 feet ; of the upper, 684. The walls that sustained the sides of the terrace, both upper and lower, are in a ruinous state : they were formerly covered with plaster, wrought into various figures ; the area of the lower is strewed with the fragments of small decayed buildings, but the upper is kept free from filth, and is in tolerable good order. There is reason to conclude that this building and the fortress are coeval, as the earth of which the terraces are composed, appears to have been taken from the ditch ; there being no other excavation in the city, or in its neighbourhood, that could have afforded a tenth part of the quantity.

The terraces are ascended by flights of stone steps, which are now broken and neglected. On each side, are dwellings of the Rhahaans, raised on timbers four or five feet from the ground ; these houses consist only of a large hall : the wooden pillars that support them are turned with neatness ; the roofs are covered with tiles, and the sides are made of boards ; and there are a number of bare benches in every house, on which the Rhahaans sleep ; but we saw no other furniture.

Shoemadoo is a pyramidal building composed of brick and mortar, without excavation or aperture of any sort ; octagonal at the base, and spiral at the top ; each side of the base measures 162 feet ; this immense breadth diminishes abruptly, and a similar building has not unaptly been compared in shape to a large speaking trumpet.

Six feet from the ground there is a wide projection that surrounds the base, on the plane of which are fifty-seven small spires of equal size, and equidistant ; one of them measured twenty-seven feet in height, and forty in circumference at the bottom. On a higher ledge there is another row consisting of fifty-three spires of similar shape and measurement.

A great variety of mouldings encircle the building ; and ornaments somewhat resembling the fleur-de-lys surround the lower part of the spire ; circular mouldings likewise girt it to a considerable height, above which, there are ornaments in stucco not unlike the leaves of a Corinthian capital ; and the whole is crowned by a Tee, or umbrella, of open iron-work, from which rises a rod with a gilded pennant.

The tee or umbrella is to be seen on every sacred building that is of a spiral form ; the raising and consecration of this last and indispensable appendage, is an act of high religious solemnity, and a season of festivity and relaxation. The present king bestowed the tee that covers Shoemadoo. It was made at the capital ; and many of the principal nobility came down from Ummerapoora to be present at the ceremony of its elevation.

The circumference of the tee is fifty-six feet ; it rests on an iron axis fixed in the building, and is farther secured by large chains strongly rivetted to the spire. Round the lower rim of the tee, are appended a number of bells, which agitated by the wind, make a continual jingling.

The tee is gilt, and it is said to be the intention of the king to gild the whole of the spire. All the lesser pagodas are ornamented with proportionable umbrellas of similar workmanship, which are likewise encircled by small bells.

The extreme height of the edifice, from the level of the country, is 361 feet, and above the interior terrace, 331 feet.

On the southeast angle of the upper terrace, there are two handsome saloons, or kioums, lately erected, the roofs composed of different stages, supported by pillars ; we judged the length of each to be about sixty feet, and the breadth thirty : the ceiling of one is already embellished with gold leaf, and the pillars are lackered ; the decoration of the other is not yet completed. They are made entirely of wood ; the carving on the outside is laborious and minute : we saw several un-

finished figures of animals and men in grotesque attitudes, which were designed as ornaments for different parts of the building. Some images of Gaudma, the supreme object of Birman adoration, lay scattered around.

At each angle of the interior and higher terrace, there is a temple 67 feet high, resembling, in miniature, the great temple: in front of that, in the southwest corner, are four gigantic representations, in masonry, of Palloo, or the evil genius, half beast, half human, seated on their hams, each with a large club on the right shoulder. The Pundit who accompanied me, said that they resembled the Rakuss of the Hindoos. These are guardians of the temple.

Nearly in the centre of the east face of the area, are two human figures in stucco, beneath a gilded umbrella; one, standing, represents a man with a book before him and a pen in his hand; he is called Thasiamee, the recorder of mortal merits and mortal misdeeds; the other, a female figure kneeling, is Mahasumdera, the protectress of the universe, so long as the universe is doomed to last: but when the time of general dissolution arrives, by her hand the world is to be overwhelmed and everlastingly destroyed.

A small brick building near the northeast angle contains an upright marble slab, four feet high, and three feet wide: there is a long legible inscription on it. I was told it was an account of the donations of pilgrims of only a recent date.

Along the whole extent of the north face of the upper terrace, there is a wooden shed for the convenience of devotees who come from a distant part of the country. On the north side of the temple, are three large bells of good workmanship, suspended nigh the ground, between pillars; several deers' horns lie strewed around; those who come to pay their devotions first take up one of the horns, and strike the bell three times, giving an alternate stroke to the ground: this act, I was told, is to announce to the spirit of Gaudma the approach of a suppliant. There are several low benches near the foot of the temple, on which the person who comes to pray, places his offering, commonly consisting of boiled rice, a plate of sweetmeats, or cocoonut fried in oil; when it is given, the devotee cares not what becomes of it; the crows and wild dogs often devour it in presence of the donor, who never attempts to disturb the animals. I saw several plates of victuals disposed of in this manner, and understood it to be the case with all that was brought.

There are many small temples on the areas of both terraces, which are neglected, and suffered to fall into decay. Numberless images of Gaudma lie indiscriminately scattered. A pious

Birman who purchases an idol, first procures the ceremony of consecration to be performed by the Rhahaans; he then takes his purchase to whatever sacred building is most convenient, and there places it in the shelter of a kioum, or on the open ground before the temple; nor does he ever again seem to have any anxiety about its preservation, but leaves the divinity to shift for itself. Some of those idols are made of marble that is found in the neighbourhood of the capital of the Birman dominions, and admits of a very fine polish; many are formed of wood, and gilded, and a few are of silver; the latter, however, are not usually exposed and neglected like the others. Silver and gold are rarely used except in the composition of household gods.

