THE EDINBURGH NEW PHILOSOPHICAL JOURNAL,

EXHIBITING A VIEW OF THE

PROGRESSIVE DISCOVERIES AND IMPROVEMENTS

IN THE

SCIENCES AND THE ARTS.

CONDUCTED BY

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EDINBURGH NEW PHILOSOPHICAL JOURNAL.

On the state of Natural History, and the progress which it has made since the return of the Maritime Peace. By Baron Cuvier *.

At the first origin of society, man was enjoined to make himself acquainted with the objects of nature. Our sacred books represent, at their commencement, the Creator as making his works pass under the eyes of the first of our race, and ordering him to impose names upon them,—a happy allegory, which plainly teaches us, that one of our first duties is to fill our minds with the goodness and wisdom of the Author of Nature, by a continued study of the works of his power. This duty, like all others, is in man an innate feeling; and traces of it are to be found in the opinion of nations at all the epochs of their history. The Hebrews make its accomplishment enter into the merits of the prince whom they present to us as the ideal of human wisdom. That other ideal of every thing great, Alexander has indissolubly connected his memory with that of Aristotle; and it is even from this concurrence of the most fortunate of warriors and the greatest of philosophers, that the history of our science begins. Similar coincidences have marked the epochs of its most brilliant advances. The kings, of whom the history of France speaks with most pride, St Louis, Francis I., Henry IV., and Louis XIV., are precisely those who afforded it the most

* Eloges Historiques, t. iii. p. 450.

protection. With their great renown are, in some respects, associated the more humble names of Rubruquis, Vincent de Beauvais, Belon, Tournefort, and Plumier. It would seem as if these princes remembered that of so many monuments raised to Alexander, the works of Aristotle form the only one that has continued imperishable.

Natural history, in fact, is one of those sciences in which genius is impotent, unless seconded by power; and the efforts of power vain, unless its results are arranged by the co-operation of genius.

The names, which man is ordered to impose, are not incoherent signs applied by chance to some isolated objects. To render them appropriate and significant, the objects, as it is said, must pass before the namer; in other words, he must compare these objects, apprehend the relations of their similarity and difference, and classify them; which he cannot do unless he see them together, and make himself intimately acquainted with them. In short, to name well, taking the word in its fullest acceptation, it is necessary not only to know well, but, it may be said, to know all. The superstition of the Cabalists believed in the magic power of names. This was a false consequence of a principle, that names, were they perfect, would represent the essence and aggregate of things.

Such is the object of this department of science, which unreflecting minds would doom to contempt, under the name of Nomenclature. To refute their assertions, it is only necessary to repeat the fundamental condition which we have just announced, namely, that *to name well, it is necessary to know well.* Now, those beings, and those parts of beings, which it is necessary to know, present themselves by millions; and still it is not enough to know them singly: they are subjected to an order, and to mutual relations, which must also be known; for it is in this order, and by these relations, that they have each a part to perform, that they disappear each at their particular periods, that they are reproduced always alike, always according to the same relative proportions, and with the powers and faculties necessary for the maintenance of these proportions, and of their part in this scene of continual change. Not only is each being an individual organism; the whole world is one, only millions of times more complicated; and what the anatomist does for a single animal, for the little world, according to the expression of the mystical philosophers of the middle age, it is the business of the naturalist to do for the great world, the universal animal, the aggregate of that astonishing multiplicity of partial organisms.

Fortunately the human intellect has also an organising power, the use of which is elicited by a sort of instinct. It is, as it were, independently of his will, that the observer classes, names, brings together, and distinguishes; just as it is by instinct, and with scarcely any reflection, that the rudest tribes create a language, subject it to rules, over which, it might be imagined, that a philosophical analysis had presided.

But in systems of classification as in languages, there may be infinite degrees of extent and accuracy, and even of that quality, more easy to be felt than defined, which, in the sciences, as in the works of art, is denominated elegance.

The ancients made no attempts to form a general system; and two centuries had already elapsed since the revival of letters, before one was ventured to be proposed. Linnæus was the first who had the boldness to undertake this immense enterprise, and he saw his courage receive the most satisfactory recompence. The sagacity of his distributions, the precision of his terminology, the very extent of his system, made him be almost universally recognised as dictator. A multitude of young men, enrolled under his colours, and swearing only by him, dispersed themselves over the globe; and, as an ingenious writer has said, everywhere interrogated nature in his name. In ten years, his nomenclature had become a universal and necessary language.

His edifice, however, still rested upon ruinous bases. Not having sufficiently contemplated the innumerable quantity of species which people the surface of the globe, he imagined that short definitions would be sufficient to distinguish them, and that characters taken solely from their external configuration, would serve for their distribution; and, on this confidence, his pupils believed that they had found his genera and species wherever they thought they could apply his phrases. Hence arose inextricable mistakes and embarrassments. So long as he lived, his authority was sufficient to reduce them to order; but when the master was removed, anarchy possessed itself of the nomenclature, and the universal language quickly became the language of confusion.

In reality, Buffon, Daubenton and Pallas, had opened up better paths, by giving more perfect models of descriptions; and Jussieu had shewn how many more delicate and more numerous relations must be apprehended by him who would pretend to distribute the productions of nature in such a manner as to satisfy the mind. But to change habits that have become general, is to effect a revolution; and the most necessary revolutions do not take place without some circumstance for which it is often necessary to wait a long time.

On this occasion, it has been better seen how every thing aids the progress of science, even the delays and oppositions which it appears to experience. The events which have disturbed the world, and for a time dried up the external springs from which natural history derived its riches, obliged it to retire within itself, and subject what it possessed to a new examination, more fertile than the most fortunate career could have been. During this apparent rest, all the parts of the system have been deeply studied; the interior of animals has been explored; even mineral substances have been reduced to their mechanical elements. A still more intimate analysis has been made of them by a more improved chemistry; the earth itself, in this interval, has been, it may be said, dissected by geologists; its depths have been sounded; the order of superposition of the strata which form its envelope has been discovered. In the deficiency of foreign contributions, the interior of the ground on which we walk became the tributary of science. The beings whose remains it encloses have again appeared upon the earth, and have revealed a natural history anterior to that of the present day, different in its forms, and yet subjected to the same laws, and which has given these laws a kind of sanction which no person could have expected. Botanists did not accumulate in their herbariums so many plants; but with glass in hand, they demonstrated more and more the intimate structure of the fruit and seed, the various relations which connect the parts of the flower, and the indications which these relations furnish for a natural distribution. The most delicate parts of the tissue of organised bodies have been laid open. Medicine and chemistry have united their efforts to appreciate, in its minutest details, the action of the external elements upon the living being. The different combinations of organs, or what is called the different classes and genera, have not been less studied than the general theories. The internal structure of the minutest animals, ascertained by dissection, has been made as well known as that of the human being. Each of the organic systems has, in like manner, been submitted to a particular examination. The brain, that index of the intellectual faculties; the teeth, those signs of the nature and energy of the digestive powers; the osseous system especially, which is the basis of all the others, and which determines the general forms of animals, have been followed out, even in the smallest species, and in their smallest parts. M. Geoffroy Saint Hilaire undertook to demonstrate the identity of the plan on which nature has formed the vertebrate animals. The most dissimilar forms were found by him to be referable to the same model; and, even in monsters themselves, he still found the traces of each point of ossification.

It may readily be conceived that after studies like these, no more should be said of external and artificial methods. The old natural history ceased to reign, and a science full of youth and vigour, armed with means entirely new, saw the return of peace lay open to it the world. Its energy has borne witness to this renovation. From all civilized countries ardent young men have darted forth into distant climates. The ice of the pole, the pestilential marshes of the torrid zone, the cruelties of savage nations, have all been braved. Who does not call to mind the sufferings thrice endured by the companions of Ross and Parry; the horrors to which those of Franklin and Richardson were exposed; the entire and absolute destruction, by disease, of all Captain Tuckey's expedition on the Zaire? And how many have been victims? Peron and Delalande expired, almost within sight of their native land, in consequence of their fatigues in burning climates. Havet was cut off at the moment when he set his foot on the shore of Madagascar, that land of promise, as Commerson called it, but whose approach seems to be guarded by contagion, the most cruel of monsters. Godefroy was murdered in an insurrection of the ignorant inhabitants of Manilla against the strangers whom they supposed to have introduced among them the cholera morbus. Duvaucel, dangerously wounded by the ferocious beasts on the banks of the Ganges, has long languished on a bed of pain.

This devotion to science has not been confined to the young alone. Noel de Morinière, whose age and former labours gave him so just a title to repose, did not hesitate to seize the opportunity of visiting Norway and Lapland. The cold of the North Cape brought on inflammation of his brain, of which he died at Drontheim.

Foreign nations also have had their martyrs to natural history. The adventurer Badia, murdered on the road to Mecca; the young and interesting Ritchie, perishing in despair at Fezzan; Kuhl falling a victim to the contagious climate of Batavia, did not cool the ardour of their successors, who quickly filled up their places. Very recently the intrepid Bowdich, guided only by hope, went forth to penetrate anew into the interior of Africa, respecting which he has given such interesting accounts. He was accompanied by his young wife, a lady of the greatest accomplishments and talents, who, like him, had, by long study, prepared herself for this new enterprise. Every thing seemed to promise the most happy results. Scarcely had he arrived at the Gambia, when death put an end to his projects, and to the expectation of the friends of science. But renown is nowhere to be purchased but by danger or suffering. Science, like victory, subjects to hard conditions those whom she enrols among her followers.

Happily there are also successes which console and encourage, of which several marine expeditions are shining examples. There is no longer a christian nation which does not send out such expeditions, and which does not consider it honourable to contribute in this manner to the progress of natural history and geography. Still more, the zeal of private individuals no longer scruples to engage in similar undertakings. After the Russian Admiral Krusentern's voyage round the world, which had already enriched zoology and geography, we have seen Count Romanzof sending out Captain Kotzebue at his own expense, and this expedition has been not less fortunate than the other. Who could have imagined such an event 130 years ago, when Peter the Great built on a lake his first frigate?

Among the French, Captain Freycinet has been particularly useful to physics and astronomy, and notwithstanding his shipwreck, brought home a multitude of valuable objects collected by his medical officers, MM. Quoi, Gaymard, and Gaudichaux. Of these, scientific Europe will soon be in possession, through the attention of the government, which has ordered their publication; and in this matter we have reason to praise it, for it has too often happened, that after expeditions have been sent out at a great expense, the small additional sum has been refused which would have rendered their results useful to the public. MM. Milius and Philibert have peopled our gardens with many vegetables of the torrid zone. Already what we learn of Captain Duperrey's expedition, excites our curiosity and kindles our hopes. Thus, every thing announces that our navy will not remain behind any other in brilliant results of their exertions, any more than in science and courage.

However, a much less expensive method, and one still more fruitful with respect to natural history, has been devised and put in practice by some governments, since the commencement of the period of which we are speaking.

Young naturalists have gone to settle in different climates, and, from the central point which they have chosen, hunting and fishing in all directions, their researches have been much more productive than they would have been, had they only touched at a few ports. Thus Austria has sent to Brazil MM. Mikan and Schott; Bavaria, MM. Spix and Martius; Prussia, MM. Dolfers and Sello; while the government of the Low Countries has successively kept at Java MM. Reinward, Kuhl, and Van Hasselt.

The king of France has employed equal perseverance and munificence in favouring establishments of this kind, and his views have been perfectly seconded by the ministers entrusted with the departments of the interior and of the navy. France has sent out her scientific ambassadors to all quarters, and war itself has not interrupted this new diplomacy. M. Delalande first betook himself to Brazil, where he made very fine collections, and afterwards to the Cape of Good Hope, for the same purpose. MM. Diard and Duvaucel, led at first by their zeal, but finding every where the most generous protection, collected an immensity of objects in Bengal and the Isles of Sunda, and especially at Sumatra, which had never before sent any thing to the cabinets of Europe. M. Leschenault, during a residence of five years on the coast of Coromandel, has scarcely left any thing unknown of the productions of that rich country. He has lately set out for North America, and we are already informed that he has there resumed his labours with fresh ardour. M. Fontanier is at Teflis in Georgia, engaged in collecting the productions of the Caucasus, a labour in which he is seconded by M. Gamba, the French consul in that city. M. Caillaud, among his discoveries in Nubia, and as far as the borders of Abyssinia, has made some which are not less interesting to natural history than to the study of antiquity. They complete those for which we are indebted to the scientific men of a memorable expedition. M. Milbert and M. Lesueur have traversed the United States. M. Happel Lachesnaye has resided in Carolina and Guadeloupe. M. Moreau de Jonnès had already, during the war, made important observations at Martinique. M. Pley has visited several of the Antilles, and touched at Terra Firma. From all these places great quantities of plants and animals have arrived at the Museum. M. Milbert especially, a distinguished artist, who had formerly accompanied Baudin as far as the Isle of France, excited by M. Hyde de Neuville, our ambassador to the United States, has made unheard of exertions in his researches, and has sent home nearly sixty cargoes. Without being originally a naturalist by profession, he is one of those to whom natural history will owe the deepest gratitude.

It was, on the contrary, after preparing himself by the studies and reflections of many years, that M. Auguste Saint-Hilaire visited Brazil. A profound botanist and an accomplished naturalist in every department, during the five years which he passed there he made great collections of animals, minerals, and especially plants, forming a magnificent supplement to those which M. Humboldt made some years before in Mexico, Peru, and Columbia, and of which that general scholar had already described so astonishing a number.

This passion for science has even made its way among the higher orders of society. Prince Maximilian of Neuwied has been exceeded by none in courage, in patience, or in the number and interest of the objects which he has collected in Brazil. Prince Paul William of Wurtemberg, leaving Europe at the age of twenty-three, ascending as far as the upper Mississippi and the great lakes, and trusting himself to the most savage tribes, has explored the central parts of North America more completely than they ever were before. What is already known of his discoveries excites the most lively desire to see them soon published.

Even persons engaged in commerce no longer despise this kind of riches. There are some who, along with their account-books, keep journals of their scientific observations. M. Dussumier, a young merchant and shipmaster of Bordeaux, who has made several voyages to China, has never failed to bring each time his tribute to the Museum. His returns are there expected and marked as at the custom-house or exchange.

For a long time naturalists in vain sought for accurate information respecting the great Cetacea, which it is so difficult to examine, and still more to place in our cabinets. It was the master of a private vessel, Captain Scoresby, who furnished it, and that, too, in the most complete and precise manner.

By a revolution of entirely the same nature, the European settlements in the two worlds are now becoming foci of intelligence which rival those of Europe. We have nothing better executed than Russell's descriptions of the serpents and fishes of Bengal, or Buchanan's fishes of the Ganges, the figures of which were drawn by natives. M. Dussumier had drawings of plants made by Chinese painters at Canton, of which the pupils of M. Redouté would not be ashamed. Wilson's Birds of the United States, drawn, engraved, and printed in that country, and by artists of that country, do not yield to our most beautiful collections; and there is no difference, as to solidity and authenticity, between the descriptions which are sent us by the natives of these great colonies, the Bartons and Mitchells, and those which we draw up ourselves. The botanic garden of the English East India Company at Calcutta, under the direction of Dr Wallich, has become as large and as beautiful as any of ours, at the same time that it surpasses them all in the facility which the climate there affords of rearing and studying that magnificent vegetation of warm countries, of which in Europe we see but meagre specimens.

The noble liberality with which the learned of different nations communicate what they possess, adds still more to the rapidity with which science advances. We have already in the Paris Museum the objects collected last year by the English near the North Pole, and those which they have just obtained from their new discoveries at Botany Bay. We have specimens of all the fossils disinterred in Great Britain, Germany, and Italy. Java furnishes nothing to the Dutch of which we do not immediately participate. No jealousy now exists, no other emulation than that of more powerfully contributing to the general diffusion of knowledge.

It is through this immense union of efforts, that we are now, it may be said, only beginning to acquire an idea of the riches of organic nature. Linnæus, in 1778, in his general review of vegetables, indicated about 8000 species. There are 25,000 in Wildenow's System, which was commenced thirty years later. M. Decandolle, in the general system which he is at present drawing up, will describe 40,000; and, MM. de Humboldt, Kunth, Martius, and St Hilaire, are preparing rich supplements to it. In a few years the number will have exceeded 50,000. The extraordinary forms which they assume are not less surprising than these numbers; and certainly Linnæus could never have imagined the existence of the *Rafflesia*, a parasitic plant, having neither stem nor leaves, and consisting solely of a flower, but of a flower three feet in diameter. It was in the depths of the forests of Sumatra that this plant was a short time ago discovered.

Buffon estimated the number of existing quadrupeds at about 300. M. Desmarest, in a recent work, has counted more than 700; and he himself is far from considering his enumeration as complete. It was supposed that the large species at least were all known, but India has furnished very large quadrupeds in abundance; four or five stags, as many bears, two rhinoceroses, and even a tapir, a genus which was supposed to exist only in America. It is especially to MM.

Diard and Duvaucel that we owe these additions in the class of quadrupeds; and they are inserted, with many others, in the great work which MM. Geoffroy St Hilaire and Frederick Cuvier have undertaken in this department of zoology.

The menageries in which these animals have been collected, have afforded to the observer means of examining instinct, and of fixing with precision the limits by which that faculty is separated from human intellect. The labours of M. Frederick Cuvier on this subject have opened a new path in this department of philosophy.

We have no precise ideas as to the number of birds, reptiles, and fishes, on which there have not lately been any general works; but all the collections swarm with new species waiting to be described.

After the beautiful collective descriptions of birds by MM. Levaillant, Audibert, and Vieillot, MM. Temminck and Laugier have lately undertaken one which already approaches the 300th plate, without there being any thing in it that has appeared in former works.

The Count de Lacepede, twenty years ago, in his celebrated History of Fishes, described not less than 1500 fishes, comprising all those of which authors had spoken, as well as those which he had seen. The royal cabinet alone possesses at the present day 2500, of which more than the half have been added within the last ten years. But these 2500 species probably form but a small proportion of what the sea and rivers will furnish. The rivers of France produce about 50, and the Ganges alone has already afforded 270 to Dr Hamilton Buchanan. There is no doubt that the other rivers of warm countries possess proportional numbers.

Similar augmentations are manifested in M. de Lamarck's great works on the Invertebrate Animals, in that of M. Lamouroux on the Polyparia, and in the magnificent work which M. de Ferussac has lately devoted to the land and fresh-water Mollusca alone. M. Rudolphi has almost revealed a world in his history of the worms which live in the bodies of other animals.

In the class of insects in particular, the numbers are altogether astonishing. There is no country, however well examined it may be, that does not daily furnish new species; and it is by thousands that each traveller brings them home from warm climates. The royal cabinet alone at present possesses more than 25,000 species; and, according to the most moderate estimates, there are at least as many in the other cabinets of Europe which it does not possess. M. de Latreille, who has done more than any one else in advancing the knowledge of this class of animals, has calculated that a person intending to describe all that have been collected, would require thirty years of very assiduous labour; and, in the course of that time, if the zeal of travellers is not relaxed, there will have arrived an equal number of new species. And, let it be observed, I only speak here of mere external descriptions. With respect to the internal organization, two or three of these beings which the vulgar treat with contempt, might occupy the whole of a man's life.

We cannot look without admiration on that work on the anatomy of a single caterpillar to which Lyonnet devoted ten years. A similar examination of the Maybug, recently made by a young naturalist, M. Strauss, is not less calculated to confound the imagination. In this small body, scarcely an inch long, there may be counted 306 hard pieces, serving as an envelope, 494 muscles for moving them, 24 pairs of nerves for animating them, all divided into innumerable filaments; 48 pairs of tracheæ not less divided, for carrying air and life into this inextricable tissue. The delicacy and regularity of the whole afford a delightful spectacle. Down to the beautiful arrangement of the colours, all seems calculated to please the eye of man, of man who perhaps never before saw it since the creation.

What can be more calculated to excite our reflections than the object of so many beauties lavished by Nature on the most hidden of her works, those which are most withdrawn from our view? Those thousands of fishes, for example, whose scales shine with the splendour of gold and of all the precious stones, in which all the colours of the rainbow are displayed, reflected in bands, spots, undulating and angular lines, always regular, and always of admirably combined or contrasted shades. For whose pleasure were those wonders destined, which the depths of the ocean conceal from us? They cannot even be seen by each other, for the light scarcely penetrates into the depths where they live. The more one reflects, the stronger becomes the persuasion that so many beauties purely relative to man, are an attraction for man. The wonders of the earth, like those of the heavens, are destined to captivate our mind, to excite our genius. It is the continuation of the command to see and name, with which the life of our species opens; it is the path that is to lead us, whether to higher contemplations or to inventions only useful.

In fact, natural history makes no step without physiology and philosophy marching with an equal step, and without society receiving their common tribute. Nor does the epoch of which we have been speaking shine less for the sciences of experiment and combination, and for their applications to our wants, than for those enormous accumulations of the objects of our studies; and it would not require less time than I have already occupied, to present a mere enumeration of the benefits these sciences have conferred. I would shew all that botany has gained for us. The *araucaria* cedar, brought from Brazil by M. St Hilaire, and which will form so fine an ornament for our southern woods. I would speak of the *Phormium tenax*, formerly imported by M. de la Billardiere, and whose propagation in France is now insured. Its threads, which are smaller, and at the same time stronger, than those of hemp, will be of the greatest utility for our navy. I would make known the services which M. Leschenault has rendered to the Island of Bourbon, by teaching the inhabitants, what they were previously ignorant of, the mode of applying their cinnamon-trees to use, and the new source of riches which he has given to Cayenne, by transporting there the tea-plant of China. In reality, our colonies live only on the gifts of our botanists, and it is surprising they have not erected monuments to Jussieu and Desclieux, who procured for them the coffee-tree, or to Poivre and Sonnerat, who went, amid so many perils, to seek out spice trees for them. I would explain how the discoveries of botany are rendered doubly useful by those of chemistry, which, in these later times, has succeeded in unfolding the medicinal principles, and in appreciating, almost mathematically, the degree of virtue of each substance. The labours of M. Sertürner, of MM. Pelletier and Caventon, would appear here with lustre. I would join those of M. Chevreul on the principles of animals, which open new views in physiology; those of M. Mitscherlich and M. Beudant on the production of crystals, which afford important ideas both for mineralogy and for the theory of the earth. But, above all, should we see physiology itself, the science of life, conducted by natural history, chemistry and physics, opening up on all sides untrodden paths, and giving the greatest hopes to humanity. That multiplicity of forms under which life shews itself in so great a number of different animals, has given rise to less confined views of it; and the rigour of the experiments to which it has been submitted has impressed upon the science to which its investigation belongs a character of precision, of which, fifty years ago, it could not have been thought susceptible. A generous man, M. de Monthyon, by the prizes which he founded for it, still gives it a lively impulse; and already, what among ourselves M. Edwards has determined respecting the action of external agents on living bodies, M. Serre on the formation of the bones and the developement of the brain, M. Magendie on the process of absorption and the distinction of the nerves of the will and of sensation, and M. Fleurens on the particular functions of each of the masses of the brain, announces a new era, of which the improvement of the art of healing cannot fail to be the term.

But I perceive that these brief indications have already carried me beyond the range to which I had designed to limit myself. Their fuller exposition I shall reserve for another opportunity. Let it suffice for the present, that I have sketched the picture of the tribute which peace has bought to the sciences. It enables us to see at once the immensity of nature, and the enjoyments which its investigation still promises us. All the labours of naturalists, it must be allowed, are as yet but slight perceptions, furtive glances cast over this vast field. But let not this idea discourage. The only one that could truly be discouraging would be, that we had arrived at the end, and that there remained nothing more to exercise the genius of the observer.

On the Excavation of Valleys, as illustratéd by the Volcanic Rocks of Central France. By CHARLES LYELL, Esq. F. R. S., Vice-President of the Geological Society of London, &c.; and RODERICK IMPEY MURCHISON, Esq. F. R. S. Secretary to the Geological Society of London, &c. (Communicated by the Authors *.)

THE illustration afforded by the volcanic phenomena of Central France, of the power of rivers in excavating valleys, has already engaged the attention of many authors; but every additional fact and argument bearing on this subject, will, it is hoped, be of interest; and apology will be unnecessary, should we repeat, for the sake of perspicuity, some doctrines on the origin of valleys, long ago announced by Saussure, Playfair, and Montlosier, since it is well known that the opposite opinions of De Luc and his school have enjoyed almost an equal share of favour amongst our countrymen.

Before we advert to examples of lava currents, which have suffered considerable destruction from the erosive action of running-water, it will be necessary to remark some characteristic peculiarities of form in such currents as have remained nearly entire and unaltered from the time of their first flowing, either because they descended over a surface elevated above the levels of torrents or rivers, or because, where they occupied a water-course, they diverted the stream into another direction, so that its new passage was not worked out through the lava. In these cases, the lateral termination of the current is generally abrupt and broken, and such as would not have been anticipated by those who have not observed phenomena of like nature in lavas proceeding from existing volcanoes. Thus the current, or "Cheire †" of Puy de la Vache in Auvergne, crosses an inclined plane immediately on leaving its crater, and proceeds in

* Read before the Geological Society of London, December 5th and 19th 1828.

† "Cheire" or "Cherre" is the local name of basaltic currents in Auvergne, and M. de Montlosier states (p. 48. *Essai sur la Theorie des Volcanos*), that it is derived from the Latin word "Scirae" signifying rugged places or defiles; and hence, in the old deeds relating to this country, the word "Cherulæ." (Duc.)

the shape of a long dike or mound, rising in the middle between 100 and 200 feet high above the plain; and its sides, which are about 50 feet high, instead of slanting down gently to the subjacent granite, descend at the rapid angle of 40° or 45°. The same lava, in a lower part of its course, presents a long steep face towards the lake of Aidat, of which it occasioned the formation, by damming up the course of the stream.

Several of the "cheires," descending from the western granitic plateau from the chain of Puys of the Monts Dome, exhibit the same phenomenon in a striking manner; but it will be sufficient to allude to that branch of the lava-current of Côme, which changed the course of the Sioule, and of which M. de Montlosier has given so faithful and animated a description *. "But what," says he, "has this branch of the lava-current of Côme effected? After encrusting all the higher portions of Mont Ceysatt, it descended to the bed of the Sioule, and barred the course of that river, by presenting to it an impenetrable barrier. The waters thus checked, must, in rising gradually, at length have overrun this parapet, had they not found, somewhat higher up upon the left, an argillaceous hill, through which they insinuated themselves, and in which, after softening the entire mass, they made enormous excavations, and finally poured themselves into the bed of the Monges one and a-half league higher than the original point of junction of that stream with the Sioule."

The barrier of lava before mentioned, caused above the point where it stopped the course of the Sioule, a stagnant water called the Etang de Fung. The side facing towards the Etang is a steep rocky slope 80 feet in height, the general inclination of which is at an angle of 45°, and entirely devoid of vegetation. The lava is compact, and does not appear to have suffered at all from decomposition, and as there has been no stream at the bottom to undermine and remove a talus, any external waste can only have had the effect of diminishing the original declivity. On the other hand, this barrier of lava would present a still loftier precipice, were not its base concealed by a deposit of white alluvial clay, formed in the Etang de Fung before its drainage, the depth of which is unknown. But the

* Essai sur la Theorie des Volcanos d'Auvergne, p. 33.

height now exposed is sufficient to strike an observer inexperienced in volcanic phenomena with astonishment. They who have examined modern lavas are aware, that the surface and sides of the stream consist, even while it is moving on, of a thick coat of scoriæ and solid lava, and often to a considerable depth, of broken angular masses of heavy lava, so that the external form of the current bears no resemblance to that assumed by a liquid mass.

Below the Etang de Fung, the "cheire" of Côme occupies the whole valley down which the Sioule formerly flowed, continuing in full force past the village of Mazayes, which is built upon it. We have here, therefore, an opportunity of observing the original form of a stream of lava, which has taken entire possession of a river-gorge, and has subsequently remained undisturbed. Notwithstanding occasional irregularities, the central part of the "cheire" swells to the greatest height, and on approaching the gneiss on either side, it generally slopes at a considerable angle, sometimes not less than 40°. As the gneiss usually meets it at a steep inclination, a lateral valley is formed on each side, destitute of water. If the Sioule, when first dammed up, had been compelled to find an exit in this direction, it would naturally have taken its course through one of these, passing between the lava and the gneiss. But we may also affirm, that it would have flowed down the western side, for when a "cheire" descends into a valley in a course at right angles to that of the river which it dams up, the barrier of the lake thus caused is necessarily of much greater height on the side where the lava enters. Upon this principle, we may explain why the basalt of the volcano of Chaluzet in Auvergne, and of Jaujac in the Vivarais is confined to one side of the river, viz. that on which are the respective volcanic vents. In these cases, the rivers opened a new channel between the lava and the primary rock, on the side opposite to that on which the lava first entered. From considering the above facts, it will appear, that when a river has eaten out a new channel, and the lava presents a perpendicular section on one side, we may easily exaggerate the quantity of matter removed, unless we bear in mind the probable form of its original termination. It is only when some remnants of the lava are observed on both sides of the new excavation, that we can form a very exact estimate of the extent of the waste.

The waters of the Sioule being, as before mentioned, dammed up at the Etang de Fung, opened for themselves a new passage nearly at right angles to their former course, in order to join the Monges. It becomes, therefore, an interesting matter of inquiry, to learn how the new valley was formed, what was the nature of the argillaceous hill mentioned by M. de Montlosier, and whether the entire mass was softened, as he supposed, previous to excavation. As no one has yet described this locality, we may be permitted to offer a few details concerning it. The barrier which originally separated the courses of the two rivers, consisted of alluvial clay resting on gneiss, so that the deflected stream hollowed out its bed sometimes entirely through clay, sometimes through the subjacent primary rock. The Sioule is now seen immediately after its entrance into the new valley, washing on its right bank the foot of a precipice of alluvium 140 feet perpendicular, undermined, and in a state of gradual decay. This bank consists of blue and red clay not laminated, but shewing by slight shades of colour that it was deposited horizontally, and exhibiting here and there some irregular sandy beds, about one foot thick, containing small pebbles of gneiss and quartz, but no volcanic fragments, so that we may conclude the whole to have resulted from the waste of primary rocks *. Not far from this section, the subjacent gneiss is seen on the same bank, worn through to the depth of twelve feet. The river next flows for some distance through an alluvial plain, bounded by hills of clay, and then passes through a narrow gorge of gneiss, which rock on the right bank overhangs the river in a cliff 40 feet perpendicular, still slowly wasting. A plateau of ancient basalt is seen at the height of about 250 feet or more above the Sioule on either bank, and from the general structure of the country, we may infer that here, as at Mount Perrier (afterwards to be mentioned) alluvial deposits between

* Primary clay-slate exists at the distance of a few miles from the Etang de Fung, on the western slope of the granite of the Puys of the Monts Dome. It may be seen between Montari and Brameau, where it is vertical. The destruction at some former period, of parts of this formation, may have occasioned the immense preponderance of argillaceous matter in the above-mentioned alluvium.

200 and 300 feet in thickness had filled an ancient excavation, which in this instance had been effected through gneiss capped with basalt, as in Mount Perrier, through tertiary marls capped with a similar basaltic plateau. The exact depth of the alluvium removed cannot be precisely stated, but the height of some parts, which ascend to the foot of the basaltic plateau, is above 250 feet, and one of the vertical cliffs composed of alluvium, of depth unknown, is, as we before stated, about 140 feet high. This new excavation forms a sinuous valley about * two and a half miles in length, sometimes expanding so widely, that the Sioule runs in sweeping curves without reaching either bank, in a valley which may be compared, in point of size, to a large majority of those in our tertiary and secondary formations, where it is equally difficult to conceive that such prodigious effects can have resulted from causes apparently so feeble. The mode of operation whereby so narrow a stream has eaten out so wide a valley, may still, however, be detected. Here and there are the remains of ancient land-falls, the ruins of alluvial cliffs formerly undermined. These are now covered with vegetation, and constitute under-cliffs or taluses. By such obstructions, the stream has been deflected from time to time against new points of attack, where it is now undermining steep precipices of clay, and at the top of these are large fissures threatening future land-slips. The solid gneiss moreover, now occasionally laid bare at the bottom of the valley, causes sudden flexures in the stream.

In proportion as the distance between the opposite banks increases, (and it often fails in its present bendings to reach either side), the shifting of the course of the Sioule is becoming less frequent. As the rate of waste therefore diminishes with the width of the valley, the mode of its formation may become at a remote epoch an obscure and difficult problem. We refer the operation in question to the Sioule, because no extraordinary inundation can have co-operated. For the "cheire" of Côme, which flowed down before the formation of the new valley had begun, occupies so low a level, that had the waters risen

* See Dumarest's map of Auvergne, the earliest work of merit on the physical structure of this district, and one of the first successful efforts at combining geographical and geological information.

about 200 feet high, they must have left some marks of their passage in that lava. But the rugged surface of the "cheire" from the Etang de Fung to Mezayes, is remarkable for the entire absence of sand or pebbles of any kind, or the slightest covering of mud in the numerous hollows, as also for the angularity of the blocks of loose scoriæ scattered over it in abundance.

These last-mentioned circumstances tend also to invalidate the conclusions of some geologists, who attribute powerful effects, in the shaping of hills and valleys, to mere frost, disintegration, and the vertical descent of rain-water. It is at least certain, that during the time required by the Sioule to excavate the valley above described, no visible effect has been produced on the exposed surface of the "cheire" of Côme.

Volcano of Chaluzet.

We shall next recall the attention of geologists to an interesting spot near the village of Chaluzet, on the Sioule, below Pont Gibaud, where volcanic products were first noticed by Dolomieu, and of which Mr Scrope has given a brief description in his recent work. Previous to entering into details, it may be desirable to give a slight sketch of the lava-current, and of the source from whence it issued.

Immediately on the north of the village of Pranal rises a conical hill called the Puy Rouge, composed entirely of red and black scoriæ, including much puzzuolana, and many volcanic bombs, which materials present about the same degree of freshness of aspect as in the volcanoes of the Vivarais. On the western side of this cone there is a considerable depression towards the village of Chaluzet, resembling a worn-down crater, and issuing from thence, a powerful stream of lava is to be traced round the western and southern sides of the Puy Rouge by Pranal, until it almost entirely occupies the valley of the Sioule, leaving only a narrow gorge through which that river forces its passage. Hence the lava deflected to the north-west, by the lofty and serrated ridge of gneiss which forms the right bank of the Sioule, follows the course of that stream to Les Combres, where it terminates. Throughout this space the windings of the river are so tortuous, that they must have materially impeded the flow of the liquid matter, and may thus probably have occasioned those great protuberances and irregularities of surface, which, although characteristic of all lava-currents, are remarkably displayed in this. These peculiar features are several times repeated, for whenever an expansion of the valley offers itself, the lava is spread out into a broader and thinner sheet, and at those points where salient promontories of gneiss-rock seem to have barred its passage, the volcanic matter swells up to great heights. Since the mineralogical account of this current has been described by Mr Scrope *, we shall here merely state, that in general characters it is identical with most others of nearly a contemporaneous origin, in having an upper part light, cellular, and scoriaceous, which passes downwards into a basaltic mass, occasionally divided into irregular and converging columns, and frequently terminating at its base in most perfect vertical prisms. The deepest section of the lava occurs directly under the village of Chaluzet, where the left bank of the Sioule consists almost entirely of vertical cliffs 400 feet in depth, exposing in their higher parts black and red scoriæ, in their lower columnar basalt. These rocks abound in caverns, some occurring in scoriæ black and cellular, as those of Vesuvius, whilst others, situated at lower levels, are grotesquely hollowed out of the compact basalt. Amongst the latter, the arcades of Pranal are remarkably picturesque.

The lower ends of the prisms of basalt generally terminate at some height above the present bed of the Sioule, and whenever not obscured by debris, they are seen to rest upon a bed of pebbles, of varying thickness, below which the subjacent gneiss is cut through, down to the actual level of the river. Near Pranal this pebble-bed is observable in the cliff, about fifty feet above the stream, and the space thus denuded exposes a face of gneiss, nearly vertical, in which lead-mines are now extensively worked †. If, however, no other than these longitudinal sec-

* Geology of Central France, p. 85.

† The greatest depth of gneiss worn into by the river under the basalt, appeared to us, after a careful examination, never to exceed fifty or sixty feet. Mr Scrope had conjectured the amount of excavation through gneiss (called mica-schist by him), at 200 feet.

tions had been afforded, there might have existed some difficulty in proving that this alluvium did at any time pass horizontally under the basalt, constituting a river bed, and not merely debris covering a mountain slope; but we obtained the most unanswerable evidence in support of this fact at Les Combres. There, within a very short distance of its termination, and when the lava-current has diminished to the thickness of thirty feet, it rests upon a pebble-bed, having between it and the stream about eighteen feet of gneiss *. Fortunately at this point there is an ancient excavation (said to have been a mine of the Romans), and a gallery has been driven in horizontally through the upper part of the gneiss and the superposed alluvium, so that the lower ends of the columns of basalt form the roof, resting on the pebble-bed, which can be traced for the space of fifty or sixty feet inwards on either side of the gallery, occupying, regularly throughout, the space between the basalt and the gneiss. In this alluvial bed are fragments of old basalt, with others of gneiss, and much white quartz and schist. Many of these boulders are quite rounded, whilst others are flat and slightly angular, as in the bed of the present river, and the surface of the gneiss on which they are deposited is slightly undulating.

The higher portion of the alluvial bed consists of fine brown sand, identical with bands occupying similar positions at Montpezat and other localities in the Vivarais, and the ends of the prisms of basalt terminating upon this sandy bed are here, as in that district, scoriaceous and cellular.

No remnant of the lava of Chaluzet is now found on the right bank of the Sioule, but it must once have reached it at many points, as the gorge is every where narrow, and at Pranal cannot far exceed fifty or sixty feet in width, although here the basalt, resting on gneiss, forms an impending and vertical cliff, about 100 feet in height. For two-thirds of this thickness the basalt is prismatic, and this structure implies its former liquidity and slow cooling on the spot, and that it did not form the exposed surface of a "cheire." It may indeed be contended, that the Sioule excavated the present chasm between the basalt and the gneiss, and chiefly through the latter, because this would

* See Plate I.

account for some ranges of basaltic prisms lying on the gneiss, nearly horizontal, and presenting their ends towards the gorge. For, in the valley of Antraigues in the Vivarais, where a section is afforded of basaltic current abutting against a precipice of gneiss, the prisms are nearly horizontal; whereas they are oblique on the slope beneath, and vertical where they rest on the level bed of the ancient river, in accordance with a fact now generally established, that the axes of the prisms are always at right angles to the cooling surfaces.

The comparative destructibility of the basalt and the gneiss is by no means unfavourable to this hypothesis; for although there are here, as usual, in the gneiss formation, some strata of a hard granitic texture, yet in general it is a slaty rock, containing much mica and decomposing felspar, and its high inclination, usually at an angle of about 65°, and numerous fissures parallel to the main course of the river, facilitate disintegration. This tendency to waste is evinced by the huge slaty masses encumbering the foot of the cliffs or the middle of the river-bed. The basalt, on the other hand, is extremely compact, resists decomposition, and is only perishable in some parts where the prisms happen to be vertical, and exposed to the mechanical action of an undermining current.

Mr Scrope has observed, that the undisturbed and perfect state of the cone of loose scoriæ whence the lava of Chaluzet proceeded, demonstrates that no denuding wave, or extraordinary body of water, has passed over this spot since the eruption; and we may add, that here as at Côme, the upper scoriaceous surface of the "cheire" preserves its original asperities, and is in no part strewed over with sand or alluvial pebbles. Now, if we compare the extent of waste at Chaluzet with that undergone by the "cheire" of Côme below Pontgibaud, it is difficult not to conclude with Mr Scrope, that the eruption of Chaluzet was considerably anterior. But we can have no hesitation in assuming that Chaluzet is at least as ancient a volcano as Côme. Whence it follows, that in times comparatively recent, there has passed through the narrow gorge of the Sioule near Chaluzet, 1st, The whole contents now removed from the higher valley before alluded to, connecting the Sioule and the Monges; 2dly, All that has been excavated out of the "cheire" of Côme below Pontgibaud; 3dly, All the basalt and subjacent gneiss destroyed as above stated between Pranal and Combres; and, 4thly, The whole detritus of primary rocks brought down from countries higher on the Sioule than the above localities. This enormous quantity of rock and soil has been carried, we say, through this gorge, in times comparatively recent; for the products of Côme and Chaluzet are modern in comparison with the ancient basalts of Auvergne, as are the latter in reference to the lacustrine tertiary strata whereon they rest.

If, then, within a period of time inconsiderable with reference to the earth's history, the volume of matter carried down by a single tributary stream of the Allier be so prodigious, it is easy to perceive, that, were all the materials which have been transported during the same time by other rivers from the central granitic mountains of France, united and presented to us in one view, they would bear witness to the force of causes that have operated, and are still operating, in nature, to an extent far beyond the calculation of many geologists.

Volcano of Montpezat.

Without regard to geographical connection, we shall next describe some phenomena analogous to those of Chaluzet, as presented by the valley of Montpezat in the Vivarais. For the leading facts relating to this lava-current, we refer to Mr Scrope's work *. He, in common with M. Faujas de St Fond, has described the primary rock of this district as granite. But the whole country, from the source of the Ardêche in the Haut Vivarais to near Aubenas consists of gneiss, composed in general of the ordinary ingredients of granite, but distinctly laminated in strata, for the most part of great thickness, often vertical, and always highly inclined, and here rarely deviating from the same direction, viz. from NW. to SE. Some members of this formation are composed here, as in Scotland, chiefly of hornblende; others are, in mineralogical characters, true granites, though belonging to the same system, and granite veins are not uncommon. The verticality of the strata has contributed to

* Geology of Central France.

the serrated outline of the mountains, and to the deep and fissured character of the valleys.

The cone and crater of Montpezat have as perfect and fresh an appearance as the most recent in Auvergne. The volcanic bombs are extremely numerous, and the ashes are so loose, that there is no vegetation on the greater part of the northern slope. As there are no smooth rounded alluvial pebbles at the bottom of the crater, or on any part of the cone, the angular blocks of gneiss near the summit (some heavier than a man can lift) were not transported thither by water, but must have been ejected from below. These have undergone no visible alteration; a remark that will apply equally to many of the granitic fragments contained both in the scoriæ and basaltic lava of this volcano. The black cellular scoriæ that were thrown out from the crater towards Thueyts, attest, if possible, still more strongly than the state of the cone, that no general inundation has passed over the country since the eruption. These ashes and scoriæ are very light, the fragments varying from the size of walnuts to peas, covering, in beds from three to four feet thick, a rapid acclivity of gneiss. They have in great part disappeared, but, from the abrupt shape of the valley, and their feeble adhesion to the subjacent rocky slope, it is clear, that even the force of a very small body of water would have swept away the whole.

The lava of Montpezat descended from a breach on the NW. side of the crater into the bed of the Fontaulier. Now, it is natural, and indeed almost necessary, to suppose, that whenever a mountain stream is thus dammed up, a lake must have been the result, which would receive for a time all the sand and rocks brought down continually from the higher mountains. The river issuing from such a lake would exert but little power near its outlet, not being yet charged with foreign matter. These circumstances are still clearly exemplified in lakes caused by similar obstructions in Auvergne, and we shall enumerate some facts there observed, as illustrative of phenomena to be described in the sequel. At the lake of Chambon, for instance, where the lava of Tartaret blocked up the whole valley of the Couze, that river has been unable, near its outlet, to wear to the depth of more than a few feet through the barrier; whereas, not far below, at Sailhens, where the body of water is not greater, it has cut to the depth of fifty feet into the compact lava ; and still farther down, in a narrow defile in the granite below Verrieres, it has not only pierced, but entirely swept away, at many points, the whole lava-current,—a break the more remarkable, because the "cheire" is again resumed in great force, where the valley widens below, spreading near its termination at Nechers to the breadth of half a mile.

Although the Couze of Chambon produces so little effect at its exit from the lake, it has formed at the upper extremity an alluvial tract, several miles in length, and, by the continual influx of matter from the heights of Mont Dor, it will fill, at some remote epoch, the whole lake.

In like manner, the upper end of the Lac d'Aidat is shallow, and encroached upon by a marshy delta. The stream where it issues has only cut down to the depth of a few feet, passing between the granite and the "cheire," although at St Saturnin, about twelve miles below, it has not only cut through the "cheire" (above 100 feet thick), but through about twenty feet of subjacent fresh-water strata.

In the case of Montpezat, there appears to us clear evidence of the lava having occasioned a lake, and of the lake having been subsequently filled, and this lacustrine deposite, with part of its barrier, having been finally cut through. The south pier of the bridge over the Fontaulier at Montpezat, rests on basalt, constituting that part of the lava-current nearest to the crater. Overlying this, on the right bank, are seen alluvial deposites, about thirty feet in thickness, the lower half composed of layers of volcanic sand, with a few small pebbles of gneiss, the upper of coarse gravel, and rounded blocks of gneiss, several tons in weight, the whole often cemented into a puddingstone by volcanic ashes. On the opposite bank, a terrace of this coarse alluvion is also seen resting on basalt. About thirty yards higher up, on the same side of the river, the finer volcanic part of this deposite is seen reaching down to the level of the river, in thin sedimentary layers. We may suppose, therefore, that a lake was formed, and that the lower extremity was principally filled with volcanic matter, washed down, and perhaps in part ejected from the adjoining cone. Over successive layers of this finer matter, which at length overtopped the sloping sides of the barrier, the Fontaulier, having first pushed forward a delta across the lake, brought down its coarse alluvion. It then opened itself a passage through the lacustrine alluvium, and is now gradually eating out a ravine through the subjacent basalt. The enormous magnitude of some boulders resting on the basalt, do not imply a greater power than that of the present river, for we saw masses of gneiss of as many tons in weight, which had been recently brought by much smaller torrents into the Fontaulier.

The lava current, after crossing the river at the point above mentioned, spread itself over the small plain, where the town of Montpezat stands, and filled the channel of the Pourseille, a stream which unites with the Fontaulier a short distance below, at the Castle of Pourchirol *. A few yards above the point of confluence, the Pourseille falls in a cascade over a cliff, the upper part of which, to the depth of thirty feet, consists of scoriaceous lava worn through by the stream; below which is a bed of prismatic basalt, thirty feet in thickness, vertical and overhanging, for it has been undermined by a copious stream of water which runs beneath, through a bed of sand and pebbles, resting on gneiss. This ancient alluvion varies from three to nine feet in thickness, and is composed of ferruginous brown sand, and rounded boulders of gneiss, but none of basalt. The gneiss underneath is worn down in an inclined plane to the depth of perhaps thirty feet. In the natural grotto thus formed under the basalt, the original pebble-bed may be studied in nearly as satisfactory a manner as in the mine of Chaluzet before described †.

Below the Castle, the lava expands itself into a sheet about a mile in breadth, and about two miles long, forming the rich and level plateau called Champagne. The Fontaulier here flows on the north of the plain, in a ravine between the gneiss and the basalt, the latter presenting towards the river broken, and occasionally vertical, cliffs of about 100 feet in height. One of the

* See Scrope's Geology of Central France, Plate XV.

† Mr Scrope, with whose general views on the excavation of valleys in Auvergne we fully concur, has considerably over-estimated the thickness of primary rock worn through under basalt at the Castle of Pourchirol. See Scrope's Geology of Central France, Plate XV. p. 181.

small streamlets crossing the broad plateau of lava, and which was dry when we visited it, has shaped out a channel about twenty feet deep, and which, near its junction with the Fontaulier, is about 100 paces broad. In its gravel-bed we saw enormous blocks of gneiss, which it had carried for half a mile over the slightly inclined plane of the lava current. In consequence of accidents, resulting from volcanic causes, the course of the Fontaulier presents us with alluvial accumulations of three distinct dates. The most ancient occurs at various places under the lava current. It is generally not much elevated above the level of the river, and is seen continually at its edge reposing on gneiss, and containing no volcanic matter. The next in age is that seen at the bridge of Montpezat, resting on basalt, and containing volcanic sand as well as primary rocks. The last is the bed of the present river, where, notwithstanding the passage of the Fontaulier for so many miles through basalt, and that pebbles of basalt are introduced by the tributary stream descending from Burzet, boulders of primary rock predominate.

Lava of Thueyts.

The lava current proceeding from the volcanic crater of Thueyts, in the Vivarais, distant only a few miles from that last described, is remarkable under several points of view.

1*st*, Contrary to the general course of such currents, the main body of lava has ascended the bed of the Ardêche for about a mile and a-half, there occupying the widest part of the valley, and filling it up to the gneiss on either side.

2*d*, The Ardêche has eaten its present bed between the precipitous rocks of gneiss on its right bank, and the sides of the lava current, exposing in several places a pebble bed between the ends of the vertical prisms of basalt and the subjacent gneiss. The latter is thus shewn to have been cut into since the epoch of the eruption, in one instance twenty-five, in another seventy feet, below the river alluvion.

3*d*, The depth of excavation is immense in the narrowest part of the gorge, where the compact basalt has been eaten into to the depth of ninety feet, and the hard and solid rocks of gneiss below for seventy feet more, down to the present level of the river *. A single arch, only fifteen paces in width, spans the precipitous chasm; and the eye can at a glance restore the former outline of these rocks, and estimate the amount of basalt and gneiss removed by the action of the stream below.

4th, A phenomenon hitherto we believe unnoticed in lava currents of this age, occurs at the spot just mentioned. Between the lower terminations of the vertical columns of basalt and the subjacent gneiss, is an undulating zone or band of black pitchstone, at right angles to the axes of the prisms. The position of this pitchstone is of high interest, in affording an exact parallel to the layers of that mineral described by Professor Sedgwick, and one of the authors of this paper, as forming the external portions of basaltic dikes which traverse the lias, and higher members of the oolitic series in the Hebrides; and also because similar layers of a black vitreous rock approaching pitchstone, have been recently observed by the other author of this memoir, forming the exterior of dikes in the crater of Somma, or ancient part of Vesuvius. This band at the Geule d'Enfer seldom exceeds one foot in thickness, and it peculiarly resembles in mineral structure that of the dikes of Carsaig, on the south coast of Mull, in its black colour, fracture, and state of compactness. The ends of the columns terminating upon it are somewhat scoriaceous and cellular. A bed of sand and pebbles is, in one part of the gorge, seen to be interposed between the pitchstone and the gneiss †.

The greater portion of the river beds in the Vivarais are without water in summer, and the white-bleached exterior of the primary boulders contrasts so strongly with the black basalt, that we may easily form some estimate of the relative degrees of waste undergone by these rocks. In the bed of the Ardêche, before it receives from the Alignon the basaltic pebbles of Jaujac, the basalt scarcely bears to the gneiss a greater proportion than one to fifty. Its channel is blackened for a while by the influx of the basalt of the Alignon; but again, in descending the stream, the primary rocks everywhere predominate, even near

* See Plate II.

† A bed of pitchstone is described by Mr Scrope in the Ponza Isles to be interposed between the trachyte and conglomerate. Geol. Trans. vol. ii. 2d Series, p. 228.

La Begude, a few miles above Aubenas, after contributions have been received from all the lava-currents of the Vivarais.

At the above locality, the bed of the Ardêche is about 400 yards wide; it is laid open in parts to the depth of fourteen feet perpendicular, through sand and boulders of unknown thickness. The upper surface at least of this great mass moves on annually; and some islands formerly covered with trees and buildings have been overwhelmed. Here the prisms of hard basalt have, by trituration, in a few miles, lost all traces of their original form,—a fact which shews how much the quantity of matter carried into the sea in the shape of sand, must exceed that which descends in the form of pebbles.

On regarding the void spaces once occupied by basalt in the valleys of the Vivarais, the doctrine formerly advocated by Playfair is much illustrated and confirmed; and we feel disposed with M. Montlosier, Scrope, and other authors who have written on the excavations of valleys in central France, to ascribe almost unlimited power to ordinary rivers, when a sufficient lapse of time is assumed. Nature rarely affords us, as here, an accurate measure of amount of destruction occasioned during periods of definite extent, or whose limits we can fix with reference to other natural events.

