

Obs. 222.



TRAVELS
IN
ENGLAND, SCOTLAND,
AND THE
HEBRIDES;

UNDERTAKEN FOR THE PURPOSE OF EXAMINING
THE STATE OF
THE ARTS, THE SCIENCES, NATURAL
HISTORY AND MANNERS,
IN
GREAT BRITAIN:

CONTAINING

Mineralogical Descriptions of the Country round Newcastle; of the
Mountains of Derbyshire; of the Environs of Edinburgh, Glasgow,
Perth, and St. Andrews; of Inverary, and other Parts
of Argyleshire; and of

THE CAVE OF FINGAL.

IN TWO VOLUMES WITH PLATES.

TRANSLATED FROM THE FRENCH OF
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HISTORY AT PARIS.

V O L. II.

L O N D O N :

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ERRATA.

VOL. II.

- Page 10, line 15, for *perspective* read *prospect*.
 29, — 1, for *set* read *sat*.
 39, — 7, for *broke* read *broken*.
 40, for *M^cQuaire*, in the note at the bottom, read *M^cQuarie*.
 47, line 1, for *tetrahedral* read *tetrahedra*.
 47, — 4, dele the comma after *truncature*.
 47, — 18, for *great* read *greater*.
 51, — 11, for *quartose* read *quartzose*.
 64, — 6, for *unexpressible* read *inexpressible*.
 81, — 3, after *race* insert *and*.
 106, — 8, dele *as*.
 117, — 17, dele the comma after *susceptible*.
 120, — 10, for *ready* read *readily*.
 120, — 12, for *porphyric* read *porphyry*.
 128, — 26, dele the colon after *walls*.
 128, — 27, for *consist* read *consists*.
 135, — 15, for *these* read *this*.
 140, — 5, after *perfect* insert *prisms*.
 141, — 2, for *contribute* read *contributed*.
 145, — 2, for *schistus* read *schisti*.
 151, — 23, for *iron* read *inn*.
 154, — 23, for *open* read *opens*.
 164, — 7, for *ingenious* read *injurious*.
 171, — 7, for *schistus* read *schistous*.
 186, — 4, for *where* read *when*.
 191, — 3, dele the comma after *crystallization*.
 195, — 10, for *opened* read *open*.
 230, — 3, of the note, for *translations* read *transfections*.
 235, — 10, dele *are*.
 272, — 21 for *mephitis* read *mephitis*.
 272, — 2 of the note, for *gas* read *gases*.
 278, — 10, for *production* read *productions*.
 303, — 4 of the note, for *Traslemary* read *Traclestemars*.
 ———— 9 of the same, after *for* insert *in*.
 313, — 26, dele *to* after *exhibiting*.
 320, — 5, for *seem* read *seemed*.
 324, — 12, for *friendly* read *kindly*.
 338, — 6, for *arrid* read *arid*.
 344, — 20, for *inflammability* read *inflammation*.
 347, — last of the note, after *turn* insert *their attention*.
 348, — 2, for *possess* read *possesses*.

The reader will perceive that the Greek singulars *stalactites*, *zeolites*, &c. are in several places used instead of *stalactite*, *zeolite*, &c. These, with other inadvertencies, are left to his own candid correction.



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CHAPTER XXI.

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TRAVELS
THROUGH
ENGLAND AND SCOTLAND
TO THE
HEBRIDES.

CHAPTER I.

*Departure from Oban for the island of Mull.—Passage
of the sound of Mull.—Small isle of Niort.—
Druidical Monuments.—Arrival at Aros.*

I HAD finished my solitary excursions in the environs of Oban, and was nearly done with arranging my observations when the people of the inn announced the arrival of a traveller, who, astonished to learn, that there was a Frenchman alone in so desert a place, begged permission to see me.

He was a young British Officer of the name of M'Donald, who had come to wait at Oban for a favourable opportunity of going

to the isle of Sky, which was the place of his nativity.

He had prosecuted his earlier studies at the Scotch college in Paris ; he spoke the French language tolerably, and was not deficient in information. His arrival was a happy and agreeable rencounter for me. I mentioned to him the object of my journey, and my speedy departure for the isle of Mull, where my fellow-travellers were waiting for me to accompany them to the celebrated cave of Fingal, in the isle of Staffa.

Mr. M'Donald replied, that though his native country was at no great distance from that island, and though he had often heard of the cave of the father of Ossian, his education in France and his travels had not yet given him an opportunity of visiting a place so remarkable : but, that if I were kind enough to permit him, he would gladly embrace the occasion of accompanying me thither ; and that he would also have the pleasure of being useful to me in the country, as he understood the Earse or Celtic language, the only one used in the isles of the Hebrides.

I accepted the obliging offers of Mr. M'Donald with so much greater pleasure and
gratitude,

gratitude, as they appeared to proceed from a man of a sociable disposition, and were delivered in a tone of frankness and affability which prepossessed me in his favour: I reflected also that it was in his power to do me some services in the isle of Mull, where he had several acquaintance, particularly Mr. M'Lean, to whom the Duke of Argyle had given me letters of recommendation. We now waited only for the arrival of the boat which was to carry us; and which at length entered the harbour in the night of the 23d of September.

The crew consisted of no more than two fishers from the isle of Sky, who were clothed in the fashion of the Hebrides, that is, in the dress of the Scotch Highlanders. Our vessel had neither decks nor rigging; she was of the worst construction; and dragged at her stern a small skiff capable of holding at most only four persons.

The fare was agreed upon, and it was settled that we should set out on the following day; but from some capricious motive, our boatmen changed their resolution, and wished to remain for three days longer. It was not without much flattery, repeated remonstrances,

and a present of two bottles of rum, that Mr. M'Donald at last prevailed on them to make ready for our departure on the next morning.

We left the shore of Oban, at seven in the morning of the twenty-fourth. The sea, though not tempestuous, was somewhat agitated; the winds were variable, and the currents of the entrance of the found of Mull running in opposition to the tide, obliged our intrepid fishers to make several manœuvres, which were exceedingly laborious, as there were only two of them, and they were destitute of many articles of tackling. All this, however, was mere sport to men inured to the most lengthened fatigue, and accustomed, in the time of the herring-fishery, to brave all the dangers of this frightful sea.

On clearing the harbour, we came in sight of that succession of islands which skirt the found, and exhibit a diversified picture. The isle of *Lisemore* was at a very small distance on our right; that of *Kerera* in the opposite quarter; and the Peaks, or as they are called, *Paps of Jura*, towered above the numerous mountains of the Hebrides. Loch-aber, which the largest vessels may navigate as high

as Fort William, was left behind us. The isle of Mull appeared in view; that of Sky was in the distance; and the continued ridge of Morven, so much celebrated in the songs of Ossian, and which exhibits so various and picturesque an appearance, bordered the right bank of the channel which we sailed along.

In passing near the extremity of the isle of Lifemore, I observed, with the aid of my perspective, on a small neighbouring island, which was inhabited, one of those monuments of rude stone known by the Hebridian appellation of *Cairn*.

This monument, of great antiquity, and erected in so desert a situation, naturally attracted my attention. I requested my companion to induce our boatmen to convey us thither; but as this small island, or rather large rock, was surrounded with breakers, they replied, that it would be impossible to approach but in the skiff, and that even in it we should run a considerable risk.

I did not understand a word of the language of our conductors, but I observed one of our seamen preparing to enter the skiff; I confidently followed him, and Mr. M'Donald did the same. The skiff was so small and so

very shallow, that there was hardly room to seat ourselves in it. The boatman took hold of the oars; Mr. M'Donald sat at the helm, which consisted of the half of an oar, and we pushed off.

Our curiosity in this instance prevailed over our prudence; we were borne along by the current with the rapidity of an arrow, towards the small island, which is called Niort; and it required all the address of our boatman to land us safely. The isle is about half a mile in circumference, and rises only about twenty-five feet at most above the water. It may be regarded as a great rock, of which the summit is flattened into a small plain. The fury of the waves of this tempestuous sea has laid the rock almost entirely bare, and carried away the small quantity of earth which is formed there by time, so that nothing grows upon it except a few *lichens* and some scurvy grass in the sheltered cavities. The rock is composed of limestone, intermixed with a little clay; it is of a blackish grey colour, and only forms a single mass, in which there is no trace either of beds or banks.

Our

Our attention was much attracted by the kind of rustic pillar which stood on this crag. It was nine feet high, three feet broad, and two feet of average thickness. It is formed of grey granite, in which quartz and mica are predominant. The felt-spar is rather disposed in small streaks than in crystals, and though the texture of the stone is somewhat fissile, it is hard and solid in its fracture.

Though this column possesses some regularity in its form, it does not bear the slightest trace of workmanship. It may be considered as a natural block of a longitudinal shape, taken from the quarry in its rude state, and erected on the highest point of this small isle. It is two feet in the earth, and kept upright by two solid but rustic studs, which give it a very stable foundation*.

* In some quarries of granite, and even at times in porphyric rocks, are found similar blocks divided into parallelepipeds of various degrees of regularity and length. They are the effect merely of the contraction of the matter during the time of the aggregation of the particles. Near the small town of Saint Siphorien-de-Lay, within three leagues of Roane, is a porphyric rock divided into large prisms, of which several are as remarkable for regularity as those of the largest and most perfect columns of basaltés.

Our boatman told Mr. M'Donald that he had often seen this stone; that it had been placed there by the hands of Ossian; and that in several other isles we should see much larger stones, which had been set up by the same person. For in the mountains of Scotland, and the Hebrides, every thing that appears great, extraordinary, and wonderful, is uniformly regarded as the work of Ossian.

Whatever may be the prevailing traditions respecting these ancient columns, this one evidently discovers an intention of erecting a simple but durable monument.

This intention is plainly marked by the kind of stone which has been selected for the purpose. One should think that it would have been more convenient to employ that of which the islet itself is composed. But whatever must have been the motives, whether it was known that the latter was less durable than the granite; or whether, from the use of iron being unknown by those who erected it, it was impossible for them to cut out a simple pillar from a calcareous rock which is not separated in banks; it is nevertheless true that this rustic column of granite has been transported thither; an undertaking

dertaking which must have been attended with great difficulty to men ignorant of the mechanic arts.

Though we spent but a very short time in examining this stone, it was not without great difficulty that we got back to the vessel which the currents drove to a considerable distance, notwithstanding the efforts that were made to keep near us. We were nearly an hour in regaining her.

We continued our course through the sound of Mull, with the granitic mountains of Morven still on our right. We passed very near the old castle of *Ardtornish*, built upon a point which commands a view of the whole sound. On our left were the black volcanic rocks of the isle of Mull. At length, after a navigation of seven hours and a half, we entered the bay of Aros in that island, where we disembarked.

I hardly know by what term to denominate, five or six houses in a groupe, and seven or eight others scattered around, the whole of which taken together, are here called Aros. They can scarcely be called a town or a village; they may more properly be termed a hamlet; but by whatever name one may choose

choose to distinguish them, they are certainly inhabited by very kind and hospitable people.

The bay of Aros was anciently defended by a strong castle, which formed the residence of M'Donald of the isles; the ruins of this fortress are still extant; and it appears to have been partly built of basaltic prisms.

We were received with the most frank and hearty welcome by an aged gentleman, who is styled Campbell of Aros. He lives in philosophic contentment in the modest habitation of his fathers; which is a gothic building, standing on a black volcanic rock, totally destitute of verdure, beat by the tempests, and yielding no other perspective than that of a raging sea abounding in shipwrecks.

Mr. Campbell, wrapped in the Hebridian fashion, in a large mantle of variegated stuff, introduced us into his house, and refreshed us with some port wine, sea biscuit, and preserve of myrtill berries. His wife, who was not much younger than himself, seemed much astonished at seeing strangers quit their native country, to visit a region so wild, and so difficult of access. Both of them pressed us very much to remain a few days with them; but as I was anxious to rejoin my
fellow-

fellow-travellers, who were waiting for me at Mr. M'Lean's, of Torloisk, we begged the favour of Mr. Campbell to procure us horses; which he had the goodness immediately to provide. The horses were quite small, and had only a piece of rope for a bridle; but they were pretty strong and inured to the rugged roads of the country. We took leave of the old gentleman and his lady, and pursued our journey.

CHAPTER II.

Road from Aros to Torloisk.—Stay at Mr. M'Lean's.

—Accidents which happened to my fellow-travellers during their passage to, and continuance on, the Isle of Staffa.

THE miles of Scotland, particularly those of the isles, are nearly double the length of the English miles. From our ignorance of this difference, we found that we had been much deceived when we were told, that from Aros to Torloisk was only eight miles. Imagining the computation to be by English miles, as we had set off at four in the evening, we conceived that we could easily ride that distance before dark.

I ought not to forget to mention that Mr. M'Donald, who accompanied me from Oban with the intention of visiting the isle of Staffa, had no sooner reached Aros than he changed his dress. He had travelled before in English regimentals, but upon arriving here he opened his portmanteau, and to my great surprize, in about half an hour after, appeared in the complete
vesture

vesture of the inhabitants of the isles : plaid, jacket, kilt, feathered bonnet, buskin-hose, durk, no part of it was omitted. I was scarcely able to know him again in this dress. He told me, that it was the garb of his fathers, that he never appeared in any other when in these islands, and that the wearing of it was a mark of attachment to his fellow-countrymen, with which they were much pleased.

We set out on our two little horses, with two persons to conduct us and bring them back, ignorant that our way lay across ravines, heaths, marshes and mountains, difficult of access, and without any trace of a road.

Whilst day-light remained, we made pretty good progress ; our guides pushed forward with such speed, that they often outran our horses, though they went at a good pace. These two Hebridians were young and handsome ; neither streams, pools, bogs, nor mountains, could interrupt their course ; and I admired their courage, gaiety, and elegant appearance. A blue military bonnet, with a border of red, green, and white, and surmounted with one feather, decorated their heads. A party coloured mantle or plaid hung from the

the right shoulder, and passed gracefully over the left arm. They had a waist-coat and jacket of the same stuff. Their thighs and legs were half naked. A Tartan buskin with a stout kind of shoes, covered the lower part of the latter; and completed their Roman habit. The poniards in their girdles gave them a military air, and the sticks in their hands, served to help them over the waters

Their willingness to be useful to us rendered them doubly interesting. They always went before to point out the way to us, returning however at intervals to caress and animate our horses, and to enquire whether we had occasion for their services.

They seemed proud and overjoyed at seeing a man of distinction in the same dress as themselves; and testified their satisfaction by approaching Mr. M'Donald, and telling him, with a smile on their faces, in their expressive language, that they would follow him to the world's end*.

Night

* Johnson also, in his journey to the Western Islands of Scotland, praises two Highlanders whom he had hired as guides on his way from Inverness.

Night now came on, we were yet scarcely half way to the place of our destination. Our guides and our horses soon slackened their pace; the road grew detestable, and we were often obliged to alight, sometimes on the verge of marshes, and sometimes in the midst of heaths, through which we groped our way with extreme difficulty. At length we completely lost our direction. The night was so dark that our horses fell repeatedly, and our guides were greatly perplexed. After thus wandering for a long time without any certain course, we at last descried a light on an elevated situation, to which we directed our steps. We found it to be the castle of Torloisk, where we arrived at eleven, worn out with fatigue, anxiety, and vexation.

We soon discovered, as we entered, that we had now reached our place of destination.

“ At Inverness,” says he, “ we procured three horses for ourselves and a servant, and one more for our baggage, which was no very heavy load.—We took two Highlanders to run beside us, partly to shew us the way, and partly to take back from the sea-side the horses, of which they were the owners. One of them was a man of great liveliness and activity, of whom his companion said, that he would tire any horse in Inverness. Both of them were civil and ready-handed. Civility seems part of the national character of Highlanders.”

A domestic told our guides, that Mr. M'Lean had not yet gone to bed, and that I had been impatiently expected for several days.

We were shewn into a parlour, where I found Mr. M'Lean, to whom I gave the letter which I had from the Duke of Argyle. He received me with the most obliging kindness, and presented me to his wife, daughter, and several other ladies and gentlemen, who were occupied in making a little musical concert.

Miss M'Lean, a girl of a most charming figure, was seated at a harpsichord, on which she executed some excellent Italian music. Mr. M'Donald had no need of being introduced, his name was already known, and his dress sufficiently announced him. We were instantly overwhelmed with civilities, kindnesses, and delicate attentions, which dissipated all our troubles. Every one around us was so obliging and so affable, that from that moment we regarded ourselves as members of the family.

How powerfully attractive is this rural politeness, seasoned with expressions and gestures which announce the most delicate feeling. We were now on the true soil of
hospi-

hospitality; all the inhabitants of the island, though it contains a population of six thousand souls, have the same family-name of M'Lean; they are distinguished by their Christian names only, or by that of their residence; they are almost all shepherds or fishers.

We were informed that my fellow-travelers had sailed at five in the morning of the same day, to visit the isle of Staffa; that they would have waited with pleasure to make the voyage in company with me; but the season was already so far advanced, and particularly the sea was so boisterous in this region, that they had determined to take advantage of an interval of calm, which did not promise a long continuance; such was their eager impatience to see that famous isle.

They had embarked with a friend of Mr. M'Lean, and their own servants, in two small boats. But they had scarcely gone four or five leagues, before the weather suddenly changed, and the sea became tempestuous. Mr. M'Lean thought it so rough, that he was afraid they had not been able to effect a landing on the isle of Staffa, on account of the breakers which surround it, and that they

had been obliged to take refuge in the isle of *Iona* or *Yholmkill*, which is fifteen miles from Staffa, and has a small creek.

We expected that the sea would be a little calmer by the next day. We repaired therefore, at an early hour, along with Mr. McLean and his family, to the water side, which was about a furlong from the castle, to see whether the boatmen would venture to come for a supply of provisions; but the sea was still more dreadful, and totally impassable.

We now began to be very uneasy on their account. They were eight in number, including the domestics, and they had only one day's provision with them.

The evening arrived without any appearance of them; our anxiety was redoubled, and we passed a very unhappy night.

On the next day, which was Sunday, and the third day from their departure, I rose at four in the morning to examine the weather. I discovered with pleasure that the wind had somewhat fallen, and that the sea was not so high. We went, before noon, to take a walk on the bank; and at length, with the aid of a good glass, we descried them at a distance.

They

They arrived at one o'clock, to their own and our great satisfaction. They were so emaciated with fatigue, vexation and hunger, were so much in want of food and rest, and so uneasy, that they entreated us not to disturb them with any questions until they were a little refreshed, and particularly relieved from a multitude of lice that tormented them most cruelly. "Fly! fly from our approach," said they, "we have brought some good specimens of mineralogy, but our collection of insects is numerous and horrible." We could not keep from laughing at this address, their gait, and the restless motion of every part of their body. They were instantly conducted to their apartments, where their first care was to clean themselves, and, after eating something, to take a few hours repose.

In the evening they returned to the parlour, where they were received with every demonstration of kindness. Their appearance was now fresh and elegant; but we, notwithstanding, jocularly asked, whether it was yet safe to approach them. "We have cast off every thing," replied they, "and of all our evils there remains only the
c 2 "itch,

“itch, respecting which, we can say nothing,
“as it has not yet made itself felt.”

They then recounted the circumstances of their unfortunate passage. Notwithstanding the fine appearance of the weather on the day of their departure, scarcely had they proceeded six miles, when there arose a violent gale, which worked the sea into the most terrible commotion. They would have willingly put back, had not the rocks which skirt the coast of Torloisk, rendered it equally dangerous to approach it at that moment; the currents and the tide were also unfavourable to their return. They were, therefore, obliged to keep the offing, and to brave the impetuosity of the billows, driven sometimes in one, and sometimes in another direction, and every instant in danger of being swallowed up, were it not for the address and experience of the boatmen who had been accustomed to these terrible seas from their infancy.

Having, at length, after many struggles and dangers, reached the isle of Staffa, they found it still more difficult to effect a landing. By the assistance however of the people of the isle, who, on seeing their distress, threw
out

out some ropes to them, and by watching a favourable wave, they reached the shore without any other accident than that of wetting themselves to the skin.

The coast however was too rugged and steep to admit of hauling up the two boats, which were obliged to put off again, and to take shelter in the isle of Iona or Ykolmkill, about fifteen miles from Staffa.

Our friends, continuing their recital, informed us, that the only two families who inhabited this small island, received them with the most affecting hospitality, and that the one which was in the most easy circumstances invited them to enter their hut, where they were ushered into the midst of six children, a woman, a cow, a hog, a dog, and some fowls.

There was laid out for them a remnant of oaten straw which had been used to litter the cow for several days before. This served as their seat, table, and bed. A fire of bad turf, or rather ill-dried sod, lighted in the middle of this cabin, blinded them with smoak, at the same time that it dried their clothes and served to roast, in an indifferent manner, some potatoes, which, with some milk, were

the only articles the place afforded, and those in very small quantities. The provisions which they had brought with them were consumed at one repast.

The sea broke upon the island with such impetuosity, and rushed into the caves which penetrate its interior with so much noise, that the hut shook to its foundation, and our adventurers could get no sleep.

On the next day it rained incessantly until noon. The sea, far from falling, raged with still greater fury; so that the boatmen could not venture to carry any supply from the isle of Iona.

In the afternoon, the rain having ceased, the captives surveyed the island and visited the cave of Fingal. William Thornton took some views of it with great care; and they made a collection of the most curious stones, among which were some fine zeolites.

In the evening they had the same reception, the same supper, and the same bed. A new incident, however, occurred: The master of the cottage, his wife, and children lived in such a horrid state of filth that the place completely swarmed with vermin. Detachments of lice approached on all sides to
pay

pay their respects to the new lodgers, who were soon entirely covered over with them. These were their most cruel torment, and formed the object of an occupation which did not allow them a moment's respite.

On the third day, the sea was somewhat calmer. Their distress was extreme. They walked repeatedly round the island, and ascended the highest part of it to look for the approach of the boats, which at length made their appearance, and came to deliver our poor friends from their afflicting captivity. After thanking their hosts for their kind offices and hospitable attention, they took leave of them on their return to Torloisk; where we had the happiness to welcome them with all the ardour of friendship. We congratulated them on their being so fortunate as to escape with suffering only a few days abstinence. Finding them all safe, it was not without a hearty laugh, that we heard them relate their misfortunes, and particularly the diverting episode of the lice.

Their account brought to my remembrance, at the moment, a similar adventure which

happened in the same isle, and probably in the same house, to Sir Joseph Banks, who set out from London in the year 1772, on a voyage to Iceland, in company with Solander, James Lind, Gore, Walden, and Troil; and, in passing, paid a visit to the fine cave of Fingal, of which he was the first who gave a description.

On their arrival at Staffa, they erected a tent, to pass the night under it; but the only inhabitant then on the island pressed Sir Joseph so strongly to go to sleep in his hut, that he complaisantly consented, and left the tent to his companions.

On leaving the hut next morning, he discovered that he was completely covered with lice. He mentioned the circumstance to his host in terms of mild reproach. But the latter, who was touched to the quick, perked himself up, and assuming a tone of consequence, retorted the accusation in a haughty and somewhat harsh manner on Sir Joseph, asserting, that it was he who had imported the lice into his island, and observing, that he might as well have left them behind him in England.

The

The detail of the adventures of my poor friends, did not much encourage me to attempt the same voyage. Mr. M'Lean also did not cease to impress me with the inconsistency of the weather, the dangers of disembarking on the island, the advanced period of the season, and his apprehensions left, could we even seize a favourable moment to waft us thither, we should not find it equally easy to return, and lest we should be obliged to remain there, not only several days like our friends, but perhaps for several months.

“ I am advanced in years,” said Mr. M'Lean; “ I have made several voyages
“ to India, and I am accustomed to the sea;
“ but I have never yet, from complaisance to
“ any of the persons recommended to my at-
“ tention, accompanied them to the isle of
“ Staffa, without having occasion to repent
“ the attempt. During the course of my
“ life I have made this voyage six times, on
“ the most favourable days and with skilful
“ seamen, and every time I met with some
“ dangers, either in going or returning.
“ Its coast is so rocky, and the sea, which sur-
“ rounds it, rages in general with so much
“ fury, that the landing, even with the small-
“ est

the best boats, is the most terrible of all dangers*.”

All these accounts were not very encouraging, especially to one, who, like me, is almost always sick on the water; but curiosity overcame the suggestions of fear and prudence. What, said I, incessantly to myself, shall I have come in a manner to the very entrance of this renowned cave, and from such a distance too, without enjoying a view of it? Shall I thus easily forego the opportunity of obtaining new information and instructive facts, on a subject of natural history in which I feel so much interest as that of ancient volcanos? and shall I not be able to accomplish what my fellow-travellers have performed? Or, shall I hesitate to encounter the same danger? All these reflexions irrevocably fixed my determination; and I resolved to set out at sunrise next morning, if the sea should be anywise passable.

I instantly engaged a boat for the purpose. Mr. M'Donald said, that he should accompany me; and my intrepid friend, William Thornton, scarcely yet recovered from his fatigue,

* “Here,” says Mr. Pennant, “Æolus may be said to make his residence, and be ever employed in fabricating blasts, squalls, and hurricanes.”

notwithstanding all the dangers he had already met with, told me, that he was also ready to recommence the voyage. This young American had so strong a desire of information, particularly in every thing connected with Natural History, that nothing was capable of damping his ardour.

CHAPTER III.

Voyage to Staffa.

NEXT morning at four o'clock, one of our boatmen came to inform us that the weather began to be more moderate, and that it was probable we should have a fine day. Having made the requisite arrangements on the preceding evening, we were soon ready, and reached the beach before sun-rise.

Our rowers were four young and bold Hebridians, who appeared to undertake this short voyage with pleasure; for they are fond of every thing which reminds them of Ossian, and they seemed to regard it as a happiness and honour to conduct strangers to the cave of Fingal. We besides, allotted them a quantity of refreshments, of which, to be prepared against whatever might happen, we laid in an abundant provision.

The boat was so small as to be incapable of carrying a sail. Our four seamen seated themselves on their benches; Mr. M'Donald took hold of the helm, William Thornton
and

and myself, set down on a bundle of sea-weed, and we proceeded under the auspices of the genius who presides over the science of Nature, and to whom we addressed a short invocation.

In little more than an hour and an half we doubled the point of the isle of Ulva, opposite to that of Mull, near Torloisk, which we had set out from, and entered on the open sea: we soon found, that in these regions, the ancient and majestic ocean does not require the influence of the northern blast to swell its surface into immense waves.

Continuing our course, we had a view of the volcanic isles of Bacabeg, and the Dutchman's Cap, with those of Lunga, Sky, Gometra, Iona, &c.

We could not have wished for a more agreeable passage at so advanced a season. Our seamen, making Mr. M'Donald their interpreter, assured us, that so fine a day was very uncommon in that country, and seldom occurred twice in the same year. To testify the cheerfulness with which it inspired them, they began to chaunt in chorus the songs of Ossian. There is not a native of these islands, from the oldest to the youngest, that is not
able

able to repeat, from memory, long passages or hymns of that ancient and celebrated bard.

The songs continued a long time. They consisted of monotonous recitatives, ending in chorusses equally monotonous. Their predominant character was a sort of dignity intermixed with plaintive and melancholy tones. The oars, which always moved in cadence, tended to make the monotony more complete. I became drowsy, and soon fell into a profound sleep.

I know not how long I remained in this state ; but I was awaked from it by the motion and noise of the seamen, and I was told that we were now close upon the isle of Staffa, and near some reefs, which required new manœuvres. Here I had an opportunity of witnessing, not without dread, the address and intrepidity of our conductors, who knew how to seize the favourable instant to avoid being dashed to pieces, and to choose the propitious surges which afford a safe passage over those rocks that render it so dangerous to approach the island.

Two of the inhabitants of the island soon made their appearance, and threw down to

us from its craggy height some ropes, with the aid of which and a fortunate wave, we disembarked amidst a cloud of foam.

These two men conducted ourselves, and our small crew, to a level spot on the highest part of the isle, where there stood two houses, or rather huts, constructed of large blocks of lavas and mutilated prisms of basaltes, they were covered over with green sods, and had no other passage for the light than the door, which was only three feet high, and the chimney, which consisted of a pyramidal tunnel in the middle of the hut.

The women and children of the two families instantly came out to meet us, and requested that we would enter their habitations: but being already informed of their excessive slovenliness, we were inflexible to their entreaties; and justly preferred to receive their civilities and their compliments in the open air.

Finding, that it was impossible to prevail with us by the most obliging gestures, they resolved to shew the marks of their respect for us on the small esplanade in front of their dwellings.

The

The men, women, and children, first formed themselves in a large circle around us and our seamen. Then one of the women, whose appearance was rendered most disgusting by filth and ugliness, brought out a large wooden bowl filled with milk, with which she placed herself in the center of the circle. She viewed us all round with attention, and immediately came up to me, and pronouncing some words, presented the bowl with a sort of courtesy. I held out my hands to receive it; but she drank some of it, before she gave it to me. I followed her example, and passed the vessel to William Thornton, who was next to me; he gave it to Mr. M'Donald; and it thus passed from hand to hand, or, more properly, from mouth to mouth, till every person had tasted of it. Having made our acknowledgments for this kindness, they immediately appointed two guides to accompany us to the cave of Fingal, and all the remarkable places of this small isle. We ate a morsel of bread, to take off the edge of our appetite during the walk; as it was agreed upon, that in order to loose as little as possible of so favourable a day, we should postpone taking our repast till we were seated in the boat on our way

way back. This allowed us sufficient time to see all the curious objects of the island at our ease, and particularly to direct our attention to that remarkable cave which we had come so far to view, and which we felicitated ourselves on being enabled to examine on one of the finest days of the year.

We went to work, therefore, without losing a moment of time. I soon arrived at the entrance of this wonderful grotto, which an ancient, but fabulous tradition, regards as the palace of the father of Ossian. I was obliged to put off my shoes in order to avoid slipping into the sea, which rushed in with great noise. There is no other means of going into the cave, but by proceeding with the utmost precaution along a sort of cornice on the right side, about fifteen feet above the surface of the water, and formed of a number of erect basaltic columns, on the broken tops of which one must step with considerable dexterity, at the risk of falling into the sea, which extends to the inmost extremity.

Attention is so much the more necessary here, as the ledge upon which the adventurer treads is entirely perpendicular, in some places not above two feet wide at most,

and consists solely of unequal prisms, very slippery, and constantly wet with the foam of the waves and the exudations from above. The light, which comes from the grand entrance only, diminishes gradually as he proceeds inwards, and thus encreases the difficulty of his path.

I ceased not to view, to review, and to meditate upon this superb monument of nature, the form of which bears so strong a resemblance to the work of art, though the latter can certainly claim no share in it. I took all the dimensions of it with the assistance of Mr. M'Donald, whose services were of the greatest use to me. I wished to observe the most scrupulous exactness in that operation, and he perfectly seconded my intentions.

During this time, my indefatigable friend, William Thornton, took a drawing of the cave, which could be seen in a true point of view from the sea only. This task was neither agreeable nor free from danger; for it required all the address of our seamen to keep him for a few moments in front of the entrance, amidst the whirlpools and waves of a sea which seemed eager to devour the frail skiff. It was necessary to return incessantly

to the same point, and to give rest at intervals to my dear Thornton, who became sick with her rolling.

Our ardour and perseverance were unshaken, and nothing was capable of distracting our attention. We only looked abroad, from time to time, to see whether the sea was likely to be equally favourable during the remainder of the day. After noting down all the particulars of the cave of Fingal, after sketching such objects as most interested us, and taking the dimensions which I was very happy to obtain, I still proceeded to examine some other parts of the island; and I made a collection of different lavas, zeolites, and other stones, tending to illustrate the natural history of the place.

I saw with some uneasiness that the sun was now about to leave us, and that it became necessary to withdraw from a place which presented scenes so attractive and volcanic phenomena so remarkable. But the weather might change in a moment, and we had a long passage to make; we therefore prepared for our departure. We embarked at half past four in the afternoon,

and took some refreshment on our way, for we were almost starving with hunger. Our indefatigable Hebridians, who felt neither our curiosity nor our taste, except so far as respected the cave of Fingal, for which they entertain a sacred veneration, had made a hearty repast on the island, and diminished the weight of our stores, while we were occupied in seeing and observing every thing. They were quite contented, and rowed us along with a spirit and vigour, which were at once a proof of their strength and of their habitual capacity for toil. They were completely enraptured with the prospect of carrying us back safe and sound, owing to the fineness of the day and the calmness of the sea. They accordingly continued their songs till our arrival at nine o'clock at the castle of Torloisk, where the good Mr. M'Lean, his family, and our friends, were impatiently expecting us.

I employed myself during several days in digesting my observations on the isle of Staffa; and for the sake of greater method and perspicuity, I thought proper to adopt the following order. The reader will be pleased

pleased to recollect that this description is principally intended for such as employ themselves in the natural history of stones and minerals. If it be considered as rather tedious by those who are not attached to that study, it will be easy for them to pass on to other subjects.

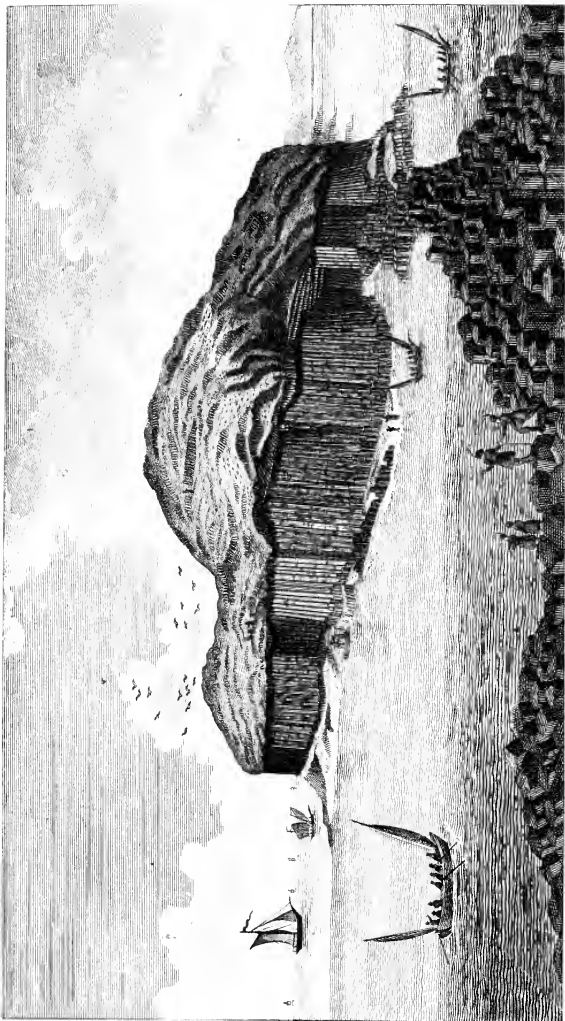
CHAPTER IV.

*Description and Natural History of the Isle of Staffa.—
General Views.*

THE isle of Staffa is situated in the fifty-seventh degree of north latitude, and fifteen miles west of the island of Mull. Its form is oblong and irregular. Its coasts are steep and craggy, surrounded with superb basaltic causeways, and hollowed into different caves, such as those of Fingal and the *Corvorant*. The isle is accessible only by a small opening or entrance, where the precipice sinks into a slope, but which can admit only a small boat, and that in the calmest weather; for if there be the smallest breeze, it becomes dangerous to attempt landing, and the boat is obliged to take shelter in the island of Iona.

The total circumference of Staffa is little more than two miles. The most elevated part of the isle is over the cave of Fingal, where it is one hundred and fourteen feet above the level of the sea in ordinary tides.

The



Designed by G. Ford.

Engraved by J. King.

*View of the Isle of 'Maifa, from the ... (with West.)
with the entrances of the Cave of 'Fugad, and the Cave of the 'Sermants.*

The sides of this vast rock are entirely bare; the waves and currents batter and undermine them every where. There is on the most elevated part only, a flat piece of ground covered with a thin dry turf, contiguous to which is a small spot but newly broke up, where a little oats and a few potatoes are raised. It has also a small pasturage and a scanty spring, which would be soon dried up, were it not that the climate is so rainy.

There is neither tree nor bush to be seen; and for firing, the inhabitants are obliged to make use of a bad sod, which they cut in the summer season in order to dry it. It cannot be called peat; for it consists simply of the fibrous roots of common grass, intermixed with earth. It would be impossible to find a worse fuel; but here necessity reigns with absolute sway.

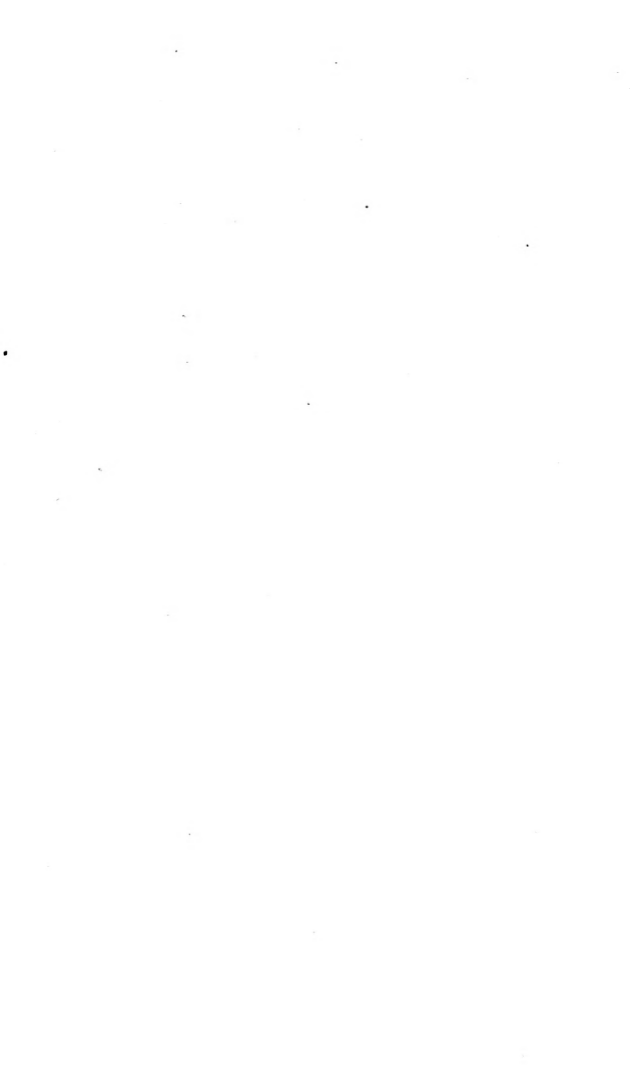
The whole of the isle belongs to Colonel Charles Campbell, of Cambeltown, in Cantyre. It is let at the rent of twelve pounds sterling; on account, probably, of its fishery, for its territorial value ought to be considered as nothing.