On both the terraces are a number of white cylindrical flags, raised on bamboo poles; these flags are peculiar to the Rhahaans, and are considered as emblematical of purity, and of their sacred function. On the top of the staff there is a henza or goose, the symbol both of the Birman and Pegu nations.

#### TRAJAN'S PILLAR.

This historical column was erected at Rome by the Emperor Trajan to commemorate his victories over the Dacians, and is considered the masterpiece of the splendid monuments of art elevated by that Emperor in the Roman capital. Its celebrity is chiefly owing to the beautifully wrought bas-reliefs, containing about two thousand figures, with which it is ornamented. It stands in the middle of a square, to form which, a hill one hundred and forty feet in height was levelled; and was intended, as appears by the inscription on its base, both as a tomb for the Emperor, and to display the height of the hill, which had thus, with incredible labour, been reduced to a plane surface. It was erected in the year 114 of the Christian era; and the Emperor Constantine, two centuries and a half afterwards, regarded it as the most magnificent structure by which Rome was even at that time embellished.

This pillar is built of white marble, its base consisting of twelve stones of enormous size, being raised on a socle, or foot of eight steps; withinside is a staircase illuminated by 44 windows. Its height, equalling that of the hill which had been levelled, to give place to the large square called *THE FORUM ROMANUM*, is 140 feet, being 35 feet less elevated than the Antonine column. The latter, the sculptured ornaments of which are not equally esteemed, is decorated with bas-reliefs representing the victories of Marcus Aurelius over the Marcomanni. A spiral staircase of nearly 200 steps leads to the summit of this column.

## STONEHENGE.

This celebrated monument of antiquity stands in the middle of a flat area near the summit of a hill, six miles distant from Salisbury. It is inclosed by a double circular bank and ditch, nearly thirty feet broad, after crossing which, an ascent of thirty yards leads to the work. The whole fabric was originally composed of two circles and two ovals.—The outer circle is about 108 feet in diameter, consisting, when entire, of sixty stones, thirty uprights, and thirty imposts, of which there now remain twenty-four uprights only, seventeen standing, and seven down, three feet and a half asunder, and eight imposts. Eleven uprights have their five imposts on them at the grand entrance: these stones are from thirteen to twenty feet high. The smaller circle is somewhat more than eight feet from the inside of the outer one, and consisted of forty smaller stones, the highest measuring about six feet, nineteen only of which now remain, and only eleven standing. The walk between these two circles is 300 feet in circumference. The *adytum*, or cell, is an oval formed of ten stones, from sixteen to twenty-two feet high, in pairs, and with imposts above thirty feet high, rising in height as they go round, and each pair separate, and not connected as the outer pair: the highest eight feet.—Within these are nineteen other smaller single stones, of which six only are standing. At the upper end of the *adytum* is the altar, a large slab of blue coarse marble, 20 inches thick, sixteen feet long, and four broad: it is pressed down by the weight of the vast stones which have fallen upon it. The whole number of stones, uprights, and imposts, comprehending the altar, is 140. The stones, which have been by some considered artificial, were most probably brought from those called the *grey weathers* on Marlborough Downs, distant fifteen or sixteen miles; and if tried with a tool, appear of the same hardness, grain, and colour, generally reddish. The heads of oxen, deer, and other beasts, have been found in digging in and about Stonehenge: and in the circumjacent barrows, human bones. From the plain to this structure there are three entrances, the most considerable of which is from the northeast; and at each of them were raised, on the outside of the trench, two huge stones, with two smaller parallel ones within.

Geoffrey of Monmouth, in his history of the Britons, written in the reign of King Stephen, represents this monument as having been erected at the command of Aurelius Ambrosius, the last British king, in memory of 460 Britons who were murdered by Hengist the Saxon. Polydore Virgil says, that it was erected by the Britons as the sepulchral monument of Aurelius

Ambrosius; and other writers considered it to have been that of the famous British queen Boadicea. Inigo Jones is of opinion that it was a Roman temple; and his conclusion he draws from a stone sixteen feet in length, and four in breadth, placed in an exact position to the eastward, altar-fashion. By Charlton it is ascribed to the Danes, who were two years master of Wiltshire; a tin tablet, on which were some unknown characters, having been dug up in the vicinity, in the reign of Henry VIII. This tablet, which is lost, might have given some information respecting its founders. Its common name, **STONEHENGE**, is Saxon, and signifies a "stone gallows," to which the stones, having transverse imposts, bear some resemblance. It is also called in Welch *choir gour*, or the giants' dance.

Mr. Grose, the antiquary, is of opinion that Doctor Stukely has completely proved this structure to have been a British temple, in which the Druids officiated. He supposes it to have been the metropolitan temple of Great Britain, and translates the words *choir gour*, "the great choir or temple." It was customary with the Druids to place one large stone on another for a religious memorial; and these they often placed so equably, that even a breath of wind would sometimes make them vibrate. Of such stones one remains at this day in the pile of Stonehenge.—The ancients distinguished stones erected with a religious view, by the name of *ambrosiæ petrae*, *amber stones*, the word *amber*, implying whatever is solar and divine. According to Bryant, Stonehenge is composed of these amber stones; and hence the next town is denominated Ambersbury.

#### THE MONUMENT IN LONDON.

About two hundred yards north of London bridge, is situated one of the finest pillars in the world, erected by Sir Christopher Wren, in memory of the great fire, which, in 1666, broke out at a house on this spot, and destroyed the metropolis from the Tower to Temple Bar. It is a fluted column of the Doric order; its total height is 202 feet; the diameter at the base is 15 feet; the height of the column 120 feet; and the cone at the top, with its urn, 42 feet. The height of the massy pedestal is 40 feet. Within the column is a flight of 345 steps; and from the iron balcony at the top is a most fascinating prospect of the metropolis and the adjacent country. It is impossible not to lament the obscure situation of this beautiful monument, which, in a proper place, would form one of the most striking objects of the kind that architecture is capable of producing.