But the waste of the gneiss during the same lapse of time has been incomparably greater, and the matter which has disappeared from the innumerable valleys falling into the Ardêche would excite much more admiration, if it could be raised again from the bed of the Rhone or the Mediterranean, and submitted in one mass to our inspection. Yet the mountains and valleys have preserved the same mutual relations, and the same general form, since the epoch of the eruptions. The lavas still share with the rivers the lowest levels, and if the basalt of Aysac could be remelted, and again made to flow down from its crater, it would descend in the same direction, and, after encircling in the same manner the promontory of gneiss on which Antraigues stands, would fill up again, to a certain height, the three valleys which converge and meet below the town; from whence the principal lava stream would then wind down as now towards the Ardêche. In these and similar cases, the lower parts of the valleys have remained stationary, because the gneiss has been protected by lava from the ravages of the rivers, which, instead of deepening and widening their *original* channels, have, in the first instance, been compelled to disencumber themselves of volcanic matter.

But the upper parts of the same valleys, to which, as above Antraigues, the lava did *not* reach, and the flanks of the hills above the contact of each lava-current, have remained during the same time unprotected. The eye nevertheless cannot, in general, recognize any difference between the steep slope of the gneiss, where it has been exposed, and the part which has been encased with lava, so as to discover in the outline any inequality in the degrees of waste. If, then, the loss of gneiss which we can calculate, in certain positions, to have been immense, has not affected, in an appreciable degree, the general shape of the hills or valleys, we may infer that the gradual decay of a continent can give birth to sedimentary formations of vast importance in the grand receptacles of transported matter, while, in the mean time, we are unable to perceive any sensible alteration in the land whence the matter is withdrawn.

All the lava-currents in the Vivarais are cut through in some part of their course, so as to exhibit the subjacent gneiss, with an intervening bed of ancient alluvium. In Auvergne, the most modern lavas have not, in general, suffered so much. This, however, cannot be safely attributed to their inferior antiquity, but to the difference in the form of the valleys, which, in Auvergne, are wider in proportion to the volume and rapidity of water flowing in them. Where, however, the configuration of the country happens to have been favourable to waste, as in the gorges before mentioned of the Sioule at Chaluzet, the Veyre at St Saturnin, and the Couze de Chambon below Verrieres, lavas flowing from craters nearly as entire as those of the Vivarais have been destroyed in as great a degree.

It may be asked, Whether, if all these lavas be referable to the same great epoch, there are not others which must be classed as intermediate between them and the oldest volcanic rocks of Mont Dor? That such connecting links in the chain do exist, we observed what amounted, in our opinion, to conclusive proofs; and we cannot doubt that more abundant examples would have occurred to us, had not our attention been chiefly directed to the relations and characters of the tertiary strata *.

Mr Scrope has mentioned†, that, in following the course of the lava of Tartaret, the sides of the valley are seen fringed at higher elevations, by sections of more ancient currents which have flowed in the same direction. We were enabled to confirm his inferences from these facts, by finding under one of these remnants of more ancient basalt a pebble-bed resting on granite, and containing granitic sand and gravel, with some few boulders of basalt, probably referable to one of the ancient basaltic plateaus. This section is seen on descending the hill to the town of Champeix, by the road from St Saturnin, on the

* Many authors have cited localities in Central France, where basaltic plateaus at different, and often very considerable, elevations above the present valleys, repose on alluvions. Among these, we may enumerate, in the order of date of their works, Messieurs Le Grand d'Aussi, Montlosier, Ramond, Scrope, and Bertrand Roux. We examined, in company with the last mentioned gentleman, several examples near Puy en Velay, and had so many opportunities of attesting the fidelity of all his geological observations, that we confidently rely on numerous other cases cited in his work, and we refer the geologist to them.

Since the present memoir was written, Messrs Croizet and Jobert have published the first part of their great work on the Fossil Bones of the Department of the Puy de Dome, in which they notice some important cases of alluvions beneath basaltic coulées of different epochs. Of the most ancient class observed by them, is the alluvion under Puy Solignat, south-west of Issoire, on the right bank of the Couze, and facing Mont Perrier. Here the gravel bed beneath the old basalt is upwards of 2000 feet above the level of the sea, and the pebbles consist of the primary rocks of the immediate neighbourhood and of the tertiary formations; and, as no basalt is found in this detritus, it is inferred, that, when these alluvions were deposited on the tertiary strata, few or none of the oldest volcanoes had then burst out.—P. 76.

Of the next in age of these pebble-beds, a good example is seen under one portion of the basaltic plateau of Pardines, where the detritus contains some portions of old compact basalt, which, it is inferred, has been derived from the loftier coulées of the same epoch, as that of Solignat. The third period comprehends the alluvial beds, containing the bones of many extinct quadrupeds, at Mont Perrier, Boulade, &c., where they are overlaid by, and alternate with, mountainous masses of trachytic breccia. A fourth class of gravel beds are seen under the lava-currents which have issued from the most recent volcanic vents, and in these the bones of elephants and other animals are found. Lastly, they describe the superficial gravel and sand in the present valleys and river beds.

† Geology of Central France, p. 117.

right hand side. The granite beneath this alluvion is worn into to the depth of about 100 feet. We also remarked, near Besse, in the valley of the Couze of Issoire, the same river which in a lower part of its course runs at the foot of Mount Perrier, a still more striking example of two lava currents, of distinct ages, which had both flowed in the same direction. The most recent has all the characters of a modern "cheire," and may be seen a short distance above the village of Ourseyre, which is built upon it, to be worn into by the river about 50 feet. Above it, and on the right bank of the Couze, an older current of columnar phonolite is seen, the base of which descends very nearly as low as the most elevated points of the uneven "cheire." But a talus of fallen prisms prevented our ascertaining whether the phonolite rested on an ancient alluvion. Although in such marked cases we cannot refuse to admit the higher and older of the two currents to be of an intermediate age, in reference to the volcanic products of Auvergne; and although we grant that the terms "ancient" or "modern" may both be equally misapplied in regard to such rocks, we are not prepared to consider the same test of relative elevation as indicating the age of ancient plateaus of basalt, forming the cappings of insulated hills, or lofty ridges, and whose position has no visible relation to existing valleys. In a country where the granite has subsequently given vent to so many separate volcanic eruptions, and where there are proofs, as might have been expected, of its having undergone considerable subsequent convulsions; where the tertiary strata, from the uppermost to the lowest member in the series, are found to dip in almost every direction, and at every inclination from vertical to horizontal,—and where they are traversed by fissures, faults, and basaltic dikes (the latter not only causing disturbance, but continuous, in some instances, with overlying plateaus);—to attempt, in such a district, to establish relative elevation as a criterion of age, seems almost as unsafe as to determine the respective antiquity of overlying trap-rocks in Scotland by the same standard.

Some travellers have considered the ancient plateaus of basalt in Auvergne as implying a discrepancy between the manner of the ancient and modern volcanic action, for there was a greater tendency, it is said, formerly, in the lavas to spread themselves out in sheets, instead of flowing, as afterwards, in long narrow stripes. But the discovery of river alluvions under so many plateaus, helps greatly to explain the phenomenon. We have remarked in this memoir, that the lava of Montpezat spreads itself out into a wide sheet, where the breadth of the valley increases greatly, and forms in these situations a columnar basaltic plateau, the flat surface of which is at a considerable height above the present river, and the foundation of which is also seen to be an ancient alluvion. We have also stated, in other cases, that the narrowest parts of several currents have been completely annihilated by the erosion of a river, whereas the same are again resumed in great force, where the valley widens, as in the case of the current of Tartaret.

It is obvious that, if these operations were continued for a great period of time, the wide plateaus of lava would alone remain, the connecting portions having disappeared; and as the process of excavation, in every country, diminishes the slope of the bottoms of valleys (where subterranean forces do not cause fresh derangement), the inclined planes of the old plateaus would be steeper than the present river beds, as seems so often the case in Auvergne. There is no difficulty in regard to the appearances now under consideration, so long as it cannot be pretended that the old plateaus are wider than the flat alluvial plains occasionally bordering the modern rivers in the same district. But, so far is this from being the case, that many rivers (as the Allier, in particular, near Vichy) exhibit large flat plains, now strewed over with gravel and sand, of greater width than any of the old plateaus. It is scarcely necessary to recall the remark of Mr Scrope and others, that the oldest lavas, however inexplicable their present position, must, when they were in a liquid state, have attained, soon after issuing from below, the lowest levels of the then surface, and consequently have occupied the course of a torrent or river.

Mont Perrier, near Issoire. (*Montagne de Boulade of MM. Deveze and Bouillet.*)

As two works have recently been published on the relations of the alluvial strata of Mont Perrier, we feel called upon to explain our reasons for offering any additional remarks on the subject. In the earliest of these publications, Messrs Deveze and Bouillet have described the series of strata in which the bones of extinct quadrupeds have been found, as overlaid by a mass of ancient basalt, and they have cited Dr Buckland as coinciding in opinion with themselves; but they were mistaken on that point, for the Professor was well known to have come to an entirely opposite conclusion. We find also that some of our own views on these extraordinary phenomena are not in exact accordance with those of any of the numerous observers who have as yet written on the subject.*

The nucleus of Mont Perrier consists of tertiary strata, which appear to have been once covered by an uniform mass of ancient basalt, by which, as represented in Desmarest's map, the western portion of the hill is still capped. Towards the east, it now descends with a gradual slope into the great alluvial plain of Issoire, this part of its surface being strewed with blocks of the same basalt in a state of disintegration. This sloping portion is deeply cut into by several ravines running from west to east, in one of which, near the farm-house of Boulade, occurs the chief deposite of bones, the geological position of which has given rise to so much discussion.

We shall first describe, in an ascending series, the strata met with between Issoire and the ancient alluvion near Boulade†, and afterwards other sections on the north-western escarpment of the hill,—the latter of which can alone elucidate the relations of the superficial deposites to the older strata. The lowest rock, in ascending from Issoire, occurs at Les Chapelles. It is a granitic aggregate, containing occasionally rounded fragments of quartz, gneiss, and mica-slate; and has been called Granite by Messrs Deveze and Bouillet, and also subsequently by Messrs Jobert and Croizet, from which, in hand specimens, it may often be undistinguishable. This rock is worked into

* The most recent of the two works alluded to, is entitled, "Recherches sur les Ossemens Fossiles du Puy de Dome," and has already been cited by us, p. 22, in a manner which shews that we accord with the authors Messrs Croizet and Jobert in many essential points.

† See Plate II.

troughs; and a variety of the same grit, at Mont Peyroux, not far distant, is employed for mill-stones. Near Nechers, in the same neighbourhood, it passes into a red and green sandstone, is of great thickness, and cannot be distinguished in character from the new red sandstone of many parts of England; although an examination of the tertiary strata of Auvergne has satisfied us that it really constitutes one of the inferior members of those great lacustrine deposites.

As the mineralogical structure of this rock has, under the denomination of Arkose, been minutely given by M. Brongniart, when describing it in other parts of this district, we may refer the reader to his memoir.*

This grit is here covered by alluvium, which extends along a plateau, stretching upwards from Les Chapelles to the farm of Boulade. From its component parts, we may conclude this alluvion to have been derived from one of more ancient date, hereafter to be described, and which has been partially destroyed.

In ascending the ravine near the farm of Boulade, the following beds are exposed in succession, beginning with the lowest,† :—

1*st,* Thinly laminated, white and green marls abounding in cypris, with some bands of siliceous limestone, about twelve feet thick. These strata dip at an angle of ten degrees WSW. and evidently form part of the tertiary lacustrine formation, so widely developed in this part of Auvergne.

2*d,* Unconformably upon these rest beds of fine and coarse sand and gravel, alternating with each other to the thickness of eighteen feet. The pebbles are chiefly of basalt and quartz, the cement sandy, and sometimes ferruginous.

3*d,* These are surmounted by a bed of sandy gravel, of an ochreous colour, varying in thickness from nine inches to two feet, whence the greater part of the fossil bones which have given so much celebrity to this hill have been extracted. Above this sand is a bed of black and ferruginous gravel, two feet in thickness.

* Sciences Naturelles, June 26, sur l'Arkose. † See Plate III.

4th, These alluvial deposites are covered by a mass of tufaceous conglomerate, or rather breccia *, very irregular in thickness, containing some pebbles of quartz and granite, but differing from the inferior alluvium by the abundance of angular trachytic fragments, and a tufaceous cement, uniting the whole into a solid mass.

We now proceed to the northern and western side of the same hill, where a steep escarpement faces the river Couze at the village of Perrier. Here the geologist is presented with a magnificent vertical section of alternating beds of alluvion, and trachytic breccias, perhaps without parallel; the whole forming a covering more than three hundred feet in thickness to the tertiary marls on which the town of Perrier stands. In the alluvial beds alternating with, and beneath, this enormous mass, Messieurs Jobert and Croizet, have detected animal remains similar to those found near Boulade †, and in vast quantities.

A few hundred yards west of the locality last mentioned, the hill bends slightly round, so as to afford a section almost transverse to the preceding, and clearly to exhibit the superposition of the deposites already described, to the basaltic mass which caps the tertiary marls. That mass is seen to pass down under beds of pumice and gravel, which slope in the same direction, but less rapidly. Some of them thin out before reaching the basalt, and they are all thinner towards their termination upwards. This is precisely the disposition which these strata may be supposed to have taken, if they filled up a lake, of which the basalt formed one of the lateral barriers.

At the village of Pardines, a few hundred yards farther to the N.W., the side of the hill may be seen still more completely divested of its alluvial coverings. This exposure is in a great measure due to the great land-slip of Pardines, which hap-

* We prefer the term breccias for these aggregates of shapeless and angular fragments of trachyte, because conglomerate is so generally applied to those puddingstones which consist of rounded pebbles cemented together by a base of sand or other matter; but we should state that our breccias are the same as the tufaceous conglomerates of many writers on Auvergne, and correspond exactly in character with the trachytic conglomerates described by Beudant as of such great extent in Hungary.

† See Plate II.

pened in 1733, probably occasioned by the undermining of the light pumiceous beds, which caused the fall of the more massive overlying trachytic breccia. The ruins of the latter form a talus a mile and a half broad at its lower extremity, and many of the fallen masses are of colossal size.

There is a great fissure in the basalt, parallel to the face of the hill, perhaps occasioned by failure of support on the removal of the trachytic breccia, which must formerly have acted as a buttress in propping up the precipitous basalt. Where the remains of this landfall do not conceal the section, the tertiary marls may be traced from the valley upwards, to within a few feet of the overlying basalt.

Before attempting any explanation of the above phenomena, we shall mention two other localities of deposites analogous in their component parts, and geological position, to those of Mont Perrier. One of these is seen on the summit of a precipitous cliff overhanging the Allier at St Maurice, near St Romain. This cliff consists of tertiary grits and marls, from four hundred to five hundred feet in thickness, still undermined by the river. Upon these strata rests alluvium and trachytic breccia, occupying a ledge, as it were, on the side of the hill; higher than which is seen a steep slope, consisting of gypseous marls, capped with basalt. The bottom bed of the alluvium is filled with rounded pebbles of quartz, granite, and porphyritic trachyte, with numerous fragments of fresh-water marls. The pebbles are stained by iron of a deep purple colour. This is about seven feet thick, and supports the trachytic breccia, which is a much greater mass, and is identical with that of Mont Dor.

The other locality of trachytic breccia, mentioned by Mr Scrope, is on the southern side of the hill of Monton, at the distance of about ten miles north of Mont Perrier. It is almost a mountain mass, very pumiceous, and contains fragments of basalt as well as trachyte, but there are no interposed beds of rounded alluvial pebbles. In the tufaceous portion of this rock, as at Perrier, the inhabitants have excavated subterranean dwellings. Below the breccia, tertiary strata are exposed to the depth of many hundred feet. They consist chiefly of thinly laminated green marls, filled with cypris, and some white marls enclosing lymnei and planorbes. These dip to N.W. generally at a considerable angle. On the road from Monton to Vayres, their inclination is 25 degrees.

If we now compare the localities last described with those alluded to in other parts of the present communication, they may perhaps be found mutually to elucidate each other; and although, considered singly and without relation to other volcanic phenomena in Central France, the deposites of Mount Perrin may seem inexplicable, and due to some preternatural causes, yet, when more closely examined, they will appear the simple results of some of the most ordinary operations.

The various sections of Perrier, Monton, St Maurice, and that of the new valley of the Sioule, above the Etang de Fung, all concur in testifying that many ancient valleys in Auvergne, have at certain remote periods been filled up with transported matter of different kinds, after which they have been re-excavated, and generally to a depth much below their original level.

Now, among the effects of the last series of volanic eruptions in Auvergne, we observe the frequent damming up of rivers by currents of lava, whereby ancient valleys have been converted into lakes, and are at present slowly filling up with alluvial matter, such as the Lac d'Aidat, and the Lac de Chambon. The Etang de Fung had a similar origin, but was drained partly by nature, and in part by man, before the alluvial accumulations had time to become considerable.

In the Vivarais, also, as we have before stated, a modern lava current barred the course of the Fontaulier, whereby the valley above appears to have become filled with alluvium and volcanic sand, some of which still remains, as at Mont Perrier, at a higher elevation than the present river.

We have stated our reasons for embracing the opinion that Auvergne has experienced, throughout several successive periods, the effects of volcanic action. It is reasonable therefore to conclude, that the lavas of every age gave rise to similar local accidents, and that many of them dammed up pre-existing valleys, wherein transported matter was gradually deposited, and which, in the course of ages, was again removed, wholly or in part, together with the volcanic barriers. And as the ancient lavas of Auvergne were infinitely more copious than the modern, so we may expect to find proofs that the obstructions offered by them to the course of rivers, were in like proportion more considerable.

It must not be forgotten, that in three of the cases under consideration, we have decisive proofs that not only the refilling, but even the first formation, of the ancient valleys, took place long after the commencement of volcanic action in Auvergne. For the original valleys at St Maurice and Perrier, and that reopened by the Sioule, above the Etang de Fung, had been excavated, in the two first instances, through tertiary strata, and in the last-mentioned case through gneiss, all capped with plateaus of basalt. Assuming, then, the existence of lakes caused by currents of lava, it is evident, that the transported materials therein accumulated, were not all introduced into them at one time; for such contiguous beds as consist almost exclusively of volcanic matter, often differ widely from each other in composition, nor are their contents arranged according to their specific gravity. On the contrary, layers of light pumice underlie others of massive trachytic breccia and conglomerate, or alternate, as above Perrier, several times with alluvium containing heavy fragments of basalt. Undoubtedly the separation of pumice from all rocks washed down at the same time, may naturally be accounted for, since, from its buoyancy, it would float for a while upon the lake, just as it is often observed to cover the sea in the Grecian Archipelago, after submarine eruptions. But as often as we see strata of pumice covered by heavier matter, we must suppose an interval during which the former had time to subside.

But if it appear that the alternating breccias and alluvions were not all formed at one time, so also is it clear that they were not all produced by the same mode of action. The beds of rounded pebbles of quartz, granite, and basalt, resemble those produced by the continued action of the present river. But the angular forms of the fragments in the interstratified trachytic breccias bespeak violence in the destroying cause, and insufficient time between their fracture and subsequent deposition to have allowed of the triturating effects of running water. As they cannot by any characters be distinguished from breccias of similar composition and magnitude entering into the structure of Mont Dor and the Cantal, they must be referred to a similar origin; and we agree with Mr Scrope, that the sudden rush of large bodies of water down the sides of an elevated volcano, at its moments of eruption, sweeping away all the loose materials surrounding its cráter, might be supposed to give rise to such breccias; and that the floods observed by Humboldt and others to descend from the trachytic volcanoes of America, countenance the hypothesis *.

The associated strata of alluvium and breccia terminate, in all the cases described by us, in abrupt escarpments towards the rivers, and they must once have extended much farther, but possibly not so far as to the opposite sides of the present valleys. For we have seen, that where the bottom of a valley, in Auvergne, or the Vivarais, has been filled with lava, the rivers have usually hollowed out a new passage through the granitic schists, as well as in part through the lava. So, if a valley become a lake, and be filled up to a great height with alluvial conglomerates and tufaceous breccias, it is highly improbable that the new excavation will coincide precisely in position with the original valley, though perhaps of equal width and depth; and especially if it happen that the ancient valley was bounded by tertiary marls, probably much softer than most of the newly imported matters.

For the same reason, therefore, that we so often see all that remains of an ancient basaltic current, exclusively confined to one and the same bank of a river, we may expect to find the relics of a lacustrine formation similarly situate.

To the hypothesis of lakes closed up by volcanic currents, it will, no doubt, be objected, that we are unable to point out any remnants of the supposed barriers. But how, we ask, is it probable, that such barriers could have survived the changes which this country has subsequently experienced in consequence of aqueous denudation, assisted, in all probability, by violent earthquakes? The present valleys are much deeper than those supposed to have been formerly converted into lakes. In the case of Mont Perrier, the excavation extends to the depth of between 50 and 100 feet in the fresh-water strata; and at St

* Geology of Central France, pp. 101—103.

Maurice, from 400 to 500 feet below the old alluvium and tufaceous breccia. At Monton, the depth of the valley below the tufaceous breccia is probably still greater; but here the high dip of the tertiary strata, and the proximity of basaltic dikes in the hill of Vayres, leave us in doubt how far volcanic disturbance may have co-operated with aqueous action. Now, we may demand, Is it reasonable to expect, that, if the present lakes of Aidat and Chambon were filled up, and their lacustrine deposites subsequently removed to as great an extent as those of Perrier and Monton, or as nearly annihilated as that of St Maurice,—or, if the valleys of the Couze de Chambon and Vayres had sunk below their present depth from 100 to 500 feet,—can it be expected that future geologists would still be able to trace the former outline of these lakes, or point out the position of their barriers? But it should be remembered, that there are other causes besides lava-streams, which frequently dam up the course of rivers in regions within the range of volcanic agency. The last great earthquakes in Sicily and Calabria, in 1783, gave rise to land-falls, wherein huge masses, more than a mile in length, bordering the coast or rivers, were suddenly precipitated into the adjoining sea or valley. In such cases, the barrier may last till the lake is filled up; but it will afterwards be more destructible, and will more readily admit of being entirely obliterated, than a lava-current. Two large lakes were thus occasioned in Calabria, the course of two rivers having been obstructed. In the case of Mont Perrier we are aware that several geologists consider a barrier wholly unnecessary. They endeavour to account for the phenomena in the same manner as Signor Lippi explained the successive alluviums, which certainly constitute a large portion of the covering under which Herculaneum is buried. The matter, it is said, washed down from a neighbouring volcano, is so copious, that rivers cannot remove what the floods carry down. To such an hypothesis, founded at least on plausible grounds, we reply, that so enormous a thickness of transported materials, severally distinct in their character, as are seen at Mont Perrier, could never have been lodged in so narrow a valley, if there had not been a permanent stoppage; for the alternating beds of rounded pebbles could not have been brought down by a river or flood, without the hollow-ing out or sweeping away of the subjacent pumiceous and other beds of lighter ingredients. Further, there would have been more confusion, and more unconformability, in the deposites, if they had subsided from turbulent waters rushing through this narrow valley, while it remained an open passage for the drainage of the higher country. But the waters of a temporary lake, on the contrary, would arrest the progress of the matter introduced into it, and allow it to spread over the bottom with some degree of regularity, the violent erosive force of the current being deadened, and each deposite being protected from destruction by the mass of water, while others were superimposed.

A lake, therefore, being regarded as alone capable of explaining in a satisfactory manner the phenomena of Perrier, it becomes an interesting matter of inquiry to decide at what epoch the valley was dammed up, and at what period, in that great succession of volcanic eruptions of which Auvergne has been the theatre, the animals, whose remains were buried in the lake, lived and perished in these regions.

Now, if the recent lava-stream, which has its course down the same valley, had flowed on as far as the village of Perrier, it would evidently have assisted us greatly in determining this relative date; for we should then have known how far the lacustrine formation had been eaten into when the "cheire" descended, and, consequently, whether the lake had long ceased to exist, before the more modern class of volcanoes in Auvergne had commenced their activity.

We have before stated, that this modern lava-current has actually flowed down the valley to a certain distance, viz. to the spot where the village of Ourseyre, below Besse, stands; but it stopped short at Sauriers, some miles before reaching the locality where the alluviums and breccias attest the former existence of the lake. This deficiency, however, is in some measure supplied by the existence, in the next adjoining valley of Nechers, of the current of Tartaret, one of the most recent in Auvergne, and which the geologist may look down upon from the summit of Mont Perrier; so that it requires no great effort of the imagination to suppose the lava transferred from the one valley to the other, and thereby to judge of the relations which a "cheire" of this age would have borne to the ancient alluviums, had it flowed as far down the bed of the Couze d'Issoire, instead of that of the Couze de Chambon. This evidence, however, is of a nature best appreciable by those who have visited the district, and are familiar with the geological phenomena of Auvergne. To such it will appear clear, that one of the modern lava-streams of Auvergne, passing by Pardines, Perrier, and the Farm of Boulade, would merely share with the river the lowest level of the valley, and would not reach so high as the lowest beds of alluvium and trachytic breccia, which last would then hold the same relative position to the recent lava as does the ancient phonolitic current before mentioned, below Besse, to the modern "cheire" beneath.

The fossil remains of animals discovered near the Farm of Boulade, were imbedded in alluvial gravel and sand subjacent to a great mass of trachytic breccia. Now, the different varieties of this rock occurring at Mont Perrier are undistinguishable from those which enter into the composition of Mont Dor and the Cantal, where they are seen in the ridgy prolongations branching off from those mountains, to alternate with ancient volcanic products of different eruptions; and near the Cascade of Mont Dor, and at the foot of the Puy Gros, they are traversed by basaltic dikes. One of the masses of trachytic breccia at Perrier is no less than 60 feet in thickness, and encloses fragments of trachyte of enormous magnitude, cemented by a tufaceous base, as hard as the rock itself. Since these fragments are fully as angular and large as any of those in similar rocks laid open in the interior of Mont Dor, there is not a shadow of pretence for regarding those at Perrier as regenerated, and as having resulted from the breaking up of more ancient breccias.

And when we identify these breccias with those of Mont Dor, it must be recollected that such a conclusion is in perfect harmony with their height above the river at Perrier, which corresponds, as we before remarked, to that of lava-currents of the intermediate age in Auvergne. From such considerations, therefore, we must infer, that the alluvium, from whence the remains of quadrupeds were disinterred, near the Farm of Boulade, and at Perrier, was of very high antiquity; nor is this inference at variance with the character of these remains, since the individuals belonged for the most part, if not entirely, to extinct species of the genera Mastodon, Elephant, Rhinoceros, Hippopotamus, Tapir, Bear, Hyæna, Stag, and others.* These quadrupeds, therefore, inhabited this district long before the more recent volcanic cones and lavas of Auvergne were in existence, ere yet the valleys had attained their present depth, and even before the fires of the ancient volcanoes of Mont Dor had become extinguished.

In concluding this article, we may observe, that Auvergne, Velay, and the Vivarais, throw peculiar light on the theory of valleys, because the volcanic rocks having been introduced upon the surface successively, and sometimes at intervals immensely distant from each other, have preserved portions of the surface in the state in which it existed at those several periods. Hence it becomes impossible to confound the effects of erosive action of one epoch with those of another. But for this circumstance, events the most remote in point of time,—the waste of floods or violent torrents of most distinct eras, would have been regarded as simultaneous. Thus the conglomerates, several hundred feet thick, on which rests nearly the whole series of alternating beds of trachyte, basalt, and scoriæ of Mont Dor, would have remained without any distinct line of separation from the latest alluvions; and the same would, in many cases, have happened in Cantal, although we have now reason to conceive that the oldest lava of Etna is not more ancient, as compared with the latest, than are the several masses of transported materials last alluded to. If the debris of all these various periods were now strewed over the country at the various elevations where they are at present observed, and if we possessed not the means, which we now have, of pointing out their different ages, they would present the appearance of having been the result of one sudden and dreadful catastrophe, whereby rocks of different

* About forty species of quadrupeds will be described by MM. Croizet and Jobert, when their splendid and valuable work is completed, from the alluvions of Mont Perrier alone. Similar remains are not wanting, it appears, near Puy en Velay; for M. Bertrand Roux has just informed us, that he has obtained from a locality first pointed out by Dr Hibbert of Edinburgh, fossil bones and teeth belonging to the genera Rhinoceros, Hyæna, Stag and others, plates of which will shortly be published. Their geological position is very interesting, since they were found in volcanic scoriæ, covered by one of the most modern lava-currents of that district.

ages were violently broken up, and carried, without the least reference to existing levels, to vast distances, often across deep ravines, and spacious intervening valleys.

Are there not, however, some other signs, we shall be asked, upon those older basaltic plateaus of Dor and Cantal, which are unquestionably more ancient than the great valleys of the same district (by whatever theory the origin of those valleys be explained),—are there not some decided proofs of a violent flood, which transported thither fragments of foreign rocks from distant regions? We answer there are none. The Coiron has not sent its quartzose grits and calcareous rocks of Jura limestone formation to the Vivarais or Velay, nor has the zone of secondary rocks encircling Auvergne lent its debris to cover the granitic and volcanic regions of Dor, or the Puy de Dome. In a word, the repeated investigations of the ablest observers have been unable to discover a single fragment of any rock inclosing marine remains, mixed up with the alluvions of the primary, tertiary, and volcanic districts of Central France.

The succession of events which have taken place in Auvergne since the tertiary lakes were in existence, indicate an incalculable period of time; yet it must not be forgotten that even these lacustrine deposites are modern in geology; and still more modern is the surface last given to the country by some of the eruptions of Mont Dor, which, nevertheless, preceded the excavation of most of the present valleys. We ought not, therefore, to wonder that Central France presents no mysterious and wholly inexplicable phenomena, in the distribution of its superficial debris, merely because frequent difficulties occur in explaining the older alluvions, and the waste caused by floods in other parts of Europe, where the comparative antiquity of the surface may, for aught we know, be infinitely greater.

Let but the convulsions and changes which have affected Auvergne and Cantal, since the lacustrine strata were formed, be multiplied several times over, and the imagination will be baffled in all its efforts to restore the successive states of the country, the former relative levels of its several parts, and of the adjoining mountain districts. The solution of every local problem will then be impossible; and however unphilosophical, even under such circumstances, may be an appeal to preter-

PLATE I.

Fig. 1. Cave at Les Combres under the Lava Current of Chaluzet.

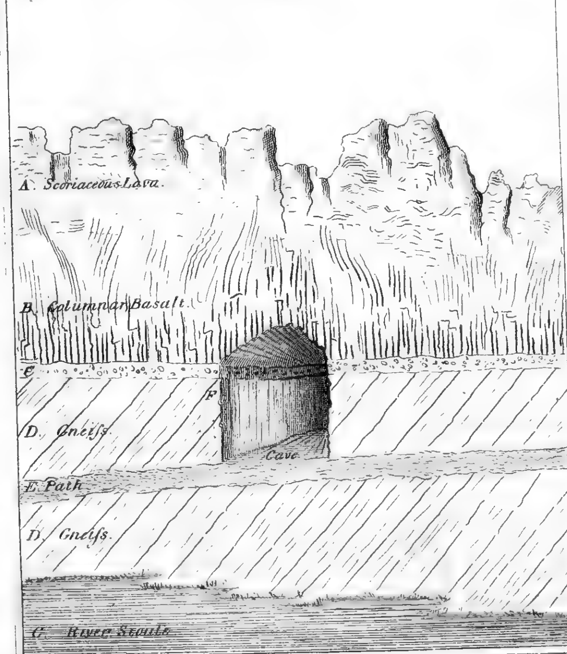
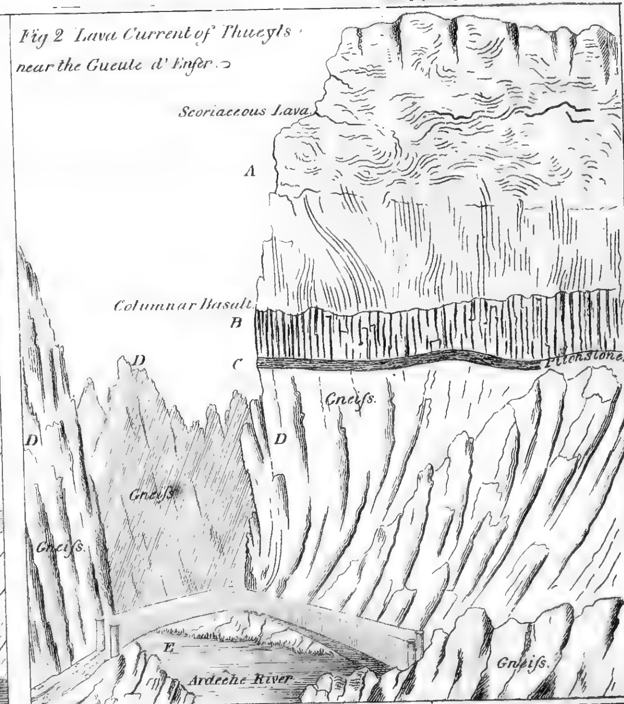


Fig 2. Lava Current of Thueyts near the Gueule d' Enfer.



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E. Mitchell sculp.

natural agency, yet to this alternative will geologists, who undertake such a task, be compelled to resort.

DESCRIPTION OF THE PLATES.

Plate I. fig. 1. represents an ancient river-bed of pebbles, and sand, under the lava-current of Chaluzet. C is a very ancient mining gallery driven in horizontally beneath the basalt, and shews the pebble-bed to be continuous between the gneiss and the volcanic rock. The river Sioule is seen to be now about twenty-three feet below the level which it occupied when the stream of lava flowed down this valley.

Plate I. fig. 2. exhibits a case of much greater depth of excavation than Plate I., and the junction between the ends of the prisms of basalt and the gneiss is marked by a thin band of black pitchstone. This lava-current flowed from the crater of Thueyts, in the Vivarais; the river is the Ardêche.

Plate II. is a section from Issoire to Mont Perrier. The trachytic breccias and conglomerates overlying alluvial beds, containing bones of extinct quadrupeds, are here seen, and their relations explained, to the original tertiary lacustrine formations of Auvergne. The latter are thus shewn to have been excavated to a considerable depth prior to the operations which gave rise to the former.

Plate III. is a transverse section of Mont Perrier, exhibiting in detail the character of all the strata of trachytic conglomerates which overlie and alternate with alluvions containing fossil bones of extinct quadrupeds. The tertiary lacustrine formations beneath are seen to have a dip unconformable to that of the superimposed masses.

Errata in the preceding sheet.

For Plate I. *at page* 22, *read* Plate I. fig. 1,—*And for* Plate II. *at page* 29, *read* Plate I. fig. 2.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1. *Cave at Les Combres under the lava current of Chaluzet.*

A scoriaceous lava, passing downwards into
B columnar basalt.
C sand and pebble-bed, three feet thick (water gushes out).
D gneiss, twenty-three feet from the pebble-bed to the level of the Sioule.
E path leading to the village.
F cave.

Fig. 2. *Lava current of Thueyts at the Gueule d'Enfer.*

A scoriaceous lava, passing downwards into
B columnar basalt.

C pitchstone.
D D D D gneiss.
E River Ardêche.

PLATE II.

Longitudinal Section of the Plain of the Allier at Issoire to Perrier and Pardines.

A oldest tertiary grit (granite of certain French authors.)
B tertiary lacustrine marls.
C older alluvium, Boulade bone-bed.
D D trachytic breccia.
E alluvium (bone-bed.)
F newer alluvium.
G land-slip.
H compact basalt.

PLATE III.

Transverse section of the various deposites on the north bank of the Couze at Perrier.

N. B.—All the tufaceous and alluvial beds, viz. from 1 to 9 inclusive, dip slightly to the east; whilst the inferior or tertiary lacustrine deposites dip from 10° to 15° W. S. W.

1. Trachytic conglomerates, identical in character with those of Mont Dore, Monton, &c. Total thickness 250 feet.

* Fossil bones in alluvium, according to Messrs Jobert and Croizet.

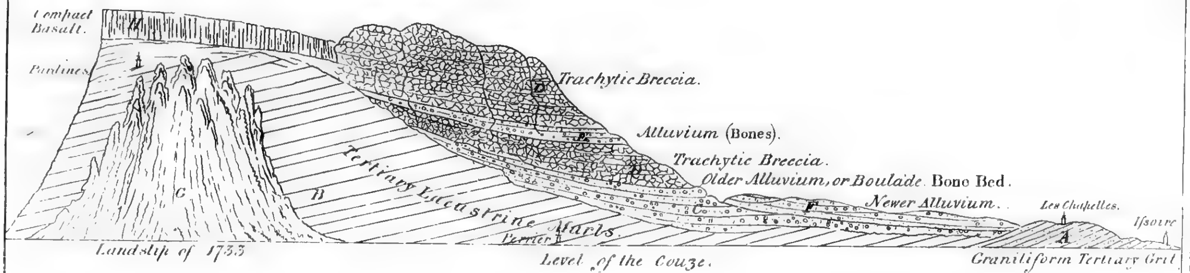
2. Brecciated tufaceous conglomerate of a light grey colour. 20 feet.
3. Black brecciated tufaceous conglomerate, filled with large blocks of dark compact basalt. The old cast le is built on this.
4. White pumiceous trap.
5. Bed of rounded pebbles.
6. Tufaceous trachytic conglomerate, with scoriæ and fragments of granite and amygdaloid.
7. Pumicose grit.
8. Alluvium in very regular beds, containing much volcanic rock and thin laminæ of filamentous pumice, granite, quartz, &c. sand and gravel of various colours alternating. Contains some bones, 50 feet.
9. Coarser alluvium than No. 8., resting unconformably on the lacustrine deposites, boulders of from six to nine inches. Contains fossil bones, 20 feet.

** Lignite of Messrs Jobert and Croiset.

10. Tertiary lacustrine deposites consisting of thirty laminated shaly marls, containing cypris, &c. alternating with compact green and yellow marl, strong beds of limestone, bluish unctuous marls, thinly laminated white and green marl, with bands of fetid limestone. 140 feet.

† Village of Perrier.

Longitudinal Section from the Plain of the Allier at Issoire to Perrier and Pardines.



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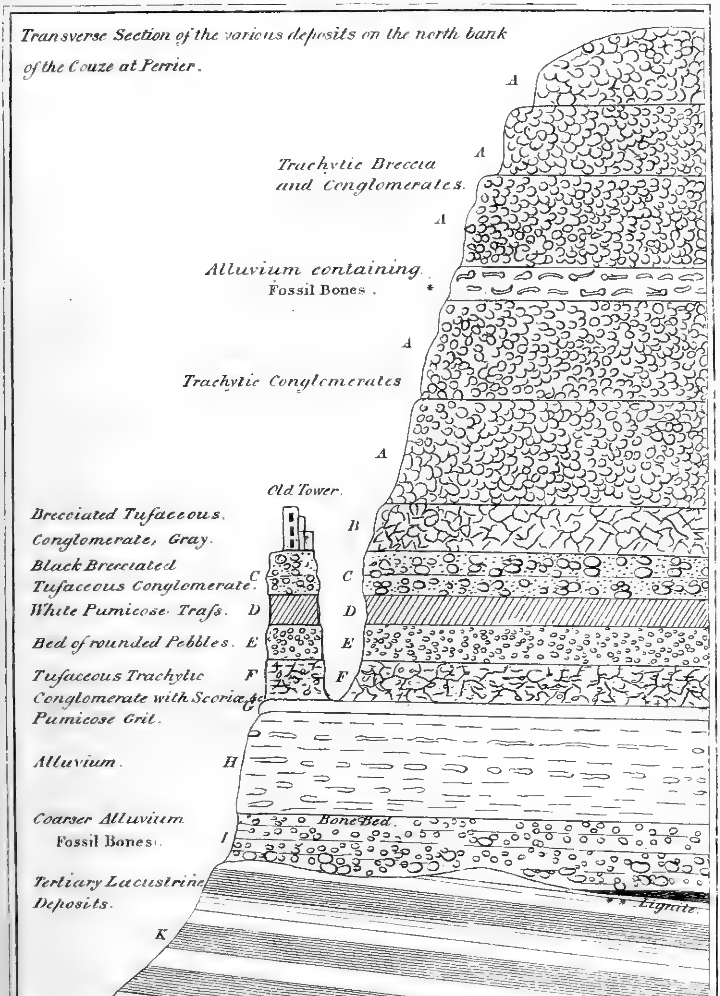

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Sketches of the Meteorology, Geology, Agriculture, Botany, and Zoology of the Southern Mahratta Country. By Alexander Turnbull Christie, M. D. Member of the Wernerian Society. (Continued from p. 120 of preceding Volume.)

Agriculture, &c.

Were I to give any thing like a detailed account of the agriculture of the Darwar district, I would have to repeat much that has already been published in the works of Buchanan and Marshall; and, moreover, such details would possess little interest for the general reader. I will therefore merely present a slight sketch of the agricultural features of the district, with an account of the different articles of cultivation and their uses, and will particularly notice whatever circumstances have hitherto escaped the observation of others.

The peculiarities of climate in the different parts of this district, necessarily occasion a great diversity in their agricultural characters. The western parts, towards the Gauts, which are covered with forest, and have a very wet climate, admit of the cultivation of a little rice only in the valleys or on the gentle slopes of the hills. As we proceed eastward, the climate becomes gradually drier, the forest diminishes, and the dry crops become more abundant. Lastly, towards the eastern parts of the district, we meet with nothing but dry crops, except in a few spots, where rice is cultivated by means of artificial irrigation. These circumstances give rise to a very natural division of the soils of the district into two distinct kinds, as has long been adopted by the natives, viz. those on which rice can be cultivated without irrigation from tanks, and those suited only for dry crops. The former are called Mulnad, the latter Belwul lands. The former are confined to the western parts of the district, it being there only that there is a sufficient supply of rain for the cultivation of rice, without artificial irrigation. The latter occupy all the middle, the eastern, and south-eastern parts. At the same time, it necessarily happens, that the mulnad and belwul lands are in many places intermixed, especially towards the eastern border of the hilly tract, where the valleys have still a sufficient natural supply of water for rice-cultivation; and the adjoining high lands can be only cultivated with dry crops.

The belwul lands are farther subdivided into several different kinds, two of which only require particular notice, viz. the regur or yerree, and mussub or mussaree. The former is the black cotton ground already described; the latter includes all those soils which have originated from the disintegration of the neighbouring hills. It therefore differs most materially in different situations, and is sometimes called red ground from its prevalent colour.

The cotton ground, or regur soil, forms one of the most curious features in the physical geography of this part of India. It has been already described in the geological part of this paper, where it was shewn that, in all probability, it has originated from the disintegration of trap-rocks *. It varies in depth from two or three to twenty or thirty feet, and even more, and is of prodigious extent, covering all the great plains in the Decan and Kandeish, some of those in Hydrabad, and perhaps also in other parts of India. It is as remarkable for its fertility as for its very great extent; and a very curious circumstance is, that it *is never allowed to lie fallow, and never receives the slightest manure.* Even the stems of the cotton plant are not allowed to remain on it, being employed for making baskets, or used as fire-wood; and farther, in all those parts of the country where the cotton-ground is met with, there is so

* I am indebted for the following report on the chemical nature of the cotton ground, to Mr Reid, Lecturer on Chemistry, who was so kind as to examine a portion of it.

"Fuses readily before the blowpipe into a dark black slag.

"In platina foil, it forms a lighter-coloured slag, having a greenish-grey colour.

"Fused into a solid mass in a large covered crucible placed in a furnace; a crust of oxide of iron gathered on its surface.

"It consists of silica in a minute state of division, with portions of lime, alumina, and oxide of iron. The proportion of vegetable and animal debris appeared to be very small. Minute portions of the roots of vegetables were seen on close inspection with the naked eye."

little wood, that the cow-dung is carefully collected (as already mentioned) and dried for fuel. Cotton, jooaree, wheat and other grains, are raised from it in succession; and it has continued to afford most abundant crops, without receiving any return for centuries, nay, perhaps, for two or three thousand years,—thus proving the inaccuracy of the opinion held by agriculturists, that if something be not constantly added to land equal to what is taken from it, it must gradually deteriorate. Attention must be paid to the order of cropping, as will be more particularly mentioned hereafter; but, with this precaution, the Ryut is always sure of an abundant return, provided the weather be favourable *.

It is probable that the fertility of this soil is principally owing to its power of absorbing moisture from the atmosphere, which is great, even when compared with the best soils of Britain. Sir Humphry Davy says, "I have compared the absorbent powers of many soils with respect to atmospheric moisture, and I have always found it greatest in the most fertile soils; so that it affords one method of judging of the productiveness of land." He farther states, that 1000 parts of a celebrated soil from Ormiston in East Lothian, when dried to 212°, gained in an hour, by exposure to air saturated with moisture at a temperature of 62°, 18 grains; and that 1000 parts of a very fertile soil from the banks of the river Parret in Somersetshire, under the same circumstances, gained 16 grains †. The following are the results of some experiments I made on the absorbent power of the cotton soil. I thoroughly dried a portion of the soil, by exposing it for a long time to a heat that was nearly sufficient to char paper. I then exposed 2615.6 grains of this to the atmosphere of a moderately damp apartment, and found, after a few days, that it had gained 147.1 grains. I now exposed it to an atmosphere saturated with moisture, and found that it daily increased in weight till the end of a few weeks, when its weight was found to be 2828.4

* It will be an interesting subject of inquiry for future observers, to ascertain whether any organic remains occur in this extensive deposite, to throw light on its origin, which I think will not improbably be found to be diluvial.

† Elements of Agricultural Chemistry, p. 160.

grains. It had therefore gained 212.8 grains, or about 8 per cent.

In the hot season, the regur or cotton-ground is traversed in all directions by very deep fissures. In the rainy season it is in the form of a very tenacious clay. Almost all the crops that are cultivated upon it are sown towards the end of the rainy season, and therefore receive, during their growth, comparatively little rain, and often, indeed, the only moisture which they receive for a length of time is that of the heavy dews.

The mussub, or mussaree soil, does not form extensive plains like the cotton ground; but is generally found at the foot of hills, or in the bottom of small valleys. At the bases of the sandstone hills, it consists of little else than loose sand. On the sides of the hills, that contain beds of quartz, it is very gravelly. The soil which covers the laterite, and which has originated from the disintegration of that rock, is, in general, not very productive, and is apt to become extremely hard in dry weather; but in the bottom of many of the small valleys in the western parts of the district, large deposites of it, which have been more perfectly disintegrated and mixed with other substances, are met with, and form productive soils. The soils in the valleys, between the clay-slate hills, are also in many places very good.

There are three different seasons of sowing in this part of India. The first is in the end of May and beginning of June, after a few of the first annual showers have fallen. The second is in the end of June or beginning of July, after the monsoon has fairly commenced. The third is in September and October, towards the end of the rainy season. During each of these periods, certain crops only are sown; and, therefore, in giving an account of the different articles of cultivation, I shall arrange them according to their seed-times.

I. *Articles of cultivation *, which are sown in the end of May and beginning of June.* These are sown, when the ground

* In the following part of this paper, I will give the Dukhuny and English names, as well as the botanical names of the different articles of cultivation, trees, &c. I thought of adding their Malabar and Canarese names, but

has been moistened by the showers which fall in May, and are ready for reaping before the end of the rains.

1. *Sesamum orientale*, Lin.; *Tul*, Duk. *Gingilie Seed.*—Only a small quantity of this is cultivated in the Darwar district on inferior kinds of mussub land.

2. *Phaseolus max*, Lin.; *Orood* or *Oreed*, Duk. *Black Ulandoo.*

3. *Eleusine coracana*, Flor. Ind.; *Cynosurus coracanus*, Lin.; *Ragee*, Duk. *Nutchanee*, Eng.—This is extensively cultivated on the poorest mussub soils; and in many parts of the district it forms the principal part of the food of the lower classes.

4. *Panicum Italicum*, Lin.; *Rala* also *Kungonee*, Duk. *Italian Panicle.*—This is cultivated on secondary kinds of regur soil in various parts of the district, and forms a very common article of diet with the natives.

5. *Panicum miliaceum*, Lin.; *Sawee*, Duk.—This is not cultivated very extensively, and is not much esteemed by the ryuts. It ripens sooner than most of the other articles in this class.

II. *Articles of cultivation which are sown in the end of June or beginning of July.* These are sown when the first heavy rains are over, and are ready for reaping towards the end of December, or beginning of January.

1. *Andropogon Sorghum*, Flor. Ind.; *Holcus Sorghum*, Lin.; *Jooaree*, Duk. *Red Juwary.*—This is very extensively cultivated in this district, principally on the mussub lands.

2. *Panicum spicatum*, Flor. Ind.; *Holcus spicatus*, Lin.; *Bajera*, Duk.—This is extensively cultivated on the best kinds of mussub lands.

3. *Phaseolus aconitifolius*, Willd.; *Mut* or *Moat*, Duk.

4. *Phaseolus mungo*, Lin.; *Moong*, Duk. *Ulandoo.*—These two species of *Phaseolus* and the *P. max* already men-

find that it would extend this paper to too great a length; and the Dukhuny names will generally be found sufficient for identifying the different articles in India. I have given no name that was not accurately determined by myself, by means of communications from intelligent natives.

tioned, are cultivated in most parts of the district, and both on the regur and mussub lands.

5. *Cytisus cajan*, Lin.; *Toour*, Duk. *Dale.*—This is always sown in rows among different kinds of grain. It is much esteemed as an article of food by the natives, and is also frequently used by Europeans in soup. There are two varieties of it, the large and small.

6. *Glycine tomentosa*, Lin.; *Kooltee*, Duk. *Madras Gram.*—This is extensively cultivated on different kinds of soil throughout the district. It is principally used, (as in other parts of the Madras territories), as food for horses.

7. *Dolichos Lablab*, Lin.—It is not improbable that the different varieties of this plant, which are extensively cultivated over the peninsula of India, will hereafter be found to constitute several distinct species. I will notice two of these, which have come under my own observation, and which have hitherto been described by authors simply as varieties. The first is the *Saim kee pullee*, Duk. This is biennial or triennial; attains many feet in length; legumes racemed, long, scymitar-shaped. Requires irrigation during the dry season, and is cultivated in gardens. There are three varieties of this *species*, which are distinguished from each other by the colour of their flowers and seeds, viz. the white, red, and green. The green legumes and ripe seeds of all these varieties are favourite articles of food with the natives. The white variety is little inferior to French beans, and is sometimes eaten by Europeans. The second is the *Bullur*, Duk. This is annual, and much smaller than the former. Legumes broad, 4-seeded. It is cultivated all over the peninsula. The beans are generally used as food for cattle; but in many places they are also a favourite article of food with the natives *.

8. *Dolichos Catiang*, Lin.; *Suffaid Lobeh*, Duk.—The lobeh is called *Dolichos sinensis* by Marshall; but it certainly agrees much better with the characters of the *D. Catiang*, as given by Persoon. Its legumes are erect, linear, in pairs. It is usually cultivated on the mussub lands, in rows, among different kinds of grain.

* Buchanan confounds together the above two plants. At the same time, he expresses a doubt whether the plant be the *D. Lablab* of Linnæus.

9. *Dolichos Tranquebaricus*, Lin.; *Hureea Lobèh?* Duk.—This is cultivated, but not very extensively, on the mussub lands.

10. *Linum usitatissimum*, Lin.; *Ulsee*, Duk.; *Common Flax.*—This is cultivated on regur soil, in most parts of the district, on account of its oil. The natives appear to be unacquainted with the mode of preparing flax; for which purpose, indeed, the plant which I have seen growing in this district, would be ill adapted, being much weaker and shorter than in Europe.

11. *Crotolaria juncea*, Lin.; *Sun*, Duk. *Indian hemp.*—This is cultivated in small quantities, in most parts of the district, for the purpose of making cordage, and the sack-cloth called gong.

12. *Hibiscus cannabinus*, Lin.; *Umbaree*, Duk.—This is generally cultivated on good mussub and sometimes on the regur soil. Its stalks afford material for cordage, and sack-cloth; and an oil is expressed from its seeds, which is used as an article of food, and also for burning in lamps.

13. *Oryza sativa*, Lin.; *Chawul*, Duk. *Rice.*—Rice is principally cultivated in the mulnad lands, that is in the valleys in the western parts of the district, where the heavy rains, and a constant supply of water from the neighbouring hills, afford facilities for the inundation of the fields. It is also cultivated in a few spots in the central and eastern parts of the district, where a sufficiency of water can be obtained from the large tanks. The best mode of culture is reckoned that by transplantation *. In this case the seed is first sown very thick in a small piece of ground, about the commencement of the rains. When the plants are half grown, they are transplanted into the fields, previously covered with water, where they are placed in rows. This practice, however, is very frequently abandoned, except by the most industrious, on account of the great labour it requires. The grain is therefore often sown at once on the ground on which it is to come to maturity Another method is to make the seed vegetate by means of its being covered for several days with water and cow dung, before sowing it. These three different methods of cultivation are also followed in other

* Vide Marshall's Statistical Report.

parts of India *. The advantage of the first method is, that it affords time for a crop of different kinds of pulse to be taken from the ground before the rice is planted.