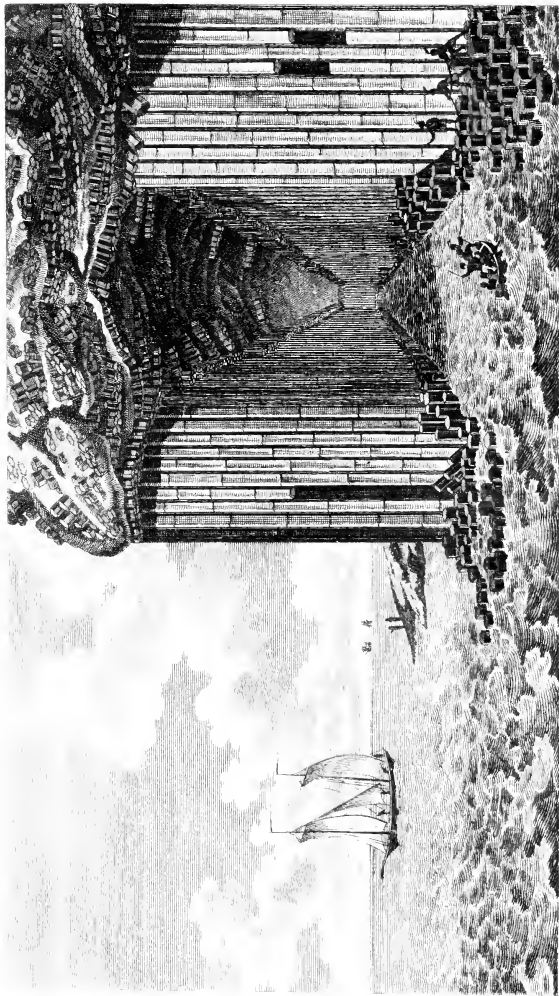
The total population, at the time when I visited it, consisted only of two families, who lived apart in two huts, constructed of rude blocks of basalt, roofed over with fods, and who amounted, men, women, and children, to the number of sixteen*. Belonging to these, there were eight cows, one bull, twelve wethers-or sheep, two horses, one hog, two dogs, eight hens, and one cock.

Buchanan has slightly mentioned the isle of Staffa and its remarkable columns. But Sir Joseph Banks, President of the Royal Society of London, is the first who examined this grand and astonishing object of natural history with the eye of an observer. It has risen into celebrity by his description of it, which was published in the *Tour to the Hebrides*, by Thomas Pennant, accompanied with plates.

* At the time when Sir Joseph Banks, in 1772, visited this island, along with several naturalists, of whom Mr. Troil was one, it belonged to Mr. Lauchlan M'Quaire, and it had only a single inhabitant.

“ There is only one hut,” says Mr. Troil, “ which is occupied by a peasant, who attends some cattle that pasture there. To testify his joy for our arrival, he sung all night over in the Earse language, which we did not understand. He regaled us with fish and with milk.”—*Letters on Iceland*, by Troil, Archbishop of Linckœping.





Designed by S. P. Pond.

Looking seaward.

View of the Cause of Fingal, in the Isle of Staffa, one of the Hebrides.

Mr. Troil, bishop of Linckœping, one of Sir Joseph Banks's fellow-travellers, has given a description of the same isle, and of the cave of Fingal, in a learned and curious work upon Iceland*. But as these two travellers have principally attended to the picturesque scenes, without entering into those details which are more particularly interesting to naturalists, I conceived that it would give satisfaction to some persons that I should pursue the latter track.

OF THE CAVE OF FINGAL, OR AN-UA-VINE.

This superb monument of a grand subterraneous combustion, the date of which has been lost in the lapse of ages, presents an appearance of order and regularity so wonderful, that it is difficult for the coldest observer, and one the least sensible to the phenomena which relate to the convulsions of the globe,

* This work, written in the Swedish language, has been translated into French by M. De Lindholm, and printed at Paris by Didot 1781, in 1 vol. 8vo. with plates. It were to be wished that the translator, to whom the Sciences are indebted for rendering that excellent book into our language, had been more acquainted with natural history; his notes would then have more interest, and contain fewer errors.

not to be singularly astonished by this prodigy, which may be considered as a kind of natural palace.

To shelter myself from all critical observation on the emotions which I experienced while contemplating the most extraordinary of any cavern known, I shall borrow the expressions of him who first described it. Those who are acquainted with the character of this illustrious naturalist, will not be apt to accuse him of being liable to be hurried away by the force of a too ardent imagination; but the sensation which he felt at the view of this magnificent scene was such, that it was impossible to escape a degree of just enthusiasm.

“ The impatience which every body felt to
 “ see the wonders we had heard so largely de-
 “ scribed, prevented our morning’s rest; every
 “ one was up and in motion before the break of
 “ day, and with the first light arrived at the
 “ S. W. part of the island, the seat of the most
 “ remarkable pillars; where we no sooner ar-
 “ rived than we were struck with a scene of
 “ magnificence which exceeded our expecta-
 “ tion, though formed as we thought upon
 “ the most sanguine foundations: The whole
 “ of that end of the island, supported by
 “ ranges

“ ranges of natural pillars, mostly above
“ fifty feet high, standing in natural colo-
“ nades, according as the bays or points of
“ lands formed themselves; upon a firm basis
“ of solid unformed rock. In a short time
“ we arrived at the mouth of the cave, the
“ most magnificent, I suppose, that has ever
“ been described by travellers.

“ The mind can hardly form an idea more
“ magnificent than such a space, supported
“ on each side by ranges of columns, and
“ roofed by the bottoms of those that have
“ been broke off in order to form it; be-
“ tween the angles of which a yellow stalag-
“ mitic matter has exuded, which serves to
“ define the angles precisely, and at the
“ same time vary the colour with a great
“ deal of elegance; and to render it still
“ more agreeable, the whole is lighted from
“ without; so that the farthest extremity is
“ very plainly seen from without, and the
“ air within being agitated by the flux and
“ reflux of the tides, is perfectly dry and
“ wholesome, free entirely from the damp
“ vapours with which natural caverns in ge-
“ neral abound.”

Let

Let us alſo, for a moment, liſten to Mr. Troil upon the ſame ſubject.

“How ſplendid,” ſays this prelate, “do
 “the porticos of the ancients appear in our
 “eyes, from the oſtentatious magnificence of
 “the deſcriptions we have received of them,
 “and with what admiration are we ſeized
 “on ſeeing even the colonades of our mo-
 “dern edifices! But when we behold the
 “cave of Fingal, formed by nature, in the
 “iſle of Staffa, it is no longer poſſible to
 “make a compariſon, and we are forced to
 “acknowledge that this piece of architec-
 “ture, executed by nature, far ſurpaſſes that
 “of the Louvre, that of St. Peter at Rome,
 “and even what remains of Palmira and
 “Peſtum, and all that the genius, the taſte,
 “and the luxury of the Greeks, were ever
 “capable of inventing*.”

Such was the impreſſion made by the cave of Fingal on Sir Joſeph Banks, and on the biſhop of Linckœping. I have ſeen many ancient volcanos, and I have given deſcriptions of ſeveral ſuperb baſaltic cauſeways and delightful caverns in the miſt of lavas. But

* Letters on Iceland, by Mr. Troil.

I have never found any thing which comes near this, or can bear any comparison with it, either for the admirable regularity of the columns, the height of the arch, the situation, the forms, the elegance of this production of nature, or its resemblance to the master-pieces of art: though this has had no share in its construction. It is therefore not at all surprising that tradition should have made it the abode of a hero.

This charming monument of nature is thirty-five feet wide at the entrance, fifty-six feet high, and a hundred and forty feet long.

The upright columns which compose the frontispiece, are of the most perfect regularity. Their height to the beginning of the curvature is forty-five feet.

The arch is composed of two unequal segments of a circle, which form a sort of natural pediment.

The mass which crowns, or rather which forms, the roof, is twenty feet thick in its lowest part. It consists of small prisms, more or less regular, inclining in all directions, closely united and cemented underneath and in the joints with a yellowish white calcareous matter, and some zeolitic infiltrations, which
give

give this fine ceiling the appearance of mosaic work.

The sea reaches to the very extremity of the cave. It is fifteen feet deep at the mouth; and its waves, incessantly agitated, beat with great noise against the bottom and walls of the cavern, and every where break into foam. The light also penetrates through its whole length, diminishing gradually inwards, and exhibiting the most wonderful varieties of colour.

The right side of the entrance presents, on its exterior part, a vast amphitheatre, formed of different ranges of large truncated prisms, the top of which may be easily walked along. Several of these prisms are jointed, that is, concave on the one side, and convex on the other; and some of them are divided by simple transverse intersections*.

These prisms, consisting of a very durable and pure black basalt, are from one to three feet in diameter. Their forms are

* Sir Joseph Banks's draughtsman, very good and accurate in other respects, has substituted, probably to give greater effect to the cave, large masses of stone irregularly piled on each other, on the right side of the kind of amphitheatre, which serves as a basis to that part of the grove. But there is in reality nothing there except columns.

triangular, tetrahedral, pentagonal, and hexagonal; and some of them have seven or eight sides. I saw several large prisms on the truncatures, of which are distinctly traced the outlines of a number of smaller prisms; that is, these prisms are formed of a basalt, which has a tendency to subdivide itself likewise into prisms. I had before observed the same phenomenon in the basaltic prisms of Vivarais.

The cave can be entered only by proceeding along the platform on the right side, which I have mentioned above. But the way grows very narrow and difficult as it advances; for this sort of interior gallery, raised about fifteen feet above the level of the sea, is formed entirely of truncated perpendicular prisms of a great or less height, between which considerable address is necessary to choose one's steps, the passages being sometimes so strait and so slippery, owing to the droppings from the roof, that I took the very prudent resolution, suggested by our two guides, to proceed barefooted, and to take advantage of their assistance, especially in a particular place, where I had room only to plant one foot, whilst I clung with my right
hand

hand to a large prism to support myself, and held the hand of one of the guides by the other. This difficult operation took place at the darkest part of the cave; and one half of the body was at the time suspended over an abyss, where the sea dashed itself into a cloud of foam.

I was desirous of penetrating to the farthest extremity, and I accomplished my purpose, though not without considerable difficulty and danger. I, more than once, found my attention distracted from the observations which I was happy to have an opportunity of making, to the thought of how I should get back again.

As I drew near the bottom of the cave, the bold balcony, on which I walked, expanded into a large sloping space composed of thousands of broken vertical columns. The bottom was bounded by a compact range of pillars of unequal height, and resembling the front of an organ.

It is worthy of remark, that at the time when Mr. Troil visited the cave, the sea, by one of those uncommon chances which do not happen once in ten years, was so calm that it permitted him to enter with a boat.

“ At

“At the very bottom of the cave,” says Mr. Troil, “and a little above the surface of the water there is a kind of small cave which sends forth a very agreeable noise every time that the water rushes into it*.”

As the sea was far from being completely still, when I visited it, I heard a noise of a very different nature every time that the waves, in rapid succession, broke against its bottom. This sound resembled that which is produced by striking a large hard body with great weight and force against another hard body in a subterraneous cavity. The shock was so violent that it was heard at some distance, and the whole cavern seemed to shake with it. Being close to the place whence the sound issued, and where the water is not so deep upon the retreat of the wave, I endeavoured to discover the cause of this terrible collision. I soon observed, that, a little below the basis which supported the organ-fronted colonade, there was an aperture which formed the outlet of a hollow, or perhaps a small cave. It was impossible to penetrate into this cavity, but it may be pre-

* Letters on Iceland.

fumed that the tremendous noise was occasioned by a broken rock, driven by the violent impetuosity of the surge against its sides. By the boiling motion of the water, however, in the same place, it is evident that there are several other small passages, through which it issues, after rushing into the principal aperture in a mass. It is therefore not impossible, when the sea is not sufficiently agitated, to put the imprisoned rock in motion, that the air, strongly compressed by the weight of the water, which is in incessant fluctuation, should, on rushing out by the small lateral passages, produce a particular strange sound. It might then be truly regarded as an organ created by the hand of Nature; and this circumstance would fully explain why the ancient and real name of this cave in the Earse language is, *the melodious cave* *.

Sir

* Sir Joseph Banks is the first who gave the cave of Staffa the name of the cave of Fingal. I made the most minute enquiries of several persons well skilled in the Earse, Gaulic, or Celtic language, to know what relation this cave had to the father of Ossian. And these gentlemen, as well as others, assured me, that the mistake was owing to the name being equivocal. The following is their explanation: The true name of the cave is *an-ua-vine*. *An*, the; *ua*, grotto, cave, cavern; *vine*, melodious. The name of Fingal in the same language is spelled and pronounced

Sir Joseph Banks in the description which he has given us of the cave of Staffa, says, that “between the angles a yellow stalag-
“mitic matter has exuded, which seemed to
“define the angles precisely.” That is true, but the learned Naturalist has not told us the nature of this yellowish matter.

Mr. Troil mentions it also: He says, that
“the colour of the columns is a dark grey;
“but that the joints are filled with a quart-
“rose stalactites, which distinctly marks the
“separation of the columns, and which, by
“the variety of its tints, has the most agree-
“able effect on the eye.” There is certainly an error here with regard to the substance. On breaking off several pieces of it, which it is not very easy to do, owing to the height of

nounced *Fion* in the nominative. But the Earse nouns are declinable, and the genitive of Fingal is *Fine*; so that if one wished to express the cave of Fingal in the Earse language, he would write *an-ua-fine*. Thus between the Earse *vine* melodious, and the genitive of Fingal *fine*, there is no other difference than the change of the letter *v* into *f*; and some person not very well versed in the Earse language, might have translated to Sir Joseph Banks the words *an-ua-vine* by the *cave of Fingal*, whilst the true and literal interpretation is, the *melodious cave*. In this case, the observation of Mr. Troil, on the agreeable sound which he heard issuing from the bottom of the cave when the water rushed in, is valuable, and comes in support of the true denomination.

the vault, I found that it was nothing but a calcareous matter coloured by the decomposition of the iron of the lava, and intermixed with a little argillaceous earth. This stalactites has also very little adhesion, and is in general of an earthy nature. In several of the prisms I found some globules of zeolites, but in very small quantity. I also broke off from between two prisms, which were so far apart as to admit of introducing my hand, an incrustation in which the white and transparent zeolites was formed into very perfect small cubical crystals, several of which were coloured red by the ferruginous lime arising from the decomposition of the lava. But I must repeat, that zeolites is very rare in this cave, and having myself broken off all the specimens that I was able to see, I doubt whether those who may visit the place after me will find any quantity of it.

DIMENSIONS OF THE CAVE OF FINGAL.

Breadth of the entrance, taken at the mouth
and at the level of the sea, 35 feet.
Height from the level of the sea to the pitch
of the arch, 56 feet.

Depth

Depth of the sea, opposite to the entrance, and twelve feet distant from it, at noon of the 27th of September, fifteen feet.

Thickness of the roof measured from the pitch of the arch without to its highest part, twenty feet.

Interior length of the cave from the entrance to the extremity, one hundred and forty feet.

Height of the tallest columns on the right side of the entrance, forty-five feet.

Depth of the sea in the interior part of the cave, ten feet nine inches; in some places eight feet, and towards the bottom somewhat less*.

I have given a description of the largest cave, as it is at the same time the most remarkable. But there is another towards the northern part of the island, in the midst of a fine

* All the dimensions were taken with great exactness with a piece of thread-tape, painted and waxed, divided into French toises, feet and inches, and rolling up into a leather case. This instrument, which I caused to be made in London, afforded a measure of 100 feet. If I, therefore, differ in the least from the dimensions taken by Sir Joseph Banks, attention must be had to the difference of the English foot. This naturalist, besides, used a fishing line, which, stretching more or less with the wet, can never give the measures sufficiently correct.

colonnade. Its name in the Earfe language is *Qua-na-Scarve*. It is, however, lefs interesting than the firft, and was befides inaccessible at the time I vifited the ifland. There is alfo in the fouthern quarter, and at a fhort diftance from the place where we difembarked, a fmall cave composed of compact lava, furmounted with a range of prifms, the total appearance of which, as is obferved by Sir Jofeph Banks, exactly refembles the keel of a vefel having her timbers expofed to view. The curvature of the prifms renders the refemblance of this fingular fpectacle very ftriking.

More than one half the circumference of the ifle is occupied by very handsome colonnades, which are completely bare on the fide next the fea. They reft in general on a current of gravelly lava, which ferves for their bafis and fupport; and they follow the direction more or lefs inclined, more or lefs horizontal of the current. All thefe prismatic caufeways are covered with a vaft fream of lava, more or lefs compact, and tending more or lefs to a prismatic form. The fummit of this covering is fpead over with a little vegetable earth formed by decomposed lava, and with fome thin common grafs.

Above one half the island therefore is supported by columns more or less perpendicular, and the remaining part entirely consists of lavas more or less compact, more or less decomposed, more or less intermixed with fragments of other lavas, zeolitic infiltrations, calcareous streaks, and calcedonious droppings, which have in some places penetrated the substance of the zeolites.

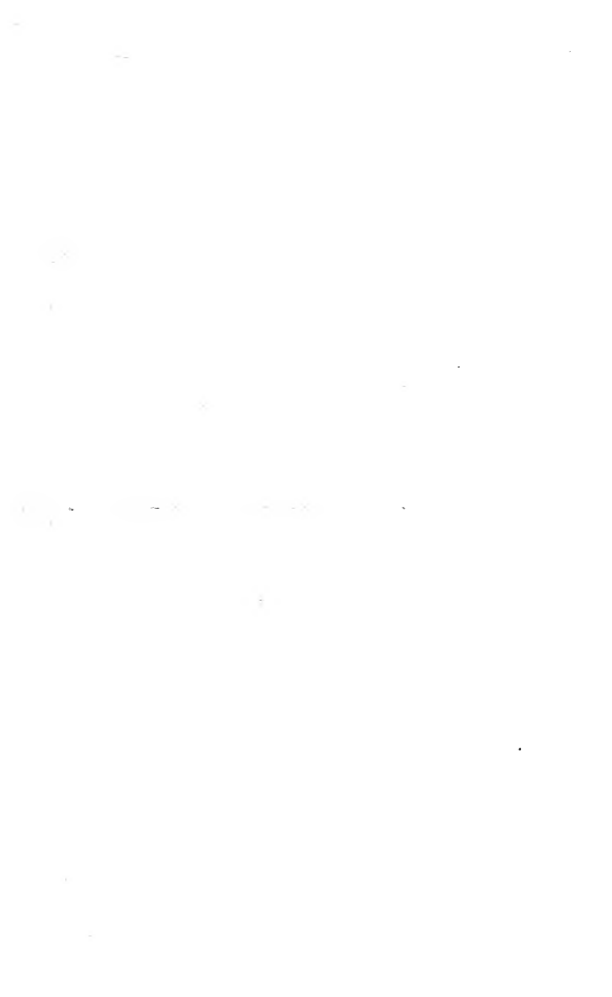
One of the causeways to the northward of the grand cave merits the attention of the naturalist by the disposition, the number, the purity, and elevation of the prisms, which are more than forty-eight feet high, and placed perpendicularly like the pipes of an organ. This magnificent colonnade is spread over with a current of compact lava, more than fifty feet thick, and composed of innumerable small prisms which diverge in all directions. It is supported by a current of black gravelly lava, nine feet thick, the paste of which is an intermixture of different other lavas divided into small irregular fragments, and united by a natural cement, composed of calcareous earth, zeolites, and a calcedonious substance. Every thing leads me to regard this current as the result of a volcanic eruption,

tion, in which the water entering into concourse with fire, has mixed all these matters in one paste. A part of this current of lava extends under the sea.

To prevent my description from becoming too tedious, I shall now only say a few words respecting what is improperly called the isle of *Boo-sha-la*; improperly, because the name of isle can never be given to what evidently forms an appendage of the principal isle.

Boo-sha-la lies at a small distance from the grand cave, and is separated from Staffa by a channel which is only a few fathoms wide; its junction with the latter may be easily traced in the sea. Boo-sha-la itself seems to be divided into two parts at spring tides. It is composed of a number of banks of prismatic basaltic of a very pure kind, piled together in some places, arched in others, and sometimes disposed in the manner of steps, which form a passable, though steep stair-case. By the side of this the columns are vertical, and form by their union and their different degrees of elevation, a regular conic peak, which is entirely an assemblage of prisms. This remarkable structure is not owing to the falling of large masses from their former positions.

It





A view of the 'Bunawit' Island of 'Boo-'. 'Ichala'. 'Uwawina to 'Sta'Ho'.

It seems rather to be the effect of a more or less gradual cooling; and the matter in shrinking appears to have undergone those fantastic modifications and accidents, which may be observed in crystallizations on a large scale; though I am far from considering the prismatic lava as the result of crystallization. On the contrary, I reject that opinion; and the comparison which I use here is only for the purpose of making myself more intelligible, and has no relation but to the accidental varieties and different dispositions of the forms.

Mr. Thomas Pennant has published, in his *Tour to the Hebrides*, two engravings of *Boo-sha-la*, taken from the very correct drawings of Mr. Banks.

It remains only that I should give a list of the lithological productions of the isle of Staffa.

MINERALOGY OF THE ISLE OF STAFFA.

1. Triangular basaltic prisms, which are here, as in other places, very rare.
2. Quadrangular, and equally rare.
3. Pentagonal: } These are the most
4. Exagonal: } common forms.
5. Hepta-

5. Heptagonal, of which a few are found here.

6. Octogonal, of a large size, sometimes four feet in diameter, exhibiting in their truncatures the elements of other smaller prisms.

7. Articulated prisms, that is, whose sections are concave on one side and convex on the other.

8. Prisms cut straight without any articulations, some of them have eight, ten, and even twelve sections.

9. Prisms which seem to have been cast at one time, in one piece; of these, some are twelve, fifteen, twenty, and even forty feet high.

10. Prisms curved in an arch of a circle.

11. Black gravelly compact lava, which easily separates into irregular pieces.

12. Black porous lava. The extinguished volcano, in the isle of Staffa, has been exposed for so many ages to the fury of a sea full of currents, and agitated with tempests, that it may well be said to have left only the skeleton of a volcanic isle, much more considerable in former times; the sea which attacks it on every side having carried away or destroyed

stroyed every thing that it was capable of acting upon. It ought not, therefore, to be a subject of wonder, that it contains neither the remains of a crater, nor scoriæ, nor light lavas. The same thing has happened to other extinct volcanos which the sea abandoned, after an incalculable lapse of ages. On examining, however, with attention the substances which compose the currents of lava, which support many of the prismatic causeways of the isle, one discovers some fragments of a black porous lava. These lavas being mixed and interspersed among the fragments of other lavas, compact, pulverulent or gravelly, compressed by the enormous weight of the superior masses, and united by a gluten, partly calcareous and partly zeolitic, are thence more protected from the action of the waves.

13. White radiated zeolites, incrufted with basaltic lava. The same zeolites incrufted with black lava, much softer, in round pieces, oval or irregular, and in diverging points. There are sometimes seen on the exterior part of these oval pieces, projecting crystals of cubical zeolites.

14. White

14. White radiated calcedonious zeolites. I obtained from one of the beds of muddy lava, on which the greater part of the prismatic lavas of Staffa repose, several spherical nuclei of zeolites in diverging rays, united to the number of three or four in one group. Several of these small balls were completely solvable in the nitrous acid, with which they formed a jelly; whilst several others adhering to these, but semi-transparent and of an unctuous polish, were impervious to the acid, and even gave sparks with steel. But on calcining and reducing the latter to powder, and digesting them in a glass vessel with nitrous acid in a sand bath, the acid dissolves the zeolites and forms a jelly with it, whilst the calcedonious particles remaining untouched, are precipitated to the bottom. I found some of these small balls of the size of a gall-nut, the one half of which was penetrated by a calcedonious milky juice, and the other by a quartzose juice extremely crystalline, and as transparent as the purest rock crystal.

15. Cubical white zeolites. There were some of the most superb pieces of cubical zeolites

lites in Staffa ; but, in our visit to that isle, we took away all that were most interesting. Before us, doctor Thompson had also made at Staffa a very interesting collection of zeolites, and among others, a number of large cubic crystals joined together on a black compact lava. This specimen, the most considerable and the most perfect of its kind, may be seen at Oxford in the collection of that naturalist.

16. Transparent cubical zeolites, of a greenish cast. I found this specimen in the interior of the cave of Fingal, in a crevice formed by the separation of two prisms. It is therefore very evident that this small group of cubical crystals had been formed in that fissure in a very slow and insensible manner, by the juxtaposition of the zeolitic particles held in solution by the aqueous fluid. The greenish colour of the latter zeolites is owing to the decomposition of the iron contained in the basaltes.

17. White semi-transparent zeolites in octagonal crystals.

18. White semi-transparent zeolites in crystals of thirty facettes.

Such are the most remarkable zeolites which I have found in the isle of Staffa. It
is

is not improbable that the waves and currents which daily wear away its coasts may afterwards discover some other varieties.

19. Granite of a red ground, and of the same texture with that of the ancient Egyptian granite, but of a much less vivid colour. This red granite is found in rounded stones of a pretty large size among the rolled lavas thrown by the sea upon that part of the island where the currents have formed the most considerable breach. As every thing in Staffa is completely volcanic, it is evident that these blocks of granite, which are not very abundant, but which have been rounded by friction, have been transported from a distance by currents; for the neighbouring islands are equally volcanic. The sea must certainly be terribly agitated to raise these rounded granites to the height at which they are found on the isle of Staffa, among the basaltic lavas equally rounded, which the sea throws up during spring tides and furious tempests.

CHAPTER V.

Stay at Mr. M'Lean's.—Customs and Manners of the Inhabitants of the Isle of Mull.

MR. M'LEAN of Torloisk has erected a commodious habitation, in the modern stile, but without any parade. Its characteristic is an exquisite neatness, joined to the most attractive simplicity.

It commands a view of the sea, and the isles of Ulva, Gometra, Staffa, Iona, and numerous clusters of rocks, which render navigation so dangerous in that region.

This house is situated on a single flat eminence, destitute of trees and verdure; so that to form a small kitchen garden, Mr. M'Lean has been obliged to dig away part of the volcanic rock, and fill up the area with transported soil; he shewed me several difficult and expensive operations of this kind which he had executed. On my asking, why he suffered to remain standing upon the place a kind of large cottage built of dry stones, covered with straw, or rather heath, and lighted
by

by two narrow holes, which scarcely admitted the rays of the sun.

“It was there,” said Mr. M’Lean with emotion, “that I was born. That is the ancient habitation of my fathers; and I feel unexpressible regard for this modest mansion, which reminds me of their virtues and frugal life.” This reply more strongly marks the character of that estimable man than the most eloquent description which I could give. It ought to be remarked, that Mr. M’Lean is a man of birth and fortune, that he has served in the British army, performed distant voyages, and is well acquainted with the world. He has, notwithstanding, preferred his native soil, and an agricultural life, to a residence in London or Edinburgh, or the most fertile plains of England; so powerful is the dominion of our first habits, when it recalls to our minds the indelible pleasures of infancy.

Several ladies from Edinburgh, of agreeable conversation, were at Torloisk at the same time with me. One of them, a relation of the Melforts, of whom there is a branch settled in France, was a woman of talents and information. A young officer, nephew to
Mr.

Mr. M'Lean, and two of his friends, were also on a visit at Torloisk, where all were united in the delightful bonds of confidence and friendship.

Miss M'Lean was an only daughter, of a pleasing countenance, elegant figure, and highly interesting from her talents, her acquirements, and her modesty. She played extremely well upon the harpsicord, and was in every respect the charm of that happy society. She had attentively studied the language, poetry, and music of the Hebridians.

Miss M'Lean assured me, in several conversations, with which she favoured me upon the subject, that to one acquainted with the language, the usages, and the manners of the country, it was difficult to conceive how the English writers, who were utter strangers to the Celtic tongue, should have so obstinately persisted in doubting the existence of the ancient poems of Ossian. She admitted, that they are in many places incomplete, and in others altered; for it cannot be supposed that they have not sustained some loss in their transmission from bard to bard, and from one generation to another. But it is nevertheless true, that several pieces of them have

come down entire, accompanied with some remains of the music to which they have been sung. This music is indeed wild and rude when compared to ours, but possesses the most powerful charms for the Highlanders, by calling to their minds the combats, victories, loves, and illustrious actions of their heroic ancestors.

No one is more capable of converting those who are incredulous upon this point than Miss McLean, and I invite her in the name of the sister arts, of poetry and music, with which she is so well acquainted, to publish her researches respecting the poems and airs of the ancient Caledonians*.

Mr. McLean's domestics, both men and women, are clothed in the Hebridian mode.

* Besides what McPherson has said upon the subject, John Smith, minister of Kilbrandon in Argyleshire, has written in favour of the authenticity of the poems of Ossian, Ullin, Onan, &c. Mr. Nichol, of Lifemore, has also treated the same subject. John Clarke, of Edinburgh, has given a translation of several of the Caledonian bards. I purchased also at Edinburgh a collection of Galic music, published by a presbyterian minister, and several other printed and manuscript pieces relative to this question; which I can communicate to such as it particularly interests. But this great question being foreign to the principal object of my researches, I shall forbear to expatiate upon it in this place.

I have

I have already described the dress of the men, in mentioning the inhabitants of Dalmally. That of the women is much less complex. Their long flowing hair, which is in general black, forms the only ornament of their heads. Some indeed have it kept back with a simple woollen fillet striped of different colours, among which red and green are invariably predominant. From one article of expence they are entirely free: they wear neither shoes nor stockings. But notwithstanding the length of the winter, and the incessant humidity of the climate, and though they go with their heads bare, their teeth do not seem to be in the least affected. Their dress consists of a bodice, or rather a kind of vest, and a petticoat of a woollen stuff chequered with red, green and brown stripes, shaded with blue. This is the general and favourite clothing of the Highlanders, and is used alike by the men and women, though it is for the most part manufactured in the southern parts of Scotland. It is known by the name of *Tartan*.

The English eat very little bread; the Scots eat more: there were three different kinds used at Mr. M'Lean's table.

The first, which may be regarded as a luxury for the country, is sea biscuit, which vessels from Glasgow sometimes leave in passing.

The second is made of oatmeal formed into an unleavened dough, and then spread with a rolling pin into round cakes, about a foot in diameter and the twelfth part of an inch thick. These cakes are baked, or rather dried, on a thin plate of iron which is suspended over the fire. This is the principal bread of such as are in easy circumstances.

The third kind, which is specially appropriated to tea and breakfast, in the opulent families of the isles, consists of barley cakes, without leaven, and prepared in the same manner as the preceding, but so thin, that after spreading them over with butter, they are easily doubled into several folds; which render them very agreeable to those who are fond of this kind of dainties.

At ten in the morning, the bell announces that breakfast is on the table. All repair to the parlour, where they find a fire of peat, mixed with pit-coal, and a table elegantly served up and covered with the following articles:—

Plates of smoaked beef,
Cheefe of the country and English cheefe, in
trays of mahogany,

Fresh eggs,

Salted herring,

Butter,

Milk and cream,

A sort of *bouillie*, of oatmeal and water. In eating this *bouillie*, each spoonful is plunged into a bason of cream, which is always beside it.

Milk worked up with the yolks of eggs, sugar and rum. This singular mixture is drank cold, and without being prepared by fire ;

Current jelly,

Conferve of myrtle, a wild fruit that grows among the heath,

Tea,

Coffee,

The three sorts of bread above-mentioned ;
and, Jamaica Rum.

Such is the style in which Mr. M'Lean's breakfast-table was served up every morning, while we were at his house. There was always the same abundance, with no other dif-

ference in general than in the greater or less variety of the dishes*.

Dinner is put on the table at four o'clock. It consists in general of the following particulars, which I correctly noted in my journal.

1. A large dish of Scotch soup, composed of broth of beef, mutton, and sometimes fowl, mixed with a little oatmeal, onions, parsley, and a considerable quantity of pease. Instead of slices of bread, as in France, small slices of mutton and the giblets of fowls are thrown into this soup.

* Knox, who travelled more upon the main land than in the islands, gives the following particulars of the breakfasts of the more wealthy families:—

“ A dram of whiskey, gin, rum, or brandy, plain or
 “ infused with berries that grow among the heath; French
 “ rolls; oat and barley bread; tea and coffee; honey in the
 “ comb, red and black current jellies; marmalade, con-
 “ serves and excellent cream; fine flavoured butter,
 “ fresh and salted; Cheshire and Highland cheese, the last
 “ very indifferent; a plateful of very fresh eggs; fresh and
 “ salted herrings broiled; ditto, haddocks and whittings,
 “ the skin being taken off; cold round of venison, beef
 “ and mutton hams. Besides these articles, which are
 “ commonly placed on the table at once, there are gene-
 “ rally cold beef and moor-fowl to those who choose to
 “ call for them. After breakfast, the men amuse them-
 “ selves with the gun, fishing, or sailing, till the evening;
 “ when they dine, which meal serves with some families
 “ for supper.”

2. Pudding

2. Pudding of bullock's blood and barley meal, seasoned with plenty of pepper and ginger.

3. Excellent beef-steaks broiled.

4. Roasted mutton of the best quality.

5. Potatoes done in the juice of the mutton.

6. Sometimes heath-cocks, wood-cocks or water-fowl.

7. Cucumbers and ginger pickled with vinegar.

8. Milk prepared in a variety of ways.

9. Cream and Madeira wine.

10. Pudding made of barley-meal, cream, and currants of Corinth, done up with suet.

All these various dishes appear on the table at the same time; the mistress of the house presides, and serves all round.

In a very short time the toasts commence; it is the business of the mistress to begin the ceremony. A large glass filled with port-wine is put into her hand; she drinks to the health of all the company, and passes it to one of the persons who sit next to her; and it thus proceeds from one to another round the whole table.

The side-board is furnished with three large glasses of a similar kind; of which one is ap-

propriated to beer, another to wine, and the third to water, when it is called for in its unmixed state, which is not often. These glasses are common to all at table; they are never rinsed, but merely wiped with a fine towel after each person drinks.

The dessert, from the want of fruit, consists for the most part, only of two sorts of cheese, that of Cheshire, and what is made in the country itself.

The cloth is removed after the dessert, and a table of well polished mahogany, appears in all its lustre. It is soon covered with elegant glass decanters of English manufacture, containing port, cherry, and Madeira wines, and with capacious bowls filled with punch. Small glasses are then profusely distributed to every one.

In England, the ladies leave table the moment the toasts begin. The custom is not precisely the same here; they remain at least half an hour after, and justly partake in the festivity of a scene, in which formality being laid aside, Scottish frankness and kindness have full room to display themselves. It is certain that the men are benefited by this intercourse, and the ladies are nothing the losers by it.

At Mr. M'Lean's we drank in particular to each of the ladies present.

To the rest of the guests, mentioning their names one by one.

To the country.

To liberty.

To the happiness of mankind in general.

To friendship.

We, foreigners, drank more than once to our good friends the Highlanders; and the company answered in full chorus with drinking to our friends in France, and in a lower tone, with a glass of mild Madeira, to our mistresses.

The ladies then left us for a little to prepare the tea. They returned in about half an hour after; and the servants followed them with coffee, small tarts, butter, milk, and tea. Music, conversation, reading the news, though a little old by the time they reach this, and walking, when the weather permits, fill up the remainder of the evening; and thus the time passes quickly away. But it is somewhat unpleasant to be obliged to take one's seat at table again about ten o'clock, and remain until mid-night over a supper nearly of the same fare as the dinner, and in no less abundance.

Such

Such is the life which the richer classes lead in a country, where there is not even a road, where not a tree is to be seen, the mountains being covered only with heath, where it rains for eight months of the year, and where the sea is in a state of perpetual convulsion.

The winter is cold only about two months in the Hebrides, and the snow lies but a very little time on the ground, but, as tempests and rains prevail during the greater part of the year, neither wheat nor rye can be brought to perfection in them. Barley and oats, however, thrive here, and are reaped in the month of October, though it is necessary to dry the grain in kilns to prevent it from shooting, and to prepare it for being ground.

The greatest part of the barley is fermented and distilled, to procure a spirituous liquor which forms their choice delight. It is called whiskey. Oatmeal is made into cakes for bread.

The isle of Mull is not much more than from twenty to twenty-two miles long, and sixteen or sixteen broad; a mile is termed in the Hebrides *scoc*. There is nothing like a regular village in the whole island; the houses
being

being almost always scattered apart, both on the coast and in the interior. They are constructed of irregular blocks of basalt, ranged, without great attention to order, in walls of great thickness; for materials of this kind are very plentiful, and always within reach of the builders. The height of the walls scarcely exceeds five feet, and that of the entrance is seldom above three feet. The more wealthy islanders, adapt a door to it; but the greater part of the inhabitants are satisfied to do without any. The roof is often covered with thin pieces of stone, which is again laid over with turfs. But those who can procure a sufficiency of wood for laths use a thatch of heath or oaten straw, fastened and kept down by long ropes of heath to protect it from the impetuosity of the winds.

The fire-place is always in the middle of the hut, and the smoke escapes by a hole in the roof, which is a little to one side, that the rain may not extinguish the fire. The Esquimaux and Laplanders display much more art and industry in providing themselves with habitations.

The islanders of Mull go both bare-footed and bare-headed, without any regard to rain

or frost. The father of a family may sometimes have a Scottish bonnet, and the married women a head-dress of coarse linen. But all the young folks, both girls and boys, go about with their heads bare, and without shoes or stockings. It should be remembered that I am speaking of the common class of people.

Almost all are shepherds or fishers. Each family has a small spot on which they raise some barley, oats, and potatoes; which latter, with milk, forms their principal aliment. Those on the sea coast, or by the side of lakes, supply themselves with fish. They catch salmon, which they dry in the smoak, and herrings, which they sell, and sometimes make into oil for their lamps.

Those who are better informed, or of a more adventurous spirit, enter into the English navy, and form robust, sober sailors, familiarly acquainted with all the dangers of the sea.

The population of the island is about seven thousand.

It contains three parishes, nine regular built stone houses, and five schools; its inhabitants profess the Presbyterian religion.

The

The women, in general, are small, ugly, and ill made; the natural consequence of toil, bad food, the want of suitable clothing, and the inclemency of the climate. I saw two or three who were a little better looked, and whose figure was even somewhat agreeable, but these belonged to families in a more comfortable condition. The sun being almost always covered with clouds, or enveloped in mists, their skin would be very white, were it not discoloured by the peat-smoke, which, from the want of chimnies, continually fills their huts.

Notwithstanding the wetness of the climate, I could never perceive that the custom of going bare-headed was injurious to the teeth. Both men and women have very fine sets, and are in general, especially the men, very healthy. The disorders which might be expected to arise from the frequent rains of this climate, are mitigated by the extreme temperance of their life, exercise, and the purity of the air. Their only sustenance consists of milk, potatoes, fish at certain times of the year, and oatmeal made into a *bouillie* or cakes. Their beverage is pure water; and a few glassful's of whiskey on
their

their festive days constitutes their supreme happiness.

On enquiring respecting the age of their oldest men, Mr. M'Lean of Torloisk assured me, that a man of his acquaintance who resided in the neighbourhood of Aros, had died about seven years before at the advanced age of one hundred and sixteen years, and that there were several living above eighty; among those, however, it should be remarked, who were in commodious circumstances.

The horses of the island are of a very diminutive race; its black cattle are equally small, but very delicate when fattened; they are generally exported to England, and they form one of the principal revenues of the isle of Mull. There are also in it two kinds of sheep which I shall soon describe, and a few goats; but there are no hogs, and only a few fowls, owing to the difficulty of feeding them. At Aros, in a house by the water-side, I saw some geese and ducks, and three turkies; but the heads of the latter were pale, and I doubt whether they will thrive there.

The

The highest mountains produce deer, though few in number, and of a smaller size than the common kind. Heath-cock, of the greater and lesser species, are very plentiful; there are also some wood-cocks, but no hares. The only small bird which I saw in my course through it was, the ortolan.