The inscription had better be erased, for no rational being can entertain the notion, that the Catholics, or any religious sect, could wilfully have perpetrated so horrible a deed as this



pillar was intended to impute to them, nor can so much be given to human foresight, as for it to be concluded fire, which broke out in a single house, could upon this, than upon other occasions, have extended its ravages in extraordinary a manner.

#### TEMPLES OF ELEPHANTA.

The Island of Elephanta, distant about two leagues from Bombay, has a circumference of about three miles, and consists of two rocky mountains, covered with trees and wood. Near the landing place, is the figure of an elephant large as life, shaped out of a rock, and supposed to have given its name to the island. Having ascended the mountain by a narrow path, the visitor reaches the excavation which has long excited the attention of the curious, and afforded an ample scope for the discussion of antiquarians. With the strongest emotions of surprise and admiration, he beholds rows of massive columns cut out of the solid rock, uniform in their order, and placed at regular distances, so as to form magnificent avenues from the principal entrance to the idol which terminates the middle vista; the general effect being heightened by the blueness of the light, or rather the peculiar to the situation. The central image is composed of three colossal heads, reaching nearly from the floor to the height of fifteen feet. It represents the triad deity of Hindoo mythology, BRAHMA, VISHNOO, and SEEVA, in the characters of the creator, preserver, and destroyer. The middle face displays regular features, and a mild and serene character; the towering head-dress is much ornamented, those on each side, which appear in profile, lofty, and adorned with jewels. The countenance of Vishnoo has the same mild aspect as that of Brahma; but the visage of the third is very different,—severity and revenge, characteristic of the destroying attribute, are strongly depicted; one of the arms embraces a large COBRA DE CAPELLO; while the others hold a lotus, flowers, and blessings for mankind, among which the apple and pomegranate are readily distinguishable. The lotus, of these, the lotus, so often introduced into the Hindoo mythology, forms a principal object in the sculpture and paintings of their temples, is the ornament of their sacred images, and the most conspicuous beauty in their flowery sacrifices.

On either side of the Elephanta triad, is a gigantic figure leaning on a dwarf, an object frequently introduced in the excavations. The giants guard the triple deity, and seem to be *it from a large recess filled with a variety of figures, male and female, in-different attitudes; they are in tolerable pro-*

but do not express any particular character of countenance : one conspicuous female, like the Amazons, is single-breasted ; the rest, whether intended for goddesses or mortals, are generally adorned, like the modern Hindoo women, with bracelets and rings for the ankles ; the men have bracelets only. The intervening space between these figures is occupied by small aerial beings, hovering about them in infinite variety. The larger images in these groups are in alto-relievo, and most of the smaller in basso-relievo, brought sufficiently forward from the rock to produce a good effect.

The sides of the temple are adorned with similar compositions, placed at regular distances, and terminating the avenues formed by the colonnades, so that only one group is seen at a time, except on a near approach ; the regularity and proportion of the whole are remarkably striking. The figures are in general in graceful attitudes ; but those of Herculean stature do not indicate any extraordinary muscular strength. Among many thousands of them, few of the countenances express any particular passion, or mark a decided character ; they have generally a sleepy aspect, and bear a greater resemblance to the tame sculpture of Egypt, than to the animated works of the Grecian chisel.

From the right and left avenues of the principal temple, are passages to smaller excavations on each side ; that on the right is much decayed, and very little of the sculpture remains entire. A pool of water penetrates from it into a dark cavern far under the rock ; but whether natural or artificial, has not been decided. A small corresponding temple on the left side, contains two baths, one of them elegantly finished ; the front is open, and the roof supported by pillars of a different order from those in the large temple ; the sides are adorned with sculpture, and the roof and cornice painted in mosaic patterns ; some of the colours are still bright. The opposite bath, of the same proportions, is less ornamented ; and between them is a room detached from the rock, containing a colossal representation of the *Lingam*, or symbol of Seeva. Several small caves branch out from the grand excavations.

An anecdote is related by Mr. Forbes, in his *Oriental Memoirs*, relative to these sculptured monuments. He accompanied an eminent English Artist on his first visit to the Elephanta. " After the glare of a tropical sun, during the walk from the landing place, it was sometime before the eye had accommodated itself to the gloom of these subterraneous chambers, sufficiently to discriminate objects in that sombre light. We remained for several minutes without speaking, or looking particularly at each other : at length, when more far

miliarized to the cavern, my companion still remaining silent, I expressed some fear of having been too warm in my description, and that like most other objects, the reality fell short of the anticipated pleasure. He soon relieved my anxiety by declaring, that however highly he had raised his imagination, he was so absorbed in astonishment and delight, on entering this stupendous scene, as to forget where he was. He had seen the most striking objects of art in Italy and Greece; but never any thing which filled his mind with such extraordinary sensations." So enraptured was this artist with the spot, that after staying until a late hour, he quitted it most reluctantly.

The caves of the Isle of Elephanta cannot be sufficiently admired, when the immensity of such an undertaking, the number of artificers employed, and the extraordinary genius of its projector, are considered, in a country until lately accounted rude and barbarous by the now enlightened nations of Europe. Had this work been raised from a foundation, like other structures, it would have excited the admiration of the curious; but when the reflection is made, that it is hewn inch by inch in the hard and solid rock, how great must the astonishment be at the conception and completion of the enterprise!