14. *Ervum lens*, Lin; *Mussoor*, Duk.—This is cultivated only in small quantity, and principally in the western part of the district.

III. *Articles of cultivation, which are sown towards the end of the rains in September and October.*—These are ready for reaping at the end of four or five months. Except at the commencement of this season, the moisture which these crops receive is principally derived from the dews, which are deposited in considerable abundance during these months.

1. *Andropogon Sorghum* (variety), Flor. Ind.; *Holcus Sorghum*, Lin.; *White Juwary.* "It differs," says Marshall, "from the red jooaree in the case of the seed being white, which in the other is brownish; in the stalk not growing to half the height, and containing much more of the saccharine principle." It is cultivated on the regur soil.

2. *Cicer arietinum*, Lin.; *Chinna*, Duk. *Bengal Gram*, or *Chick Pea.* This is cultivated on good regur land all over the district, except in the most westerly parts. It is generally employed as food for horses. In many places, also, the natives use it as a common article of diet. An acid exudes from all parts of the plant, and is often collected in the following manner by the Ryuts. The dew which is deposited on the plant over night, is found in the morning to be strongly impregnated with the acid. Long pieces of cloth are then dragged over the plants until they become quite wet with the acid liquor, which is then wrung out; and this process is renewed until the whole field has been gone over in the same manner. The liquor is of a brown colour, is slightly acid, contains a large quantity of saccharine matter, which gives it a sweet taste, and when allowed to evaporate very slowly, the acid is deposited in cubical crystals. It is sometimes used by the natives in their curries, instead of vinegar; and is also employed by the native doctors in medicine.

* Vide Buchanan's Journey through Mysore, Canara, &c. vol. i. p. 84.

3. *Gossypium herbaceum*, Lin.; *Kupas*, Duk. *Cotton.*—India has been celebrated from the earliest times for her fine fabrics of cotton; and although now excelled in the manufacture of cotton-cloths by western nations, the raw material still continues to be one of her most important productions. But even in the quality of the raw material, she has of late years been excelled in several other countries; and it therefore becomes an object of the first importance that the best methods of cultivating and preparing the cotton should be ascertained. These considerations will serve, I hope, as an apology for the length of the following observations on the cotton of the Darwar district.

The cotton in this, as well as in other parts of the Decan, is only cultivated on the regur land; and I am not aware whether it is ever cultivated on other kinds of land, in other parts of India. There is very little produced in Mysore, Malabar, and the other parts of the Peninsula, which are to the south of this district; and in the few places where it is met with in these countries, it is found to be of an inferior quality.* Is this owing to the absence of the regur or cotton ground in these parts? I am indebted for the following account of the mode of cultivating cotton in the Darwar district to J. R. Stevenson, Esq. subcollector in the Southern Mahratta country:

" The black regur land on which cotton is sown *is never manured;* but cotton crops are only raised from it once in three years. If raised two years in succession, the crop of the second year is always bad. In the two intervening seasons juwary † is generally cultivated, and the crops of juwary produced the year after the cotton are very abundant; so much so, that the Ryuts have a long story of a farmer, who, when he felt himself dying, only regretted that he was not spared to reap the crops of the year succeeding the cotton season; and he bitterly upbraided fate for its injustice in depriving him of what he had been looking forward to for three years.

" The cotton seed is sown with a drill plough, in drills about ten or twelve inches asunder, in the end of August, or begin-

* *Vide* Buchanan's Journey through Mysore, &c.

† *Andropogon Sorghum*, Flor. Ind.

ning of September, or as soon after the middle of August as the land is sufficiently saturated to receive the seed *. In about eight days the plant makes its appearance; and when it is nearly five or six inches high (about November), the weeding commences. The weeding implement is called Yedee. It is a double hoe, the blades being about three or four inches apart; is drawn by bullocks, and guided by a handle projecting backwards. The blades of the hoe, which turn rather inwards, cut out the weeds, and at the same time throw earth on the roots of the plants. This process of weeding is henceforward repeated once in eight or ten days, or oftener, if required. The cotton should be ready for gathering in the beginning of January. The first gathering is not considered good. The second and third are the most plentiful; and the harvest continues so long as the plants continue to bear, which they generally cease to do in the end of March. The labourers employed in gathering are paid in kind. They receive a fourth of the first picking, a sixth or an eighth of the second and third, and a fourth or a fifth of the remaining. When the period of ploughing arrives, the stems are picked up, and are used as fire-wood, or for making baskets, &c.

" When the cotton is brought to the cultivator's house, it is spread out in the sun, and thrashed with rods to cleanse it of the husks. It is then separated from the seed, either by the gin †, or by a small iron-roller, which a woman moves with her toes on a smooth stone. The latter is on the same principle as the gin, only she feeds it with her hands, and works the iron-roller with her feet. The seed is kept for the cultivator's cattle, or paid, in lieu of money, to the labourers employed in the separation of the seed. The cotton undergoes no more cleaning whilst in the hands of the Ryut, but is sent to the market in this state.

" The Bourbon cotton is not cultivated in this district. The Ryuts say " that a bush of this cotton takes up too much space,

* The time of sowing necessarily differs in different parts of the district, for the rains are later as we proceed eastward.

† This consists of two small wooden rollers, through between which the cotton is drawn, and the seeds are thus left behind. It appears to be similar to the gin used in the West Indies, except that it is turned by the hand.

—that it would not be so profitable as the common cotton—that, in March and April, when the regur land yawns, the roots would be exposed, and the plants would consequently die—that it would require water in the hot season," &c. &c. Notwithstanding these objections of the Ryuts to the cultivation of the Bourbon cotton, I have no doubt, that, in many parts of the district, it would answer well, and prove valuable. The above objections apply only to the regur-land, and to the eastern parts of the district. In all that part of the country which is west of the meridian of Darwar, the plants would receive a sufficient supply of moisture without irrigation; and, if planted on good mussub soil, they would not be liable to be injured by the yawning of the ground in the hot season, for this takes place only in the regur-soil. The plant is perennial, and therefore would not require to be renewed like the common cotton; and although it does not bear fruit till the third year, yet other articles can be cultivated between the rows of the cotton-plants during the two or three first years, while they are still small. I may only add, that several plants of the Bourbon cotton thrived remarkably well in red gravelly soil in my own garden at Darwar, without receiving any water, and where the climate is not nearly so moist as that of the country farther to the west. The quality of the Bourbon cotton is very superior to that of the common cotton of the district.

The common cotton of the Darwar district is of good quality, but is seldom well cleaned. Were a little pains taken to have it well cleaned, it would prove a very profitable article. A *candy* of 500 lb. of clean cotton can generally be bought at Darwar for 62 rupees. Sack-cloth and packing would cost ten rupees; and carriage to Sedasheghur, the nearest seaport, would cost ten rupees more, making altogether 82 rupees for 500 lb. If we call the rupee one shilling and tenpence, therefore, this cotton could be put on board ship at Sedasheghur, at the rate of little more than 3½d. per pound *. At present a good deal of this cotton is carried to Bombay by Parsee merchants, by way of Comtah, a place much farther down the coast than Se-

* At present no duties are levied on goods exported from Sedasheghur.

dasheghur, and therefore occasioning a much longer land as well as sea-carriage, than were the cotton carried to the latter place. The only reason that I could discover for these merchants preferring Comptah to Sedashegur, was, that the former place is nearer to the pepper country than the latter, and is therefore more convenient for that branch of trade. The latter possesses the great advantage of being situated at the mouth of a fine river, which is navigable for large boats, as high up as fifteen or sixteen miles; whereas Comptah is situated on a paltry stream at some distance from the sea, and cannot be approached closely, even by the small coasting vessels. Some cotton is also exported from this district to Mysore.

4. *Ricinus communis*, Lin.; *Erind*. Duk. *Castor-oil Plant*.—There are two varieties of this plant, the large and small seeded. The former is principally cultivated in this district. It produces an inferior kind of oil, which is mostly employed for burning in lamps. It is cultivated on the regur soil.

5. *Carthamus tinctorius*, Willd.; *Koosum*, Duk. *Safflower*.—This is cultivated in most parts of the district on good regur soil, only on account of the oil which is expressed from its seeds. In many parts of India it is cultivated merely on account of the fine red dye prepared from its flowers, which are here allowed to wither.

6. *Nicotiana Tabacum*, Lin.; *Tumbak*, Duk. *Tobacco*.—Is cultivated on the regur soil in several parts of this district; but is not considered to be of good quality. The crop is often very much injured by a parasitical plant, the *Orobanche Indica* (Roxb. Hort. Bengal.), which grows from the roots of the tobacco plants, and prevents their growth. These parasites sometimes grow as high as the tobacco plants themselves, and if they get into a field, the crop is sure to be much injured, if not ruined.

7. *Triticum æstivum*, Lin.; *Gioon*, Duk. *Wheat*.—There is a good deal of wheat cultivated in this district on the regur soil. It is chiefly exported to the western coast, and to various parts of the country.

8. *Indigofera Anil*, Lin.; *Neel*, Duk. *Indigo*.—It is curious that, although a large quantity of indigo be used in this district, and although the plant be indigenous, not the smallest quantity

of dye, until within the last two or three years, was ever prepared by the inhabitants; the consumption being entirely supplied from the Ceded Districts, and other parts of India. Its cultivation having been encouraged by the collector of the district, it has been found to thrive, and is likely to become an important article of cultivation.

Garden Productions.

Different kinds of gardens are cultivated by the natives, such as kitchen gardens, fruit gardens, or orchards, cocoa-nut gardens, betel-nut gardens, &c.; but it is only the first that we intend to consider at present. They are inclosed with a fence of milk hedge (*Euphorbia Tirucalei*, Lin.), or prickly pear (*Cactus ficus Indica*), and are irrigated either from wells or tanks. The soil is prepared by digging, and is well manured. I must remark, however, that some of the following articles are also occasionally raised in the open rice fields; and a few are also cultivated by the more industrious, in small plots of ground close to their cottages.

1. *Dolichos fabæformis*, Lin.; *Mut ke*, Duk.—This is a favourite legume with the natives.

2. *Zea Mays*, Lin.; *Muk jooaree*, Duk. *Indian Corn.*—This is seldom allowed to ripen, but is used as a vegetable when green.

3. *Hibiscus esculentus*, Lin.; *Baindee*, Duk. *Bandaky*, Engl.—This vegetable is much used, both by the natives and Europeans; and is considered very wholesome and nutritious.

4. *Saccharum officinarum*, Lin.; *Shukkur*, Duk. *Sugar Cane.*—Is cultivated both in gardens and in rice-fields; and, in the latter case, two crops of rice are always taken between each crop of cane *. The land is prepared for the sugar-cane by repeated ploughing, and a large quantity of manure; and the cuttings are planted in the end of January or beginning of February. The cane is ripe in eleven or twelve months after the time of planting. The sugar cane of this district is either sold in the bazaars to be eaten raw, or is used for making jagory, which is merely the inspissated juice of the cane. Sugar of tolerably good quality is made at Kolapore.

* Vide Marshall's Statistical Report.

5. *Convolvulus batatas*, Lin.; *Shukkur kundoo*, Duk. *Sweet Potato.*

6. *Daucus Carota*, Lin.; *Gajoor*, Duk. *Carrot.*—The carrot is very extensively cultivated in this district, and attains such perfection, that the carrot seed of the Southern Mahratta country is in great request in other parts of India.

7. *Allium Cepa*, Lin.; *Peeaz*, Duk. *Onion.*

8. *Allium sativum*, Lin.; *Lussum*, Duk. *Garlic.*

9. *Solanum Melongena*, Lin.; *Byngun*, Duk. *Brinjal* or *Egg Plant.*

10. *Capsicum frutescens*, Lin.; *Lal mirchee*, Duk. *Chilly.*—The chilly is very extensively cultivated in fields as well as in gardens, and is much used by the natives as a condiment. The Ryut often makes a mixture of chillies, turmeric, and other vegetable substances, which he takes with him to the field, and eats, spread on a juwarry cake. Marshall calls this plant the *Capsicum annuum* in his Statistical Report, which is evidently a mistake.

11. *Capsicum grossum*, Lin.; *Kaffray mirchee*, Duk. *Caffry Chilly.*—This is only cultivated, in small quantity, in the gardens of Europeans at Darwar and Belgaum.

12. *Raphanus sativus*, Lin.; *Moollee*, Duk. *Radish.*

13. *Momordica charantia*, Lin.; *Karaila*, Duk.

14. *Cucumis acutangulus*, Lin.; *Toraee*, Duk. *Acute-angled Cucumber.*—This vegetable is eaten by the natives, both raw and dressed in various ways, but is not esteemed by Europeans *.

15. *Cucumis sativus*, Lin.; *Kunkuraee*, Duk. *Cucumber.*—This is cultivated in small quantity in the gardens of Europeans. Some other cucumbers are also cultivated by the natives, but in less quantity than the last species.

16. *Cucumis Melo*, Lin.; *Khurbooza*, Duk. *Melon.*—Is cultivated in small quantity in some parts of this district, generally in sandy soil, on the banks of streams.

17. *Cucurbita lagenaria*, Lin.; *Hurea kuddoo*, Duk. *White Pumpkin.*

* A diarrhœa, which prevails to a great extent, in certain seasons, among the native inhabitants at Darwar, I am inclined to attribute to the large quantity of raw cucumbers they eat.

18. *Cucurbita Citrullus*, Lin.; *Turbooza*, Duk. *Water Melon.*—This is very generally cultivated throughout the district.

19. *Trichosanthes anguina*, Lin.; *Chikonda*, Duk. *Snake Gourd.*

20. *Trigonella Fœnum Græcum*, Lin.; *Maitee*, Duk. *Fenugreek.*

21. *Coriandrum sativum*, Lin.; *Dhunnia*, Duk. *Coriander.*—This is cultivated in fields sometimes as well as in gardens.

22. *Rumex vesicarius*, Lin.; *Chukka*, Duk. *Country Sorrel.*

23. *Piper Betel*, Lin.; *Pawn*, Duk. *Betel-leaf Vine.*—The cultivation of the betel is almost entirely confined to the western and southern parts of the district; and even there, betel-gardens are not numerous. In Soonda there are some gardens of the betel-nut palm (*Areca catechu*, Lin.), in which the betel-leaf vine is also cultivated.

24. *Arachis hypogæa*, Lin.; *Velaetee moong*, Duk. *Manilla gram.*

25. *Amaranthus polygamus*, Lin.; *Choulaee* and *Rajgheery kee bajee*, Duk.—Is used as greens by the natives.

26. *Amomum Zinziber*, Lin.; *Zinziber officinale*, Flor. Ind.; *Udruk*, Duk. *Ginger.*—Is cultivated in small quantity in various parts of the district.

The following are the principal fruit-trees met with in the Darwar district:

1. *Musa sapientum* and *M. paradisiaca*, Flor. Ind.; *Mouz*, Duk. *Banana* and *Plantain.*—Roxburgh considers the banana and plantain to be varieties of the same species; the original of which is found in the forests of Chittagong *. I have been assured that wild plantains are found in the western forests in the Darwar district, but I have not myself seen them.

2. *Tamarindus indica*, Lin.; *Umlee*, Duk. *Tamarind.*—The tamarind is not very abundant in the eastern parts of the district; but, towards the west, it is met with both cultivated and wild.

3. *Mangifera indica*, Lin.; *Am.* Duk. *Mango.*—The man-

* Vide Flora Indica, vol. ii.

go is found, in the wild state, in the western jungles, and is cultivated in various parts of the Darwar district. It flowers in January and February; fruit ripe in May and June. The mangoes of this part of India are seldom so good as those of Goa and Bombay; but a variety, cultivated in the garden of the nuwab of Savanoor, exceeds in size and in beauty any mango I have ever seen. Some of these Savanoor mangos that were sent to me, measured two feet in circumference.

4. *Artocarpus integrifolia*, Lin.; *Fannus*, Duk. *Jack.*—This fruit is not abundant in the Darwar district.

5. *Anacardium occidentale*, Lin.; *Kajoo*, Duk. *Cushoo-nut Tree.*—I have only seen this at Kittoor; but it probably occurs in gardens in other parts of the district.

6. *Spondias mangifera*, Linn.; *Junglee awm*, Duk. *Wild Mango.*

7. *Eugenia jambos*, Linn.; *Jamb* and *Ghoolabee-jamb*, Duk.—*Rose Apple.*

8. *Psidium pyriferum*, Lin.; *Jam*, Duk. *Guava.*—This fruit is to be met with in almost every village in the district.

9. *Citrus medica*, Lin., two varieties; *Turanj* and *Neemboo*, Duk. *Citron* and *Lime.*

10. *Citrus aurantium*, Lin.; *Naringhæ*, Duk. *Orange.*—A small, sweet, pleasant-tasted orange grows in the gardens at Misrecottah. It is not common in other parts of the district.

11. *Citrus decumana*, Lin.; *Chukotta*, Duk.—*Pumplemose* or *Shaddock.*

12. *Vitis vinifera*, Lin.; *Ungoor*, Duk. *Grape Vine.*—Excellent grapes are cultivated at Belgaum, Darwar, Dummul, Gokauk, and some other places. There are two varieties, one large, red, and fleshy; the other small and green.

13. *Annona reticulata*, Lin.; *Ram phul*, Duk. *Bullock's Heart.*—This is cultivated in some native gardens.

14. *Annona tripetala*, Lin.; *Seeto-phul*, Duk. *Custard Apple.*—This delicious fruit thrives well in most parts of the district. It flowers at Darwar, in March and April. I am not aware whether it occurs in the wild state in the western jungles; but it grows in such great abundance in the granitic soil of the Hydrabad country, as to have sometimes afforded food to the inhabitants, in times of scarcity, in very dry seasons.

15. *Ficus carica*, Lin.; *Unjoor*, Duk. Fig.—Excellent figs grow in various parts of this district.

16. *Ziziphus jujuba*, Lin.; *Bair*, Duk.—This is found in great abundance in the Darwar jungles, and the fruit is sold in the bazaars. The Dukhuny name of the fruit has been adopted by the English in India.

(*To be continued.*)

On Thirst in Snow-covered Countries. By Mr J. F. Sloane. Communicated by the Author.

Before opening any book of travels, an intelligent reader has a general idea of those scenes which his author has undertaken to describe, and he can almost fortel what was the nature of the toils, and the risks, and the dangers, the traveller had to encounter. It is by anticipations of this kind that we are disposed to draw our chair a little nearer to the fire, the moment we prepare to peruse Parry's Voyages to the Pole, or Franklin's and Richardson's most interesting Travels to the Shores of the Artic Sea; and it is thus, too, owing to previously formed associations, that the very mention of Africa sets our imagination to work among scorching sands and pathless forests, and venomous reptiles, and vindictive savages. Travellers have not deemed the fact worth mentioning, and, therefore, no one who has not been there can imagine or believe that, during winter, man is exposed, on the cold and snow-covered plains of North America, to the most painful of the many privations connected with African discovery;—that, even while walking on frozen-water, he is agonized by parched and burning lips,—and that by snow, eaten under such circumstances, the thirst of the traveller, or hunter, is proportionally increased.

In the higher latitudes of North America, all the snow falls at the commencement of winter. Clear skies, and an intensely cold atmosphere, characterize the climate, until warmer airs, and fogs, and flights of birds, intimate the approach of spring. The sun, however, during winter, and even on the shores of Hudson's Bay, has power sufficient to melt a small portion of the surface of the last fallen snow. This is frozen by the cold of the succeeding night, and then presents a glassy surface, on which the sledge is drawn rapidly along, and enables the hunter, on his broad snow-shoes, to travel with an ease very different from that which he experiences on entering the woods, where the snow is always soft, and altogether inconceivable by persons who cannot separate from the idea of snow those qualities of moisture, softness, and tenacity, which it exhibits in countries nearer to the equator. Owing to such causes, the winters on the shores of the Winipeg are far from disagreeable; and as it is then that the chief objects of their pursuit are in best condition, the hunter and the fur-trader make them the seasons of their wanderings.

When out in either of these capacities, the agony sustained by them from thirst is often very great. It does not by any means go to that extreme length endured by travellers in the torrid zone, because a speedy and certain remedy is almost always at hand. But it is truly painful while it lasts, and, contrary to his expectation, the sufferer finds that, by eating snow, his mouth is more and more inflamed—his desire for drink fearfully augmented—while a lassitude comes over him which water only can dissipate. More than once, when traversing wide plains, where the snow, resting on the long rank-grass, stretched out in all directions a smooth, white, unbroken surface, till it terminated in the horizon, I have seen a party of men tearing up the *houses* built by musk rats, in swamps formed during the summer rains, in hopes to get at the water which sometimes lies below them, and then drinking that foul and stinking water with the utmost avidity.

It is to be observed, however, that it is only on the plains, and during winter, that the experienced hunter or traveller is exposed to such hardships. Every one going to any distance at that season, carries, as an essential article in his equipment, a small pot or kettle, in which he melts snow, and boils that water. To allow the water to boil is a necessary part of the process; for, if the snow is merely melted, the water has a smoked and bitter taste, and a drink of it is far from refreshing. On the contrary, when the water is allowed to boil, and then cooled by throwing into it plenty of the purest snow, no spring-water is more delightful to the taste, or more satisfying to the wants of the thirsty traveller.

But it is in the woods and sheltered places only that those who inhabit the wilds of the northern parts of America, during winter, have the means and opportunity to boil a kettle. On the plains, in many places, during that season, no fuel can be procured; the cold, too, is so exceedingly intense as to render a delay to look for firewood often most hazardous, and at all times very inconvenient; for, should the wind become violent, as not unfrequently happens, it tears up the surface of the snow, and bears it along in such clouds as to obscure the sun, and to hinder even the Indian for days from proceeding on his journey.

During these snow-storms, and in such situations, the value the Canadian generally attaches to his dogs, can be most correctly appreciated. The stranger who sees the voyageur paying L.50 for three *small* animals, is disposed to laugh at the simplicity of the purchaser. Larger animals of the same kind would unquestionably appear more deserving of the price; but even the largest, most men would be disposed to think, were, at that sum, far too dearly purchased. But suppose this Canadian overtaken by such a storm, in the middle of an extensive plain; ignorant of the direction of his home; the path leading to it covered, in many parts, with ten or twelve feet deep of snow; and the atmosphere so filled with drift as to render it impossible for him to see the foremost of his three little dogs,—this man, apparently so helpless, so certain of being lost, who prides himself in watching and directing, on other occasions, even the slightest movements of his canine companions, throws himself on his sledge, calls to the animals to advance, leaves it to them entirely to determine whether they shall go to the north or south, east or west. His anxiety about his safety, if at all excited, lasts only while they are dragging him, in all directions, to recover that path which the wisdom of man compelled them to abandon: for, by the barking of the leader, he quickly learns that the tract has been regained; and then sweeping, like the wind, over the slender crust of snow, through which larger dogs sink, and flounder, and perish with fatigue, he is carried to his own fort, or to the nearer tents of some friendly Indians. I have seen all this; I have experienced it.

Sometimes the traveller finds it safest to remain until the storm has passed or subsided a little. It seldom continues long. Good weather invariably succeeds; and, as there may be many tracks, in opposite directions, and as the sagacity of the dogs cannot then determine the one which conducts to the post their master would arrive at or avoid, he takes off their traces, and gives them a little food. He changes his mocassins, and puts dry socks about his feet. He rolls himself in his blanket or buffalo-skin; and, with his gun by his side, lies down *deep* among the snow. His dogs come and stretch themselves upon him. The whole party are soon asleep; and, in such a resting-place, many *besides myself* have spent a solitary yet comfortable night, in the neighbourhood of wolves, with many miles between us and any other human being, and risen next morning, in health and strength, to proceed on our journey, and to offer thanks to a watchful Providence who had not only protected us during the night, but who had led us back, in our dreams, to our distant country and homes, and who had surrounded us, while thus sleeping on our snowy couch, with the forms of the friends and companions most deserving of our love.

Thus, contrary to opinions which might be previously entertained, man may be tormented with thirst even while travelling among snow; and, although a covering of it, even to many feet deep, allows a free passage for those minute particles of matter by which alone the sense of smell can be excited, a human being, after taking the necessary precautions, may make it a safe, a warm, a comfortable bed, when the thermometer is many degrees below zero, and when to sleep, even wrapped in leather, on its surface, would be followed by immediate and certain death, from the effects of the intensely cold and penetrating wind.

On Clinkstone or Phonolite *. By C. G. Gmelin.

Gmelin has published in the Naturwissenschaftliche Abhandlungen von einer Gesellschaft in Wurtemberg, ii. 107, &c. the first memoir of his classical work on volcanic rocks. It contains an account of a series of very interesting chemical experi-

* *Vide* Jameson's Manual of Mineralogy, p. 159.

ments, illustrative of the nature of the different kinds of clinkstone. Our limits preclude us from giving more than the following, which are concluding inferences and questions.

1. It follows, from the preceding investigations, that the clinkstones of the *Hegau*, as also those of the *Rhongebirge*, are intimate combinations of *mesotype* and *felspar*. In the clinkstone of the Hegau, the mesotype preponderates over the felspar, whilst in that of the Rhongebirge, the mesotype is almost excluded by the felspar, thus rendering it a nearly pure felspar rock.

2. Although we cannot expect, in a compound of this description, that the constituent parts should occur in the same determinate proportions, as in an *individual* formed by the power of crystallization, it is worthy of notice that the differences are not considerable. When we view the constituent parts of mesotype (exclusively of the water, which is always in less quantity than in crystallized mesotype, owing to its being intermixed with a foreign matter), we find that the fixed constituent parts agree very nearly with what occurs in crystallized mesotype. The mesotype mass, in its composition, approaches sometimes more to natrolite, sometimes more to mesolith, mesoline, &c. The felspar mass approaches very nearly in chemical nature to the crystallized felspar: The following formula will express its constitution.

$$\left.\begin{matrix} K \\ N \end{matrix}\right\} S^3 + 3\ AS^3.$$

In a chemical view, the felspar bears nearly the same relation to orthoclase, as perecline to albite, and hence arises the question, whether or not the *glassy felspar* which occurs in clinkstone, notwithstanding its agreement in form with orthoclase, be not distinguished from it by a considerable dose of natron?

3. We can infer, with considerable certainty, from the specific gravity of the clinkstone, the proportion of mesotype to felspar, it being a fact that the specific gravity diminishes as the quantity of mesotype increases. This may indeed apply to all zeolitic compounds, in so far as these possess a lower specific gravity than felspar. The clinkstone of Hohenkrahen, in which the mesotypic mass predominates, has a specific gravity of 2.504;

in that of the *Pferdekuppe*, the specific gravity is 2.605; the fresh clinkstone of Abstrode equal 2.623; the decayed, from the same place, which has parted with nearly all its mesotypic-matter, is 2.651.

4. When a clinkstone affords a small quantity of silica, and a larger quantity of alumina, we infer a considerable intermixture of mesotype: if the silica is above 60 per cent., the clinkstone is nearly a pure felspar. The analysis of Klaproth, Bergman, and Dr Struve, point out clinkstones that contain less mesotype than the clinkstone of the Hegau, but more than that of the Rhongebirge. Dr Struve analyzed the white decayed crust, and also the fresh mass under it, of the clinkstone from the Rothenberg near to Brux, from which it results, that, by the process of decomposition, the clinkstone is deprived of its mesotype, and is converted into a pure felspar mass *.

5. This composition of clinkstone excludes the idea of the formation of the zeolitic crystallization, by a process of *infiltration:* it is evident that the very generally distributed natrolite in the cone of *Hohentwiel*, has separated itself by a process of secretion from the mass of the rock in which it is contained. Natrolite occurs in but small quantity in the cone of Hohenkrähen, probably because the lava on cooling, split into fewer rents, and thus afforded fewer opportunities for the secretion of crystals.

6. Although clinkstone and basalt have been formed in the same way, they present a remarkable contrast, which we shall now notice. In clinkstone, natron, potash, and silica prevail; whereas in basalt, oxide of iron, magnesia, and lime, are the predominating constituent parts, natron and potash being nearly excluded. We can say, natron and potash characterize clinkstone, iron, and magnesia basalt. This is remarkably the case with the clinkstones and basalts of Hegau: The first contain no

* Dr Struve considers, as worthy of notice, the fact ascertained by his researches, viz. that, in the decayed minerals, the proportion of potash was nearly double that in the undecayed, whereas the quantity of soda diminished. It may be explained by remarking, that the zeolitic constituent part is removed by the act of weathering, while the felspar remains. In the first, natron predominates, in the second, potash prevails; hence, in the decayed mineral the relative quantity of potash will increase, and the absolute quantity of alkaline matter diminish.

magnesia, the latter a considerable proportion. Magnesia and oxide of iron in general shew a great tendency to enter into combination with each other.

7. It is well known that clinkstone mountains are favourable to the growth of plants, particularly for the growth of vines. It appears from the analysis of the weathered and fresh clinkstone of *Abstrode,* 1. That, during the process of weathering, nearly the greatest part (about three-fourths) of the mesotypic constituent part of the clinkstone, which can be decomposed by acids, is removed : 2. That the removal of these constituent parts does not take place in an uniform manner, but that certain constituents only are principally removed by the influence of the weather. Thus we observe, that nearly the whole of the alkali, and the greater part of the silica and alumina, have disappeared, while the quantity of oxide of iron and oxide of manganese has much increased. The tendency of clinkstone to part with its mesotypic constituent part, through weathering, by which a large quantity of alkali is carried into the soil, may explain the luxuriance of the vegetation on the sides of clinkstone hills, whose highest summits only are bald.

8. May not volcanic rocks, as basalt and clinkstone, answer well for building under water, and, therefore, take the place of puzzolana and trass? May not the hydraulic character these rocks possess, depend on the loose state in which a part of the silica exists? At least, all these rocks, however different their composition may be, have this property in common. It is worthy, therefore, of inquiry, whether the quality of hardening under water with lime, increases with the quantity of matter which gelatinises? Whether the weathered mass, deprived of its gelatinising mass, loses this property? Whether the pure gelatinary mass itself, as the natrolite, for example, possesses this property, and in a marked degree? The determination of these questions are important for the theory of hydraulic mortar.

1. *Observations concerning Fossil Organic Remains.* By J. C. Doornik, M. D. &c.* 2. *Werner's Views of the Natural History of Fossil Organic Remains.* 3. *Werner's Advice to Students of Geology.*

The study of fossil remains is, without doubt, one of the principal branches of geology, one of the best established means for explaining the most important phenomena connected with the natural history of our earth. It is therefore of the utmost importance that we should be familiar with the whole series of organic remains, before we form our ideas upon the subject in its full extent, and before we allow ourselves to undertake an explanation of the apparent labyrinth.

Notwithstanding my conviction of the great utility of a thorough knowledge of organic remains, as connected with the genera and species to which they belong; the various localities where they are found, and the situations which they occupy in the different strata belonging to epochs so remote; still I cannot subscribe to the views of M. Cuvier, when he speaks of the high importance of organic remains.

"Do we not perceive," says he, "that to *fossil remains alone*, is due the origin of the theory of the earth; and that, without them, we should possibly have never dreamed that there had been in the formation of the globe *successive epochs, and a series of different operations.*"

Such a position, it seems to me, proves too much, and therefore nothing decidedly.

After having read and meditated much upon it, I take the liberty to ask M. Cuvier, if the knowledge we possess concerning the various rock formations, the manifest differences in their constituent parts, in the succession, alternation, and regular occurrence of their strata; that relating also to the obvious order which reigns in the superposition of rocks, and the striking instances of conformity, of identity, of equivalence, and parallelism in these superpositions, proved by the researches of the most able geologists, and found true in countries the most remote from each other. I would ask, if such knowledge is not

* Silliman's American Journal, vol. xv. for October 1828.

sufficient to afford some positive data in a theory of the earth, and whether we should not add to it whatever may be derived from the study of fossil remains, so that they may mutually assist each other, and become two inseparable sources from whence we may derive the materials of a theory of the earth?

According to the views of M. Cuvier, then, a theory of the earth should be the result of a knowledge which is partial; whilst it ought to be, on the contrary, the result of a knowledge which is general, and which embraces every thing belonging to the science of geology. The discovery of fossil remains; the observation of differences among their genera and species; their diversified appearance when in different strata, and the epochs to which they may be supposed to belong, are so many materials for framing a theory of the earth; but they are not the only materials; they merely co-operate with other branches of knowledge to form a complete system.

Therefore I maintain, *that the origin of the theory of the earth cannot be attributed exclusively to organic remains.*

The arguments which I have cited prove, if I mistake not, that we already had collected many materials for the commencement of a theory of the earth, previous to any progress in the study of fossil remains, and their scientific classification, founded upon comparative anatomy; for which we are indebted to M. Cuvier as the original author.

I take it for granted that M. Cuvier, in advancing this position, forgot for the moment that he was accusing the great Werner of not having given sufficient attention to the study of organic remains. Nevertheless, Werner had erected a geological system, which has rendered the name of this distinguished philosopher immortal, although, according to the opinion of M. Cuvier, he did not sufficiently occupy himself with what he maintains to have been, and to be, the only foundation for a theory of the earth. Every one will maintain with me, I think, that Werner has laid the foundation of geology. His labours have brought to light materials which are, and must always remain, of the highest value in the formation of a theory of the earth; although connected with a class of knowledge different from that which is derived from the study of organic remains.

Finally, let us suppose, for a moment, that we were ignorant of all that is at present known concerning organic remains, and that our geological knowledge was limited to what we know of those formations called primitive, transition, secondary and tertiary, gathered from their conformation, structure, position and mutual relations,—information purely geological; that our knowledge was confined to what has been observed concerning the summits of mountains, their planes and bases, concerning valleys and lakes; and to the removal of immense masses of rock to great distances; is it probable that there could be a philosopher found who would maintain, that this amount of knowledge does not, or could not, contribute to furnish the materials for a theory of the earth? I cannot believe it, or ever persuade myself, that M. Cuvier seriously meant to maintain such a proposition. His vast erudition in every thing which relates to physical science, forbids my believing it; and I choose to think, that the passages which have been cited are, so to speak, slips of the lively pen of this justly celebrated author.

A little farther on we read, "It is only by analogy that we have extended to primitive formations the conclusion, which organic remains furnish, *directly* for the secondary formations; and if there had only existed formations without fossil remains, *no one could have maintained that these formations had not been simultaneous.*"

Here I must commence with the same remark that I have just made upon the first position, which is, that M. Cuvier assumes infinitely more than sound logic will sustain him in doing. I allude more particularly to the latter part of the above quotation, where he says, "and if there had only existed formations without fossil remains," &c.

Truly, when this point shall be yielded to M. Cuvier, geology will lose very much of its dignity; for the science must then acknowledge, that it owes every thing to our knowledge of organic remains. But how shall we make a position of this sort agree with what we know concerning the constituent parts of rocks of different composition—information derived entirely from chemical analysis? How shall we then dispose of our discoveries relating to the different structure of formations, which are so geologically distinct, that they have based upon this circumstance the characters for distinguishing the formations? Is not all we know concerning succession in the primitive formations, directly the result of observations purely geological? Are we not able to distinguish successive formations in strata, which do not belong to the primitive? Should we confound the formation of chalk with that of the calcaire grossier, if deprived of the aid of their imbedded shells, when there exists the formation of plastic clay, of molasse and conglomerates of various kinds, intermediate between the strata? In every formation, from the lowest to that which is uppermost, we perceive a repetition of rocks and strata, whose chemical composition is similar; that is, siliceous, argillaceous, or calcareous. But the difference in structure is most obvious. The lower formations are crystallized and firm; whilst the upper are earthy and loose. The intermediate formations differ from these, as well as from each other, in a manner no less remarkable. A striking character of the transition formation, and which separates it from the primitive and secondary, is seen in the alternation of a series of rocks, in which there is a regular recurrence of similar beds, rendering perfectly obvious, likewise, the limits of this extensive class of rocks. Another characteristic of the same formation exists in the three great formations, which hold nearly the same rank in different parts of the globe. They are, 1*st*, Talcose granular limestone, greywacke with anthracite and micaslate; 2*dly*, Syenite and porphyry, with crystals of hornblende, and occasionally quartz; 3*dly*, Clayslate, greywacke and black limestone.

The micaslate, with anthracite and clayslate, serves as the connecting points of the transition and the primitive; whilst, on the other hand, the fine-grained greywackes and porphyries, abounding in the crystals of quartz, cause it to approximate to the secondary.

The different ages of these formations are likewise indicated by their position. For example, the porphyries of Guanaxuato repose upon bituminous clayslate; those of Hungary upon a transition micaslate; whilst those of the Andes of Quito are situated upon primitive rocks. Large masses of greywacke are to be seen in the oldest slate rocks of the transition class; whilst extensive beds of greywacke are met with, whose origin is more recent. In fine, the transition class of rocks is distinguishable both by structure and age from the primitive:—the limits of the latter are in general simple; while those of the former are more complex.

When we observe the highly uniform and decidedly crystalline structure in the primitive rocks; when we view this character much less distinctly in the transition, still less in the secondary, and not at all in the tertiary, is it probable that a geologist could be found, who would maintain that they were, nevertheless, all formed at the same epoch?

It is well known, that over an extent of some thousand square leagues (in Thuringia and all the northern part of Germany), nine of the upper formations, viz. the transition limestone, the greywacke, the red sandstone, the zechstein, with bituminous shale, the muriatiferous gypsum, the oolitic limestone, the gypsum in clay, the muschelkalk, the white sandstone, and the quadersandstein, have been distinguished from each other without the aid of zoological characters.

M. Cuvier, in his theory of the earth, after having done justice to the high reputation of Werner, observes, "that neither M. Werner nor M. de Saussure, the geological historian of the Alps, *have described the species of the organic remains in each of the strata, with that accuracy which has now become necessary, since the number of animals already known is so great.*

It is true, Werner was not so well versed in comparative anatomy as M. Cuvier, who in this branch surpasses all his predecessors, and probably his contemporaries also; yet I will venture to say to M. Cuvier, that it appears to me he is not acquainted with the merits of Werner in contributing to the promotion of the natural history of organic remains. Far from confining himself to the mere science of mineralogy, in forming his theory of the earth, Werner, from the first, occupied himself with the study of the different relations of all the classes of organic remains. A genius like his must naturally have perceived that a complete knowledge of these relations was absolutely necessary to a geologist, and accordingly, with such a conviction, he informed himself of all that was known of petrifactions. During his lectures, he often called the attention of his auditors to the importance of forming collections, which, besides a complete series of rocks and minerals, to illustrate the formation of our globe, he insisted, ought also to embrace an extensive collection of organic remains, both of vegetables and animals. Neither did he neglect, at the same time, to make mention of the numerous researches and discoveries relating to those caverns which contained large quantities of animal remains.

Werner also insisted much upon the observation, made, if I mistake not, by M. Lister, more than one hundred and fifty years ago, that the different formations were capable of being distinguished by means of the fossil remains they contained; and also, that these relics were first apparent in the transition-class, though in a very small proportion; and belonged only to the class of zoophytes and testaceous animals. Thus he explained, most decidedly, the antiquity of the marine and terrestrial animals; maintaining that the first possessed the most ancient origin.

It was when pursuing these investigations, and engaged in the study of the genera and species of organic remains, that, with his customary sagacity, he remarked, how widely those species differ, which are the products of more ancient rocks, from such as exist at the present day; and, on the contrary, how closely those species which occur in the most recent formations approach to existing animals.

To conclude: Here is another observation of Werner, by which it is proved, beyond a doubt, that he attached a high importance to these studies. He insisted upon the observation, that many fossil species are limited to particular rocks, while others, on the contrary, possess a wider distribution; these last appearing to have enjoyed an organization, which enabled them to live during a variety of changes, which exterminated those found only in particular rocks.

My profound veneration for the high merits of Werner has occasioned the foregoing remarks, and which, I trust, have been made with propriety.

The following observations by Professor Jameson, in the fourth edition of Cuvier's Theory of the Earth, led to the preceding remarks.

2. *Professor Jameson's notice of Werner's Views of the Natural History of Petrifactions.*

From the observation in Section 22, Cuvier does not appear to have known how much Werner has done for the advancement of the natural history of fossil organic remains. He did not rest satisfied with the development of the mere mineralogical branch of the Theory of the Earth. On the contrary, early in life he began to investigate the relations of fossil organic remains, being well convinced, that, without an accurate and comprehensive knowledge of these interesting bodies, geological speculations would have excited comparatively little notice.

Many years ago he embodied all that was known of petrifactions into a regular system. He insisted on the necessity of every geognostical cabinet containing, besides complete series of *rocks*, for illustrating the mineralogical relations of the globe, an extensive collection not only of *Shells*, but also of the various productions of the class *Zoophyta*, and of *Plants*; and an examination of the remains of *Quadrupeds*, in the great limestone caves and alluvial soils of Germany, and of *Fishes* and *Amphibia* in various rocks, soon pointed out to him the necessity of attaching to the geognostical cabinet also one of comparative osteology. As his views in geognosy enlarged, he saw more and more the value of a close and deep study of petrifactions. He first made the highly important observation, that different formations can be discriminated by the petrifactions they contain.

It was during the course of his geognostical investigations, that he ascertained the general distribution of organic remains in the crust of the earth. He found that petrifactions appear first in transition rocks. These are but few in number, and of animals of the zoophytic or testaceous classes. In the older secondary rocks they are of more perfect species, as of fish and amphibious animals; in the newest secondary and alluvial rocks, of birds and quadrupeds, or animals of the most perfect kinds. He always maintained that no fossil remains of the human species had been found in secondary rocks, or in any of the older alluvial formations; but was of opinion, that such remains might be discovered in the newer alluvial depositions. He was also led to believe, from his numerous observations, that sea plants were of more ancient origin than land plants. A careful study of the genera and species of petrifactions, disclosed to him another important fact, viz. that the petrifactions contained in the oldest rocks are very different from any of the species of the present time; that the newer the formation, the more do the remains approach in form to the organic beings of the present creation; and that, in the very newest formations, fossil remains of the presently existing species occur. He also ascertained, that the petrifactions in the oldest rocks are much more mineralized than those in the newer rocks, and that in the newest rocks they are merely bleached or calcined. He found that some species of petrifactions were confined to particular beds, others were distributed throughout the whole formations, and others seem to occur in several different formations; the original species found in these formations appearing to have been so constituted, as to live through a variety of changes, which has destroyed hundreds of other species, which we find confined to particular beds.

3. *Werner's Advice to Students of Geology.*

The following observations, addressed to students of geology by Werner, as given by Daubuisson in his excellent System of Geology, will be read with interest.

I would, in the first place, he says, remind them, that there are various branches of physical science with which they must be acquainted.

In the first rank we would place Mineralogy (*Oryctognosy*), the department of natural history which makes us acquainted with simple minerals, and enables us to distinguish them from each other. All the observations of the geologist who is unacquainted with it are imperfect, and generally of but little value. When he would ascertain the constitution of a formation (*terrain*), and such is almost always his object, he must first indicate the mineral substances which enter into its constitution, and then describe the manner in which they are disposed. Mineralogy can alone enable him to execute the first; and it is only when it has been accomplished that he can properly pass to the second. How many estimable naturalists have unprofitably wasted their time and their labour, from having engaged in geognostical undertakings without a sufficient knowledge of mineralogy! The book of nature, they said, was open to them; but it was necessary to know the characters in which that book is written, and these characters are, in this case, the simple minerals.

It is sufficient to bear in mind that natural philosophy makes known the laws which seem to regulate matter; and especially, that, having the phenomena of nature, and the causes which produce them, continually before our eyes, it enables us to seize and appreciate the relations which may exist between effects which we see, and the causes to which we are led to attribute them, to show how necessary this science is to geology, which occupies itself with the revolutions of the terrestrial globe, and which endeavours to account for the changes which its surface undergoes, or may have undergone.

When this same observer enters into the details of the formation of minerals, he sees nothing but precipitations, crystallizations, and solutions: the forces which have produced minerals, which have collected and united their elements, are forces of affinity; he cannot duly appreciate their effects, without a profound knowledge of *general chemistry.* But it is necessary for him to employ much reserve and much discernment when, from what takes place in our laboratories, he would draw inferences respecting what takes place in those of nature. Nature acts on immense masses; she has time at her disposal, it is nothing to her; and these two circumstances often suffice to render entirely dissimilar the effects of the same agent and the products of the same cause. Besides we cannot flatter ourselves with possessing a knowledge of all the means which nature employs in her formations,—nor can we conclude that she cannot produce a particular effect, because we have not yet been able to imitate it in our laboratories; for example, that a substance is indecomposable, because we have not yet been able to decompose it.

The other branches of natural history, zoology and botany, are also of great utility to the geologist. They make known to him that multiplicity of corals, and shells, those remains of other animals, and also of vegetables, which he finds so abundantly in many of the strata of the globe, and which throw so much light upon the different epochs, and upon many other circumstances, of formation. A person ignorant of this kind of knowledge being always obliged to have recourse to other naturalists, would be interrupted at every step in the study of secondary, tertiary and alluvial deposites.

Besides the various acquirements which we have already enumerated, the geologist ought to possess a mind capable of comprehending not only those extensive relations that exist in the mineral kingdom, but also its minuter details. Placed in some measure between the astronomer, who carries his observations into the immensity of space, and rises to the infinitely great, and the scrupulous naturalist, who, armed with a microscope, endeavours to discover the secrets of nature in the organs of a mite, or the laminæ of a small crystal; with the grand and extensive views of the one, he must combine the sagacity and accuracy of the other.

Furnished with the necessary knowledge, and endowed with the requisite qualities, he who is desirous of prosecuting the study of geology, ought to take Nature as his principal conductor. It is only by examining minerals in their native bed that he can be led to rational ideas respecting their formation; it is only by seeing the beds and veins with his own eyes that he can acquire an accurate knowledge of their form, structure, and mutual arrangement; it is only after he has seen and observed much for himself, that he will be able to appreciate the observations of others, submit them to just criticism, and draw inferences from them. It is to him especially that the first lesson applies, which Wallerius gave to his pupils in mineralogy, when he recommended to them to go, on foot, and hammer in hand, to study and interrogate Nature in her own workshops. "Ite filii," says he, "emite calceos; montes accedite; valles, solitudines, littora maris, terræ profundos, sinus inquirite; mineralium ordines, proprietates, nascendi modus notate: tandem carbones emite, fornaces construite, et sine tædio coquite; ita enim ad corporum proprietatumque cognitionem pervenietis; alias non*."

It is not so much the number as the accuracy of the observations that is of importance; and here unfortunately observers have too often to struggle against the inclination natural to all

* Systema Mineralogicum, Præfatio.

men desirous of instruction. When, on traversing a country, they have acquired a general idea of its nature, and wish to go farther, it is with difficulty that they can persuade themselves to retrace their steps, to see and see over again the same object under all its aspects, and in all its details; and yet these are the observations that are truly useful to science, those which assure its progress, and which it carefully preserves in its archives. Let the geologist who would make such observations, undertake, for example, the complete description of a country, interesting from its mineralogical nature, but of small extent. Let him acquire a first idea of the ground, by traversing it in two or three different directions, so that he may be enabled to form a right plan of the labour to be executed, and determine the series of questions to be solved. Let him again return to the places. His intelligence, and the habit of observing, will point out to him, whether, from what he has already seen of the country, or from what he will see by multiplying his researches, what are the points whither he ought to betake himself to make his observations, and acquire his data for the solution of the questions which he has proposed to himself. He will not leave the ground until he has solved them, or until he has been convinced of the impossibility of solving them in whole or in part.

It may be considered as superfluous to recommend to the observer to see and note the facts such as they really are, divesting himself of all prejudice, and of all desire to make them enter into a systematic theory. A system is frequently nothing but a coloured-glass, which, placed before the eyes of the naturalist, alters or even changes the colour of the objects seen through it.

Although we recommend the rejection of all theory not sufficiently founded on facts, and maintain that actual observation is the only true basis of geology, we would notwithstanding recommend to him who devotes himself to its study, not to confine himself to the determination and collection of facts. It is also necessary, as we have already remarked, that he class them, in order to understand their relations, and acquire a general knowledge of their nature. He must combine them, in order to draw inferences from them. It is even necessary that he should endeavour to ascend to a knowledge of their causes; but, in his investigations, he ought always to bear in mind, that all the conclusions which he draws, all the principles which he endeavours to establish, can be viewed only as consequences of the facts observed, and that all hypothesis is interdicted. If sometimes the want of a sufficient number of data prevents him arriving at a rigorous solution, and analogy and induction lead him to an inference, he must be careful not to exhibit it with a reality which it does not possess, or to make it one of the foundations of his doctrine. In rearing the edifice of science, the only means he is permitted to employ are observation, the principles of sound physics, and the rules of strict logic.

Observations on the Characters and Affinities of Darwinia, Brunsfelsia, Browallia, Argylia, Eccremocarpus, and of a Plant improperly referred to the latter genus. By Mr David Don, Librarian of the Linnean Society, Member of the Imperial Academy Naturæ Curiosorum, of the Royal Botanical Society of Ratisbon, and of the Wernerian Society of Edinburgh, &c. Communicated by the Author.

DARWINIA.

This genus was first proposed by Mr Rudge, in the eleventh volume of the Transactions of the Linnean Society, where a description and figure of the then only known species, *D. fascicularis*, is given; but both being probably taken from an imperfect specimen, the structure of the ovarium was left undetermined; which circumstance may sufficiently account for its not having been referred to its proper place in the Natural System. Mr Allan Cunningham, probably misled by the analogous resemblance in habit of *Darwinia* to *Cryptandra*, has referred it to the *Rhamneæ*, with which it certainly has no affinity whatever. The examination of a series of specimens, both with flowers and perfect fruit, has convinced me that its true place in the system is among the *Myrtaceæ*, next to *Calythrix*, with which it agrees in almost every particular, except in the absence of petals. This intimate affinity would not have escaped so experienced an observer as M. Decandolle, had he possessed similar facilities of examination, while engaged in preparing the third volume of his invaluable Prodromus. I shall proceed to give a description of the genus, and also the characters of the two species already published.

DARWINIA, *Rudge.*

Syst. Linn. DODECANDRIA MONOGYNIA.

Ord. Nat. MYRTACEÆ, *Brown.*

Calyx tubulosus, obtusè pentagonus, coloratus: *tubus* e medio deorsùm ovario arctè adhærens; *dimidio superiore* membranaceo, deciduo! *faux* dilatato-campanulata, venosa: *limbus* 5-lobus: *lobis* subrotundo-cordatis, obtusissimis, concavis, pellucido-punctatis, æstivatione imbricatis. *Petala* nulla. *Stamina* indefinita (10 v. 15) limbo calycino inserta, sæpiùs per tria approximata, medioque sinus laciniarum occupante: *filamenta* brevissima, angustè linearia, complanata, glabra: *antheræ* subglobosæ, biloculares, basi insertæ: *loculis* tumidis, rimâ longitudinali dehiscentibus. *Pollen* pulvereum. *Ovarium* inferum, pentagonum, uniloculare: *ovulo* solitario, erecto. *Stylus* capillaris, exsertus, supernè attenuatus, apice barbatus. *Stigma* punctum pruinosum. *Pericarpium* capsulare, monospermum, pentagonum, apice clausum. *Semen* etiam pentagonum, pericarpio vix dimidio brevius: *testa* membranacea, spadicea, extùs scrobiculata! *albumen* nullum. *Embryo* erectus, cavitatem seminis omninò implens, angulisque ejusdem impressus, obovatus, lacteus: *cotyledones* brevissimæ, crassæ, obtusæ: *radicula* crassa, truncata, cotyledonibus duplò longior, recta, centripeta.

Frutices (Australasici) *decumbentes, ramosissimi, foliosi.* Folia *sparsa, angusta, pellucido-punctata, basi ramis articulata.* Flores *terminales, fasciculati (veruntamen axillares propriè dicti), rosei v. albi, nunc paleis (foliis mutatis) scariosis interstincti.*

1. *D. fascicularis,* foliis acerosis, receptaculo paleaceo, stylo flore ter longiore.

Darwinia fascicularis. *Rudge in Linn. Trans.* ii. 299. t. 22.