The island is now denuded of trees, though formerly it must have been covered with them. This may be easily seen by the turberies; on digging which to a certain depth, it rarely happens that roots and stumps of beech, pine, and birch are not met with. It is my opinion that were the proprietors to give themselves the trouble of planting evergreens and birches, they would still thrive there. In this opinion I am confirmed from a small thicket which I saw at *Achnacregs*, on the extremity of the isle opposite to that of *Torloisk*.

The level country and the mountains are in general covered with heath and sod.

The tides rise to a great height in this part, and the shores abound with sea wreck, which has for some time back been burnt for its alkali, which some of the merchants of *Glasgow* come to purchase. But this useful
object

object of industry is exclusively engrossed by the *lairds*, or a few wealthy persons. The sea wreck, when fresh, is used with success as a manure.

There are yearly exported from Mull about fifteen hundred head of black cattle; but, from their small size, they bring only about three pounds sterling each.

OF THE SHEEP OF SCOTLAND, PARTICULARLY
THOSE OF THE ISLE OF MULL.

I shall here give an account, in as few words as possible, of the information which the best local opportunities enabled me to procure upon this subject, with the intention of being useful to those, who occupy themselves with this great branch of national economy.

In the mountains of Scotland, and the Hebrides, there are only two kinds of sheep; the original race of the country, and a kind which has been introduced from England, and which is accordingly called *English sheep*.

The wool of the former, or Scottish sheep, is much superior to that of the English sheep, and even approaches the Spanish wool in fineness

ness. But many people prefer the English kind because they yield a fleece double that of the Scottish race, are fatter and fuller of flesh. They accordingly sell at a much higher price.

An English sheep, in good condition, sells upon the spot, for half a guinea and often twelve shillings; whilst a Scottish one seldom brings above six or seven shillings.

The wool is sold here by a weight of twenty-four pounds, denominated a stone; this quantity is generally valued at from six to seven shillings. The pound contains sixteen ounces.

The flocks of sheep range the mountains or valleys, both night and day, summer and winter, without any shelter; yet the extreme wetness of the climate does not seem to do them the least injury.

They never have any fodder during the winter, not even when there is snow; but it should be observed, that, in these isles, though in so northern a latitude, the snow does not continue long on the ground. By a very rare occurrence, in the winter of 1783, it remained upon it about two months; during which time, the sheep fed upon the tops of a

tall kind of broom which remained above the snow. The poor animals, however, suffered severely during that winter, and became very meagre. But a much greater number of them died from accident, than from want or disease; and on the reappearance of the grass they recruited very fast, and fattened as usual.

The rams are carefully separated from the ewes in the month of September, and are not admitted among them again till the twentieth of November, that the lambs may be yeaned only in the best season.

The ewe brings forth and takes care of her lamb without any assistance. The shepherd, who, from time to time, visits his numerous flocks, to prevent them from straying too far, or endangering themselves amidst the rocky precipices, takes the number of the young lambs, who soon run after their dams and crop the new sprung herb.

In the third month after parturition the lambs are taken away from their mothers, being then strong enough to do without them, and are formed into flocks which are put into separate enclosures, under the care of a keeper.

When

When the pasture grounds are contiguous and of great extent, one man and two dogs are sufficient to keep fifteen hundred sheep. But when the pastures are of inconsiderable extent, and it is necessary that they should feed more regularly, a keeper and two dogs are requisite for every eight hundred.

Nineteen or twenty rams are sufficient for eight hundred ewes. The keeper repairs every evening to a cottage in the form of a dwelling-house, erected in the midst of the pasture ground.

The only disorders to which the sheep are subject here, are the pleurisy, which happens but seldom, and the staggers, which turns their heads to one side, and always ends in their death. This disease is unfortunately very frequent, and often attacks those which appear to be the most healthy*.

The

* This disease is the same as that known in Tuscany by the name of *Pazzia*. The animals affected with it, and which are called in France *moutons louras*, *moutons imb cilles*, waddle in their walk. Abbe Fontana, in a letter upon this subject addressed to M. Darcet, and inserted in the *Journal de physique*, tom. i. page 227, 1784, says, "it is very remarkable that the sheep attacked by it, generally fall on one side, and that the vesicle, which occasions it is found to be in the lobe of the brain opposite to the side on which they fall. This observation holds good

The Hebridians never give any salt to their sheep; they are not however ignorant of its good effect; but their flocks being very numerous, and the salt, from government duties and carriage, extremely dear, the expence would be too great for their abilities. Were it not for this hindrance, the inhabitants would undoubtedly use it for the fleecy race; for they are very sensible that the cows and oxen, who feed upon the herbs washed by the sea, thrive well, become plump, and have a sleek skin.

Here I ought to mention a custom used in several parts of the north of Scotland, particularly in the lower districts, though it is not practised in the Hebrides or more inland parts of the Highlands, I mean that of smearing their sheep with tar.

“in all cases; and the animals constantly fall on the same side.” The celebrated physician of Tuscany, from several microscopic experiments on the liquor contained in these vesicles or *idatides* in the brain of sheep, concludes, that “the particles, which are seen floating in that liquor, are *real animalcules.*” This new and singular discovery, says that learned philosopher, “may throw light on some disorders of the human brain, and even on insanity; since vesicles as large as a pea, and sometimes larger, have been found in the brains of persons who have died of that malady, which is so terrible and humiliating to human vanity,” page 231 of the same paper.

The owners of the numerous flocks of these districts, where the winter is far severer than in the Hebrides, entertain an opinion that the intense cold makes the sheep scabby; and as a security against this, they make use of the following preservative:

In the month of November each shepherd takes two barrels of tar and one barrel of butter; or a greater quantity of each, according to the number of the flock, but always in the proportion of two-thirds of tar to one-third of butter. These two substances are then boiled or melted together; and after being completely mixed and permitted to cool, each sheep is tied up by the feet, stretched on a hurdle, and rubbed over with the composition. This operation is performed by separating the wool into thin flakes that the tar may be applied to the skin with as little injury as possible to the fleece.

According to the opinion of the sheepfarmers of the country, two advantages result from this practice. The first is, the preserving of the cattle in a state of health; the second, that of making them yield a greater

quantity of wool. The most wealthy sheep-farmers, whom I had an opportunity of consulting upon the subject, assured me, that the fleece was certainly more abundant when the sheep were tarred; but they, at the same time stated, that it sells for nearly one-half less than unsmear'd wool, being rendered a great deal heavier than its real weight, by the dirt which adheres to the tar. The operation by which the tar may be taken off, consists in soaking the fleece after it is shorn in warm-water, into which butter has been melted. But this process must be expensive; and the wool never reaches the quality of its natural state.

Five thousand sheep require twenty barrels of tar, and one-third that quantity of butter. This expence appears at first much more considerable than it really is; for, on dividing it among five thousand, it does not amount to five *sols* a-head. Besides, this composition of butter and tar gives the sheep a sort of artificial fat, which supplies what the rigour of the climate deprives them of; and if it tends to keep these useful animals in better health, and also to encrease the quantity

tity of their wool, however ridiculous, expensive or difficult to those unaccustomed to it, the practice may at first appear, it is yet, perhaps, worthy of profound attention and examination on the part of those who are particularly interested in this important branch of economy.

CHAPTER VI.

Departure from Torloisk.—Stay at Aros.—Visit to two worthy Farmers and Brothers, the Stuarts of Aros.—Excursion to the Mountain of Benmore, the highest in the Isle of Mull.—Stop at Mr. Campbell's, of Knock.—His agricultural Operations.—Curious Lavas.—Departure from Aros for Achnacregs.

I WAS treated with such engaging marks of politeness and affection by Mr. M'Lean and all his family, as well as by his visitors, that it was impossible for me to leave them without feeling a sentiment of gratitude and regret. I should be happy to prove to them that they will never fade from my remembrance. This respectable philosopher kindly accompanied us for several miles on our return.

During my stay at Mr. L'Lean's I took a survey of the volcanic hills in his vicinity, and directed my researches to the right and left of his house, along a tract of coast which the waves have washed into naked precipices
capable

capable of affording a complete view of the structure of substances formerly acted upon by subterraneous fire. I shall give a description of them in the chapter appropriated to the mineralogy of the isle of Mull.

We set off, mounted upon little half-wild horses, and on the same day reached Aros. Here we remained the whole of next day in a very uncomfortable lodging, where we found only some barley meal, which was made into pottage for us with milk, a little smoke-dried salmon, and a few sheep-trotters; no wine nor beer; but whisky, which scalded our mouths, and, to crown all, our beds were of the very worst kind. Our host, however, was a good sort of man, and used every possible exertion for our accommodation. With this we expressed ourselves satisfied for the present; and he promised to procure us some fresh fish by the next morning.

Of these, two of my companions were left to enjoy the benefit, for I had determined myself to set out with the first dawn to visit the high mountain of Benmore, and William Thornton, who now felt an increased ardour for the pursuits of Natural History, resolved to accompany me.

There

There are not much more than three miles from Aros to Knock, along a pretty good road, which here and there presents some picturesque landscapes, of an appearance, however, somewhat wild.

On a meadow in the bottom of a narrow valley, washed by the sea, we observed one of those columns called *Cairns*, of which, from the ground being overflowed at the time, I was unable to procure the dimensions. But as near as I could judge by the eye, it might be about fourteen or fifteen feet in height, and seemed to consist of grit stone. There is certainly something astonishing in the frequency of these ancient monuments through the Hebrides and the main land of Scotland. Popular tradition traces every one of them back to the time of Ossian, which is merely to say, that their origin has been lost in the lapse of ages.

The house of Mr. Campbel, of Knock, is very agreeably situated at the foot of a high mountain, and not far from an arm of the sea, very plentiful in fish. Mr. Campbel was gone at this time to Oban, but the mistress of the house received us in the most affable manner, and treated us with tea and rum.

We

We requested that she would procure us a guide to direct our way to the top of Benmore; but her son, a youth of seventeen or eighteen years old, offered to accompany us himself. This young man, who had a very agreeable figure, and was dressed in the Hebridian stile, immediately presented us with fowling-pieces, saying, that he had excellent dogs, and that we should certainly find some *black-cocks*; for he had no conception that we could wish to climb so rugged a mountain, for any other purpose than the pleasures of the chase, which he passionately loved himself. He was, therefore, much surpris'd when I took out my hammers, and told him, that I had come to examine the stones of the place. On receiving that information, he shewed us immense heaps of them which had been taken off a considerable tract which his father had cleared in the midst of some lavas. All these stones, broken into small lumps, were afterwards used to form enclosures to a piece of ground which required much labour, time and expence, to reclaim. A larger collection of lavas is seldom met with than this presented. I shall presently mention its particulars.

As

As we intended to return to Aros in the evening, we lost no time in beginning to scale the steep sides of Benmore. In my travels among the high Alps I never experienced so much difficulty as in this ascent. An almost impenetrable heath, growing upon a marshy soil, covers the basis, the middle and the summit of the mountain, which rises in the shape of a sugar loaf. It is impossible to make any progress, but by following the small gullies which the waters have worn, and walking in the very midst of the slender streams, which occupy the bottom of these steep and narrow paths. The black and bushy heath spreads its gloomy veil over those stones, which might interest and repay the fatigues of the naturalist. Not a single plant, nor so much as a tuft of moss is to be seen, every thing is here smothered by its destructive progress.

The stones which the most considerable gullies have uncovered, and those which have been broken off by frost, are all volcanic. But they present no variety; all of them are whitish-grey lavas, slightly maculated with zeolite.

We had reached to a considerable height, when, wearied with seeing only the same lavas,

lavas, and meeting with no other plant than the toilſome heath, whence ſtated from time to time ſome black-cocks, which young Campbell brought to the ground with great dexterity, I reſolved to go no farther. But William Thornton braving every difficulty and deſirous to gain the higheſt ſummit, proceeded onward. The ſtones which he brought down with him afforded no variety. Upon the whole the mountain of Benmore, notwithstanding its height, and a kind of reſemblance which it has at a diſtance to mount Veſuvius, does not repay the trouble of aſcending it. We gladly returned therefore to reſt ourſelves at Knock, where the lavas being much more intereſting, I made a collection of ſome ſpecimens. We then took leave of young Campbell and his mother, notwithstanding their preſſing ſolicitations to ſtop, and proceeded for Aros, where we were expected.

It was determined that we ſhould ſet off for Achnacregs at ten next morning. This was a diſtance of eighteen or twenty miles, which we willingly performed by land, as we ſhould thus have an opportunity of examining that part of the iſland, and at the ſame time avoid the navigation of the tempeſtuous ſound of Mull ;
for

for from Achnacregs we could next morning easily reach Oban to breakfast.

We left Aros at the appointed hour; but first had the pleasure of breakfasting, by invitation, with the Messrs. Stuarts of Aros.

These two gentlemen, who are brothers, occupy a commodious habitation on a small hill, which they have brought into cultivation, and rendered productive of pasturage, barley, oats, and potatoes. In that modest asylum, free from care and disturbance, they pass away their days with a happiness which ambition has never tasted. Two intelligent and industrious sisters partake with them in the management of their household affairs. Here they enjoy all the gentle delight of rural life; I sincerely wish that they only lived under a more favourable sky, and on a soil capable of exercising their agricultural taste and talents to more advantage.

We took leave of them at ten in the morning of the 29th of November.

A few miles from Aros, near the water-side, we observed the ruins of a catholic chapel, where are still visible a gothic basso-relievo in freestone, representing the Virgin Mary between two seraphims, and a large grave-

grave-stone which exhibits the effigy of a warrior in complete armour, that is, with helmet, bracelet, cuisses, buckler, and sword. One of our guides told us, that it was the figure of a hero of the clan of M'Lean. Beside this sepulchral relic, we observed another representing also in relievo, a woman of tall stature, dressed in the gothic style of the ancient ladies of France. The name of the place where we discovered these ruins is *Galchayle*.

Thence we continued our course along a way, which might be called rather a path than a road, to *Lenigorn*, *Ardmitrail*, and *Corinahinish*. It must not be supposed that all these names indicate villages, or even hamlets. Alas! they are applied only to some huts, scattered at distant intervals amidst these dismal deserts.

Every thing along this road is volcanic; but the compact homogeneous grey-coloured lavas which it presents, are not very interesting. They are besides so thickly covered with moss or lichens, that it is necessary to break them before they can be distinguished.

In the vicinity of *Ledkirk*, however, I found some hard compact lava, disposed in
slabs,

slabs, which gave me considerable pleasure. This lava was of a white kind; and at first sight might be taken for a fine limestone of that colour. But on a more attentive examination, its vitreous appearance proves beyond doubt that it is merely a basaltic lava bleached by its contiguity to some crater, or by remaining long in a fluid impregnated with some acid. It is remarkable that these lavas have preserved their magnetic property. I collected some specimens to compare them with some of the same kind which I found on Mount Mezinc, in Vivarais, and to those of the extinct volcanos in the environs of Padua, and of the Euganean mountains.

From Ledkirk we passed on to *Garmony*, and thence to *Scallafdel*, leaving the little fort of Duard on our left. On a green rising ground, near Scallafdel, we saw a druidical circle, formed of very large pieces of rough granite. We stopped for a moment to examine this altar or temple; but quitted it hastily and with indignation, on reflecting that here the cruel priests, of a still more cruel religion, had, perhaps sacrificed some Iphigenia, thrown by a tempest upon this new Taurica.

We

We arrived in the evening at Achnacregs. This is the name of a small creek, where there is only one house, wretched and smoky, of two stories however, and with chimnies. From its first appearance, it was difficult to know whether it was a farm-house or an inn; we found that it was both the one and the other. The arm of the sea which separates this part of the isle of Mull from Oban, the opposite point of the main land of Scotland, being of inconsiderable breadth, the passage is much frequented for the transportation of cattle; and this house affords shelter to those who are driven in by bad weather, or who come to the island on commercial pursuits. Our entertainment here was in the style of Hebridian frugality; but, our landlord was a good sort of man, very inquisitive after news, somewhat of an antiquary, and had as much veneration for Fingal and Ossian, as the Jews have for Moses.

A heavy rain detained us within doors the whole of next day; I employed the time, therefore, in ticketing my specimens, and arranging my journal.

On the succeeding day, the rain was not so thick and frequent, but the sea was very boisterous. We made some excursions in

the vicinity ; and about half a mile from our lodging observed a bank of lime-stone adjoining a bed of free-stone, and both of them inclosed in a current of lava.

At a short distance from this bank, we came to a large rough column of free-stone, lying flat on the ground, and broken in the middle. On measuring, I found it to be twenty-one feet long. Our host, who accompanied us at this time, did not fail to excite our admiration of this ancient monument. “ Never was there a person, except “ *Offian*,” said he, “ who could move this enormous stone. The operation of time, or perhaps an earthquake has overthrown it, and “ now there is not one in the island who can “ set it up again.”

It rained all the morning of the following day ; but towards the evening it became fair for a little. Count Andreani, who began to be weary of so dismal a solitude, and so bad a lodging, resolved to take advantage of this short interval, to cross over to Oban, where he should wait our arrival. The only vessel which the place afforded, was a small skiff, very badly equipped, and rowed by two boys, of whom the eldest was not more than fourteen years. The wind was variable, and the

the

the sea not very smooth. In vain, however, did I represent to him that it were better to wait till the next morning; nothing could prevail on him to stop. He set off in the skiff, with his two servants, at half past four, telling us, that he should sleep in a good bed, and eat a better supper than we, at the house of the brothers Stevensons, of Oban, where he expected to arrive by seven the same evening.

Less adventurous, though perhaps more prudent, than Andreani, I persuaded William Thornton to remain with me at Achnacregs, till the sea became more moderate. After wishing our friend a good passage, and looking after him as far as we could see him, we slowly returned to our wretched and dreary habitation. I wrote till eight; we then supped, and I went to bed at ten.

The wind by this time increased to a violent gale, accompanied with a great deal of rain; but I was nowise anxious respecting the situation of my companion, whom I imagined safe in Oban long before.

I had scarcely shut my eyes, however, when a loud noise awaked me. I heard a rapping and calling at the door; I rose, and after informing the people of the house, who went and opened it, we saw our poor friend An-

dreani enter with his attendants, as completely drenched, as if they had been repeatedly plunged under water. They were overtaken by a storm, when half way over, and though several times driven near to Oban, they were unable to make the harbour. The night was so dark, that it was almost impossible to know where they were, and it was not without encountering the greatest dangers, and in a manner by mere chance, that they regained the little haven of Achnacregs.

They were numbed with cold; our first care, therefore, was to warm them. A large fire was lighted, rum and tea were given them to drink, and every possible means were taken to recover them. Count Andreani was himself the first to laugh at his adventure; but his two servants, who had never before travelled beyond the fertile and smiling fields of Italy, and who, therefore, felt somewhat awkward in their present situation, were not so merrily disposed. They were so deeply impressed with the dangers and frightful appearance of a stormy sea, amidst the darkness of night, that, returning a thousand thanks to the Blessed Virgin, who had heard their invocation and brought them safe to land, they raised their hands to heaven, and swore, that they

they would never again leave the island, barren as it was. "We should prefer," said they, "to crop the herbs in this place, to exposing ourselves, a second time, to the fury of that abominable sea." They then muttered their displeasure at their master's imprudence and folly, in coming to visit the most detestable country in the world. Their pantomimic gestures, the expression of their countenances, and the serious tone of their lamentations, entertained me with a scene truly comic.

Repose during the remaining part of the night, and the appearance of a fine morning, partly effaced the impressions of the preceding evening. The sea, however, was not yet navigable; and the best means of dissipating tedium was to betake myself to active employment.

At sun-rise, therefore, I made one of those excursions from which there is always derived some benefit, either for instruction or health, and in which I always find my advantage, in whatever country I may travel.

A vast black rock, perfectly perpendicular, and almost insulated, forced itself upon my attention, ever since my arrival at Achna-

cregs. I conjectured that it might be a basaltic colonade, and I wished to ascertain the truth of this conjecture. After walking about a mile and a quarter, I arrived at the foot of one of the most astonishing productions of volcanic combustion that I ever had an opportunity of observing.

It presented the appearance of an ancient circus, formed of natural walls of basaltic, rising perpendicularly with so regular a construction, that at first view, the spectator cannot avoid thinking it to be the production of human industry and art. But the utmost stretch of human force, heightened by all the aid of the mechanic powers, could never have been capable of elevating such enormous masses. The whole must be regarded as the effect of a vast combustion, which, instead of destroying, has here produced appearances analogous to those of a creative power.

This grand natural monument excited a just admiration and even enthusiasm in my mind. I spent two hours in viewing, studying, and observing it over again in different points of view, and I was still unwearied of gazing upon it. I went in quest of my companions, who were transported with no less admiration than myself at the sight of these vast basaltic

basaltic walls, standing alone, and rising in a bold and perpendicular fabrick around a circular space, which presented an arena that would have been well adapted to the games of the ancients.

It is no less remarkable, that the accessory parts of this singular production of subterraneous fire seem to have been placed in the vicinity, as if with the design of furnishing a key to the problem of its formation.

I measured, with the most scrupulous attention, the height and thickness of the walls, and the diameter of the circular enclosure.

On the 6th day, I visited it once more. In the afternoon of that day, the weather beginning to assume a more settled appearance, Count Andreani said, that he was resolved to try his fortune a second time, and that he should set off at four o'clock; which he accordingly did. The wind was at this time favourable, and as the skiff could not carry us all, we suffered him to proceed, promising, that we should speedily follow him.

He sent back the boat, during the night, with a supply of eatables, for our cheer had been but very poor and scanty for some days before, having exhausted almost the whole stock of Achnacregs.

This supply was extremely useful, as the storm returned by the next morning, and the sea ran too high for us to trust ourselves upon it in so frail a vehicle. I employed the time in new excursions, and in arranging my notes, particularly those which related to the mineralogical history of the isle of Mull. These I have thrown into a separate section, that such of my readers as are interested in that science may find the objects which refer to it, united under one head, and that those to whom the subject may be indifferent or tiresome, may easily pass it over. It may not be improper to mention a second time, that this is my ordinary mode of proceeding.

At length, on the evening of the 6th of October, which was the eighth of our confinement, a bark having come in to Achnacregs with a cargo of beeves, which was to return on the morrow, we resolved to embrace the opportunity of a passage in her; we accordingly embarked at six next morning, not for Oban, but for the isle of Kerrera, where we landed at eight. We walked along the isle, which is very small, and at its extremity found a boat, which conveyed us in less than one hour to Oban, where our friend Andreani most impatiently expected our arrival,

CHAPTER VII.

Natural History of the Island of Mull.

THIS island, which is one of the largest of the Hebrides, is not more than from twenty to twenty-two miles in length, and fifteen or sixteen in breadth; but being of a very irregular form, it may be stated at eighty miles in circumference at least.

I shall proceed to describe the parts which I visited, in the order of my journey. Those who would wish to explore the island in the same pursuit, by disembarking at Achnacregs, coming back to Aros, and travelling along the left bank of the sound of Mull, will trace my itinerary by commencing where I finished it.

A R O S.

ROAD FROM AROS TO TORLOISK.

Columns of Basaltes. Lavas, compact, black, grey, reddish, intermixed with Globules of white Zeolite. Blocks of rounded Granite on the Summit of some basaltic Mountains.

THE ancient castle of Aros, once the residence of the famous M'Donald of the Isles, now presents nothing more than a ruin. Its remains stand on a small colonade of basaltes by the brink of the sea, and on the right side of the entrance of the small bay of Aros.

The river of Aros, which might with more propriety be called as a pretty large brook, takes its rise from a marshy tract, about the middle of the island. From its source to its mouth it runs on a compact lava, which varies in colour from a deep black to grey and reddish. This lava is in general durable and compact; some beds of it, however, are found of a gravelly and friable texture.

These compact lavas contain, in general, so great a quantity of knobs of white zeolite, that this last matter may be said to form nearly one-third of the weight of the lava.

The zeolite is found here in a globular form, and in general about the bigness of a
pea.

pea. Some of the globules are radiated; but they are more frequently crystalized in a confused manner, and without any determinate form. I found nothing of this kind sufficiently interesting for the cabinet of the naturalist, from Aros to Torloisk. The reason was obvious. Every thing was so covered with moss, lichens and heath, that I was forced to confine my researches to the bed of the small river, and to some gullies connected with it, where the rock was somewhat exposed.

As we drew near to Torloisk, at the distance of about three miles from the castle, we came to some mountains entirely volcanic, and at least two hundred and fifty toises high. It excited my astonishment as I passed along their summit to observe some large blocks of granite, rolled and partly rounded, detached from each other, and resting on the volcanic matter, to which, however, they do not adhere, having been evidently transported hither by the effect of some convulsion. For adventitious bodies of that kind, and of so great bulk, found on mountains and in an island where there is no solid rock of granite, must have been deposited here by some very powerful revolution.

These

These lumps of granite may have been ejected from granitic quarries, which perhaps existed at great depths under these ancient volcanos, by the explosions which took place at the epoch when extensive combustions devastated these countries, and formed groups of islands which appear to have the same origin.

It is besides within the verge of possibility, that those parts of the mountains where they are now found, were not at that period elevated summits, but rather formed part of the bottom of the sea; and that these granitic blocks were rolled from a distance by the currents. It is possible, that circumstances of subterraneous explosion, equally terrible with those which formed the isle of Santorini, in the Archipelago, or Montenove, in Italy, may have raised up the bottom of the sea into volcanic peaks; or, if it should appear more plausible to some, we may refer to a period when mountains still higher were entirely covered with the sea; a fact, which cannot be doubted, since marine bodies are found in great abundance in beds of lime-stone or clay, situated on the Alps or Apennines, at a height three or four times greater. But the subject would require illustrations, which the nature of this work does not permit me to enter into.

TORLOISK.

Black Basaltes, with and without Zeolite; altered Lava, which has lost its Hardness and its Colour; Basaltes calcined on the Surface of a Blood-red Colour, and having the Appearance of a clayey Bole.

AT a little distance from Mr. M'Lean's house, near the road leading to the sea on the side of Kilnynen, is an extent of rugged steep rocks bounding the coast, which are beat upon by the waves and by frequent rains. They are easily observed along the whole of that part of the coast, being entirely bare.

This craggy tract which extends as far as *Loch-mari*, is composed of different currents of basaltic lava, of a deep black colour. Several of these streams are formed of irregular masses, others of tables, and some have assumed a prismatic form. Here I found some pretty large specimens of fine zeolite, several of which were crystallized into cubes, some had the appearance of diverging rays, and others were a little calcedonious. They are in general very white, but there are some
which

which have become fallow from the decomposition of their iron; and several also have a light greenish tint. They are most frequently seen in large lumps buried in the lava; but those which have adopted the cubical form, are often found in the fissures which separate the different streams of lava.

The traveller should not omit visiting on the opposite quarter, that is, towards the path on his left as he proceeds from Mr. M'Lean's house to the shore, a quarry, out of which all the stones of his buildings have been taken. Here there are found several lavas which are worthy of attention. They may be observed with the same facility as the preceding; the interior of the volcanic eminence being completely exposed to view by digging away the stones.

The upper beds of the quarry are formed of a black hard compact lava, containing some globules of white zeolite.

Those immediately below, having been probably acted upon by the sulphurous acid, have lost a part of their colour and their hardness. They are grey, whitish, and most frequently of the colour of iron rust. The zeolite which is found buried in it, has preserved
its

its forms and chymical properties, but has notwithstanding assumed various tints.

Other beds, still lower, have sustained a more considerable and different kind of alteration; they are of a bright red, and contain, as well as the lavas over them, some globules of zeolite, unaltered with respect to their principles, but softer and a little coloured. The lava itself has lost its hardness.

The lavas of this quarry, though of the same texture and composition, have undergone different modifications, as well from the exhalations which rise from this burnt soil, as from the action and effects of long continued fire.

The different craters afford a constant and remarkable example of the active operation of the vapours, not only on the colours, but also on the grain and hardness of the lavas which they decompose, and form into new combinations of gypsum, iron, allum, sulphur, &c. I have proofs, likewise, that the long continued application of fire, will, in certain circumstances, transform the hardest and blackest lavas, basaltes for example, into a state of red calx, if I may use that expression.

These

These superficially calcined lavas in losing their first colour, lose also the elements of their hardness; and there are circumstances in which they become soft and soapy to the touch like fat clays. I have described a variety of this kind in my *Mineralogy of Volcanos*, page 395, No. 10.

It is, therefore, of essential importance to distinguish accurately the two kinds of alteration which I have mentioned, and of which the one is owing to the action of acids, and the other to that of long applied heat. Thus the black lavas which compose the first beds of the volcanic quarry of Torloisk are nowise altered. Those which succeed them, and which are grey and whitish, seem to have been discoloured and altered by acid vapours; whilst the deepest strata, in which the lava is of a blood-red colour and friable texture, appear to derive that modification solely from the long continued action of fire, and a real calcination of the surface. In this case the fire has not been sufficiently violent to change the lava into a vitreous substance; but its prolonged operation has disunited its parts, and rusted and oxidified its ferruginous particles, which have changed to a red colour, like that of the calx of lead, which a very
violent

Violent and long applied heat, converts into the most beautiful minium. The globular zeolite which is found in the upper as well lower strata of the quarry of Torloisk, that is, in the black, grey or whitish lavas, is the same. It is the same also in the deepest beds, where the lava is more altered and has become red. This zeolite differs from that of the other beds only in being a little softer; but the difference is not very perceptible.

What has happened here as to the zeolites, has taken place also with respect to pointed schorl in a lava of *Chenavari* in Vivarais. The black schorl remains almost untouched in the midst of a lava altered and turned to a red colour by the continued action of a strong fire, but which has not been able to vitrify it*.

I have

* The following is the passage of the *Mineralogy of Volcanos*:—"Argillaceous basaltés of a blood red, with specks of black schorl in the most excellent preservation, though the lava itself is changed completely into an argillaceous matter soft and soapy."—*Mineralogy of Volcanos*, page 395, No. 10, in 8vo. Paris, 1784.

I ought to add here, that in saying, that the lava had changed into an argillaceous matter, I did not mean that it had passed into the state of real clay. My intention was

I have quoted in the same work, which I published in 1784, on the Mineralogy of Volcanos, a daily example of this superficial calcination effected by art. In Vivarais, and also on the other bank of the Rhone, limekilns are constructed with their interior lining of very black and hard basaltic lava. The pit-coal fuel, with which these kilns are continually supplied, soon vitrifies the whole of the inner surface, which then runs into one piece. But as the vitrification does not penetrate above four or five lines in the blocks of lava, which are several feet thick, the part in immediate contact with it, being exposed to a less degree of heat, passes at length into a state of calcination. Its colour becomes red, its hardness is destroyed, and when the

merely to state that the lava thus altered had put on the exterior appearance of clays; that is, that it was tender, earthy, and soft to the touch. I am the more desirous to explain myself upon this subject, because several naturalists, who have written upon volcanos, have taken these substances for real clays, regarding them not merely as earthified lavas, but as embodied clays burnt by subterraneous fires. In these cases, however, the schorls, crysolites, zeolites, and even pieces of porous lava which are found in it, remove every doubt respecting the identity of these altered lavas with those which join or cover them, or lie in alternate order with others, and which are perfectly sound.

kilns

kilns are taken down or repaired, it is easy to observe through the thickness of the lava, the gradual action exerted by a heat so violent and long continued. The reader will excuse this digression, which is by no means foreign to the subject.

K N O C K.

MOUNTAIN OF BENMORE, THREE MILES FROM
AROS.

Lavas in Slabs, prisms, and irregular Masses, hard, sound, compact; internally of a blackish grey, externally of a dull white; decomposed to the Depth of four or five Lines, and exhibiting the primitive Elements of their Composition; in some of them are found Globules and Dots of white Zeolite.

IN mentioning the mountain of Benmore, I said that it was covered with heath so thick as hardly to permit me to discover the lava of which it is composed. But on passing through several hollows formed by the water which runs down its sides, I observed only one kind of lava, which is grey, hard, compact, and

intermixed with several globules of zeolite. I carefully examined several of these chafins from the bottom to the top of the mountain, and no where did I meet with any other kind of lava. But, as the way was very difficult, I was able to visit the north side only of this volcanic peak. I therefore invite those naturalists who may follow me in the same journey, to attempt the south side of the mountain, to discover whether the lavas there be equally homogeneous.

Knock is the name of the residence of Mr. Campbel; and to distinguish him from other persons of the same clan, he is described by the appellation of Campbel of Knock.

His house, situated on an eminence, at the foot of Benmore, has a view on one side of a delightful valley, covered with flocks, and, on the other, of a fine loch or arm of the sea, navigable, rich in fish, and visited by the herring at the time of their migration.

A considerable tract which he has cleared in the midst of the lavas, to obtain the small quantity of soil produced by their decomposition, must have required a labour which nothing but the most inflexible constancy, supported by the hope of fertilizing and embellishing

bellishing the place of his habitation, could have been capable of surmounting.

This vast undertaking produced considerable quantities of volcanic stones, broken, split, and cut in various directions; from which the ground is cleared by forming them into dry walls of great extent and proportionate thickness. These enclosures, which are very numerous, present to the naturalist a most agreeable field of observation. The lavas are compact, and of a black or rather deep grey colour approaching black. They are frequently disposed in tables, sometimes in prisms, and at other times in irregular masses. Their fracture presents a paste of a homogeneous appearance, of a grain compact, smooth and susceptible, of a fine polish. But a peculiar alteration observable on its surface, and which has penetrated a few lines into its interior, merits all the attention of the naturalist, and renders this kind of lavas very interesting.

This alteration, operated by time, or rather by the different modifications of the air upon the lavas, has discovered their constituent principles. It may be regarded as a sort of natural dissection, which, by destroying cer-

tain parts, has exposed to view those which would otherwise remain concealed, and which no chymical analysis could have ever brought to light. This requires a more particular explanation; which I proceed to give, with a specimen in my hand, that those who may have occasion to observe similar lavas, which are very common in the ancient extinct volcanos of France, may be better able to correct my errors, if they shall be of opinion that I have committed any, or make use with me of a means which may sometimes discover to what stone a particular lava belonged before its fusion.

The lavas in question I repeat, appear on being broken, of a hard compact texture, and of a dark grey colour, approaching to black. The particles seem well amalgamated and homogeneous; nor does the microscope even discover any difference between them.

If we proceed to the examination of their exterior parts, we find their surface grained, unequal, and rugged to the touch, and exhibiting crystals and plates of felt spar, jutting points of black schorl, fixed often in the felt spar itself, and both the one and the other surrounded with small cavities, by which they

they are completely insulated, and which prove that the particles, amidst which the felt spar and schorl were inclosed, have been destroyed.

The white crystals of felt spar are slightly touched with a reddish tint; which is a little deeper in the interstices where it has been more difficult for the rain-water to insinuate itself, and to wash away the ochreous particles produced by the decomposition of iron.

The naturalist, most experienced in lithology, on seeing their decomposed surface, cannot avoid regarding them, at first view, as real granites. He does not find himself embarrassed, until he examines their fracture and their interior texture, and especially until he presents to the magnet the unaltered part which attracts it as strongly as basaltic lava of the richest iron ore; whilst the exterior crust has no impression upon it.

It thence results, that the iron which forms one of the constituent principles of this lava, has sustained a complete change of its natural properties, in which it has been accompanied with the earthy particles which were combined or united with it.

This connexion being destroyed, the substances which escaped decomposition, such as felt spar, schorl, and several small pieces of quartz have been exhibited to view; so that on removing the covering under which they are concealed, it is not very difficult to discover their organization.

Their original state appears, therefore, to have been that of a granitic or porphyric rock. The naturalist will more readily decide in favour of the latter from the consideration that the basis of real porphyric is in general petrosilex, which, whatever be its hardness or its colour, is sometimes found decomposed naturally in the open air, and is also capable of being acted upon by sulphurous acid vapours.

But to be assured that this lava owes its existence to a porphyric substance, with a basis of petrosilex, nothing else is required than to fuse with the blow-pipe a small fragment of the soundest part, that is, the part which has preserved its hardness and its black colour, and the result will soon appear to be a white enamel, which is a characteristic mark of petrosilices; whereas the lava with a horn-stone basis produces a fine enamel of a deep

deep black colour. My learned friend, Deodat Dolomieu, has sufficiently established that distinction in his excellent memoirs.

Similar lavas are found at the foot of Mount Mezinc, in the Vivarais, near Pui, in Velai, on the Euganean mountains, and in the isles of Ponces.

It always presents itself as a subject of astonishment, on examining certain lavas, that subterraneous fires should have melted into a stream, stones which now appear of the hardest consistence, and that with scarcely any change in their primitive organization.

LEDIRKILL.

ROAD FROM AROS TO ACHNACREGS.

White compact Lavas which have preserved their hardness.

ON the road to Ledirkill, I observed some hard compact and very white lavas. They do not appear to have undergone any alteration, either spontaneously, or by means of emanations of gas. Their texture is pretty homogeneous; but the particles are a little scaly,

scaly, and bear a resemblance to those of a certain felt spar.

Their white colour does not seem to announce the presence of iron. But one would be led into an error by trusting to their first appearance; for they have a very sensible action on the loadstone. There are some white mines of very rich spathose iron, of which the colour does not exhibit the least indication.

The white lavas of Ledirkill have some resemblance to stones of tolsa with this difference, that the latter are nowise magnetic, and that the former produce no alum.

I am therefore induced to consider the lavas of Ledirkill, as naturally white, and as deriving their existence from stones of the same nature as those with a petrosiliceous base, or a base of felt spar in one mass*.

ACHNA-

* Deodat Dolomieu, who has so well observed the different causes which tend to decompose or discolour lavas, thinks with me, that there are some of them naturally white. "There are a number of lavas," says this learned mineralogist, "of a white or whitish colour, which have never been attacked by vapours, and which have not sustained the least alteration. This is proved by local circumstances, by the hardness, and the perfect preservation of the felt spar and the micas which they contain. I could instance a vast number of lavas which are naturally

ACHNACREGS.

Beds of Lime-stone, between two Banks of Free-stone, in the midst of the Lavas, and with Belemnites in the Lime-stone.

ABOUT half a mile from Achnacregs, and at no great distance from the prostrate column which I have mentioned, and which the inhabitants regard as the work of Ossian, there is by the sea-side a craggy ridge, upon which the waves beat with so much fury, that they have torn the volcanic rock in several directions.

By incessantly attacking this natural mound, for so many ages, the waves have brought to view a bed of lime-stone, that formerly lay buried under a current of black basaltic lava, of which the whole coast is formed. This bed, which is at a medium, about fifteen feet broad, is completely uncovered for a space of at least twenty toises in length at low water; and loses itself in the mass of lavas which rise into hills as they recede from the coast.

“turally white; such are those of the Euganean mountains near Padua, named *granitello*, several lavas of *Ætna*, Germany, &c.” *Memoirs on the islands of Ponces*, by Deodat Dolomieu, Paris, Archet, 1788, in 8vo. p. 37.

The

The lime-stone is grey, hard, and brittle. It is not very pure, being mixed with a small quantity of argillaceous earth; it is good, however, for making lime. I found some belemnites in it, the largest of which were five inches in length, and an inch and a half in circumference towards the base.

This calcareous stratum does not adhere directly to the basaltic lava. There is an intermedium of two pretty thick beds of quartzose free-stone with large grains, united by a cement partly calcareous. It is to these that the lava adheres; and had not the free-stone been uncovered by the daily and violent action of the sea, it would never have been imagined that there existed under these enormous masses of basaltic lava, a layer of calcareous matter, inclosed itself between two beds of free-stone*.