#### TEMPLES OF SALSETTE.

The excavations of the Island of Salsette, also contiguous to Bombay, are hewn in the central mountains. The great temple is excavated at some distance from the summit of a steep mountain, in a commanding situation. This stupendous work is upwards of ninety feet long, thirty-eight wide, and of a proportionate height, hewn out of the solid rock, and forming an oblong square, with a fluted concave roof. The area is divided into three aisles by regular colonnades, similar to the ancient basilic, a pile of buildings twice as long as it was wide, and one of the extremities of which terminated in a hemicycle, two rows of columns forming a spacious area in the centre, and leaving a narrow walk between the columns and the wall. In these *basilici* the Roman emperors of the east frequently administered justice. This magnificent excavation at Salsette appears to be on the same plan, although, doubtless, intended for a place of worship: towards the termination of the temple, fronting the entrance, is a circular pile of solid rock, nineteen feet high, and forty-eight in circumference, most probably a representation of the lingam, the symbol already alluded to in the description of the temples of Elephanta. In this temple there are not any images, nor any kind of sculpture, except on the capitals of the pillars, which are in general finished in a very

masterly style, and are little impaired by time. Several have been left in an unfinished state ; and on the summit of others is something like a bell, between elephants, horses, lions, and animals of different kinds.

The lofty pillars and concave roof of the principal temple at Salsette, present a much grander appearance than the largest excavation at the Elephanta, although that is much richer in statues and bas-reliefs. The portico at Salsette, of the same height and breadth as the temple, is richly decorated : on each side a large niche contains a colossal statue, well executed ; and facing the entrance are small single figures, with groups in various attitudes, all of them in good preservation. The outer front of the portico, and the area before it, corresponding in grandeur with the interior, are now injured by time, and the mouldering sculpture intermingled with a variety of rock-plants. On the square pillars at the entrance are long inscriptions, the characters of which are obsolete, and which modern ingenuity has not as yet succeeded in decyphering.

Farther up the mountain, a flight of steps, hewn in the rock, and continued to the summit, leads, by various intricate paths, to smaller excavations, most of which consist of two rooms, a portico and benches, cut in the rock. To each is annexed a cistern of about three cubic feet, also hewn in the rock, for the preservation of rain water. Some of these excavations are larger and better finished than others ; and a few, although inferior in size and decoration, in their general effect resemble the principal temple.

The whole appearance of this excavated mountain indicates it to have had a city hewn in its rocky sides, capable of containing many thousand inhabitants. The largest temple was, doubtless, their principal place of worship ; and the smaller, on the same plan, inferior ones. The rest were appropriated as dwellings for the inhabitants, differing in size and accommodation according to their respective ranks in society ; or, as it is still more probable, these habitations were the abode of religious brahmins, and of their pupils, when India was the nursery of art and science, and the nations of Europe were involved in ignorance and barbarism.

## GREAT WALL OF CHINA.

[See Plate, No. 21.]

This stupendous wall, which extends across the northern boundary of the Chinese Empire, is deservedly ranked among the grandest labours of art. It is conducted over the summits of high mountains, several of which have an elevation of not less than 5225 feet, (nearly a mile,) across deep vallies and over

wide rivers, by means of arches : in many parts it is doubled or trebled, to command important passes ; and at the distance of nearly every hundred yards is a tower or massive bastion. Its extent is computed at 1500 miles ; but in some parts, where less danger is apprehended, it is not equally strong or complete, and towards the N. W. consists merely of a strong rampart of earth. Near Koopekoo it is twenty-five feet in height, and the top about fifteen feet thick ; some of the towers, which are square, are forty-eight feet high, and about forty feet in width. The stone employed in the foundations, angles, &c. is a strong grey granite ; but the materials for the greater part consist of blueish bricks, and the mortar is remarkably pure and white.

The area of the construction of this great barrier, which has been, and will continue to be, the wonder and admiration of ages, is considered by Sir George Staunton as having been absolutely ascertained ; and he asserts that it has existed for two thousand years. In this assertion he appears to have followed Du Halde, who informs us that " this prodigious work was constructed two hundred and fifteen years before the birth of Christ, by order of the first Emperor of the family of Tsin, to protect three large provinces from the irruptions of the Tartars." However, in the History of China, contained in his first volume, he ascribes this erection to the second Emperor of the dynasty of Tsin, named Chi Hoang Ti ; and the date immediately preceding the narrative of this construction is the year 137 before the birth of Christ. Hence suspicions may arise, not only concerning the epoch when this work was undertaken, but also relatively to the purity and precision of the Chinese annals in general. Mr. Bell, who resided sometime in China, and whose travels are deservedly esteemed for the accuracy of their information, assures us that this wall was built somewhere about the year 1160, by one of the Emperors to prevent the frequent incursions of the Monguls, whose numerous cavalry used to ravage the provinces, and effect their escape before an army could be assembled to oppose them. Renaudot observes, that this wall is not mentioned by any oriental geographer whose writings boast a higher antiquity than three hundred years ; and it is surprising that it should have escaped Marco Paulo, who, admitting that he entered China by a different route, can hardly be supposed, during his long residence in the north of China, and in the country of the Monguls, to have remained ignorant of so stupendous a work. Amid these difficulties, it may be reasonably conjectured, that similar modes of defence had been adopted in different ages ; and that the ancient rude barrier, having fallen into decay, was replaced, perhaps after the invasion of Singis, by the pre-

sent erection, which, even from its state of preservation, can scarcely aspire to a very remote antiquity.

## CANALS AND BRIDGES.

### THE PONT DU GARD.

This celebrated Roman monument is distant about three leagues from the city of Nismes. Instead of finding it in a ruinous condition, as he might reasonably have expected, the traveller, on approaching it, is agreeably disappointed, when he perceives that it looks as fresh as a modern bridge of a few years standing. The climate is either so pure and dry, or the free-stone with which it is built is so hard, that the very angles of the stones remain as acute as if they had been recently cut. A few of them have, indeed, dropped out of the arches; but the whole is admirably preserved, and presents the eye with a piece of architecture, so unaffectedly elegant, so simple, and, at the same time, so majestic, that it defies the most phlegmatic spectator to view it without admiration. It was raised in the Augustan age, by the Roman Colony of Nismes, to convey a stream of water between two mountains, for the use of that city. It stands over the river Gardon, a beautiful pastoral stream, brawling among rocks which form a number of pretty natural cascades, and overshadowed on each side by trees and shrubs, which add greatly to the rural beauties of the scene.