Hab. in Novâ Hollandiâ. *White, Paterson, Caley.* ♄ (v. s. sp. in Herb. Lamb.)

Frutex decumbens, ramosissimus. *Folia* acerosa, uncialia. *Flores* copiosi, rosei, paleis scariosis lanceolatis v. setaceis distincti.

2. *D. taxifolia,* foliis acinaciformibus, stylo flore breviore.

Darwinia taxifolia. *Cunningham in Field's Geogr. Mem.* p. 352.

Hab. in Novâ Hollandiâ. *Caley, Cunningham,* ♄ (v. s. sp. in Herb. Lamb.)

Frutex decumbens, ramosissimus. *Folia* sparsa, in apice ramulorum conferta, fasciculata, falcata, acinaciformia, mucronulata, vix ultrà semuncialia. *Flores* pauciores, foliis rarò mutatis interjecti. *Calyx* albus. *Stamina* 10. *Pericarpium* capsulare, monospermum, pentagonum. *Cætera* ut in genere.

BRUNSFELSIA.

A comparison of the structure and habit of *Brunsfelsia* and *Franciscea* appears fully to justify the propriety of uniting them under one generic denomination. The habit alone, independent of minuter characters, would seem sufficient to indicate to the most superficial observer the intimate affinity existing between these plants. Dr Pohl has referred his genus to the *Scrophularinæ*, and compares it with *Browallia*, without even adverting to any probable affinity between it and *Brunsfelsia*; but, judging from his descriptions and figures, it seems probable that Dr Pohl had not seen the perfect fruit; and this circumstance may account for his overlooking the real affinities of *Franciscea*, of several species of which I have had an opportunity of examining dried samples, and of one species, namely, the *F. Hopeana* of the Botanical Magazine, but which does not appear to differ specifically from Dr Pohl's *F. uniflora*, in a living state; and I beg to subjoin the following description of the parts of fructification, taken from a plant of this species in the choice collection of the Comtesse de Vandes at Bayswater.

BRUNSFELSIA UNIFLORA.

FRANCISCEA UNIFLORA, *Pohl. Bras. i. p. 2. t. 1.*

F. HOPEANA, *Hook. in Bot. Mag. t. 2829.*

Syst. Linn. DIDYNAMIA ANGIOSPERMIA.

Ord. Nat. SOLANEÆ, *Juss.*

Calyx tubulosus, laxus, cartilagineus, 5-dentatus: *fauce* parùm ventricosâ: *dentibus* ovatis acutis, conniventibus. *Corolla* hypocrateriformis: *tubus* infernè pentagonus, calycem longitudine parùm excedens: *faux* prominula: *limbus* patens, 5-lobus: *lobis* subrotundis, integris, planis, æstivatione imbricatis, demùm flaccidis. *Stamina* 4, didynama, absque quinti rudimento: *filamenta* glabra, corollæ tubo ferè omninò adhærentia apicibus tantùm solutis: *antheræ* bilobæ, lobis apice confluentibus, hinc uniloculares! fissurâ unicâ dehiscentes. *Ovarium* biloculare, annulo carnoso basi cinctum: *septo* contrario, placentifero: *ovulis* indefinitis, ovalibus, lævibus, curvulis, hinc embryo (si nobis conjectare licet) verisimilitèr curvatus. Fructus maturus nondùm vidi. *Stylus* compressus, glaber, supernè latior, clavatus. *Stigma* nutans, bilabiato-ringens: *lobis* (styli angulorum continuatio) crassis, obtusis, inæqualibus, glandulâ (stigma verum), magnâ, carnosâ, minutissimè papillosâ, madidâ interjectis; *lobo inferiore* minore.

In Brunsfelsiâ americanâ ovarium certè biloculare, bacca septo disrupto unilocularis, polysperma, semina angulata, testâ exteriore crustaceâ minutè scrobiculatâ badiâ, interiore membranaceâ fragili! albâ, albumine copioso densè carnoso lutescente, embryo curvatus lacteus, cotyledonibus ovalibus planoconvexis vascularibus! radiculâ tereti his parùm longiore obtusâ umbilico oppositâ.

In the structure of the flower, both *Brunsfelsia* and *Franciscea* precisely accord. It is true that the tube of the corolla is very much lengthened in *B. americana;* but its being found to vary considerably in *Franciscea*, shews that this character is not constant, and therefore only to be considered as of specific importance. The structure of the seeds, and the direction and form of the embryo, shew that the true place in the system for this genus is among the *Solaneæ*, and that it is scarcely to be separated from the normal group of that family. The ovarium of *B. americana* is clearly bilocular. There is an interesting additional species to this genus in the herbarium of Don Hipolito Ruiz, collected by Don Juan Tafalla, at Uchiza, in Peru, in 1798. This new species I have named *B. grandiflora* *.

BROWALLIA.

From the form and plicate æstivation of the corolla, I am also disposed to remove this genus from among the *Scrophularinæ*, where it has been hitherto placed, to the *Solaneæ*, with which it seems better to accord, even in habit. As the genus appears to me not to have been described with that accuracy so essentially necessary in matters of this kind, I beg to subjoin the following description, which may not prove unacceptable to my botanical readers.

* B. *grandiflora*, foliis elliptico-oblongis acuminatis, floribus corymbosis, tubo corollæ limbo vix longiore.

Hab. in Peruvia ad Uchiza. *Tafalla*, ♄. (v. s. in Herb. Ruiz. nunc in Mus. Lamb.)

Frutex ramis virgatis, glabris. *Folia* sparsa, petiolata, elliptico-oblonga, acuminata, plana, glabra, lætè viridia, 3-6-pollicaria, latitudine sesqui v. bipollicaria. *Petioli* vix semunciales. *Flores* plures (6-8) terminales, corymbosi, brevitèr pedicellati. *Calyx* tubulosus, 5-dentatus, unguicularis: *dentibus* ovatis, acutis. *Corollæ tubus* cylindraceus, ultra unciam longus: *limbus* amplus, diametro ferè biuncialis. *Stamina* subæqualia.

BROWALLIA, *L.*

Syst. Linn. DIDYNAMIA ANGIOSPERMIA.

Ord. Nat. SOLANEÆ, *Juss.*

Calyx membranaceus, tubulosus, 10-costatus (costis alternis validioribus) limbo 5-dentatus, basi attenuatus, utroque latere profundiùs fissus: *laciniis* obtusis, carinatis. *Corolla* hypocrateriformis (ob pedunculi contortionem flos resupinatus!): *tubo* nervis 15 peragrato, suprà ad apicem ventricoso: *limbo* obliquo, 5-lobo, æstivatione plicatâ! *lobis* rotundatis; *superiore* (inferiore verò propriè) majore, trinervio; *cæteris* uninerviis. *Stamina* 4, didynama, fertilia; *quinti* rudimento nullo: *filamenta* complanata, apice barbata pilis ramosis copiosis; *inferiora;* (superiora verò propriè) duo, longiora, apice arcuata, cuneato-dilatata, truncata, colorata, antheras omninò tegentibus, hinc corollæ faux quasi fornicibus clausa! *Antheræ superiores* reniformes, biloculares, basi emarginatæ, filamentorum contortione centrifugæ, iisdemque contrariæ, loculis æqualibus, tumidis, rimâ longitudinali dehiscentibus; *inferiores* (verò propriè superiores) filamentis parallelæ, loculo superiore minimo. *Pollen* e granulis minutissimis pellucidis compositum. *Ovarium* biloculare: *ovulis* numerosissimis. *Stylus* compressus, glaber, angulis septo contrariis. *Stigma* inclusum, amplum, compressioni styli parallelum, fissurâ levitèr bilobum, 4-tuberculatum dorso excavationibus 2 depressum, pro receptione antherarum superiorum: *lobis* glutinosis, suprà depressis. *Capsula* oblonga, bilocularis, bivalvis, polysperma; *valvis* bipartibilibus. *Dissepimentum* contrarium, ob discum fronti dorsoque floris oppositum. *Placentæ* 2, carnosæ, septo insertæ, scrobiculatæ, seminiferæ. *Semina* angulata, ad baseos latus superius umbilico prominulo notata, extùs punctis exiguis depressis confertissimis scrobiculata; *testa exterior* cellularis, fuscescens, crassiuscula; *interior* tenuissimè membranacea, alba: *albumen* copiosum, carnosum, album. *Embryo* teres, rectus, obliquè centralis, niveus: *cotyledones* brevissimæ, rotundatæ: *radicula* his duplò longior, obtusa, crassa, centripeta, ad latus inferius ultra umbilicum prona.

ARGYLIA.

Syst. Linn. DIDYNAMIA ANGIOSPERMIA.

Ord. Nat. BIGNONIACEÆ, *Brown.*

Calyx 5-partitus. *Corolla* basi tubulosa, fauce ventricosa: *limbo* 5-lobo, subæquali, æstivatione imbricatâ. *Stamina* 4, didynama, fertilia. *Antheræ* imberbes, bipartitæ: *lobis* obtusis, divaricatis, apice distinctis, rimâ longitudinali dehiscentibus. *Ovarium* biloculare. *Stylus* filiformis, lævis. *Stigma* bilamelloso-partitum, pruinosum. *Capsula* siliquæformis, bilocularis, bivalvis, polysperma, torulosa: *valvis* crustaceis, navicularibus. *Semina* transversa, aptera! obreniformia, apice biloba, margine obtusa, hinc concava, striata, indè convexa, tuberculata: *testa exterior* coriacea, intùs sulcata; *interior* membranacea, plicata! *albumen* nullum. *Embryo* cavitati seminis conformis: *cotyledones* foliaceæ, undulatæ, basi emarginatæ: *radicula* brevissima, obtusa, centrifuga. *Plumula* inconspicua.

This very distinct genus was first proposed by me in the "Edinburgh Philosophical Journal*;" but not having then seen perfect fruit, the description there given will be found to contain some inaccuracies which are now corrected. We are indebted to our indefatigable friend Mr Caldcleugh for samples of a second species of this genus, collected by him at Coquimbo, in Chile. This new species may be named and characterised as follows:

1. *A. canescens*, cano-pubescens; foliorum segmentis linearibus canaliculatis, corollæ tubo calycem parùm excedente.

Hab. in Chili ad Coquimbo. *Caldcleugh.* ♃. (v. s. sp. in Herb. Lamb.)

Herba habitu graciliore, pube copiosâ brevi canescens. *Flores* minores.

2. *A. radiata*, glabra; foliorum segmentis planis apice dilatatis, corollæ tubo calyce duplò longiores.

Argylia radiata, *Don in Edinb. Philos. Journ. No.* 18. p. 260.
Bignonia radiata, *Linn. Sp. Pl.* 871. *Willd. Sp. Pl.* 3. p. 301.
Bignonia flore luteo, foliis radiatis et elegantissimè dissectis. *Feuill Peruv.* 1. p. 731. t. 22. (mediocris.)

Hab. in Peruviâ. *Feuillée, Ruiz et Pavon.* ♃. (v. s. sp. in Herb. Ruiz et Pavon, nunc in Mus. Lamb.)

ECCREMOCARPUS.

Eccremocarpi Sp. *Ruiz et Pavon.*

Syst. Linn. DIDYNAMIA ANGIOSPERMIA.

Ord. Nat. BIGNONIACEÆ, *Brown.* Sect. 2. TOURRETIEÆ.

Calyx amplus, membranaceus, 5-fidus, coloratus. *Corolla* tubulosa, fauce æqualis, limbo 5-loba: *lobis* obtusis, æqualibus. *Stamina* 4 fertilia, æqualia; *quinti* rudimento subulato. *Antheræ* lineares, biloculares, medio insertæ, versatiles: *loculis* parallelis, omninò connatis! *Ovarium* placentis intervallo distinctis uniloculare, annulo carnoso basi cinctum. *Stigma* bipartitum: *segmentis* recurvis. *Capsula* unilocularis, bivalvis: *valvis* medio placentiferis. *Placentæ* 2, magnæ, carnosæ. *Semina* imbricata, horizontalia, complanata, margine membranaceo repando-sinuoso nervoso alata: *umbilico* basilari: *testa exterior* planiuscula, crustacea: *albumen* nullum. *Embryo* luteolus: *cotyledones* subrotundæ, plano-convexæ: *radicula* brevissima, teres, obtusa.

Frutices (Peruviani) *scandentes.* Folia *opposita, tripinnata cirrho composito spirali terminata:* pinnis primariis *bijugis:* foliolis *integerrimis.* Flores *longè*

* No. XVIII. Oct. 1823, p. 260.

pedunculati, penduli, racemosi. Racemus *laxus, oppositifolius.* Calyx *ruber, apice pallidus.* Corolla *flava, limbo viridi.* Capsula *magna, lævigata.*

This genus is here limited to include the *E. viridis* of Ruiz and Pavon, and the *E. longiflorus* of Humboldt and Bonpland, both being natives of Peru; but the *E. scaber* differing so essentially in the structure of its anthers, and having likewise a different formed corolla and calyx, is here separated as a distinct genus. It is probable that Chile contains several species of the latter genus, as the plant of Ruiz and Pavon appears different from the one cultivated in the gardens, of which an excellent description and figure will be found in the Botanical Register; but my materials are at present insufficient to decide this point. These genera, together with *Tourretia* are clearly referable to the *Bignoniaceæ*, of which they appear to me to constitute an osculant group, connecting that family with the *Cobœaceæ*.

CALAMPELIS.

ECCREMOCARPI Sp. *Ruiz et Pavon.*

Syst. Linn. DIDYNAMIA ANGIOSPERMIA.

Ord. Nat. BIGNONIACEÆ, *Brown.* Sect. 2. TOURRETIEÆ.

Calyx campanulatus, semiquinquefidus. *Corolla* fauce ventricosa, basi tubulosa: *ore* coarctato, 5-lobo. *Stamina* 4, didynama, fertilia; *quinti* rudimento nullo. *Antheræ* biloculares, bipartitæ: *lobis* obtusis, divaricatis apice distinctis: *ovarium* placentis intervallo distinctis uniloculare. *Stigma* bipartitum: *segmentis* obtusis, canaliculatis, apice hispidulis. *Capsula* unilocularis, bivalvis: *valvis* medio placentiferis. *Placentæ* 2, magnæ, carnosæ. *Semina* horizontalia, obovata, imbricata, complanata, alâ latiusculâ repando-sinuosâ, membranaceâ, argenteo-nitidâ, subpellucidâ, pulcherrimè nervosâ, basi emarginatâ circumcincta: *testa exterior* atra, crustacea, rugulosa, parùm scrobiculata: *interior* tenuissimè membranacea: *albumen* nullum. *Embryo* luteolus: cotyledones orbiculatæ, plano-convexæ, non foliaceæ: radiculâ crassa, brevissima, cotyledonibus triplò brevior, infera, centripeta, basi obtusissima, funiculo umbilicali partìm remanente.

Planta (Chilensis) *suffruticosa, scandens.* Folia *opposita, petiolata, bipinnata, cirrho composito spirali terminata:* pinnis primariis *bijugis:* foliolis *serratis.* Flores *racemosi, secundi.* Racemus *oppositifolius pedunculatus, multiflorus.* Calyx *brevis, viridis.* Corolla *coccinea.* Capsula *magna, muricata.*

A Notice of the Beaver, from Observations made on Two Living Specimens at present in this Country.

The arrival of two beavers at the Garden of the Zoological Society, (of which I am a member), has afforded me an opportunity of paying some little attention to the habits and structure of these interesting animals.

On a visit to the garden during the very hard frost which occurred in the latter part of last January, I happened to find the keeper busily occupied in clearing away a quantity of mud from the door of the beavers' house. On inquiry, I discovered, that the industrious animals, finding themselves inconvenienced by the cold air forcing its way through the key-hole and chinks of the door, had employed themselves in stopping up all the interstices on the outside, so that it was only after some considerable trouble that the keeper was enabled to turn the key in the lock. Being on the spot a few days after, I was amused to perceive that the beavers, nothing discouraged by the demolition of their architectural labours in the first instance, had again set to work, and covered the whole surface of the door with a thick coating of plaster, which had been hardened by the frost into a solid cement. Though these outworks were repeatedly destroyed, the creatures continued with undiminished perseverance to fortify their dwelling against the cold, and so late as the month of March I found the doors completely blocked up. Indeed those who had the charge of them, found it an unprofitable labour to persist in clearing away the accumulated mud, as no sooner was a portion removed, than the breach was instantly repaired anew. The habitation allotted to the beavers is a low oven-shaped hut, divided into two apartments, with a view that the two individuals might live apart. They have, however, preferred dwelling together, in one of the divisions of the building, and they seem to have been influenced in their choice, from finding that two of the entrances to it were supplied with doors, and therefore that less labour would be required in rendering it fit for their occupation. The other side, which has two inclosed entrances, is turned by them into a store-house; they convey thither the supplies of wood and bark which are given them as food, and preserve them there until needed.

The animals have covered over the two doors of their dwelling apartment, but have left open the entrance which faces a small tank or pool of water, contained within the enclosure, in which they are confined.

I was curious to examine the materials of which the little plasterers had availed themselves in their operations. I found that they had procured the mud from the bottom of the tank, bringing up handfuls at a time. This they had carefully tempered, and intermixed with thin shreds, and splinters of wood, the remains of the faggots which had been given them as food, and from which they had gnawed all the bark and nutritious portions, leaving only the woody fibres, which, however, they turned also to account. The use of the introduction of these shreds, was evidently to give stability to the plaster, to make the mud bind, and in this respect they served the same purpose as the straw which the Egyptians employed as one of the necessary ingredients in the composition of bricks.

As the object to be gained by the beavers was merely to render the door weather-tight, no sort of frame-work was required in this process, and they seem to have used very few large sticks, but merely this kind of mortar, consisting of the slime interspersed with woody fibres.

Much has been said of the effects which captivity produces, in depraving the instinct peculiar to the beaver in its wild state. I think, however, that it must be evident from the facts which have been stated above, that the animals were influenced by a feeling, that the habitation prepared for them differed from that to which they had been accustomed in their native country. The improvements which they introduced into their dwelling, may serve to correct an error in natural history, which had been pointed out by Hearne, viz. that the beaver forms more than one entrance to its house. The proceeding of the animal in this instance, in closing up two outlets, tends to corroborate the assertion of the northern traveller.

Independent of these external arrangements, in order to make themselves more comfortable, they have effected what may be stiled the fitting up of the inside of their house. They have introduced from time to time large quantities of supple twigs, or any soft substance that happened to fall within their reach, so as to form a bed, which they have heaped up nearly a foot from the floor, so that it is on a level with the top of the doorway; it slopes down, however, gradually towards the entrance. An advantage is gained by this contrivance, this elevation places them in a certain degree out of the influence of the cold air; and the declination of the bed towards the water, looks like a precaution derived from their situation in North America,—a provision to guard against the sudden inroads of water, caused by the swelling of the stream on whose bank they may have settled. Though there is no risk of an irruption of the pond which now lies at their door, the instinct which teaches them to provide against such an event still remains.

Numerous are the fictitious wonders which swell many of the relations of the habits and structure of the beaver,—a history sufficiently curious and interesting without the addition of any exaggerations. Among other gratuitous assertions, it has been maintained by some, that the animal makes use of its tail as a trowel, to work up the materials with which it builds. Were this the case, the tail, which is covered with scales, by no means hard, would soon exhibit proofs of the uses to which it was applied; but in fact these scales are never found rubbed or injured. During the process of building last winter, the beaver employed its tail in no such hard service. All their materials were conveyed in their fore-paws; and, though these are small, yet the animals managed, by holding them together, and close up against the throat, to transport considerable masses of mud at once. The tail is, however, by no means an useless member. In its shape it bears some resemblance to the blade of an oar or paddle, and, like it, is adapted *to take hold* of the water. A great portion of the beaver's life is spent in that element. On land it is a clumsy animal, slow in its movements, and easily overtaken by its enemies. Conscious of this, its first impulse, when an alarm is given, or an enemy at hand, is to plunge into the water. There it dives and swims with great facility; and it may easily be supposed how advantageous it is to the creature to possess so powerful a rudder as its broad flat tail. By means of this instrument, it is enabled to sink to the bottom, or pursue its course under water with the greatest celerity, and with equal quickness to raise itself to the surface, when out of reach of its enemies. The root also (Nuphar luteum), which composes the principal part of the beast's food, grows at the bottom of streams of water, where are also placed the stores of bark and branches of trees, which the animal collects as part of the provision for winter.

The beaver appears to be singularly scrupulous in preserving the inside of its house perfectly clean and dry. I have observed it, on leaving the water, to enter its hut, pause on the threshhold until it had shaken off all the drops of water from its sides and tail, after which it betook itself contentedly to its couch.

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1. *Climate of New South Wales.* 2. *Climate of Sennar.*

1. *New South Wales* *.

With regard to the climate of Sydney, winter sets in with May, spring with September, summer in November, and autumn in March. Mr Martin observes, that it is only during the summer months that the hot winds occasionally blow, and raise the mercury to 120° F., when exposed to the wind. When these siroccos are about to occur, the sky assumes a lurid appearance, the sun is hid from view, the wind suddenly shifts to the NW., and blows with tremendous violence, and can only be compared to a fiery blast issuing from an immense furnace; the dust is whirled with rapidity; distant thunder is heard. At night the flashes of stream-lightning present a continually illuminated horizon; vast forests become a universal blaze of fire, and the flames, borne along with the blast, readily find fresh fuel, carrying terror before, and leaving ruin and desolation behind. Not only does the field of corn, ready for the sickle, become a charred stubble, but houses and domestic animals are reduced to a heap of ashes; and man himself, while attempting to save his property, has sometimes fallen a victim to its ravages. Fortunately these winds seldom last long, rarely more

* At a meeting of the Medical and Physical Society of Calcutta, held in Chowringhee, on the 4th October, a sketch of the topography of New South Wales, by Mr R. M. Martin, was read and discussed, from which the above is extracted.

than two days at a time. Their termination is marked as decisively as their commencement. The air becomes darkened; a severe thunder storm comes on, accompanied with rain and hail, the latter of a very large size; the wind shifts to the SE., and a cold southerly squall sets in, which lasts for a few hours, when the sun reappears, the sky assumes its usual pale blue, and the atmosphere acquires its wonted serenity. Collins speaks of these siroccos as killing birds, beasts, and men, who are exposed to them; but Mr Martin has ridden through the forest when the red hot charcoal beneath his horse's feet, and the falling columns of fire from trees in his path, made it highly hazardous, without feeling any other effect than excessive fatigue, after riding forty or fifty miles in such an atmosphere.

Rainy weather is most frequent in the month of March, sometimes in February or January; it lasts about twenty days, and occasionally the rivers are so swollen by the mountain torrents, as to sweep away from the banks stacks of corn, dwelling-houses, men, and cattle. The month of April, which is the Australian autumn, is very similar to the same month in England: fires are pleasant in the morning and evening. May is truly delightful. The winter months, viz. June, July, and August, have an extremely bracing effect on a debilitated constitution; the atmosphere being not only cool, but entirely divested of the humidity which characterises an English winter, the greatest height of the mercury being 63°, and the lowest 27°. The ground is covered with a hoar frost in the morning, and ice, about the thickness of a Spanish dollar, is found even some hours after sunrise. On the mountain road to Bathurst, snow of two feet in depth has remained on the ground for several days, and ponds have been frozen over sufficiently thick to admit of a loaded waggon being driven over them without breaking.

Mr Martin exemplifies by a fact, that the winters of New South Wales are delightfully mild. He has placed, at night, at Paramatta, a vessel of milk under a tree in his garden, and in the morning, while eating the iced cream, plucked the ripe and ripening oranges and citrons. Frequently a second crop of pears and other summer fruits is produced in winter, and trees blossom again.

Mr Martin thinks that neither time, civilization, nor cultivation, has diminished the claim of New South Wales, since our earliest knowledge of it, to the appellation of the "Montpelier of the world," merited by its moderate temperature, dryness of atmosphere, and congeniality to the human constitution. Many of the diseases which afflict mankind are totally unknown there. Individuals arriving in the colony with constitutions impaired, are soon restored to health, and attain a robust old age.

The smallpox has not yet made its appearance among the colonists. Shortly, however, after the first settlement, in 1788, it raged among the aborigines in the neighbourhood of Sydney, and nearly depopulated the country. The caves on the sea-shore were found filled with dead bodies, and in some places were observed the deceased left to perish without human aid, those who had strength remaining having fled from the contagion to the interior of the country, leaving the dead to bury the dead,—a circumstance not at all usual among that simple race of men.

Neither measles, hooping-cough, nor scarlet fever, have yet been seen in the colony. Hydrophobia is equally unknown. Cutaneous eruptions are rare; but among the aborigines a scaly disease covers their bodies, which they ascribe to a constant use of fish.

Females seem to be in a great measure exempt from the suffering denounced on our first parents. The aborigine, when seized with the throes of labour, if on a journey, stops on the way side, and is attended by her husband, who sprinkles her with water until parturition is over, when the new-born babe is wrapped in a soft paper-like bark, and the mother arising, resumes her progress in search of food.

Mr Martin mentions a very curious fact. The increase of population, he says, has been most rapid, and is to be accounted for by the number of females born, the proportion being, with regard to males, as three to one! The greatly preponderating number of females brought forth among domesticated animals, will account for the countless herds of cattle which overspread the colony.

Viewed as a place of convalescence for individuals suffering under the influence of tropical diseases, Mr Martin is of opinion that New South Wales appears to possess many advantages. The voyage is sufficiently long to benefit an invalid, without his being exhausted by its duration, if the passage be made through Bass's Straits, or to the southward of Van Diemen's Land. After arriving at Sydney, any climate requisite, whether cold or warm, may be chosen in twenty-four hours. There is an extensive and elegant society, a perfectly English town, and as fine animal food as is to be had in the world, together with all the delightful vegetables and fruits, which are so seldom to be found good out of England.

2. *Climate of Sennar**.

After a long and tiresome sojourn of nearly five months at Chartum, I set out for Sennar with that sort of hilarity which a man feels when released from "durance vile."

For nearly eight months of the year, the country around Sennar wears an aspect of the most frightful sterility; realizing, in every sense, the ideas we are apt to form of the regions of the torrid zone. Immense plains, which extend farther than the eye can reach, present an unvarying expanse of arid sands, strewn with withered plants; or, should a scanty vestige of verdure occur, it consists of mere thistles and *oshar*. The forests wear an equally melancholy appearance. In the months of April and May, when our own country is clothed in renovated verdure, it remains dead and lifeless under the sky of these climes; whilst the trees are quite as naked, and their branches quite as leafless, as during the winter season with us, unless, indeed, a solitary leaflet may here and there be seen struggling into existence. No sooner, however, does the rainy season set in, than the scene undergoes a complete metamorphosis; and one or two falls of rain are sufficient to produce it. The sands of the desert, which, to all appearance, were unsusceptible of vegetation, smile with their carpets of verdant brilliancy, and are not excelled in beauty by our gayest pastures. The plains are covered with a variety of grasses, which afford an ample and acceptable subsistence to the flocks; the soil, from which every living thing had been banished, is at once instinct with life; the woods array themselves in all their splendour, and afford their

* From the manuscript Journal of G. B. Brocchi, as given in the London Literary Gazette.

refreshing shelter to herds of oxen and camels; the cultivated fields are clothed with crops of grain in every direction.

The rains of a European summer not only renovate vegetation, when sinking under the effects of excessive drought, but impart new life and vigour to the human frame. The fresh and elastic temperature of the air reanimates our mental and bodily faculties; the atmosphere, rich with the perfume of the glade and garden, draws us from our dwellings with its voluptuous breath; the heavens become serener, a fine morning ushers in a more delicious evening, and our whole soul is knit with greater festivity, and energy, and activity. Never do we enjoy existence so thoroughly as at such a moment as this. An effect, the very reverse of this picture, takes place under the Nubian sky. The first impressions which the novelty of the scene has excited, are quickly succeeded by indifference and disgust. A damp oppressive wind blows from the south without cessation, during the rainy season. Our appetite fails us, our strength succumbs, and our mind is stultified, as if blasted by its malignant breath. A state of absolute torpor takes possession of our every sense. However heavy may have been the shower, the heavens never entirely recover their serenity, but murky clouds flit across their face, threatening a fresh descent. * * * The great variableness of the temperature destroys the equilibrium of health; the broiling sun of the mid-day is the harbinger of a piercing breeze: the atmosphere, surcharged with moisture, keeps our clothes and furniture in a state of constant humidity; and thence proceed stoppage of the circulation and rheumatic affections. A thick stratum of viscid mud puts an end to all intercourse with the adjacent parts; and the camel himself, whom nature seems to have created for the peculiar use of these climates, becomes, for the moment, a useless incumbrance, though he is the only beast of burthen. Innumerable swarms of noxious insects,—flies of every form and size,—gnats and ants of various species, arise, gorged with a green-coloured liquid, from the slime of this universal marsh, as if they had been generated by putrescence; and they cover every hole and corner of the houses. Add to this, the roofs being composed of mud, on the appearance of an impending shower, the whole family is in a state of daily and nightly uproar, in their anxiety to provide against any forcible entry of the descending enemy. And, with all these miseries, the season affords no set-off, like our autumn, of multifarious fruits, smiling and diversified pastures, the varied produce of the vegetable garden, or any of those useful productions which render a southern autumn so delightfully attractive.

Being at Sennar at the commencement of the rains, I quitted it to pass the remainder of the season at Chartum. The rains of the former place are heavier, of more frequent occurrence, and of greater duration, and are accompanied by a storm of wind from the south, which drives the rain with prodigious fury before it. So soon as the shower approaches the earth, it is dispersed and rebounds, whilst the wind tosses up the rain-drops, grinding them into such minute particles, that the ground appears covered with a layer of dense fog. These pluvious storms are waited upon by thunder, lightning, and sometimes hail; the latter, however, is a phenomenon unknown at Chartum. The clouds frequently descend, and cover the surface of the ground; but at Chartum, which is close upon the skirts of the pluvial zone, the rains are later, nor are they so abundant, or so continued. The first of them fell this year on the 18th of July; and, from that time until this day (the 31st of August), the thermometer remained constantly stationary between the 26th and 28th degrees of Reaumur; nor did it rise, during that space, for more than three days to 30°, nor for more than one single day to 31°. Before the rains came on, and during the preceding months, it had risen every day to 33° and 34°. It must be regarded as a rare occurrence, that, when the rainy season is at its height, namely, on the 2d of August, the thermometer, as Bruce relates, should rise to 116° of Fahrenheit, which corresponds with 37° of Reaumur. It is remarkable, that, at sunrise, and during the rainy season, the thermometer should have maintained nearly the same elevation of 21° and 22°, which it usually maintains in the hottest weather at the same hour. The cause I should assign for this fact, is the calmness which pervades the atmosphere during the night: it was seldom interrupted by the smallest breath of wind.

Throughout these countries there are not more than three or four species of plants, though the magnificence, brilliancy, and verdure of the carpets, with which nature temporarily endows them, would lead the observer to infer that they were the effect of a great variety of species. These are confined to the *Trianthema pentandra*, the *Boerhavia repens*, and the dwarf *Convolvulus*, bearing a little white flower.

Analysis of the Water of a Spring on the Estate of Fordel near Inverkeithing, 1829. By the Rev. W. Robertson *junior*, of Inverkeithing. (Communicated by the Author.)

This spring flows from rocks of that coal formation, which, in this county, rests upon the new transition or mountain limestone. The strata are sandstone, slate-clay, and bituminous shale, clay ironstone, and coal. Iron-pyrites occurs disseminated through the strata. In the neighbourhood greenstone and basalt rocks, of the secondary trap series, are intermingled with the regular coal formation.

The water running from the spring would apparently fill a pipe of an inch in diameter, and it deposites an ochreous sediment in its channel.

Bubbles of gas were observed ascending through the water at intervals, and a portion of these was collected by means of a phial and funnel inverted, and submitted to the following trials:

In agraduated glass-tube, it did not render lime-water turbid, nor did it sustain any diminution by agitation with, or standing over, either that fluid or solution of potash. It therefore did not contain carbonic acid.

Upon introducing a stick of phosphorus into another portion, slight fumes appeared, and, after standing for two days, an ultimate diminution in volume of six per cent. took place, which, on adding the correction of two and a half per cent. for the augmentation in bulk of the residual nitrogen by the vapour of phosphorus, gives of oxygen .085.

In a detonating tube, it could not be made to explode with hydrogen gas by the electric spark, though atmospheric air, treated in the same manner, exploded with facility.

It did not explode by the electric spark, when mixed with atmospheric air.

The oxygen gas which it contained being previously removed by phosphorus, it was mixed with chlorine gas, and exposed to the light for some hours. The chlorine was then removed by agitation with lime-water, and the oxygen, which the action of the light might have extricated, by phosphorus. The diminution amounted to one and a half per cent., which might have been carburetted hydrogen, or may have arisen from absorption, by the water confining the gas, during so many agitations with it.

The residual gas, which was probably nitrogen, after the proper allowances were made, amounted to . .900

The Oxygen	.085
The carburetted Hydrogen or Loss	.015
	1.000

A large flask, fitted with a bent tube, and containing eighteen and a half ounces of the water, yielded, by a *slight boiling*, half a cubic inch of gas, which, from the want of a mercurial trough, was collected over water. This is in the proportion of about .42 of a cubic inch from an English pint.

Four and a half per cent. of this gas were absorbed by lime-water; the lime-water, at the same time, becoming milky. This gives of carbonic acid .02 of a cubic inch from the pint.

By phosphorus there was a farther loss of seven per cent., to which the correction for augmentation in volume of the residual nitrogen being applied, gives of

Oxygen, ...	.095
Carbonic Acid Gas, . .	.045
Nitrogen, ...	.860
	1.000

A large flask, with a bent tube, containing twenty-seven ounces of the water, was *strongly boiled for a very considerable time*, until bubbles of gas ceased to come over. The quantity collected was two and a half cubic inches. Of this, when treated as before, .75 of a cubic inch were found to be carbonic acid, .317 of a cubic inch oxygen, and 1.43 cubic inches nitrogen, which, exclusive of the carbonic acid, is nearly .18 of oxygen to .82 of nitrogen.

At the above rate, the volumes of the gases contained in an English pint of the water, are, of

Carbonic Acid, . .	.420 of a cubic inch.
Oxygen, . . .	179
Nitrogen, . . .	.810
	1.409 cubic inches.

Which is in the proportion of

Carbonic Acid, . .	.300
Oxygen, . . .	.127
Nitrogen, . . .	.573
	1.000

Preliminary trials of the Water by Tests.

Even when recent, it did not perceptibly redden tincture of litmus, though the tint was compared with the colour of the tincture diluted to a similar extent.

It did not affect the colour of Brazil wood or turmeric test-paper. With tincture of galls it gave a slight tinge of purple, and ultimately a scanty purplish brown flocculent precipitate, shewing the presence of iron, and by the purplish tinge also the presence of earthy or alkaline salts.

The water, next day, gave no tinge with the tincture, shewing the iron to be principally in the state of a carbonate.

When the water was evaporated by a gentle heat, flocculi of oxide of iron were deposited.

The water, upon being boiled, gave a considerable yellowish-white precipitate, indicating carbonates. This precipitate was soluble, with considerable effervescence, in nitric acid.

The water decanted off from this precipitate, gave no tinge with tincture of galls, but, on boiling it with a few drops of nitric acid, to peroxidise the iron which it might contain, the excess of acid being afterwards neutralized by ammonia, it gave unequivocal traces of iron, by a darkish tinge with the tincture. From this it was inferred that the iron in it was in the state of protoxide. A portion of this water, after being thus treated, also gave a red tinge, with sulpho-cyanate of potash.

With ferro-cyanate of potash, and a drop of muriatic acid, the water, when recent, gave a whitish precipitate, becoming blue by exposure to the air, indicating iron in the state of protoxide.

With lime-water, the recent water gave a copious flocculent precipitate, the lime uniting with the excess of the carbonic acid, and the whole of the carbonates falling down together. This precipitate was redissolved, on adding more of the mineral water, which shewed a considerable excess of carbonic acid, and it was also soluble with effervescence in dilute acetic acid.

With the bi-carbonate of potash there was no precipitate, the whole being kept dissolved by the excess of carbonic acid.

With ammonia, and also with potash, a flocculent white precipitate took place, partly owing to the abstraction of free carbonic acid. With the carbonates of potash, soda, and ammonia, there were similar precipitates, but more scanty,—they were all soluble in a dilute acetic acid.

With a solution of soap in alcohol, a great milkiness.

With acetate of lead, a considerable milkiness, and a precipitate insoluble in acetic acid.

With oxalate of ammonia, a considerable precipitate, indicating lime.

With carbonate of ammonia and phosphate of soda, an immediate milkiness, and a precipitate, after standing, indicating magnesia; the precipitate soluble in acetic acid. With carbonate of ammonia or phosphate of soda, separately, no milkiness, after standing for the same length of time.

With muriate of baryta, a slight precipitate insoluble in muriatic acid, indicating sulphuric acid.

With nitrate of silver, a copious precipitate, white, while secluded from the light, becoming rapidly purple on exposure to light, indicating muriatic acid.

Two ounces of the water, evaporated to dryness, gave, with nitro-muriate of platinum, slight traces of potash.

The water, very much concentrated by evaporation, gave, with starch and sulphuric acid, no trace of iodine.

From the above indications, it was concluded, that the water contained sulphuric, muriatic, and carbonic acids, together with protoxide of iron, lime, magnesia, and a little potash. The presence of alumina was inferred to be incompatible with that of the earthy carbonates, neither could any be subsequently detected.

In this analysis, the evaporation was performed in a glass flask, so as to exclude dust; the precipitates were collected, without the use of a filter, by decantation; and repeated affusions of distilled water, and, for the most part, transferred at last into a small glass flask, of the size of a pigeon's egg (not exceeding in weight from ten to fifteen grains), the weight of which, being previously accurately marked, was afterwards subtracted from the gross weight, and in it they were dried, heated, and weighed.

Analysis.

1. An English pint of the water was evaporated to dryness. The remaining saline matter being heated to redness, afterwards weighed one grain and thirteen-twentieths. It was blackened by the heating, which indicated the presence of a little vegetable matter.

2. An English pint of this water was concentrated by evaporation to about an ounce and a-half (a few drops of nitric acid being previously added to prevent any precipitation), and the sulphuric acid contained in it was precipitated by nitrate of barytes. The sulphate of barytes thrown down, after being heated to redness, weighed three-tenths of a grain, equivalent to .10 of a grain of sulphuric acid. This twice repeated gave the same result.

From the residual liquid the muriatic acid was precipitated by nitrate of silver. The chloride of silver, after fusion, weighed six-tenths of a grain, equivalent to .15 of a grain of muriatic acid.

This gave the same result, both in regard to the sulphuric and muriatic acids, when repeated without any previous acidulation of the water by nitric acid. This was done, as there was room for suspicion that a portion of the muriatic might have been expelled by the excess of that acid during the evaporation.

3. An English pint of the water, acidulated and concentrated as above, had the excess of nitric acid exactly saturated by ammonia. The lime being now precipitated by oxalate of ammonia, was converted into a sulphate, which, after being heated to

redness, weighed one grain and three-tenths, equivalent to .535 of a grain of lime.

The iron was thrown down by ammonia, and dried: it weighed about .04 of a grain.

From the residual liquid, which contained an excess of ammonia, the magnesia was thrown down by the addition of phosphate of soda; the precipitate, dried by a red heat, weighed exactly the same on three separate results, being seventeen-twentieths of a grain, equivalent to .309 of a grain of magnesia.

4. Tincture of galls was added to a pint of the recent water. The precipitate, after being calcined in a red heat, weighed three-twentieths of a grain. Being suspected not to be wholly iron, it was redissolved in an acid, and precipitated as in the following process. It then weighed about .05 of a grain. The residual liquid was found to contain a little lime.

5. The iron in another pint was peroxidised by boiling with nitric acid, the water being considerably concentrated by evaporation, and then precipitated by adding to the acidulated solution an excess of carbonate of soda. It weighed about .05 of a grain.

The residual liquid being boiled, the lime and magnesia also precipitated in the form of carbonates. Dried by a red heat, they weighed one grain and three-tenths, which, assuming the result in No. 3. to be correct, is three-tenths of a grain less than they should have weighed according to the rules of atomic proportion; but a little of this precipitate was lost in transferring it into the small flask.

6. Another pint of the water was concentrated by evaporation, the iron peroxidized, and precipitated by ferro-cyanate of potash. As ferro-cyanate of iron it weighed about one-fourth of a grain, equivalent to about .05 of a grain of oxide of iron.

The iron of another pint was precipitated by a polished piece of zinc, the precipitate redissolved in an acid, and again precipitated by a large excess of ammonia, that any zinc present might be retained in solution; but the precipitate still contained oxide of zinc.

The precipitation of the peroxide of iron from another pint, by a crystal of carbonate of lime, was only partial after a lapse of three weeks.

The precipitate from another by benzoate of ammonia, weighed only one-twentieth of a grain, being so very indistinct that it could not be wholly collected.

7. Four pints of the water were evaporated to about three ounces, the carbonates which the boiling had precipitated were separated, and then the remaining liquid evaporated to dryness. The dry matter weighed one grain seven-tenths.

Upon it alcohol was poured and digested. The alcoholic solution was poured off and evaporated to dryness. The residuum heated became black, and being redissolved in water yielded some black flakes.

What the alcohol had not dissolved was now boiled in a little distilled water; some earthy matter remained, weighing, after being heated to redness, three-twentieths of a grain.

This watery solution contained the salts of potash and soda, with perhaps a little sulphate of magnesia. To try this, a drop of it was added to a solution of carbonate of ammonia and phosphate of soda, upon which a slight cloudiness appeared. Carbonate of ammonia was now added to the solution, a little white precipitate which fell down was separated, and the solution being evaporated to dryness, the residuum, after being heated to redness, weighed three-fourths of a grain.

This substance was also blackened by the heating, and when it was redissolved, a few black flakes separated. Nitromuriate of platinum was now added, the solution evaporated to dryness, and again redissolved. The yellow crystalline substance left, after the liquid was decanted off, being dried, weighed .23 of a grain, equivalent to .046 of a grain of potash, or .011 of a grain in the pint.

The liquid poured off had the excess of platinum precipitated by ammonia, and being evaporated to dryness, the matter left, after being heated to redness to expel the ammoniacal salts, weighed eleven-twentieths of a grain.

On this being redissolved, a few black flakes separated, weighing one-twentieth of a grain. The solution crystallized shewed minute prismatic crystals of sulphate of magnesia. The magnesia separated as ammoniaco-phosphate, weighed in that state one-tenth of a grain, equivalent to .08 of a grain of sulphate of magnesia, which, together with the one-twentieth of a grain of black matter, being subtracted from the eleven-twentieths of a grain, gives .42 of a grain of chloride of sodium, equivalent to .22 of a grain of soda, or .105 of a grain of chloride of sodium, and .055 of a grain of soda in the pint.

That it was chloride of sodium, was shewn by a portion of it obtained from another quantity of the water, burning, when put on platinum-wire before the blowpipe, with a rich yellow flame, exactly like that afforded by pure common salt.

The carbonate separated, after being heated to redness, weighed four grains and seven-tenths, which, added to the one grain and seven-tenths formerly obtained, give for the whole saline contents six grains and four tenths, or one grain and six tenths per pint, almost the same result as that in No. 1.

The small flask containing these carbonates, another small flask with diluted nitric acid, and a capillary syphon, were then placed in the scale of a delicate balance, and accurately counterpoised; and the syphon being put into the acid, so as to transfer it upon the carbonates, the loss of weight, arising from the escape of carbonic acid, amounted to one grain and six-tenths, or .40 of a grain per pint.

The iron contained in the solution thus made, being peroxidized by boiling with nitric acid, was precipitated as in No. 5. In the state of hydrated peroxide, it weighed seven-twentieths of a grain, equivalent to one quarter of a grain of protoxide of iron, or rather more than .06 of a grain per pint.

8. To ascertain the quantity of free carbonic acid, four pints of the recent water were mixed with lime-water, and the precipitate allowed to subside in close vessels. It was collected, and the carbonic acid was expelled from it as above. The loss of weight amounted to four grains and nineteen-twentieths, or 1.24 grains per pint, from which the carbonic acid in union with the lime, magnesia, and iron, being deducted, there remains .8 of a grain for the quantity of free carbonic acid; but this must surely be incorrect, as it amounts to nearly four times the quantity of that which was obtained by boiling the water. The whole of the carbonic acid, however, thus obtained, is nearly in the proportion of two atoms of the acid to one atom of each of the bases with which it is combined; so that the lime, magnesia,

and iron, exist here in the state of bi-carbonates, if such compounds be possible.

This experiment was repeated with a pint of water, which had remained in a bottle for several days. The loss of weight amounted to .95 of a grain, from which the quantity in combination in the carbonates being subtracted, leaves .51 of a grain, more than double the quantity procured by boiling.

In these experiments, it was observed that the precipitate was frequently buoyed up to the top of the liquid by bubbles of gas. This of course arose from the atmospheric air contained in the water; and it was the more remarkable, as very few of these air bubbles escaped from the water, so long as it was unmixed. *Qu.* Could this be owing to an affinity exerted by the carbonic acid?

9. The experiment in No. 7. respecting the loss of weight, arising from the expulsion of carbonic acid from the carbonates, was repeated upon the carbonates, precipitated by boiling from two pints of the water. The result was nearly similar, the loss being three-fourths of a grain, or .37 of a grain per pint.

10. To ascertain the state in which the salts existed, the following experiments were made.

It was found that the excess of carbonic acid did not affect the colour of litmus, and that it could be expelled only by long and violent ebullition.

When the water has been boiled down to two-thirds of its bulk, a large portion of the magnesia, together with almost the whole of the lime and iron are precipitated.

This precipitate was redissolved in nitric acid with great effervescence. To some of the solution nitrate of baryta was added, but it gave no trace of sulphuric acid. It became quite black with tincture of galls, and very turbid on the addition of oxalate of ammonia.

The water from which this precipitate had been deposited, gave, with nitrate of barytes, most decided marks of containing sulphuric acid, and with oxalate of ammonia a very slight trace of lime. It shewed no marks of containing iron, but after being boiled with a few drops of nitric acid to peroxidise any iron which it might contain, it gave unequivocal, though slight, traces of that substance with sulpho-cyanate of potash, and also when the solution was previously neutralised by ammonia, with tincture of galls, thus shewing that the small portion which it still held, was in the state of a sulphate or muriate of the protoxide.

To ascertain the precise quantities, a pint of the water was concentrated by evaporation, and the precipitated carbonates being carefully separated, were re-dissolved in nitric acid.

To this solution, somewhat diluted, and exactly neutralised by ammonia, oxalate of ammonia was added. The precipitate, when converted into a sulphate as before, weighed one grain and two-tenths, equivalent to .494 of a grain of lime.

The liquid decanted off from the oxalate being now supersaturated with ammonia, the iron subsided: it weighed about .05 of a grain.

The magnesia was thrown down by adding to the solution, already supersaturated with ammonia, phosphate of soda. The precipitate, after being heated to redness, weighed eleven twentieths of a grain, equivalent to .20 of a grain of magnesia.

To the liquid, from which the carbonates had been thrown down by the boiling, a little oxalate of ammonia was added. The oxalate of lime precipitated weighed about one-fortieth of a grain, equivalent to .011 of a grain of lime.

The magnesia was then precipitated by aqua-ammoniæ and phosphate of soda. The precipitate, after being heated to redness, weighed eleven-fortieths of a grain, equivalent to .10 of a grain of magnesia.

STATEMENT OF THE PRECEDING ANALYSES.

Gas ascending through the water.

Nitrogen,	.900
Oxygen,	.085
Carburetted hydrogen, (uncertain),	.015
	1.000

Gas expelled from an English pint of the water by boiling.

Carbonic acid gass,	.420 of a cubic inch.
Oxygen,	.179
Nitrogen,	.810
	1.409 cubic inches.

Saline contents of an English pint of the water.

Sulphuric acid,	.10 of a grain.
Muriatic acid,	.15
Carbonic acid,	.40
Lime,	.535
Magnesia,	.309
Protoxide of iron,	.06
Potash,	.011
Soda,	.055
A little vegetable matter soluble in alcohol, and a little soluble only in water, estimated about	.03
	1.65 grains.

Of the bases there were ascertained to be in combination with

Carbonic acid,	Lime,	.494
	Magnesia,	.20
	Protoxide of iron,	.06
Muriatic acid,	Lime,	.011
	Magnesia,	.05
	Protoxide of iron,	a trace,
	Potash,	.011
	Soda,	.055
Sulphuric acid,	Magnesia,	.05
		.931 of a grain.

There were therefore in an English pint of the water,

Carbonate of lime,	.882
of magnesia,	.420
of protoxide of iron,	.096
Muriate of lime,	.025
of magnesia,	.142
of potash,	.019
of soda,	.118
of protoxide of iron,	a trace.
Sulphate of magnesia,	.150
	1.852 grains.

There is here an increase of weight, partly owing to the salts of the muriatic acid being calculated as in the state of *muriates*, though actually obtained and weighed as *chlorides*, and partly to a portion of the carbonic acid being driven off by heat, or detained in the diluted acid used to extricate it from the carbonates. The ascertained weight was .4 of a grain, while the quantity, by calculation, necessary to saturate the quantity of bases found to be in combination with that acid, is .644 of a grain.

The ochreous sediment, deposited in the channel of the spring, is owing to the iron passing, by absorption of oxygen from the atmosphere, from the state of *protoxide* into that of *peroxide*, and so becoming insoluble; for, in the state of *peroxide*, it is incapable of remaining in combination with that carbonic acid, through the medium of which it was dissolved while a *protoxide*.

The difficulties in the results of this analysis are as follows:

The discrepancy between the quantity of nitrogen stated in chemical works to be capable of being absorbed by water, and the quantity here obtained, which is nearly double of that statement. Both the flask and tube were completely filled with the water, so that not one particle of air from the atmosphere was admitted; therefore, supposing the result to be correct, it can be accounted for only from the great compression, to which the water is evidently subjected under ground, causing it to take up a larger proportion of the gas.

The quantity of carbonic acid, obtained in Nos. 7 and 9, is also about one-third less than it should have been according to the rules of atomic proportion, but this may partly be accounted for from a portion of it being retained by the diluted acid used to expel it from its state of combination.

But the greatest difficulty arises from the discrepancy between the quantities of the carbonic acid, obtained from the water by boiling, and by the method in No. 8. In the mode adopted in No. 8., there seems to be no source from which the carbonic acid could be derived, but from the water; and though the gas got by boiling was collected only over water, yet, as that water was warm, and the tube in which the gas was collected very long and narrow, the absorption could not be such as to account for the enormous deficiency.

The remaining difficulty arises from the magnesia, not in respect to the accuracy of the results obtained in Nos. 3. and 10., but with regard to the calculations to be made from these results. In Dr Turner's work, page 684, it is stated that 100 parts of ammoniaco-phosphate contain 40 of magnesia; and in page 486, that 76 of the same salt contain 20 of magnesia. *Which of these statements is the correct one?* I have made my calculations according to the result of my own experiments on that salt, which give 20 of magnesia from 55 of the precipitate.

As connected with the water of this spring, it may be noticed that there is a considerable efflorescence on the sides of the quarry at Sunnybank, about half a mile to the westward, and towards the rise of the strata. A solution of this efflorescence gave with oxalate of ammonia no precipitate, but with nitrate of barytes a most copious precipitate, the solution remaining scarcely affecting nitrate of silver. With ammonia and phosphate of soda, there was a most copious precipitate, and with tincture of galls a considerable blackness. The solution of it deposited an ochreous sediment on standing, and crystallized by evaporation to the last particle in four sided prisms, terminated by short four sided pyramids, the crystals often crossing one another. On exposure to the air they became ochreous on the surface. With ammonia and phosphate of soda, they yielded the same quantity of ammoniaco-phosphate of magnesia, as an equal weight of sulphate of magnesia did. They were, therefore, sulphate of magnesia contaminated with a little iron.

On the Cavities containing Fluids in Rock-Salt. By WILLIAM NICOL, Esq. Lecturer on Natural Philosophy. Communicated by the Author.

THE rock-salt of England is in general of a reddish colour, and more or less opaque; but portions of it are often to be met with, not only snow-white, but perfectly transparent. On inspecting a specimen of the latter kind, which I lately received from Cheshire, a considerable number of very small irregular cavities were observed dispersed through certain parts of it. These were all filled with a fluid, and some of them had also a minute globule of air. Such of the cavities as had no globule, constantly acquired one on the application of a moderate degree of heat; but the globule never appeared until after the heat began to diminish.