* In the 160th and following pages of my *Mineralogy of Volcanos*, I have mentioned some analogous, but much more remarkable appearances, which I observed in the mountains of Chamarelle in Vivarais, near Villeneuve de Bery, where there are beds of lime-stone and basaltic lavas placed in alternate succession, and where belemnites are found in the lime-stone, as in that of Achnacregs. In that work I have stated my conjectures respecting the manner in which these different beds might have been formed at the remote period when every part of the ocean was agitated by volcanos.

Grand natural basaltic Wall resembling an ancient Circus.

To the north of Achnacregs, on the right side of the road from the house, and about six hundred toises distant from it, we observed, close by the sea, a natural platform of a semi-circular shape, situated on an eminence which rises about a hundred and fifty feet above the level of the water, and which is entirely composed of black lavas of a basaltic nature. This small plain, which has a gentle slope, is bounded on the south by a perpendicular volcanic cliff.

A vast detached wall lines a portion of the circle, formed by a basaltic rock which rises in the opposite quarter, and there thence results a kind of antique circus that fills one with astonishment at the first glance, and gives this singular place the appearance of a ruin as extraordinary as picturesque.

The objects assume a new character of grandeur in proportion as they are approached; and the picture becomes more striking when the height of the wall and its astonishing regularity are viewed from a near situation.

At first, one is lost in considering how, or from what motive, human beings should have raised, in a place so remote and desert, a monument presenting the image of a Roman circus.

The farther the observer advances, the more surprising does this kind of arena become. A large angular breach in the midst of the wall permits the eye to discover the interior of this antique ruin. On approaching the opening he feels a lively curiosity intermixed with uncertainty, respecting the nature of the object presented to his view. Such at least were the sensations that my companions and myself experienced the first time that we went to see this remarkable place, which we conceived, even when quite close to it, to be a monument of art.

There is nothing here, however, but the work of nature, and one of the most extraordinary productions of subterraneous combustion; no less astonishing, perhaps, in its kind, than that which gave existence to the cave of Fingal.

I have mentioned, that a rock of black basalt, cut perpendicularly down, and describing a natural segment of a circle, forms the

the bottom of the circus. A vast wall, perfectly upright, forms the remainder of the inclosure.

This wonderful wall engrossed all our attention. It is eighty-nine feet long, perfectly straight, and composed entirely of prisms of black basalt, of equal length, and placed horizontally above each other; that is, all these prisms, which are in good preservation, and pretty equal, laid one upon another, form the thickness of this wall which is detached on both sides. Its facings are pretty even, and it stands erect without any buttresses, though it exceeds twenty-five feet in height. It is connected, at its northern extremity only, with a projecting part of the volcanic rock which forms the circular bottom of the amphitheatre.

The breach in the middle of the wall is fourteen feet four inches wide at bottom, that is, even with the ground, and forty feet at the top. It forms a large obtuse angle, and give a very picturesque appearance of a ruin to the whole of the circus. This opening is probably the effect of an earthquake. I counted about forty prisms within the wall which seemed to have belonged to it, and
about

about thirty-nine without. But these are no-
thing to what would be still necessary to fill
it up; and it is not very probable that any
person carried them away. The sea is at pre-
sent a hundred feet distant from the wall, and
forty feet lower than it. It is possible, how-
ever, that the waves may have beat out the
part at some very remote period, and carried
off the greater portion of the materials which
are wanting. This conjecture, will perhaps,
appear more probable than the first, when I
shall have described other objects in the vi-
cinity of the wall, which are well fitted to
throw some light on the theory of its forma-
tion. I shall shortly return to this subject.

Nothing is better calculated to convey an
idea of this basaltic wall than the manner in
which the wood for firing is arranged in
the wood-yards of Paris. It is well known
that these pieces are all of the same length,
and that they are piled up horizontally above
each other. I do not mean those enormous
piles which over top the houses, and form vast
masses of wood; because, in that case, the pieces
are placed longitudinally and crosswise alter-
nately, but I mean those kinds of walls: the
thickness of which consist of the length of a
single

single piece, and which are carried only to the height of ten or twelve feet, that the wood may be more at hand for daily sale.

I am obliged to use this trivial comparison, in order to make myself better understood. It is not easy to be perspicuous, and at the same time to avoid fatiguing the reader with details too minute or imperfectly expressed, when it is necessary to describe objects which Nature seems to have produced in her capricious moments, to embarrass us with aberrations of which she exhibits a few examples only.

I am fully conscious of my inability to express all that I saw, or all that I felt, on seeing the volcanic circus in the vicinity of Achnacregs. I therefore entreat the most ample indulgence with respect to what I have already said, and what I have yet to observe.

The height of the great wall is twenty-five feet ten inches, its thickness seven feet ten inches, and the prisms, of which it is composed, are consequently of the same length.

The prisms are pentagonal, hexagonal and seven sided. A very few are quadrangular; but the most common are the pentagonal and hexagonal. They are black, hard, found in their fracture, and magnetic.

The first eight courses of the upper part of the wall are formed of prisms of the same shape and size, in excellent preservation, and placed horizontally one above another without any adhesion; that is, they might be easily raised one after another. But they lie so close upon each other that there is no vacancy between them except merely the lines of separation which define the prisms, and give the facings of this singular wall a resemblance to mosaic work.

The prisms which succeed the first eight courses are likewise of the same mould; but they are cut transversely in some parts, either from the natural effect of contraction at the time of the lava's cooling, or from the weight of the incumbent mass at a period long subsequent to their formation.

The wall commences towards the west, where it supports itself against a rock of lava. It then takes a south-east direction, and turning, stretches along to the north-north-west, and afterward to the south-south-east. It is not of an equal height throughout. The highest part, which is also the best preserved, is twenty-five feet ten inches, as I have stated already; the other parts are about twenty-

one feet seven inches high. It is detached on both sides, and is, in all, eighty-nine feet in length, including the breach. The greatest diameter of the circus, which is rather of an oval than circular form; is sixty-six feet eight inches; and to bring all the measurements into one view, I may repeat, that the wall is a hundred feet distant from the sea, and stands on a ground entirely covered with lava, and raised forty feet above the level of the sea in ordinary tides.

It is doubtless very difficult to conceive how the lava, when flowing, could have formed a wall so high, of such regular construction, unconnected with any other mass and composed entirely of differently sided prisms, placed horizontally by the side of each other, with such order and perfect symmetry, that the art of the most able stone-cutter could never have arranged them with equal dexterity.

This problem, however, which is certainly attended with great difficulties, finds, on the spot itself, some means of solution, arising from particular circumstances capable of conveying some idea of the manner in which this prismatic wall was formed.

For this purpose, it is necessary only to step about forty paces towards the south-south-east part of the circus, which is close by the sea. There two facts may be discovered, which serve to explain this remarkable theory.

I am happy that I continued so long on the spot, and that I so carefully traced all the windings of this singular volcanic monument ; for, otherwise, this important observation might have escaped me.

Two extensive excavations naturally formed in the lava itself, one of which is twenty-two feet deep, sixteen feet broad, and a hundred and forty-six feet long, and the other eighty-five long, nineteen broad, and twenty-one deep, at a medium, seem as if they had been designedly placed there, at no great distance from each other, to invite the observer to repair thither in order to learn the manner in which nature operates in the construction of such walls.

Let the reader imagine to himself, for a moment, two streams of lava of a considerable thickness, which at the time of some great eruption, have flowed parallel to each other, with an interval of several toises between

between them: The case is not without a precedent, at *Ætna*, the volcano of the isle of Bourbon, and elsewhere. From these two streams result a long and deep gallery, or a kind of covert-way, more or less straight, more or less circular or winding, according to local circumstances, and the obstacles which might have occurred in their progress.

But admitting that two currents of lava might, by approaching each other, form a gallery, still it may be asked, how is it possible that they should assume a direction so equal and so parallel as to produce a channel nearly uniform throughout, and of which the interior surface is perfectly even? I might reply, that the case may have existed, since we have several instances of it, and I would add, that naturalists know very well, that in great eruptions, the lava does not flow along with the same fluidity as melted metals, but in the state of a thick paste, which the air, by cooling the parts exposed to its influence, consolidates in an erect position. This is a fact which may be witnessed in a number of instances, in which the boiling lava proceeds along slowly, but at the same time to a great distance, in a stream with perpendicular

pendicular sides. What is still more surprising is, that these currents are sometimes seen to divide into two parts, like two branches of a river, on merely meeting with a body which one might suppose they could easily overturn, such as a stone mound, or even a house. Sir William Hamilton has accurately observed, and described this astonishing phenomenon in his excellent description of the eruption of Vesuvius.

Other causes may contribute to give regularity and smoothness to the interior facings of a gallery formed by two parallel currents of lava.

The volcano, for instance, may have been submarine, or only in the vicinity of the sea, where those at present in activity are almost all situated. We have, then, only to suppose two currents of lava, flowing at a small distance from each towards the water, and extending under it to a certain distance. The sudden cooling, the resistance of the fluid, the thick and deep slime which generally covers its bottom, a bank of shifting sand, or other unknown causes, may give rise to what so much astonishes us, namely, the parallelism and equality of the interior surface.

It

It is of little importance to know the exact and perfect theory of these works of nature. It is sufficient that the fact exists, and that it cannot be doubted, after examining the two large and deep galleries mentioned above, which appear in open view at no great distance from the circus, and which enable us to explain the formation of the great wall. I have only to entreat the readers' patience and indulgence for the details, already too long and tedious, which I am obliged to enter into in order to make myself intelligible upon a subject, dry and difficult in itself, but calculated to entertain with curious facts such as are attached to these kind of studies and observations.

The first of the two galleries was such as strongly to excite our attention at first sight. I have already said that it is eighty-five feet long, nineteen broad, and twenty-one feet of average depth. It is wholly uncovered. There is no access to it, however, except at one place, where, with a little address, and by the aid of some blocks of lava which have fallen in and form a kind of steps, one may descend to the bottom.

This long and profound excavation is the effect simply of two currents proceeding in the same direction, with an interval of fifteen feet between them. The lava of which they are composed is black, and of the kind which I have denominated in the *Mineralogy of Volcanos*, gravelly lava; that is, which has little adhesion and falls naturally into gravelly splinters, in the form of knobs of a greater or smaller bulk having a general tendency to separate in that manner, particularly in the parts exposed to the air and to the alternate effects of dryness and humidity.

Matters being in this state, and the channel or gallery being formed, it then served as a mould to a current of basaltic lava, compact, homogeneous, and of great solidity, which subsequently flowed into it, and thus created a wall something similar to the cased walls of the Romans.

As the current of basaltic lava would pour along the channel in a boiling state, its sides, that is, the parts in contact with the faces of the gallery must have necessarily been the first cooled. The caloric thus escaping by the sides, the lava would shrink into a smaller bulk and must thence have unavoidably cracked
into

into pieces of a' prismatic form. The loss of heat, and the *gaseous* emanations forcing the matter to contract itself, the result must have been that this sort of cast wall should split into horizontal prisms of several sides, placed naturally one above another.

The outer walls, which served as moulds, and which are composed of a gravelly earth, need only have been attacked and destroyed by the water, either gradually during a lapse of time, or by some extraordinary agitation of the sea; and the middle wall, which consisted of the most solid materials, being thus stripped of its mould, would appear to have been erected in a miraculous manner, and to have arisen out of the earth as an amphitheatrical decoration.

This is precisely what happened in the present case, at least to such a degree as to admit of no doubt respecting the fact: For, in the middle of the gallery I have mentioned, there appears a perpendicular wall, three and a half feet thick, and eight high, completely divested of lava, detached on both sides, and entirely composed of prismatic columns laid horizontally above each other, but preserving a certain mutual adhesion, which has prevented

vented them from falling, and enabled them to resist the action of time and the elements, which they could not otherwise have withstood.

I thought I should never weary of admiring this wall. I could walk round it with ease; the whole breadth of the gallery being only nineteen feet, of which the prismatic wall occupied only four and a half; so that it stands nearly in the midst of a vacant space of fourteen feet six inches, having seven feet three inches on each side.

This vacancy was probably once filled up with the same gravelly lava of which the sides of the gallery consist. The sea, which rushes into the gallery with violence during tempestuous weather and spring tides, by an aperture which communicates with it, must have carried off the gravellous lava wanting, and and in the center of which the wall was inclosed.

It is probable that from the continued action of time, rain, hoar-frost, and the sea, on the gravelly lava of the gallery, the wall will one day be entirely stripped of any inclosure on either side, and that no vestige will remain of the primitive mould to which it owes its formation.

I have

I have now only to mention its present height, which is no more than eight feet, whilst that of the cavity in which it is placed is twenty-one feet.

I reflected upon this fact on the spot, and I think I shall be able to account for it by saying, that it is probable that the wall was once higher, but that the upper courses having been formed of prisms which did not adhere to each other, the sea must have undermined and carried them away.

This opinion gains some strength, from an examination of the second gallery, which is at a small distance from the first, and on which I shall dwell for a moment only.

This gallery, which is much larger than the other, is a hundred and forty-six feet long, twenty-two feet deep, and sixteen feet broad. It may be regarded, in one sense, at least, as the reverse of the former. The two parallel currents, which have served to form it, consist of black, compact, very hard lava, in a solid mass, which has resisted all the injuries of the weather, the action of the air, and the highest tides.

A stream of compact, homogeneous, lava, occupied also the whole length of this vast gallery.

gallery. But the basaltic lava of this secondary current consisted of a paste so smooth and so well amalgamated, and which had so great a tendency to divide into regular and perfect, that they lay horizontally upon each other without any connection or adhesion between them, as far as I could judge from a small part of it remaining towards the beginning of the gallery, which the sea had not yet reached.

The prisms of this remnant are truly astonishing from their excellent state of preservation and the complete regularity of their form. They seem as if they had been placed there with all the care and art of human hands: so very wonderful is the symmetry and perfection of their arrangement. There is not one of these prisms, picked up at random, which would not figure in a cabinet of natural history.

Their want of adhesion has been the cause of their gradual demolition; for the waves meeting the most obstinate resistance from the sides of the gallery, which are of unshaken solidity, directed all their fury against the prisms, which they easily undermined and dragged into the depth of the ocean. Thus has the prismatic
wall

wall been entirely destroyed, whilst the mould, which contribute to form it remains unimpaired.

Such is the manner in which volcanos, so frequently the agents of destruction, are able to create, or rather to imitate, by a succession of accidental circumstances, productions which cannot be effected by mankind without much labour and a train of tedious and difficult means and combinations*.

From

* I made these observations on the spot in the month of October, 1784. Deodat Dolomieu, three years afterwards, that is, in the month of July, 1787, on visiting the isles of Ponces discovered a similar wall, but consisting of much smaller prisms. As the comparison may be interesting to Naturalists, I shall make use of the language of my friend: "The small basaltes are very numerous in the isles of Ponces. They are found in a multitude of places, but principally in the rocks of Chiardiluna, to the left of the subterraneous gallery. There are thousands of them on both sides of the small bay of St. Mary, especially on the mountain in the rear of the houses. These small prismatic columns naturally split asunder and fall into the sea. Some of them are of the most perfect regularity, and exhibit all the variety of forms of which they are susceptible. They are seen in heaps of different forms, but more frequently piled horizontally on each other, and rising above the ground in the form of walls which perfectly resemble those in the ancient fabricks called *opera reticulata*. Several rows or walls made of prisms nearly a foot long, rise one behind another."

Dolomieu

From the preceding observations it would appear that the grand wall which forms the volcanic circus of Achnacregs, can have no other than the same origin. But as the flat tract on which it stands is forty feet above the present level of the sea, and the wall itself is still twenty-five feet ten inches high, it must follow that the sea has fallen sixty-five feet ten inches in that quarter, unless we suppose that the coast has been elevated by the incalculable efforts of some vast subterraneous explosion.

Mr. Anderson, who travelled by command of the English government, with a view to the fisheries, through several of the Hebrides, at the time I visited them, told me, that he saw in the isle of Islay, a volcanic wall of the same kind with that of Achnacregs, respecting which I had given him some details. He further informed me, that the wall commences to the west of the island in a place called *Cove*; that it describes a diagonal line of three hundred paces long; that it is at least fifty feet

Dolomieu entertains the same opinion with me respecting the theory of these walls; he regards them as having been formed by inclosure in the interstices of the lava.

Memoire sur les isles Ponces, by Deodat Dolomieu.
Paris 1788, in 8vo. 93 and following pages.

high

high and four feet thick ; that about one-half of it stands out of the water, and the other projects into the sea, where it forms a jutty so extraordinary and so much resembling the work of art, that, at the first view, it would appear to be the production of human labour.

CHAPTER VIII.

The Isle of Kerrera.

THE isles of Mull and Kerrera are separated by a narrow channel which may be crossed from Achnacregs in less than four hours. Kerrera almost touches the main land, by a point which runs out towards Oban; for the strait on that side is in some places not above fifty toises broad. I crossed the isle of Kerrera diagonally in order to get to a small ferry-boat, which was at one of its extremities.

A part of the island is volcanic. On the coast fronting Mull there are collections of compact lavas disposed in masses and in large currents. This basaltic lava appears sometimes in the form of prisms, which are not very regular, at least in the places which I had an opportunity of examining. I also found some rocks of micaceous schistus of a whitish colour, and others which were
greenish

greenish with a fibrous texture. These schistus or *kneifs* are composed of quartz, steatites and small scales of mica.

Near the rocks of micaceous schistus there is found common slate of a deep grey colour, approaching to black, the beds of which are almost even with the ground: quarries might be easily opened here with great advantage to the country. They would even become an object of commerce. Among the slate there are found some brilliant pyrites, the crystalizations of which are cubical.

Such were the objects which engrossed my attention in the isle of Kerrera, where I observed a good deal of pasture ground, and some cultivated parts bearing barley and oats. The cottages were scattered to the right and left, but they were few in number.

I was only four hours in crossing the whole length of the island. I found at its extremity the ferry-boat which I mentioned above. It was a small skiff managed by a single man. I was fatigued. I made the boatman proceed directly to Oban, where I landed in less than an hour, and I

found Count Andreani with our carriages, and every thing ready for our departure on the next day. In the evening, we made every necessary preparation for commencing our journey by day-break.

CHAPTER IX.

Departure from Oban.—Dalmally.—Tindrum.—Lead Ore.—Killin.—River Muscle containing Pearls.—Description of these Pearls and their origin.

WE left Oban on the 7th of October, at six in the morning, to proceed to Dalmally. The distance is about twenty-four miles, along a stony road, passing through ravines. We arrived at the place of our destination about seven in the evening.

Bunhave, of which I have already spoken, is about midway; it is a small hamlet, built at the union of a branch of Loch Awe, with Loch Etive, which has sufficient water for small vessels, and where salmon abounds.

We visited an iron foundry, at a small distance from Bunhave. It stands in a charming situation, embellished around with woods, verdant banks, and cultivated fields. A beautiful avenue led to the Loch, which was at this time covered with vessels, that

rendered the scene so much the more enchanting. This delightful spot formed a strong contrast with the barren mountains of reddish porphyry, and the piles of rocky fragments with which it is surrounded.

We were agreeably surprised to find an establishment of this kind in so distant a part of Scotland, where cultivation and the arts have made so little progress; we were informed that it belonged to an English company who had been induced to erect works in this place in consequence of the abundance of wood and water and its proximity to the sea.

We waited upon the manager of the works, who received us very politely, and shewed us some iron of a very fine quality, the result of his labours. I expressed my astonishment that this iron should be made in a place where there was no indication of ore, and observed to him, that I had not seen the smallest vestige of any all the way from Oban. He replied, that my surprise was very natural, for that the ore used in this foundry was brought in vessels from Cumberland; he then shewed me some collections of red hematites, partly decomposed, of an excellent quality and rich in iron.

This

This establishment appeared to be conducted with equal skill and economy ; but the wood was beginning to become scarce, as the neighbouring forests were not sufficiently extensive to yield constant and regular supplies. It is therefore to be feared that this foundery cannot be carried on much longer.

On arriving at Dalmally I had the pleasure of seeing our good friend, Patrick Frazer, who supped and passed the evening with us. He informed me of new researches he had made with respect to the poetry of Ossian, some fragments of which he had recovered, in the different excursions he made for that purpose among the inhabitants of the mountains, and little frequented places of this part of Scotland. He had also enriched his collection with other poems made by the more modern bards of the country. This worthy man, of a mild, modest character, and passionately fond of literature, was unfortunately placed like an exile in the midst of these barren and melancholy mountains, where, to preserve his existence, he was obliged to perform the functions of a schoolmaster. I earnestly wish that his condition may be ameliorated. The Antiquarian Society, established at Edinburgh,

would do well to employ the knowledge and activity of Patrick Fraſer in reſearches reſpecting the ancient ſtate of ſcience and literature in Scotland. He has the advantage of being perfectly maſter of the original language of his country, which has not the ſmalleſt relation to the Engliſh.

Patrick Fraſer begged that I would ſend him ſome French books which he wanted; and, on my return to Paris, I ſhall haſten to pay to him this ſmall teſtimony of my eſteem for his talents, and reſpect for his moral qualities *. “ I can only,” ſaid he, “ in return, “ give you my addreſs, and offer you my poor ſervices in this country.” I here with pleaſure tranſcribe this addreſs in Engliſh, that thoſe who may feel an intereſt in knowing this affable and amiable man may not be ignorant of the place of his reſidence. It was exactly as follows: “ *Patrick Fraſer, Schoolmaſter, of Glenorchy, by Inveraray, Scotland.*”

* I have ſent him ſuch books as I thought would be agreeable to him; but the diſtance and the difficulty of communication to this diſtant part of Scotland, have, doubtleſs, prevented me from hearing from him; it is even poſſible that he has neither received my letter, nor my packet.

We slept at Dalmally, and proceeded next morning to Tindrum ; the journey was only twelve miles, but we wished to arrive in time that we might have an opportunity of examining the lead ore which we were informed was to be seen in the neighbourhood of that place.

The valley of Glenlochy, through which we passed, is in some places very agreeable. It is skirted with hills which are covered with flocks of sheep ; but we found that the mountains closed as we advanced, and the soil became marshy and sterile. The turf with which it was covered, gave a very dismal hue to the face of the country, which excited in our minds a sensation of corresponding melancholy.

The hamlet of Tindrum consists of only a few houses which are almost all detached ; it stands upon a low marshy piece of ground : a humid and unwholesome vapour renders its situation very disagreeable.

The place where the lead ore is found is not far distant from the iron, but it is very elevated. It is necessary to form the galleries in a very high mountain of difficult access. They are cut through a grey micaceous schistus rock, which is intermixed with a

considerable quantity of white quartz: the vein of lead ore is found in a matrix of the latter substance. The ore is usually accompanied by pyrites or horn-stone, and it is sufficiently abundant. It is sometimes covered with fine crystals of calcareous spar. The galleries in general are in a very bad condition, and the works are very negligently managed.

When the pieces of ore are extracted they are broken with hammers, they are then washed to separate the ore from foreign substances, which, when thus prepared, is transported to a foundery situated in the valley at the bottom of the mountain: charcoal and turf are used in smelting it; but I do not know in what proportion, because the foundery was not worked at this time, on account of some reparations which were then making in the furnace. Besides, the English, as well as the Dutch, are very reserved in explaining their processes, even in the most simple arts, which they always exercise with a kind of mystery: It is not so in France; there the managers of the most interesting establishments, are in general very complaisant, and frankly communicate to a stranger all the information he can desire.

I observed

I observed under vast sheds considerable piles of peats, and near them a heap of pit-coal. From this, I presumed, that in using the peats, a mixture of a fourth or fifth part of coal is added. The latter article must be carefully husbanded, on account of the distance of the pits, and the dearness of land-carriage.

It would be desirable for the benefit of our manufactories in which wood begins to be scarce, that a similar mixture of peat and coal should be employed, where they can be procured. As I should have been happy to support my recommendation with an example, I begged of one of the superintendants of the works to inform me in what proportions the peat and coal were used; but he turned a deaf ear to my request, and changed the conversation to some other topic.

It is very easy, however, to make experiments upon the subject, and there is no doubt of their being attended with success; particularly if conducted by persons well acquainted with the quality of the peat and turf which are to be used.

It appears that the lead-mines of Tindrum have formerly been much more productive and valuable.

I left this place and proceeded to Killin, by a road as dismal as uniform in its appearance. I much doubt whether another such can be found. It is made upon a bottom of spongy turf, which permits the water to filtrate easily through its elastic and moving substance, without however becoming marshy, for carriages pass over it without any inconvenience.

But what renders it most insupportably tiresome is, that it extends in this state for several leagues, between two close mountains, covered with a black turf, on which there grow nothing but short heath and some yellowish mosses, that distil the water, drop by drop, on all sides.

The mind soon participates in the gloomy hue, and is more and more overcast with sadness, as the traveller advances; but on reaching the extremity of this kind of sombre gallery, the scene is suddenly changed, the horizon expands, and the fine valley of *Glen Dochart*, succeeded by that of *Straflan*, open to his view.

Here limpid and copious streams, teeming with fish, glide in serpentine meanders, through the smiling verdure, and form islets shaded

shaded with wide spreading trees. On every side appear neat rustic habitations, with numerous flocks of black cattle and sheep, and the young shepherds and shepherdesses who tend them make the air resound with their songs, and animate the delightful scene with their dances.

This day we rode twenty-four miles at our full ease, and reached Killin before night.

Killin, though called a town, is in fact nothing more than a hamlet, consisting of a few scattered houses at the extremity of Loch Tay. The inn is very plain in its appearance, but its accommodations are tolerably good, and the landlord is a very civil man. Over the chimney-piece of a small parlour hung several native birds, which himself had carefully stuffed with straw, among others a white wood-cock, which William Thornton purchased, as he also did some heath-cocks.

We were about sitting down to table, when I was surprized with hearing a stranger, who wished to speak with me, call me by my name: I soon perceived from his manner and his language that he was a Frenchman; his person also was somewhat known to me. I told him

*was the
same
man*

him that I thought I had seen him in Paris, but that I could not at the moment recollect who it was that I had the honour of addressing. "I am Bombelles," said he; "I travel like yourself, for pleasure and instruction. I am now on my way to *Port Patrick*, where I design to embark for Ireland." It was from one of our servants that he heard of my being in the inn, where he had just arrived himself in one of Lord Bredalbane's carriages, at whose house he had gone to spend a few days.

I had never had any intimacy with M. de Bombelles. But two Frenchmen who meet each other in the wilds of Scotland are not long in forming an acquaintance; and we had besides several common friends. From the course which M. de Bombelles pursued, as well as from a number of military and other charts which he had along with him, I judged that diplomacy and politics were more suitable to his taste than the natural sciences or the arts, and that he was probably charged with some particular mission, very foreign from the object of my studies. I ought, however, to do M. de Bombelles's talents and activity the justice to say, that he neglected
nothing

nothing which was in any degree interesting to his country. This I had an opportunity of judging from some ostensible parts of a well-written journal, which he communicated to me at the time, and in which I saw several articles relative to rural economy and commerce, and likewise a curious physical fact respecting a very extraordinary flux and reflux, which had been recently seen in Loch Tay. I had already heard it mentioned in the Duke of Argyle's, at Inveraray; and M. de Bombelles, during his stay at Lord Bredalbane's, which is close to the lake, received the best information that could be procured on the subject. I shall here insert the note which he gave me, as it served to direct my enquiries when I visited the place on the following day.

“ Between the hours of eight and nine in the
“ morning of the 12th of September (1784)
“ the water of the eastern part of Loch Tay
“ retreated to the distance of more than three
“ hundred feet from its ordinary limits, and
“ the whole of that space, in which it was
“ generally three feet deep, was left quite
“ dry. The water on leaving it, ebbed to-
“ wards the west, but met with a contrary
“ wave,

“ wave, when the violence of the shock
 “ raised both to the height of four feet, ac-
 “ companied with much foam. The waters
 “ thus rushing in opposite directions, formed
 “ by their junction one vast wave, which
 “ moved towards the south, still preserving
 “ a height of more than four feet above the
 “ level of the lake, and remained in that
 “ state nearly ten minutes. This extraordi-
 “ nary tide then began to subside gradually,
 “ and in about an hour and a half entirely
 “ disappeared. It is very singular, that during
 “ this phenomenon, the sky was perfectly
 “ serene, and the air calm, and that there
 “ was no perceptible motion at the opposite
 “ extremity of the lake. Two days after,
 “ the same appearance recurred; but one
 “ hour later, and not in so remarkable a de-
 “ gree.”—*Note extracted from the Journal*
of M. de Bombelles, 9th of October 1784.

M. de Bombelles * took the road to In-
 veraray; whilst I made a little longer stay at
 Killin, to procure as much information as pos-
 sible relative to the pearl-fishery of the river

* This is the person who was shortly after appointed
 Ambassador to Portugal.

Tay, which here falls into the lake, to which it gives name.

The master of the inn, who obligingly exerted himself respecting every thing that could gratify my curiosity, brought me two fishers, whose particular employment was searching for pearls.

They conducted us to the river which runs in a very pure stream upon a bottom of sand or pebbles, and they soon brought up several dozens of shells, from three and a half to four inches long, and a little more than two inches broad: their exterior colour was a deep brown, inclining a little to green. The upper shell was thick, and of a fine mother-of-pearl colour within, slightly tinged with rose colour. I regarded this species as belonging to the *ma pictorum* of Linæus, or at least, as very nearly resembling it.

The fishers, in consideration of a handsome reward, which we promised them, engaged to open these shells in our presence upon the bank. But they stipulated for the reservation of the pearls, if any should be found, that they might sell them to us at a separate price; and to this proposition we acceded.

Imagining

Imagining from this that we should put a higher value on those which might be found, while we were present ; these artful practitioners brought with them some pearls, which they dexterously introduced into several of the shells in opening them. They appeared to be well exercised in this petty sort of imposition, which, however, I detected in a manner that astonished and perplexed them, and that deserves to be mentioned, as it depended upon a memorable fact with regard to one of the causes which contribute to the formation of pearls.

I desired them to open the muscles before my fellow-travellers, whilst I went to amuse myself with fishing some of them ; but they were to inform me when they discovered any pearls. I was soon called and shewn a very fine pearl, perfectly round, and of a good colour. I looked at the shell and the pearl, and then told them, that the latter was not found in the muscle shewed me. The fishers assured me that it was, and appealed to the testimony of my companions, who confirmed their assertion. I assured the latter, however, that they were deceived, and begged them to watch more narrowly the next time.

time. I retired a few steps, and a minute or two after I heard one exclaim, we have found another. I went up, and on examining the muscle, I pronounced that the pearl had, for that time also, been slipped into the shell. The pearl was beautiful; but the price which they demanded for it was six times its value.

The fishers exhibited the utmost degree of astonishment; for, as I was at some distance from them, it was clear that I could not have observed their motions; my fellow-travellers who attentively watched them, were themselves deceived, or at most entertained only a vague suspicion; so well skilled were these men in an art which procured them a few additional shillings from travellers.

My art was so supernatural in their estimation, that they confessed the imposition, and frankly shewed us some other pearls which they had in reserve for the same purpose. They were very anxious to learn my secret, which would save them the pains of frequently opening a vast number of shells to no purpose, for they seldom found above one or two pearls in a week. But as they knew no other language than the Earse, and not even so much as a word of English, I could explain

myself only by signs and gestures; and, though my instructions were not very difficult, I doubt whether they were completely intelligible in a conversation of this sort.

My secret consisted merely in examining attentively the outside of the muscles, and when neither of the parts had any cavity or perforation, but presented a surface smooth and free from callosities, I could pronounce, without any apprehension of being deceived, that there was no pearl in such a shell. If, on the contrary, the shell was pierced with auger-worms, and indented by other worms of the same kind, there were always found pearls more or less valuable, or, at least the embryos of pearls.

This observation, which I have found invariably true hitherto, was the result of some enquiries in which I had been engaged a long time before, respecting the formation of that beautiful animal product. Bouffon introduces the information, which I communicated to him upon this subject, in his article upon pearls, page 125, vol. iv. of the *Natural History of Minerals*. At that time I discovered that the pearl fish is attacked by two classes of enemies. One is a very small auger-worm,

worm, which penetrates into the inside, near the edge of the valve, by working a longitudinal passage between the different laminæ that compose the cover. This small channel, on extending to an inch or an inch and a half in length, doubles back in a line parallel to the first, and separated from it by a very thin partition of shelly matter. These two parallel lines discover the direction of the worm in entering and returning; which is also very distinguishable on the surface by two small holes, close to the edge, and in general near the mouth of the shell.

The parallelism of the two passages may be demonstrated by introducing a pin into each orifice. At the inner extremity, however, there is a small circular portion, formed by the worm in turning round.

As these small channels or covert-ways are excavated in the part nearest the mother-of-pearl, or silvery internal coat, the pearly juice soon extravasates and produces protuberances in that direction. The cylindrical bodies thus formed may be considered as elongated pearls, adhering to the internal lining of the shell. When several worms of this kind penetrate near each other, and unite their labours, the

result is a sort of pearly wen, with irregular protuberances, in which the issues of the passages which they have formed are easily distinguishable.

Another sea-worm, much larger, and of the family of the multivalvous shell-fish, attacks the pearl shells in a much more ingenious manner. This worm is a pholas of the species of sea dates. I have in my cabinet an oyster from the coast of Guinea, pierced by one of these pholades, which are still as they were found in the heel of the oyster. The shells of these singular pholades are hinged in the form of a crooked bill. The small hole which they bore resembles the figure of a pear; and pearls of this shape are sometimes found, which were in high estimation among the ancients, and are at present very valuable in the East-Indies: I shall give a more particular description of this rare species of pholades in another work.

There are undoubtedly several other kinds of worms which pierce the pearl shell, and form cavities more or less round, in which the juice consolidates into pearls.

It is this observation which has no doubt been made by others besides me, that probably
first

first suggested to some persons concerned in the pearl fishery, the trick of making artificial perforations in the shells, and thus forcing them to produce pearls. At London I saw some shells brought from China, which must have undergone this operation : for the artificial hole was filled up with a piece of brass wire, rivetted on the outside of the shell like the head of a nail, and the part of the wire which pierced the interior shining coat, was covered with a well shaped pearl, which seemed as if soldered to its extremity. It is probable, that, with the Chinese, who have been so long skilled in the arts, and whose astonishing and multiplied industry teaches us, that we are but a comparatively new people, this is not a discovery of very modern date.

Broussonet, with whom I had a conversation upon this subject in London, at the house of Sir Joseph Banks, told me, that a person had assured him, that there is still another method of obtaining pearls. The shell on which the experiment is to be made, must be opened with the greatest care in order to prevent the animal from being injured. A small

portion of the inner surface is then scraped off, and in its room is inserted a spherical piece of mother of-pearl about the size of a very small grain of lead-shot. This globule serves as a nucleus to the pearly juice, which concretes around it, and at a certain distance of time, produces a fine pearl. He said, that experiments of this nature had been tried in Finland, and repeated also in other countries.

From these observations it may be inferred that the production of pearls depends, perhaps, much more upon an external and accidental cause, than upon a natural superabundance or extravasation of the juice of which they are formed.

There are very excellent pearls found in the river shells of Loch Tay, if we may judge from some which the fishers of Killin offered to sell us, at more than double the price of those which are in current sale. But these fine pearls are far from numerous; on the contrary, a very great number are found, which the jewellers reject, but which, though they may be not well calculated to form decorations for the ladies, are yet very interesting

ing for the cabinet of the Naturalist, since they afford a confirmation of the theory which I have now mentioned. The greater part of these pearls have little or no lustre; some are round, oval, or elongated and cylindrical; others are hemispherical and resemble a button; several oblong ones have a contraction towards the middle which gives them the appearance of two joined together; others also are somewhat conical; and all are of a pretty large size, and of a pale red or brown colour. The end of the pearl touching the tegument of the shell which forms what is called mother-of-pearl, is so deeply impregnated with the shining substance, that it exhibits a singular contrast with the surrounding brown colour of the other parts, and seems to derive additional splendour from it. This coating is of an orient bordering on rose colour, which is extremely agreeable to the eye, and is therefore heightened in its effect by the contrast.

Pearls of this kind are so seldom met with, that they might at first be taken for oculated agates prepared for being set,

or rather for *buffonites*, particularly those which have no mother-of-pearl. Their texture is very hard, and yields with great difficulty to the file.

The auger-worm, which occasions the formation of the pearls of Loch Tay, pierces the whole thickness of the shell, which is of considerable density and of a fallow brown colour; and as the shelly juice oozes out from all parts of the orifice which the worm has formed, it necessarily results that the pearl must participate in the quality and colour of the substance of the shell, from the exterior layer to that which lines and embellishes its inner surface.

Hence originate those rude but singular gems above-mentioned, which have only a thin coating of mother-of-pearl upon one side. There are, however, some instances in which the pearl is pure and brilliant throughout; proceeding, probably, from an extravasation of the interior coating only; which may have been occasioned by another kind of auger-worm attacking the shell solely in the direction of that coating. It is the province of those Naturalists, whose attention

tention it has more particularly engaged, to investigate more profoundly this very interesting subject, our knowledge of which must yet be considered as nothing more than a rude outline.

CHAPTER X.

Kenmore.—Extraordinary Flux and Reflux of Loch Tay.

We now took leave of the pearl fishers and our landlord, who obligingly gave us all the information in his power, and proceeded on our way to Kenmore, along the left bank of the Tay which is skirted on both sides by granitic mountains, that confine the view within a very narrow compass. The foot of the mountains is tolerably well cultivated; but the only produce is oats, which are not reaped till about the middle of October. These oats are very tall; they were only beginning to be cut down at the time I passed; I measured several stalks, and found the shortest to be four feet high, and the longest five feet six inches*.

The

* I do not entirely agree with Knox, who visited this place sometime after me, when he says, "that its banks on both sides are fruitful, populous, and finely diversified by the windings of the lake, and the various appearances of the mountains." The views upon both sides

The lake is about fourteen miles long, and about a mile of mean breadth. I had no certain information of its depth*. It abounds in fish, and its waters are soft and clear.

The mountains which are nearest the lake, and enclose it on all sides, are composed of a schistus micaceous rock, intermixed with felt spar and quartzose matter; the latter is most abundant. In this rock I found a few garnets, of a bad configuration and coarse texture.

On reaching the southern extremity of Loch Tay, we found on a very agreeable spot a commodious inn, several private habitations, a new-built church, and a bridge thrown over a small river which issues from the lake; the whole is surrounded with trees, which enliven this fine little landscape. The name of the place is Kenmore.

Here the traveller begins to perceive that he approaches the open country, and is soon to emerge from the barren mountains of the

sides are too confined, and exhibit only the same dreary aspect, and a few scattered patches of oats, present only the image of an ungrateful soil.

* The same author, speaking of the depth of the lake, says, "that it varies from fifteen to a hundred fathoms;" this appears to me very extraordinary.

north of Scotland. The air which he inhales, the cultivated face of the soil, the encreasing number of inhabitants, every thing conveys the intelligence; and this first gradation of change fills his soul with a sentiment of mild delight, which I cannot better express, than by comparing it to that which we feel on the return of spring, though at this time it was the end of autumn. But it might be said, that all was wintry, wild, dreary and sterile in the region which I had traversed.