This elegant structure consists of three bridges; or tiers of arches, one above another; the first of six, the second of eleven, and the third of thirty-six arches. The height, comprehending the aqueduct on the top, is 174 feet 3 inches, and the length, between the two mountains, which it unites, is 723 feet. The order of the architecture is Tuscan; but its symmetry is inconceivable. By scooping the bases of the pilasters of the second tier of arches, a passage was made for foot travellers; but although the ancients far excelled the moderns in point of beauty and magnificence, they certainly fell short of them in point of convenience. The inhabitants of Avignon have, in this particular, improved the Roman work by a new bridge by apposition, constructed on the same plan with that of the lower tier of arches, of which indeed it seems to be a part, affording a broad and commodious passage over the river, to horses and carriages. The aqueduct, for the continuance of which this superb work was raised, conveyed a stream of pure water from the fountain of Eure, near the city of Uzes, and extended nearly six leagues in length.

## NEW-YORK CANAL, OR ERIE CANAL.

This Grand Canal, extending a distance of 350 miles, opens a water communication from Hudson river to Lake Erie. Beginning at Albany, it passes a westerly direction until it opens into Lake Erie at Buffalo. From the lake to the river there is generally a descent, though in some places there is an ascent, so that the aggregate of rise and fall is 662 feet, and the difference of level between the lake and the river is 564 feet.

The canal is 40 feet wide on the surface, 28 at the bottom, and 4 feet deep, having, in the whole distance, about 80 locks. The cost has been estimated at \$5,000,000. The greatest distance without a lock, is 67 miles. Barges of 70 tons burthen, drawn by two horses, pass through it at the rate of 5 miles an hour. This Canal, whether for its magnitude, the rapidity with which it has been completed, or for the important benefits it will secure to the State, may be justly ranked among the most splendid enterprises that have ever been undertaken or completed by any nation whatever. Among the principal benefits resulting from it, beside furnishing an outlet for the agricultural produce of vast and fertile regions, salt may be supplied to the Atlantic States, from the great salt works at Salina, cheaper than from abroad. In the progress of the Canal, also, gypsum of the best quality has been discovered, sufficient to supply the whole United States.

THE ROAD OF PILLARS IN CHINA, OR THE BRIDGE OF  
SUEN-TCHEON.

The Chinese bridges, from their construction and extent cannot be sufficiently admired. They are sometimes built upon barges, strongly chained together, yet so as to be parted to let the vessels pass that sail up and down the river. Some of them run from mountain to mountain, and consist only of one arch. Among the most magnificent structures of this kind, is the bridge of Suen-tcheon, built over an arm of the sea, and supported by above 300 pillars. Its length is about 2500 feet, its breadth 20; and the stone work from pier to pier, at the top, consists of large single massy stones. A more perfect idea of the beauty and grandeur of this structure, can be derived from the view of it as represented in the annexed plate, than language can easily communicate. The lofty projecting cliffs of massy rocks, the summits of which are crowned with verdure; the rugged fragments, lower down, which seem struggling to resist the impetuosity of the

torrent, and the wild confusion of the waters breaking in every direction, form such a contrast with the splendid production of art above, stretching from rock to rock, as serves to present at one view, in the most impressive form, the wildest magnificence of nature, and one of the most imposing structures of civilization.

### FORTRESSES.

#### GIBRALTER.

This impregnable fortress, belonging to Great Britain, is situated upon a tongue of land, at the southern extremity of Europe, on the north side of the narrow sea, which forms a communication between the Mediterranean and Atlantic, called the straits of Gibraltar. A fortified line is drawn by the Spaniards from sea to sea, to cut off the communication of the garrison with the rest of Spain. The length of Gibraltar, from the lines on the Spanish side, to the most southern part, called *Europa point*, is about three English miles, and the circumference seven. On the west side, stands the town of Gibraltar, on the water side, and is defended by a line of ramparts, forming a continued fortification from the north and perpendicular side of the rock, to the extremity of the Moors' wall, which nearly divides the rock into two equal parts. This wall was built about the year one thousand, and runs from the water side about one third of the way up with a very rapid ascent, till it meets an inaccessible part of the rock, where it was discontinued, and another built further to the south at an accessible place. The fortifications have since been continued round the rock, and rendered impregnable by works cut into the interior on the north and eastern side, where it is perpendicular. The English, since they became masters of this place, have been indefatigable in excavating the rock, and forming subterraneous walks, 5000 feet in length, galleries and caverns, into which the besieged might retreat during an attack, in case the outer works should be carried by an enemy. These galleries form several tiers or ranks (23 in number) of batteries, from 300 to 1300 feet above the surface of the flat country below, called the *neutral ground*, which is between the Spanish and English lines. Were a general battering of all the embrasures to take place at the same time, it would afford one of the grandest spectacles in the world. It would resemble a huge monster, with a thousand mouths, each vomiting out thunder, smoke, and red hot balls. The cannon have all been so well practised, and are so well elevated, that the



object aimed at, is hit with as much certainty as with a fusee. The whole surface of the rock, outside, is planted with cannon, in every place where it is possible to make an attack, even with one or two men only at a time. Should the water lines be carried by an enemy, they would have to dispute the ascent to the top of the mountain, inch by inch, and in many places, by narrow passes, between stupendous rocks, which are not more than 25 or 30 feet wide. Should they even succeed and obtain possession of the whole surface of the mountain, they would have to combat with an army in the bowels of the rock, against a thousand mines and other artifices, which would render the situation of the conquerors very unsafe. It is said there are close quarters in the rocks for more than twelve thousand men, and provisions for three years always stored in the rocks, with a sufficient quantity of ammunition.