On heating a piece of salt containing a globule of air, the globule diminishes in bulk as the heat increases, and in general entirely disappears, even before the heat becomes so great as to be painful to the touch. As the heat diminishes, the globule re-appears, and increases in bulk until the temperature be reduced to that of the atmosphere.

On the application of a heated wire to that side of a cavity which was opposite to the place of a globule of air, the globule in no instance had the slightest tendency to move from its place; and when a rent was made to extend from the surface into a cavity, the globule sustained a very slight enlargement, but was unable to expel any part of the fluid through the rent to the surface. In respect of elasticity, the globule of air in the fluid cavities of rock-salt, is therefore greatly inferior to that of the globule of air in the fluid cavities of fluor-spar and sulphate of barytes.

When a direct opening is formed into a cavity of the salt, the fluid remains in the cavity, but shews no tendency to crystallise, even in those states of the atmosphere when a saturated solution of muriate of soda is rapidly crystallising. If heated, however, the fluid submits to the laws of crystallization, and assumes the form of extremely slender acicular crystals; but these rapidly deliquesce even in the driest states of the air.

From this circumstance it evidently appears, that the fluid is not a solution of common salt, and although the application of a very few chemical agents enables us to indicate the materials of which the fluid is composed; yet, on account of the smallness of all the cavities I have had an opportunity of operating on, I am unable to determine their relative proportion.

When a solution of nitrate of silver is applied to the fluid, a copious precipitate ensues, which indicates the presence of muriatic acid. As muriate of barytes gives no precipitation, it is evident that the fluid contains no sulphuric acid. Oxalate of ammonia gives a slight precipitate, which shews the presence of a small portion of lime; and as carbonate of potash throws down a dense precipitate, magnesia is clearly the principal ingredient with which the muriatic acid is combined. The fluid in the cavities of rock-salt may therefore be considered as a saturated solution of muriate of magnesia, mixed with a little muriate of lime; and as the salt itself, when free from cavities, gives no indication of either of these, or of any other foreign matter, it may be considered as pure chloride of sodium.

List of Geological and Mineralogical Collections in Great Britain and Ireland.

I. ENGLAND.

BUCKINGHAMSHIRE.—Duke of Buckingham's, (contains the mineral cabinet of Haüy). *Stow.*

CAMBRIDGESHIRE.—At *Cambridge*, the Woodwardian Collection, belonging to the University, augmented by Professor Sedgwick, &c.

CORNWALL.—Royal Geological Society of Cornwall, *Penzance,* (a general collection of Cornish rocks and minerals). Williams, Esq. *Scorrier House;* and Rashly, Esq. of *Menabilly,* (superb collections of Cornish minerals); Mudge, mineral-dealer, *Falmouth.*

CUMBERLAND.—Hutton's and Crossthwaite's collection, *Keswick,* (minerals and rocks of the county).

DERBYSHIRE.—White Watson at *Bakewell, mineral-dealer;* Brown and Mawe at *Derby*, and at *Castleton* (collections for sale).

DEVONSHIRE.—Johnson, Esq. *Exeter* (Devonshire minerals). Philosophical Institution, *Exeter.* Reverend Mr M. Every, *Torquay,* (interesting collection of fossil bones from that neighbourhood).

DORSETSHIRE.—Miss Phillpotts, *Lyme Regis,* (lias fossils); Miss Anning, *Ditto,* (specimens for sale) Colonel Gordon, Shaftesbury, (fossils).

DURHAM.—Marquis of Cleveland, *Raby Castle,* (splendid collection of fluors and calc spars from the lead-mines of Alston and neighbourhood).

ESSEX.—Philosophical Institution, *Colchester.* Mr Dyk's collection of crag fossils, *Harwich.*

GLOUCESTERSHIRE.—At *Bristol,* the Philosophical Institution in Parliament Street contains a good collection of specimens, illustrating the neighbouring country, including the collection of encrinites, &c. belonging to Mr Miller, the curator. Private collections at Bristol, rich in the fossils of the adjacent country; Mr Johnson's; Cumberland's and Blackenridge's. Other collections there belonging to the Reverend Dr Beelie, and to R. Bright, Esq. Ham Green. At *Tritworth*, Reverend Dr Cooke's.

HAMPSHIRE.—Philosophical Institution, *Portsmouth*. Vine, Esq. *Isle of Wight*. Mrs Murchison, Nurstead House, near *Petersfield*, (chalk and green-sand fossils). Miss Beaminster, *Christchurch* (sells collections of tertiary fossils). Mr Griffith, near *Christchurch*. Mrs Newby of Newlands, near *Lymington* (London clay, plastic clay, and fresh-water shells of Herdwell).

KENT.—Philosophical Institution of *Canterbury*. Mr Crow of Margate (Sheppy fossils).

LANCASHIRE.—Philosophical Institution of *Liverpool*. Dr Traill (minerals).

LEICESTERSHIRE.—At *Queenby Hall*, an interesting suite of lias fossils.

MIDDLESEX.—In *London*, the best collections of minerals are at the British Museum; at Mr Heulands', mineral-dealer, King's Street, St James's; at Sir A. Hume's, &c. Best collections of rocks at the Geological Society, Somerset House; Royal Institution in Albemarle Street; London Institution in the City; Mr Greenough's, Regent's Park. Mr Stokes, Grey's Inn, (fossil shells and plants, &c. &c.

NORFOLK.—Philosophical Institution, *Norwich*; Mr Woodward, *Ditto*; (crag and chalk fossils); Mr Henley of Landringham, *North Lynn*, (lias fossils); Reverend Mr Leith, (*Shropham Hall*.)

NORTHUMBERLAND.—Duchess of Northumberland, *Alnwick*; Messrs Winch and Hutton at *Newcastle*, (coal fossils); Philosophical Institution at *ditto*; Sir J. Trevelyan, *Wallington*; Mr Bigg of *Lindon*, near *Morpeth*.

OXFORDSHIRE.—At *Oxford*, public geological collection, (extensive series of British rocks and organic remains, together with a considerable assemblage of foreign ones; private collections of rock specimens, particularly volcanic, belonging to Dr Daubeny.)

SOMERSETSHIRE.—Philosophical Institution, *Bath*; private collections at *ditto*; Mr Lamb; Mr Pratt's; Dr Davies; and Reverend Mr Richardson's (illustrative of the adjoining country), near Bath; Mr Meade's, (fossil remains, minerals, &c.); Reverend Mr Skinner of *Camerton*, (coal fossils).

SUFFOLK.—Miss Edgar, Red House, near *Ipswich;* Mr Leather, *ditto.*

SURRY.—Mr Turner of *Rook's Nest,* (minerals).

SUSSEX.—Mr Mantell of *Lewis,* and Reverend Mr Hoper of Portslade near *Brighton,* (chalk fossils).

WARWICKSHIRE.—Philosophical Institution, *Birmingham;* Mr Russel, *ditto.* (minerals).

WESTMORELAND.—At *Kendall,* Todhunter's collection, containing fossils and minerals for sale.

WILTSHIRE.—At *Warminster,* Miss Benett, (fossils from the chalk and green sand); at *Salisbury,* Mr Shorte, (chalk fossils, especially alcyonia from flint).

YORKSHIRE.—Philosophical Institutions with Museums, at *York, Leeds, Hull, Sheffield, Wakefield, Whitby,* and *Scarborough.* Collections for sale at Mr Calvert's, *Leeds,* Mr Behne's, *Scarborough,* Mr Meynell, *Yarm.*

SOUTH WALES.—Mr Dellwyn's at Pentlegarve, near *Swansea.*

II. SCOTLAND.

MID-LOTHIAN.—At *Edinburgh,* the mineralogical and geological collection in the College Museum; collection at the Royal Society; the private collection of Professor Jameson; Dr Hope; Mr Allan, banker; H. Witham, Esq. of Lartington, Yorkshire; Mr T. Jameson Torrie; Mr William Copland; Mr Nicol. Rose, mineral dealer.

At *Leith.*—Near to *Edinburgh,* Dr Charles Anderson.

FIFESHIRE.—At *Raith,* Robert Ferguson, Esq. of Raith.

ABERDEENSHIRE.—At *Aberdeen,* Dr Knight; Dr Davidson.

RENFREWSHIRE.—At *Glasgow,* the mineralogical collection in the College Museum; the private collections of Dr Thomas Brown, Dr Cowper, Dr Thomas Thomson, Mr Edington, &c.

INVERNESSHIRE.—At *Inverness,* the collection of the Northern Institution, and that of the Secretary, Mr Anderson.

III. IRELAND.

DUBLIN.—The collection of minerals and rocks of the Dublin Society, in Leinster House, in Dublin; the private collections of Sir Charles Giesecké; Mr Joy.

CORK.—The collection of minerals and rocks belonging to the Cork Institution.

BELFAST.—The collection of minerals and rocks belonging to Dr Macdonald.

Observations on the Geology of the Meywar District. By JAMES HARDIE, Esq. Member of the Medical and Physical Society of Calcutta. Concluded from page 335 of preceding volume.

I SHALL now proceed to give a description of the northern portion of Meywar. The plains in the north of Meywar are exceedingly fertile. Many large tracts of land, however, are left uncultivated; but, from the luxuriance of the jungles, with which, in many situations, they are covered, we can judge of the richness of the soil. This portion of the country is supplied with abundance of excellent water. Besides the various rivulets with which it is intersected, there are numerous artificial lakes, some of large extent. The principal of these is the Dhabar tank, well known all over India *.

Although the northern portion differs so much in its external aspect from the southern, it is nevertheless, like it, composed of primitive rocks. About eighty miles due east of the city of Oudeypore, is the northern termination of the table land of Malwah. This table land is succeeded, towards the north, by flinty slate, and sandstone of a slaty structure. These rocks also skirt the trap formation of Malwah to the west, in the form of a narrow belt, which runs southward betwixt it and the southern portion of Meywar, described above. To the north of this formation we find a compact limestone of a bluish-grey colour, slightly translucent on the edges, with a splintery inclining to conchoidal fracture. It is distinctly stratified, has a slight dip, and easily splits into flags of considerable magnitude. It forms a favourite building stone with the natives, and seems admirably adapted for this purpose. It contains nothing like fossil organic remains, and appears to rest immediately on the clay-slate formation. The flinty slate strata, mentioned above, are arranged exactly in a similar manner with these, and might, at first sight, be mistaken for them. These formations extend

* The Dhabar tank, and also the Oudeypore tank, are formed by magnificent dams thrown across the beds of the rivers Bedus and Gometee. These dams are faced with white marble, and are adorned with small temples, sculptured elephants, &c. Vide Malcom's Central India.

thirty miles north of the table land of Malwah, where they terminate in a primitive district. They are bounded on the east by the Cheetore range, and extend westward to a distance of about fourteen miles, when we again meet with primitive rocks.

Over this portion of the country are scattered several detached groups of low hills. One of these it may be worth while to describe. It is situated about fourteen miles north of the cantonment of Neemuch, near a village called Sawah. I found that the lowest strata of this hill consisted of clay-slate of a bluish colour, approaching to roofing slate, but of a more friable nature. Immediately above these, strata of flinty slate occur, which are succeeded by another earthy slate of a light colour, sectile, adhering to the tongue, and with a distinct slaty structure. On exposure to the air, this variety acquires a white crust, apparently of an aluminous nature. Above this is stratified quartz rock, which gradually passes into a conglomerate, containing rounded masses of Lydian-stone, quartz, &c. Above this, again, there is another bed of the last-mentioned earthy rock. The hill was here so completely covered with jungles, that I could proceed no farther. I was, however, very near the summit, and as it was covered with debris, composed of a very beautiful conglomerate, I have no doubt that it was formed of this. This conglomerate was composed of rounded grains of quartz, about the size of a pea; the centre of which sometimes contained minute quartz crystals. These were cemented together by a base of a very pretty agate-jasper; which is capable of receiving a high polish. It was associated with a red clay ironstone, in which were found specimens of botryoidal hæmatite. Except the clay-slate, which forms the base of the hill, and the flinty-slate, I did not observe any of the rocks which are seen in the plains.

We shall now make a few observations upon the valley of Oudeypore. This valley is about thirty miles in circumference. The primitive range of mountains which extends from the district of Ajmere to the south, splits here into several collateral ranges, betwixt two of which the valley in question is situated. It is completely surrounded on every side by hills, the only passages through which are by narrow gauts or ravines. It is not a valley, properly so called, but consists of a number of very low hills or rather swells, surrounded as above described. On a ledge of rock, at the south of the valley, the city is situated, in which are several houses and temples of large extent. The palace itself is of immense extent, and in the distance has a very imposing appearance. The city is surrounded on three sides by a wall and wet ditch, but of no great strength; and on the fourth side it is skirted by a lake about twelve miles in circumference. This lake presents one of the most picturesque objects which I have ever seen. It is completely closed in by hills of a broken and rugged aspect, which are seen rising one above another in the perspective, and which are covered to the very top by a thick jungle, giving to the scene a rich and luxuriant appearance. Scattered over it are several islands, on two of which are erected hot-weather residences of the Ranah. The buildings completely surround the islands, presenting to the view colonnades, virandahs, and domes of a pure white colour, from the central courts of which are seen rising above the edifices cocoa nut trees, palmiras and cypresses; and in these islands also are produced the finest oranges of India. Altogether the scene is truly oriental, and although the buildings on close inspection appear rather heavy, in the distance they look light and airy. They are built of a coarse white marble; out of which, also, is carved a kind of light frame-work, which nearly surrounds the islands as well as the roofs of the different apartments. Besides the lake just described, there is another of equal extent in the north-east part of the valley, on which are also observed several small islands, but without buildings upon them.

The rocks, composing that portion of the range of hills which passes Oudeypore, are quartz-rock and clay-slate, similar in appearance to those described as occurring in the southern portion of the district. The quartz-rock is distinctly stratified, and the strata are nearly vertical. In its structure this rock is exactly similar to the variety mentioned as forming the singular bed near Bando.

In the range of hills skirting the Dhabar Lake, which lies about thirty miles to the south-east of Oudeypore, the quartz-rock appears to pass into gneiss; and here the gneiss presents itself in a very beautiful form. I visited this well-known lake during the hot winds; and although the season was unfavourable for viewing it in perfection, the strata forming the range were more distinctly seen, being completely destitute of all vegetation. The gneiss is composed of the usual ingredients. The hills are ridge-shaped, and terminate in a sharp angle; and the perfectly bare and nearly vertical strata seem to the fancy like the huge ribs of some enormous skeleton. The gneiss passes into quartz-rock. To the north of Oudeypore chlorite slates and clay-slates are found, which occur for a considerable distance, associated with quartz-rock, until we reach the Ajmere district, where the predominating rocks are gneiss, mica-slate, and granite, with subordinate formations of marble and serpentine. In this district several metals are found.

In the valley of Oudeypore there is yet another formation to be mentioned. It is generally seen in low situations. Sometimes, however, it occurs on the top of low hills, which we have mentioned as occupying what is called the Valley. These hills themselves are composed of quartz-rock or clay-slate. The formation in question is carbonate of lime, which rests immediately on the primitive rocks. The surface, which is exposed to the action of the atmosphere, has a loose, friable and earthy appearance. The fresh fracture, however, exhibits more of a crystalline structure, and has a brownish red, and in some instances a dirty white colour. This rock, which the natives call Kunkur, is burnt for lime, and is well adapted for this purpose. It is not only found in the valley, but is extensively distributed throughout the country. Rounded masses of the different primitive rocks, together with Lydian stone and flinty slate, are contained in it; and its whole substance is traversed by numerous veins of quartz. I have seen a formation of a similar nature to this on the top of a granite hill near the Fort of Buneerah, about nine miles from Oudeypore, in a north-easterly direction. It was of a blackish brown colour, exhibited an earthy appearance externally, and was of a crystalline structure internally. Mica, which, viewed in the mass, exhibited a brass yellow colour, and between the eye and the light a greenish yellow, or rather straw colour, was plentifully distributed through it; and numerous agates and agate-jaspers were found imbedded in it. It becomes of a deeper black colour on exposure to the air, like the pearl-spar; of which mineral, indeed, it seemed to form a variety. By a rough analysis, it appeared to contain about 50 parts in 100 of carbonate of lime, 20 of silica, and the rest of carbonate of iron with traces of manganese. It exhibited numerous drusy cavities, in some of which quartz-crystals were seen, in others calcareous spar, either crystallized or in a botryoidal or stalactitic form; while all were incrusted with a substance resembling brown iron ochre (carbonate of iron).

Between the Cheetore range and the range which passes Oudeypore, we have, as I have already stated, plains of large extent, from the surface of which are seen rising several detached hills and mountain groups. For about forty miles north of Oudeypore, the country between these two ranges presents the usual quartz-rock, with clay-slate and chlorite slate formations. The detached hills are principally composed of the quartz, and present the same appearances of precipices, &c. which we have described as occurring in the Bheel district. North of this we find granite, gneiss, mica-slate, primitive greenstone and hornblende-slate, with the universally distributed quartz-rock. The strata frequently appear at the surface of the plain; and I had in many situations an opportunity of examining their various alternations, more especially in the more northern parts of Meywar. These consisted of different granitic rocks, in which the garnet is a very abundant mineral; indeed, the whole surface of the plains is covered with it, giving to the sand a red appearance. Both the precious and common garnets are found. The former are small, and seldom in perfect crystals. The latter are large, often of the size of a hen's egg, opaque or translucent on the edges, and regularly crystallized in the usual forms. I also observed a rock in this portion of the district, which was almost entirely composed of quartz and felspar. The felspar was of a milky-white colour; and longitudinal filamentous stripes pass through its substance, of a more opaque whiteness than the rest. This mineral, with the quartz, is arranged in irregular portions of pretty considerable size, and which are intimately connected together. Felspar also occurs in this formation, in thin seams, which run parallel to the strata. It is nearly transparent, of a greenish colour, and exhibiting slightly the play of colours so remarkable in the Labrador felspar. Besides these, another rock, composed of quartz, red felspar, and steatite, with occasional scales of mica, is found; and also hornblende slate, through the substance of which quartz is disseminated. Schorl frequently occurs in these rocks.

At a village called Bheelwarrah, I observed, at the surface of the plain, an extensive series of alternations of strata of greenstone approaching to hornblende-slate and quartz. The quartz in some situations was nearly pure; in others hornblende was disseminated through it, while in others mica made its appearance, but in small quantity. In the greenstone strata, numerous veins of quartz were observed; and both sets of strata were traversed by numerous veins of calcareous spar, obviously of posterior formation, and which could be traced to a bed of limestone resting upon the alternating beds, similar to the kunkur before mentioned. This series I traced along the dried up course of a rivulet, for a considerable distance.

About forty miles north-west of Cheetore, stands the fortified town of Buneerah, situated at the termination of a range of hills, which extends from this town to a considerable distance, in a south-westerly direction. I examined one of the hills of this range. The base was formed of different granitic rocks, distinctly stratified, and alternating with one another. One set of strata consisted of a very fine granular grey granite, easily affected by the atmosphere, and, in its partially decomposed state, exactly resembling a sandstone. Another was granite, in which the quartz and felspar occurred in large angular concretions; and the mica, though more plentiful than in the former, was still in small quantity; and the whole mass was traversed by veins of felspar, or rather adularia, with a beautiful pearly lustre. Another variety of granite also occurred, in which the mica, of a dark grey colour, was distinctly crystallized, as were also the quartz and felspar. On the very summit of the hill was the limestone or kunkur formation already described. The shape of the hills in the neighbourhood was round, approaching to conical, and the rocks composing them were distinctly stratified. I sent my servants to collect specimens, from various other situations, which I pointed out, and I found them of a similar nature to those mentioned above. In this neighbourhood I found traces of copper; and I believe that copper-mines are worked, but with no great activity, near Mandul, situated in this range.

About twenty-four miles south of Buneerah is the fort of Humeerghur, situated on a hill, which forms one of a small group. On examining one of the hills, the first set of strata which presented themselves consisted of mica-slate, of an earthy appearance, and approaching to the nature of clay-slate, with veins of quartz traversing its substance. Immediately above this was a quartz rock, of a granular texture, and, in some situations, highly crystalline. Above this was mica-slate as before, and, superior to all, was a quartz rock, of a more opaque compact nature than the former, and having a greyish, and sometimes a brownish colour. These different strata were arranged in a highly inclined position. Both varieties of quartz rock were distinctly stratified, but the higher one inclined more to the slaty structure, and split easily into thin plates.

From Humeerghur, southward to the Cheetore range, and close to the city of that name, we have a succession of hills, composed of quartz rock, resting upon clay-slate. The line of march between these two places is hedged in with a thick, and almost impenetrable, jungle, so that a person can scarcely see a yard in any direction, except where an occasional gap presents to the view the white precipices of quartz with which this portion of country abounds, rising above the trees. The outgoings of the clay-slate strata, which appear at the base of the quartz precipices, approach in some situations to writing-chalk, and in others they had a silky appearance, owing to the occurrence of very minute scales of mica, which were disseminated through the substance of the rock. The latter variety was sectile, and adhered to the tongue.

On approaching the city of Cheetore, about twenty-four miles from Humeerghur, the country becomes less covered with jungle; and, as the line of march runs along the slope of the hills, we have an excellent view from the heights of the plains below. On descending and leaving the quartz strata, the first rock that presents itself is clay-slate. Next appears the compact limestone formation described above; which forms gentle swells and elevations, giving to the country something of a waved outline. We have now a splendid view of the city of

Cheetore; a city which the natives believe to be impregnable; and into which no stranger is permitted to enter without permission from the Ranah. It is situated on a tabular shaped hill, about 500 feet high, detached from the great chain, and surrounded by a plain where clay-slate is seen in the ravines and low situations, with the limestone resting upon it. The plain on the summit of the hill, and on which the city is situated, is said to be fourteen miles in circumference; its breadth varying from a quarter of a mile to half a mile. It runs in a direction nearly parallel to the chain, that is, from north to south. It is surrounded by a perpendicular escarpment, which rises from the slope of the hill in the same manner as Salisbury Craigs does near Edinburgh. This escarpment forms a natural fortification, which surrounds it on every side, except towards the south, where its place is supplied by a strong wall, with buttresses, &c. Besides this natural fortification, there is an artificial wall skirting the summit, where the crags are low; and upon the whole, this place must have merited the appellation of impregnable, at the time it was in its glory, and when native armies alone were opposed to it. The slope of the hill consists of clay-slate of an earthy friable appearance; and which splits into very thin slates. From its easily disintegrating nature, it affords a soil, on which grow a profusion of trees; among which the tamarind is conspicuous. Ths summit of the hill is composed of waved strata of quartz rock, which rest immediately on the clay-slate, and the exposed ends of which form the escarpment or crags described above *. The following are the varieties which were observed in the quartz rock,—a pure white, fine granular variety; a coarser grained reddish and brownish variety; and a third, containing minute grains of reddish felspar.

The only other formation which I observed in this neighbour-

* The whole of this paragraph of Mr Hardie's paper has been necessarily much abridged. It is not very evident from his manuscript, whether or not the strata of quartz rock are conformable to the strata of the subjacent clay-slate. It is not improbable that this rock is exactly the same as some of the varieties of the old red sandstone, described by Dr Turnbull Christie as occurring in the Southern Mahratta Country, for it agrees with them very closely in its mineral characters and geognostical position; and moreover, we are informed that the same sandstone formation occurs in the Vindhya range, which is close upon Meywar. Vide Dr Turnbull Christie's paper in the last number of this Journal.

hood is a chalky rock, which occurs about a mile and a half west of Cheetore. It forms gently rising swells in the plain. It is not stratified, and appears to be of a newer formation than any of those which occur near it. It is friable, sectile, adheres to the tongue, and soils the fingers. It effervesces strongly with acids, and is used for cleaning the leather belts of the sepoys. It contains no organic remains, nor do any nodules of flints occur in it. Immediately above it, rests a thin bed of a quartzose rock, also unstratified, of a brownish colour, and containing imbedded masses of different rocks. This layer varies in thickness, from a foot to a foot and a half, and is extremely irregular on its surface. The chalk-bed is several feet in thickness. Numerous veins of quartz traverse its substance, and can be traced to the bed resting upon it. These veins are so numerous in many situations, that they render it perfectly unfit for the purposes to which it is applied. The above formation appears to be of trifling extent; and I should be inclined to refer it to the limestone formation, which I have described under the name of Kunkur.

In situations where marshes had existed during the wet season, and also in the dried up beds of rivulets, an efflorescence, consisting of muriate of soda, and sometimes carbonate of soda (called by the natives Preh), is very frequently met with in this and the neighbouring districts; and in many situations it is collected for domestic purposes, the latter being used in the manufacture of soap. Muriate of soda is not common in the lakes of Meywar; but in the wells of the Nusserabad, and in the Sambur lake, lying between the Ajmeer and Jeypore districts, it is very abundant. From the latter, immense quantities are yearly procured for the purpose of commerce. Many of the wells of Nusserabad, though bored through the rock to the depth of eighty feet, are so salt that they are unfit for ordinary purposes *.

Mr Hardie mentions, in a postscript to his paper, that, since writing the above, he had an opportunity of hearing some par-

* It is also mentioned by Rennel that extensive salt mines exist in this quarter of India, which makes it probable that the whole of that tract of country which lies to the west of Meywar, Ajmeer, and Jeypore, is occupied by an extensive formation of new red sandstone.

ticulars concerning metals found in the range of hills described as passing Gudeypore, and running into Ajmeer. They were found in the hills surrounding the ancient city of Ajmeer. He continues: The specimens which I have seen were ores of lead and copper; and silver, in small quantity, as I am told by the late superintendant of Ajmeer, is associated with the lead. Mines of this last metal are worked to a considerable extent, some of them being seventy yards deep. The ores which I saw were galena and phosphate of lead. Sulphate of lead also occurs there.

The native method of reducing the metal is at once simple and economical. The ore is pounded very small. It is then mixed with wet cow-dung, and rolled into balls; and these, after having been dried in the sun, are, with the addition of a small quantity of charcoal, set on fire. The heat produced by this process, with the assistance of the bellows, is sufficient to separate the metal, which is then collected for commerce.

Copper is not extensively worked. To private individuals, the expense and risk attending the operation are too great; but were government to hold out sufficient encouragement, I have no doubt that, from the specimens which I have seen, mines of this metal might be worked to great advantage. The ore was the green carbonate of copper. The rocks in which these metals occur are primitive; and I have seen specimens of granite from the hills in which the veins of lead and copper are observed. The veins are described as being very numerous, and rich. The mica of the granite was olive-green, apparently tinged with copper. The felspar and quartz were in large concretions. Steatite was also found associated with these.

On a Submarine Forest on the Coast of Tiree, one of the Western Isles. By the Rev. COLIN SMITH of Inverary. (Communicated by the Author.)

THERE are few subjects in which the mind may not lose itself. A master spirit may grasp great and important truths, and rove over the face of existence, with a freedom that may seem to bespeak an all-illuminating power; but when he confines his energies to a point, and strives to scan the mysteries of any minute portion of being, the distinctness of his comprehension is found to be vagueness, and the clearness of his understanding ignorance.

It has been well remarked, that a blade of grass would be sufficient to confound him, who considers himself "a genius equal to the majesty of nature;" and when we examine the plans of unerring wisdom as they are exhibited to us in the objects of creation, we constantly find our progress impeded by difficulties which surpass the bounds of our comprehension. It is not difficult, indeed, to speak generally, and out of chaos to arrange a more or less consistent system of things, as if it were a very simple matter to form a world; but when the materials of which it is made are considered in their existing relations, the opposition of talent to talent, and of theory to theory, have already demonstrated, that the book of nature must be taken as it stands, and, like the book of Revelation, be made its own interpreter.

I was powerfully impressed with these views in the summer of 1826, when, being on a visit to the Island of Tiree, I was told by some of the natives, that hazel-nuts were found in the sand-banks along the shore, though the hazel was no longer indigenous to the island. With the view of ascertaining the truth of this report, I examined a bay on the north-west side of the Island, where the nuts were said to be most numerous. This bay is open to the full lash of the Atlantic wave, its general exposure being NNW., and having no land seaward to break the force of the tides, which flow here with great rapidity. It is close to the well-known quarry of Bally-pheadrais, on the SE., and is bounded on the west by a low ridge of gneiss rocks, and around, by an alluvial deposite, from twelve to sixteen feet in thickness, composed principally of gravel, which the sea has rolled in, from age to age. The bank thus formed is covered by a thin coating of soil, fertile in such plants as commonly grow in other similar situations, and it seems frequently subjected to the capricious workings of its parent element, as the high tides easily destroy a barrier composed of such rude materials. Not, however, that the sea is making general encroachments on the island; on the contrary, a plain of 1500 acres, of which this bank is the termination on the NE., and a great part of which is scarcely elevated above the level of the sea, manifests a marine and a late formation. Along the centre of the Island, and bounding this extensive plain upon the east, there is a tract of moss-land, containing the remains of oak, birch, and other trees, which no longer grow in this exposed situation, and existing here as if to give their testimony to the supposed kindliness of nature to the ages that are past. It is not wonderful to hear the native hum with enthusiasm a song of the times of old, as in passing through this tract he finds the majestic remains of extensive forests, while he is obliged to launch his skiff, and steer for the continent, in order to procure a few sticks for supporting the roof of his thatched cottage.

This moss-land does not now stretch to the NW., so far as the fore-mentioned bay, as a portion of the plain or reef which runs along the whole of the western side of the island lies between it and the sea; but there are symptoms of its having stretched, at some earlier period, to a considerable distance beyond its present limits, and having formed one continuous sheet with that which is now found constituting part of the bed of the ocean.

It was about half tide when I happened to visit the bay, and I could not but remark that the gentle acclivity along which the breakers rolled majestically, was of a darker colour than the gneiss of the district would have led me to suppose; and, on examination, I found that a thin stratum of moss was extended along the western side of the bay, and seaward, as far as the rolling of the breakers, and the depth of the water, would allow me to discern it. The waves seemed to roll easily over the smoothed surface of this bed, and although they had rendered it broken and incontinuous in many places, and torn it almost entirely away in the immediate vicinity of the bank, where heavy stones and sand were frequently tossed about; still they had not even here done their work so effectually, that small portions might not be found *in situ*, while they had produced little or no effect, thirty or forty yards seaward from the high water-mark. It could not be traced under the alluvial depositions of the bank, though the nearness of the moss-land of the island renders it more than probable that they were at some time united.

The general depth of the moss-land is several feet, but the stratum which extends into the sea, is only four or five inches. The general consistency of the latter was firm, and it adhered so closely to the bed of sandy clay, on which it rested, that I found it necessary to use the shaft of my hammer in separating them,—and I succeeded, by poising the moss upwards in thin lamina, like those of slate-clay. The colour was brownish-black. The remains of trees were very obviously seen in it, and I could distinguish the birch by its bark, which presented its decisive characteristics; but I could not be equally satisfied in regard to the more decomposed portions of trees which were crowded together, without any such obviously distinguishing property. The whole appeared as if merely undergoing the putrefactive process, while its fibrous texture and woody appearance seemed to denote that fallen trees had contributed more to its formation than decayed musci.

That other and smaller plants entered into its composition, was also rendered obvious, since, on breaking the moss into small pieces, it abounded with seeds, appearing as fresh as if the hand of the gardener had sown them the day before. Upon drying, they became darker in the colour, and split longitudinally, probably owing to their long immersion. In this state they were submitted to Dr Hooker, who writes, " The seeds have the appearance of belonging to some plant of the natural order Leguminosæ, and Mr Drummond suggests that they may probably be those of Genista Anglica."

The existence of one such fact proves much. Marine depositions and organic remains being found in situations elevated far above the present level of the ocean, have led all to conclude what the frequency of such facts fully demonstrates, that the relative position of the sea and land has changed, and that many portions of the earth which are now fertile in the higher orders of plants, were once covered by the waters of the ocean. If our knowledge were confined to a single observation of this nature, we might not be entitled to call for such mighty agency as the moving of the whole earth or seas to account for the phenomenon, and the heavings of an internal volcano, would be deemed a probable, because a more partially operating cause. And when depositions and remains evidently non-marine, exist in the bed of the ocean, though we must allow that an individual fact of this kind should not lead us to the ascription of a cause more powerful than is sufficient to account for its occurrence; still the existence of marine depositions above the present level of the sea, can be accounted no surer a proof, that what is now dry land was once the bed of the ocean, than the existence of such non-marine and vegetable remains under the waters of the sea, is a proof that what is now the bed of the ocean was once dry land.

The number of observations made in demonstration of the latter truth, have been necessarily fewer than those by which the former is supported; yet great as the difficulties obviously are, in obtaining knowledge of situations which are comparatively inaccessible, the facts ascertained even on the coast of Britain are by no means unimportant.

Proceeding northward of Tiree and Coll, we find at Lochalsh, near the manse of the Reverend H. Maclean, a bed of submarine moss extending into the sea considerably below low water-mark *; and still further north, to the Orkney Islands, Mr Skaill has related † a fact very similar to that which occurs at Tiree: "The sand in the Bay of Skaill being removed by a storm, exposed a great moss, containing fir-trees, &c. in a very decayed state;" and what renders the connection of the two circumstances complete, "there were numerous small seeds intermixed (with the decayed leaves) about the size of a turnip-seed, of a reddish colour." Turning to the south-east, Dr Fleming has observed a submarine forest in the Frith of Tay near Flisk ‡, which, along with decayed trees, contained the shells of nuts whole, but having no kernel. J. Correa de Serra has described ‖ such another submarine moss, but of great extent, and traceable in one unbroken bed to a considerable distance into the interior of Lincolnshire. At Mounts Bay in Cornwall mossy ground is found stretching into the sea 300 yards beyond high water-mark §; and in the neighbouring islands of Scilly, stone-fences and ruins, the remains of ancient architecture, are

* Stated on the authority of the Reverend H. Maclean.

† Edinburgh Philosophical Journal, vol. iii. p. 100.

‡ Edinburgh Philosophical Transactions, vol. ix.

‖ Ibid. 1789, p. 145. § Ibid. 1757.

frequently exposed by the shifting of the sand; and upon the supposition that they were originally built nearly on a level with the sea, it is calculated * that they must now be depressed at least sixteen feet. Neither are the tin-mines described by Diodorus Siculus as frequent in these islands, any longer to be found; and the number of the islands is no more the same, as Strabo states them to have been ten, and these ten have now multiplied themselves into 140 or more, thus proving such a general change of position in regard to the sea, as would lead us to suppose that the tin-mines are now covered by the ocean, and that the traditionary tale which connects the whole of them with the neighbouring continent of Cornwall, is true †.

Returning northwards, in Pembrokeshire, Giraldus Cambrensis says, that, in Henry the Second's days, by the force of extraordinary storms, the sands were driven off the shore, so that a great number of the roots and trunks of trees were discovered in their natural position, with the marks of the axe quite fresh upon them. In Neugal in the same county, and also in Cardiganshire ‡, similar discoveries have been made. And still approaching our starting-post, Mr Stevenson has given us an account || of a submarine forest on the coast of Cheshire, between the Mersey and the Dee. The Liverpool Courier of December 1827 stated, that, to the north of the Mersey, after a severe storm also, trunks and roots of trees were found buried under the sand below high water-mark, bearing evident proof that they had a living existence on the spot where they are now seen. In the Harbour of Oban in Argyllshire, the flukes of anchors have taken up pieces of moss from a depth of twenty fathoms §; and on the coast of the island of Coll I found submarine moss by no means unfrequent.

Similar observations have been made on the coasts of Sweden, Belgium and France, and perhaps every portion of the world may yet make its contributions; but, independent of these, the cursory view now taken of the coast of Britain, demonstrates that the existence of non-marine remains in the bed

* Edinburgh Phil. Trans. 1753.

† See Camben, p. 11. and Carew's Survey.

‡ Edin. Phil. Trans. *passim*.

|| Phil. Journ. April 1828.

§ Anderson on Peat-moss.

of the ocean, is neither a singular nor a rare fact, and that it is connected with some extensively operating cause.

Different naturalists having their attention more powerfully directed towards one class of events, or towards another, have accounted for these appearances accordingly. It sometimes happens that one bed of earth or rock slides or passes over another, thus changing their relative position, while their structure remains unaltered. An event of this kind was observed * at Solutre near Maçon, where a mass of earth, loosened by heavy rains, slid along the mountain of Solutre, for several hundred yards, to the great hazard of the village, which it had nearly reached; and also a part of the mountain Goina, in the Venetian States, on which several houses were built, glided along to the valley beneath, to the after-astonishment of the inhabitants, whose sleep was not disturbed by the motion. At Folkstone in Norfolk †, some of the inhabitants attested, that they considered that the land was yearly sliding or pressing forwards into the sea; and the Reverend L. Lyon, who observed a slipping of the earth in that country in 1785, tells us ‡, that water running through a substratum of sand, had formed an arch of the surface, and that some of the earth being loosened at the top of the inclined plane, on which it was situated, pushed before it the whole surface stratum, thus arched, to a considerable distance.

There are excavations of this kind frequently made in the ground by the united agency of frost and water, which, after depriving the surface of its support, cause it to sink down or subside. The waters of the Glommen in Norway, on their entrance into the North Sea, formed a cascade, which caused an eddy below, that gradually wore away the bank, and formed a subterranean lake, in which the castle of Borge, situated above, was engulfed in 1702, and nothing but a lake left. Malte Brun ‖ mentions several facts illustrative of such subsidence, and thus accounts for the existence of submarine forests.

But though Malte Brun founds his theory on antecedents which prove the possibility of its truth, and though it could not

* Malte Brun. Geol. vol. i. p. 434.

† Phil. Trans.

‡ Ditto, 1785.

‖ Ibid. 429.

perhaps be proved, that what happened in one situation might not also happen in another, we cannot conceive that the above explanation extends to such submarine forests as those of Lincoln and Tiree, where the submarine depositions form a continuous, or nearly continuous stratum, with the interior and unsubsided country. To render the explanation satisfactory, it would be necessary to shew that there was a sinking of the strata supposed to have subsided from their original level; and while appearances do not permit us to suppose such a sinking, they also forbid us to acknowledge the truth of this theory of subsidence. Dr Fleming of Flisk has obviated this difficulty. He found that decayed vegetable formations generally lay upon what he calls Lacustrine silt; and knowing that lakes suffer a gradual diminution of their depth, owing to earthy, saline, and metallic substances which their waters hold in solution, as well as to particles of detritus supplied by the influx of rivers, and the disintegration of the neighbouring rocks, all of which being deposited, eventually fill up the whole basin of the lake; he supposes that, when a lake situated upon a level with the sea had been thus filled up, and when the earth thus deposited passed into soil fit for the support of trees, that the seaward barrier may have been broken down, that damage by the tide may have taken place, followed by subsidence, and thus that the soil may be daily covered at flood, which was formerly beyond its reach, and above its level *.

While I admit the ease with which this accurate observer of nature calls facts to his aid, and explains modes of existence, I would suppose that his theory, encumbered with so many supposed facts, cannot bear with it the force of conviction. It is difficult to establish negative evidence, or to say that all these causes might not have combined in producing the above results. Nothing is supposed which might not possibly have happened; but it must be acknowledged, that, when a number of fortuitous events is necessary for the explanation of any particular natural occurrence, it is at least a presumptive evidence against the frequency of such occurrences. If the fact to be explained were unique in its nature, we might perhaps, in our

* Edin. Phil. Journ. vol. xii. p. 120.

love for explanation, be allowed to suppose rivers, and lakes, and detritus, the filling up of a basin, the lake on a level with the sea, the formation of land in its place, the growth of trees, the destruction of the seaward barrier, the drainage, the subsidence, and the consequent overflowing, even perhaps in such a place as Tiree, where none of these at present exist; but when the facts are so numerous, and found under such a variety of circumstances, sometimes in friths, sometimes in bays into which no stream now flows, and always where other symptoms of lakes are deficient; when they are so frequent, that, by the above supposition, we must consider *a variety of particular and fortuitous causes in general operation*, before we can admit its truth, it appears to me that some strong foundation should be found in fact before the theory can be deemed legitimate. The existence of lacustrine silt under the submarine moss, may be a foundation of this nature. But might it not be requisite to show, that it is always found under submarine forests; that it is not to be found except in situations where lakes have undoubtedly existed; that its characters are universal and decided, and that its existence and properties are incompatible with any other supposition or illustration, before it can justify us in making any decided statement? I am not aware that this has been done or attempted.

Other explanations have been given. The effects of earthquakes in destroying whole districts, and otherwise changing the relative levels of different portions of the earth, have been but too frequently marked. Accordingly, Dr Borlase, in his remarks upon the present state of the Scilly Islands, and the appearance at Mount's Bay*, has attributed these to the agency of central heat excavating, agitating, and finally depressing this portion of country. Correa de Serra is of the same opinion †. Calculating upon the force with which the level of soft grounds is borne down by the operation of the ordinary laws of gravity, he considered that this natural force of subsidence, called into sudden and violent action by the instrumentality of an earthquake, was the most easy mode of accounting for the appearances at Lincoln. Wherever earthquakes have exerted a local

* Phil. Trans. 1757. † Ibid. 1789.

and destructive influence, operating violently upon any portion of ground, the connection of that portion with the contiguous district has been more or less broken, and the effects of the earthquake so operating have remained to be traced in manifest disruption and shifting of strata. But, as in Lincoln, the strata are unbroken, it is to be presumed that no partially operating cause has affected them. It is indeed the destruction of connection in corresponding strata, that enables the observer to ascribe locality to an earthquake by its effects, or to set limits to any cause operating on the surface of the earth; and in finding the bed of moss extending unbroken into the interior, it is wonderful that this acute observer did not think of ascertaining his reasons for prescribing extent to a cause which may affect a spot, or convulse the universe.

The frequency of any particular class of facts, is a general measure of the cause to which they are referable; and the greater the number of circumstances are by which these facts are assimilated, the stronger is the evidence afforded, that they have arisen as a general consequence. To refer them to one or to more precedents, to unite them together as the result of a general state of things, or to ascribe them to a greater number of precedents, operating at different times according to a variety of contingent circumstances, is a second point, the determination of which does not depend upon the frequency of the facts, but upon the circumstances by which they are connected, and the traits of simultaneous formation by which they are assimilated. The number of submarine forests already discovered in such various circumstances, affords a presumptive evidence that they do not owe their present station to any number of fortuitous events, acting locally, but to some cause which operated widely over nature, neither destroying the relative position of strata, nor tearing one part of the soil from another. Whether the immersion of all these places happened at the same time, or whether it was the result of the same general cause exerted at various times, might be questionable, if these forests exhibited no assimilating character to enable us to connect two or more of them with any particular season; but I should suppose that a resemblance of this nature exists, which gives us as fair a foundation for reasoning upon, as could possibly be expected in a matter which is removed from our immediate observation by the mist of years.

In the submarine moss of Tiree, the ripe seeds of a leguminous plant are abundantly interspersed: in that at Skaill, there are ripe seeds resembling those of the turnip, but of a reddish colour; and in that at Flisk, the shells of nuts containing no kernels. In these three stations, the appearances presented, direct us to the same season of the year, viz. that in which the seeds of plants are ripe, as the time in which all suffered a change of position in regard to the sea. This would lead us to infer, that the same cause had induced not only the same changes in these three stations, but had induced them also at the same time, operating upon the whole extent of coast from Tiree to Flisk.

There are no facts stated by which we can trace a connection of time between the appearances in these three places, and those in Cornwall, Pembrokeshire, Cardiganshire, and Oban; yet it is not improbable, that, if the moss in these latter stations were carefully examined, sufficient evidence might be obtained of a simultaneous change of position; and such a strong relationship established between the whole, that the identity of their removing cause could not be doubted. Even in the absence of all time-marking circumstance, it is not unreasonable to suppose, nor even to conclude, that a cause operating so extensively as from Tiree to Skaill, must have affected the whole of Great Britain, and changed the whole of its maritime outline.

Independent of the evidence given by submarine forests, that the island is not now on the same level in regard to the sea as it once was, there is another circumstance which renders this more than probable, and which, taken in connection with the frequent occurrence of submarine forests, amounts to a proof that a change has, at some era, taken place along a great portion of the British coast, but especially on the west and north-west, where large trees are found lying in situations in which no trees can now be made to grow, on account of the close proximity of the sea. I would speak with deference, but I should conceive that this fact cannot be accounted for otherwise, than by supposing that the sea was at one time more distant from the stations in which they grew and are found, than it now is.

For though it has been supposed that large forests would protect themselves, when suffered to grow over a whole country, and thus enable trees to attain to a great size even on the shore, this only forces us to inquire how forests could ever become large in the present circumstances? or how, in the islands of Tiree and Coll, and other smaller islands on the west coast, where trees of an immense size are found in the moss lands, and where the present breadth of the islands is not such that the spray arising on one side might not be driven to the other, any forest could exert a self-protecting power?

To account for the existence of such forests where trees do not now grow, by considering them the produce of another soil, transported by the agency of some strong current, seems unsatisfactory; and, when it is remembered that these trees are not spread generally through diluvial depositions, but occur partially in patches, and principally in mossy ground, and that they are disposed in such a manner as would lead us to believe that they are lying where they grew, to maintain that they have suffered transportation seems rather an arbitrary judgment. Considering the remains of forests which are so abundantly found along our coasts, as now decaying where they once vegetated, and finding that the spray, as well as the unbroken blast from the sea, stint and destroy the growth of trees now planted even at a greater distance from their influence than are those mighty remains of past times, we must conclude that there *is a change*, and that all things are not now as they then were. Obliged to consider the nature of the vegetable fibre and growth, as well as the influence of the spray and the breeze, the same now as formerly; considering that the absorbing vessels of plants were then as liable to have their healthy action interrupted and destroyed as now, and that the sea-breeze would also have had as little deference for their constitution, we must believe that such forests of trees as are found buried under the soil on many parts of our coast, could not, all things being the same, have existed in countries where the desolating sea blast now destroys every shrub that raises its head above the artificial protection which the cultivating hand of man gives it; and so we must conclude, that all things are not the same, and that all those lands contiguous to the ocean, upon the W. and NW. coasts especially, in which remains of large trees are found, where none can at present be grown, do not occupy the same station in regard to the sea, which they once did, but have been brought near it, by some cause sufficient to raise the level of the waters of the ocean, or to depress that of the land.

If this be admitted, the whole difficulty of accounting for these appearances, as well as for submarine forests, vanishes; and if we should be inclined to reason from consequences, the admission of such a fact, so far from being discordant with the observations made upon the conformity of strata in Norway, and the North of Scotland, or militating against the conclusions which geologists have founded on this and other circumstances regarding the former connection of these countries, is beautifully illustrative of these opinions, and, as far as I am aware of, incompatible with no ascertained fact.

Whether the waters of the ocean have been acted upon, and the level of their superficies raised in regard to the bounding lands; or whether the crust of the earth has been affected, and a general depression of the level of its surface induced along the whole extent of this island, may not be easily determined: Our present knowledge of the changes which take place at the bottom of the sea, does not entitle us to expect any considerable rise of its level in a given time. The subject is not one of recent interest. The changes in the relative position of the sea and land have been observed and speculated upon for ages; and there is little doubt that the discovery of submarine forests would, at one time, have been hailed as a trophy of victory by warm and zealous disputants, and received with some perplexity by the supporters of a theory which was as wild as the facts it proceeded upon were assumptive.

When water was supposed to form the creating elements of nature; when the mountains of the earth, from the highest of the Andes and the Himalayan range, down to the lowest sandhill, was supposed to mark the different productions of the same parent at different periods, generating, according to a rule which M. Maillet, in his famous work entitled Telliamed, fixed at three feet four inches in the hundred years, thus supposing 675,000 years to be the age of our highest mountains, then Celsius, and many other eminent men, considered that the waters of the ocean, as well as the level of their superficies, were diminishing as a necessary consequence of the waste of their substances in the formation of land; whilst Browallius and others maintained, on the contrary, that the level of the ocean was in progress of being gradually elevated, and supported their theory by contrary facts. So blinding is the influence of theory, and so plausibly does it warp facts to suit itself, that the rocks in the neighbourhood of Geffle were adduced both by Celsius and Browallius as proofs of the truth of their respective systems. Celsius supposed that the rocks at Loffgrand to the west of Geffle, entitled him to infer that the level of the sea lowered at the rate of 45 geometrical inches (pouces geometriques) in the hundred years; while Browallius, from other rocks in the same neighbourhood, endeavoured to prove that the level of the sea was rising; and M. Gadolin again concluded, from his observations on the rocks on which the Chateau d'Abo was built 500 years before, and which, by either of the former suppositions, ought to have been considerably elevated or depressed, as well as from the existence of a tree which was ascertained to have been in the same station in regard to the sea for 364 years, that there could be no considerable change of level on the waters of the ocean. Facts, indeed, have been adduced by Manfredi regarding the foundations of the Cathedral of Ravenna, which seem to prove a rise in the level of the Mediterranean. But, on the other hand, Tournefort has shewn that the relative positions of many of the islands in the Archipelago, is the same as when they were described by Pliny and Strabo; and M. Ferner having travelled over a great part of Europe to ascertain this question, found that Ravenna was built in a marsh, which, notwithstanding the use of stakes, might sensibly yield to the weight of the buildings raised on it, even as many of the houses in other cities of Italy were much sunk in the earth; and as the wall of Severus, which still extended from sea to sea, as well as that of Adrian, were covered by a mould of several feet; and so concluded that the facts assumed annihilated their own evidence, and that nothing could be determined regarding the elevation or depression of the superficies of the ocean *.

* See Introduction aux Observations sur la Physique, par M. l'Abbé Rozier, for the preceding and additional facts.

It is reasonable, however, to suppose, that there must be a change induced on the level of the ocean, in consequence of detritus carried into it by rivers, as well as from the disintegration of neighbouring rocks and coasts.

M. Hartsoecker endeavoured, at an early period, to prove, from the analysis of the waters of the Rhine, that they contained $\frac{1}{100}$ parts of earth; and, generalizing on this, concluded that the bed of the ocean must be elevated by the detritus of mountains conveyed into it by rivers over the globe, at the rate of one foot in 100 years. Mr Stevenson, without attempting to fix the rate at which this elevation proceeds, has reasoned * judiciously and clearly on the subject, and the observations lately made on the coast of Africa by gentlemen sent from France for that purpose, have led them also to conclude that the level of the waters of the ocean is elevated by the above cause.

It is obvious, however, that, with whatever certainty this elevation may be carrying on, it must be very slowly, and that we cannot refer the depression of submarine forests to the agency of a cause operating so gradually that the same particles of moss would be for centuries exposed to the lash of the wave, and carried away by as sure a process as can be conducted under the laws of filtration and combination; and therefore it is that I should be disposed to consider that the ocean has not been elevated so as to inundate these lands, especially at Tiree, where the sea, so far from making encroachments, is daily receding, and consequently adding to the size of the island. Indeed, as the displacement of many feet of water over the whole depth and level of the ocean, could not fail to be rendered as obvious on every coast in the universe as on one, so as to be observable, especially in cities and forts, it is not to be supposed that there would not be surer and more frequent proofs of the agency of a cause, which operated so rapidly as to give moss no time to combine with the wave, or to be carried away by the tide, which regularly rolls over it.

The depression of the land, by some cause operating upon the crust of the earth, and suffering these islands to subside at

* Philosophical Journal, April 1828.

once into the ocean to a certain extent, seems more consistent with the present appearances; and we may conceive, that thus suddenly conveyed into the bed of the ocean, its waters would prove much less destructive to the moss-lands in rolling smoothly over them, than they would do, if they lashed against a bank composed of such a perishable material. Whether or not this depression was owing to the agency of central heat, producing a general system of elevation and depression over the whole globe, as formerly advocated by Lazoro Moro, Hutton, and his eloquent illustrator, and now revived and supported with many important facts by M. L. Cordier, it might be presumption in me to say; but I should certainly conceive, from a long and minute investigation of the subject, that this is the supposition with which the facts are most consistent.