My first care, on arriving at Kenmore, was to procure the most exact accounts respecting the flux and reflux of the lake, which happened on the 12th of the preceding September; as it was near this that the phenomenon first took place, and it was here, therefore, that it could have been observed with most advantage.

The master of the inn to whom I applied for information, and who understood English, transported with the reputation which that event had conferred on the place of his residence, conceived that I had come from France, for the express purpose of seeing a country, which was, in his opinion, so justly deserving of celebrity. He, accordingly,
gave

gave me the most cordial reception, for which I feel pleasure in this opportunity of expressing my grateful acknowledgment.

“ I cannot myself,” said he, “ have the
“ pleasure of explaining how, what you wish
“ to be informed of, happened, because I
“ was absent from home, on the first day of
“ the lake’s motion. But I can direct you
“ to two persons who saw, and attended to,
“ the whole of its progress, and who will
“ shew on the spot how it proceeded. One
“ of them, in particular, who is a lad of some
“ acuteness, has carefully observed all the
“ facts ; and you will have reason to be satis-
“ fied with what he may tell you. You may,
“ however, examine both ; I shall go and
“ order them to accompany you, and to an-
“ swer all your enquiries ; for they are both
“ my servants.”

The one was called James Allan, the other John M’Kenzie. The latter was the younger of the two ; but he seemed to possess a greater portion of intelligence, and a spirit of observation more rational, and less disposed to the admission of the marvellous than his comrade.

M’Kenzie

M'Kenzie told me, that at nine of the morning of the 12th of September, the sky being serene and the air calm, a peasant who had gone to wash his hands in the part of the lake where the river issues, observed the water leaving the bank in a very perceptible manner, which obliged him to advance a few paces farther; but it still continued to retreat from him. This appearance gave him so much surprize, that he hastened to inform his neighbours of it; one of whom then told him, that, at sun-rise, having heard a noise similar to that of a sudden blast of wind, he went to the window, when, to his no small astonishment, he perceived the water receding from its banks, as if acted on by the impulse of a violent hurricane; but finding the air perfectly calm, his astonishment rose to the highest degree.

M'Kenzie having told me that he had these accounts from the peasant, I requested to see the latter. He was immediately sent for, but he had previously set out for a village six miles off. Having, therefore, had no opportunity of conversing with him myself, the details which I am to communicate, cannot be delivered as positive facts. Peasants being in general strongly inclined to the

marvellous, the noise, which, according to his account, preceded the ebbing of the waters, appeared to me somewhat apocryphal. M^rKenzie entertained the same opinion.

The latter, continuing his relation, said that he was not informed of this extraordinary motion of the lake until ten of the morning on which it first appeared. He instantly repaired to the brink of the lake, where he remained more than an hour and a half, observing the facts as they occurred with the most minute attention. During this period, he plainly saw the water ebb and flow ten times successively; and the same alternate motion continued for the whole of that day.

He communicated to me all these circumstances on the edge of the lake, and on the same spot upon which he stood when making his observations. He pointed out a large stone pretty far in the water, as the limit of its retreat.

As this part of the lake was little more than three feet in depth, I caused the space between the stone and the water's edge to be carefully measured, and found it one hundred and fifty French feet. But John M^rKenzie did

did not omit to inform me, that when the phenomenon happened, the water was not so high upon the bank by eight feet. To prove this, he pointed to a stake which he had driven into the ground at the level at which it then stood, and which was about eight feet below its present margin. The exact measurement, therefore, of the space abandoned by the water, was one hundred and fifty-two feet. From this, it should seem that the account which M. de Bombelles received at Lord Bredalbane's, stating this space at three hundred feet, requires to be corrected. It ought, indeed, to be observed, that as M'Kenzie was not on the spot until an hour after the water began to move, it is not improbable that the first impulse, which he did not see, might have been much stronger, than those which succeeded it. But as there is no proof to support this supposition, whilst the fact which fell under M'Kenzie's observation is ascertained by precise measurement, it is more adviseable to adopt his account.

The lake exhibited the same phenomenon on the following day, and likewise on the third day, but not in so frequent and regular a manner.

No body observed its appearances in the night; nothing, therefore, is known of what happened during that time.

M^cKenzie said, that during the ebb, the water receded from the bank without any violent or sudden agitation, but with the most gentle motion, until it reached the large stone, from which it returned to its former verge in the same slow and gradual manner.

The inhabitants of Kenmore, whom I had access to consult, all agree with M^cKenzie in the following facts:

1st. The motions of the lake during the fourth day, happened only at very distant intervals. 2dly. On the fifth, sixth and seventh days, there was no ebb of the waters. 3dly. On the eighth, the motion appeared for a few hours only; and this was the case during two whole weeks, with intervals of two or three days, entirely motionless. 4thly. The motion abated gradually, and the lake resumed its former stillness. 5thly. During the whole of this time, there was no violent wind, nor the slightest shock of earthquake.

These are the facts which are most deserving of credit, and I conceive it not improper to introduce them here, for the purpose of dispelling those additions of the marvellous, with which the English papers did not fail to embellish them. Having myself carefully collected the preceding accounts on the spot, they may be safely confided in. This is not a suitable place for entering into an examination of the causes which might have occasioned this wonderful flux and reflux in a lake where such a phenomenon had never occurred before. Similar phenomena have, indeed, taken place in other lakes. But we have not as yet a sufficient number of facts, and those which are already known have not been collected by persons sufficiently exercised in the difficult art of observation, to enable us to form any satisfactory speculations upon the subject.

We had scarcely left Kenmore on our way to Dunkeld, when we were agreeably surprized to find ourselves on a road bordered with fine Scottish and American pines, and other beautiful evergreens, kept in good order,
disposed

disposed with taste, and diffusing over the scene an attractive and enlivening appearance, which announced the vicinity of some great habitation.

About a mile farther, we came to the verge of a vast park, decorated with plantations of various kinds in the midst of verdant lawns, and divided through its whole length by the river Tay, over which are thrown two or three bridges of different constructions. Numerous herds of deer feed in this delightful place; sheep, fine looking beeves, and horses of various breeds, give the whole an air of abundance, usefulness, and taste, which display at once the enlarged mind and high fortune of the proprietor. A vast pile of building, partly in the gothic and partly in the modern style, closed this magnificent prospect. It is the residence of the Earl of Bre-dalbane.

I had heard so much praise of the character of this nobleman, whose chief occupation is to spread industry and happiness around him, that I was extremely sorry I had not procured a letter of introduction to him, with which the Duke of Argyle would have certainly obliged me, had I requested

it. But it did not form part of my original plan to pass through Tindrum or Kenmore; on the contrary, it was my intention to return by Inveraray; and it was not until my second arrival at Dalmailly, that I resolved to change the order of my journey, with the view of obtaining authentic accounts respecting the ebb and flow of Loch Tay. I regret the loss of this opportunity of acquiring a knowledge of the extensive improvements in agriculture and rural economy, conducted with so much success by the Earl of Bradelbane, and of becoming acquainted with a man who enjoys so excellent a reputation, and is so useful to his country.

We dined at a very good and commodious inn, about a mile from Dunkeld, opposite to that agreeable little town, and built on eminence surrounded with woods and rocks. A vast ruinous gothic church gives Dunkeld a very picturesque appearance.

We reached Perth a little late in the evening, by a road extremely rugged and fatiguing.

CHAPTER XI.

Perth, its Harbour and Manufactures.—Mr. M^cComie, Professor of Mathematics; Mr. M^cGreggor, Professor of the French Language at the Academy.—Volcanic Mountain of Kinnoul.—The Agates found upon it.

THE small city of Perth stands in a very agreeable situation on the river Tay, which the tide enters to a considerable distance, and renders navigable for small vessels. It is in a pretty flourishing condition, and contains a population of about twelve thousand souls.

The stone bridge over the Tay was constructed by the same person who built that of Blackfriars, at London. It is very well executed, but is rather narrow for its length.

William Thornton had an acquaintance at Perth, of the name of M^cComie, who was professor of Mathematics in the college, which bears here the title of academy. We paid him a visit, and such was his goodness and complaisance, that he was constantly with us during our stay at Perth, where we re-

mained nearly a week. We derived the most useful services from him, as well as from one of his colleagues, Mr. M'Gregor, professor of the French Language, who had received his first education at Paris, and who was kind enough also to favour us with his company, and to conduct us to several manufactories.

Before the reformation took place in England and Scotland, the town of Perth, where the catholic worship reigned in all its splendor, contained some considerable religious foundations, besides a number of churches. Of these, the greater part have since been laid in ruins, or converted into churches for the use of the presbyterians. In several of the streets are seen some fine gothic facades, which once belonged to cathedrals, chapter-houses, monasteries, and nunneries. These remains of monuments, consecrated to a worship which formerly flourished so vigorously in the three kingdoms, announce that religions, as well as governments, have their periods of instability and revolution, which incessantly succeed each other at intervals of longer or shorter extent, but which, when the impulse is once given, no human power is able

able to arrest: So true is it, that in morals, as well as in physics, there is nothing durable in this world.

Machines for carding and spinning cotton, had been introduced at Perth only a little before our arrival there. We saw the first of them at the manufactory of an individual who had caused them to be constructed at Manchester. He found it impossible, however, to convey them out of that town but during the night; so jealous are the manufacturers of Manchester of this happy invention of Arkwright, which has given such extensive celebrity and immense advantages to its commerce.

The most considerable manufactures of Perth are fine linen, thread, and flax; and some very excellent articles are produced in this line. Here I saw a loom for weaving very large bed sheets, in one piece, by means of a shuttle fixed on small rollers. A pair of these sheets, made of very fine linen, costs from a hundred and fifty to a hundred and sixty livres of French money.

I purchased at a table-cloth manufactory a dozen small napkins and a breakfast-cloth. They were of an excellent quality, and cost

me four Louis-d'or. I was happy to have an opportunity of carrying them to France by way of models.

I was also shewn, with an air of mystery, at the house of a rich manufacturer of fine linen, an instrument as ingenious as useful for ascertaining the fineness of texture with the greatest precision.

It consists of a kind of small microscope of a very simple construction, which, instead of an object glass, has a round hole, about three lines or a little more in diameter. The glass or lens corresponds to that circular aperture at the distance of the focus. The instrument is placed upon the cloth, the threads of which are so magnified by the lens, that the observer can easily count how many are contained within the space of the hole. It is evident that the greater the number, the finer is the fabric of the stuff. It likewise shews whether the thread be too flat or otherwise. The artisan who is acquainted with the mode of using the instrument, if he should present a piece of cloth which he charges as fine, has no admissible excuse when it is found to be of a coarser quality, by making himself count the number of threads with this instrument,

The

The weavers, therefore, by its means, have become accustomed to the greatest precision.

The wholesale dealers equally employ it in their purchases. They have, therefore, good reason not to wish that every one should be acquainted with it; because, with its assistance, they can transact their business on a surer footing than those who are obliged to depend upon the naked eye. I brought one of these instruments to France, where they were soon multiplied.

VOLCANIC MOUNTAIN OF KINNOUL, IN THE
VICINITY OF PERTH.

The desire of examining the hill of Kinnoul, was what principally determined me to pass through the town of Perth, from which it was only two miles and a quarter distant. I was therefore able to make several visits to it during the three days that I staid at Perth.

The lavas and agates which I collected there were very numerous. I spent half a day and a whole night in sorting and ticketing them. The number of the finest specimens were doubled, and in some cases tripled, for
the

the purpose of distributing them among my friends. The whole filled a large chest*.

Scarcely had I crossed the bridge of Perth, where I observed some lavas in strata, unformed masses, and ill-shaped prisms. These different currents proceeded from several eminences forming part of the mountain of Kinnoul, the basis of which, occupied a very considerable extent. Pursuing the road along the Tay, with the mountain on my left, for two miles and a quarter, I came to a very steep and almost perpendicular rock, nearly six hundred feet high, and on the very edge of the road. The traveller ought to make directly for this place, because it is the richest in agates and other productions worth collecting.

Though the mountain appears extremely steep in that quarter, one may, notwithstand-

* This chest, together with my whole collection of the products of Scotland and the Hebrides, which was in the best order, was lost on a sand bank, near Dunkirk. The vessel which carried them from Leith sunk, and only the crew were saved. By this unfortunate accident, I have lost all the fruits of a toilsome journey, except a small box of the most remarkable articles, which I brought along with me in my carriage. But I had carefully copied into one book the lists of all my collections.

ing, clamber up to its summit, with a little precaution. But, for this purpose, it is necessary to have a stout stick, armed with an iron spike; nor must the adventurer hesitate to scale the craggy rocks. This labour, however, may be saved by approaching in the direction just mentioned, where the forms and different dispositions of the strata are in a manner plainly legible in its side, which is completely exposed to view. The following is a note of the different articles which I collected:—

VOLCANIC MINERALOGY OF KINNOUL.

1. Black basalt, of a fine grain and homogeneous texture, forming an extensive current, adhering to a stream of black porphyric lava, with a basis of trapp, and so disposed as to leave no doubt that the basaltic lava in this state derives its origin from porphyric lava. The latter has preserved its crystals of felt spar, which are small but well defined, whilst the basaltic lava has lost its crystals, which are amalgamated and blended with the very basis of the porphyry, either by a sudden and violent, or a long continued combustion.

On

On examining the basaltic lava with a microscope, small crystals are still seen in some parts of it, which are not entirely amalgamated with the lava; their course may be pretty well traced, even from their exterior appearance. Small splinters of the porphyric lava, on being urged with the blow-pipe, afford an enamel of a beautiful black colour; and the basaltic lava yields a vitreous matter or enamel in every respect similar.

2. The same basaltic lava, divided into large prisms, very irregular, though well defined. These prisms present nothing in the fracture but an homogeneous lava, without the least crystal of felt spar.

3. Basaltic lava of a delicate green colour, very hard, sometimes sonorous on being struck, disposed in a large current. This greenish lava transversely intersects a current of black compact lava. Its greenish colour is owing to a particular modification of iron. I was well acquainted with the earth of Verona, which has its origin from a very remarkable decomposition of a volcanic product; but I had never before seen a stratum of compact, hard, and sonorous basaltic lava, which had that greenish appearance.

4. A qua-

4. A quadrangular prism, well defined, in excellent preservation, and of an agreeable delicate green colour. I found it among the wreck of a considerable mass of lava of the same colour, which had fallen from the top of the precipice.

5. The same greenish basaltic lava in a tabular form.

None of the green coloured lavas were magnetic.

6. Compact porphyric lava, of a black ground, studded with a number of crystals of white felt spar, which have not undergone any alteration. This lava is strongly magnetic.

7. A quadrangular prism of blackish porphyric lava, magnetic, with a knob of flesh-coloured agate on one of its faces.

8. Porphyric lava, mouldering into gravel, and forming extensive beds. I have no doubt that if this gravelly lava, which is not very hard, were reduced to powder by the aid of stamping-mills, like those used in Holland, for pounding the lavas or *tras* in the environs of Andernach, it would afford a puzzolano, an excellent cement, of great and indeed indispensable use for building in water.

9. Compact

9. Compact porphyric lava, with a ground of deep iron grey inclining to violet, intermixed with particles of green steatites, some knobs of variegated agate, and a few globules of white calcareous spar, disposed in a large current:

10. Compact porphyric lava; magnetic; with knobs of white, and sometimes flesh-coloured calcareous spar, and globules of the finest green-coloured steatites.

11. Reddish-coloured compact, porphyric lava, forming a layer between two currents of basaltic lava of a delicate green colour, and adhering to them:

12. Black porphyric lava; magnetic, intersected with belts of red porphyric lava, resembling the red porphyry of the ancients. This lava, in which both the lavas are united, is very remarkable.

13. A geode of agate, internally studded with shining crystals of violet-coloured quartz, in the form of hexagonal pyramids, incrustated with compact porphyric lava, of a dark brown colour, a little inclining to violet, with some knobs of white calcareous spar, and several globules of agate and green steatites.

14. A geode

14. A geode of bright red agate, having in its interior a brilliant crystallization, of white quartz of the greatest purity. This geode is found in a black porphyric lava, which is magnetic.

15. Eye-spotted agate of a delicate rose colour, incrustated with dark brown compact porphyric lava, intermixed with globules of green steatites. This specimen is very agreeable to the eye.

16. Red striped agate, inclosed in black porphyric lava, strongly magnetic.

17. Semi-transparent agate of the most vivid red, in a porphyric lava inclining to violet, with knobs of white calcareous spar, and globules of a delicate green coloured steatites.

18. A geode with a crust of calcedonious blueish-oculated agate, internally studded with crystals of sparkling quartz. In the interior of the crystals are seen particles of black lava taken up during the process of crystallization; from which it is beyond doubt that the formation of the geodes was posterior to that of the lava.

19. A lump of white calcareous spar, sparkling, disposed in rhomboidal laminæ,
amidst

amidst a slight envelope of steatites of a fine green colour. The whole is incrustated in a black compact lava, magnetic, and more nearly resembling basalt than porphyry.

20. A lump of green steatites, enveloped with a slight covering of white calcareous spar, in a porphyric lava, of a brown colour, inclining to violet. This fragment is the reverse of the preceding.

Such are the most interesting articles which I collected on the mountain of Kinnoul. I have no doubt that a longer stay would have considerably augmented my collection. But others may perfect what I give here as a sketch only. I had neither direction nor guide to regulate my researches on that mountain. It was not even so much as conjectured to be volcanic at Perth. All that was known there respecting it was, that some Edinburgh lapidaries visited it from time to time in quest of agates, which they polished and turned to an object of a petty traffic.

CHAPTER XII.

*St. Andrews University.—Library.—Old Churches.—
Natural History.*

WE set out from Perth for St. Andrews by way of the small town of Cupar in Fife, where we changed horses. We accomplished this journey in seven hours. All the hills on the road are formed of blackish gravelly lava and basaltes.

We had letters of recommendation to Mr. George Hill, professor of Greek, and Mr. Charles Wilson, professor of Hebrew, in the university of St. Andrews. We waited upon these gentlemen on the following day, and both of them exerted themselves with the greatest eagerness to oblige us, and to procure us such information as could gratify our taste or curiosity.

UNIVERSITY.

This university recommends itself to the notice of the traveller by the name of the celebrated Buchanan, who was professor of philosophy there.

There were formerly * two colleges which are now consolidated into one. There was a professor of the Latin language in each of the colleges; one of the professorships is now suppressed, and a chair of Natural History substituted in its stead. The Greek professorship is also of recent erection.

The revenues of the professors, who are thirteen in number, amount together to fifteen hundred pounds sterling, which gives a fixed salary of nearly three thousand French livres for each place.

The names of the professors are as follows :

- Joseph M'Cormick, Principal ;
- James Flint, professor of Medicine ;
- John Cook, Moral Philosophy ;
- George Forrest, Natural Philosophy ;
- Nicolas Vilant, Mathematics ;
- John Hunter, the Latin language ;
- George Hill, the Greek language ;
- W. Barron, Logic ;
- Hugh Cleghorn, Civil History ;

* There were formerly three colleges, namely, St. Salvador's, St. Leonard's, and St. Mary's; the two former of which have been united. *Translat.*

Dr. J. Gillespie, }
 Dr. Henry Spence, } Divinity ;
 William Brown, Church History ;
 Ch. Wilson, the Hebrew language.

LIBRARY.

The college library is open to the public for seven months in the year, during which they are at liberty to enter it every day at stated hours. There are likewise some other days of the year upon which it is opened. The revenues appropriated to the maintenance of this establishment arise from some tythes belonging to an old ecclesiastical foundation which were seized upon by the crown and afterwards assigned to this library. Their produce does not amount to more than thirty-six pounds sterling, a sum nowise adequate to the most urgent current expences. But some casual emoluments from the admission of graduates increases the total revenue of the library to the sum of an hundred and fifty pounds sterling. The number of books is not more than eleven or twelve thousand. They are almost all modern, with the exception of several bibles and some devotional books, among which there is nothing extraordinary.

I saw nothing worthy of notice but a manuscript which was somewhat interesting from its excellent preservation; it was a Saint Augustin of the thirteenth century, written on vellum. There is also in the same apartment, as an object of curiosity, an Egyptian mummy in a very bad state, without even its ancient case, and appearing to me to be one of those which the Arabians join together of patches and fragments for the purpose of selling them to such as are unable to detect the imposition.

ANCIENT CATHOLIC CHURCHES.

This city, during the reign of the catholic religion, possessed the archiepiscopal pre-eminence. The famous Cardinal Beaton was one of its archbishops. Vast and superb churches announced the opulence of their founders, and the generous sacrifices of a people powerfully attached to their mode of worship. The ruins of all these monuments, of which there are still some fine remains, give the city an aspect of antiquity which forms a singular contrast with the simplicity, the modesty, and I had almost said, the poverty of the greater part of its present habitations.

The

The church of the second college, as it is called, which is still standing, appears to be very ancient. The steeple is a high tower, of a quadrangular form, and of a good and solid construction. The church is spacious, and in the gothic stile of building; it is consecrated to the Presbyterian worship, and contains the tomb, now partly in ruins, of an archbishop who founded the university of this city. This monument is built in the wall with stone of a very common kind, and exhibits nothing remarkable. On an occasion of making some repairs, there was discovered within it * a church mace, of gilt copper, four feet long. This ensign of dignity, which I was permitted to examine, is charged with gothic ornaments finely executed, but in a bad taste. It is covered with small steeples, and niches occupied by monks with cowls on their heads and in an attitude of prayer. The angles are filled with winged angels placed in pulpits and in a preaching

* The monument here referred to is the tomb of bishop Kennedy, within which were found six maces; three of them were distributed among the other Scotch universities, and the remaining three are preserved in that of St. Andrews. Translator.

posture. Gothic medallions are suspended all round it by way of ornament; and the whole is surmounted with a figure of Christ on foot, and standing upright in a pyramidal niche. This work, to judge by its stile, may be from two hundred and sixty to three hundred years old. It can only serve to give us an idea of the arts, and of the bad taste of the time.

We likewise visited another church, which, from an inscription on one of its doors, appeared to have been built in the year 1112. In this church we saw a grand mausoleum of white marble, representing an archbishop, as large as life, kneeling, and an angel placing a martyr's crown on his head. A spacious basso relievo, at the foot of this monument, exhibits the same archbishop attacked by some men who assassinate him. A young girl in tears, detained by some other persons, near a coach, which they have stopped, makes the most violent struggle to go to the assistance of the archbishop, in whom she seems to have the most tender interest. Despair is strongly marked in her gestures and her figure.

This scene instantly brought to my remembrance the disastrous event which happened

pened to Cardinal Beaton *, who was killed on the 29th of May, 1546, by Norman Lesly, eldest son of the earl of Rothes, accompanied with fifteen conspirators. Beaton, was doubtless a man of great talents, but at the same time ambitious, insolent, a cruel enemy of the Reformers, and had the abominable inhumanity to cause the unfortunate George Wishart to be burnt alive.

I was astonished at seeing a monument of this sort permitted to remain in a church now applied to the use of the reformed religion, which holds Beaton in such abhorrence. But my astonishment soon ceased on learning that this monument, the sculpture of which was executed in Holland, had been erected by the relations of the archbishop a long time after his death, and that they had appropriated a certain yearly sum for keeping it in repair. It thence results, that in order to obtain this sum, the mausoleum must be allowed to exist as a work that has received their complete

* The author's conjecture has been in this instance erroneous. This monument is a representation of the death of archbishop Sharp, who, in revenge for his cruel persecutions of their sect, was assassinated by nine presbyterian enthusiasts, on the 3d of May, 1669, on Magus Moor, in the vicinity of St. Andrews.—Translator.

sanction. But it also happens that the monument receives no repairs, though it begins to be greatly in want of them; and the money is very probably applied to the use of the church. No part of it, however, will be demolished as long as the yearly allowance shall continue to be paid: an evident proof that every where, and in every case, gold has the power of reconciling the most opposite opinions.

It would appear that the relations of cardinal Beaton had no wish to conceal that the holy archbishop was a father, since his daughter is represented in tears, with her arms extended towards her father, and forcibly held by two of the conspirators, at the moment when the others accomplish the murder. But the solemn Robertson informs us, in his history of Scotland, that the prelate openly acknowledged this daughter. “ Cardinal Beaton,” says he, “ with the same
“ public pomp, which is due to a legitimate
“ child, celebrated the marriage of his natu-
“ ral daughter with the earl of Crawford’s
“ son;” and in a note he says, “ the marriage
“ articles, subscribed with his own hand, in
“ which he calls her *my daughter*, are
“ still

“ still extant,” vol. i. p. 88, of the 8vo. edition.

The facade of the church of St. Leonard, though gothic, possesses an elegance and grandeur which are very impressive. This was the chapel of the college which has been dissolved. Johnson in his *Journey to the Western Islands of Scotland*, complains, that he was always by some civil excuse hindered from entering it, and that in fact it had been converted into a green-house. I was not more fortunate than Johnson. But I found that the area in front and on one side of the chapel was turned into a kitchen garden; and from what I saw myself, it is not improbable that the house of God has become the house of the gardener, and that it affords a shelter to his carrots and his turnips during the winter.

By way of compensation, however, I viewed at my ease, the ruins of the cathedral and the adjoining palace, which formed the residence of the archbishop. Both these vast edifices, stood on an elevated situation, which commands a full prospect of the sea. The palace was, indeed, so close to it, that the waves

waves have undermined a part of its foundations.

The cathedral, as far as can be estimated from its remains, without comprising some adjoining chapels, a kind of cloister, and other subordinate buildings around it, was three hundred and fifteen feet long, and sixty feet broad. Nothing can be more remarkable and interesting than this ruin. Not only does it bear the impression of time and neglect, but it also discovers the strongest marks of a religious and fanatical zeal which rose to the most abominable phrenzy.

Towers of the most solid construction overthrown; columns broken in pieces; the remains of magnificent gothic windows suspended as it were in the air; pyramidal steeples, more than a hundred feet high, of stones so solidly laid, that it being difficult to demolish them entirely, they were pierced through and through and indented in every direction; winding stair-cases which seem to stand without any foundation; altars heaped upon altars under the remaining vaults; fragments of friezes, capitals, entablatures, scattered among sepulchral tablets, and mutilated tombs; the wreck of cloisters, chapels, porticos;

ticos ; and some columns still maintaining an erect posture in the midst of such wide-spread havock : such is a rapid sketch of the picture presented by these extensive ruins, which strike the man, who beholds them for the first time, with dread and astonishment.

The traveller is at first lost in conjecturing whether a terrible earthquake, a long siege, or an invasion of barbarians, was the cause of so much devastation. A quadrangular tower an hundred feet high, well constructed, and in perfect preservation, rises single and unimpaired by the side of these vast ruins. It is difficult to account for this contrast.

At the view of this scene one is irresistibly led into a train of melancholy reflexions, on the maladies of the mind, which degenerate into madness and mortify our reason. Are these frenzies, these deliriums of the intellect, like corporeal diseases, inseparable from the condition of humanity ? If the affirmative be true, mankind in the gross, are the most ferocious, and at the same time the most mischievous of animals, and one might be tempted to renounce this life at once, were it not for a few chosen individuals who encourage one to support it,

I was

I was assured that the quadrangular tower which stands entire in the midst of these extensive ruins, has existed for upwards of eleven hundred years. It was probably a light-house in former times : at present it is a memorial only of the feudal rights which the king has over the city ; and on this account it is preserved with great care. I mounted by an inside stair-case to the highest balcony ; whence there is a view of a wide extent of country.

Blaauve has inserted in his large atlas very exact engravings of the principal monuments of St. Andrews, as they appeared at an epoch when they existed in all their splendour. Mr. Cleghorn assured me, that the materials which had been furnished to Blaauve were very correct.

These same monuments, in their ruinous state, have been carefully engraved in four plates, by Pouncy, from drawings of striking effect, by J. Oliphant. I saw a collection of them at the house of the college librarian, who would not agree to sell them for any money. He carefully preserved them in frames of glass ; he said they were now very scarce, and hardly to be met with for sale.

Before

Before a crowd of fanatics, inflamed to fury by the homicidal sermons of the gloomy Knox, carried the torch of destruction to men and things, through that unfortunate city, it was a place of considerable eminence; letters and the sciences flourished within its walls, and rich and numerous establishments were dedicated to public instruction.

The blow which it received from the hand of barbarians, suddenly changed its appearance. It requires ages to build, but an instant only to destroy. This city, notwithstanding the length of time which has elapsed since the date of its misfortunes, still appears as if it had been ravaged by the pestilence. Its streets are large and commodious; but are every where covered with grass. All is sadness and silence. Its inhabitants, ignorant of commerce and the arts, present only the image of indolence and languor. This state of inactivity has its correspondent effects on the population; for though the place is still capable of lodging from fourteen to fifteen thousand people, it does not contain at most above three thousand.

I therefore join in the opinion of Johnson, who, indignant at the desolate condition in
which

which the English government suffers establishments consecrated to instruction to remain, exclaims, "It is surely not without just reproach that a nation, of which the commerce is hourly extending, and the wealth increasing, denies any participation of its prosperity to its literary societies; and while its merchants or its nobles are raising palaces, suffers its universities to moulder into dust."

SOME OBJECTS OF NATURAL HISTORY IN THE
ENVIRONS OF ST. ANDREWS.

The rock on which the castle of this city stood, is in many places at least one hundred feet above the level of the sea; and the place itself, though built on a plain, has the same height above the water.

This huge precipice consists of beds of white quartzose free-stone, crossed at intervals with small horizontal layers of black argillaceous schistus, soft, a little shining, and deriving its colour from impalpable particles of pit-coal.

In the part where the free-stone comes in contact with the schistus, the first is always
divided

divided into small strata which easily separate, and are themselves somewhat tinged with coaly particles. There also may be distinguished some small bits of wood converted into coal.

To these alternate beds of free-stone, coloured with coal, and of black argillaceous schistus, succeed thick banks of white free-stone, interrupted in their turn with thin layers of black schistus and coloured free-stone; but here the coaly particles are more copious.

In short, under the deepest beds of free-stone in the part where the sea has uncovered them, are seen strata of coal almost pure and fit for burning.

Industry is here in such a state of stagnation that no person has attempted, by following these remarkable indications, to sink a pit, or even so much as to sound for a mine of coals which presents itself under such favourable appearances, and which from its situation on the very edge of the sea, would form a source of riches to the country.

I expressed my astonishment on the subject to several intelligent persons, who framed excuses for this negligence, by saying, that three or four miles inland there were some mines
of

of coal worked, which were sufficient for the supply of the country.

The sea, notwithstanding the barriers opposed to it by the bold bank of free-stone on which St. Andrews is built, has gained upon the land so perceptibly, that, as I was assured on the strongest authority, within less than two hundred and fifty years, it had undermined and worn the rock with such activity as to destroy almost the whole of the site of the ancient archiepiscopal castle. A road which led from the castle to a mole still existing is entirely carried away, so that the water completely intercepts the passage in a direct line; and it should be remarked, that the space destroyed between the castle and the head of the mole is about five hundred toises. Thus has the sea in so short a period wasted away a very considerable extent and thickness of solid rock; and at low water nothing is to be seen but rubbish and ruins.

From this encroachment, however, we are not to form general conclusions respecting the advancing or receding of the waters of the ocean. It is a circumstance purely local that has occasioned this accidental invasion, which

I regard

I regard as completely unconnected with any general theory.

By an attentive examination of the spot, I discovered some of the causes of this great degradation.

And first, the facility which there has always been of drawing large masses of free-stone from this craggy tract on the reflux of the tide, is one cause, which we will not be apt to reject, if we consider that the immense quantity of materials employed in constructing the cathedral, several large churches and convents, the castle and the houses of the city, has been taken out of this place. I myself saw a great number of workmen employed in cutting out pretty large stones for some repairs which were making on the mole.

On the other hand, the position of the beds, the various substances of which they are composed, and their unequal degrees of hardness, tend to accelerate their degradation. The coast is so steep that the deep excavation which extends from the castle to the mole-head, bears the name of *the Precipice*.

The masses of free-stone being placed on beds of argillaceous schistus, which is soft,

pyritous and susceptible of being dissolved by water, are liable to slide from their place and to lose their balance. The upper beds give a violent concussion to the others in their fall; and this permanent cause of destruction, joined to the action of frost, the atmosphere, and the changes of wet and dryness, must at length occasion extensive havock. But what is very remarkable and worthy of attention, is, that all these fragments, which are subject to the powerful action of the waves and currents of the sea, being dashed against each other or rolled upon the hard and rugged bottom, are soon reduced to powder; thence there result considerable deposits of sand which the sea throws up in banks on the beach, and which the winds form into small hills. Thus the waves which tear asunder the free-stone and carry it off the coast in huge solid pieces, throw it back on a neighbouring part in the form of sand, which may in time acquire consistence and form good soil.

It is easy to perceive the identity of this sand, which is intermixed with some coal and clayey matter, with the free-stone, whence it originated. This newly formed tract of sand occupies a space of four miles long, and half
a mile

a mile broad *. Such is probably the origin of the greater part of sands, which may in a course of time, and with the aid of certain circumstances, be a second time formed into free-stone.

I ought to have stated, before dismissing the subject of *the Precipice*, that the inferior strata, which support a mass more than eighty feet thick of schistus and free-stone, are themselves very remarkable, being composed of very hard free-stone, and containing pebbles of different forms and sizes, and of a reddish colour in their crust or exterior surface. On breaking these pebbles, they are easily discovered to consist of black basaltic lava, still retaining their magnetic quality, though their crust has undergone alteration.

As the rounded lavas thus confined are seen in great number in the lower beds of free-stone, and as it is probable that those which have been invaded by the sea contained similar ones, it is beyond doubt that these pebbles existed prior to the formation of the

* In these sands are found several living shell-fish. The large razor fish or *sollen*, the *cardium senatum* of Linnæus, or *bucarde dentè* of Bruguiere, described in his article on the Natural History of Worms, page 227, of the French Encyclopædia, and the *cardium ciliare* of Linnæus, or *bucarde frange* of Bruguiere, page 218 of the same book, are very common.

free-stone; that is to say, that they are the products of volcanos, and that they have been rounded by the sea before the sandy substances became united and consolidated into a mass of free-stone.

There is no room for any doubt or hesitation respecting the quality of the substances. The basaltic pebbles are so many traces of discovery and useful indications to those who endeavour to peruse the grand volume of nature. But this is not a fit place to expatiate further upon the subject. I shall only say, that if accidental circumstances of this kind cannot determine to a very high degree the time which has elapsed since the formation of these lavas and the free-stone, in which they are inclosed, they induce us at least to believe that both the one and the other must have taken place at a very remote epoch.

CHAPTER XIII.

*Departure from St. Andrews.—Largo.—Leven.—
Dysart—Kirkaldy.—Kinghorn.—Leith.—Return
to Edinburgh.*

SCARCELY had we left St. Andrews and entered on the road to Largo, when we found the fields scattered over with very large blocks of basalt. The farmers have inclosed their lands with them, and thus afforded to naturalists an easy opportunity of examining them.

They are of a fine black colour, great hardness, and a pure and homogeneous substance. I attentively examined a great number of the stones which were but recently broken, to try whether any extraneous body had entered into their internal composition. But I found their texture in general very pure, and found in a single lump only a few small crystals of black schorl. The schorls are in general very rarely met with in the volcanic products of Scotland and the Hebrides.

After a ride of three miles, we reached a pretty high flat, entirely covered with blocks

of basaltcs, which scemed to have been scattered about at random, and which very much incommode cultivation, as it would not be an easy matter to displace them. This elevated plain is of vast extent, and yields oats and rye; though the vegetable mould cannot be much more than five or six inches in depth.

This cultivated soil repofes on blackish argillaceous schiftus, difpofed in strata. Banks of free-ftone, like thofe of St. Andrews, fucceed the schiftus, and then follow at a confiderable depth beds of excellent coal. The number of pits which are feen along the road, announce that the collieries are worked with great activity. I counted more than fifteen coal-pits within the fpace of a mile.

Largo is only a fmall village; we ftopped at it to bait our horfes. Banks of free-ftone of great thicknefs are expofed to view on all fides; they are over-topped with enormous pieces of basaltcs. I had not before feen in the volcanic parts of Scotland, detached mafles of basaltcs of fo great a bulk. This compact lava is very pure and found, fo that it may be formed into flabs or even ftatues.

Leven and Dyfart are pretty large villages, which lie on the road by the fea-fide. In
their

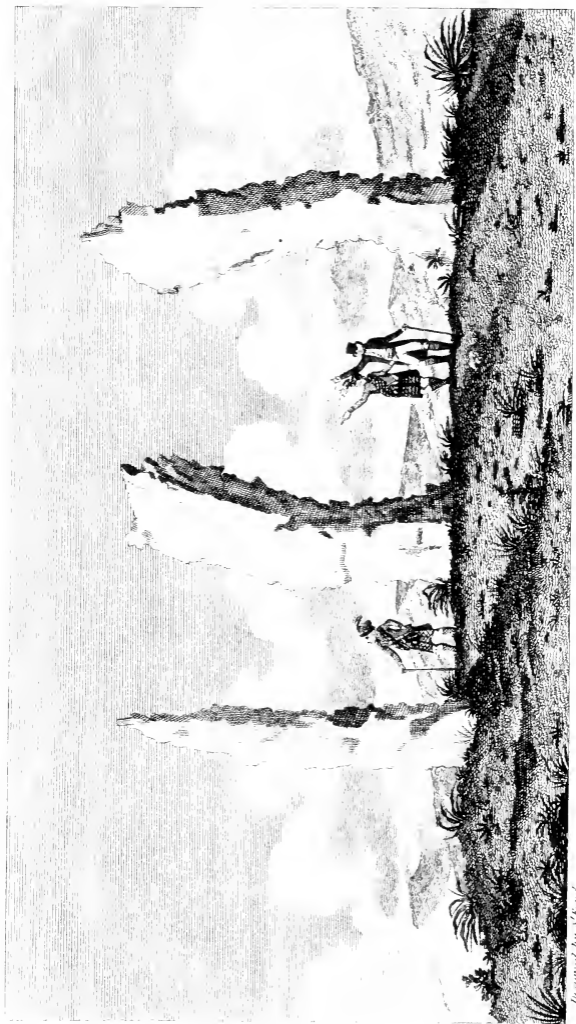
their environs are several collieries, which employ a great number of persons. They are carried on upon a greater scale than those in the neighbourhood of St. Andrews, and conducted with greater intelligence and more extensive means. Those of the inhabitants who are not employed in the collieries apply themselves to fishing, in which they are very skilful.

Kirkaldy is a considerable burgh. The whole of its environs is strewn with blocks of basalt; and this scattered train of lavas extends from Largo to beyond Kirkaldy, along a space of more than twenty-four miles in length, and eight miles in breadth. What terrible convulsion was it that transported these basalts, and thus rolled and dispersed them over so vast a surface?

I had already seen in Vivarais, a state of things in every respect similar; but upon a plain much higher above the coast of Maire. The masses of basalt are there equally large and not less numerous. They may be traced to the small town of Pradelle, through an extent of more than twenty miles long, and four or five miles broad. This resemblance ought not to escape consideration.

From Kirkaldy we pursued our road to Kinghorn, a burgh situated on the water's edge. The blocks of basaltic seemed to multiply as we approached the vicinity of Kinghorn; but very near the town we found the basaltic in imbedded masses, that is, disposed in large currents as it was discharged by the volcanos.