Gibraltar was first fortified in the modern style in the reign of the emperor Charles V. It was taken by the English in 1704. It has since been repeatedly besieged, but always without success. In July 1779, commenced the celebrated siege by the combined forces of France and Spain; every scheme which ingenuity could devise, which rashness could hazard, or force execute, was tried by the besiegers to no purpose, when, in 1783, the siege was abandoned.

#### QUEBEC.

This seat of ancient dominion—now hoary with the lapse of more than two centuries—formerly the seat of a French Empire in the west—lost and won by the blood of gallant armies, and of illustrious commanders—throned on a rock, and defended by all the proud defiance of war, is the strongest town in America, and with the exception of Gibraltar, is the strongest in the world. It is situated on a bold promontory, formed at the junction of the river St. Charles with the St. Lawrence, and rising above 300 feet above the level of the water. It is, therefore, possessed of great natural advantages; the lofty perpendicular precipices of rock, which, on the south and east, separate a great part of the lower town from the upper, constitute, in themselves, on those sides, one insurmountable barrier; the river Charles, with its shallow waters, and low flats of sand and mud, drained almost dry, by the retiring of the tide, forms an insuperable impediment to the erection of commanding works, or to the location of ships on the east and north, not to mention that all this ground is perfectly commanded by the guns above. The only vulnerable point is on the west and south from the plains of Abraham. Cape Diamond, the highest point of the town, it is true, is rather

more elevated than any part of the plains, but the highest ground on the plains of Abraham, commands most of the works on this side of the town; besides, there is no barrier of rock, no river, ravine, marsh, or other natural obstacle, to hinder an approach upon this side; this is the vulnerable side of Quebec, and here, therefore, it is fortified with the most anxious care.

The distance across the peninsula, from one river to the other is very nearly one mile. The circuit within the walls, is two miles and three quarters; immediately without, it is probably three miles, and the average diameter is very nearly six-sevenths of a mile.

A complete wall of massy stone, hewn, and laid up with elegance, as well as strength, completely encircles the town, and is furnished with strong massy arches and gates, and with deep ditches.

The walls vary much, in different parts, in height and thickness. Every where, however, they are high enough to render escalade very difficult, and a breach almost hopeless. In the strongest parts, next to the plains of Abraham, they are fifty feet thick, and equally high. Even the lofty precipices of naked rock, are surmounted with a stone wall, and with cannon, and the highest points are crowned with towers and distinct batteries. In general, the curtains of the wall are looped for musketry, and projecting bastions present their artillery towards the assailant, in every direction, and of course so as to rake the ditches.

Immediately adjacent to the inner wall, which we have already remarked, is fifty feet thick, runs a deep ditch, and then there is an exterior but lower wall, and another ditch, both of which must be scaled, before the main wall can be approached. A storming party would be dreadfully exposed while mounting this exterior wall. The avenue to the Gate St. Louis, which opens to the plains of Abraham, is bounded on both sides by a high wall, and makes several turns in zig-zag. At every turn, cannon point directly at the approacher; and generally down every ditch, and in every possible direction, where the wall can be approached, great guns are ready to cut down the assailants.

The promontory of the rock which constitutes the loftiest point of the fortifications, is called cape Diamond, and upon this is erected the famous citadel of Quebec. This is not, as one might suppose, a building or castle, covered with a roof; it is open to the heavens, and differs from the rest of the works only in being more elevated, stronger, and therefore more commanding. *The highest part of the citadel, is Brock's battery,*

which is a mound, artificially raised, higher than every thing else, and mounted with cannon, pointing to the plains of Abraham. From the citadel, the view of the river, of the town, and of the surrounding country, is, of course, extremely grand and beautiful.

Within the walls, are numerous magazines, furnished with every implement and preparation, and more or less proof against the various missiles of war. Piles of cannon balls are every where to be seen, and the cannons mounted on the walls and other places, amount to several hundred.

Beyond the walls, on the plains of Abraham, are the four Martello towers. They are solidly constructed, about forty feet high, the diameter at the base being about the same; as they have cannon on their tops. They of course sweep the whole plain, and effectually command it; the particular object of their construction is, to prevent an enemy from occupying the high ground on the plains of Abraham. These towers are very strong on the side farthest from the town, and weaker on the side next to it, that they may be battered from it, should an enemy obtain possession of them. On the whole, Quebec is so strong in its defences, and so well garrisoned, that an attempt to take it by any force whatever, would undoubtedly prove a fruitless undertaking.

### RUINS, &c.

#### RUINS OF PALMYRA.

[See Plate, No. 22.]

This noble city of ancient Syria, also called TADMOR, is of uncertain date and origin, but is thought by many to have been THE TADMOR IN THE WILDERNESS, built by Solomon. Its splendid ruins consist of temples, palaces, and porticoes of Grecian architecture, scattered over an extent of several miles. The most remarkable of them is the Temple of the Sun, the ruins of which are spread over a square of 220 yards. It was encompassed with a stately wall, built of large square stones, and adorned with pilasters within and without, to the number of 62 on each side. Within the court are the remains of two rows of very noble marble pillars 37 feet high, with their capitals of most exquisite workmanship. Of these 58 only remain entire; but there must have been many more, for they appear to have surrounded the whole court, and to have supported a double piazza. The walks on the side of the piazza opposite to the front of the castle, seem to have been the most spacious and beautiful. At the end of this line are two niches for statues, with their pedestals, borders, supporters, and canopies,