In concluding this paper, which has already been too much extended, I may be allowed to remark, that, as to the era in which such a depression may have happened, nothing can probably be determined. In a conversation which I had in 1825 with Mr Webster of the Geological Society of London, he told me that he had found a hazel-tree, with ripe nuts attached to it, sunk in diluvial soil, and exposed by the action of the waves on the shore of the Isle of Man; and that he considered this circumstance as a proof of the correctness of the Mosaic account of the season in which the deluge recorded in the Bible occurred. But the seeds and nuts found in these submarine forests, though they speak to us of autumn, do not carry us back to an era so remote—nor does the Biblical account require their aid. The sceptic has seized upon many strong posts, and been regularly forced to abandon them. He has tried to extend the world into a past eternity, but the cypherings of time derided him;—he has endeavoured to build unto himself a fortress in metaphysical inquiry and purely abstract speculation, but, in the abandonment of reality, his baseless fabrics have fallen and perished;—he has struggled to secure to himself a place in the bowels of the earth, but they have ejected him, even the caves, the rocks, and the mountains, have refused to cover him; and, therefore, the believer may walk into the fields, knowing that the Book of Nature, with its grandeur and its beauty, speaks to him concerning the same Spirit that dictated the Book of Revelation; and he may return to his dwelling, and lay his head upon his pillow, in confidence that the hand of the infidel can neither shake the foundations of the earth, nor roll the waves of the ocean over him, far less destroy the fabric of the heavens, or chain his soul in its flight to eternity.

Ascent to the summit of the Jungfrau, in the Canton of Berne.

The two colossal chains of Mont Blanc in Savoy, and Mont Rosa in Valais, although they include the highest summits of the Alps, are more accessible to the hunters than that of the Alps of the Bernese Oberland. The latter is rather a group than a chain. In a space of a few leagues are crowded together a number of peaks, little inferior to those of the two other chains. The following are the principal:

	Feet.
Finsteraarhorn, - - -	14091
Jungfrau, - - - -	13746
Mönch, - - - -	13498
Schreckhorn, - - -	13383
Grand Eiger, - - -	13071
Wetterhorn, - - -	12201
Blumlis-alp, - - -	12143

The sides of these gigantic peaks, covered with eternal snows, present on all hands frightful precipices, and their bases are separated by vast glaciers, which seem to render them for ever inaccessible. Very few of them, accordingly, have ever been scaled. The perilous attempts made to scale the highest have always been unsuccessful. We now learn that, on the 10th September 1828, the summit of the Jungfrau was reached by seven hunters or shepherds of the village of Grindelwald, named Peter and Christian Roth, Peter and Christian Baumann, Ulrich Widmer, Peter Moser, and Hidbrand Bürgner.

On the 8th, furnished with pikes, ropes, ladders, and a red and white flag, they began to ascend the glacier, which is situated between the Grand Eiger and Mettenberg; then turning to the right, they rested all night under an arch of rocks, on the southern side of the Grand Eiger.

On the 9th, they crossed the summits of the Viescherhorn, then descended again upon the glacier of Aletsch, and slept behind some rocks which have fallen from the Twisteraarhorn, having the Mönch to the right.

On the 10th, still turning to the right, they scaled and followed the ridge which descends from the Jungfrau towards the Breithorn. There they found several wide crevices, which they crossed with the assistance of a ladder. The ice was so steep in this place that they were obliged to cut steps in it for two hours. At length, about four o'clock, they arrived on the plane of the highest summit, and in half an hour more had ascended the small conical rock which crowns it. There they planted their flag, to the depth of two feet, in the ice, where it was still seen several days after from the village of Interlaken.

The same evening they returned to sleep at the rocks of the Finsteraarhorn, on the glacier of Aletsch, and on the 11th, at noon, returned to Grindelwald.

The temperature of the summit was pretty mild. The view from the summit was very extensive, as the Jungfrau is only overtopped by the Finsteraarhorn near it, and by some of the summits of the Alps of the Vallais and of Savoy.

It is to Mr Rohrdorf of Zurich, who has resided for several years at Berne, that we owe the execution of this project, which had often been undertaken, and as often abandoned, on account of the extreme difficulties which it presented. A detailed account of the enterprize ought to be transmitted to the Government *.

Answer to Dr Fleming's View of the Evidence from the Animal Kingdom, as to the former temperature of the Northern Regions. By W. D. Conybeare, Esq. F. R. S., M. G. S. &c. (Communicated by the Author.)

With every feeling of respect for your correspondent Dr Fleming, as a diligent and meritorious compiler in natural history, I trust I may be well excused in exercising the same liberty of dissent from his opinions which he himself so liberally assumes

* Bibliotheque Universelle, October 1828.

in differing from the greatest original discoverer, and first philosophical authority in his own favourite science, as well as from all the most eminent names in geological research,—a subject on which his own information is evidently extremely limited; and yet one, without an intimate acquaintance with which, it is impossible to conduct, to a satisfactory conclusion, the discussions upon which he has chosen to enter.

I regret, then, that I feel obliged, by what appear to myself the interests of scientific truth, to object to his estimate of the value of the evidence derived from the animal kingdom, as to the former temperature of the northern regions (published in your last Number), as altogether insufficient and superficial.

These characters appear to me to attach to his remarks, because he has allowed no due weight to that which, in fact, constitutes by far the most important feature of that evidence,—its cumulative character. In his introductory statement, he has indeed made a brief enumeration of the classes of organic remains which involves it; but he has altogether overlooked it in the argumentative part of his memoir. He may perhaps be himself of opinion that his reasonings are so conclusive against every particular inference, that they are equally valid against the collective sum of all those inferences: but I shall endeavour to shew, that the great proposition which his argument involves, namely, that it is impossible to reason from generic affinities as to the geographical distribution of particular species, is altogether unsound, being in direct contradiction to all that we know of the actual laws of nature in this respect; and these laws are obviously the only basis on which philosophical reasoning can be built.

First, then, allow me to remind your readers of the cumulative nature of the evidence on which the geologists opposed to Dr Fleming rely. They do not, like himself, reason from a few detached cases, but from an induction of the *whole* phenomena presented by the distribution of organic remains,—from a collective view of all the analogies. Each of these analogies, taken separately, must surely, unless it can be neutralized by some countervailing argument, be allowed to constitute a probability. The united force arising from the constant repetition of these analogies, without the occurrence of one solitary analogy of a contrary tendency, must, to ordinary understandings, multiply that probability till it assumes the highest rank of which probable reasoning admits. How will Dr Fleming account for the remarkable fact, that, in every extensive family of organic remains,—every secondary formation *, which has been examined,—*all* the analogies *invariably* lean one way,—all point to the products of warmer climates, as the only beings with which the tenants of our strata hold affinity? How, on the supposition that this coincidence is only accidental, will he account for the absence of even a solitary example on the opposite side? I confidently challenge him to produce one. Dr Fleming's views of the doctrine of chances must be as remote from those of the reputed masters of that science, as his geological notions from the speculations of Professor Buckland, if he does not feel the force of this mass of collective argument. However often, in this game, we throw the dice, they always fall on the same face. "Ne faut il donc conviendre que les dis de la Nature sont pipées;" or shall we say, nearly in the words of Milton, that this capricious dame has purposely thrown deceptive indications as stumbling blocks in our way, in wanton mockery of the scrutiny of geologists.

> "Her fabric she
> Hath left to their disputes, perhaps to move
> Her laughter at their quaint opinions wide
> Hereafter, when they come to model earth,
> And calculate its beds,—how they will wield
> The mighty frame,—how build, unbuild, contrive
> To save appearances."

Let us inquire, however, farther, What are actually the laws observed by nature, in the geological distribution of her organic creatures? Does she impose any limitations? If she does, Are those limitations regulated only by the consideration of species, or do they extend to genera also? To propose these questions to any naturalist, is in effect to answer them.

* I may except, perhaps, the lacustrine deposites of most recent origin, and of merely local occurrence, which these circumstances exclude from weight in the general question which regards the former temperature of the earth during the period of this formation of the regular strata, and the so-called diluvial gravel.

The botanist will smile at an interrogatory implying doubt whether palms are limited to warm, and pines to cold climates. Unless Dr Fleming had exhibited in himself an instance to the contrary, I should have supposed every geologist would have given a similar reception to the querist. The imperfect treatises on the subject, which I have been in the habit of perusing, having betrayed me into the idea that it was universally admitted that most of the genera of lamelliferous polyparia*; that very many genera of testacea; that most of the large reptile tribes, crocodiles, turtles, and many others, were so limited; and, with regard to the particular races on which Dr Fleming dwells in his memoir, elephants, rhinoceroses, and hyænas, I had hitherto been led by the same blind guides to conceive that the law of climate, affecting their distribution, was, in point of fact, as far as we know any thing of it, from the actual state of things, a law affecting genera as well as species.

To me Dr Fleming's argument appears to resolve itself into this, "Because some genera are not limited, therefore no genera are so limited." Or, to put it in another form, "Because, in certain widely diffused genera, you cannot argue from the habits of some of the congenerous species to the rest, therefore you cannot argue thus in any genera whatsoever †. The narrow

* Of the known recent lamelliferous polyparia, the genera, with two straggling exceptions, are stated, by the best authors, to be inhabitants of warm climates. Lamarck, speaking of Sarcinula organum (sarcinula being the second genus of the first section of the lamelliferous division), says, "Habite dans la Mer Rouge. On là trouve fossile sur les cotes de la Mer Baltique." —*Animaux sans vertebres*, tom. ii. p. 223.

† I cannot pass, without notice, one of Dr Fleming's illustrations, where he taxes Cuvier with inaccuracy (assuredly using sufficient philosophical boldness), because that writer has said you might infer from the bisulcous hoof the ruminating habits of the animal possessing it. Dr Fleming adduces the pig as an instance to the contrary. Living in the country, I myself am in the habit of keeping some of these "residuary legatees of all other animals," as a friend of mine calls them. Now, my pigs are not bisulcous, but wear four distinct toes on their feet, although the middle ones, being most elongated, and armed with large hoofs, certainly produce an external resemblance to cloven footed animals, which has occasioned their being classed, in the Levitical law, (which purports not to be a philosophical arrangement), as dividing the hoof though chewing not the cud. The impression of their feet in walking may, if carefully examined (as Cuvier says), be distinguished from the genuine bisulca. I take it for granted, however, that Dr Fleming possesses bisulcous pigs.

system of Oxford logic in which I have unfortunately been trained, renders me less sensible to all the merit of such modes of ratiocination. At present I fear I must rest contentedly in my old belief, that nature has limited, by the laws of climate, not only species, but genera; not only genera, but families in the organic kingdoms; that, in many instances, this limitation is absolute; and that, in many more, genera and families require particular circumstances of temperature for their full and vigorous developement; so that although some stray species may be found beyond the general limits, yet these are rare, and always attest, by their dwarf size, how uncongenial is their habitation.

If, therefore, I find fossil remains attesting the former existence of genera and families actually thus limited in geographical seats, where none of the races are now found, although they must formerly have flourished there in all the rich variety of the most luxuriant developement, I shall persist in believing it probable that the circumstances which I know to be necessary to the actual existence of the congenerous tribes were originally present in these localities, and that a change of circumstances in this respect, affords the most plausible solution of the problem presented by the local extinction of so many classes of organic beings in districts where they once so much abounded.

To proceed from generals to particulars, the surest test of truth, I will not now dwell on the evidence afforded by the organic remains of the vegetable kingdom, because the admirable exposition of that evidence by M. Brongniart appears in the same number of your Journal with Dr Fleming's memoir; and I gladly notice the expression of the entire accordance of your own views

Neither can I refrain from adverting to the observation, that, although we may agree with Cuvier in supposing, that the mastodon had a proboscis like the elephant, from the general resemblance in structure of the two animals, yet that this conjecture is only a probability, and not a remarkably strong one,—because the giraffe can provide food from the ground without a proboscis, and because the hippopotamus can swim. The last quoted observation I leave without comment; but the former is one of the most extraordinary I have met with in the writings of any naturalist. The provision of a trunk to the elephant is, on account of the shortness of the neck, requisite to enable it to reach the ground, as well as the branches of trees. The length of the giraffe's neck gives it the means of reaching the ground, as well as branches of trees, without such an appendage. I abstain from farther remarks upon this extraordinary passage in Dr Fleming's paper.

with the principles there developed; but I must remind Dr Fleming, that this forms an essential part of the argument of the geologists he opposes, and must not be overlooked by him, if he seriously buckles himself to the task of overthrowing their theories. But, for the present, I will confine myself, as he has done, to the evidence from the animal kingdom.

I will begin with the simplest forms of these, briefly noticing a few of the most important families in ascending the scale. A complete survey must, of course, be precluded by the limit of a periodical journal.

1st, The most remarkable remains of the zoophytes are those of the Lamelliferous Polyparia (Madrepores of Linnæus). This family is actually found in its fullest developement, only in the tropical seas of Polynesia and the East and West Indies.* The Mediterranean also contains a considerable assortment of species, though inferior in size, abundance and variety. Beyond these latitudes I can only find one single species, and that a small one, in Lamarck's catalogue, though he divides this section into 19 genera, some of them containing more than 30 species; his solitary exception, is Oculina polifera, which inhabits the seas of Norway †. Not to overstate the argument, however, I must deduct about a fifth of the species included in this list, as being only found in a fossil state; but there will still be left hundreds of species inhabiting warm latitudes, against the solitary tenant of colder seas.

Now, the fossil deposites of these zoophytal structures, are in the older strata completely parallel to those of the tropical regions, in the abundance, variety and size of the species included. They have given name to one of our English formations (the Coral Rag) some of its beds being almost entirely constituted by the labours of these active polypi. We here find an accumulation quite resembling the coral banks of the East or West Indies, and scarcely differing more widely in species from either of these,

* Captain King observed that no coral reefs occur south of 25° 30′ on the East of New Holland.

† In the Zoological Journal vol. iii. p. 486, Mr Broderip has described an English Caryophyllea (C. Smithii), in an appendix to the notes of De la Beche on the habits of this zoophyte, which he found in Tor Bay, and fed with pieces of crustácea, &c. for some time. A plate (pl. 13.) in which the animal and polyparium are figured, accompanies the memoir.

than they are actually found to do from each other; several of the fossil species are indeed marked in Lamarck's catalogue as identical with recent specimens.

In the chalk, species of this family are more rare, though many small caryophylleæ are still found, in the tertiary beds. Even these are of unfrequent occurrence. Thus in ascending the geological series, we always find a nearer approximation to the actual distribution of organic beings, in advancing to the most recent formations.

How will Dr Fleming account for the gradual disappearance of this family in our latitudes? why does a page of our natural history once so rich, now present a total blank? If I remember rightly, he ascribes the extinction of the elephant, rhinoceros, &c. to the successful prowess of our hunting ancestors. Will he say that they were equally diligent and expert in their coral fishery?

2. *Crinoidea.*—The only recent species of any size is a native of the West Indian seas, and appears very closely allied to one of the fossils of the lias. The species still inhabiting our seas is so minute, that it cannot be ascertained to belong to the family at all, without a powerful lens; yet, in the fossil state, there are near 20 genera, at least twice as many species, all large.

This family is divisible into two great sections (from the consideration of their structure), and their geological distribution exactly tallies with this division; the former section belonging to the formations inferior to the new red sandstone, the latter to those of more recent origin,—the existing species belong to the latter.

I shall pass over the bivalve and unchambered univalve shells for the present, as their detailed examination would prove a task of too great length and labour for the limits to which I must confine myself. I shall only observe, that the analogies presented are always with the natives of warm latitudes, and challenge Dr Fleming to point out an exception.

4. The *Nautilidæ.*—The few existing species of this class are confined to warm latitudes. One of them, the Nautilus pompilius, is considered by Lamarck as identical with a fossil of the tertiary formations. I need not dwell on the amazing variety and number of the species of this and the allied genera of ammonite, belemnite, &c. &c. all at present extinct. Surely

nothing short of some general change in the physical condition of the earth's surface can account for such a discrepance in the ancient and actual races of its inhabitants; and as we find that temperature limits the species which still exist, the analogy is surely favourable to the supposition that a change of temperature has been the cause of this difference.

5. *The Crocodilidæ.*—This family actually includes many species, and is exclusively limited to warm latitudes. I have been enabled to ascertain ten distinct fossil species, six occurring in this island. They are all of the division Leptorrhyncus. One of these in the tertiary strata approaches very nearly to the existing species. Of these I hope shortly to lay a detailed account before the Geological Society.

I will pause here to consider for a moment the nature of the resulting argument. If the actual limitation can be predicated only of species, and not of genera, how comes it that not one of the many species included has wandered into colder regions? I here find a genus having numerous fossil and numerous recent species; and I know *all* the recent species to be confined within warm latitudes. Does not every law of analogy warrant me in considering it at least probable that the fossil species were similary confined? I find that these animals must once have swarmed in localities where they are now extinct. It is impossible to contemplate so extraordinary a fact, without being led to the inquiry, whether any probable cause can be assigned for it; and analogy again presents a diminution of temperature as a sufficient cause, seeing that the genus is now limited by temperature. Has Dr Fleming any more probable solution of the problem to offer? or can he prove that this is in itself so improbable that the presumptions in its favour cannot be ascertained?

The other fossil Saurians may be objected to, as too remote from any existing types to admit any argument from analogy; but without pressing the subject, I will observe that all the larger living tribes are confined to warm latitudes.

6. *Testudinata.*—The existing Chelonians, with a few minute exceptions, are also confined to warm latitudes, in the actual order of things; yet their occurrence in a fossil state is very common in our strata, especially in the limestone of Purbeck,

and the weald of Sussex, and in the plastic clay and the London clay.

7. *Mammalia.*—I do not know how I can exhibit the argument more comprehensively than by a list of the animal genera actually limited exclusively to warm latitudes, but occurring fossil in this country or the north of France.

1. Elephant.—2. Rhinoceros.—3. Hippopotamus.—4. Tapir. 5. Large Feles.—6. Hyænas. With these are certainly intermingled animals of genera still found in our climates, as the ox, hog, horse, stag, &c; but it must be remembered that these genera are commonly diffused, and not actually limited to any particular latitude.

We have here, then, a positive analogy deduced from six genera, exclusively belonging to warm climates; and how does Dr Fleming combat it? Does he produce any negative analogy? No such thing; he alleges certain genera which afford no indications as to temperature whatever, but are indifferent in this respect, and common to all latitudes, and therefore have no influence any way on the question. He boasts, indeed, that his elephants repose under the shade of the genealogical tree of our existing quadrupeds; but a metaphor is not an argument. He may have calculated too hastily on a repose likely to be disturbed, and the roots of his tree may be less securely planted than he imagines; for he has not offered the shadow of an argument to prove that the fossil horses of England resemble more nearly our actual varieties than they do those now inhabiting the torrid zone. And how does he account for the extinction of these last genera, and the present position of their remains? He believes them to have been exterminated by man before the period to which our earliest historical notices ascend, while yet the island was nine-tenths overshadowed with trackless forests, affording the securest coverts to the animal tribes; while the woods of Arden occupied all the midland counties, and the Sylva Anderida filled the greater portion of the southern (which yet were the most civilized, and therefore likely to be most cleared); and this by a people of whom we are informed that their habits were pastoral, and not those of hunters. We are further requested to believe that the animals thus exterminated were buried ten or twenty feet deep in gravel, by the action of certain imaginary lakes, though the slightest local knowledge of the general configuration of the ground in the vicinity of these fossil deposites must convince any one, that, in nine instances out of ten, there is no probability of the former existence of any such lakes in these districts. What, I would ask, does Dr Fleming suppose to have been the boundaries confining the waters of any lake which could account for the gravel of the plains of Warwickshire and central England?

I will conclude by proposing one more question as an illustration of my argument.

Of the Arctic Seas but little is known, of the Antarctic still less. We may anticipate, then, that future Parrys and Franklins will illustrate the age of other Barrows by pushing still further the career of discovery in these untravelled fields of ocean. How, I would ask, does Dr Fleming consider it probable that, among the interesting novelties to be detected by their researches, they will astonish the naturalists of those days by accounts of new islands discovered in those frigid seas, surrounded by coral reefs, amidst which turtles are desporting themselves in such quantities that aldermen might long to colonize the happy shores, the interior overshadowed with forests of arborescent ferns and palms; the breezes fragrant with spices, as those of Ceylon; lions, tigers, and hyænas roaming the jungle; elephants and rhinoceroses stalking over the plains; the rivers teeming with crocodiles, and haunted by hippopotamuses? I feel certain that any other naturalist's answer will be in the immediate and vehement negative. He will think it improbable that any one of these races should be so found; still more so that any two of them should occur. The improbability will go on augmenting at every fresh step, and it will mount so high against the combination of all these circumstances, as to hold the next rank to a physical impossibility.

Yet Dr Fleming's arguments, if they prove any thing, prove that this supposition involves no improbability at all.

P. S.—Lest Dr Fleming should cite the supposed musk ox of Pallas, found in Siberia, as an instance of an animal exclusively belonging to high latitudes found in a fossil state, I must observe that Cuvier found the head in the engravings given by Pallas to differ very greatly from that of the musk ox; and, 2dly, supposing this to have arisen only from errors of the designer, and the head to have been really that of the musk ox, it may have been (as Pallas himself supposed) drifted thither by currents in the Arctic Sea at a period comparatively recent.

I will add also, that the bones of cetacea, which might, at first sight, seem to indicate a cold ocean, either belong to species resembling those of the Mediterranean, (the Raiqual) ; or to extinct genera, the ziphius ; or are considered by Cuvier as doubtful.

Of the Continuity of the Animal Kingdom by means of Generation, from the first Ages of the World to the present Times.

On the relations of organic structure and parentage that may exist between the animals of the historic ages and those at present living, and the antediluvian and extinct species.

Are the animals whose remains occur buried in the earth, and which almost all belong to species or genera which are not observed in the living state, to be considered as having been the ancestors of those which now people the earth, and as having been modified by the influence of time, and of the changes that have supervened in the state of the globe ? Or is the contrary opinion to be adopted ? Are we to believe, that, after the occurrence of great cataclysms, new beings were produced by a new exertion of creative power,—in short, to make use of M. Geoffroy St Hilaire's expression, that *the six days work was resumed.* The solution of this great question is to form the subject of a series of memoirs to be laid before the French Academy of Sciences, of which the first only has been read.

The author of this memoir, M. Geoffroy St Hilaire, commenced with remarking, that science is not yet possessed of all the documents that might appear necessary for treating the question in a satisfactory manner. He even felt that he was not altogether excusable in meddling with it, at a period when the discussion which it involves might be considered premature; but a particular circumstance induced him to enter upon it. "I had been reading," said he, "some important observations communicated to the Academy by Dr Roulin *. My mind being pre-occupied with old ideas respecting the antediluvian animals, there escaped me, in drawing up my report, a reflection which, to be rightly apprehended, would have required a greater developement. This has been remarked, and I have been enjoined to do justice to the subject."

M. Geoffroy St Hilaire believes in an uninterrupted succession of the animal kingdom, effected by means of generation, from the earliest ages of the world up to the present day. The ancient animals, indeed, whose remains have been preserved in the fossil state, are all, or at least almost all, different from those which now exist at the surface of the globe. But this is not a reason for thinking that they could not have been the ancestors of these latter. In the *first* place, the extinct species are united with the living species by the closest analogy. All have without difficulty entered into the prescribed limits of our great classifications; all, as being formed of analogous organs, *seem* to be nothing but modifications of the same being, of what is now called the vertebrate animal.

Viewing the animal creation in its aggregate from the commencement up to the present epoch, the author even thinks he can recognise in it a progressive series like the following:—*Ichthyosaurus*, *Plesiosaurus*, *Pterodactylus*, *Mesosaurus*, *Teleosaurus*, *Megalonyx*, *Megatherium*, *Anoplotherium*, *Palæotherium*, &c.; all animals that have been transformed in such a manner, that none of the genera which they form subsists at the present day. Through the medium of the mastodons, the author connects with these more ancient inhabitants of the globe the animals that succeeded them, and which are composed of species of the same genera, some extinct and antediluvian, and others still living. These latter are those which have been able to accommodate themselves without transformation, or at least by only undergo-

* Vide account of Dr Roulin's observations in vol. vi. pages 190–193 of this Journal.

ing very slight transformations, to the circumstances of the present world. These animals, some of which occur in the fossil, and others in the living state, are the elephants, rhinoceroses, some didelphides, hyenas, bears, &c.

M. Geoffroy St Hilaire cited, as the performance of an author who outstripped the age in which he lived, the work in which M. de Lamarck treats *Of the influence of circumstances upon the actions and habitudes of living bodies*, and reciprocally *on the influence of the actions and habitudes of living bodies upon the modification of their parts.*

The particular facts on which M. de Lamarck rests his grand idea, are far from being perfectly correct. Perhaps there is not even one of them that is not blemished by some inaccuracy; and yet the conclusion which he draws from them is true—such is the power of genius in foreseeing the great truths of nature. It was thus that Buffon perceived, by an inspiration of his genius, that the animals of the equatorial regions inhabit one of the continents to the exclusion of the other, although none of the proofs adduced by that celebrated man in support of his opinion would perhaps be admitted at the present day; and yet this proposition has become a law which has received entire confirmation from time.

On the subject of M. de Lamarck's opinion, the author quoted a remarkable passage from Pascal: "Animated beings," says that author, "were in their commencement nothing but formless and ambiguous individuals, whose constitution was originally decided by the permanent circumstances in the midst of which they lived."

To establish M. Geoffroy's opinion in a solid manner, the important point is to demonstrate that the differences of atmospheric constitutions may have been sufficiently great and powerful to bring the different species and genera, from the types which they originally presented, to what we now see them to be. Now, of this the author thinks no doubt can be entertained. Let attention be paid to the modifications which the species may still undergo, in consequence of a mere transportation from one latitude to another,—modifications which have been determined by Dr Roulin with respect to the animals transported from Europe to America. Let the important facts, in particular, which the study of monstrosity presents, be attended to, and there will appear nothing surprising in the modifications produced in the animal species, by the succession of ages, any more than in modifications induced in the agents under the influence of which animals are developed.

To determine the power of external causes in modifying the developement of living beings, was the real object of the experiments made by the author in the establishment of Anteuil, where chickens are reared that have been hatched under the influence of artificial heat.

The philosophical object of these inquiries the author now avows for the first time; he was obliged to conceal them at a period when science was under persecution. The experiments here alluded to are conclusive. M. Geoffroy St Hilaire, by varying the phenomena of heat, dryness, and motion, not only produced monstrosities at pleasure, but even produced a given species of monstrosity by means of a particular precaution. And let it not be objected that the monstrous species thus produced in an artificial manner, were incapable of being reproduced and perpetuated. Nature, aided by time, which he had not at his disposal, acting by more numerous and gentler modifications, could have done what will always be impossible in the most judiciously conducted experiments.

M. Geoffroy also spoke of the long debated question of the pre-existence of germs, and opposed to that theory the whole of our knowledge respecting monstrosities, and in particular the experiments above alluded to, in which he made the organization deviate at pleasure, and in a determinate direction from its natural course.

On a new Species of Tapir, discovered in the Andes, with Remarks on Antediluvian Animals.

M. G. Cuvier lately made a report to the Academy of Sciences of France, on the memoir of Dr Roulin, having for its object *the natural history of the Tapir, and particularly that of a new species of that genus which the author has discovered in the high regions of the Cordillera of the Andes.*

The reporter commenced with giving a long analysis of M.

Roulin's memoir. He pointed out especially the anatomical characters which distinguish the new species of tapir from the old American species, as well as that of Sumatra; and insisted particularly upon the remark, that the new tapir has a much greater resemblance to the palæotherium than to any of the two species formerly known.

The head of the tapir of the Andes, as well as that of the Indian tapir, are more like that of the palæotherium than the head of the common tapir is.

The palæotherium, in its general conformation, principally differs from the tapirs in having a more elongated skull, and in its jaws being shorter in that part destitute of teeth, which is named the *bar*, and which exists in these two genera as well as in horses. The palæotheriums, lophiodons, tapirs, and horses, form in this respect, as in many others, four closely allied genera, and in some measure a small family, in the order of pachydermata.

"Let it not, however, be thought," continued M. Cuvier, that there is the smallest reason for supposing a metamorphosis of this antediluvian genus of palæotheria into the tapirs of our present world. The grinders of these genera do not resemble each other, and their differences are even very great. In many other details of their osteology, they equally differ, and the tapirs have on the fore foot a toe more than the palæotheriums. Now, in the whole history of animals, there is no fact discovered from which it might be inferred that any changes of food, air, or temperature, could have produced sensible variations in the forms of the teeth, the deepest mark perhaps which Nature has impressed upon her works.

Without doubt, by transporting one's self to times and spaces, respecting which we can have no positive knowledge, he may, from vague and arbitrary premises, draw conclusions which are not less so; but to emerge from these general considerations on which reasoning has no hold, to say distinctly and directly such an animal of the present world has descended in a right line from such an antediluvian animal, and to prove it by legitimate facts and indications, this is what it would be necessary to do, and what, in the present state of our knowledge, no one would even dare to attempt. M. Roulin does not propose the hypotheses of which we speak, and it is only from the analogy of the subject that we have been led to say a few words respecting it. But he throws light upon a fact which relates to the history of the antediluvian animals, and which had even been advanced by some authors, that a genus of these animals, the mastodons, probably still exists in the higher valleys of the Cordilleras. In fact, there prevails an opinion among some of the American tribes, that the forests of these countries produce a large animal known by the name of *pinchaque*, which they dread much, and which some equal to a horse, while others make it much larger. It is even asserted that vestiges of it have been seen near Bogota, and some of its dung, together with measurements of its footmarks, have been brought from that place, to which are added hairs that remained attached to the bushes. But M. Roulin, after the strictest examination, shews that in all this there is nothing that may not relate either to the new species of tapir, or to the bear of the Cordilleras. It is thus, he says, that a great number of facts, all true in themselves, coming to arrange themselves around the first fact magnified by fear, would necessarily have confirmed the Indians in their belief in an animal such as the *pinchaque*. They might even have given to this animal a prodigious form, or related very extraordinary things of it, without deviating in any thing from the truth. The tapir of the plains itself is so vigorous, that it breaks, at the first effort, the nooses with which the Spanish hunters arrest the most furious wild cattle. Nor is the *pinchaque* the only fabulous animal that has derived its origin from exaggerated accounts respecting animals of the tapir family.

The Chinese have in their books a quadruped which they call *Me*, and whose figure is evidently that of a tapir with the livery of early age, and only with the trunk or proboscis a little exaggerated as to length; and they have attributed marvellous properties to it. For example, its bones resist iron and fire, it devours serpents, and gnaws copper and iron. All this may still have some foundation in the history of the animal. The real tapir breaks and swallows wood, and in its somewhat savage nature it seizes with its teeth all kinds of bodies. Nothing more was necessary to make it be said that the *me* gnaws iron. But, according to M. Roulin, it is to the tapir also that much older and more celebrated fables refer. Ignorant persons seeing the *me* or oriental tapir at a distance, and in a state of rest, when its short proboscis had its extremity inflected before the mouth, might have imagined that animals furnished with a hooked beak resembling that of an eagle; while its feet, divided into rounded toes, would have presented some resemblance to those of the lion, when his claws are retracted; whence, according to our author, would have arisen the fable of the griffon. In fact, when the tapir is sitting or lying, it bears a considerable resemblance to the figures which are given of griffons, the wings excepted; but these wings appear to be a posterior addition; and, as our author remarks, Herodotus makes no mention of them in his description of that mythological animal. These ideas are ingenious, and will be estimated by antiquarians; and as to the naturalists, M. Roulin furnishes them with enough of new and well ascertained facts to deserve their gratitude.

He makes known all that has been observed as to the manners and habits of this animal. He enters into curious details respecting the nomenclature of the tapirs in general, in the different countries of America which they inhabit, and the errors to which it has given rise among naturalists. He shews that the name *Anta* or *Danta*, which is given it in many works, is a Spanish word, which signifies generally all the animals whose skin can be prepared like that of the buffalo, and furnish clothing of a certain thickness; and, on this subject, he gives us very interesting statements respecting the manner in which the Spaniards and Portuguese, at their first settlement in the Continent of South America, applied the names of European animals to species quite new to them, without much troubling themselves about the real affinities of these animals to those with which a superficial resemblance had led them to compare them. Naturalists might derive information from this part of his memoir with respect to several other animals besides the tapir.

In a word, there is everywhere evinced in the production of this learned traveller, a mind equally active and enlightened. We are of opinion that this memoir, which has the very rare advantage of having added to the catalogue of animals a large quadruped belonging to a genus which for a long time contained but a single species, and which, moreover, dissipates the obscurity in which ill observed facts had involved an important point of geology, deserves the full approbation of the academy, and is worthy of being printed among those of foreign members.

These conclusions were adopted by the Academy.

Fossil Antediluvian Animals mingled with human remains in the Caves of Bize.

IN the caves of Bize in France, there has been found not only remains of antediluvian animals, but also human bones and remains of works of art. MM. Tournal and Marcel de Serres found the mud of the caves to contain abundant fragments of pottery, which must be referred to the Etruscan era.

M. Tournal intends to publish, conjointly with M. Marcel de Serres, a description of the Bize caves. In the mean time the authors present separately the conclusions to which they think the observations that have hitherto been made might lead.

M. Tournal's Conclusions.

1. The two caves of Bize have been entirely choked up with a black mud containing a prodigious quantity of fossil bones. Sometimes these bones are in a complete state of alteration ; but it is seldom that they are found connected.

2. The bones are not gnawed.

3. There has only as yet been observed a single tooth of a carnivorous animal.

4. The black mud does not contain excrements of carnivorous animals.

5. The population buried in the mud of the Bize Caves differs entirely from that which has been observed in the caves of France, Germany, and England.

6. The same black mud which contains the fossil bones, of which several, as will be seen in our work, belong to extinct species, also contains human bones, which have, in a great mea-

sure, lost their animal matter; land shells, of which some species no longer live in the neighbourhood; modern marine shells; numerous fragments of pottery; pebbles of green sandstone, and grey and white secondary limestone. Lastly, there are also observed in it fragments of wood charcoal.

7. The roof and walls of the cave are in several places covered with an osseous breccia, which is nothing else than the black mud cemented by stalagmitic infiltrations.

8. This breccia contains the same objects as the black mud.

From the above considerations, says M. Tournal, I think I am authorised to conclude,—

1. That all the objects contained in the mud and breccia are of the same date.

2. At a certain epoch, the first cave was entirely choked up, which is sufficiently shewn by the breccia that invests the roof. In the second cave, the roof being much higher, the mud did not reach it; but every thing indicates that the mud attained a greater height than that of its present level.

3. The caves were filled during the period intervening between the times of geological formations and the historical times.

4. The mud which has filled them, and the fossil bones which it contains, are much more modern than those found in the caves of Lunel Viel, and in the principal caves yet known.

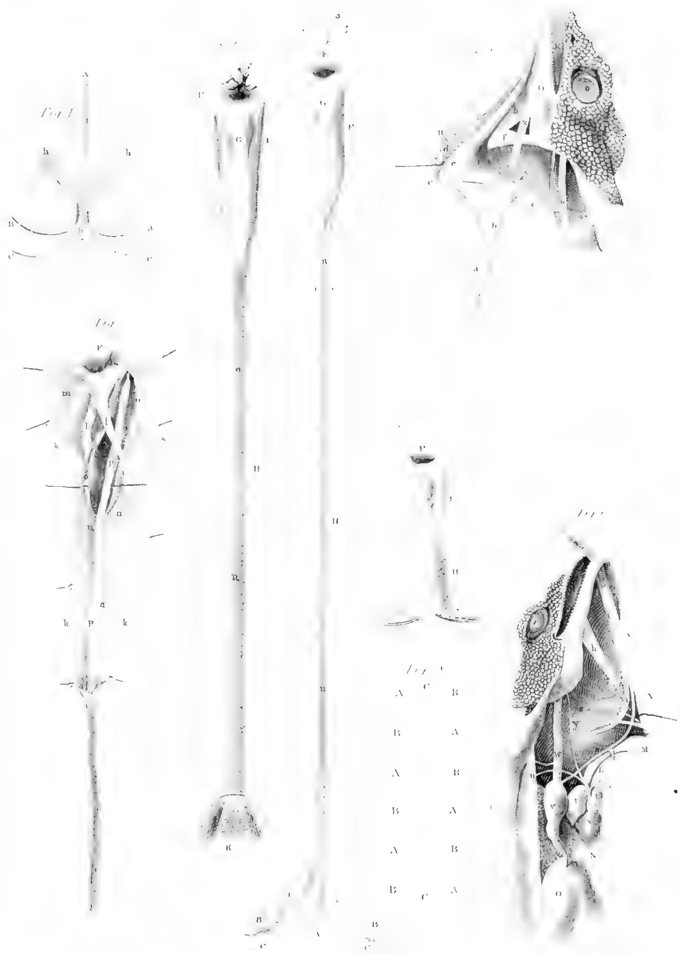
5. During the time that elapsed between the deposition of the mud of the caves of Lunel Viel, and the deposition of that which has filled the caves of Bize, the animals which inhabited France had undergone great changes.

6. Some species of animals have disappeared from the surface of the globe since the commencement of historical times.

7. Man existed at the period when the caves of Bize were filled.

Conclusions of M. Marcel de Serres.

The existence in the same mud and breccia of human bones, and remains of land mammifera, belonging to extinct species, proves, in an incontestible manner, that, since the appearance of man upon the earth, species have been completely destroyed, or at least have ceased to exist in the different parts of the globe which have been explored by geologists.



Drawn by J. H.

The simultaneous occurrence of these remains also proves, that the *antediluvian deposites*, at least those which have been deposited after the separation of the seas, cannot be distinguished by any certain and positive character, from the *postdiluvian deposites*, especially when the former belong to displaced formations, since the effects have been the same in the two periods, these effects having depended upon the same causes; and that henceforth the fossil organised bodies of the most recent deposites cannot be discriminated from those which have been buried in the transported formations produced in the present epoch.

This association, joined to the other phenomena which the tertiary deposites present, further announces,

1*st*, That geological periods are connected, in some measure, and without interruption, with the historical periods.

2*d*, That the tertiary deposites produced after the retreat of the seas into their respective basins, have taken place at an epoch not very remote from the present, since they contain so great a number of species, similar, or at least analogous, to those which still occur in a living state.

On the Structure and Mechanism of the Tongue of the Chameleon. By John Houston, Esq., Member of the Royal College of Surgeons in Ireland, Conservator of the Museum, and Demonstrator of Anatomy in the School of Surgery, &c. With a Plate *.

That the Chameleon possesses the power of suddenly darting out its tongue in a remarkable manner, for the purpose of seizing the insects on which it feeds, is a fact which has been long admitted; but notwithstanding that so singular a phenomenon has attracted the attention of the most distinguished anatomists, it appears to me that neither the cause nor mode of elongation in the organ, has ever yet been satisfactorily explained.

Two of these animals having been lately presented to me, in

* This interesting memoir was communicated to the Royal Irish Academy, by Dr Brinkly, the Lord Bishop of Cloyne, and will appear in the Transactions of the Academy. Through the attention of the intelligent author, we have been favoured with a copy of the memoir, and also of the beautiful plate illustrative of its details.

sufficient health to take food in their natural way, an opportunity, such as rarely occurs, was afforded me, both of observing their tongues in the act of elongation during life, and of making a most satisfactory examination of their structure immediately after death. I therefore entertain a hope that the facts which I have collected, under such favourable circumstances, may be calculated to remove much of the obscurity in which the subject has been hitherto involved.

The animals were brought from Malaga in the month of October 1826. They corresponded in characters to the Lacerta Chameleon of Linnæus. One measured twelve inches in length, the tail included, the other ten. Both were females, and contained numerous ova, which could be felt through the thin parietes of the abdomen. One of them while in my possession discharged, apparently with much labour, two eggs which were of an oval form, about the size of a wren's, and covered with thin yellowish coriaceous shells.

The external surface of their skin was thickly set with soft tubercles, like the heads of small nails, some of a whitish, others of a bright yellow colour: the white tubercles were most numerous, and existed every where over the body; the yellow ones were so arranged as to form along each side of the back two rows of lozenge-shaped spots, and round the legs and tail annular bands. When examined in the morning, or during sleep, the whole surface presented a greyish cast, with the exception of the yellow marks; but when the animal was excited in any way, as by pricking, or transferring it from a cold to a warm temperature, an evident change of colour took place, sometimes all over the surface, sometimes only partially, according as the excitement affected the entire or only a part of its body. A brownish tinge gradually overspread it, engaging equally the tubercles and the intermediate skin; while the spots, which were previously yellow, acquired a slight admixture of green. The shades, however, were few, and confined to those intermediate between a light grey and a deep brown, with a little yellow or green interspersed through them, but never, that I could observe, bore any relation to the colour of the surface on which the animal happened to be placed. In dissecting the skin after death, its exceeding thinness and vascularity attracted my attention. In every part, but more especially between the tubercles, it was so thin as to be almost transparent: and its internal surface, when examined through a magnifying glass, presented a complete net-work of fine vessels, rendered visible by the dark blood which they contained. A portion of skin removed from about the eyes, where in death it became dark, even to blackness, displayed most satisfactorily the great abundance of its vessels.

These observations on the skin I have deemed it right to make, as they appear to confirm the opinion entertained by some physiologists, that its changes in colour are produced by vascular turgescence, just as the increased redness in blushing is caused by a rush of blood to the cheeks. The colour of the blood appearing through the semitransparent skin, and modified by the various permanent colours of that structure, is sufficient to account for every diversity of tint which the chameleon exhibits. I have been induced more particularly to offer these remarks in this place, because, from the facts which I have noticed regarding its tongue, I have been led to infer, that the peculiarities of that organ are all referrible to the same general cause, viz. vascular turgescence.

By keeping my chameleons in an equable temperature of about summer heat, I succeeded in preserving them both alive for upwards of two months, during which I had ample opportunities of observing the action of their tongues in the prehension of the insects on which they fed almost daily.

When a fly so maimed as not to be able to escape, but still sufficiently vigorous to move its legs or wings, was so placed that its fluttering might attract the chameleon's attention, the animal advanced slowly until within tongue's reach of it, then steadying itself like a pointer, sometimes stretching out its tail, sometimes fixing it against an adjacent body, and directing both eyes steadfastly on the prey, it slowly opened its mouth, and suddenly darted forth its tongue, which advancing in a straight line, seldom failed of striking with its glutinous cupped extremity the object aimed at. But even when the point happened to err, the prey did not always escape, being, nevertheless, sometimes secured by a similar adhesive matter which coated the sides. The tongue then retired, thus laden, into the mouth, though somewhat more tardily than in its advance; and whenever the elongation had been considerable, its extremity was bent a little downwards, giving to the organ a slightly curved appearance. When projected, the tongue acquired a thickness equal to the largest swan's quill, and a length not less sometimes than six or seven inches. Its consistence I attempted, on one occasion, to ascertain, by catching it between my fingers, when it imparted the feel of an elastic body, yielding slightly when pressed on, and springing back instantly to its former state as soon as the pressure was removed. The experiment caused only a short delay to its progress, but neither altered its form or course, nor unfastened the prey from its extremity. Its colour along the centre was a dark livid; and each side, to within about an inch of the extremity, presented a whitish band, which, during the act of elongation, was straight and uniform, but in the retraction of the organ became evidently tortuous and wrinkled; while the whole surface, both centre and sides, was irregularly streaked with innumerable very minute blood-vessels. Near the extremity, a few veins much larger than the others, and having a longitudinal course, were in the highest state of turgescence.

It seems probable that the tongue is the sole agent assigned to the chameleon for obtaining its sustenance. Flies have often rested on every part of its body, and though it has looked wistfully at them, it had no means of apprehending its annoyers. I have frequently observed them for a considerable time on its very lips without any attempt being made at their seizure. Even when placed before it, if not sufficiently distant to afford room for the necessary evolution of its tongue, the chameleon was under the necessity of retiring, or raising back its head for the purpose.

It would appear to possess the power of regulating the force of propulsion of its tongue according to the distance of the prey; for when the latter lay near to the mouth, the organ advanced on it slowly; when farther off its velocity was more marked; and whether nearer or more remote it invariably darted with greatest quickness as its point approached the object.

The chameleon, when vigorous in its natural climate, is said to shoot forth its tongue with a velocity equalling that of an arrow shot from a bow*; but mine, weakened by long confinement and want of food, had become incapable of such activity—a circumstance favourable to my purposes—as by the prolonged exposure of the tongue, which occupied about five or six seconds, an opportunity was gained for making observations on its condition while protruded. I have several times mechanically detained it in view, by placing the fly to be aimed at in such a position on a flat surface, that the tongue might strike it in a direction perpendicular to that surface, under which circumstances its glutinous cupped extremity adhered like a sucker, and held the organ exposed for nearly double the ordinary period. Attempts at seizing insects similarly placed on the side of the animal's case, which was made of paper, gave it particular embarrassment, not so much from the delay caused by the adhesion, as from the annoyance which the down of the paper sticking to the mucus on the extremity of its tongue seemed to produce. Indeed it appeared to dread the inconvenience which resulted from striking at objects under these circumstances, as it always endeavoured to take aim in such a direction that the end of its tongue might escape a little beyond them without danger of interruption. On one occasion, when both animals attempted at the same moment to catch a fly placed nearly midway between them, their tongues struck against each other, and held them connected for a short time.

It has been observed by naturalists, that the chameleon requires hours to accomplish the eating of a fly, but from having seen each of those in my possession swallow six or eight within the space of one hour, I can so far testify that the observation is incorrect.

To understand the motions of the chameleon's tongue, it is necessary to possess a clear knowledge of all its parts; I shall therefore give, first, the anatomy of the os hyoides and muscles, and, secondly, that of the moveable portion of the organ.

The os hyoides is unconnected with the larynx. It consists of a body and four cornua, two of which are anterior, and two posterior (Plate IV. fig. 1.) The body is prolonged towards into a process named the style (A), which is

* See Belon—Observations, &c. liv. 2. ch. 34.

rounded and smooth, and about an inch and a half in length, and whose point, when the mouth is closed, rests against the back part of the chin. The anterior cornua (BB) are about three quarters of an inch long; their outer extremities, which are cartilaginous and pointed, are directed obliquely forwards. Their inner extremities are articulated with the body of the bone, and a small plate of cartilage stands out from each, which serves as a pully for one of the muscles of the tongue, the hyoglossus. The posterior cornua (CC) are about the same length, and slightly curved upwards. One end of each is attached to the body by a moveable joint, the other passes round towards the back of the occiput.

The muscles are nine in number on each side. Three connect the os hyoides to the thorax, the sterno-hyoid, the sterno-ceratoid, and the omo-hyoid. Five extend from the os hyoides to the lower jaw, viz. the mylo-hyoid, genio-hyoid, together with three which may be called cerato-hyoid, and distinguished by the names external, middle, and internal. The ninth is a remarkable muscle, the hyo-glossus.

1*st*, The *sterno-hyoid*, (Fig. 2. a) a strong muscle, is attached by its posterior extremity to the lower and back part of the sternum, and by its anterior one to the body of the os hyoides.

2*d*, The *sterno-ceratoid* (b), at its origin from the sternum, is partly concealed by that of the sterno-hyoid. It runs forwards and outwards, and is inserted into the outer extremity of the posterior cornu of the os hyoides.

3*d*, The *omo-hyoid* (c) is long and slender, and interrupted about its centre by a short tendon. It proceeds from the scapula to the middle of the os-hyoides, passing in its course along the inner side of the sterno-ceratoid. These three muscles serve the office of drawing back the os hyoides and tongue.

4*th*, The *mylo-hyoid* * is a superficial muscle. It arises from the whole length of the ramus of the lower jaw, and from the skin along side of the neck, and running thence inwards, joins its fellow of the other side, underneath the os hyoides. It supports the parts contained in the mouth and throat, while at rest, and while performing the complicated actions of prehension and mastication of insects.

5*th*, The *genio-hyoid* consists of two parts; one internal, slender (d), arises a little to one side of the symphysis of the lower jaw, and is inserted into the posterior part of the body of the os hyoides. The other (e) somewhat more external, is larger and stronger, and inserted into the whole length of the posterior cornu. A part of its external border bends inwards to be attached to the anterior cornu.

6*th*, The *external cerato-maxillary* (f) arises from the posterior part of the ramus of the lower jaw, and becoming broader, is inserted into the anterior cornu of the os hyoides.

7*th*, The *middle cerato-maxillary* (g) is narrow, and in part concealed by the external. It extends from near the centre of the ramus of the lower jaw straight backwards, to be attached to the outer extremity of the posterior cornu of the os hyoides.

* This muscle I have deemed it unnecessary to delineate. I have retained the name previously given to it, though I could not discover any attachment between it and the os hyoides. It might, I think, be better named platisma myoides.

8th, The *internal cerato-maxillary* is long and slender (Fig. 1, 2, 6, h), and situated deep in the mucous membrane of the mouth. It arises from the anterior part of the side of the lower jaw, and passing thence backwards on the upper surface of the style and muscles, ends in a tendon, which, after uniting with its fellow of the other side, about two lines before the articulation of the cornu with the body of the os hyoides (Fig. 1. h), becomes broad, and is inserted into the roots of the posterior cornua. The last four muscles, by contracting, will draw forwards the os hyoides, and protrude the end of its style a short distance out of the mouth.

9th, The *hyo-glossus* (Fig. 4, 6. iiii) arises from the outer extremity of the posterior cornu of the os hyoides. At first it accompanies the cornu inwards to near the body, then leaves it, winds round the cartilaginous pully on the anterior cornu, runs forwards along the sides of the style and erectile portion of the tongue, and is inserted into the anterior prehensile portion. This muscle admits of remarkable elongation, as its extremities, which are not more than an inch apart while the tongue rests in the mouth, become separated during its complete protrusion to a distance of five or six inches. It can only exert an action on the prehensile portion of the organ, which it retracts into the mouth after having been protruded in the search for insects, and which it may settle and keep steady when so retracted.

The moveable portion of the tongue consists of two parts, which are distinct from each other both in their structure and functions. One of them I propose to name *prehensile*, the other *erectile.*

The first, or *prehensile* portion, is anterior (Figs. 2, 3, 2, 7, E.) It is somewhat cylindrical, about an inch and a quarter in length, and an inch in circumference. Its bulk undergoes no change during the elongation or retraction of the tongue, in consequence of its being surrounded by a dense fibrous sheath, which prevents any such alteration. Its anterior extremity is hollowed into a pouch lined with mucous membrane (Figs. 3, 4, 5), which is rugose, and smeared with a viscid adhesive matter for entangling the insects it strikes against. During the projection of the tongue the lips of this pouch are everted so as to expand considerably its surface. Its posterior extremity is smaller than the anterior, and continuous with the erectile portion. The anterior half of its superior surface is occupied by an oblong glandular body (G), from which perhaps is secreted the glutinous coating of its extremity. The openings of this gland are on its lower surface, next the pouch, on which it rests. (Fig. 5, m.) On the posterior half of this surface the ramifications of large blood-vessels are observable. Along its sides, posteriorly, the insertions of the hyo-glossi muscle present themselves. Its inferior surface is smooth and rounded. A tube (Fig. 5, p,p.) about the thickness of a small crow's quill runs through its centre. This tube is prolonged into it from the erectile portion, and serves as a resting place for the style of the os hyoides, which it surrounds like a sheath, when the tongue is drawn into the mouth. It is encircled by an annular muscle (Fig. 5, o, o), the fibres of which are very numerous and strong, and have but a loose connection with the tube. This muscle may, by contracting round the tube when it rests on the style, prevent its revolving on that bone, and thereby make steady the prehensile portion, and adapt it for the ordinary uses of the tongue in mastication. Two retractor muscles (Fig. 5, l, l.) arise, one from either side of the back part of the annular muscle, and thence pass to its upper surface, where they meet under the mucous gland, to be inserted into the bottom of the pouch. They may contribute to the more effectual security of the prey, by deepening and closing the pouch upon it, a change which this part evidently undergoes while the organ is retiring into the mouth.