Between Kirkaldy and Kinghorn, and at a little distance from the road, are three upright rude stones, which have been erected as a memorial of some event, which it is now impossible to trace. These monuments consist of a rough-grained yellowish free-stone. The highest is about fifteen feet above ground, and must have sunk at least five feet below the surface; it is of considerable thickness: the other two are not so large. They appear to be of very high antiquity. Have they been erected by the Romans? This is not very probable; for, that warlike people, at the time they over-ran England and attempted to subjugate the Caledonians, who gave them the most vigorous resistance, were too familiar with the arts, to raise such rustic monuments which have no inscription, nor any mark of workmanship. It is not im-
probable



J. King sculp.

Designed by N. P. East

probable that these rude columns were consecrated to the superstition of the ancient Druids, or that they were erected by a warlike people little skilled in the arts, in remembrance of some important events which have not descended to our knowledge.

Monuments of this kind are very numerous in Scotland and the Hebrides. The natives entertain various and doubtful opinions upon the subject. Some call them the altars, temples, or monuments of the Druids; while others, regarding them as of greater antiquity, say, that they were erected in the time of Fingal; that is, at an epoch indeterminate, and perhaps fabulous; and another class maintain that they are Roman tombs, and contain the ashes of illustrious warriors, who fell in their combats with the Caledonians. I shall leave the developement of this enigma to the Edinburgh Antiquarian Society, with merely calling to their recollection that similar monuments are found in Lower Brittany, and that the language of its inhabitants has a strong resemblance to that of the Hebridians, and I entertain the hope that they will throw some
light

light upon a subject so worthy of being investigated.

There are twenty-seven miles from St. Andrews to Kinghorn. We were obliged to use the same horses for the whole way; there being no place where we could change them. Kinghorn is situated on the edge of the sea; and at this place is the ferry for crossing the Frith of Forth to Leith, which is within a very short distance of Edinburgh.

The beach of Kinghorn, and, indeed, of the whole coast, is bordered with layers of lava; some of them in the form of basalt, in an extended mass, or in prisms, and others in a gravelly and decomposed state. These several streams of volcanic matter repose immediately on an argillaceous schistus under which are frequently found beds of coals.

In the lavas of Kinghorn I found some zeolite, and a great deal of calcareous spar, adhering to decomposed lavas.

The passage from Kinghorn to the port of Leith is seven miles. We performed it in two hours, in one of the ferry-boats, which are tolerably commodious, and set out regularly at certain hours. In the middle of the
Frith

Frith is a very rapid current, which is observable at all times; for, where it runs, the sea is always agitated during the greatest calms.

The harbour of Leith, at the time we entered it, was filled with vessels, English, Scotch, American, &c. I saw several vessels belonging to Glasgow and Leith, which were done over with bitumen or tar, extracted from pit-coal at the manufactures of Lord Dundonald, who has introduced the making and using of this tar on a great scale in that country. The vessels coated with it appeared of a fine shining black, which distinguished them from the others. Several ship-masters whom I spoke to on the subject, and some of whom had come from the West Indies, assured me that their vessels which had been covered with this tar, arrived in the best possible condition, and were completely free from worm-holes. Navigation is doubtless much indebted to Lord Dundonald, who persevered with the most undeviating constancy, in bringing to perfection this useful product of coal, and also in bringing it into general use, a thing not easily effected upon every occasion when it is necessary to change ancient customs.

We reached the harbour of Leith about six in the afternoon of the 16th of October. William Thornton, who proceeded directly forward from Perth, without accompanying us to St. Andrews, waited for us at Edinburgh. We went from Leith to Edinburgh in less than half an hour, along a superb road.

Thornton had procured us lodgings at a private house, and at a reasonable rate; for we had determined not to go to Dun's Hotel, where such exactions had been practised on us during our first stay in that city. Our new lodgings, for ourselves and our three domestics, cost only eighty-four livres a week.

As we intended to spend a fortnight at Edinburgh, we made an arrangement with the master of a tavern who served us with provisions, dressed in the French style, adding a few Scotch dishes, which were agreeable to us. This man is a native of Bourdeaux, and was brought from France by a Scotch Lord, with whom he resided a long time. He afterwards married and settled in Edinburgh. He is a very good landlord and full of attention and complaisance. I would recommend his house to such naturalists and
others

others as intend to visit Edinburgh. They have only to ask for the master of the French tavern, which is very well known.

At this table, we formed an acquaintance with Baron Hartfield, whose ordinary residence is at Berlin. He is a man of estimation and talent, and travelled for the purposes of information. He had pushed his researches as far as the Hebrides, and visited the isle of Staffa; in his passage to which, he told us, he encountered the most imminent danger.

CHAPTER XIV.

Edinburgh.—*The University.*—*Learned Societies.*—*College of Physicians.*—*College of Surgeons.*—*Cabinet of Natural History.*—*Robertson.*—*Smith.*—*Black.*—*Cullen, &c.*

EDINBURGH is situated in $55^{\circ} 57'$ of north latitude, and $3^{\circ} 14'$ of west longitude, from the meridian of Greenwich. The distance of this city from London is, by the east road, through Berwick, 388 miles; by the middle road, through Wooler, 378 miles; and by the west road, through Carlisle, 396 miles.

The sciences, literature, natural history, and the arts, being the principal objects of my journey; what I shall have to say of Edinburgh will chiefly relate to them: topographical descriptions of this city are to be found in a number of other works.

THE UNIVERSITY.

The following is the establishment of the University of Edinburgh, with the names of those who were at this time its professors.

The

The King, is the Protector ;
 Doctor Robertson, Principal ;
 Robert Hamilton and A. Hunter, pro-
 fessors of Theology ;
 Robert Cumming, Church History ;
 Doctor J. Robertson, Hebrew ;
 A. Dalziel, Greek ;
 D. Stewart, Mathematics ;
 A. Fergusson, Moral Philosophy ;
 J. Robison, Natural Philosophy ;
 A. Tytler and J. Pringle, Civil History ;
 William Wallace, Scottish Law ;
 Robert Dick, Civil Law ;
 A. M'Conochie, the Law of Nature and
 Nations ;
 Hugh Blair, Rhetoric ;
 John Hope, Botany ;
 Francis Home, Materia Medica ;
 William Cullen, Practice of Medicine ;
 James Gregory, Theory of Medicine ;
 Joseph Black, Chymistry ;
 Alexander Monro, Anatomy ;
 Alexander Hamilton, Midwifery ;
 John Walker, Natural History.

ROYAL SOCIETY.

The Duke of Buccleugh is President of the
 Royal Society ;
 Henry Dundas, Vice-President.

The Presidents of the Physical and Literary
Classes, &c. are

Baron Gordon ;
 Lord Elliock ;
 General H. Campbel ;
 Adam Smith ;
 John M'Laurin ;
 Doctor Adam Ferguffon ;
 Doctor Monro ;
 Doctor Hope ;
 Doctor Black ;
 Doctor Hutton ;
 Professor Dugald Stewart ;
 John Playfair ;
 Professor J. Robertson, Secretary.

ANTIQUARIAN SOCIETY—COLLEGE OF PHYSICIANS—COLLEGE OF SURGEONS—MEDICAL SOCIETY.

There is a society lately established in this city for the purpose of collecting and preserving every thing that relates to Scottish antiquities. The Earl of Bute is the President, the Earl of Buchan is First Vice-President, and Lord Gardenstone is Second Vice-President.

There

There are besides a college of physicians, a college of surgeons, and a medical society.

There is also a popular establishment called the *High School of the City*, which announces that here nothing connected with public instruction is neglected. This school is divided into several classes, the masters of which are employed in teaching the elements of the Latin language to youth.

These institutions shew that the arts, the sciences, and the Belles-lettres are cultivated and esteemed in this city, which is honoured by the distinguished characters it has produced in every branch of learning. The celebrity of the professors is so great that vast numbers of foreigners come from every quarter of the world to study at the university, and the money they spend is a considerable advantage to the town.

Edinburgh, both from its situation and its tranquillity, is a proper place for the sciences. It is not disturbed by the tumult of parliamentary discussions, the bustle of an overgrown commerce, nor the distracting amusements of London. From time immemorial the muses have chosen to reside on the top of a hill near a solitary fountain.

Mentioning the muses, brings to my recollection an inscription in their honour, which is placed above one of the gates of the university. It is rather extraordinary :

MUSIS ET CHRISTO.

TO THE MUSES AND CHRIST.

This association may to some appear profane, but it is only a little conceit by which the author probably intended to announce that both letters and religion are taught in this building. A minister of the presbyterian religion, who accompanied me on my visit to the university, was very eager to justify this singular inscription, which he thought remarkably ingenious: He asked my opinion of it.

I replied to him with a smile, that I believed the inscription might be interpreted in a very favourable manner, if the meaning which I was inclined to give it, were adopted.

It is proper, said I, that the muses should preside over an establishment which elevates man to the true dignity of his nature by instructing him. They may be here considered

as supplicating reason to proscribe the two chairs of *Theology* and *Church History*; and of those of *Logic*, *Moral Philosophy*, *Natural Philosophy*, *the Laws of Nature and Nations*, *Civil Law*, and *Scotch Law*, to make only one, which may be called the Professorship of the *Laws of Nature and Nations*.

On the other hand, the greatest of moralists, placed by the side of the muses, ought to remind the inhabitants of these countries that true knowledge is the enemy of fanaticism and intolerance; that those who have shed so much of the blood of Scotland in theological disputes, were strangers to morality as well as to the spirit of humanity, which belongs to the religion they pretended to profess*; and that those who overthrew and destroyed the ancient monuments of the nation, because they were connected with a religion which they did not approve, were real barbarians, whose ferocity was only equalled by their ignorance.

* Such as Knox, who entitled an account of the assassination of Cardinal Beaton, "The Joyous Narration, &c." Such as that sanguinary priest, Beaton himself, who burnt human beings alive, because they were what he called heretics.

CABINET OF NATURAL HISTORY.

The cabinet of natural history, in the university, is under the direction of Doctor Howard. The examination of this collection gave me great pleasure, and interested me much more than that of the British Museum, in London, though it was far less considerable; but, the objects which compose it, are in a more methodical order, particularly the stones and minerals: Besides, the managers of this museum have very properly taken care to collect all the productions of Scotland they have been able to procure.

Thus this museum is as instructive and interesting to the natives of Scotland, as it is agreeable to foreigners, who are always much more desirous of seeing collections of the natural and local riches of a country, than the multitude of disconnected and inconsequential objects constantly brought from India, and which are repeated over and over in every cabinet.

Some reforms are, however, wanting to the museum of the university. The place allotted for it ought to be larger and decorated

rated with more taste. The classification should also be extended to the other parts as well as the minerals. These improvements will certainly one day take place; that they have not been made already can only be ascribed to the remaining influence of that erroneous mode of education which in all ancient universities has occasioned natural science to be too much neglected. It is only lately that a professorship in this important branch of instruction was established in the college of Edinburgh; but as a taste for this delightful study will, doubtless, increase very rapidly in a city where the other sciences have so long fixed their residence, it is to be hoped that this cabinet will soon be placed in a building more worthy of a nation which is capable of furnishing it with the richest specimens. I therefore invite Doctor Howard, who possesses much knowledge, and who loves his country, to solicit from the government the grant of a building suitable to the collection he superintends, with grounds sufficiently extensive to join the botanical garden to the cabinet of natural history.

Lithology, and the study of minerals, have as yet made little progress in Scotland. There

are therefore few collections of these objects. Doctor James Hutton is, perhaps, the only individual in Edinburgh who has placed in his cabinet some minerals and a number of agates chiefly found in Scotland; but I observed, that he had not been sufficiently careful in collecting the different matrices which contained them. I therefore experienced much more pleasure in conversing with this modest philosopher than in examining his collection, which presented me with nothing new, since I had seen and studied upon a large scale and in the places where nature had deposited them, almost all the specimens of his collection.

Doctor Hutton was at this time busily employed in writing a work on the theory of the earth*.

* This work, which contains rather general views of the subject than a body of observations, appeared in 1785, in the translations of the Royal Society of Edinburgh, for that year, under the following title: "Theory of the Earth, or an Investigation of the Laws observable in the composition, dissolution, and restoration of land upon the globe, by James Hutton, M.D. F.R.S.E. and Member of the Royal Academy of Agriculture at Paris*."

This work has since been considerably enlarged; in 1795, it was published in 2 vols. 8vo. under this title, *Theory of the Earth, with Proofs and Illustrations, in four parts.*—Translator.

During

During my residence at Edinburgh I visited, as often as possible, the celebrated chymist, Dr. Black, who in 1761 gave the first analysis of calcareous earth, in which he demonstrated the existence of the aerial acid, commonly called fixed air. This illustrious philosopher honoured me with the most polite and kind attention.

After dining with him one day he shewed me two pieces of petrified, or more properly, *quartzified* wood; for, upon examining them with a microscope, it appeared that the quartzose juice had penetrated through all their parts, and given them such a degree of hardness that they struck fire with steel. This wood had been sent to Doctor Black from Ireland. Their colour was brown, and nearly the same as that of the wood of Mahaleb when it is worked.

This wood penetrated by quartz in the manner I have described, possesses the following singular property: If small fragments are broken off with a hammer and thrown on a piece of burning coal, in about a minute an agreeable smell is perceived resembling that which proceeds from the wood of aloes.

It is doubtleſs aſtoniſhing that the eſſential odoriferous oil of this wood ſhould have been preſerved during the long time neceſſary for transforming the wood into a ſtate of quartzoſe petrification; but ſuppoſing that ſome particular circumſtances had accelerated the petrification, it is ſtill very extraordinary that this wood, which bears all the marks of a vegetable foreign to theſe countries, ſhould be found on the banks of Lough Neigh in Ireland.

Doctör Black was pleaſed to give me the two ſpecimens he had of this curious wood, informing me at the ſame time, that he did not collect objects of this kind, and that he ſhould be very happy if I would place them in my cabinet.

This learned chymiſt alſo ſhewed me the mechanism of a portable furnace of his own invention, which will prove of great utility in the arts, and in chymiſtry. It is ſo contrived that the heat may not only be gradually increaſed at pleaſure, but carried to ſuch a high degree as to reduce iron nails to a ſtate of fuſion. This plan may be extended and perhaps even applied to high furnaces in which iron ore is ſmelted.

I ſhall

I shall describe the manner in which the interior of this furnace is formed: for in it the merit of the invention chiefly consists. It is made of thick iron plates, and differs very little in its structure from the ordinary stove. Its form is cylindrical, and a cover is fitted to the top, which is occasionally taken off to supply the stove with fuel.

The mode by which the air enters is through holes of different sizes formed in a ring which turns round, so as to give facility to the admission of the air in the quantity wanted: but I repeat it, the construction is not the great merit of the invention, for I have seen, both in France and Germany, many furnaces, the mechanism of which is nearly the same with this, as well with respect to the mode of graduating the admission of the air as that of raising the heat to the degree required.

It is the manner in which the interior is covered, and the substances used for fuel that do honour to the profound knowledge of Doctor Black.

A quantity of the best charcoal is reduced to a fine powder, and passed through a sieve; some fine clay is also reduced to powder: the
colour

colour of the latter is of no importance; the least fusible and the most refractible, is the best.

The clay is soaked in water in a tray, in the proportion of a quart to three quarts of charcoal dust. This mixture is well kneaded and amalgamated, and the paste which is formed, is left in a state of moisture. If the clay be very glutinous, the proportion of charcoal is encreased. The inside of the furnace is then plastered over with a quantity of this composition sufficient to form a thin bed, which is smoothed with the hand and rendered every where as equal as possible. This first plaster is made about a line thick, and allowed to dry slowly, without the operation of fire, that it may not be exposed to the danger of cracking. When this first plaster has acquired a sufficient degree of hardness, a second bed is formed; which being allowed to dry, a third is laid over it in the same manner. Thus different beds are formed in succession above each other until the plaster has acquired the thickness of about an inch.

Great attention must be paid to drying the beds slowly and forming them into one body, to which the fire will afterwards give great consistence.

It is well known to experimental philosophers and chymists, that charcoal is one of the worst conductors of heat. Founders, blacksmiths, and other workmen, have long been acquainted with this fact, transmitted from father to son, and have used charcoal dust to great advantage in many of their operations without thinking of the manner in which it acted. The useful effects it produces are, however, result less from its combustible quality than that of its being a bad conductor of heat; or rather that it retains the heat, concentrates it, and prevents it from escaping and losing itself on the surrounding points.

I have been induced to enter into these details, because I am of opinion that what has been said will not prove inuseful to the arts, and that those who love and cultivate this particular branch of economy, may make successful applications of Doctor Black's invention. These motives will excuse the length of this article.

I was several times in company with Doctor John Aiken, a private professor of Anatomy, in Edinburgh. He shewed me a number of ingenious machines of his invention;

tion; and, among others, one for facilitating difficult births, the use of which was not at all dangerous, and in the invention of which he had followed nature as closely as possible.

This instrument may be compared to a long slender hand. It is introduced quite open and without any kind of compression into the womb of the mother. This artificial hand, which is covered with a fine soft skin, is placed against the child upon which it is made to collapse to the degree of contraction wanted, by the means of a screw in the handle, which acts with a gradual and gentle motion. The accoucheur then using his right hand, aided by this point of support, may deliver a woman in difficult labour with much more facility than in any other manner. Doctor Aikin assured me, that he had experienced the greatest success in the use of this instrument.

The knowledge of whatever may contribute to relieve suffering humanity, ought to be as widely diffused as possible. I therefore begged Doctor Aiken to allow me to take a model of this instrument to France. He readily consented, and procured an excellent workman, who in a few days executed an instru-

instrument perfectly similar. I packed it up with the intention of bringing it to Paris, and submitting it to the examination of our most celebrated practitioners in midwifery.

Doctor Aiken also shewed me a lock which he had contrived for great guns, by which they might be easily made to perform a double discharge; but while I admired his inventive genius, I could not avoid telling him, that I was far better pleased to see so skilful a physician employed in healing than in destroying, and that I loved his invention for bringing men into the world, much more than I did that for sending them out of it.

Some days after, I had the pleasure of dining with Doctor Cullen, who, perhaps, is the oldest, and certainly is one of the most celebrated physicians of Europe. The science of medicine owes him great obligations, and the city of Edinburgh ought never to forget that his reputation has attracted within its walls a multitude of foreigners who come from all quarters of the world to receive instruction in that learned school, in the creation of which he has had a principal share.

Doctor

Doctor Cullen lived in the midst of a numerous family, who formed around him an amiable circle of friends. Good nature and amenity reigned in his house. This learned physician merited all these advantages, for he possessed himself manners and a disposition of the most agreeable kind. I found that he very much resembled Bouffon in his behaviour and mode of living, which rendered him doubly interesting to me. His table was plentifully served, but without any luxury. I was however astonished to find a profusion of punch brought in between the desert and tea.

This regimen, in the house of a physician of such great reputation, appeared to me very extraordinary. He observed my surprize, and said to me with a smile, that this beverage was not only suited to his age, but that a long experience had convinced him that when taken with moderation it was very salutary for the inhabitants of Scotland, particularly during the latter part of the autumnal season, and in winter, because the cold humidity which then prevails in this climate often checks perspiration. *Punch*, he remarked, *is a warm stimulant, which operates wonderfully in*
main

maintaining that necessary secretion, or in restoring it to its equilibrium.

This humid and penetrating atmosphere had, for some time, affected me in a very disagreeable manner notwithstanding the active life which I led. I am persuaded, that it is one of the causes of that sombre melancholy to which the people of England are so frequently liable. In vain I took exercise, and endeavoured to employ my time in a manner perfectly suitable to my taste; I found that the mists, the frequent rains, the daily winds, passing suddenly from heat to cold, a sharpness in the air, which cannot be so easily described as it is felt; the absence of the sun, which fogs or clouds almost constantly eclipse at this season, plunged me into an involuntary melancholy, which I should not have been able to support long.

To raise my spirits, my friends often informed me that the sun was about to appear; but in my bad humour, I was more than once tempted to reply to them, as Caraccioli, the viceroy of Sicily did to an English nobleman, who desired him to look at that luminary in London: "Your English sun, my lord, very much resembles our Sicilian moon."

This

This disagreeable feeling was not to be endured, and I resolved to adopt the regimen of Doctor Cullen. Each day after dinner I took a glass of punch, composed of rum, sugar, lemon juice, a little nutmeg and boiling water, which soon restored me to my usual condition*.

I saw several other men distinguished in various branches of literature, among whom were Doctor Anderson, Sir John Dalrymple, and the celebrated historian Doctor William Robertson, with whom I enjoyed many agreeable conversations.

That venerable philosopher, Adam Smith, was one of those whom I visited most frequently. He received me on every occasion in the kindest manner, and studied to procure for me every information and amusement that Edinburgh could afford.

Smith had travelled in France, and resided for some time in Paris. His collection of books was numerous and excellently chosen: The best French authors occupied a distin-

* That excellent physician, Doctor Cullen, is no more. He was regretted by his friends, and mourned by the city of Edinburgh which erected a funeral monument to his memory: He was worthy of that honour, and that city was worthy of him.

guished place in his library, for he was very fond of our language.

Though advanced in years he still possessed a fine figure. The animation of his countenance was striking, when he spoke of Voltaire, whom he had known and whose memory he revered, "Reason," said he, one day, as he shewed me a fine bust of this author, "owes him incalculable obligations; the ridicule and the sarcasms which he so plentifully bestowed upon fanatics and hypocrites of all sects, have enabled the understandings of men to bear the light of truth, and prepared them for those enquiries to which every intelligent mind ought to aspire. He has done much more for the benefit of mankind than those grave philosophers whose books are read by a few only; the writings of Voltaire are made for all and read by all."

On another occasion he observed to me, "I cannot pardon the emperor Joseph II. who pretended to travel as a philosopher, for passing Ferney without paying homage to the historian of the Czar Peter I. From this circumstance I concluded that Joseph was but a man of inferior mind."

One evening while I was at tea with him he spoke of Rousseau with a kind of religious respect, "Voltaire fought to correct the vices
"and the follies of mankind by laughing at
"them, and sometimes by treating them
"with severity; Rousseau conducts the reader to reason and truth, by the attraction
"of sentiment, and the force of conviction.
"His *social compact* will one day avenge all
"the persecutions he experienced."

He asked me one day, whether I loved music? I answered, that it formed one of my chief delights whenever I was so fortunate as to hear it well executed. "I am very glad of it," said he, "I shall put you to a proof which will
"be very interesting for me; for I shall take
"you to hear a kind of music of which it is
"impossible you can have formed any idea,
"and it will afford me great pleasure to know
"the impression it makes upon you."

Next morning at nine o'clock, Smith came to my lodgings. At ten he conducted me to a spacious concert-room, plainly but neatly decorated, in which I found a numerous audience. I saw, however, neither orchestra, musicians, nor instruments. A large space was left void in the middle of the room, and
fur-

ſurrounded with benches which were occupied by gentlemen only. Ladies and gentlemen were diſperſed over the room upon other ſeats. Adam Smith informed me, that the gentlemen who ſat in the middle were the judges of the muſical competition which was about to take place; they were almoſt all, he obſerved, inhabitants of the iſles or highlands of Scotland and might therefore be regarded as the natural judges of the conteſt. They were to decree a prize to him who ſhould beſt execute a favourite piece of Highland Muſic. The ſame air was therefore to be played by all the competitors.

In about half an hour, a folding door opened at the bottom of the room, and to my great ſurpriſe, I ſaw a Highlander advance, playing upon the bagpipe. He was dreſſed in the ancient Roman habit of his country. He walked up and down the empty ſpace with rapid ſteps and a martial air, blowing his noiſy inſtrument, the diſcordant ſounds of which were ſufficient to rend the ear. The tune was a kind of ſonata, divided into three parts. Smith requeſted me to pay my whole attention to the muſic, and to explain to him afterwards the impreſſion it made upon me.

But I confess that at first I could not distinguish either air or design in the music. I was only struck with the piper marching continually backward and forward with great rapidity, and still presenting the same warlike countenance. He made incredible efforts with his body and his fingers to bring into play the different reeds of his instrument, which emitted sounds that were to me almost insupportable.

He received however great applause. A second musician succeeded, who was also left alone in the intermediate area, which he traversed with the same rapidity as the former. His countenance was no less dignified and martial than that of his predecessor. He appeared to excel the first competitor; and clapping of hands and cries of *bravo* resounded on every side. During the third part of the air I observed that tears flowed from the eyes of a number of the audience.

Having listened with much attention to eight pipers in succession, I at last began to discover that the first part of the air was a warlike march: the second seemed to describe a sanguinary action; the musician endeavouring by a rapid succession of loud and discordant

dant sounds to represent the clashing of arms, the shrieks of the wounded, and all the horrors of a field of battle. In this part, the performer appeared convulsed; his pantomimical gestures resembled those of a man engaged in combat. His arms, his hands, his head, his legs, were all in motion. He called forth all the various sounds of his instrument at the same moment, and this singular disorder made a great impression upon the company.

With a rapid transition the piper passed to the third part, which was in a kind of andante. His convulsive motions suddenly ceased. His countenance assumed an air of deep sorrow. The sounds of his instrument were plaintive, languid and melancholy. They were lamentations for the slain—the wailings of their friends who carried them from the field of battle. This was the part which drew tears from the eyes of the beautiful Scotch ladies.

The whole of this entertainment was so extraordinary, and the impression which the sounds of this wild instrument seemed to make upon the greater part of the audience was so very different from that which they made upon me, that I could not avoid conceiving that the lively emotions exhibited by the per-

sons around me were not occasioned by the musical effect of the air itself, but by an association of ideas which connected the discordant sounds of the bagpipe with some historical facts thus brought forcibly to the recollection of the audience *. There are scarcely any traces of a written language among the Highlanders, either in manuscripts or upon their monuments; it may therefore be presumed that they have had recourse to songs to transmit to their posterity the history of the events in which they were deeply interested. Accustomed to hear these airs from their infancy, and taught by their parents to connect them with transactions which are to them of the greatest importance: they never hear them without being strongly affected. It is not therefore astonishing that they are so passion-

* Johnson makes the following observation on an air which he heard at the seat of Sir Alexander M'Donald in the isle of Sky: "As we sat at Sir Alexander's table, we were entertained, according to the ancient usage of the North, with the melody of the bagpipe. Every thing in those countries has its history. As the bagpiper was playing, an elderly gentleman informed us, that in some remote time, the M'Donalds of Glengary having been injured, or offended by the inhabitants of Culloden, and resolving to have justice or vengeance, came to Culloden on a Sunday, where finding their enemies at worship, they shut them up in the church, which they set on fire; and this, said he, is the tune which the piper played while they were burning."

ately

ately fond of this kind of music. They have however another kind which is better adapted to the voice, and constructed more according to the rules of art, which they use in their dances, and their amorous and convivial songs: But they regard this music as inferior to the former.

The same air was played by each competitor, of whom there was a considerable number. There appeared to be no preference given but to talents, and the most disinterested applause was bestowed on those who excelled in their art. I confess I did not admire any of them. To me they were all equally disagreeable. The music and the instrument constantly reminded me of a bear's dance.

The competition was followed by a lively and animated dance, formed by a part of the pipers while the others played suitable airs, which possessed expression and character; but the union of so many bagpipes produced a most hideous noise.

The competitors afterwards formed themselves into a line two deep, and marched in that order to the castle of Edinburgh, which is built upon a volcanic rock. There they

played an air, which was a kind of ballad, in honour of the unfortunate Mary Queen of Scots, for whom the Highlanders still preserve a warm attachment and religious respect. They speak of her with a tender affection: They regard her as the innocent victim of the cruel and implacable jealousy of Elizabeth. Mary was their Queen. They knew that she was beautiful, mild, affable and generous; that she loved the arts; that she long languished in a painful captivity; and that she died with resignation and courage. Less would be sufficient to interest honest peaceable men, whom state policy, and the crimes which it engenders, have not yet corrupted, and who abhor the shedding of blood in any way but for legitimate defence.

I do not know the antiquity of competitions of this kind. During my stay in Mull, I was informed that there had been beyond all time of memory a college or society of bagpipers in that island. This school was not entirely extinguished in consequence of the death of the famous Rankin, who had the direction of it for about thirty years. M'Rimmon kept a similar school in the isle of Sky, and each of the principal families of the

the Hebrides always kept a piper, whose office was hereditary.

While I remained at Edinburgh I made several excursions for the purpose of examining the natural history of the environs of that city, and I formed a large collection of volcanic substances, and other interesting mineralogical specimens. Each article was carefully ticketed, and Doctor Swediaur kindly took upon himself the charge of sending them to France with the other collections I had made in the Hebrides.

This rich collection, the fruit of so much pain and so much pleasure, was lost, as well as the vessel in which it was embarked, on the coast of Dunkirk. The crew with difficulty saved themselves in a boat, and I was deprived in a moment of a treasure to which I attached the greater value because it contained a variety of new objects which would have been highly interesting to naturalists.

Fortunately, whenever I had leisure, I wrote exact descriptions of the specimens I collected, which have enabled me to give a correct account of the lithology of Glasgow, Perth, Staffa, the isle of Mull, and other places. My various engagements at Edinburgh, however,

ever, did not leave me time to take descriptions of the whole of the specimens I collected there. This is the only omission of the kind I have to charge myself with; but unfortunately it prevents me from giving a complete account of the various and remarkable productions with which the hills that are grouped around that city abound, and which have almost all been a prey to the action of subterraneous fire.

I should have been the more desirous of giving a detailed account of these specimens, which left no doubt as to the existence of ancient volcanos, since I found the greater part of the learned men of this city obstinately prejudiced against this opinion.

The castle, which commands the town, is built upon a hill formed of compact lava in the form of basalt. The black colour of this lava, and the gothic aspect of the castle which surmounts this volcanic precipice, forms a striking and very pleasing contrast with the elegant white houses, built with great taste in that part of the city which is called the New Town.

Not far from this there is another eminence called the Calton Hill, formed of
greyish

greyish lava, near the top of which there stands a monument erected to the memory of a philosopher and an historian—It contains the ashes of David Hume. >

Behind the town there is an elevated chain in a part of which the hills seem piled up one against the other, and are composed of basaltic lava. This substance, which, at one time, must have been liquefied, exhibits prismatic septa occasioned by the cooling of the lava. There is here, however, none of that astonishing regularity displayed in the prismatic columns of the cave of Fingal, or the Giants Causeway of Antrim. The rapid mode in which this lava probably cooled, may have prevented this beautiful effect from taking place, or perhaps that regularity is produced by causes of which we still are ignorant.

One of the hills of this ridge, has a hollow in its summit, and in the whole of its form somewhat resembles a chair or gigantic seat. This spot, in which there is nothing remarkable but its elevation and its steepness, is known in the Old Chronicles under the latin name of *Arthuri Sedes*,
and

Arthuri Sedes

and in English by that of *Arthur's Seat*. It is possible, however, that this name may have its origin in some other cause than the figure of the top of the hill, the tradition of which is lost.

Sibbald, in his *Scotia Illustrata*, printed in 1684, gives an account of a barometrical observation made by the mathematician, George Sinclair, on the summit and at the bottom of a mountain which he calls *Sedes Arthuri*. There is no doubt but it is the same as that of which I have been speaking*.

I examined the large blocks of basalt which are detached from this mountain and lie scattered about at its base, in which I observed spots of zeolite even in the centre of the lava. I collected some very fine specimens. This zeolite which is white, and

* Ex observatione Georgii Sinclari mathematici nostratis, in vertice illius montis, cui nomen vulgo ARTHURI SEDES, ob id imprimis celebris, quod civitati Edinburgi, ob vicinitatem imminet, mercurialis cylindri altitudo reperta est 28, digitorum cum quadrante; apud radices autem montis 29. Sibbald, *Scotia Illustrata*, par I. lib. i. folio 10.

in some parts clouded with a blueish tinge, is neither radiated nor crystallized in a regular manner. It is rather of the scaly texture of white marble. It is hard and susceptible of the most brilliant polish. This is not surprising, when it is considered that it contains a small mixture of quartzose earth. This gives it something of a calcedonious appearance; but it is fusible with the blow-pipe, bubbles in smelting, and has all the properties of zeolite.

Behind these volcanized mountains there are beds of quartzose free-stone, which has experienced in a very considerable degree the action of fire, and thereby acquired a reddish colour. Indeed, the operation of subterraneous fire is manifest every where around Edinburgh, where it exhibits the same characteristic traces as in the environs of Perth, Glasgow, and Dunbarton, and in the island of Staffa.

I regret that I am obliged to confine myself to this general description: If my valuable collection had not been lost, I should have described a series of volcanic productions which would have removed every doubt on this subject, and demon-
strated

strated that the vicinity of Edinburgh has been the prey of ancient volcanos, since it still exhibits lavas similar to those of Etna and Vesuvius.

CHAPTER XV.

Departure from Edinburgh.—Itinerary to Manchester.—Natural History

AFTER taking leave of Doctors Black, Cullen, Smith, and the other respectable characters who had treated me with so much kindness in Edinburgh, I made preparations for my return to London; I determined to take the Carlisle road, which would give me an opportunity of seeing Manchester, Derby, Buxton, Castleton, Birmingham, &c.

When I left London with my fellow-travellers our party consisted of four persons, on returning from Edinburgh it was reduced to two.

I forgot to mention that M. de Mecies, after visiting the cave of Fingal, which was the principal object of his journey, left us at Mr. M'Lean's, in the isle of Mull, and set out for London, where business required his presence.

Our other interesting and agreeable fellow-traveller William Thornton, intending
to

to pass some months with his friends in America, determined to remain in Edinburgh, where he had a numerous acquaintance, until he should find a vessel to carry him to his native country. We separated from him with much pain, for his excellent moral qualities, and his love for the sciences, rendered him truly amiable and worthy of all our attachment.

All our business being at last arranged, Count Andreani and I left Edinburgh on the 3d of October, taking the Carlisle road.

About a mile and a half from Edinburgh, the lavas and other volcanic substances which surround that city, disappear: they are succeeded by quartzose free-stone, which in several places cover rich mines of coal. This sandy zone, which is pretty extensive, disappears in its turn, and the face of the country again exhibits volcanic substances from Lasswade to Selkirk, in passing through Middleton, Bankhouse, Stagehall, Crosslee, &c.

The aspect of this part of the country is wild and sterile. The black, blueish, and reddish brown lavas which we observed on the road, were almost all disposed in tables or plates like slate; but they had all experienced

rienced the action of fire, some were of the nature of basaltes; but others, which were less hard, exfoliated and decomposed in the air.

We proceeded on to Arnskirk, Hawick, Allanmouth, Binks, Redpath, and Langholm. The mile-stone at this last place is marked 69 from Edinburgh. Volcanic appearances prevail from Arnskirk to Langholm. The lavas at Hawick form steep hills, and are disposed in horizontal beds, or rather lamellæ, which resemble slate; their colour, however, is more pale. There is little doubt but that all the hills and mountains in this quarter have experienced the action of fire.

Kirk-Andrews, Longtown, Westlington, Carlisle.—Sand and quartzose free-stone of an ochreous red colour—fine cultivation in the neighbourhood of Carlisle—large and excellent ploughs—a number of kilns for making lime, which is used for manure. Lime is not only used for the meadows, but also for the arable land; small heaps are formed which are allowed to slack in the air, and are afterwards spread over the fields.

A stage before we arrived at Carlisle, we had a view of Solway Frith, which separates England from Scotland on the West.

Haraby, Carleton, Lowhesketh, Highesketh. The same materials as above, that is to say, sand, red quartzose, free-stone, and calcareous stones.

Perith. At a mile from this town, on the declivity of a mountain, there are large rounded blocks of basaltic lava, intermixed with masses of granite, which are also rounded.

Eumont Bridge, Clifton, Thrimby. Blocks of reddish granite of a considerable size, with some rounded basaltes, both placed upon beds of calcareous stone.

Shap, Hausefoot. Here the hills of tabulated and foliated lava re-appear. Some of them resemble those of Mount-Mezen, in Velai, which I have described in my *Mineralogie des Volcans*.

Kendal, Syzergh. The same volcanic appearances.

Haverham, Milthorpe, Holme, Burton, Dure-Bridge, Carnford, Bolton, Slyne, Lancaster. This road is almost entirely through a calcareous country; rounded basaltes are, however,

however, sometimes found scattered in the fields. The country is in general rich in pasture. The meadows are manured with a mixture of lime, dung, and common earth, which forms an excellent compost.

From Lancaster we proceeded to Manchester.

CHAPTER XVI.

Manchester.—Doctor Henry and his Cabinet.—Cotton Manufactures.—Messieurs Thomas and Benjamin Potter.—Charles Taylor.

IT was late when we arrived at Manchester. As I had letters to Doctors White and Percival, I wrote to them next morning, requesting to know at what hour it would be convenient for them to see me, but it happened that they were both obliged to visit patients at the distance of some miles from the town. Doctor Percival sent a young German of his acquaintance to state the regret he felt in consequence of not being able to see us; and Doctor White engaged his friend, Doctor Henry, to wait upon us in his stead. These two gentlemen had the complaisance to offer every service in their power, and to shew us whatever was remarkable in the town. They paid us the most polite attention, and never left us during the stay we made in Manchester.

Manchester is a large town; it contains between thirty-six and forty thousand inhabitants;

tants; but if the manufacturers who live in its environs were added to this number, the population would be greatly increased, and might be ranked with that of most cities of the second order.

The old cathedral is large and well built. We saw also some other structures of this kind which were not uninteresting: the cotton-mills, however, which have enriched this town, were objects still more worthy of engaging our attention.

But notwithstanding the desire of our kind conductors to oblige us we found it impossible to see any thing of the kind. Every attempt was vain. The vigilance of the manufacturers was redoubled in consequence of having persuaded themselves that a French colonel, who was there some time before us, wanted to procure plans of these machines in order to carry them to France. Since that period no strangers, not even the most respectable citizens of the town were permitted to enter the works*.

The

* At this time the machine for carding cotton had already been carried to France and was used there. Not long after the mills were introduced by an intelligent

The largest of these cotton-mills are moved by water: they spin the cotton to so much perfection, and with so much economy, that those who first erected them have made great fortunes. Arkwright, who invented them, was merely a barber, in the town of Manchester. The difficulties he must have had to surmount in that situation, doubtless, add to his merit. He had the good sense to turn his discovery to profit. He joined in company with manufacturers whom he enriched, and at the same time made a great fortune himself.

Though I had not an opportunity of seeing the cotton-mills, I was, however, very complaisantly shewn large warehouses full of manufactured goods. The finest pieces were unfolded in order that I might see the patterns and the colours. We entered into conversation on the chymical processes used in

Englishman, who disputed the merit of the invention with Arkwright. These ingenious machines are now erected in several departments where they are constantly employed. This manufacture will doubtless be carried on with spirit, until caprice and fashion return to the use of silk, that beautiful and sumptuous production of France, which employed such a number of hands and yielded revenues so immense.

dying

dying the colours with very intelligent men, particularly with Messrs. Thomas and Benjamin Potter, and Mr. Taylor, who treated us in the most affable manner. It is with pleasure I here express the gratitude I feel for their kindness.

We were doubtless indebted to Doctor Henry for all the politeness that was shewn to us in Manchester. I wish that I may one day have an opportunity of making a return to his kindness in France. He translated the works of Lavoisier into English, and studies chymistry much more than natural history. At his house, however, I saw some stones and minerals; but that which gave me the greatest pleasure in his collection was a fine fossile *Os femoris*, of the unknown animal whose bones are found on the banks of the Ohio, and which is perhaps only a lost species of the elephant. This *Os femoris*, which was in the most perfect preservation, weighed forty pounds.