carved with the utmost elegance. The space within the inclosure appears to have been an open court, in the centre of which stood the temple, encompassed with another row of pillars of a different order, and much taller, being 50 feet in height; of these 16 only remain. The whole space contained within these pillars is 59 yards in length, and nearly 28 in breadth. The temple which points north and south, is 33 yards in length, and 13 or 14 in breadth. At its centre, on the west side, is a most magnificent entry, on the remains of which, vines and clusters of grapes are carved in the most bold and masterly imitation of nature that can be conceived. Over the door was displayed a pair of wings extending its whole breadth; but the body to which they belonged is totally destroyed, so that it cannot certainly be known, whether it was that of an eagle or of a cherub, several representations of both being visible on other fragments of the building. Its north extremity is adorned with the most curious fret-work and bas-relief; and in the centre is a dome or cupola, about 10 feet in diameter, which appears to have been either hewn out of the rock, or moulded of some composition which by time has become equally hard. North of this place is an obelisk, consisting of seven large stones, besides its capital, and the wreathed work about it. It probably supported a statue, which the Turks, in their zeal against idolatry, have destroyed. At the distance of a quarter of a mile from this pillar, to the east and west, are two others, besides the fragment of a third, so as to lead to the supposition that there was originally a continued row.

About 100 paces from the middle obelisk, strait forward, is a magnificent entry to a piazza, 40 feet in breadth, and more than half a mile in length, inclosed with two rows of marble pillars 26 feet high, and 8 or 9 feet in compass. Of these there still remain 129; and by a moderate computation, there could not have been originally less than 560. The upper end of this piazza was shut in by a row of pillars, standing somewhat closer than those on each side. A little to the left are the ruins of a stately building, which appears to have been a banqueting house: it is built of better marble, and is finished with still greater elegance than the piazza. The pillars by which it was supported were of one entire stone, so strong that one of them which has fallen down, has not received the slightest injury. It measures 23 feet in length; and in compass 8 feet 9 inches. At the west side of the piazza are several apertures for gates into the court of the palace, each of them ornamented with four porphyry pillars, not standing in a line with those of the wall, but placed by couples in the front of the gate facing

the palace, two on each side. Two of these only remain entire, and one only standing in its place. They are 30 feet in length, and nine in circumference. On the east side of the piazza stand a great number of marble pillars, some perfect, but the greater part mutilated. In one place 11 of them are ranged in a square, the space they inclose being paved with broad flat stones, but without any remains of a roof. At a little distance are the remains of a small temple, also without a roof, and having its walls much defaced. Before the entry, which faces the south, is a piazza supported by six pillars, two on each side of the door, and one at each end. The pedestals of those in front have been filled with inscriptions, both in the Greek and Palmyrene languages, which are become totally illegible. Among these ruins are many sepulchres, ranged on each side of a hollow way towards the north part of the city, and extending more than a mile. They are square towers, four or five stories high, alike in form, but differing in magnitude and splendour. The outside is of common stone; but the floors and partitions of each story are of marble. A walk crosses the centre of this range of buildings, and the space on each side is subdivided by thick walls, into six partitions, the space between which is wide enough to receive the largest corpse. In these niches six or seven are piled on one another.

#### RUINS OF BALBEC,

These magnificent ruins are described by Mr. Bruce as even surpassing what he had seen at Palmyra. He was particularly struck by the splendid vestiges of the great temple, supposed to have been dedicated to the sun. THE CASTLE OF BALBEC, or TOWER OF LEBANON, is described by Father Leander, of the order of bare-footed Carmelites, in his interesting travels, as a surprising monument of antiquity, built, according to the tradition of the natives, by Solomon.—His relation is as follows.

“Balbec is distant from Damascus, towards the north, about fifty miles, and on the southern side is watered by springs and rivulets, brought thither, no doubt, to fill the ditches by which it was to have been surrounded for defence, but which were not completed. It is situated on the lofty summit of a hill, in approaching which, the facade of the castle is seen, having two towers at its right angles, between which is a great portico, resembling the mouth of a vast cave, and provided with very strong walls. That on the right hand, by which the portico is attached to the tower, from the west to the north, is composed of four stones only, the fifth, which was to have completed the fabric, being deficient. The length of

each of these stones is not less than sixty-two feet, and their breadth and height thirteen. They are so artfully brought together, without any cement, that they appear to be only one solid block. The remainder of the wall to the left, is of hewa stones, well cemented with quick lime, the smallest of which are 6 feet in length, and 4 feet six inches in height, there are many which are upwards of fifteen feet in length, but the height of all of them is the same.

“ Having entered the cavern by the grand portico, the traveller proceeds in obscurity to the distance of eighteen paces, when he at length perceives a ray of light proceeding from the aperture of the door which conducts to the centre. At each of the sides, and within this grand portico, is a flight of stone steps which leads to the subterraneous prisons. Their aspect is horrid, and they are dangerous, inasmuch as they are wont to be frequented by banditties of robbers, who here plunder, kill, and bury such wretched travellers as are imprudently led by their curiosity to penetrate, and risk the descent without being well escorted. Following the road above, by the cavern, to the extent of fifty paces, an ample area, of a spherical figure, presents itself, surrounded by majestic columns of granite, some of them of a single piece, and others formed of two pieces, the whole of them of so large a dimension, that two men can with difficulty girt them. They are of the Ionic order of architecture, and are placed on bases of the same stone, at such distances from each other, that a coach and six might commodiously turn between them. They support a flat tower or roof, which projects a cornice wrought with figures of matchless workmanship: these rise above the capitals with so nice an union, that the eye, however perfect it may be, cannot distinguish the part in which they are joined. At the present time, the greater part of this colonnade is destroyed, the western part alone remaining perfect and upright. This fabric has an elevation of 500 feet, and is 400 feet in length. In its exterior, and behind, it is flanked by two other towers similar to those of the first facade, the whole projecting from the wall, which withinside is provided with loop holes, to keep off the enemy, in case of necessity, by the means of stones, fire, &c. It also surrounds the colonnade, more particularly in the part which looks toward the east. At the left flank rises a temple which tradition says, was the hall of audience of Solomon, in height at least 80 feet, and long and large in proportion. Its stones are all sculptured with bas-reliefs, similar to those which ornament Trajan's column at Rome, representing many triumphs and naval engagements. Several of these bas-reliefs have been defaced by the Saracens, who are

its decided enemies of all sculptures. Withoutside this grand hall is an avenue of the same size and breadth, where the traveller admires a large portal, constructed with three stones only, attached to which, in the middle part, serving as an architrave, is seen, in a garland of laurel interwoven with flowers, a large eagle, admirably sculptured in bas-relief. At the sides of the portal are placed two columns, in one of which, although formed of a single stone, is a winding staircase by which to ascend to the architrave: the passage is, however, very narrow. There is in the vicinity another temple of an octangular shape, with a portico of superb architecture, and having three windows on the side opposite to the former."