To the second portion of the tongue I have given the name *erectile*, on account of the resemblance which I conceive it bears to the other erectile structures of animals. It is placed between the prehensile portion and the os hyoides, and exhibits remarkable changes in bulk under different circumstances. When drawn from the mouth after death, which it may to the length of five or six inches (Fig. 4, H), it presents itself as a slender chord, so flexible and soft as scarcely to be felt when caught between the fingers, and to appear little adapted for the purposes to which it is applied. During life, while the tongue rests in the mouth, this portion occupies an exceedingly small space (Figs. 2, 7, H); but when projected in the pursuit of insects, it becomes greatly increased in dimensions (Fig. 3, H), and appears to be wholly the seat of that change which the organ undergoes in its elongation. Its structure is complex and peculiar. A fine transparent mucous membrane, which is continuous posteriorly with that which lines the mouth and throat, and anteriorly passes over the prehensile portion, encircles it on all sides. The hyo-glossi muscles occupy its lateral surfaces. They are round and thick posteriorly at their origin from the os hyoides, and become thin and flat as they advance forwards to their insertion into the prehensile portion. Their pale fibres are rendered evident by a dark vascular net-work which is placed underneath them. Through the centre of the erectile portion runs a tube (Fig. 5, p, p), which is attached behind to the style, and in front is continuous with a similar structure already described in the prehensile portion. It is soft, whitish, and homogeneous, of uniform size throughout, and remarkably extensible. When the tongue is quiet in the mouth, the tube lies folded on the style; when advanced, it is drawn off and elongated. It follows all the motions of the organ, gliding with it alternately off and on the style, which is rounded and smooth for the purpose; but it cannot, as some have supposed, take any part in causing the propulsion or retraction of the tongue. A highly vascular structure exists between this tube and the encircling mucous membrane, (Figs. 3, 4, 5, n, n). It extends from the root of the style to the very end of the tongue, surrounding the tube equally on all sides. Its vessels, which are rendered visible even to the naked eye by their dark blood, appear, when examined with a magnifying glass, like a beautiful trellis-work, the branches crossing and anastomosing with each other to incalculable minuteness. A coloured spot, which resembles a mere stain, exhibits through a glass a congeries of vessels. This vascular appearance has been described by the anatomists of the French Academy in the following words: "La membrane estait couvert de taches tout du long comme si elle avoit esté imbuë en dedans d'un sang noirastre, extravasé et inegalement amassé en plusieurs endroits." In another passage: "La langue estoit semée de quantité de vaisseaux apparens à cause du sang qui y estoit en grand abondance, ainsi que dans tout le reste du corps." But the circumstance is noticed by them only to excite our astonishment, " que Aristote ait dit que la chameleon n'a du sang q'autour du cœur, et des yeux, et que la plus part des modernes le mettent au rang des animaux qui ont peu de sang." *

The lingual *arteries*, which are derived from the carotids, are of considerable magnitude (Fig. 2, 6, z.) They run before the posterior cornua of the os-hyoides as single trunks, and are soon subdivided into numerous small branches, which ramify through the erectile portion. Coagula of blood, together with the tortuosity of the vessels, prevented the ingress of injection to their minute terminations, though it passed sufficiently far to show their general course and distribution.

Two large *veins* (Fig. 5, 6, x.), which take their origin round about the prehensile and erectile portions of the tongue, run along its lower surface, and having arrived at the os hyoides, where they are very conspicuous, one passes on either side of the root of the style, between it and the hyo-glossus muscle; then it escapes between the anterior and posterior cornua, and applies itself on the side of the trachea (L). It next courses along the trachea, first overlapped by the thyroid gland (r), then by the carotid artery (y), and aorta (u), and at length opens into a large sinus (v), connecting with the corresponding auricle of the heart (t), by an orifice which is distinct from that of the jugular vein, and a little to its inner side. I have succeeded in injecting the lingual veins with quicksilver through a pipe introduced where they lie on the trachea, and, when distended with this fluid, they acquired a size fully equal to that given them in the plate. The quicksilver ran into the tongue, and filling many of the larger branches, produced an evident turgescence in the most dependent part of the organ; but the delicate vessels being unable to support the increasing weight of fluid, it soon becomes extravasated: sufficient, however, remained to show in a preparation the extremely vascular nature of the organ. I am happy in being also able to adduce, in evidence of the fact, the names of Professors Jacob and Harrison, who witnessed the recent injection of the vessels, and who can bear testimony to their magnitude and numbers.

The exact mode of termination of the ultimate vessels in the tongue may not be easily ascertained; but, from the extremely fine ramifications which are perceptible in it, I am inclined to think that it is by a congeries of vessels, the termination of arteries and commencement of veins, without the intervention of a spongy or cavernous texture †. And, if this were established, it would, in my opinion, afford a still farther confirmation of the analogy between the erectile portion of the chameleon's tongue and the corpus cavernosum, for that the latter is purely a vascular body, without any intermediate cells between its arteries and veins, many experiments and observations have satisfied me.

The heart in the chameleon consists of one ventricle (Fig. 6, s.) and two auricles (t, t), with each of which is connected a large sinus (v), for receiving

* See Mem. de l'Academie Royale des Sciences, T. 3me, 1re partie, p. 46.

† The minuteness of the globules of the blood in this animal, which renders it highly diffusible, appears particularly favourable for making observations on the magnitude of its ultimate vessels; for, with a glass, one could discover vessels tinged with the coloured parts of the blood, which were not visible to the naked eye.

the blood of the body and tongue. This remarkable cavity between the veins and auricles has never, that I am aware of, been before noticed in this animal. The French Academicians have described the auricles as being large, and the left in the chameleon which they dissected was the more capacious; but they have made no allusion to distinct sinuses apart from the auricles. In both those which I examined, these sinuses were well marked; the right, however, exceeded by one half in magnitude the left, and formed a larger cavity than both the auricles taken together. It extended the whole length of the chest (Fig. 6, v.), from the superior aperture to the liver, and was not less when distended than two lines in diameter. Both were filled with coagulated blood; and the texture of their coats appeared the same as that of the veins which emptied into them. Their use may probably be connected with the varying condition of the circulation in the skin, and the erectile portion of the tongue, on which I conceive depend all the phenomena for which these two parts have gained such notoriety. They may serve as reservoirs for the blood, when suddenly abstracted from either of them, previous to its readmission into the heart.

After this detailed description of the structure of the chameleon's tongue, we may be enabled to estimate the applicability of the several theories, which have from time to time been advanced, to account for its peculiar powers of motion.

It was denied by Marmol, who examined many chameleons for the purpose of clearing up this point, that their tongue had any such powers at all. He assures us that it is never exercised as a trap for insects, and that any thing which he had observed of the animal, would not induce him to change his opinion, that air and the sun's rays are its only nutriment*.

M. Perrault attributed the elongation to an expiratory effort of the animal, which darted its tongue from its mouth, "comme si il la crachoit avec violence"†. The great size of the lung he supposed was for the purpose of effecting this movement. But there is no circumstance connected with the anatomy of the organ, or its mode of advancement, to countenance this explanation. Besides, the chest during the act, in place of evincing the motions attendant on an effort of expiration, remains dilated and immoveable: respiration for the moment appears to be suspended.

M. De la Hire suggested that perhaps the state of the rest of the tongue is that in which it exists when elongated, and in

* See Mem. de l'Acad. Roy. des Scienc. t. 3. 1re. partie, p. 47.

† Ibid. T. 9, p. 156.

which it is kept by some tendons so attached on a zig-zag form to the outside of the tongue (Fig. 8, B, A) as to act after the manner of a spring; and that its retraction into the mouth might be effected by the action of a longitudinal muscle (C, C,). M. De la Hire offers a sufficient apology for so absurd a supposition, in acknowledging that he had never an opportunity of examining the structure of the organ.

The central tube was described by the anatomists of the French Academy as being a nerve which had the power of throwing forth the tongue (meaning the prehensile portion) which was attached to it by elongation itself, and of drawing it back again by contracting. It is a sufficient reply to this explanation, that the part alluded to is not a nerve; and even granting it were so, that nervous structure is no where possessed of powers of elongation and contraction.

There is a common supposition, that the tongue is extended by inflation with air, and drawn back again by the supposed nerve in its middle, which after having been elongated by the effort, returns it again suddenly to its former state. But this explanation is as untenable as the others, for no opening of communication can be discovered between the mouth or trachea and the tongue, through which air could find admission into the organ.

The Baron Cuvier, who has contributed so much to the advancement of natural science, supposes that the propulsion of the organ from the mouth, and its subsequent retraction, are effected in part by the alternate elongation and shortening of that portion which I have named prehensile, and in part by the advancement and retreat of the os hyoides. The entire process, according to his explanation, is the result of muscular action. With regard to the elongation or shortening of its prehensile portion, which he conceives may be produced by the annular and retractor muscles *, a reference to my account of its structure will shew that no such change in its form can take place. A dense, fibrous, inelastic sheath which surrounds it must effectually prevent an alteration being made either in its length or thickness, by any muscular force which it possesses. Even when removed from the body, attempts to stretch it with the

* Leçons d'Anatomie Comparée, T. 3. p. 273, 274.

fingers are unavailing. Its cupped extremity admits of being spread out a little, but neither before nor after death can its form or bulk undergo any greater change. The protrusion of the style of the os hyoides from the mouth will be found, on studying its form and connections, an equally inefficient cause. The Baron compares this part of the process to that accomplished by the tongue of the woodpecker. He says*, "Il peut s'alonger considérablement par un méchanisme analogue à celui qui a lieu dans les pics." But the difference in the form and arrangement of the os hyoides and its muscles in the two animals, will not sanction a comparison of their actions to an extent which would account for the phenomenon. In the woodpecker, the cornua of the os hyoides are remarkably long and curved; they at first descend in the neck for some way; then turn up in a loose sheath over the occiput, and pass as far forwards as the upper mandible, into a groove of which they enter. Muscles which arise from the chin, and follow the course of these cornua to their very points, have the power of retracting them, and in the same proportion of propelling the tongue, which is a solid continuation of them, out of the mouth. Whereas in the chameleon, whose tongue can be projected even farther than that of the woodpecker, the cornua of the os hyoides are not so much as an inch long, and the space they have to move in is so limited, that the muscles extending from them to the lower jaw could not, by pulling them forwards, advance the tongue out of the mouth more than half an inch. Since then, the structure of the prehensile portion of the tongue will not admit of its elongation; and since also the point of the style cannot be advanced from the mouth more than half an inch, to which two circumstances alone the Baron attributes the protrusion of the organ, it is evident that his explanation is incomplete, inasmuch as it does not account for its usual propulsion to the distance of five, six, or seven inches.

Having thus passed under review the several theories advanced in explanation of this remarkable process, and shown their respective insufficiency to that end, I venture to offer one which to me appears not only unobjectionable, but adequate to

* Ibid. T. 2. p. 681.

account for all the phenomena: namely, that the projection of the chameleon's tongue is caused, partly by the advancement of the os hyoides, but chiefly by blood rushing into the numberless vessels of the organ distending and elongating its erectile portion: and that its subsequent replacement in the mouth is effected by the retreat of the os hyoides and subsiding of the turgescence, aided by the contraction of the hyoglossi muscles.

7. The appearance of the tongue when protruded during life, its rigidity, its dark colour, and the turgid condition of its vessels, first suggested the idea of its being an erectile organ. The peculiarities of its organization discovered after death, its high vascularity, the remarkable size, course, and termination of its veins, and above all, the unique and beautiful provision near the heart to receive the sudden reflux of blood, gave it additional confirmation. And the experiment of imitating the natural process by filling the vessels with quicksilver, though necessarily not as conclusive as might be desired, was nevertheless sufficiently so, in my opinion, to place the matter beyond a doubt.

An additional argument in favour of the supposition, that the chameleon's tongue undergoes, in being protruded, an erectile action, may be found in the influence which the state of warmth and vigour of the animals had on their projectile powers; for except about noon-day, and during the sunshine, or while the animals were near the fire, they could seldom be excited to attack a fly; any attempt, except under such circumstances, rarely being successful. I have several times seen one of them, when cold and sickly, make the effort. It opened its mouth, and advanced its tongue a short distance, about as far as the muscles going from the chin to the os hyoides might effect it, but could succeed little farther: the prehensile part either did not leave the style at all, or bent towards the ground, and fell short of its object. In this state of the animal, the power of changing the colour of its skin was as imperfect as that of protruding its tongue; both failures perhaps alike resulting from the same cause, the languid state of the circulation.

If, by any cause, the chameleon were provoked to anger, of which it appeared very susceptible, its tongue, as well as its skin, gave evidence of the same excitement: it swelled out prodigiously in the throat, so that had the style, which pressed forcibly against the integuments under the chin, been elevated, I have little doubt the organ would have undergone a partial elongation.

The effect on the animal of frequently protruding its tongue, might also be advanced in support of the same theory. An interval of rest was always taken between the acts, which I have never seen repeated above six or eight times in succession; and even this was evidently followed by fatigue. Mere muscular action would not so soon produce exhaustion; the tongue of the woodpecker, which is protruded solely by this cause, can be shot out many times in quick succession, without the animal's evincing any subsequent fatigue.

When the mouth is shut, and the tongue at rest, both its erectile and prehensile portions are drawn on the style, the point of which rests against the symphysis of the chin, close behind the front teeth. In this state the prehensile part surrounds the two anterior thirds of the style, and the erectile portion is folded in plaits on its posterior third (Fig. 7. E and H). When the tongue is about to be darted forth, the mouth opens just enough to give it passage, and the style, carrying with it both portions of the tongue, is protruded from the mouth for about half an inch, by the actions of the genio-hyoid, and three cerato-maxillary muscles. The progress of the os hyoides under the skin is visible, and so far it can advance the tongue, but no farther. The prehensile portion, unchanged in bulk, now flies off the style in the direction given it by that bone, and propelled by the erectile portion, which, from being so small and pliable as to lie folded on the root of the style, acquires a length equal to the entire body of the animal, a thickness nearly as great as that of the prehensile portion, and a rigidity which enables it to advance in a straight line, carrying the latter before it. The stretching of the mucous membrane on the sides everts the edges of the pouch on its extremity, which is thereby expanded to cover the prey with more certainty.

The object of the propulsion of the tongue being attained, the mouth opens wider, partly to give more ready admission to the prey, and partly, perhaps, for the purpose of relaxing the muscles, and favouring the return of the accumulated blood;

the os hyoides is drawn back by the sterno-hyoid, sterno-ceratoid, and omo-hyoid muscles; the turgescence of the erectile part subsides; the pouch on the end is again deepened by the action of the retractor muscles, and the relaxation of the mucous membrane on the sides; and the hyo-glossi draw in the tongue, folding up the erectile portion and replacing the prehensile on the style. The parts thus arranged, the organ is made fit for the ordinary purposes of mastication by the annular muscle fixing the prehensile portion, and preventing its rotation on the slippery style, and by the hyo-glossi drawing it in the direction of the cornua of the os hyoides, so as to obviate any displacement forwards.

The chief objection urged against this theory is the difficulty of conceiving how vascular congestion could affect the elongation with the rapidity ascribed to it during health. This objection, however, does not apply to the act as observed in those animals from which I have drawn my conclusions, for the motion of their tongues was by no means so rapid as to be irreconcileable with such a cause. It was not more rapid than the instantaneous blush on the cheek of youth; nor more rapid than several other phenomena which are universally allowed to be the result of vascular turgescence. How far in a state of nature the rapidity of projection exceeds what was observed in those weakened by confinement, I cannot determine; but perhaps the difference may not be so great as is usually believed. Few of our accounts on the subject have been given by naturalists on the testimony of their own observation; and it is not going too far to suppose, that it may have been with their descriptions of the chameleon's tongue, as with those given by them of its skin, in which fancy contributed so largely to the colouring: for we must admit, that much of imagination has mingled with their accounts of the organ, when we find it described, and even figured, as in the act of turning backwards and seizing objects placed on its tail, a range of motion by no means compatible with its structure or cause of action.

I have already observed—and it may partly account for the reputed quickness of the tongue—that at one period of the elongation the rapidity, even in my chameleons, was such as might justly be compared with that of an arrow, but then it was only momentary, and observed during a very short stage of the process. The progress of the tongue on leaving the mouth was at first slow, and became gradually accelerated as it approached near the prey, when it shot forwards with remarkable quickness, —a mode of proceeding much more likely to ensure success than if it had advanced with uniform rapidity from the commencement. This quickness perhaps equalled that which is attributed to the organ when in vigour; but it was only manifested after its gradual repletion with blood, and when a slight impulse was sufficient to produce it.

Should the explanation which I have given of the mechanism of the chameleon's tongue, founded on its structure and appearance during life, be admitted as applicable to the animals on which I have made my observations, it may be likewise to all, however vigorous, for the same cause must equally produce the elongation whether the act be rapid or slow—whether it take place during a state of activity or weakness.

Several individuals who have witnessed the change of colour and mode of feeding of my chameleons, can corroborate the accuracy of the above statements; but I shall particularly refer for evidence of it to my friend Mr Tagert, who took a particular interest in observing their habits; and who, even while the animals were alive, agreed with me in the opinion, which I hope my after dissections have sufficiently established, regarding the cause of elongation of the tongue.

Most of the preparations from which the drawings were taken I have preserved, and placed in the Museum of the Royal College of Surgeons.

31. York Street.

EXPLANATION OF THE PLATE.

Fig. 1st.—*The Os Hyoides.*

A The Style. BB The anterior cornua and cartilaginous pully. CC The posterior cornua. hhh The internal cerato-maxillary muscle.

Fig. 2d.—*The Muscles.*

C The posterior cornua of the os hyoides. D Lower jaw. a Sterno-hyoid.

b Sterno-ceratoid. c. Omo-hyoid. d Internal genio-hyoid. e External genio-hyoid. f External cerato-maxillary. g Middle cerato-maxillary. h Internal cerato-maxillary. w Internal jugular vein. y Carotid artery. z Lingual artery. E Prehensile portion of the tongue appearing in the mouth. H Plaited condition of the erectile portion.

Fig. 3d—*Superior surface of the Tongue as seen when protruded at the will of the animal.*

E Prehensile portion. F The pouch. G Mucous gland. H Erectile portion. K Upper jaw. nn Vessels of the tongue.

Fig. 4th.—*View of the Tongue as it appears when drawn from the Mouth after Death.*

A The style. BB Anterior cornua. CC Posterior cornua. E Prehensile portion. F The pouch. G Mucous gland. H Erectile portion. iiii Hyo-glossi muscles. nn Vessels as seen in the erectile portion without injection.

Fig. 5th.—*Dissection of the Prehensile and Erectile portions.*

kkk Investing membrane and vascular tissue laid open. F The pouch. ll Retractor muscles of pouch. m Under surface of mucous gland. nn Vessels of the erectile portion, some containing quicksilver. oo The annular muscle which surrounds the tube, laid open on one side to shew pp The tube.

Fig. 6.—*Dissection of the Heart and Vessels.*

A The style. ii Hyo-glossi muscles. h Internal cerato-maxillary muscle. L The trachea. r Thyroid gland. M Membranous bag at top of larynx. N Lungs. O Liver. s Ventricle of heart. tt Right and left auricles. uu Aorta. v Great venous dilatation. w Internal jugular vein. x Lingual vein of right side. y Carotid artery. z Lingual artery.

Fig. 7th.—*This figure is intended to explain the manner in which I conceive the prehensile and erectile portions are fitted on the style when in the mouth.*

E The prehensile portion. H The erectile portion thrown into plaits, some of which lie round the style, others overlap the back part of the prehensile portion.

Fig. 8th.—*M. de la Hire's Drawing of the Elastic Tendons, &c.*

BABA The tendons by which the tongue is kept in a state of constant elongation. CC The longitudinal muscle by which it is retracted.

Description of several New or Rare Plants which have flowered in the neighbourhood of Edinburgh, and chiefly in the Royal Botanic Garden, during the last three months.

10th June 1829.

Acacia verniciflua.

A. *verniciflua;* phyllodiis lineari-lanceolatis. 2-nervis, falcatis, basi attenuatis, margine superiore ad basin uniglandulosis, ramisque junioribus viscidis; capitulis globosis, axillaribus, geminatis.

Acacia verniciflua, *Cunningham*, in Field's Memoirs on New S. Wales, p. 344.

Description.—*Shrub* erect, branching. *Branches* slender, spreading, green viscid and angular when young, when older red and scabrous. *Phyllodia* (3 inches long, 4½ lines broad,) falcate upwards, 2-nerved, and slightly veined, one of the nerves passing nearly in the middle, the other towards the upper edge, scabrous and shining, when old dull green, when young bright green and viscid, uniglandular on the upper edge at the base. *Capitula* globular axillary, geminate, pedicelled, spreading; *peduncles* (3 lines long) articulated at the base, filiform, tomentous; when a branch pushes from between the capitula, these sometimes take their origin from it, a little way above its base, and are opposite. *Flowers* yellow, numerous in each capitulum, sessile, crowded, each rising from the axil of a minute, brown, spathulate, ciliated bractea. *Calyx* sub-adpressed, minute, 5-cleft, as long as the bracteæ, segments blunt, slightly tomentous. *Corolla* ($\frac{1}{16}$th of an inch long) twice as long as the calyx, 5-cleft, segments linear, acute, spreading, and concave at the apex, smooth. *Stamens* very numerous, arising from the base of the corolla, of deeper yellow than it or the calyx; filaments half as long again as the corolla; anthers small, bilobular, orange coloured. *Stigma* minute, style projecting a little beyond the stamens, lateral. *Germen* small, green, oblong. *Ovulæ* numerous.

This species was raised from seeds received at the Botanic Garden from Mr Frazer, colonial botanist, New South Wales, in 1825, under the name of *A. vernosa*, and has received the ordinary treatment in the greenhouse. It flowers freely in March and April. Judging from the character given by Mr Cunningham in the work above quoted, I do not see any reason to doubt that it is his *A. verniciflua*, which he says is a native of Rocky Hills, near Cox's River, &c. and was first collected in 1817 by him during Mr Oxley's expedition.

Andromeda hypnoides.

A. *hypnoides*; pedunculis solitariis unifloris, terminalibus; corolla campanulata, 5-fida, laciniis obtusis, conniventibus; stylo ovato, acuminato; foliis imbricatis, plure seriatis, erectis, subulatis.

Andromeda foliis aciformibus confertis, *Linn.* Fl. Lappon. 165. t. 1. f. 3.

Andromeda hypnoides, *Linn.* Fl. Suecic. 355.; Sp. Pl. i. 563.—*Willd.* ii. 608.—Fl. Danica, t. 10.—*Persoon*, i. 480.—*Wahlenberg*, Fl. Suecic. 450. —*Sprengel*, Syst. Veget. ii. 289.—Hort. Kew. iii. 51.

Description.—*Stem* procumbent, much branched, every where covered with leaves. *Leaves* imbricated, erect, minutely pubescent, ciliated, subulate, flat above, rounded below. *Peduncles* (3 lines long) terminal, solitary, 1-flowered, red. *Flowers* drooping. *Calyx* 5-parted, red, subacute. *Corolla* pure white, when, as in the specimens here described, raised under glass, but said to be reddish in native specimens, campanulate, 5-cleft, segments rounded, but having a minute mucro, and slightly connivent, 3-ribbed, central rib undivided, those at the sides fainter, and branched. *Stamens* 10, connivent; filaments glandular, flat, slightly dilated below, yellowish above and below, colourless in the middle; anthers orange-brown, bilobular, lobes blunt and rounded at the terminations, pores rounded, each with two reflexed awns, much longer than itself, and diverging a little. *Pistil* rather longer than the stamens; germen green, globose, scarcely lobed, wrinkled, surrounded by brownish glands at its base; style articulated on the top of the germen, suddenly swollen above its base, and gradually tapering upwards; stigma blunt.

This extremely pretty little plant was introduced from Canada by Mr Blair into the extensive and interesting collection of Mr Cunningham at Comely Bank, near Edinburgh, in 1826; and this enterprising cultivator had the satisfaction of seeing the plant come into flower in his garden in May last; the first time it had been seen in Scotland, and after it had been lost in England.

Pursh and Nuttall confine the American station of this plant to the north-west coast; but this Mr Blair did not visit. It is therefore more diffused in the northern parts of America, and as it is a most abundant plant in the north of Europe and Asia, it is extremely probable that it may one day in the north of Scotland reward the labour of some British botanist, for, unless when it is in flower, it may be very easily overlooked.

Androsace carinata.

A. *carinata;* caule brevissimo, ramoso; pedunculo terminali, umbellifero; foliis lanceolatis, acutis, subintegerrimis, subpubescentibus, ciliatis; involucris integerrimis; umbella pauciflora, capitata, radiis calyce brevioribus; corolla calycem excedente, scapo hirsuto.

Androsace carinata, *Torry*, " Plants of the Rocky Mountains," in Annals of Lyceum of Nat. History of New York, vol. i. p. 33. t. 3. f. 1.

Description.—*Stem* short, red, branched, somewhat hairy, hairs spreading. *Leaves* lanceolate, acute, somewhat succulent, without veins, shining and roughish, towards the apex often pubescent on both sides, spreading, star-like. *Peduncle* ($\frac{3}{4}$ths of an inch long) terminal, grooved, red, especially towards the base, hairy, hairs numerous, spreading. *Umbel* about 5-flowered. *Involucrum* of 5 or 6 imbricated entire segments, one to each flower, resembling the leaves, but smaller and pubescent on the outside. *Calyx* 5-cleft, tumid, hairy without, smooth within, segments connivent at the apices, subacute. *Corolla* yellowish, the colour deepening towards the faux and in the tube: tube inflated, as long as the calyx in which it is inclosed; limb 5-parted, segments obovato-elliptical, as long as the tube; faux somewhat prominent, 5-gonous. *Stamens* included; filaments arising from the base of the corolla, and adhering to it for more than half their length, connivent above; anthers large, yellow, cordate, bursting along their sides; pollen yellow. *Pistil* about as long as the stamens, green: stigma capitate, flattened above, and perforated in the centre; style filiform; germen top-shaped, equal in length to the style; ovules about 12.

We raised this species at the Edinburgh Botanic Garden, from seeds collected by Mr Drummond on the Rocky Mountains, and presented by him in 1828 under the name of *Androsace chamæjasme.* It certainly very much resembles that European species and *A. villosa*, but may be distinguished from these, especially by the flowers being almost sessile upon the top of the peduncle, while in them the pedicels are longer than the involucrum. The leaves, too, seem longer in the present plant, and lanceolate rather than ovate. Its identity with Torry's plant is proved by an original specimen of this in Dr Hooker's herbarium. It flowered in a cold frame in April, and is of course perfectly hardy.

Androsace linearis.

A. *linearis;* cæspitosa, scapo umbellato, umbella sub-sexflora, radiis elongatis, erectis, corolla calycem acutum excedente, laciniis linearibus, retusis, foliis supra sub-pubescentibus, linearibus, acutis, apice subdentatis.

DESCRIPTION.—*Plant* cæspitose. *Leaves* all radical, linear or spathulato-linear, acute, generally with a few teeth near the apex, somewhat fleshy, veinless, concave above, middle rib somewhat prominent below. *Scape* (7½ lines long) erect. *Umbel* about 6-flowered. *Involucre* segments ovate-acute. *Pedicels* (1 inch long) longer than the scape, and, like it, filiform, erect. *Calyx* 5-cleft, segments ovate, acute, spreading a little, resembling the involucre, and equal to it in size, reddish, as well as the pedicels scape and upper part of the leaves minutely and indistinctly pubescent: pubescence most distinct on the leaves, and decreasing upwards. *Corolla* longer than the calyx, 5-cleft, red when opening from the bud, but soon becoming white, yellow in the throat, segments linear, retuse; tube ovate, greenish, 5-nerved. *Stamens* included; anthers pale yellow, cordate, notched at the apex; filaments equal in length to the anthers. *Stigma* capitate, reaching to the base of the anther. *Style* filiform. *Germen* top-shaped, green, 5-valved. *Ovules* about 10.

This species was raised in the Royal Botanic Garden from seeds presented by Mr Drummond. It flowered freely in April, May and June, and is chiefly interesting as extending a genus which has been hitherto believed to be of rare occurrence in America. Nuttall and Pursh describe only one, *A. occidentalis;* but we have alive in the Edinburgh Garden three other species, from the kindness of our enterprising countrymen who have within these few years visited the Arctic shores of America. These are the two now described, and *A. septentrionalis*, which differs only from European specimens in being smoother, and more entire in the leaves.

Begonia semperflorens.

B. *semperflorens;* caule herbaceo erecto glabro flexuoso, foliis subæqualiter ovato-cordatis, subacutis, cucullatis, glabris, serratis, setaceis; stipulis ovatis ciliatis; capsula alis inæqualibus, duabus acutis, tertia obtusa.

Begonia semperflorens, *Lodd.* Bot. Cab. t. 1439.

DESCRIPTION.—*Stem* herbaceous, succulent, erect, branched, flexuose, reddish or green, slightly marked with oblong red spots. *Leaves* (3 inches long, by 2½ broad) petioled, subequally cordato-ovate, subacute, cucullate, green, glabrous and shining on both sides, dotted above, paler below, serrated, and serratures acute and crowded at the base, more sparse and blunter above, each terminated with a bristle. *Petiole* (2 inches long in the lower leaves, generally much shorter in the upper,) channelled above, often stained bright red at its origin, and at its termination in the leaf, the stain at its origin generally passing round the stem at the insertion of the stipulæ. *Stipulæ* geminate, ovate, large, ciliated, erect and applied to the stem, submarcescent. *Peduncles* axillary and terminal, longer than the petiols, slightly compressed, erect, glabrous, shining, dichotomous. *Flowers* monœcious. *Corolla* spreading, white: *male*, large, tetrapetalous, two of the petals subrotund (7½ lines broad), two others rather shorter, narrow, and spathulate, as long as the pedicel; *stamens* scarcely monadelphous: *female* smaller, with three small marcescent bracteæ at the base, tetrapetalous, petals subequal; *stigmas* three, each cleft to its base, and segments screw-like, yellow. *Germen* unequally winged, the largest and one of the other wings acute, the third rounded. Biparted receptacle of the seeds in each of the three loculaments of the germen of bright green. *Ovules* very small, very numerous, and white.

Seeds of this species were received from M. Otto at Berlin under the name of *B. setaria.* It has reached this country under other names, and with one of these, *B. semperflorens*, it has been published in the Botanical Cabinet. Rather on this account, than because I think it the most applicable, I adopt it. The species, though handsome enough in the stove, is much less ornamental than several others which have been published lately.

Bonatea speciosa.

B. speciosa, *Willd. Sp. Pl.* iv. 43.—*Persoon, Synop. Pl.* ii. 506.—*Lodd. Bot. Cab.* t. 284.—*Sprengel, Syst. Veget.* iii. 694.

Orchis speciosa, *Thunb. Prodr.* p. 4.—*Linn. Suppl.* 401.—*Swartz, Act. Holm.* 1800, p. 206.

Description.—" *Roots* fascicled." Whole *plant* ($1\frac{1}{2}$ foot high) erect. *Stem* jointed, joints swelling a little upwards, round. *Leaves* ($4\frac{1}{2}$ inches long, 2 broad), sheathing, ovate, spreading on all sides, undulate, reflected at the apex, coriaceous, smooth and shining, deep green above, lighter and irregularly stained with rusty spots below, collected towards the upper part of the stem, the lower part of which is only cased in black decayed sheaths; middle rib strong and prominent behind, 4–8 much smaller lateral nerves. *Spike* (7 inches long, 5 broad) terminal, erect, many-flowered. *Bracteæ* large, pale green, ovate, attenuated at the base, acuminate, smaller upwards. *Flowers* ascending obliquely on all sides, nearly sessile, perfume somewhat resembling that of the orange flower, but more faint. *Outer perianth* of three, membranous, nerved, pointed, green segments; of which the upper is cucullate, the two lower ovate, oblique, spreading, undulate, reflected at the apex, and whitish on their inner side. *Inner perianth* 3-parted; the two upper segments narrow, membranous, linear, pointed, green, as long as the cucullate portion of the outer perianth, along the edges of which they are laid, and each has arising from its upper edge near the base, a filiform, erect, straight, white appendage, about half as long as itself. Lower segment *(labellum)* fleshy, unequally divided into five; the lateral portions separated to the base, are spreading, falcate, acute, pure white, the reflected apex tipped with green, the inner part thick and fleshy, the outer, especially towards the apex, reduced to a thin edge; below these, and rather less deeply separated, are two white, shorter segments, of similar structure to them, but, from their thin edge being convolute, they appear like two parallel, nearly straight cylinders, distilling honey from their extremities, and projecting downwards upon the surface of the central lobe, which is the longest of any, and is cleft into three long, green, linear, flexuose segments, and from its base, in the centre of the flower, rises a short, white, blunt, slightly curved, cylindrical tooth, round which and round the mouth of the spur, a fold of the perianth passes, connecting to each other the bases of the convolute segments. The two lower segments of the outer perianth are connate at the base with the inner. Between the bases of the first and second portion of the labellum, there is on each side a short, broad, subcrenate, fleshy scale. *Spur* ($1\frac{1}{4}$ inch long) blunt, flattened, nearly straight, shorter than the germen, green. *Stamen* green, cucullate, placed under the hood of the outer perianth. *Pollen masses* two, marginal, spathulato-elliptical, flattened, bi-parted, yellow, granular, on long elastic pedicels, which enlarge at their upper extremities, and arise from a little adhesive scale, which, as in other *Orchideæ*, attaching itself firmly to any body that is brought into contact with it, causes the pollen-mass to be readily drawn from the flower; segments of the pollen-mass somewhat concave on their inner side, granules large, loose, and attached only to the outside of the segments. *Anther-cases*, greatly attenuated at their bases, project forwards like two teeth in the middle of the flower, partly covered by the reflected edge of a white, ciliated, cucullus, which rises in front of the anther-case, and is much larger than it. This investing fold of its edge passes backwards, and terminates on each side in the fleshy scale, between the base of the first and second segments of the labellum. *Germen* (about 2 inches long) longer than the spur, green, twisted, unilocular. *Ovulæ* minute, very numerous, white, naked, forming two waved lines nearly the whole length of the germen, on each of three parietal receptacles.

This rare plant, the solitary species of a genus presenting a very complicated form of flower, is a native of the Cape of Good Hope. Here, and I suspect in other cases among the *Orchideæ*, the sudden abstraction of the pollen-mass by the adhesion of the scale at the base of its pedicel to the finger of the examiner, has given rise to the belief that it starts out from an elastic power. The pedicel, when forcibly extended, contracts from elasticity, but never forces the pollen-mass from its case, otherwise than by dragging it after a substance to which the scale at its base had adhered.

The specimen described was kindly communicated to the Royal Botanic Garden, Edinburgh, by Mr Ayton, from the rich collection at Kew, in 1826. It has been always kept in the stove, in soil containing a large proportion of peat, and flowered very freely both last year and this in March and April. The flowers remain expanded for a considerable time.

Dillwynia juniperina.

D. *juniperina;* foliis sub-filiformibus, levibus, mucrone pungentibus, patentibus, rectis, pluri serratis; capitulis terminalibus; pedicellis bibracteatis, ramulis virgatis, patentibus, pubescentibus.

Dillwynia juniperina, *Lodd.* Bot. Cab. t. 401.

Description.—*Shrub* erect; *bark* brown. *Branches* long, slender, spreading, rough, from the persisting callous bases of former leaves, pubescent towards their extremities. *Leaves* crowded, spreading at right angles, straight, smooth, filiform, but channelled above, terminated with a rigid straight mucro, and arising from a short suberect petiole with a tumid persisting callous base. *Flowers* terminal, capitate, on short pedicels, each of which has two minute lateral and opposite brown bracteæ near the top, and each springs from the axil of a bractea, which is somewhat larger and acuminate, but otherwise similar. *Calyx* bilabiate, and, as well as the pedicel and younger branches, clothed with adpressed pubescence; upper lip somewhat compressed laterally, 2-toothed, teeth broad, short, blunt, and slightly divaricated; lower lip shorter, more deeply divided into three narrower pointed teeth. *Corolla* orange-yellow, vexillum very broad, much reflected, slightly notched, and having connivent, radiated red streaks, proceeding from near the faux, leaving in the centre a cordate spot of the same colour as the rest of the limb, claw slender; alæ as long as the vexillum, connivent along their upper edge, spreading at the lower, divaricated at their apices, and standing forwards from the centre of the flower, red in their lower half; carina half the length of the alæ, yellow, blunt, gibbous below, upper edges connivent. *Stamens* free, included in the keel, inserted with the corolla into the tube of the calyx; filaments subulate, reddish; anthers yellow, obovate, bilobular, and each lobe furrowed along its outer side, where it subsequently bursts. *Stigma* capitate, green, reaching as far as the anthers; *style* green, hooked; *germen* green, shorter than the style, covered with white wool; *ovules* two, round and compressed.

This is a very pretty species, first introduced by Messrs Loddiges, was subsequently imported by F. Henchman, Esq., and raised in the nursery of Mr Mackay at Clapton, from whence we had a specimen in 1828. It flowered freely in the Botanic Garden, Edinburgh, in the beginning of March following, and, like others of the family, remained long in flower. Its identity with the plant of the Botanical Cabinet I have ascertained by a specimen obligingly sent to me by Mr G. Loddiges.

Draba crassifolia.

D. *crassifolia;* cæspitosa, perennis; foliis confertissimis lanceolatis, subcarnosis, glabris, subdenticulatis, pilis simplicibus ciliatis; pedunculis multifloris cumque calyce et silicula oblonga glabris ; petalis emarginatis, calyce sublongioribus ; stylo abbreviato.

Description.—Plant densely cæspitose, perennial. *Leaves* (5 lines long, 2 broad,) much crowded, subcarnose, smooth, veinless, indistinctly keeled, subdenticulate, rather sparingly ciliated with simple spreading hairs. *Peduncles* (1½ inch long) smooth, racemose, many-flowered ; pedicels smooth, nearly as long as the flowers. *Calyx* smooth, green, edged with yellow. *Corolla* yellow ; petals emarginate, rather longer than the calyx. *Stamens* and *pistil* included. *Style* nearly awanting. *Silicle* smooth, oblong, inclined to linear in the wild, broader and more ovate in the cultivated specimens.

This species was added to our collection by seeds from the Rocky Mountains, N. America, presented by Mr Drummond in February 1828. It flowers most freely, has been constantly kept in the open air, produces abundance of seed, and has come up in many of the neighbouring pots in the Edinburgh Botanic Garden without any change of character.

We have a plant which seems to be a white-flowered variety of this, raised from seed presented by Dr Richardson, from his collection formed during the same expedition. The plant is more lurid, the calyx reddish, and the corolla white, but I can perceive no other difference.

Both varieties exist in the herbarium of Mr Drummond, now in the possession of Dr Hooker, through whose kindness I was enabled to compare the cultivated with the wild specimens, and to ascertain that the appearance of the plant is quite unchanged. The flowers are much smaller than in *Draba glacialis.*

Draba glacialis.

D. *glacialis;* foliis lineari-lanceolatis integerrimis pedunculoque elongato stellato pubescentibus; calycibus villosis; siliculis ovatis glabris; stylo brevi.

Draba glacialis, *Adams.* Mem. Soc. Nat. Mosq. 5. 106. fide DC.—*De Cand.* Syst. Veg. ii. 338. ; Ib. Prodrom. i. 167.

Description.—*Plant* (2 inches high) cæspitose. *Stems* procumbent and rooting at the base, erect above, leafy, hairy, hairs reflected and generally branched. *Leaves* (10 lines long) scattered, linear-lanceolate, blunt, glaucous, thickly set with branching hairs on both sides, suberect and connivent at the apices. *Peduncle* (2 inches long) filiform, rising from near the bottom of the stem, opposite to a leaf, slightly flexuose, sparingly provided with hairs, which are generally branched. *Pedicels* about as long as the flowers, and elongating with the silicle, nearly smooth, the lower one occasionally having a leaf. *Calyx* turgid, slightly pubescent, blunt, greenish-yellow. *Corolla* yellow, longer than the calyx, petals obovate, emarginate, veined, claws short. *Stigma* capitate, yellow. *Style* very short, green. *Silicle* ovate, smooth ; seeds about 12.

Plant raised at the Edinburgh Botanic Garden from seeds communicated by Mr Drummond, having been collected by him on the Rocky Mountains. The native specimens, which are abundant in the excellent herbarium of Mr Drummond, are covered with a profusion of flowers, so that the plant will probably be found worthy of cultivation as an ornamental species.

Eulophia streptopetala.

E. *streptopetala ;* foliis lineari-lanceolatis nervosis, scapis simplicibus, sepalis exterioribus oblongis obtusis : interioribus duplo majoribus coloratis basi tortis, labelli lobo medio rotundato emarginato : calcare conico abbreviato.—*Lindley.*

Eulophia streptopetala, *Bot. Reg.* t. 1002.

Description.—*Bulb* (3 inches long, 1 broad) ovate and somewhat elongated, green and smooth, but cased in the withered bases of the leaves. *Leaves* (1 foot long, 1 inch broad), bright green, equitant, articulated above their dilated bases, by which they ensheath the bulb, strongly nerved, plicate, linear-lanceolate, about 7 perfect, and 2 or 3 on the outside, having the dilated bases only. *Scape* (3 feet high), rising from the base of the bulb, erect, jointed, alternate marcescent pointed sheaths rising from the joints. *Spike* many-flowered, evolved before the leaves on the bulb which produced it decayed, and after the leaves of a new bulb had nearly attained their full size. *Bracteæ* resembling diminished sheaths, ovate, pointed, equal in length to the germen. *Flowers* single, inodorous, handsome. *External perianth* of three segments, reflected, ovate, acuminate, contracted at the base, obscurely nerved, green and irregularly spotted with brown within; *internal perianth* of two segments, similar in form to the external, but rather broader, and blunt with a smaller point, projecting forwards, nearly horizontal, bright yellow on the outside, paler within. *Labellum* articulated at the base of the column, of three segments, the two lateral the smallest, erect, broad and blunt, reflected in the edge, pale yellow on the outside, brownish within, with a few dark streaks at the base, crenate where it joins the central lobe, which is subrotund, reflected at the sides, crisped, but entire at the edge, excepting at the apex, where it is subcrenate, on the outside having nearly the same colour with the outside of the inner perianth, but darker and somewhat orange within, thicker than any other part of the perianth, all of which is somewhat fleshy, the green outer segments the least so. *Spur* very short, straight, conical, but gibbous on both sides towards the apex. *Column* projecting horizontally into the centre of the flower, nearly white, clavato-oblong, thick and fleshy, rounded above, flat below. *Anther-case* terminal, pear-shaped, emarginate, having two cysts for the pollen-masses, and in the middle of each an imperfect longitudinal septum. *Pollen masses* 2, waxy, orange, pear-shaped, furrowed on the side next the anther-case for the reception of the imperfect septum, simple, arising by a common, thin, colourless, oblong pedicel, longer than themselves, from a scale of similar appearance, oval, and glutinous. *Germen* (1 inch long) rather slender, green, twisted, furrowed, flat on one side, rounded on the other.

In one of the flowers on our specimen, there is a remarkable monstrosity. One of the segments of the inner perianth is reflected, and assumes the appearance of the outer perianth, and *on each side* of the perfect anther there is an abortive but distinct appearance of *two* others, making the whole number five. Mr Brown remarks, that the appearance of *one* abortive stamen on each side of the perfect one in many *Orchideæ*, brings them within the ternary arrangement so common in monocotyledonous plants; and Dr Hooker shews, that in *Epidendrum fuscatum*, Bot. Mag. 2844, the three anthers are all perfected; but the singular monstrosity which I have noticed, would shew that a tendency exists to carry our plant forward to the quinary arrangement of *Dicotyledones.*

We received our plant in 1828 from the garden at Kew, where so much has been done lately to extend the high reputation of that noble collection. It has been kept in the stove, and flowered in April, growing in a pot among chips of bark.

Lantana mollis.

L. *mollis;* inermis; foliis oppositis, cordato-ovatis, acuminatis, crenato-serratis, utrinque pubescentibus, pedunculo longioribus; bracteis cordato ovatis, acutis.

Description.—*Shrub* erect, unarmed; *branches* long and lax, subtetragonous, when young grooved on two sides. *Leaves* (3 inches long and 1 broad) opposite and decussating, cordato-ovate, acuminate, rugose, pubescent on both sides, the pubescence being rather more harsh above than below, crenato-serrate, decurrent along a short petiole, middle rib and veins prominent behind. *Capitula* flat, axillary, on peduncles which are as long as the petioles (½ inch), and like them pubescent. *Bracteæ* ovate, acuminate, imbricate, pubescent, especially on the outside. *Flowers* expand from without inwards, the capitulum at the same time elongating a little, but the expanded flowers always form a nearly flat surface. *Calyx* minute, nearly colourless, obscurely bilabiate, pubescent on the outside, lips subentire. *Corolla* every where pubescent, except on the upper surface of the limb; tube (about 3 lines long) reddish, nearly white at its base, dilated in the middle; limb shorter than the tube, rose coloured, with a yellow throat, irregular, the outer segment the longest, and obcordate, the inner broadest and emarginate; stamens 4, inserted at irregular heights about the middle of the tube; filaments short; anthers small, oblong, orange. *Pistil* single, style longer than the calyx; stigma oblong; germen ovate smooth.

This species, received at Buryhill from Mexico, was obligingly communicated to the Botanic Garden by Mr Barclay in 1828. It has been kept in the stove, flowered in March and April last, and is handsome.

Lupinus littoralis.

L. *littoralis;* perennis, floribus verticillatis, pedicellis ebracteolatis, calycis labio utroque integro, foliolis 5–7, lineari-spathulatis (potius elliptico-obovatis), utrinque sericeis, leguminibus 10–12 spermis transversim sulcatis, radicibus granulatis.—*Douglas*, in Bot. Reg. fol. 1198.

Description.—Perennial. *Stem* decumbent, pubescent. *Leaflets* 5–7, elliptico-obovate, nearly flat, silky on both sides, but especially below. *Petioles* spreading, semicylindrical, two and a half times as long as the longest foliole. *Stipules* (above half an inch long) subulate, hairy. *Spike* erect, rachis pubescent, especially towards the top. *Bracteæ* subulato-filiform, hairy, caducous, twice as long as the pedicels, which, however, are elongated after the bracteæ fall. Bracteoles none. *Calyx* bilabiate, lips entire, the lower the largest. *Vexillum* ovate, strongly keeled on the back, purple, paler towards the middle, and in the centre having a few oblong dark spots. *Alæ* rather longer than the vexillum, hatchet-shaped, blue, their edges every where in contact except towards the base both above and below. *Carina* pale, with an acute deep purple apex, which scarcely projects beyond the alæ. *Stamens* alternately long and short, the former nearly straight, with roundish anthers, the latter shrivelled and supporting long anthers; pollen very abundant, of deep orange colour. *Stigma* small, oblique, hairy. *Style* equal in length to the keel and to the longest stamens, smooth, slowly tapering upwards, curved. *Germen* silky, green, slightly curved.

We have this plant in the open border of the Botanic Garden, raised from seeds collected in the Rocky Mountains, and presented by Mr Drummond; but the specimen which first came into flower in this neighbourhood, was raised in the collection of P. Neill, Esq. at Canonmills, from the same seeds. This specimen was kept for a time in a hot-frame, and was in consequence more upright, and less hairy than our specimens, or than that figured in the Botanical Register; but it did not differ from either in any other respect. Mr Douglas's seeds were gathered from plants growing in abundance on the shore between Cape Mendocino and Puget's Sound. We learn from him that the roots are eaten after having been roasted, and that this is the liquorice of Lewis and Clarke, and of the navigators who have visited the NW. coast of America.—*Douglas*, loc. cit.

Mitella trifida.

M. *trifida;* scapo erecto piloso; floribus pentandris, petalis trifidis; foliis cordatis, lobatis, duplicato crenatis, rugosis, setaceo-pubescentibus.

Description.—*Root* fibrous. Whole *plant* rough from harsh, erect hairs. *Leaves* (1¾ inches long, and nearly as much in the greatest breadth,) all radical, petioled, spreading, cordate, concave, slightly lobed, wrinkled, very much resembling the leaves of *Rubus chamæmorus*, generally doubly crenate, bristle-like hairs erect on both surfaces, most numerous on the upper, which is shining, and of darker colour than the lower, early marked all round with a yellowish border, from commencing decay, 5-ribbed, the outermost ribs branched from the base, finely reticulated all the over the back. *Petioles* (2–3 inches long) reddish at the base, obscurely channelled above, hairs in general recurved. *Scape* (1 foot high) erect, round, hairs smaller than on the leaves. *Spike* (3 inches long) secund, lengthening as the flowers fade. *Flowers* nearly sessile; pedicels of the flowers spreading, of the fruit more robust, and erect. *Calyx* campanulate, persisting, 5-cleft; segments reflex-spreading, acute, mucronulate, reddish-white; tube green, angled. *Corolla* 5-petaled, spreading, white; petals inserted into the calyx at the bottom of the incisions, 3-cleft, segments acute, fan-shaped. *Stamens* 5, alternating with the petals, opposite to the segments of the calyx, and rising from its base, but adhering to the inside of its tube; filament free for a little way, where the calyx becomes coloured. *Anthers* rather large, cordate, attached by the back near the base to the filaments, connivent; lobes furrowed on the outside, at first yellowish-white, afterwards leaden coloured; stigmata 2, sessile, spreading, blunt. *Germen* half inferior, green, ovate, unilocular, in the upper half bivalvular, opening very early after the pollen is shed, and exhibiting the ovules long before they are ripe, or have even attained their full size, the lower part of the capsule remaining as a cup, filled with ovules, and surrounded by another cup, somewhat shorter than itself, formed by the persisting calyx. *Ovules* obovate, smooth, shining, green, crowded upon two parietal receptacles.

We have raised this plant in the open ground at the Botanic Garden, Edinburgh, from seeds presented by Mr Drummond after the return of the last overland journey to the arctic coast of America. It flowered in May.

Pimelia clavata; fœm.

P. *clavata;* erecta, ramosa, floribus dioicis; foliis oppositis, erectis, lanceolato-oblongis, apice callosis, subtus pubescentibus, demum coriaceis, capitulo masculo nudo terminali superantibus; perianthiis, pedunculis, ramulisque pubescentibus, tubo perianthii ovato persistente, limbo dimidium tubum æquante, stylo exserto.

Pimelia clavata, *La Billard.* Nov. Holl. i. 11.—*Brown*, Prodr. 361.

Description.—*Shrub* erect; *branches* spreading, when young villous, red. *Leaves* crowded, erect on short petioles, lanceolato-oblong, bright green, smooth and shining above, paler and pubescent below, channelled over their whole length above, and towards their apex below, when young soft, and callous at the apex, afterwards stiff and thick, middle rib distinct, and slightly prominent behind only towards the petiole, veins oblique, and little branched. *Flowers* diœcious. Female: *Capitulum* terminal, peduncled, flat, consisting of several small yellow flowers, without involucrum. *Peduncle* pubescent, hairs subappressed, white. *Perianth* pubescent without, hypocrateriform; tube ovate, persisting, green; limb 4-parted, imbricated, spreading horizontally, yellow, segments with reflected sides, smooth above. *Stamens* abortive, minute, inserted into the throat. *Pistil* single; stigma hairy; style lateral, exserted; germen ovate, green, smooth; ovule single, pendulous.

This species was introduced from New Holland by Mr Henchman, and raised by Mr Mackay at the Clapton Nursery. The specimen in the Botanic Garden, which is female, was obligingly sent from that collection under the name of *P. incana* in 1828, and flowered freely in the greenhouse under the usual treatment in April. I have Mr Brown's authority for stating that it is the *P. clavata* of La Billardiere and of his Prodromus. The plant is handsome, but the flowers insignificant.

Polemonium moschatum.

P. *moschatum;* foliis pinnatis, multijugis, foliolis cordato-rotundis subglabris; calycibus hirsutis; laciniis corollæ obtusis; caulibus diffusis.

Polemonium moschatum, *Wormskiold*, MSS. fide Hooker.

Description.—*Root* fibrous, crown throwing out many stems. *Stems* (3 or 4 inches long) spreading, angular, reddish, branched. *Leaves* pinnate, indistinctly pubescent on both sides, somewhat fleshy; leafets subopposite, on the root-leaves (which are about 2 inches long) about ten pairs, cordato-rotund, on the stem-leaves fewer and oblongo-ovate, terminal leafet on both obovate and free. *Petioles* more distinctly pubescent than the leafets, grooved on their upper surface. *Flowers* paniculato-corymbose, terminal, nearly inodorous, peduncles generally 2-flowered, somewhat drooping. *Peduncles* and *pedicels* filiform, and, as well as the calyx and stem, glanduloso-pubescent. *Calyx* 5-cleft, reddish, segments blunt. *Corolla;* limb blue, with obscure darker veins; segments blunt, indistinctly crenate; faux yellow, with a white border; tube yellow, darker upwards, angular, smooth without, hairy on the inner side. *Stamens* shorter than the corolla; valves sublinear, hairy; filaments smooth, colourless; anthers subrotund, bilobular, white. *Germen* green, subrotund, trigonous; *style* filiform, equal in length to the stamens; *stigma* 3-cleft, revolute, subacute, as well as the style white.