CHAPTER XVII.

Departure from Manchester.—Buxton; its Mineral Waters; five Baths, constructed on a Plan by Carr, at the Expence of the Duke of Devonshire, the Proprietor of the Waters.—Doctor Pearson.—Manufacture of Vases and other Articles in Fluor Spar of different Colours.—Cave of Poole's Hole.—Toad stone, composed of a Basis of Trapp, interspersed with Particles of calcareous Spar, and cracked into prismatic Sections like those of basalt, though not produced by Fire as the latter has been.

WE were received in a very polite manner, as I have already observed, by Doctor Henry, and those to whom he was good enough to introduce us. But we did not experience an equally kind treatment from the master of the *Bull's Head* inn, where we had put up. For two sorry dinners he charged us no less than seventeen shillings a-piece, to which we had to add three shillings to his servants; and this was exclusive of the bill for our domestics. The best thing that poor strangers can do in such a case is to pay the money. Travellers are equally liable to this sort of exaction in Italy, Germany,

Germany, and France, as in England; but in neither is it general or derived from national character. It must be imputed to a few individuals only, who have lost all feelings of delicacy and justice, but who make a very wrong calculation with respect to their real interests, as they soon destroy both their own reputation and that of the houses they keep. It is a very difficult matter to devise good regulations of police upon this subject. It is a truth well known to such as are in the habit of travelling, that the charges are always highest at those inns where the entertainment is the worst. It is to be hoped that some remedy will be found for this abuse; but in the mean time it will be necessary for travellers to keep a separate purse for those plundering inn-keepers, as is done in England for those *gentlemen* who rob on the highways, to whom those who venture to travel at late hours give without fear or danger the sum which is set apart for them. I must say for my part, however, that I passed through England and Scotland twice, and by different roads, without meeting any of these *gentlemen*; and that I experienced no extortion but at two places, *Dun's Hotel* in Edinburgh,

burgh, and the *Bull's Head* in Manchester.

From Manchester to Buxton is twenty-four miles. The road through Derbyshire is neither agreeable nor commodious. It sometimes crosses over craggy mountains, and at others runs along narrow, wet and dirty valleys, and though the turnpikes are numerous and dear, the roads are notwithstanding in a bad condition. They are in general, however, well supplied with post-horses. We left Manchester at seven in the morning, and did not reach Buxton till two in the afternoon.

Buxton is remarkable for its mineral waters, for the benefit of which a considerable afflux of company repair thither in the fine season. Buxton, however, is situated in the midst of the most dismal and cheerless country that I have ever seen. Its waters may be excellent, but most certainly its atmosphere is impregnated with sadness and melancholy. The houses, almost entirely of a uniform appearance, but solid construction, resemble hospitals or rather monastic establishments. A superb structure, executed in a grand and beautiful stile of architecture, which appears

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at the bottom of the place, and is appropriated to the baths, might be taken for the palace of the abbot.

We had letters of recommendation for Doctor Pearson, a London Physician, who belongs to the establishment of the baths of Buxton, where he generally spends six months of the year. We were fortunate enough to find him there, though it was now pretty late in the season. As he was well acquainted with the country, and had published an analysis of the waters, in which he described the stones and earths that form the soil of Buxton, he kindly and readily offered to conduct us to the most remarkable mines and caverns, the noted beds of lime-stone, in his opinion, intersected with several currents of lava, and to the different other places mentioned in his book.

Doctor Pearson was very intimate with Whitehurst, and had adopted his opinion respecting the beds of toad-stone, which he regarded as the product of subterraneous fire*. We fixed a day for going to see these sup-

* *Observations and experiments on Buxton Waters, &c.*
By Doctor Pearson. London,

posed remains of volcanos in a country, where, on the contrary, every thing indicates the agency of water; and he had the goodness, in the mean time, to accompany us to the shops of several artists in stone, who cut, turn, and polish the fine Derbyshire fluor or phosphoric spars * of different colours, gypseous alabasters, and some marbles.

WORKERS IN FLUOR OR PHOSPHORIC SPAR.

Several artists in this line have settled at Buxton on account of the numerous and in general opulent visitants who resort thither for the waters, and whose fancy or taste inclines them to purchase their productions. The fluor spars are turned into small hollow or solid vases, columns, eggs, pears, and watches, and cut into pyramids, pedestals, &c. As the colours are beautiful and variegated, and the stone is susceptible of a fine shining polish, it was formerly sold at a very high rate; but since it has been found in so great abundance, the increase of artificers, and the consequent competition among each other,

* The *Fluas calcareus* of the new nomenclature of chymistry, page 172.

have contributed to diminish very much the price of these articles of ornament. There are very few among the stone-cutters of Buxton who shew any taste for the beautiful forms. They have signs above their shop-doors with their names and the addition of *petrification-works*.

The most intelligent of them, in my opinion, was one Noel, who was in easy circumstances, and had succeeded well in this branch of trade. He was bringing up to the same art a daughter and a son, who were already almost as well skilled in it as himself, though the boy was only eight, and the girl nine years of age. It was at his shop that the best turned vases were to be seen.

Samuel Cooper had the best stocked shop; but his pieces were dearer than those of the others.

John Evans and Mottershed, are two other artificers who have pretty good assortments.

It is necessary to guard against a number of little contrivances which they make use of to repair the accidents which sometimes happen to their productions, and consequently to deceive the purchasers,

They

They introduce, for instance, into the accidental cavities or fractures, which they are dextrous enough at repairing, quantities of lead in its native state, that is, as it comes from the mine. They then polish it; and are not wanting in assurances to the purchaser that it is natural to the spar, and enhances its value.

I remarked also, that to give a finer lustre to their productions, they had always some water at hand to plunge them into, on the pretence that it was only to wash off the dust. But it was easily seen that the water had a singular effect in enlivening the colours, the polish, and the semi-transparency of the stone.

The fluor spar, which is fashioned at Buxton, is procured from the lead mines of Castleton, about ten miles from the former. The only stones of value found in the environs of Buxton, are a very fine gypseous, white, semi-transparent alabaster, which is made into vases and pedestals, a black marble emitting a bituminous smell on being rubbed, and a yellowish calcareous spar, both of which are applied to the same purpose.

THE BATH-HOUSE.

This superb edifice has more the appearance of a palace than that of a place for bathing. It is a vast fabric, in the shape of a rotunda, ornamented all round on the outside with large pilasters which support a rich cornice crowned with a ballustrade.

This building, in addition to the space occupied by the baths, contains apartments for more than two hundred gentlemen, exclusively of the chambers for their domestics, the persons employed about the baths and wells, and the different masters of taverns and ordinaries necessary to provide for so numerous an assemblage, and who are the principal renters of the whole structure. It contains also coffee-rooms, gaming-rooms, and ball-rooms.

The whole of this vast fabric was erected at the expence of the duke of Devonshire, upon the plans and under the superintendance of the architect Carr. It is executed in an excellent stile of architecture, uniting to a character of grandeur an air of taste, which does honour to the talents of that able artist, whom
I had

I had the pleasure of seeing, and who was kind enough to conduct me through every part of it.

The baths are disposed with the same judgment as the other parts of the work. There are common and private ones for the women; those for the men are in a separate quarter and possess the same conveniencies. There are several also appropriated to the use of the poor.

The mineral waters for drinking run into a large cistern of white marble, over which is erected a neat little temple finely executed in an antique stile.

The waters of Buxton are rather moderately warm than hot; as they do not raise the mercury in Fahrenheit's thermometer above eighty-two degrees. Doctor Pearson, who has analyzed them, says, "that the air which is extricated from it in great abundance, does not contain any fixed air, but atmospheric mephits, or the *azotic gas* of the new nomenclature *." This is a very remarkable fact.

The

* The term azot, is derived from the Greek, and signifies the privation of life; but, as other gas produce the same effect, the word is improper. I do not mean to attack

The village of Buxton is not very considerable, and the greater part of the houses are the property of the duke of Devonshire. They are generally rented by tavern-keepers, and yield him a great revenue. The one nearest the baths lets for twelve hundred pounds sterling; and, I was assured, that the baths alone produce a yearly rent of at least thirty-six thousand French livres.

To draw a greater number to the houses belonging to himself, the duke of Devonshire adopted a plan which has met with complete success. Those who are lodged in any of them are charged only ten-pence English a-day, for the waters, whilst such as have apartments elsewhere pay a shilling a-day.

LITHOLOGY OF THE ENVIRONS OF BUXTON.

Buxton is situated in the midst of a number of small hills, which are quite close to

tack the principles of pneumatic chymistry, but its language only. If this malady, which is as dreadful to the language of Racine, Fenelon, Bouffon, Voltaire, &c. as the leprosy is to the beauty of a fine woman, gains ground in the other sciences, we shall soon realize the fable of the tower of Babel. A confusion of language will introduce a confusion of ideas; and we shall thus be replunged in the gloom of barbarism.

each other, and the highest of which does not exceed six hundred and fifty feet. The fine river Wye takes its rise at a little distance from the elegant structure of the new baths; and soon after plunges into a deep chasm, and winds along between two approaching cliffs.

The mountains on the road from Buxton to Manchester are composed of banks of free-stone. In some parts hard and in others soft and friable, and sometimes foliated. The hard kind, besides the name of free-stone, is here called *greet*, *grit*, and sometimes *mill-stone-greet*; the foliated kind is termed *slate*. These free-stones are disposed sometimes in large horizontal banks, and at other times in foliated strata; they are in general white or reddish.

Near these, and almost opposite to them, are hills entirely formed of lime-stone in horizontal beds in some places, and in a continuous uninterrupted mass in others. These masses are sometimes divided by perpendicular or diagonal fissures.

This lime-stone is hard, almost of a sparry texture, and yields on being burnt a lime of a very fine quality. It is used,

as well as free-stone, for making door-cases, chimney-pieces, pedestals, and other works. Its colour is in some quarries whitish or greyish, and in others black. The latter is employed for the same purposes as marble; and it scarcely contains any marine body. It exhales a very disagreeable smell on being rubbed; it may be regarded as a kind of pierrepore.

The grey, on the contrary, contains madrepores, entrochi, and other marine petrifications. There are also found in it some pieces of filex which are full of entrochitæ. The grey calcareous stratum does not possess the same degree of hardness throughout. The soft part emits a disagreeable smell on being rubbed, not so strong, indeed, as that of the black kind, but still very sensible. The harder pieces of the grey sort are used for several domestic purposes. I shall resume the consideration of these calcareous beds, which are remarkable for the circumstance of being interrupted with alternate beds of toad-stone.

There is also found in that part of Derbyshire called the *Peak*, in which is situated Buxton, Matlock, Wirksworth, Middleton,

Maffon Crumford, Winfter, Caftleton, Eyam, &c. black argillaceous fchiftus, more or lefs hard, and fometimes refembling flate, or as it is here called *shale* or *shiver*, black and grey martial argil, more or lefs hard, which is not applied to any ufe, and which bears the name of *iron-ftone*, and red and grey marl, befides a brownifh kind of marl of a very fine grain, and loaded with calcareous particles, which is ufed like tripoli for polishing tin, copper, cryftal, &c. this kind is called *rotten-ftone*. In this tract are alfo feveral mines of coal, which are worked in abundance. They are not however very deep in general; their roof is a black argillaceous fchiftus, marked with numerous prints of ferns, the greater part of which feem to be foreign. Here are like-wife found pyrites, black marble, grey marble, foft lime-ftone, free-ftone, compact, gypfum, ftriated gypfum, fluor fpar of the appearance of amethyft, yellow, red, grey, or white; and a ponderous fine grained white earth which may be cut as eafily as chalk, is faid to abound in gypfeous earth, and is indifferently termed *caulk*, *calk*, *cawlk*, *kerwel*, and *keble*. This matter is one of the moft common matrices of the mines of Derbyfhire, and is frequently

quently seen adhering to fluor spar*. To the above enumeration may be added double pointed rock crystals, ponderous spar, and opake fluor spar, in detached cubical crystals, which three substances are found on Diamond Hill, about three miles from Buxton; calcareous tolsa, with several plants incrufted in it, manganese in kidney-shaped lumps, lead, copper, calamine, and blende; the wells of Matlock old bath, Matlock new bath, and Buxton; the acidulated mineral waters of Quarn, or Quarnden, an intermitting spring at Tideswell, and a number of natural grottos or caverns, several of which penetrate to a great extent, such as those of Castleton, Poole's-hole, Elden-hole, Hofen's-hole, Burmforth-hole, and Lathkill arse. It is very remarkable that pretty copious streams of water issue from almost all of these caverns.

Such is a brief sketch of the principal objects observed in the Peak of Derbyshire; and this astonishing variety of substances within

* It is thought that the *caulk* makes the regulus of antimony more ductile, and gives it a compact texture. It is used at Birmingham in the manufactory of yellow copper. Some persons imagine that it is for the purpose of molds, but of this there is no certainty, the greater part of the processes being concealed in the English manufactories.

so small a compass, must certainly astonish the most experienced geologists. We accordingly find Mr. Ferber, so well known for his "*Letters on the Mineralogy of Italy*," in the preface to a pamphlet which he has published on that of Derbyshire, acknowledging that, without the aid of Mr. Whitehurst and Mr. Burdett, who has published a fine map of Derbyshire, he should have been completely bewildered amidst the production of so singular a country.

"I sincerely acknowledge," says he, "that
 "without the assistance of these two persons,
 "I should have frequently found it very diffi-
 "cult to explain a great number of pheno-
 "mena which were quite new to me. I
 "had till then seen only homogeneous moun-
 "tains; and none of the stratified mountains
 "which I had examined, and of the interior
 "structure of which I had perfect knowledge
 "by visiting the mines, furnished any in-
 "stance to be compared with what I saw in
 "Derbyshire. The great diversity of the
 "strata and their frequently fantastic dispo-
 "sition which I had never seen any where
 "else, very often embarrassed me; and I am
 "persuaded

“ persuaded that the ablest mineralogists will
 “ experience the same difficulty*.”

THE CAVE OF POOL'S-HOLE.

Mr. Ferber, in his “ *Essay on the Orycto-*
 “ *graphy of Derbyshire,*” does no more than
 slightly mention the cave of Pool's-hole.
 “ This cave,” says he, “ which is at a little
 “ distance from Buxton, abounds in stalaçtite.
 “ It is said to be half an English league in
 “ length, and a very noisy stream runs
 “ through it.”

The following is a more minute descrip-
 tion:—Pool's-hole is about a mile from
 Buxton; and its entrance is at the foot of a
 large hill consisting of lime-stone, bare on all
 sides, and presenting to the view a number of
 kilns, where the stone, which is of an excel-
 lent quality, is burnt into lime. This lime-
 stone contains a number of entrochi and other
 marine bodies, converted for the most part
 into calcareous spar.

Doctor Pearson was so obliging as to ac-
 company us to the cave. Scarcely had we

* *Essai sur l'Oryctographie du Derbyshire, province
 d'Angleterre, par M. Ferber, traduction de l'Allemand.*

arrived at the mouth of it, which is narrow and of an oblong shape, when we were joined by several women who made briskly up to us; some of them, to sell us pieces of bad stalactite and shining calcareous spar; and others to furnish us with lights, and to offer their services in the capacity of guides. We accepted their offers, and entered the cave. Here, as in almost all natural caves, are galleries sometimes narrow, and at others broad, now winding and then running in a straight line, and at intervals expanding into spacious and lofty chambers. We were desired by our guides to stop when we came opposite to a very large stalagmite, which is only an irregular and confused accumulation of calcareous spar deposited by the droppings.

This is called by the natives *Poole's chair*. They have heard it termed so by their fathers, those who succeed them will give it the same appellation; and though this sparry mass has no more resemblance to a chair than it has to a horse, the power of imagination and habit, will concur in maintaining this absurdity, and those good folks will always have the satisfaction of thinking that they see what they do not see. Alas! this is the
case

case with respect to many other things in this world.

On penetrating into a more profound cavity, our conductors were not wanting in telling us that this was *Poole's chamber*; and a little farther we were shewn *Poole's table**.

The cave is about two thousand four hundred and fifty English feet in length, including the passages into it, some of which are very incommodious. A small stream of water, which becomes more considerable perhaps in rainy seasons, runs through the whole length of the galleries, and makes the way a little disagreeable. Upon the whole, this cave contains nothing very interesting. We saw in it only a few bad and mutilated stalactites, and these not in any great quantity. From the shock of an earthquake, or the looseness and weight of the incumbent mass, part of the roof of one of the galleries has fallen in, and the passage is almost entirely blocked up by the number and bulk of the stones which have tumbled down.

* Credulity has always amused herself with seeing something marvellous in these dark subterraneous caverns. There is still shewn in the cave of Sassenage, near Grenoble, the famous table of the fairy Mellusina.

On coming out of the cave, we were anew surrounded by some women, who offered for sale some coarse pieces of crystallized calcareous spar, to which they seemed to affix a great value.

We then visited the numerous quarries of lime-stone dug on all parts of the hill, which contains the cave of Poole's-hole. More than a hundred families have been occupied, from father to son, in working the quarries and converting the stones into lime. The consumption of this article must be extensive, and the demand for it very great, for lime-kilns are seen smoking on every side.

I looked in vain for the habitations of so many labourers and their numerous families, without being able to see so much as one cottage, when I at length discerned that the whole tribe, like so many moles, had formed their residence under ground. This comparison is strictly just; not one individual of them lodged in a house, or even the hollow of a rock. Their dwellings were in the midst of heaps of cinders and refuse of lime, which formed so many small mounts, or mole-hills.

These

These materials, which the workmen have hollowed into subterraneous habitations, have been consolidated by rain into a compact cement which is now impenetrable to the water. As the excavation is not very difficult, these families have taken sufficient precaution against cold and wet, by fixing their abode immediately contiguous to the limekilns which communicate to them a comfortable degree of warmth.

The greater part of these habitations have three or four rooms, almost all of a round form, for the purpose of greater solidity. They are lighted by the side, when the position is such as to admit it ; or merely by the chimney, which is nothing else than a round hole pierced through the middle of the roof to allow the smoke to escape. Apertures are also made by the door of the place to admit a little light. Such is the effect of the whole, that when the workmen descend into their cave, at the hours of repast, and a stranger sees so many small columns of smoke issuing out of the earth, he imagines himself in the midst of a village in Lapland. I felt much pleasure in visiting the residence of these troglodytes. Their occupation is certainly not attended with

with much profit as they are unable to procure the smallest convenience, and though in the midst of stones and lime, have hitherto been too poor to erect walls.

STONES KNOWN IN DERBYSHIRE BY THE
NAME OF TOAD-STONE.

As I had now reached the principal source of these stones, so much talked of by the English Naturalists, and which furnished the basis of Mr. Whitehurst's theory, I resolved to examine them with the most scrupulous attention. I had the advantage of being accompanied by a mineralogist of the school of Mr. Whitehurst, who was well acquainted with the place, and who, like him, was convinced that the different species of toad-stone were real lavas. I was under a promise, besides, of giving an account of my researches to Mr. Whitehurst himself. Being provided with his book, and Mr. Ferber's essay on the oryctography of Derbyshire, the only remaining preparation requisite was the instructing myself in the vocabulary of the miners. The names which they have at all times given this stone, vary according to its colour, its hardness,

ness, the extraneous bodies found in it, and the disposition of its strata. These names are not scientific, it is true; but the miners are accustomed to them, and perfectly understand them, being derived from their native language; and it is not to be supposed that they will ever be induced to change them.

This stone derives its name from its resemblance to the colour of a *toad*, having a very dark brown and sometimes black, basis entirely sprinkled over with small particles of white calcareous spar. These white specks are in general, pretty uniform, and sometimes protuberant. A stone in every respect similar is found in the bed of the torrent of Drac, near Grenoble, by which it is hurried along from the high Alps of Champfaur. It is from this spotted appearance that it has received the name of *Variolite du Drac*. But this term already affixed to a stone of a different sort, ought to be rejected, in order to prevent mistakes.

The term toad-stone is very common at Buxton, Matlock and Winster, because stones of this kind are more frequent there than in the other lead or copper mines of Derbyshire.

At Tideswell, the same stone, but with few or no globules of calcareous spar, and disposed in thick banks, which alternate with beds of lime-stone, bears the name of *channe*

At Athover, in the mine of Gregori, being of a blacker kind and not so hard, it is called *black clay*.

At Castletown, the miners have given to a greenish variety of this stone, which falls into earth on exposure to the air, the singular name of *cat-dirt*.

Mr. Ferber, in his essay on the oryctography of Derbyshire, pages 163 and 168, mentions only the two denominations of *toad-stone* and *channel*; but he adds, that the same stone bears in England the names of *dun-stone* and *black-stone*, and in Scotland, that of *whin-stone*. It is certain that the Derbyshire miners know very well how to apply the four different names which they give it, according to its different modifications. This is not the case with respect to the English term *black-stone*, which may be equally applied to other stones of the same colour, but of a very different nature, such as volcanic basaltes, touch-stone, black rock-schorl, horn-stone, certain
fine

fine grained black granites, &c. This denomination is, therefore, too general and vague.

The term *whin-stone*, which the Scotch employ, is no less objectionable. Under this name they comprehend every black stone, without distinction, which is hard and rough to the touch. At Edinburgh, when I asked the naturalists and workmen of the country to shew me whin-stone, some of them brought me a black hard stone of the same nature with what the Swedes call trapp, which is not in the least volcanic, some presented a compact lava of the nature of basaltes, and others a variety of black granite, which has sustained the action of subterraneous fire without any alteration in its hardness, and which makes most excellent pavements. The case was the same at Glasgow. This term, then, having like the preceding, a variety of acceptations, which tend to produce confusion in the mind, ought to be rejected on the same account. A fact worthy of remark, and which proves that the colour of stone has been more attended to than any other characteristic, is, that in Germany, where the science of mineralogy has long flourished, several black hard stones, of very different

different natures, are likewise denominated *black-stones*, *schwartz-stein* *.

Mr. Ferber, though profoundly versed in mineralogy, neither compares the toad-stone of Derbyshire to any other stone, gives it any distinctive name, nor takes any notice of the opinion of Mr. Whitehurst, who regards it as a volcanic product. He contents himself with stating, that “ this stone has an argil-
“ laceous basis more or less hard ; some parts
“ appearing to be merely an indurated clay,
“ whilst others approach the jasper in hard-
“ ness ; that it is interspersed with small par-
“ ticles of calcareous spar, varying in form
“ and size ; some of which are so minute
“ that to the eye they appear identified with
“ the black substance of the stone itself, whilst
“ others are of the bigness of a pea, or even a
“ bean.” He adds, “ that on trying the stone

* In France, as in other places, we have in several instances given names to mountains from the colour of their rocks ; such as *roche maure* for *roche noire* (black rock) *roque brune peire noir*, for *roche brune* (brown rock) *pierre noire* (black stone) &c. But on every occasion when I have shewed to peasants of any degree of intelligence, pieces of compact lava, and blocks or columns of basalt, and asked them how they termed those stones, they have uniformly replied, that they were *pierres mortes* (*dead stones*.)

“ with

with acids, they effervesced with and dissolved the portions of calcareous spar without effecting any change in the basis of the stone; which, after the experiment, was still hard enough to scratch glass, though it gave only a few inconsiderable sparks with steel; and finally, that the substance of the toad-stone, when divested of its calcareous particles, seemed to him to be refractory to the blow-pipe, but that with the addition of salt of tartar it was converted into a black scoria, which would seem to indicate a siliceous principle, though it does not possess the hardness of siliceous stones."

To enable those naturalists, who have not visited the place, to form a correct notion of this stone, and to accompany me in the following examination, it only remains that I should give them a preliminary description of the singular position which it occupies in the mountains of the Peak of Derbyshire. A part of the details I shall borrow from Mr. Whitehurst and Mr. Ferber, adding to them what additional circumstances have fallen under my own observation.

DIFFERENT SUBSTANCES WHICH PRECEDE
AND ACCOMPANY THE TOAD-STONE OF
THE PEAK OF DERBYSHIRE.

1. Quartzose greet, gret, or free-stone ; termed mill-stone by Mr. Whitehurst from the use to which it is applied in some places ; it varies in its colour, grain, hardness, and the thickness of its strata. This naturalist, in page 147 of his " Inquiry into the original state and formation of the Earth, says, " that " the bank is 120 yards in thickness, and composed of granulated quartz and quartz pebbles." The former retain the sharpness of fragments newly broken, the latter are rounded by attrition as stones upon a sea beach."

2. Black argillaceous schistus of the nature of slate, shale or shiver. Its thickness, according to Mr. Ferber, who measured it in the mine of Yatestoope, is from a hundred and forty to a hundred and fifty feet * ; and according to Mr. Whitehurst, who measured it in another place, about a hundred and twenty yards †. As it is useful, when giving a local description, to be acquainted with the nomenclature of the miners, it is proper to state that

* Page 160.

† Page 148.

they give the toad-stone several denominations according to its greater or less hardness, or as it is more or less penetrable. Hence the various terms of *skale*, *hard-beds*, *penny-shale*, and *black-beds*.

There are found above this schistus at several places, and, among others, near Winstet, where the high-way is opened through beds of it, which are completely visible, large fragments of black lime-stone, which on being rubbed with iron, emits a strong smell of burnt corn.

3. The first bed of lime-stone, which, in the neighbourhood of Dafford, is black, very hard and used as marble. It has an offensive smell on being rubbed, is in some parts without any marine bodies, and in others abounds in *anonymæ bivalves*; it sometimes contains round knobs of flint, and is intersected at intervals with thin layers of a kind of slate. The thickness of this bank varies from thirty-five to fifty feet.

4. First bed of toad-stone. The thickness of this bed varies greatly; in some places it is fourteen, and in others sixteen feet, and at Tidswell it has been dug to the depth of a hundred and sixty feet without reaching its bottom; though, in the same mine, at the

distance of a hundred toises only from this spot, it is no more than forty feet; and three hundred toises farther, only three feet. This would seem to shew that the matter which composes the toad-stone has accumulated there rather in one vast deposit than in regular beds.

But let us hear Mr. Whitehurst, whose opinion upon this stone is very explicit:

“Toad-stone is a blackish substance, very
 “hard; contains bladder-holes like the *scoria*
 “of metals, or Iceland lava, and has the same
 “chymical property of resisting acids. Some
 “of its bladder-holes are filled with [cal-
 “careous] spar, others only in part, and others
 “again are quite empty. This *stratum* is not
 “laminated, but consists of one entire solid
 “mass, and breaks alike in all directions. It
 “does not produce any minerals or figured
 “stones representing any part of the animal
 “or vegetable creation.—Neither does it uni-
 “versally prevail, as the lime-stone strata, nor
 “is it like them equally thick; but in some
 “instances varies in thickness from six feet
 “to six hundred. It is likewise attended with
 “other circumstances, which leave no room
 “to doubt of its being as much a lava, as that
 “which flows from Hecla, Vesuvius or Etna.”

A second

A second reason, which induced the English naturalist to regard the toad-stone as a real lava of posterior existence to the formation of the calcareous beds, is, that the vertical fissures with which the latter are occasionally intersected, are filled with toad-stone; which necessarily infers the pre-existence of these fissures, and consequently that of the calcareous strata.

5. The second bed of lime-stone. This is about thirty-three toises thick, of a grey appearance, and contains a number of petrified marine bodies, among which may be distinguished *comes* of a large size, madrepores, &c. The stone is not in all parts of equal hardness. The softer parts, which emit a disagreeable smell on being rubbed with iron, are used for making lime. The harder parts are cut into shape, receive a polish, and answer the same purposes as marble. Some parts of it are penetrated with a siliceous matter in which are several entrochi.

6. Second bed of toad-stone, which is forty feet thick. Mr. Ferber says, "that in the mine of Hubberdale, this stone deviates so much from its ordinary hardness that it has a perfect resemblance to soft clay." But this alteration, which is doubtless ob-

ferred in some pits, is merely local; and the toad-stone of the second bed, as Mr. Whitehurst justly states, is of greater solidity than that of the first. A circumstance worthy of attention is, that it contains no cavity, and consequently no particles of calcareous spar.

7. Third bed of lime-stone; grey, like the second, and, according to Mr. Ferber, seventy yards thick. Mr. Whitehurst says, that it contains fewer petrefactions than the preceding ones, and that it is thirty fathoms thick.

8. Third bed of toad-stone, resembling the second, and twenty-two feet thick. "In the mine of Hubberdale," says Mr. Ferber; "this stone has the consistence of a tender and soft clay of a green colour, and is filled with small nodules of black clay, and several veins of white calcareous spar. It is denominated channel."

9. Fourth bed of lime-stone. This is grey, like the preceding, but a little whiter. Its thickness is yet unknown; several parts of it having been dug to the depth of forty fathoms, without discovering its bottom. It is therefore uncertain whether this fourth calcareous bed be again succeeded by toad-stone.

The direction of the veins of metal is in general very irregular; the seam is distinct and well marked; its depth varies, being sometimes several feet only, and at others several toises thick.

But what is truly extraordinary and may be regarded as a phenomenon in mineralogy, is, that the veins, which are very rich in the four calcareous beds, always disappear, as they approach the strata of toad-stone, which alternate with the former, so that it is necessary to penetrate through the whole mass of toad-stone, however thick, in the direction of the seam, without any trace of the ore, until the calcareous bed be reached, where the miners are sure of re-discovering it. Thus, for example, when a vein is exhausted in the first bed, that is, in the first black lime-stone, the ore disappears on reaching the toad-stone, and no vestige of it is found till the bed of toad-stone has been entirely dug through. “ This phenomenon,” Mr. Ferber justly says, “ is, without contradiction, one of the most
 “ rare and singular in its kind; and to ac-
 “ count for it is no less difficult. Another
 “ singularity respecting the beds of toad-stone
 “ is, that this substance so completely separates

“ the different strata of lime-stone, that an
“ inundation of a gallery in the first bed not
“ wise disturbs the labours in the second,
“ and that the miners may be dry in a lower
“ gallery, whilst all the galleries above it are
“ filled with water.”

From violent disruptions of the ground, at periods too remote to be traced, the beds are found sunk to a great depth in some parts, while they are much nearer the surface in others. New adventitious and calcareous substances, transported by subsequent convulsions, have filled up many of these chasms, and thus partly concealed the first ruggedness of that wonderful country; but the deep excavations which the miners have made through a great extent of the elevated flat of the Peak, have furnished the means of obtaining an exact knowledge of the topography of Derbyshire, of which I have just here given a slight sketch. More detailed explanations will be found in the work of Mr. Whitehurst, who has given very accurate engravings of the plans, and profiles of the most interesting sections of the mountains.

Impressed with the importance of the subject, I had stopped several times before I
reached

reached Buxton, at the foot of some crags where the toad-stone was visible, for the purpose of examining it. With the same view I now asked Dr. Pearson, whether, in his work on the mineral waters of Buxton, he had particularized any bed of toad-stone which we might visit together, assuring him, that any information which he could give me would be so much the more gratifying, as nothing that I had yet seen in that part of Derbyshire bore the least trace of a volcano? I further observed, that a stone in every respect the same as the toad-stone, which he regarded with Whitehurst as a real lava, was found on the high Alps of Champfaur in Dauphiny; that it presented precisely the same varieties of toad-stone, with particles of calcareous spar, with empty cellulæ, and without any spar, often imporous, sometimes hard and compact, at other times tender, tending to decomposition and changing its colour, and that it was sometimes found in the form of small prisms, which led me to think that we might probably meet with it here in the same state.

I mentioned also, that M. De Lamanon, a very estimable naturalist, who fell a victim to his ardour for natural history, in a voyage
round

round the world with La Peyrouse, had written a pamphlet tending to demonstrate that the stone of Champfaur was a product of subterraneous fire; and that he for some time considered himself the discoverer of an extinct volcano in the Alps; though very able naturalists had affirmed that those vast mountains exhibited no vestige of volcanic combustion. I added, however, that M. De Lamanon, whose opinion I combated, relinquished his error and suppressed the whole impression of his work, with the reserve of twelve copies, to each of which he had the honourable firmness to annex a printed recantation; that those few were sent to the most zealous of his opponents as an acknowledgment that the stones which he had taken for lavas were merely trapps, and that he had the goodness to send me one among the rest*.

* See my essay on trapp-stones, in which I have traced the itinerary from Grenoble to the mountain of Chaillotte-veil, in the Alps of Champfaur, with a description of all the varieties of trapp, in every respect like those of Derbyshire, in a much higher country; for the mountain *Peyre-Niere* (Pierre noire) or *Haut-Puy*, which is about one thousand four hundred toises above the level of the sea, is covered to the top with real toad-stones, that is to say, trapps.

Excursion in the Vicinity of Buxton with Doctor Pearson.—The Stratum of Toad-stone which, he describes in his Book on the Mineral Waters.—A small Isle in the River Wye formed entirely of Toad-stone divided into Prisms.

“ Let us set off then,” said Doctor Pearson, “ I shall be very happy to shew you the bed of toad-stone that I have described, and you will tell me what you think of it.” We directed our course to the hollow which forms the bed of the little river Wye, which, if we may judge by the channel which it has worn, swells into a torrent with rains. We ascended its banks for nearly a mile towards a corn-mill.

Before reaching the mill, particularly on the right bank, and immediately under the vegetable soil, are some beds of black schistus which vary in thickness and exfoliate in small pieces on being exposed to the air. This schistus is sometimes covered with a slight efflorescence of martial vitriol; it is the same which the miners called *shale* or *shiver*. This bed of schistus, which is in some parts three, and in others two feet thick, and which conceals itself at intervals under the vegetable soil,

foil, pursues the same direction to the verge of the mill where it entirely disappears.

Here the nature of the ground suddenly changes; the valley diminishing into a narrow strait formed by two calcareous hills, approaching each other. Between these the mill is erected: the construction of the channel must have suggested this as a very proper situation.

The calcareous rock is of a grey appearance, and its strata incline towards the bed of the river on both sides; but so vigorous is vegetation in this humid region, that, except in a few places, the rocks are completely covered with mosses, lichens, heath, and other creeping plants.

The road leading to the mill runs along a natural causeway formed by the rocks which are entirely bare in this deep hollow. A little above this mill the road is crossed with a bed of toad-stone several feet thick, the black colour of which forms a striking contrast with the grey lime-stone.

This is the bed of toad-stone which Doctor Pearson has drawn as alternating with lime-stone. But on examining it attentively, I observed to this naturalist, that it was difficult

cult to determine whether it was a real bed or a kind of vein; the numerous chasms which must have formerly existed in both the hills, from the falling in of the surface, and the vegetable earth with which they have been in general filled up again, scarcely permit one to ascertain with any degree of certainty the exact and primitive disposition of the calcareous beds.

On an inspection of the parts where the road-stone is uncovered, it appears rather to intersect transversely than to follow the direction of the calcareous strata, a fact, which if sufficiently ascertained, would be completely destructive of the Doctor's hypothesis founded on the stratification of the calcareous beds in alternate order with toad-stone.

An attentive observation, indeed, of this small valley or hollow, formed by the subsidence of the intermediate space through which the Wye now flows, warrants the supposition that the chasms, cavities, and fissures occasioned by the shock and falling in of such enormous masses, have been again filled up by a secondary deposition and alluvion, proceeding from a revolution posterior to that which produced them.

These

These reflexions I submitted to the consideration of Doctor Pearson, stating, at the same time that my conjecture would have still greater probability if we should find the toadstone lying in a mass above the lime-stone, at the bottom of the valley.

Whilst I was making these observations, I cast my eyes on a small isle of an oblong form, situated in the very center of the place in question. "Let us see," said I, "whether that kind of natural mound, which has by its resistance, forced the river to divide into branches, consists of the same stone as the neighbouring hills."

Doctor Pearson said, that he had not directed his enquiries to that spot. We then repaired to the small isle, which is about a hundred paces long, and from ten to twelve paces broad, but which must have been much more considerable, before it was worn away by the water. It rises only a few feet above the river.

With equal pleasure and astonishment we discovered that it was entirely composed of a blackish brown toadstone, filled in some parts with particles of calcareous spar, and in others thinly maculated, or without any at all. But what I regarded as most remarkable was,

was, that the first or uppermost stratum of toad-stone, which is about two feet and a half thick, is in several places divided into prisms which form the most exact representation of a small basaltic causeway. It is still farther astonishing, that it affects all the various appearances of the round balls of basaltes, which are often found beside the prisms, or into which the prisms themselves are sometimes changed by the mouldering of their angles. These balls are formed of concentric layers, and exfoliate in the same manner as those of basaltes*.

* "Trapp," says the celebrated Bergmann, "is sometimes found in the form of triangular prisms, though this is a rare case. It sometimes has the appearance of immense columns, such, for instance, as the *Trasflemary* at the foot of the mountain of *Hunneberg*, opposite to *Bragnum*, which have detached themselves from the rest of the mass. The first time I saw them, they formed an angle of eight degrees with a line perpendicular to the horizon. For almost all the mountains of Westrogothia that have a stratified form, the upper bed consists of trapp. It is important to observe, that this bed always reposes on a black alluminous slate. Is it possible then that this matter should have been in a state of fusion without the slightest diminution, even in the point of contact, of the blackness of the slate below it, though it is evidently alterable by the heat of our common fires? We have a still finer trapp, which generally runs in veins, and is frequently found in very ancient mountains, in which not the faintest marks of subterraneous fire can be seen."

Lettres de Bergmann a Truil, page 448, de la traduction des *Lettres sur l'Islande*.

These prisms and balls are in a state of commencing decomposition; they are of a brown colour, and sometimes of a yellowish iron grey. Their texture is often intermixed with numerous particles of calcareous spar, the colour of which is frequently stained with the tints produced by the decomposition of the toad-stone. This stone, so divided into prisms and balls, reposes on a bed of friable and gravelly matter, which is in reality nothing else than toad-stone decomposed and reduced to the form of a sandy earth.

It must be acknowledged that nothing can be more volcanic in appearance than this little isle of toad-stone. A vein of this matter, which has considerable resemblance to a current of lava, crosses the calcareous rock which forms the bottom of the mill-road, and then sinks and loses itself in the Wye, so as to lead one to imagine that it has given rise to the isle, which is composed of a substance, which, in the parts where the particles of calcareous spar have been destroyed has the colour and appearance of certain porous lavas, and is further possessed of prismatic and spherical configurations. There is nothing,
how-

however, really volcanic, either in this place or its vicinity.

This serves to shew the utility of correct local descriptions to the progress of natural history, and the importance of having, in certain circumstances, an opportunity of seeing substances in their native place.

The substance of toad-stone is a composition of siliceous and argillaceous earths, with a small quantity of calcareous earth and iron. The proportions of the component parts differ according to the varieties of the toad-stone. That of Derbyshire, which is the subject of our present enquiry, has been analyzed by Doctor Withering, who found that *in a hundred parts of this stone there are sixty-three parts of siliceous earth, fourteen of argillaceous earth, and seven of phlogisticated iron.*

I myself, also, analyzed a piece of the same stone which was broken off from a part that had no calcareous particles; the results which I obtained were a little different. From a hundred grains of it the produce was as follows:

Siliceous earth	-	54	grains.
Argillaceous earth	-	19	
Aerated calcareous earth		8	
Aerated magnesia		4	
Iron	-	13	
Lost during the process		2	
		<hr/>	
	Total	100	
		<hr/>	

In making other experiments on stones of the same kind, taken from different beds, I always found the same constituent principles, but with greater or less variations in the results; sometimes the iron, and at other times the calcareous or argillaceous earth, being in greatest quantity. In a word, and to conclude this already too long and fatiguing discussion, the toad-stone of Derbyshire, is entirely foreign to volcanos, and is precisely the same with the Swedish trapp*.