On a large stone are inscribed these words in Latin: *Diviso Mosei*, on which Father Leander confesses he knows not what interpretation to bestow. Thrice he returned to visit this splendid vestige of antiquity; and on the last of these occasions, being well escorted, he proceeded to the distance of about a mile, to the foot of the mountains of Damascus, whence the stones, employed in its construction, were brought. He measured the stone which remained there, and which has been already noticed as having been intended for the fifth in the construction of the wall: it had been hewn out on all sides, was lying on the ground, and was simply attached to the rock, at the inferior part. Its length and dimensions were such, that he could not conceive how it would have been possible to detach it, and still less with what machines to move, transport, and raise it to the height at which the other stones are placed, more especially as the sites, the roads, and the masses of rock are such, as to exceed in asperity whatever the imagination can picture to itself. In the vicinity of the cave whence these stones were drawn, is a very beautiful sepulchre supported by columns of porphyry, over which is a dome of the finest symmetry.

## MISCELLANEOUS CURIOSITIES OF ART.

### JERUSALEM.

[See Plate, No. 23.]

This ancient city of Asia has been the scene of occurrences, the most interesting to the spiritual welfare of the human race. While the warrior, forgetting it as the place where the God of heaven deigned to commune most intimately with his creatures, and where the founder of our religion displayed most miraculously the powers of that God, with the deepest interest, traces upon the page of its history, sieges and battles—victories and defeats more shocking in their progress, and more bloody in

their termination, than are found recorded, perhaps, of any other city on the earth.

It was here that David strung his sacred lyre, the strains of which are still echoed from the sanctuaries of the living God. And it was here too, that Solomon built that temple, the splendour of which was so much admired in the ancient world. The most remarkable siege it ever underwent, is that when it was taken and destroyed by Titus, 70 years after the death of our Saviour. According to Josephus, 97,000 prisoners fell into the hands of the conqueror, 11,000 perished with hunger, and the whole number slain and taken prisoners during the war, was 1,460,000. It since has been the prey to various conquerors, until about 1150, when it became permanently subject to the Turks, under whose dominion it appears to be in a state of gradual decline.

Dr. Clark, however, in his recent visit, by no means found it to present that aspect of desolation which some travellers have reported. On obtaining the first view of it in the approach from the north, instead of a wretched and ruined town, he beheld a flourishing and stately metropolis, presenting a magnificent assemblage of domes, towers, palaces, churches, and monasteries; all of which, glittering in the sun's rays, shone with inconceivable splendour. The streets of Jerusalem are cleaner than those of any other city of the Levant; but like all of them are very narrow. The houses are lofty, and as no windows appear on any of the lower stories, and those above are latticed, the passage appears to be between blank walls. The present population is estimated at from 20 to 30,000, consisting of Arabs, Turks, Jews, and Armenians, among which are to be found but about 200 Christian families. The city itself is situated between two hills, named Acre and Moriah. The walls which surround it are said to have a circumference of 4,500 paces. It has seven gates, of which that of Damascus to the north, and that of Ephraim or Bethlehem to the west, are the most romantic and picturesque. The walls of the latter are high, crenated, and provided with square towers from distance to distance. Several of its steep and unpaved streets are without inhabitants; and many spacious houses, together with churches and monasteries, have been entirely abandoned.

#### DR. HERSCHEL'S GRAND TELESCOPE.

To lead to a clearer comprehension of the principle on which the telescopes of Dr. Herschel are constructed, it is necessary to advert to those of Newton and Gregory. The former of these consists of a tube, towards the end of which a con-



cave mirror is placed. The converging rays, before they reach the focus, are made to fall on a plane mirror, placed at an angle of forty-five degrees, and thrown upward to the focus of a convex lens, fixed in the upper side of the telescope, through which the eye looks down on the object. The latter consists of a tube, on which a concave mirror, having a hole in its centre, is placed. Any parallel rays from an object falling on this mirror, will, after reflection, form an inverted image at its focus. This image, however, is intercepted by a smaller mirror, which reflects it back to an eye-glass in the hole of the large mirror, through which the observer views the object.

In the telescopes made by Dr. Herschel, the object is reflected by a mirror, as in the Gregorian telescope, and the rays are intercepted by a lens at a proper distance, so that the observer has his back to the object, and looks through the lens at the mirror. The magnifying power is the same as in the Newtonian telescope; but there not being any second reflector, the brightness of the object viewed in the Herschel telescope, is greater than that in the Newtonian telescope.

The tube of DOCTOR HERSCHEL'S GRAND TELESCOPE is 39 feet 4 inches in length, and 4 feet 10 inches in diameter, every part being made of iron. The concave polished surface of the great mirror is 4 feet in diameter, its thickness 3 1-2 inches, and its weight upwards of 2000lbs. This noble instrument was, in all its parts, constructed under the sole direction of Doctor Herschel: it was begun in the year 1785, and completed August 28th, 1789, on which day was discovered the sixth satellite of Saturn. It magnifies *six thousand times*.

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