Some

* If the reader wish for still further information respecting this stone, he may consult page 7, 23, 31, 43, and 53, of the work which I have published on trapp-stones; where he will find that the *argilla martialis indurata* of Cronstedt, the *schwartzstein* of the Germans, the *toad-stone*, *channel*, *cat-dirt*, and *black clay*, of Derbyshire, the *whin-stone* of the Scotch, and the *variolite du drac* of some Frenchmen, are nothing else than trapp in a greater or less degree of hardness,

Some may perhaps blame me for wishing to generalize too much the name given to a stone which is in the class of compounds, and which itself serves as the basis of several other stones. But I have never pretended to affix the denomination trapp, exclusively of all others, to stones, abounding in the matter of trapp, in those cases where they are diversified by a peculiar character. I have not, for example, ceased to use the terms porphyry, amygdaloides, variolite, &c. though trapp be the basis of all these stones.

I perfectly coincide with the opinion of my illustrious friend, M. de Sauffure, that “when two fossils exhibit any remarkable difference of character we are not to refrain from distinguishing them by different names, on the pretence that there are intermediate varieties which appear to unite them, by being equally referrible to either *.”

It is with the view of closely adhering to this principle, that, whilst I still preserve the

ness, and more or less altered. This stone also forms the basis of the most part of porphyries, &c. &c. But whilst I wish to retain the genuine term trapp, I would conjoin with it the different vulgar names which the miners use to distinguish its various modifications.

* Voyage Dans les Alpes, in 4to. Tom. iv. p. 127.

genuine term *trapp*, which must be respected, as it has always been used by the mineralogists of the north, I would apply it by way of preference, and specifically to that stone in every case where it has the hardness, the colour, and the homogeneous appearance which is peculiar to itself, and is void of any very distinguishable extraneous body. But when it contains any particles of calcareous spar, I—would call it, with the miners of Derbyshire, *toad-stone*. When the trapp, however pure, has lost its hardness, and its original colour, particularly when it inclines to a greenish colour, and when I at the same time find it in the form of small veins intersecting rocks of another nature, would I never hesitate to call it *cat-dirt*; and thus I would proceed with respect to all the other known modifications as often as they are sufficiently distinct. This is the most simple manner of making ourselves understood, and at the same time respecting the works and the memory of those naturalists who have cleared for us the thorny paths of science.

CHAPTER XVIII.

Castleton.—Description of the Cave called *The Devil's Arse*.—Mines of Lead and Calamine, Veins of Fluor Spar.—Lead found in Channel or Cat-dirt.

WE rode from Buxton to Castleton, a distance of twelve miles, on one of the finest days of autumn, but along a road as disagreeable and fatiguing as the worst of winter.

During our stay in this little place, which is agreeably situated in the midst of some mountains, we had an opportunity of seeing the different workmen in fluor spar, and visited the magnificent cavern called the *Devil's Arse*, near Castleton, and likewise several mines in its vicinity. The result of my observations is as follows :

DESCRIPTION OF THE CAVE OF CASTLETON,
VULGARLY KNOWN BY THE NAME OF THE
DEVIL'S ARSE.

This cave, regarded at all times as the principal of the seven wonders of Derbyshire,

has been celebrated by several poets. But as, since the time of Homer, Virgil, and Ovid, who united extensive knowledge to sublime talents, few poets have pretended to scientific correctness in their description of physical facts, I shall not here repeat any of the verses, with which the English Muses may have inspired those who have described this grand work of nature.

I feel more satisfaction in telling my readers, that this cave has been honoured with the visits of several respectable men of science, among the latest of whom were, Sir Joseph Banks, President of the Royal Society of London and Dr. Solander, accompanied by Omai, a native of the South Seas, who was received with the most lively interest in England, where he remained a considerable time, and after being loaded with presents, was generously conveyed back to his own country.

This cavern is situated at the foot of a vast range of rocks thrown up by nature on the side of a steep mountain, upon which stands an old castle, built, it is said, in the time of Edward the black prince.

The principal entrance is 120 English feet in width, and forty in height; it forms a circular

cular arch which opens in a rock of grey, and somewhat sparry, lime-stone, sufficiently hard to admit a fine polish, and containing a number of marine petrifications, among which the entrochi and some *anonymæ* of a very large species, are the most common. This stone, on being rubbed against a hard body, gives a smell somewhat like that of burnt corn, and some parts of it, which are of a deeper grey and more sparry grain than the rest, emit so strong a smell, that it may very justly be classed among the *lapides foillæ* or stinking stones.

An inhabitant of the place who gains a subsistence by conducting strangers into the interior of the cave, having learnt our arrival, came to wait upon us. He first presented each of us with a printed paper containing the most ridiculous and exaggerated details of the extraordinary things which were to be shown to us, preceded by the following short preamble; “As many persons have complained of the exorbitant sums demanded by those who show this cave, it is proper the public should be informed of what ought to be given, as those who shew it pay no rent to the king. One person ought to pay

“two shillings and sixpence (about three French livres); and a party at one time, five shillings. These prices, however, are not fixed; and the public may give more or less as they choose. J. HALL.”

J. Hall has adopted in this preamble a very ingenious mode of taxing his customers. But I must do him the justice to acknowledge that he is very active and obliging, anticipates every question, and does not fail to give the most minute details respecting those objects which he conceives deserving of remark. In short, he is perfectly master of his lesson, and recites it with a consequential gravity and sometimes with a tone of enthusiasm, calculated to attract the attention of those who are under his guidance in this darksome cavern.

A party of Englishmen joined us, and we entered the outer porch. It is lighted from without, is forty-two feet high, a hundred and twenty feet wide, and two hundred and forty-six feet long. The light was pretty strong at the entrance of this vast vault, but gradually diminished as we proceeded inwards, or as the fore parts were broken into projections of a greater or smaller bulk. The effect

is so much greater as the scene is enlivened with two manufactories, the one a rope yard, and the other an inkle manufactory, entirely within the place.

All is life and motion in this apparent solitude. On the one side are seen young girls turning their wheels, winding up their threads, and lightening their labours with their songs, and on the other, men spinning cords and twisting cables, or forming them into coils. What is still more extraordinary, there are two houses in this subterraneous apartment standing opposite to each other, entirely separate from the rock, with roofs, chimnies, doors, windows, and inhabited by several families.

It is difficult, without having seen it, to conceive the effect produced by the view of two houses in a situation of this kind. We were soon surrounded with several groups of young girls, some of whom were very handsome.

It appeared that J. Hall here yielded the pre-eminence to the ladies of the place, reserving exclusively to himself the privilege only of exhibiting to the more profound caverns; all these young girls flocked to shew

us the rope and inkle manufactories, and the interior of the two dwelling-houses; after which they directed our admiration to the beauty of the vestibule, the great height of the vault, and the curtains of stalactite which decorate it.

They called our attention more particularly to a stalactite of an extraordinary form at the beginning of the principal arch, a little beyond the farthest house, and at the height of about thirty-five feet. "See," said they, "the famous *leg of pork*; observe its excellent shape, and admire this master-piece of nature." But the more we examined this pretended *leg of pork* the more did we find it resemble an object which young girls are not often permitted to examine, and of which they are still more rarely permitted to allow an examination to others. This object was a heart and not a leg; but it was a heart of the same kind as that of M. de Boufflers. This shews the facility with which young folks may be persuaded that they see what they do not see; but it is at the same time a proof of their amiable candour and innocence. Decency, however, demanded that we should preserve a grave and serious countenance.

Testi-

Testifying our grateful sense of their services by a small present, we took leave of them, and proceeded under the auspices of Hall, who, after distributing to each of us a lighted flambeau, opened the door of a subterraneous gallery at the bottom of the grand vestibule, and desired us to follow his steps through the darksome labyrinth of which he willingly held the clue.

The way appeared at first neither agreeable nor easy. In some places we proceeded in an upright and free posture, whilst in others parts the vaults were so low, that we were obliged to stoop as we advanced, to avoid striking against the protuberances of the rock. This first gallery is a hundred and forty feet long. Here we observed a quantity of sand accumulated into a small oblong eminence. Hall, who was attentive to the minutest circumstances, did not forget to excite our admiration at this sand, which was the production, he said, of a small stream issuing from a subterraneous tank, which we should soon reach. This stream swells after heavy rains, and carrying along with it considerable quantities of sand, often renders the cave inaccessible during its overflow.

Our

Our guide, still advancing and accompanying his observations with expressive gestures, entertained us with an account of the rapidity of the current, the height of the water, its quality, and the noise which it made; when a small lake, with a skiff floating upon it, interrupted our progress. This lake, which is not much more than three feet deep, is wholly inclosed in the solid rock, and stretches under a very low vault of which we could not see the farther end. Here it was necessary to stop.

We stood for some time on the brink, and the light of our dismal torches, which emitted a black smoke, reflecting our pale images from the bottom of the lake, we almost conceived that we saw a troop of shades starting from an abyss to present themselves before us. The illusion was extremely striking.

This piece of water was about forty-eight feet broad; J. Hall gave it the name of the first water. He informed us, that we must cross it one by one in the small skiff, stretching ourselves at full length, as we had to pass under the vault which was very low and narrow; he assured us, how-
ever,

ever, that the passage was not attended with the least danger.

Count Andreani embarking first, stretched himself flat in the bottom of the little vessel which was furnished with some straw. The guide then entered the lake and bending his head almost to the surface of the water, pushed forward the skiff with one hand, while he carried his torch in the other.

Five minutes were sufficient to cross over, and to return for another passenger. My turn having arrived, I lay flat on my back like the others; but in attempting to move as I passed through this low and narrow tunnel in order to examine the stone of which it is composed, my hat struck against the roof, and was thrown into the water. I was safely landed on the inner bank, where we silently waited the arrival of some new companions.

It is impossible for the adventurer, however cheerful his temper may be, not to trace in this scene a representation of the passage of the dead in the fatal bark of Charon. The whole retinue being now landed, Hall, after first drying himself a little and warming his inside with a bumper of rum, which he drank to the health of his followers, called our at-
tention

tention to the spacious extent of the place which we had now entered. We found ourselves in a cavern a hundred and twenty feet high, two hundred and twenty feet long, and two hundred and ten broad. It excites real astonishment to discover such extensive natural excavations in the centre of the hardest rock, and one is lost in conjecturing what has become of the materials which must have formerly occupied those vast vacuities.

In a passage at the inner extremity of this vast cavern, we again met with water, which our guide called the second water. But we easily passed over on a platform running along the side of this small pond, which is only thirty feet in length.

On issuing from this passage we again found ourselves in a vast cavern. At the entrance projects a pile of rocks, from the summit of which the water trickles slowly and deposits a calcareous sediment. This projection has been transformed by the imagination into a house, though it has not the smallest resemblance to one, and as the water incessantly drops from it, the genius of rain is supposed to have made it his habitation. It is accordingly

ingly distinguished by the name of Roger Rain's house.

A little beyond this we came to the grand cavern which bears the name of the *Chancel*. The vaults here are very lofty; and in their sides are different cavities resembling gothic portals and windows. Large stalactites descend from the roof upon the prominent parts of the rock, in the manner of drapery or curtains, and produce a very striking effect. The pavement also is very smooth, being formed of solid rock, covered over from time to time with some stalagmites. The whole has the appearance of a gothic church.

As we advanced our conductor made signs to us with his hand, and by expressive gestures, to preserve silence, as if he wished to inspire us with a respectful awe; and he particularly desired each of us, in a very low voice, not to look behind until he should give notice to do so. He then assembled his company in a group, and placing himself at our head with his face towards us, continued to walk backwards, as if teaching us the military exercise, still making signs and gestures in order to attract our whole attention, and incessantly requesting us to keep our eyes fixed on himself.

left any one should be tempted to look behind. Having in this manner reached almost the inner extremity of the cavern, he desired us to halt. We then heard sweet and harmonious voices which seem to burst from the lofty roof; and involuntarily turning round to see whence the angelic sounds proceeded, we observed in a natural niche at the other end, about forty-eight feet from the bottom, five figures dressed in white, immovable as statues, holding a torch in each hand, and singing in parts a sublime and melodious air to some verses from Shakespear.

It thus appeared that Mr. Hall was playing off his grand machinery for our entertainment; he was delighted even to exultation with the surprise which it produced in us. This unexpected scene, indeed, made a very lively and agreeable impression on us. It had a melancholy and affecting character, which might be ascribed less perhaps to the air and words than to the profound and remote place where they were sung, and where we seemed to be secluded from the rest of nature. Those of the ancients who selected similar places for their initiations, appear to have admirably managed their business. Their grand myste-
ries

ries were never celebrated but in subterraneous caverns.

The chantresses disappeared as soon as they had finished their song, and we proceeded in our course through a lengthened gallery. We had been listening to angels, and we had now to make a short visit to the infernal regions. Our master of ceremonies, J. Hall, introduced us into what is called *the Devil's cellar*. Here we saw a great number of names inscribed on the walls. I know not whether those who wrote them have entered into a compact with the evil spirit, and whether out of gratitude he has permitted them to drink all the wine in his vaults; but this much is certain, that the cellar is at present very ill provided. However as there is no entering a cellar without tasting with the butler, especially in England, Mr. Hall pulled out his small bottle, swallowed a glass of rum, and offered each of us a glass after him, but we begged to be excused.

On leaving this gloomy mansion, which is nothing else than a large cavity blackened by the smoke of lamps and torches, we suddenly came to a heap of quartzose sand. Here it was necessary to proceed along a rapid descent a hundred and fifty feet long, and sinking to

the depth of forty feet below the level of the entrance. On one side of this sandy path is a deep channel, hollowed by nature in the solid rock, through which a pretty large stream, rising at a distance, gently murmurs along, until it loses itself, with loud noise, amidst some caverns.

Here J. Hall played off upon us one of the little tricks of his vocation. He told us in an emphatic tone, that this subterraneous brook, notwithstanding the total privation of light, produced fish, but of a species which he called black fish. To give us a proof of his assertion, he descended to the water through a narrow passage, and after plunging his hand repeatedly into the stream, held up to our view, at a considerable distance, one of his black fishes. He was about to throw it back into the water to prevent the destruction of the species, which he said was already become scarce, when, upon approaching to take a nearer view of it, I soon found it to be a tadpole which he had carried with him for the purpose of deceiving us, and which was already half dead. He was himself the first to laugh at the cheat, and he candidly confessed it, as soon as he perceived that it was detected.

Proceeding

Proceeding forward, we soon passed under *the arcades*, a place so denominated because the rock here forms three distinct circular arches, very much resembling those of a bridge.

A little beyond this we heard the noise of a distant cascade, and saw a pyramidal mass of stalagmite, which is named *the Tower of Lincoln*. Here the cavern was formerly thought to terminate; but, a few years ago, a new gallery was discovered, which extends four hundred and ninety-two feet farther. This we traced to its inmost extremity, where the little river again appeared to our view, issuing from a natural tunnel as perfectly constructed as if it had been the work of art, but so strait and low, that there was no possibility of penetrating into it. At the entrance of this sort of aqueduct we saw several names engraved in the rock, among which we distinguished those of Sir Joseph Banks and Dr. Solander, and also that of Omai, who accompanied them in this subterraneous journey.

The entire length of the cavern, from its entrance to the place where these inscriptions are, is at least two thousand seven hundred, and forty-two feet.

We performed our visit, which lasted several hours, without the slightest accident, and returned equally safe. We made a liberal acknowledgment for the services of our guide, who was much more fatigued than we were, as he was incessantly occupied in pointing out and describing the various objects in our course. He appeared to be as well satisfied with us as we were with his zeal and obliging readiness to serve us; and though he was a little chagrined at the discovery of the black fish, we took leave of each other very friendly.

FLUOR SPARS.

Fluor spar is an important article of production from the lead mines of Castleton, in which it is found in greater abundance than any where else. The violet is the most common kind, and serves as the salband to the white sort. Several other kinds are also found there; such as fine yellow topaze coloured, violet blue, violet purple, white inclining to rose colour, water coloured, &c. There are some pieces, in which several of these colours are united and produce a very agreeable effect.

Fluor

Fluor spar would be the most beautiful of all substances, if it were only a little harder. This stone not only forms a considerable object of traffic in its rough state, between Castleton and Derby, Winster, Matlock, Buxton, and other parts in the vicinity, but is also worked on the spot into vases and other articles of ornament, which are sent to Birmingham, where they are mounted with gilded copper or any other metal.

The largest pieces of fluor spar do not much exceed a foot in thickness, and are very rarely found of that bulk.

LEAD MINES.

The lead mines of Castleton are not very rich, and not more than sixty persons are employed in them; the principal productions of these mines being the different kinds of fluor spar above mentioned.

Several mines have been opened in the very steep calcareous mountain of *Mann-Zor*.

Oden mine is at a very little distance from the town, and presents a very extraordinary mineralogical phenomenon, consisting of a

glittering galena, which is here called *Slikons-fides*. It is usually found in large pieces, forming a double vein. The intermediate space is only a few lines broad, and is filled up with a very white and ponderous gypseous earth, to which the workmen give the name of *keble* or *caulk*.

To break away large pieces of this glittering galena, they make use of a sharp iron wedge, which they drive with a hammer into the thin bed of keble that separates the two veins.

On performing this operation the miners retire with great haste to a distance ; and a few minutes after the veins break asunder, with a terrible noise and a general concussion, which must overturn all the props of the roof, if they had not carefully provided against such accidents by strengthening the principal beams with walls formed of the rubbish, and leaving no vacant space. The miners assert that a hollow noise precedes the explosion, and marks the moment when they must consult their own safety by a speedy retreat.

This terrible phenomenon takes place also in the mine of *Lady Wash* near the village of *Pyam*, in the same district of Derbyshire.

Mr.

Mr. Whitehurst has given a very correct description of all the circumstances connected with this phenomenon. Mr. Ferber, who has likewise mentioned it, says, that no reason could be assigned to him for this extraordinary effect; but that he conceives it to arise from an effort of the air, which is strongly compressed, especially in the narrowest parts of the vein, to procure itself a passage.

But to be capable of deciding upon a matter of so much difficulty, it would be necessary to observe with attention all the circumstances that precede and accompany the explosion, to know whether there be any inflammation or smell. It would be proper also to analyze with the minutest exactitude the substance of the gangue, and the keble, which is not yet sufficiently known.

The theory of gas might tend to throw great light upon this phenomenon. It is known that the phosphoric acid is sometimes found in union with lead. The effects of inflammable gas intermixed with phosphorus are likewise well known, and that it kindles with such rapidity by the mere contact of atmospheric air, as to produce the most violent explosions. This branch of science, indeed, is now suffi-

ciently advanced to enable an intelligent observer, who should have an opportunity of tracing all the circumstances upon the spot, to give a satisfactory explanation of this astonishing phenomenon.

TOAD-STONE CONTAINING LEAD ORE.

Mr. Whitehurst and Mr. Ferber affirm, that in all the mines which have been yet opened, the vein of ore is found exclusively in the limestone, and disappears so completely on reaching the bed of toad-stone, that not the smallest vestige of it is discoverable in the latter; but that on piercing through the toad-stone, however thick, the vein as certainly makes its reappearance, and this fact they affirm holds good through every series of strata to any depth. This disposition, however astonishing, is in general true, and thence Mr. Whitehurst conceived the opinion that the toad-stone which thus separates the calcareous strata and interrupts the course of the ore must be the result of different currents of lava. My thoughts upon this subject have been already explained, but if there should still remain any doubt that the toad-stone is not a product of volcanic fire,

fire; the fact which I am now going to state will be sufficient to remove them.

Doctor Pearson having spoken to me at Castleton of a miner who sold select specimens for the cabinet, we went to pay him a visit. I purchased from him a collection of the most interesting minerals of Derbyshire, and some fine specimens of fluor spar, the crystals of which were in the most perfect preservation.

In the course of conversation with him, I asked whether it was true, that no vein of ore was ever found in the toad-stone? he replied, that such had uniformly been the fact hitherto, and though long employed in the mining business, he had never heard that the slightest trace of lead had been discovered in that stone; but that he had just learned to his cost that the rule was not without exception, if not in respect to the toad-stone, at least as to the cat-dirt or channel.

On requesting a further explanation, he told me, that he had been ruined by working on his own account, a vein, which at first had the most promising appearance, but which, after opening a deep gallery, at a great expence, was lost in a bed of channel, where,
how-

however, it was again recovered, but in too poor a state to indemnify him.

As the mine was but a little way off, he offered to shew it to us, especially when he perceived that I doubted his account. Providing himself therefore with some mining implements, he desired us to follow him, and we willingly complied.

We directed our steps about a mile to the east of Castleton, along the steep side of the mountain which fronts it, and upon a narrow road about 200 feet above the subjacent plain. The mountain is calcareous, and in some parts exhibits traces of strata; but its general disposition presents a uniform and continuous mass like most calcareous rocks of great elevation. Marine bodies are not very abundant here; I observed, however, a few fragments of entrochi and some terebratulæ. Several lead mines have been opened in it, and it also affords calamine in an ochreous form.

We soon reached the entrance of the gallery which penetrates in an horizontal direction, and opens in the stratified part of the calcareous rock, in a seam of white calcareous spar, which presents a small but very
distinct

distinct vein of galena intermixed with fluor spar.

This indication, which was regarded as very promising in a mountain which contained several other lead mines, determined Elias Pedley and his associates to commence their operation. But scarcely had they reached the depth of twelve feet when the lime-stone terminated, and they had the misfortune to meet with the channel.

As, till then, there had never been any instance of the most slender veins of metal being found in this unproductive stone, they would have immediately discontinued their labours, had not the same vein of galena, which they traced through the lime-stone, continued its course in the channel or trapp. This appearance was so extraordinary and novel, that seduced by it, the miners pursued the ore in the channel to the horizontal depth of ninety feet, in the constant hope that the vein, which never exceeded an inch in thickness, would soon enlarge its dimensions.

But the farther they proceeded they found the trapp become so hard, and it required so much labour and expence to cut through it, that Elias Pedley told us, he was on the point
of

of altogether abandoning the work. This bed of trapp was little more than seven feet thick, but it is very probable that it extends a great way into the mountain, when it is considered that the gallery had been already carried ninety feet in an horizontal line without discovering any appearance of alteration.

This bed of channel, or cat-dirt, is really a greenish trapp, very hard in the interior of the mine, but upon being taken out of the gallery and exposed for some time to the atmosphere, it becomes friable, its colour changes, and it passes into an earthy state. It is probable that this decomposition arises from some invisible particles of pyrites, which become efflorescent and cause the substance to fall into a detritus.

Here then is a proof that galena has been found in a bed of channel, in which it has been traced in an uninterrupted line of ninety feet, accompanied with a small portion of calcareous and fluor spar. This instance exhibits a direct and unequivocal exception to the observations hitherto made respecting the mines of Derbyshire. The existence of lead ore in the trapp is a certain proof that it is not the product of fire. I know that those mineralogists

ralogists who are conversant in the study of lithology, who have examined the trapp upon the spot, and are fully acquainted with that stone and all its varieties, have no need of this proof. But the fact appeared to be of so much importance that I conceived it proper to mention it, to do away every doubt upon the subject. This consideration, therefore, will form my excuse to those who may be displeased at the minute and tedious details which I have been obliged to enter into, that I might place the question in the clearest possible point of view.

CHAPTER XIX.

Derby.—*Richard Brown, a Dealer in Curiosities of Natural History.*—*A Manufacture of Vases, and other Workmanship, in Fluor Spar.*

SATISFIED with what we had seen at Castleton, we left that little town, and returned to Buxton, where I put in order the collection I had made of the most remarkable curiosities of Derbyshire.

All our business being finished, we waited upon Doctor Pearson, thanked him for the kind attention he had paid us, and left Buxton next morning for Derby. This journey occupied eight hours, though we had excellent horses and good postillions, but the road was very bad.

Derby is a commercial town. We saw a number of manufactories of different kinds; several porcelain works, and common potteries. We had been informed that a person named Richard Brown, who dealt in natural curiosities, resided here, and that he had in his possession not only the finest productions of
Derbyshire,

Derbyshire, but minerals from different parts of England and Scotland: We visited him. His shop was well replenished with vases of every form and every size, as well as other works in fluor spar of different colours, but much better cut and of a finer polish than those sold at Buxton and Castleton. I purchased a complete collection of his spars cut into small square tablets, in such a manner that they might be placed in drawers, which is the best method of keeping them for study, and the most convenient arrangement for a cabinet.

We were told that Mr. Brown charged very high for his curiosities, but we found that he sold even those which were most interesting and of the finest workmanship at a very reasonable price. He was far from seeking to take advantage of us because we were foreigners; on the contrary, he was moderate in his demands, and treated us with the greatest civility. When he saw that I was fond of lithology, and that I named some stones with respect to the nature of which he was doubtful, he testified much happiness at seeing us, and begged that we would stop with him and drink to the friends of the science of nature.

nature. He instantly ordered glasses and several kinds of wine to be brought; but as we had just been drinking after dinner, we declined this invitation, of the kindness of which however we were very sensible, for Mr. Brown pressed us with the greatest cordiality.

While we were disputing this point of politeness, a dog, which I had purchased in the highlands of Scotland, suddenly left me in the street: he differed from the common shepherd dog. The Scottish dog has more ingenuity and manages a flock of sheep better than the ordinary kind. It is also excellent for keeping off the fox. I tried, but in vain, to recover this animal: my dog was lost or rather stolen.

Next day we went to see another vender of articles of natural history, who was himself a worker in fluor spar and marble. He resided at one of the extremities of the town, by the side of a small river, which flowed at a short distance from his house.

He was a very intelligent young man. I never any other where saw vases of such perfect forms, such exquisite lightness, and such fine materials; but his prices were higher and his manners less accommodating than those

those of Mr. Brown ; wishing, however, to take something from him, I purchased a vase which charmed me by the beauty of the colours of the spar, its elegant form, and the delicate finish of the workmanship. This dealer had also some of the minerals of Derbyshire for sale, but in his collection of them I found nothing interesting.

CHAPTER XX.

*Departure from Derby.—Arrival at Birmingham.—
Its numerous Manufactures.—Doctor Withering.—
Benjamin Watt.—Doctor Priestly—His House,
Library, and his chemical Elaboratory.*

WE left Derby at noon, but as the roads were all very bad in this quarter of the country, we had some difficulty in arriving on the same day at Birmingham. At nine in the evening we entered an inn in this town, after having crossed some black arid heaths, and passed through a savage and dreary region.

We had letters of recommendation to Doctor Withering, the translator of the *Scia-graphia* of Bergman, and a lover of botanical and chemical studies: We waited on him next day. He inhabits a fine house, furnished with taste and elegance. We had tea with him in company with some amiable and beautiful ladies, and to complete our good fortune, we were here introduced to Mr. Watt, a man of singular merit, one of the most skilful mechanists of England, and who possesses
great

great knowledge in chymistry and natural history.

The extensive commerce and manufactures of Birmingham render it one of the most interesting towns in England: Here the traveller may have a comprehensive view of a most active and varied industry exercised in the different arts of utility, of pleasure, and of luxury.

I know that some travellers who have not sufficiently reflected on the importance and advantage of manufactures in a country, such as England, have disapproved of extensive works of the kind established in this town. I know that even Englishmen who have taken but a hasty and inconsiderate view of these magnificent establishments, have observed that it was difficult for the eye to be long pleased in the midst of so many frivolous arts, and where the labours of a hundred men are confined to the making of a tobacco box*. But besides that this statement is exaggerated, these travellers have overlooked the vast works where steam engines are made, these astonishing machines, the perfecting of

* See Gilpin's Picturesque Tour.

which does so much honour to the talents and knowledge of Mr. Watt; the manufactories constantly employed in making sheet copper for sheathing ships bottoms; those of plate-tin and plate-iron, which render France tributary to England, and that varied and extensive hard-ware manufacture which employs to so much advantage more than thirty thousand hands, and compels all Europe, and a part of the new world, to supply themselves with these articles here, where every thing is made in greater perfection, with more economy and greater abundance, than in any other country.

I must observe here, what cannot be repeated too often to Frenchmen, that it is the abundance of coal which gives this advantage, and produces, in the midst of a barren desert, a town with forty thousand inhabitants, who live in plenty, and enjoy all the comforts of civilized life.

The various manufactures in which this useful mineral is employed have covered a sterile and sombre heath with groves of lillies and roses, and converted a savage wilderness into fertile and delicious gardens. The works established by Messrs. Boulton and Watt, in which more than a thousand hands are employed,

ployed, have contributed greatly to promote this change.

The population of Birmingham encreased so much during the American war, that at least three hundred new houses were, during that period, added annually to the town. At the conclusion of the peace, this increase was doubled. The gentleman who made me acquainted with these facts, and who possessed much information, one day shewed me a new street of considerable length, in which the construction of the houses was just commenced upon an uniform plan, and the building was carried on with so much rapidity that there was little doubt but the whole would be finished in less than two months.

I experienced much pleasure in visiting Mr. Watt, whose extensive knowledge in chymistry and the arts, rendered his conversation very interesting. His moral qualities, and the engaging manner in which he expressed his thoughts, daily encreased my respect for him. He has a number of fine children, who are all distinguished by their information and their talents.

I dined one day with this agreeable family, when Doctor Priestly, who is a relation of

Mr. Watt, was present ; I had the pleasure of forming an acquaintance with this celebrated man, to whom experimental philosophy owes so many obligations. I afterwards visited him in company with Mr. Withering. Doctor Priestly does not reside in Birmingham, but at the distance of about a mile and a half from the town, in a charming house, with a fine meadow on the one side, and a delightful garden on the other. There was an air of the most perfect neatness in every thing connected with this house, both without and within it. I know not how to give a better idea of it than by comparing it to those snug houses so often to be met with in Holland, particularly on the road from Harlem to Leyden, and from Leyden to the Hague.

Doctor Priestly received me with the greatest kindness. He presented me to his wife and his daughter, who were distinguished by vivacity, intelligence, and gentleness of manners. The young lady spoke to me of one of her brothers, who was then finishing his education at Geneva, and to whom she seemed very much attached.

The building in which Doctor Priestly made his chemical and philosophical experiments
was

was detached from his house to avoid the danger of fire. It consisted of several apartments on a ground floor. Upon entering it we were struck with a simple and ingenious apparatus for making experiments on inflammable gas extracted from iron and water reduced to vapour. The tube, which was thick and long, was made of red copper and cast in one piece to avoid joinings. The part exposed to the fire was thicker than the rest. Into this tube he introduced cuttings or filings of iron, and instead of dropping in the water, he preferred making it enter in vapour. The furnace destined for this operation was supplied with coak made of coal, which is the best of all combustibles for the intensity and equality of its heat.

By these means he obtained a considerable quantity of inflammable gas of great lightness and without any smell. He observed to me, that by increasing the apparatus and using iron or copper tubes of a larger calibre, aerostatic balloons might be filled with far less trouble and expence than by vitriolic acid. Doctor Priestly allowed me to take a drawing of this new apparatus for the purpose of communi-

cating it to the French chymists who are engaged in the same pursuit.

The composition which Doctor Priestly used to prevent the gas from escaping, either in this or other experiments, appeared to me so excellent that I begged of him to tell me how he made it. He informed me, that after a multitude of trials, he had found nothing answer the purpose so well as the paste of almonds, such as it is when the oil is extracted. This moistened with a little water, in which glue had been dissolved, made an excellent lute. He observed, however, that the glue might be dispensed with.

Doctor Priestly did not regard the experiments made relative to the decomposition of water as satisfactory. He could not admit the fact to be demonstrated so long as the gas was only obtained through the medium of iron, a metal which is itself susceptible of inflammability; but he waited with impatience for the result of the experiments of the French chymists, particularly these of Lavoisier, who had invented, and caused to be constructed, an extensive apparatus for the same object.

“The decomposition of water,” said this indefatigable philosopher, addressing himself
to

to me, “ is of fo much importance in natural
 “ philofophy, and would occupy fo diftin-
 “ guifhed a place among the phenomena of
 “ the univerfe, that far from admitting the
 “ fact upon flight evidence, and as it were
 “ from enthufiafm, it were rather to be wifh-
 “ ed that all objections that may be made, and
 “ which will ftill long continue to be made
 “ againft this theory, were completely refuted:
 “ In the conflict of opinions, truth may at
 “ laft be obtained. But I have ftill fo many
 “ doubts upon this fubject, and I have fo many
 “ experiments to make, both *pro* and *con*,
 “ that I can as yet regard the queftion as
 “ only ftarted*.”

Doctor Priestly has embellifhed his foli-
 tude with a philofophical cabinet, which con-
 tains all the inftruments neceffary for his ex-
 periments, and a library rendered valuable by
 a choice of excellent works. The learned

* Mr. Benjamin Watt, who has published fome ex-
 cellent papers upon the theory of fire, was of the fame
 opinion with Dr. Priestly. “ The theory of the decom-
 “ pofition of water is feducing,” faid he to me, “ as it
 “ would be convenient for explaining the different pheno-
 “ mena of nature ; but the more I reflect on this delicate
 “ fubject, and upon all that has hitherto been done and
 “ written relative to it, the more I find it involved in diffi-
 “ culties.”

pofteffor

possessor employs himself in a variety of studies: History, moral philosophy, and religion, have all in their turn engaged his pen. An active, intelligent mind, and a natural avidity for knowledge, gave him a passion for experimental philosophy; but the sensibility and gentleness of his disposition have sometimes directed his attention to pious and philanthropic studies, which do honour to the goodness of his heart, since they always have for their object the happiness of mankind. Besides his situation as a preacher, renders it often necessary for him to speak in public*.

Next day I had the pleasure of meeting Doctor Priestly at Mr. Watt's, where we partook of an agreeable repast, in company with several amiable and intelligent men.

* I shall not here detail the persecution which this worthy man experienced since the period in which I saw him. His chymical laboratory, his cabinet of natural philosophy, his library, his charming house, were all destroyed by barbarous fanatics. The government has endeavoured to repair this loss by proportional indemnities, which amounted to fifteen hundred louis. But wishing, as a philosopher, to fly from intrigue and to seek repose, and desirous of avoiding similar dangers, he has retired to the United States of America. Let us hope, that in this asylum, he may prosecute his studies with his usual zeal, and that he will be able to repair in part the loss of his valuable manuscripts.

Mr.

Mr. Watt is a man of great conceptions: Nature has endowed him with a very vigorous mind, and to his other excellent qualities he joins the mildest and most prepossessing manners which interest even at first sight.

Mr. Watt shewed us a corn-mill, which he had constructed, and which was set in motion by a steam engine. The application of this principle to the mechanism of a mill is a happy idea, which may be very advantageously applied in a country which has few streams, and is rich in coal. This first attempt will lead to others, and the principle will soon be applied to a number of useful purposes*.

Mr.

* Since this period similar mills have been successfully erected at Nantes, and some at Paris, where some steam engines are used for stamping coins. Steam engines were first established in France, by the brothers Periers, who joined much activity to a great deal of knowledge: But these excellent machines cannot reach the perfection they have obtained in England, until our government shall seriously turn its attention to the opening of coal mines. Those who know the exhausted state of our forests are convinced that the moment will soon arrive when we shall be obliged to work them from necessity. Those who are acquainted with the neglected situation of our coal mines, tremble, lest it should hereafter happen that we shall want both wood and coal at the same time. There is some reason for anxiety on this subject, when we consider that at Paris a weigh of bad coal costs six times more than the best did some years ago. But if the legislature were to turn to
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Mr. Watt is so familiar with great inventions, possesses so much knowledge in the higher branches of mechanics, and has brought the means of execution to so much perfection, that he may justly be ranked among the men who have chiefly contributed to create the present high prosperity of the useful arts and commerce in England. He is a native of Scotland: A country which has long been accustomed to supply England with men who honour it the most in every science and profession.

We passed several days at Birmingham, where we may be said to have resided in the midst of the arts and industry. The society of enlightened men and amiable women added new charms to our situation. Our minds were informed and delighted; our heads were filled with facts, and our hearts with gratitude. Such were the pleasures we experienced in this town. We left it with regret.

the consideration of this subject, as well as that of canals, with the earnestness they deserve, it would be found that our resources of this kind are as inexhaustible as those of another kind, which we have already exhibited to the astonishment of all Europe.

CHAPTER XXI.

Departure from Birmingham.—Coventry.—Warwick.—Oxford.—Saint Albans.—Barnet.—London.—Return to France.

AS we were preparing to leave Birmingham, Mr. Watt requested to know whether we could take under our care one of his sons, who was to go to Paris, and thence to Geneva. We answered, that it gave us a great deal of pleasure to be able to afford him a seat in our carriage, in which there was sufficient room for his accommodation, and that we should pay every possible attention to his son, who was a very engaging young man. Count Andreani and myself were extremely pleased to have an opportunity of justifying the confidence which Mr. Watt reposed in us, and of proving to him how happy we were to be able to give him that small mark of esteem and attachment.

On leaving Birmingham we were delighted to see the country on every side studded with gentlemens seats possessing a simple but elegant

gant appearance, which was greatly heightened by the effect of the rosy colour of the bricks upon the white ground of the stone work. Every thing here was so much more striking, as these elegant habitations were almost new. But scarcely had we lost sight of them, and passed through some woods, when we entered upon an extensive tract of wild and barren heaths.

Between Birmingham and Coventry we had a view of an ancient mansion belonging to Lord Aylesford. It is not very agreeably situated, but it was easy to see that the proprietor had employed the assistance of taste and art in embellishing it.

Coventry is a pretty neat little town. The spire of the church is seen a great way off. The soil here consists of broken flints intermixed with reddish earth.

From Coventry to Warwick we passed over a flat country, in some places woody, and in others naked, and with a soil like the preceding.

We stopped at Warwick in order to visit the church, which is a very fine structure in the gothic stile. The chapel where the chiefs of the house of Warwick have been interred,
and

and where is seen the tomb of the earl of Leicester, is charged with sculptures and gothic ornaments of the most finished neatness. Having visited the other curious monuments of the place, which are described at length in several productions, we proceeded on our way to Stratford, celebrated as the birth-place of the immortal Shakespeare. We crossed the river Avon by a bridge of fourteen arches, erected at the expence of one Hugh Clifton, who was a mayor of London, and a native of this town.

We next reached Oxford, where we visited the most remarkable monuments of science and art. But all these are already so generally known, that it would be superfluous to describe them. I should have been happy to have met here with Mr. Thompson, a very excellent naturalist, with whom I had formed an acquaintance at London, whence he had gone to settle at Oxford. But he was unfortunately absent from home. It would have been not only very agreeable, but also very useful to us to have seen him, as he could have introduced us to the learned men of the place, to whom, from a reliance upon his presence, we had not provided ourselves with any recommendation.

From Oxford we proceeded to London through Saint Albans and Barnet.

Our stay at London was not long. Having taken leave of our learned friends, who had kindly gratified us with the numerous objects of instruction and entertainment, which that city affords, we set out for Paris, where we arrived five days after. Count Andreani prepared for his return to Milan, young Watt took the road to Geneva, and I remained at Paris.

FINIS.