This pretty little species, approaching in its characters to *P. Mexicanum*, was raised from seeds presented to the Botanic Garden, Edinburgh, by Mr Drummond, and flowered in May. From the same channel seeds were liberally distributed to other establishments, and I have seen the plant in the Botanic Garden of Glasgow, and in the garden of Mr Neill. It is very deserving of cultivation among alpine plants. The perfume is only considerable, if ever it be, in certain states of the atmosphere. When I examined it, I rejoiced that its value was not diminished by the oppressive fetor remarkable in others.

The specific name rests upon the authority of a specimen sent by Wormskiold to Dr Hooker, whose extensive herbarium is rendered doubly valuable by the liberality with which every information to be derived from it is communicated. Were I to dwell upon this, it would only be because the acknowledgment would afford a personal gratification to myself, for it is known to every botanist.

Ranunculus affinis.

R. *affinis;* foliis radicalibus pedato-multifidis petiolatis; caulinis subsessilibus digitatis; lobis omnium linearibus, caule erecto 1–2 floro cum calycibus ovariisque pubescentibus, fructibus oblongo cylindraceis, acheniis rostro recurvo.—*Brown.*

Ranunculus affinis, *Brown*, Suppl. to Appendix of Parry's First Voyage, p. 265.

Description.—*Root* fibrous. Whole *plant* somewhat hairy, particularly the peduncles and calyx. *Stems* (6–8 inches high) erect, branched, flattened particularly at the base, hollow. *Radical leaves* petioled, dark green above, paler below, pedated, or more frequently (and both kinds occur on the same plant) rotundato-kidney-shaped, flat, inciso-crenate, lobes largest towards the apex, 3-ribbed, the lateral ribs branched, and the central especially somewhat keeled at its termination in the petiole; petioles ($\frac{3}{4}$ths of an inch long) deeply channelled above. *Lower cauline leaves* like the root-leaves, but deeply incised and pedated. *Upper cauline leaves* few, sessile, embracing the stem, digitate, segments 3 to 5, entire, linear-lanceolate, and having generally a slight curve laterally. *Calyx* hairy, yellowish internally, and greenish externally, with narrow yellow edges, spreading or slightly reflexed; phylla boat-shaped, but scarcely keeled, slightly reflected at the apex and margins, falling off with the corolla. *Corolla* yellow; petals varying in size and shape, blunt, entire, shining on the inner surface, generally nearly twice the length of the calyx. *Stamens* shorter than the pistils. *Achenia* nearly round, filled by the ovule, dotted, compressed, collected into an oblong, or, in some cases, even on the same plant, a nearly globular head. *Style* persistent, recurved, oblique.

Ranunculus affinis, β.

This plant precisely resembles the last, but is nearly apetalous. It should scarcely be considered even a distinct variety, for in some of our plants both kinds of flowers appeared on the same stem. The plants flowered in May, having been raised from seeds collected on the Rocky Mountains by Mr Drummond, and presented to the Botanic Garden, Edinburgh, by Dr Richardson.

Ranunculus ovalis.

R. *ovalis;* foliis radicalibus petiolatis, ovatis, crenatis, pilosis, caulinis sessilibus, digitatis, laciniis linearibus pilosis; caulibus patulis, ramosis, pilosis; fructibus globosis, acheniis turgidis, obovatis, nudis, vix rostratis.

Ranunculus ovalis, *Rafinesque-Schmaltz*, in Journ. Bot. 1814, ii. 268. fide DC.—*De Cand.* Syst. Veget. i. 302.—Ibid. Prodr. i. 43.

Description.—*Root* fibrous. Whole *plant* covered with long, soft downy hairs. *Stems* (6 or 8 inches high) spreading, slightly angled, somewhat quadrangular at the base, branched, hollow. *Radical leaves* petioled (above 1½ inch long, 1¼ inch broad), ovate, crenate, entire, and occasionally somewhat wedge-shaped at their base, nerved; nerves branched, and nearly equal; petioles (1½ inch long) grooved, particularly at their upper and lower parts. *Cauline leaves* few, subsessile, digitate, segments from 3 to 5, entire, linear, with a slight lateral curvature, and a distinct but not prominent middle rib; hairs most numerous on the back. *Peduncle* (lengthening when in fruit to 3 inches) terminal, subtetragonous, striated, swelling a little upwards, hollow, less hairy than the other parts of the plant. *Calyx* hairy, yellowish, marked with green veins on its outer surface, phylla ovate, concave internally, reflected, falling off with the corolla. *Petals* yellow, shining, smooth, slightly emarginate. *Scale of the nectary* slightly reflexed and curved at its superior margin. *Achenia* obscurely dotted, smooth and shining, obovate, turgid, obliquely tipped by the small recurved marcescent style, collected into a rounded capitulum.

This plant (which is placed by De Candolle both in the Systema and Prodromus among the species imperfectly known) was raised at the Botanic Garden from seeds collected on the Rocky Mountains by Mr Drummond. It flowered in May.

Ranunculus Schlechtendalii.

R. *Schlechtendalii;* foliis radicalibus petiolatis, 3-partitis, incisis, pilosis, laciniis cuneatis, ciliatis, apicibus mucronulato-callosis; caulinis petiolatis, laciniis ovato-lanceolatis, integris, pilosis: caule erecto, ramoso, piloso: fructibus globularibus, acheniis nudis, rostro suberecto.

Ranunculus Schlechtendalii, *Hooker*, MS.

Ranunculus fascicularis, *Schlechtendal*, Animadversiones Botanicæ in Ranunculeas Candollii, Sectio posterior, 30. t. 2.—non Muhl.

Description.—*Root* of many strong fibres. Whole *plant* hairy. *Stems* (8–9 inches high) oblique, flattened, branched, hollow. *Radical leaves* petioled, veined, and veins channelled on both sides, especially on the upper, tripartite, the central lobe trifid, the lateral deeply divided into two secondary lobes, each of which is again cut into two or three minor lobes; petioles (1½ inch long) channelled above, round below. *Lower cauline leaves* very much resembling the radicle, but segments longer and more entire. *Upper cauline leaves* few, always less divided, and lobes often entire, more and more departing from the form of the radical leaves as they ascend, and those nearest the flower nearly sessile, lanceolate or linear-lanceolate. *Peduncle* (sometimes elongated to 4 inches) occasionally rising almost from the root, and then very much resembling the stem in shape and pubescence, when terminal more smooth and rounder. *Calyx* hairy, at first green, and afterwards yellow, falling off with the corolla; phylla elliptical, folded backwards upon themselves and the upper part of the peduncle, membranous, and slightly reflected in the edges. *Corolla* yellow; petals emarginate, elliptical; nectariferous scale spathulato-linear, involute in its margin; stamens longer than the pistils, half the length of the petals; anthers deeply grooved on their outer surface. *Achenia* rounded, compressed, collected into a globular head, obscurely dotted, shining, terminated obliquely by the slightly recurved persisting style. *Ovules* single, much smaller than the achenia.

Raised from seeds gathered on the Rocky Mountains by Mr Drummond. Flowered in the Botanic Gardens of Edinburgh and Glasgow in May and June. I have received wild specimens of the *Ranunculi* now described from my liberal friend Dr Hooker, and have thus ascertained that the characters are not changed by cultivation.

Celestial Phenomena from July 1. *to October* 1. 1829, *calculated for the Meridian of Edinburgh, Mean Time.* By Mr George Innes, Aberdeen.

The times are inserted according to the Civil reckoning, the day beginning at midnight. —The Conjunctions of the Moon with the Stars are given in *Right Ascension.*

JULY.

D.	H. ′ ″	
1.	4 35 58	● New Moon.
1.	16 30 –	☌ ☽ ☿
2.	3 52 34	☌ ☽ ♀
2.	6 29 15	☌ ♀ κ ♊
2.	11 44 48	☌ ☽ ♂
3.	5 54 50	☌ ☽ ♄
3.	22 24 35	Im. III. sat. ♃
4.	10 25 37	☌ ☽ ξ ♌
4.	15 6 17	☌ ☽ ο ♌
5.	0 51 36	☌ ☽ π ♌
5.	15 20 –	Inf. ☌ ☉ ☿
6.	22 58 3	☌ ☽ ρ ♌
8.	14 26 58	♀ near ♂
9.	5 6 21	☌ ☽ ϑ ♍
9.	6 23 4	☽ First Quarter.
10.	13 9 15	☌ ☽ κ ♍
12.	4 38 36	☌ ☽ γ ♎
12.	12 52 21	☌ ☽ ϑ ♎
12.	22 18 33	Em. I. sat. ♃
13.	4 41 19	☌ ☽ ♃
13.	5 3 10	☌ ♀ γ ♋
13.	5 25 44	☌ ☽ φ Oph.
13.	16 34 24	☌ ♀ ♄
14.	0 25 37	☌ ♀ δ ♋
16.	7 52 28	☌ ♀ 1 α ♋
16.	14 35 21	○ Full Moon.
16.	15 52 54	☌ ♀ 2 α ♋
17.	3 34 27	☌ ☽ β ♑
17.	8 54 22	☌ ☽ ♅
19.	3 5 53	☌ ☽ ϑ ♒
19.	13 14 0	☌ ♂ ♄
22.	21 42 46	☌ ☽ ο ♓
23.	4 54 32	☉ enters ♌
23.	6 7 41	☾ Last Quarter.
25.	17 39 1	☌ ☽ γ ♉
25.	18 58 32	☌ ☽ 1 δ ♉
25.	19 29 16	☌ ☽ 2 δ ♉
26.	. . . .	☿ greatest elong.
26.	0 42 40	☌ ☽ 2 α ♉
27.	19 24 –	☍ ☉ ♅
28.	20 37 21	Em. I. sat. ♃
29.	0 29 –	☌ ☿ δ ♊
29.	0 40 –	☌ ☽ ☿
30.	17 32 55	● New Moon.
31.	4 54 16	☌ ♀ α ♌
31.	11 35 –	☌ ☉ ♄
31.	17 29 36	☌ ☽ ξ ♌
31.	21 36 5	Em. II. sat. ♃
31.	22 10 0	☌ ☽ ο ♌

AUGUST.

D.	H.	′	″	
1.	7	53	40	☌ ☽ ϖ ♌
1.	12	28	29	☌ ☽ ♀
2.	6	30	–	☌ ☿ κ ♊
3.	5	54	58	☌ ☽ τ ♌
3.	17	59	51	☌ ☽ β ♍
4.	9	24	52	☌ ☽ η ♍
4.	22	35	0	♂ ♀ ρ ♌
5.	12	17	31	☌ ☽ ϑ ♍
6.	15	36	49	☌ ♂ ξ ♌
6.	20	46	16	☌ ☽ κ ♍
7.	22	5	15	☽ First Quarter.
8.	13	3	15	☌ ☽ γ ♎
8.	20	54	44	Em. III. sat. ♃
8.	21	31	31	☌ ☽ ϑ ♎
9.	12	51	41	☌ ☽ ♃
9.	14	29	3	☌ ☽ φ Oph.
11.	19	50	–	☌ ☿ ♄
13.	13	51	24	☌ ☽ β ♑
13.	17	17	9	☌ ☽ ♅
14.	22	17	1	○ Full Moon.
15.	12	39	35	☌ ☽ ϑ ♒
15.	20	30	32	☌ ♀ σ ♌
16.	16	7	48	☌ ♀ ι ♌
17.	14	21	25	☌ ♀ τ ♌
19.	3	36	–	☌ ☉ ♂
19.	4	28	52	☌ ☽ ο ♓
19.	14	43	25	☌ ♀ υ ♌
20.	10	45	–	☌ ☿ ♂
20.	20	51	27	Em. I. sat. ♃
21.	0	–	–	Sup. ☌ ☉ ☿
21.	7	25	35	☌ ♂ α ♌
21.	13	25	8	☾ Last Quarter.
21.	23	10	35	☌ ☽ γ ♉
22.	0	29	31	☌ ☽ 1 δ ♉
22.	1	0	4	☌ ☽ 2 δ ♉
22.	6	11	43	☌ ☽ α ♉
22.	16	8	45	☌ ♀ β ♍
23.	11	23	1	☉ enters ♍
27.	6	26	24	☌ ☽ ♄
27.	23	45	29	☌ ☽ ξ ♌
28.	4	16	14	☌ ☽ ο ♌
29.	1	37	51	☌ ☽ ♂
29.	7	30	10	☌ ♀ η ♍
29.	8	43	5	● New Moon.
30.	4	20	–	☌ ☽ ☿
30.	12	15	30	☌ ☽ τ ♌
30.	22	39	–	☌ ☿ σ ♌
31.	0	18	26	☌ ☽ β ♍
31.	16	0	54	☌ ☽ η ♍
31.	22	3	38	☌ ☽ ♀

SEPTEMBER.

D.	H.	′	″	
1.	1	35	21	☌ ☽ ♀
1.	18	35	33	☌ ☽ ϑ ♍
3.	3	16	22	☌ ☽ κ ♍
3.	6	14	17	☌ ♀ γ ♍
4.	19	3	–	☌ ☿ β ♑
4.	20	9	17	☌ ☽ γ ♎
5.	4	48	16	☌ ☽ ϑ ♎
5.	19	10	21	Em. I. sat. ♃
5.	22	12	17	☌ ☽ φ Oph.
5.	23	48	50	☌ ☽ ♃
6.	11	47	20	☽ First Quarter.
9.	13	53	–	☌ ☿ η ♍
10.	0	17	25	☌ ☽ β ♑
10.	3	55	54	☌ ☽ ♅
10.	11	12	43	☌ ♀ ϑ ♍
11.	23	39	39	☌ ☽ ϑ ♒
12.	23	54	26	☌ ♀ α ♍
13.	6	12	39	○ Full Moon.
15.	13	42	52	☌ ☽ ο ♓
18.	6	16	45	☌ ☽ γ ♉
18.	7	33	34	☌ ☽ 1 δ ♉
18.	8	2	16	☌ ☽ 2 δ ♉
18.	13	6	39	☌ ☽ α ♉
19.	23	46	25	☾ Last Quarter.
22.	3	16	–	☌ ☿ α ♍
23.	7	56	22	☉ enters ♎
23.	19	50	3	☌ ☽ ♄
24.	5	39	53	☌ ☽ ξ ♌
24.	10	22	48	☌ ☽ ο ♌
24.	20	9	24	☌ ♀ λ ♍
24.	20	10	53	☌ ☽ ϖ ♌
26.	18	29	55	☌ ☽ τ ♌
26.	18	31	27	Em. II. sat. ♃
26.	20	59	29	☌ ☽ ♂
27.	6	23	32	☌ ☽ β ♍
28.	1	40	50	● New Moon.
29.	0	32	45	☌ ☽ ϑ ♍
30.	6	40	–	☌ ☽ ☿
30.	9	7	18	☌ ☽ κ ♍

Times of the Planets passing the Meridian.

JULY.						
	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	12 29	12 53	13 10	21 42	13 49	1 56
5	12 3	12 58	13 6	21 25	13 35	1 40
10	11 32	13 4	13 0	21 4	13 19	1 19
15	11 2	13 11	12 53	20 42	13 2	1 0
20	10 47	13 16	12 47	20 21	12 45	0 39
25	10 42	13 20	12 40	20 1	12 27	0 19
AUGUST.						
	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	10 49	13 26	12 30	19 34	12 3	23 46
5	11 3	13 29	12 26	19 19	11 50	23 30
10	11 22	13 32	12 18	18 59	11 32	23 9
15	11 43	13 35	12 10	18 40	11 15	22 48
20	12 21	13 39	12 3	18 22	10 58	22 28
25	12 18	13 41	11 54	18 3	10 41	22 7
SEPTEMBER.						
	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	12 40	13 44	11 45	17 38	10 17	21 39
5	12 49	13 46	11 39	17 21	10 3	21 22
10	12 56	13 49	11 32	17 7	9 47	21 3
15	13 5	13 51	11 24	16 51	9 30	20 43
20	13 11	13 53	11 16	16 32	9 12	20 22
25	13 17	13 57	11 8	16 16	8 55	20 4

On the 22d of August there will be an Occultation of *Aldebaran* by the Moon:

	D.	H. ′ ″		°	
Immersion,	22.	5 29 25	at	93 to the Left	of the ☽'s vertex.
Emersion,	. .	6 45 1	at	105 to the Right	of the ☽'s vertex.

On the 13th September, there will be an Eclipse of the Moon, which will be *partly* visible:

	D.	H. ′ ″
The Eclipse begins, . . .	Sept. 13.	5 7 51
Moon's upper limb sets, ...		5 18 21
Ecliptic opposition, ...		6 12 31
Middle, ...		6 20 1
End of the Eclipse, ...		7 32 11

Digits eclipsed 6 dig. 5′ on the south part of the Moon's disc.

Proceedings of the Wernerian Natural History Society. (Continued from former Volume, p. 391.)

1829, *March* 28.—HENRY WITHAM, Esq. V. P. in the Chair. The Secretary read a paper by Dr Fleming of Flisk, on the insufficiency of the evidence of a milder climate having formerly prevailed in the Arctic Regions. (This interesting paper is printed in the preceding Number of this Journal, p. 277. *et seq.*) The Rev. Dr Scot of Corstorphine then read an essay, entitled The Natural History of the Bee illustrated from the Sacred Writings. The Secretary next read a notice contained in a letter from Mr Stuart Menteath, younger of Closeburn, to Professor Jameson, regarding the breeding of the Emu of New Holland, at North Cray near London. Professor Jameson read extracts of a letter from Lieut. Alexander of Chatham to Professor Wallace, giving an account of a deposite of bones of the ancient ox and deer, found in a chalk cave. At this meeting a fine skeleton of a recent elk from Lapland was exhibited; and the President pointed out the difference between the existing elk and the fossil species found in Ireland and the Isle of Man.

April 11.—Dr WALTER ADAM, V. P. in the Chair. Mr Henry Witham read a paper on the Red Sandstone of Scotland, illustrating his remarks by specimens of the New and of the Old Red Sandstone, and shewing that coal may be found under the former, but cannot be expected under the latter. The Rev. Dr Scot then read an essay on the Honey of the land of Canaan. Mr Mark Watt exhibited and described his instrument for measuring the different degrees of solar magnetic intensity. The Secretary read a report by Mr Robert Spittal and Mr Robert Stevenson jun. relative to the nature of the impression left on soft clay by the feet of the common pig, both on a horizontal surface and on an inclined plane, proving in general that the impression is multungulated, not bisulcated.

April 25.—Dr ADAM, V. P. in the Chair. The Secretary read part of Dr Murray's account of the Botany of the Upper District of Aberdeenshire. The President then gave an interesting view of the most important observations or discoveries in natural history recently made in different parts of Europe. The Society adjourned till November.

SCIENTIFIC INTELLIGENCE.

ASTRONOMY.

1. *Comet of Short Period.*—M. Humboldt communicated to the Academy of Sciences of Paris the results obtained by M. Encke, relative to the progress of the Comet of Short Period. M. Encke first made the calculations, on the supposition that the comet performed its revolution in vacuo; and again on the supposition, that the ether opposed a certain resistance to it. The latter hypothesis has led to a much nearer approximation than the first. In fact, in adopting it, the mean error is only 18″, while on the supposition that the comet moves in a perfect vacuum, the mean error is 7′ 38″. These results are therefore of a nature to confirm the hypothesis, which for other reasons is probable enough, of a resistance opposed by the ether to the motions of the heavenly bodies.

METEOROLOGY.

2. *Malaria.*—At a late sitting of the Academy of Medicine in Paris, M. Villernie read a paper on the influence of marshes upon human life, from which he drew the following conclusions:—In the salubrious portions of our climates, the winter and spring months are those which give the greatest number of deaths, and the winter is more favourable in the north than in the south. In marshy countries, the greatest number of deaths is in the months of July, August, September and October; and the evaporation of the marshes is most fatal to persons from one to six years of age. The complaint which generally attacks children, owing to the malaria of marshes, is stated to be an acute gastro-intestinal affection.

3. *Influence of the Aurora Borealis on the Magnetic Needle.*—M. Arago made a communication to the Academy of Sciences on the influence which the aurora borealis exercises on the magnetic needle. We have already had occasion to speak of the discussion raised between M. Arago and several English philosophers, relative to the limits of the extent within which the aurora exercises a perceptible action upon the magnetic needle. M. Arago, from a great number of observations made by him-

self, maintained that the action of the aurora is exercised in a sensible manner, even in places where it is not seen. This assertion was keenly contradicted in England. Several very remarkable examples of auroras observed toward the north, at periods marked beforehand by M. Arago, have, however, continued to render his assertion more and more probable. The observations very recently sent by the Professor of Casan, confirm in the most satisfactory manner the truth for which science is indebted to M. Arago. These observations present, in fact, a perfect coincidence between the motions observed at Paris in the magnetic needle and the auroras seen at Casan. M. Arrago remarked, that the influence exercised by the auroras seen at Casan upon the needle, which was very remarkable on account of the distance between the two places, is rendered still more so when it is considered, that there is every reason to think that Casan is not subjected to the influence of the same magnetic pole as Paris. A great number of magnetic phenomena, in fact, appear incapable of being explained by the admission of a single magnetic pole, and there is every reason to believe, that, in Siberia, there exists a particular pole, which exercises its influence upon all the neighbouring regions.

4. *Rain at Bombay.*—During a late monsoon at Bombay, we are informed there fell from 113 to 116 inches of rain.

GEOGRAPHY.

5. *M. Kupfer's Journey to Siberia.*—M. Arago lately announced to the Academy of Sciences, that M. Kupfer, the natural philosopher and mineralogist, has been directed by his government to undertake a journey to Siberia. He will be accompanied by several distinguished philosophers. A corps of troops is to accompany the travellers, who will have to traverse regions where this precaution will be necessary for their safety.

HYDROGRAPHY.

6. *Level of the Caspian.*—Mr William Monteith lately made a series of observations with Fahrenheit's thermometer in boiling-water, at different heights on the shores of the Black Sea and the Caspian Sea. At the level of the Caspian Sea, water boiled at 212° 75′: the barometer stood at 28.7‴.1,; hence the surface of the Caspian is 375 feet below the level of the sea.

ZOOLOGY.

7. ***Height of the Patagonians.***—An officer of Captain King's expedition communicated to us the following interesting notice.

Measurement of the largest Patagonian in a Tribe of about 150 *in number.*

	Feet.	Inches.
Height, - - - - - -	6	2
Circumference of the chest, - -	3	11
Do. of the loins, - - - -	3	5
Do. of the pelvis, - - - -	3	10

The limbs in this man were finely formed; but the muscles were not so strongly marked, and did not exhibit those elevations, when thrown into action, so much as in stout sailors, or other athletic Europeans, who have been accustomed to muscular exertion. There was seemingly, in the whole of them, of both sexes, a thickish layer of adipose substance under the common integuments, covering the whole of the body, which seemed to fill up the hollows of the muscles, seen so distinctly in most hard-working persons. The shortest man in their party was five feet ten inches and a half high; the generality of them appeared to be about six feet, with large bodies. The women, I thought, were larger in proportion to the men than is observed in civilised society.

8. *Hint to Practical Anatomists.*—A dead child was brought to the dissecting-room, and had already been some time in the amphitheatre, when the anatomist set about dissecting it. But at the moment of operating, he fortunately thought of inflating the lungs for a few moments. At the end of two or three minutes heat returned, the circulation began to be established, the heart beat, and presently the child revived, and was sent back to its parents. A similar event happened to an anatomist of Lyons, who communicated it to the French Academy. In reporting these cases to the Academy of Sciences, M. Julia de Fontanelle remarked how conclusive they are in favour of the advantage that might be derived from insufflation, particularly in new-born children, provided always the air be introduced into the lungs with precaution. From the accounts published of the monstrous, fearful, and hitherto unimagined murders lately perpetrated at Edinburgh, it would almost seem, that, if some of the bodies had been treated with the view of resusci-

tation, there was a chance—it is true a feeble one—of the younger and healthier individuals being restored to life. At all events, the sickening, revolting, and heart-rending scenes disclosed in the late investigations—scenes which would have struck with horror the most debased in the darkest times of unchristian Europe—ought to sharpen the attention of those connected with the business of practical anatomy. Our national character must not be stained, nor public feeling outraged, by the irregularities of any profession, however useful and important it may be.

9. *The Giraffe and Unicorn.*—M. Eduard Rüppell, who has resided during six successive years in the north-eastern regions of Africa, has lately published several numbers of a work illustrative of the natural history of these regions. To our knowledge of the Camelo-pardalis Giraffa he has added considerably. He obtained in Nubia and Kordofan five specimens, two of which were males and three females. He regards the horns as constituting the principal generic character, they being formed by distinct bones, united to the frontal and parietal bones by a very obvious suture, and having throughout the same structure with the other bones. In both sexes one of these abnormal bones is situated on each branch of the coronal suture, and the male possesses an additional one placed more anteriorly, and occupying the middle of the frontal suture. The anomalous position of this appendage furnishes a complete refutation of the theory of Camper with regard to the unicorn, that such an occurrence was contrary to nature, and proves at least the possibility of the existence of such an animal. M. Rüppell also obtained some information in Kordofan respecting this much debated animal. It was stated to be of the size of a small horse, of the slender make of the gazelle, and furnished with a long straight slender horn in the male, which was wanting in the female. According to the statements made by various persons, it inhabits the deserts to the south of Kordofan, is uncommonly fleet, and comes only occasionally to the Koldagi Heive Mountain, on the borders of Kordofan.

10. *Female Child with Two Heads.*—M. Geoffroy St Hilaire presented to the Academy of Sciences of Paris, on 25th May 1829, a drawing of a monster, which was living at Turin in the

beginning of last March, and was two months and a half old. This drawing, and the news of the event, were communicated to him by Professor Rolando and M. Jules Arthaud, a French physician. The individual represented is a girl with two heads. The lower parts alone are common to the two individuals: the rest is separated, and presents the conformation proper to the normal state. The priest, seeing in this creature two distinct individuals, baptized each of them separately: one received the name of Ritta, the other that of Christina. They were born at Sassari in Sardinia, in the beginning of March 1829. Their common size is that of a child at the full term. Ritta appeared to be suffering. The father has the intention of carrying them to Milan, whence he is to go to Geneva. There have been examples of such monsters living to a pretty advanced age. In the reign of James VI. of Scotland, and at his court, there lived a man who was double from the navel upwards. The king had him carefully brought up. He made rapid progress in music. The two heads acquired several languages: they disputed together, and the two upper halves sometimes even beat each other. In general, however, they lived on good terms. When the lower part of the body was tickled or pricked, the two individuals felt at the same time. When, on the contrary, one of the upper individuals was irritated, it alone experienced the effects. This monster lived to the age of twenty-eight. One of the bodies died several days before the other.—*(Rerum Scot. Hist. auct. G. Buchanan)*. In 1723, M. Martinez observed at Madrid a bicephalous man, who was shewn there for money. Sigebert also says that he saw a child double above and single below. The one ate, the other did not. They often fought together. One of them dying, the other scarcely survived four hours.

11. *Observations on a Human Monster belonging to a new genus.*—M. Geoffroy St Hilaire, in May 1829, read to the French Academy of Sciences a memoir on a new production of the human species, struck with monstrosity in the fourth month of intra-uterine life, and on the concurrence of circumstances which, produced the monstrosity, by disturbing a formation, which, until that period, was regular. On the 26th April last, was born, in the Rue du Fauxbourg St Martin, of a woman aged 24 years, who had no children previously, a child of regular period, and

of large size. On measuring it, from the projection of its eyes, its length was found to be twenty inches. The upper region of the cranium was wanting. The woman had been attended by Madame Fremaux, midwife, and Dr Brion, both residing in the same street. The latter has drawn up a notice, in which he has described the defects of the conformation which the child presented. M. St Hilaire remarked, that it is to him, therefore, that the observation in question belongs. At a meeting of anatomists called by Dr Brion, one of the medical men present made the most singular assertions as to the causes of the monstrosity. " The monster has large eyes," said he, " which is because the mother had her view constantly fixed on large eyes which she singularly loved. It has long and pointed ears, because the imprudent mother had her caressing hands continually upon the long ears of her dog." M. Geoffroy St Hilaire mentioned this fact, for the purpose of ridiculing the explanations which some medical men still give of cases of monstrosity. After enumerating the different kinds to which the monster in question may be referred, he shewed that it comes nearest to the *Thlipsencephali*. Now, in this monstrosity, the fœtus going on in a regular manner until about the fourth month, only deviates at a later period, and under the influence of some violent cause, from the normal organisation. Confiding in his previous researches, he did not hesitate to declare, that the mother of the new and very singular *thlipsencephalus* which was before him, had been rudely struck about the third or fourth month of gestation, and even added that it was probably by a violent kick. This explanation was utterly rejected by the medical man who had proposed the singular one mentioned above. On questioning the woman, it was in fact discovered, that, at the period of four months' gestation, she had actually been struck and severely wounded by a violent kick, which hit upon the right side of the uterine region. Dr Brion's inquiries led him to the following results:

Conception took place on the 19th June 1828;
Lesion produced by wound, 17th November 1828;
Birth accomplished on the 26th April 1829;
Total duration of gestation, 282 days.

Until the period when she was struck, that is to say, during the first four months of gestation (112 days), the mother enjoyed excellent health; but from the 17th November to the period of delivery (during the next five months) she did not cease to experience in the lower abdomen, and in the whole pelvic region, pains more or less acute, which she attributed to the brutality of which she was the victim. It was also a kick on the lower belly that had produced the organic deviations of the second species of *thlipsencephalus* observed by M. Geoffroy; but this species, as well as the first, presented smaller dimensions, the individuals to which they belong, having been only sixteen inches in length. On examining with more attention, and with the aid of dissection, the new *thlipsencephalus* which was submitted to him, he found that it differed from the first two by characters so important, that he was led to consider it as a new genus, to which he gives the name of *Nosocephalus*. Like the *thlipsencephalus*, it is the natural and almost necessary result of a violence exerted upon the organ which contains the product of conception, only at a more advanced period than that at which the deviation would lead to the production of a *thlipsencephalus*. The author concluded with some considerations respecting the theory of monsters. Recurring to the observation which formed the subject of his memoir, he remarked, that the manner it which it was possible to guess, from the inspection of a monstrous production, the cause to which the monstrosity should be referred, and the differences of deviation observed in the *nosocephalus*, which accord so well with the more advanced period at which the perturbing accident took place, leave no doubt respecting the theory of the formation of these kinds of monsters; so that at least in well defined cases, science possesses facts which may be considered as attaching themselves to principles sufficiently demonstrated to be capable of being applied to use in the practice of medicine. The theory is so perfect in this respect, that, on the inspection of certain monstrosities, it is possible to assign the month, the week, and almost the day, on which the perturbing accident has interrupted the regular order.

BOTANY.

12. *On the calcareous crystals which occur in the tissues of living vegetables.*—M. Raspail, in a late memoir, shews that the crystals of the pandani, orchides, scillæ, &c. in short, all those

which are about $\frac{1}{10}$th of a millimetre in length, and $\frac{1}{300}$dth in breadth, are hexahedral crystals of phosphate of lime; and that the crystals of the tubercles of the iris, which are $\frac{1}{3}$d of a millimetre in length, and $\frac{1}{50}$th in breadth, are rectangular crystals of oxalate of lime. It was by means of a magnifying power of from 1000 to 2000 diameters that these new researches were established. These crystals, it will be remembered, were taken for microscopic hairs, and very recently an author imagined he saw them perforated in the middle of their length, and figured them as such.

NEW PUBLICATIONS.

I. *Flora of Berwick-upon-Tweed.* By GEORGE JOHNSTON, M. D. Fellow of the Royal College of Surgeons, &c. Vol. I. Phænogamous Plants.

Although botanists have made extensive collections of the plants of Great Britain, and Floras of different kinds have made their appearance, we are still without a connected and philosophical view of the vegetation of this interesting portion of Europe. The Flora of Berwick-upon-Tweed, by Dr Johnston, a man of superior intellect, is in the usual form. It is, notwithstanding, interesting and amusing, and cannot fail to prove acceptable, not only to collectors of plants, but also to the general reader, who will find in it curious and useful information in regard to the history and uses of the plants enumerated and described by our author.

II. *Plantæ Asiaticæ Rariores; or, Descriptions and Figures of a Select Number of Unpublished East Indian Plants.* By N. WALLICH, M. D.

The work will consist of three volumes in folio, each containing one hundred plates, engraved and coloured in the best style, from the Honourable Company's drawings, made by native artists under the direction of the author, accompanied by full descriptions in Latin, with the addition of such observations in English, as may appear necessary and interesting. It will be published in twelve numbers, each containing twenty-five engravings, with the appropriate letter-press; to appear every three months. This work will at once bear evidence to the splendid patronage of the Honourable the Court of Directors of the East India Company, and to the unwearied perseverance and profound botanical knowledge of Dr Wallich; it will also shew the splendour of vegetation in our eastern dominions, and how very much remains to be done before botanists acquire, or can communicate, a knowledge of the almost endless riches of the vegetable kingdom in the eastern world. The efforts made by the Court of Directors, in exciting and supporting an inquiry into Indian botany, ought to be generally known, not only as most creditable to themselves, but as directing the expectations of the public in regard of the forthcoming work. Not only has a botanic garden of about 300 acres been long established, and liberally endowed near Calcutta—not only have the Court of Directors, with great judgment and liberality, appointed Dr Wallich for its superintendant—not only have they enabled him to perform various extensive journeys in Hindustan, Nipal, the Straits of Malacca, and in the Burman empire, defraying all his expences, and enabling him to procure drawings upon the spot, where, surrounded by a profusion of living native specimens, he was able to guard against the errors which, in other circumstances, necessarily have their origin in casual deviations from characteristic structure—not only have they done all this, but they have brought Dr Wallich to Europe, with a vast collection of dried specimens, and living plants, that his observations may be again checked by comparison with authoritative herbaria, and that a work may be given to the world equally creditable to them and to him, and eminently conducive to the interests of science. Lastly, to enable the publishers to do every justice to the execution of the plates, the Court of Directors have taken copies to the value of L. 1200, and Dr Wallich is to have no pecuniary interest whatever in the publication. Most certainly no botanical work ever was edited under circumstances better calculated to promote just expectations of splendid execution, and great scientific exactness.

The herbarium brought home by Dr Wallich contains at the least 8000 species, and the Court of Directors, with a disinterested liberality which has no parallel, have authorised the many duplicates of this noble collection to be distributed to the principal public and private herbaria in this country, on the continent of Europe, and in America. The collection of living plants and seeds, unique both as to extent and rarity, has been divided between the Royal establishment at Kew, and the garden of the Horticultural Society at Chiswick. Every considerable garden in Britain bears evidence to the success attending the exertions of the East India Company in behalf of botanical science, for there is not one of them which does not contain plants recently introduced into Britain through the garden at Calcutta. It is believed that in Chiswick garden alone, there is at this moment from one to two hundred new East Indian plants introduced in this way.

III. *The Influence of Climate in the Prevention and Cure of Chronic Diseases, &c.* By JAMES CLARK, M. D. Fellow of the Royal College of Physicians of London, &c. 1 vol. 8vo.

To the physician, natural historian, and also to the invalid labouring under diseases likely to be cured or alleviated by a change of climate, we recommend the perusal of this valuable work. The facts it contains are accurate and well arranged—the inferences from them judicious—and the practical rules stated with great clearness and precision. It is divided into two parts. The *first Part* contains an interesting account of the mild climates of the south of Europe and of England ; points out the manner in which the climate of different places resorted to by invalids is modified by local circumstances, and compares these places relatively to their influence on disease. This portion of the work shews the importance of a knowledge of natural history to the physician. Some *medical communities*, however, maintain that all natural history, with exception of a little *medical and technical botany*—the least interesting department of the beautiful science of plants—may be safely dispensed with by the student of medicine ! The *second part* gives an account of the principal diseases which are benefited by a mild climate. Dr Clark remarks,

" As I anticipated that the following work would be perused by many persons not of the profession, but who are yet deeply interested in the subject of climate, in relation to its effects on disease, I have endeavoured to express myself in as plain language as possible ; and I trust I have succeeded in making myself intelligible to the generality of readers, without at all diminishing the utility of the book to the members of my own profession. It has been my wish to lay before the public such a work as might serve at once as a manual to the physician in selecting a proper climate for his patient, and a guide to the latter, while no longer under the direction of his medical adviser. It is only those who have resided abroad, and have mixed much with that numerous class of our countrymen who travel for health, that can know how very much such a publication is wanted. I may perhaps be permitted to add, at the same time, that it is only those who have attempted such a work that can be aware of the difficulties of the task."

List of Patents granted in England from 23d January to 28th March 1829.

1829,

Jan. 23. To J. H. Caney of Aylesbury Street, Clerkenwell, for "improvements in umbrellas and parasols."

27. To J. Fraser of Limehouse, for "an improved arrangement of flues to communicate with the various parts of culinary apparatus, such as steam-boilers, ovens, hot plates, or closets, and stewing stoves."

31. To J. Braithwaite and J. Ericsson of the New Road, Fitzroy Square, for their "method of converting liquids into steam."

To Lieut. R. Parker, R. N. of Hackney, for "an improved drag or apparatus applicable to stage-coaches and other wheel-carriages, and whereby the motion may be retarded or stopped when required.

Feb. 5. To J. Rayner of King's Square, Old Street, for his "improvements in apparatus for conducting heat and applying it in washing, scouring, dressing, dyeing, and finishing woollen cloths, and in callendering, straining, &c."

To J. Pumphrey of Tally Hill, Worcestershire, for "improvements in steam-engines and machinery for propelling steam-boats."

To A. Dannios of Leman Street, Goodman's Fields, for "an invention, communicated from abroad, for the manufacture of improved hats and bonnets in imitation of Leghorn straw hats and bonnets."

To J. Burgis of Maiden Lane, Covent Sarde, for "a method of gilding woven fabrics in burnished and dead or matted gold or silver, and which fabrics may be used as gold or silver and laced borderings, &c."

To R. Green of Blackwall, for "improvements in the construction of masts."

7. To W. H. Kitchen of High Street, St Giles's, Bloomsbury, and A. Smith of York Terrace, Westminster, for "improvements in the construction of window frames, sashes or casements, shutters and doors, designed to afford security against burglars, as well as to exclude the weather."

12. To E. Head of Devonshire Street, Vauxhall Road, for "improvements in illumination, or producing artificial light."

20. To S. WALKER of Beeston, Leeds, cloth-manufacturer, for "an improved apparatus, which he denominates 'an operameter,' applicable to machinery for dressing woollen or other cloths."

Mar. 26. To W. CHURCH, Esq. of Bordesley Green, parish of Ashton, Warwickshire, for "improvements in buttons, and in the machinery for manufacturing the same."

28. To W. MADELEY of Yardley, Worcestershire, farmer, for "an apparatus for catching, detecting, and detaining depredators and trespassers, or any animal, which he denominates the Humane Snare."

List of Patents granted in Scotland, from 10*th March to* 5*th June* 1829.

1829,

Mar. 26. To JOHN UDNY of Arbour Terrace, Commercial Road, in the county of Middlesex, for "certain improvements on the Steam-engine."

30. To PHILIP DERBYSHIRE of Ely Place, Holborn, in the county of Middlesex, Esq. for an invention of "a certain medicine or embrocation, to prevent or alleviate sea-sickness, which may be usefully applied to other maladies."

May 20. To HENRY BOCK of Ludgate Hill, in the city of London, Esq. for an invention, in consequence of a communication made to him by a certain foreigner residing abroad, "of improvements on machinery and apparatus for embroidery or ornamenting cloths, stuffs, and other fabrics."

To RICHARD GREEN of Blackwall, in the county of Middlesex, shipbuilder, for a "certain improvement in the construction of made masts."

To JOSIAS LAMBERT of Liverpool Street, in the city of London, Esq. for "an improvement in the process of making iron, applicable at the smelting of the ore, and at various subsequent stages of the process, up to the completion of the rods or bars; and for the improvement of the quality of inferior iron."

To JOHN DICKEN WHITEHEAD of Oakview Mills, in the county of York, woollen manufacturer, for "certain improvements in making, constructing, or manufacturing cartridges for sporting, and other purposes."

To THOMAS TYNDALL of Birmingham, in the county of Warwick, gentleman, for an invention, in consequence of a communication made to him by a certain foreigner residing abroad, for "certain improvements in the machinery to be employed in making nails, brads, and screws."

June 5. To WILLIAM GODFREY KNELLER of Pearl Street, Spitalfields, in the county of Middlesex, chemist, for "improvements in evaporating sugar; which improvements are also applicable to other purposes."

THE

EDINBURGH NEW

PHILOSOPHICAL JOURNAL.

Biographical Memoir of M. PHILIPPE PINEL. By Baron CUVIER *.

PHILIPPE PINEL having been from childhood designed by his father for the medical profession, prepared himself for it by the early study of mathematics and natural history, and the labours of his whole life tended to introduce into the science of medicine procedures similar to those of geometry, to bring its language to the exactness of that of naturalists, and to subject diseases to accurate divisions and subdivisions, like those under which the productions of nature are arranged,—a very bold attempt, for the mathematics treat only of simple ideas, and natural history only of beings of a determinate form, while the alterations of organized bodies, the subjects of medical science, are among the most complicated, the most changeable, and the most fugitive in nature.

But M. Pinel did not shew, in the world, this daring mind: there his reserve and bashfulness were extreme, and delayed, beyond the usual term, the period when he obtained the success and ascendancy to which he was entitled. His depressed situation in early life was perhaps the cause of this diffidence.

He was born on the 20th April 1745, in the small town of St. André d'Alaysac, near Castres, where his father, being a practitioner of surgery, he received, at home, his first instruction:

* Read at the Royal Institute of France, on the 11th June 1827.

and, till he had attained the age of seventeen, he could not be sent to Toulouse to prosecute his studies. Even then, as his parents were not rich, he found himself obliged to support himself by giving lessons in mathematics, and composing theses for students in more easy circumstances, and less diligent than himself. In the thesis which he himself at that time defended in philosophy, and which treats of *the accuracy which the study of the mathematics communicates to the judgment in its application to the sciences*, is seen the first germ of the ideas which directed him in the rest of his labours. However, as the fees of graduation were pretty high, it was not until 1773, when he was nearly twenty-nine years of age, that he was able to obtain the title of Doctor. He then went to Montpellier, and settled there, hoping that he might find some practice in a city whose medical reputation drew so great a concourse of invalids from all parts of Europe. But two causes opposed his success: his timidity and want of assurance, on the one hand; and, on the other, the reputation which he had acquired as a geometrician. Being without patients, he continued to teach pupils, and at the same time made himself master of the higher parts of mathematics, with the intention of applying them to physiology. The celebrated work of Borelli, on animal mechanics, formed the chief object of his meditations. He sought to throw on it the light of modern analysis, of which he possessed all the resources. This was publicly known; and the public thought it impossible that a man so entirely engaged with abstract sciences could ever have skill in curing.

M. Pinel imagined that, in Paris, where the sciences shine with so much splendour, these prejudices would not be entertained, and removed to that city in 1777. Cousin, an able geometrician, and a member of the Academy, to whom he was recommended, tried to induce him to confine himself to mathematics, in which he thought he would be more fortunate; but M. Pinel persisted in his plan, though his first attempts in the capital were not more encouraging. He had translated Cullen's Practice of Medicine, and expected thus to form a beginning to his reputation *. An established physician was, precisely at

* In 1785, 2 vols. 8vo.

the same time, engaged in the same work, and knew so well how to get the start among the journalists, that M. Pinel's translation was not even mentioned. Various detached papers *, an edition of Baglivi †, and translations of foreign works, made for booksellers, were hardly more advantageous to him. Three times successively he presented himself at the competitions for a gratuitous admission into the Faculty; three times he failed; and, to crown these severe trials, he had the mortification to be vanquished by a man so much his inferior, that he himself had written his doctrinal thesis; but this booby had been physician of a regiment, and had acquired boldness. He spoke with ease; while the excellent Pinel, though abounding in all kinds of science, expressed himself with difficulty, and almost stammered. M. Lemounier, first physician to the king, had arrived, on the recommendation of his friend M. Desfontaines, to make him physician to the household of Mesdames the aunts of Louis XVI; but, when he presented himself, his bashfulness made him dumb; the princesses formed an erroneous opinion of him, and from this gleam of fortune too, he was obliged to withdraw. His only resource was to place himself as physician in an establishment which an individual kept for the insane; where, though the experience he acquired was afterwards the chief means of his success, the pecuniary reward he received at the time hardly kept him from want. So many attempts frustrated, ended in reducing him to a kind of melancholy; he shunned society, and perhaps would have fallen into despair, if his friend Savary, so well known from his Letters on Egypt and Greece, had not in a manner taken possession of him, and in various ways endeavoured to inspire him with some courage.

At length, in 1791, a prospect less gloomy began to open: the Royal Society of Medicine had offered a prize for an essay *on the most effectual means of treating patients whose understanding has become deranged.* M. Pinel, whom his situation had enabled closely to observe insanity, and who had observed

* In 1780, he gave several medical articles to the Journal de Paris. At a later period, he took a principal part in the editing of the Gazette de Santé; he translated the medical and physiological part of the Abridgment of the Philosophical Transactions.

† Baglivi opera omnia medico-practica, novam editionem innumeris purgatam, notis illustravit et præfectus est Ph. Pinel. Paris, 1788.

it not less as a philosopher than as a physician, wrote on the subject. This time his work spoke for him, and he obtained the prize *. The physician Thouret, who had been one of his judges, and was also one of the administrators of hospitals, represented him to his colleagues as worthy of being called to put in practice, in a public establishment, the sound and novel views which he had disclosed in his essay, and, at the beginning of 1792, procured for him the office of physician to the Bicêtre. In 1794, he had him transferred to La Salpêtrière, and the following year, when Thouret was commissioned, along with Fourcroy, to organize the school of medicine, Pinel was one of the professors whom he nominated.

Henceforward the progress of M. Pinel was as rapid as his former endeavours had been vain †. Applying, on a great scale, his talent for observation and analysis, and giving in his lectures, with an unusual degree of method, the results of the observations which he had made in the hospitals, he soon drew a crowded audience. His numerous pupils did for him what his bashfulness had hindered him from doing for himself; and now having, with singular rapidity, from being a man of science who had been left to the seclusion of his chamber, become one of the most esteemed physicians of the capital, he might have remarked, that, if it may be said, with the proverb, *the value of a situation is that of the man who fills it*, it is not less true, that, in a thousand instances, the situation is necessary to shew the value of the man by whom it is obtained.

The popularity of M. Pinel among young men arose from the same cause as that of all the most celebrated pathologists; from the hope he had conceived of the simplification of the theory of the most difficult of all the arts; of seeing it even assume the forms of a regular science, by being reduced to fixed principles, logically drawn from more elementary sciences, or from the approximation of the facts that are peculiarly its own.

The project of assimilating medicine to natural history, was

* It was not published, but he introduced its principles into his treatises on Mania and Mental Alienation.

† He was at first conjoined in the chair of Hygiène, of which M. Hallé was chief professor. On the death of Doublet, he obtained his removal to the chair of Pathology.

what the new professor especially announced, and with this view he first endeavoured to form a precise language for the descriptions of diseases, modelled on that which Linnæus had introduced into botany. He even carried his imitation so far as to suppress the verbs in his French sentences, as they are in the characteristic Latin phrases used in natural history. He supposed that each disease, like each plant or animal, forms a characterized species; and, in fact, adopting, in this respect, the doctrines of the ancients, M. Pinel saw in each of our maladies an attack, a development, periods, and a regular termination, as each organized being has its birth, its growth, fixed periods for each of the functions which it has to perform, and an inevitable end: He imagined that, if the ordinary succession of symptoms be often changed, it is not owing to the disease changing either its species or its nature; but to its being variously complicated with diseases of other species, which may themselves be supercomplicated or become predominant, and thus, as it were, make the original disease disappear. But so long as the complications remain secondary, they form in nosology what varieties are in natural history. It is to this progress of each disease, to the whole of the phenomena in succession, that the physician ought to attend, and not to the momentary symptoms, which in general give only fallacious indications. He ought, above all, to use every endeavour to distinguish the complications, to ascertain the effect of each of them, and thus, in some measure, to decompose the disease into its elements. This decomposition is what M. Pinel named the application of analysis to medicine; and at a period when the doctrines of Condillac were not less predominant in philosophy than those of Linnæus in natural history, this announcement was alone sufficient to ensure to his book a favourable reception *.

All further explanation, and even the most of inquiries into proximate causes, seemed to him vain in the present state of physiology. He rejected especially those alterations in the blood and humours, and all those other suppositions which have varied in each succeeding age with the ideas that have been formed

* Nosographie Philosophique, ou Methode de l'Analyze appliqué à la Medicine. Paris, 1798. 2 vols. The fifth edition was published in 1813, 3 vols. 8vo.

of the physical and chemical properties of inanimate matter, but which have never, in any age, added to the history, and still less to the pathology, of living bodies, any thing but chimerical applications. It is to M. Pinel that we are chiefly indebted for having driven them from our schools; and, had he no other merit, science would be under the greatest obligations to him for this service alone. The physician, in a word, according to him, ought, without forming systems about causes, to observe and describe a disease, as a naturalist describes a plant or an insect, who does not lose himself in researches into the mechanism of its functions, too much beyond what we yet know of organisation. It was for this reason that he preferred the title of *Nosography*, or Description of Diseases, to that of *Nosology*, which, before his time, was employed for works of the same kind, and which indicates a theory of diseases, and a more intimate knowledge of their nature.

But the naturalist distributes plants and animals in a certain order. He arranges their species under certain genera, as the only means of recognising them amid so great a multitude of different beings. In this, also, according to M. Pinel, the physician may imitate him.

The principle once admitted, that each disease has its regular course, it is the series of its phenomena that constitutes its species, and the phenomena common to several diseases form the links by which they may be united into groups, ranged under each other. Different ways even may be taken, as in natural history; either the most evident phenomena may be attended to; and thus, what is called an artificial method, may be formed; or the intimate nature of diseases may be more closely investigated, attention being also paid to their situation, and to the particular kind of alterations which they produce in the tissues, or in the functions of the organised body, and thus their distribution would be assimilated to what in botany and zoology are called natural methods. But, at the time when M. Pinel began his researches, the differences of these two methods in natural history, and the advantages or inconveniences peculiar to each, were not yet fully appreciated, and he could not avail himself of the results on this subject, which the great naturalists of our day have since obtained. Linnæus was the only model whom he could follow; and it may be said, that, like him, he created a mixed method, in which some divisions have a natural basis, while the greater number are founded only on those relations which are named artificial, that is to say, on phenomena selected by preference among the most evident, and not among the most essential.

Thus, of his five great divisions of fevers, the first, that which he names essential fevers, depends only on the symptoms. The author even supposes that these fevers do not spring from a source which is incapable of being made apparent. The second division, or that of the phlegmasiæ, is, on the other hand, characterized, whether as a class or in its subdivisions, from the inflammation, which is the original cause of the fever, and from the part where it shews itself. The same variation is observed, if not in the characters, at least in the denominations of the orders and genera of his first division, that of essential fevers. Some, as the *adynamic*, or putrid fevers, and the *ataxic*, or malignant, are named according to their symptoms; others, as the *meningo-gastric*, or bilious fevers, and the *adeno-meningeal*, or mucous fevers, according to the organs which they chiefly affect. His fifth class of diseases, which is that of organic lesions, includes several infirmities, such as syphilis and scurvy, in which, at least, any original lesion has not, by any means, been demonstrated.

Still it must be allowed, that if M. Pinel did not attain a perfect method, which in medicine, still more than in natural history, properly so called, would seem to be the philosopher's stone, he had yet the merit of introducing into his distribution a much greater degree of order than any of those before him, who had engaged in a similar attempt. He had even ideas which have produced useful results, whether in his own hands, or in those of his pupils; thus, in the arrangement of fevers, he assigned only a secondary rank to the phenomena of intermittence, remittence, or continuity, which Sauvages, and other nosologists, had placed first, and had thus been induced to separate from each other affections similar in their nature.

The finest part of his classification is that of inflammations, according to the tissues which they affect, and especially the distinction which he established, more firmly than any of his predecessors, between inflammation of the membranes called mucous, which line those of our cavities that communicate with the surface, as the inner coat of the intestines, and that of the trachea and bronchia, and the inflammations of the transparent or serous membranes which line the closed cavities, such as the pericardium, which envelopes the heart, the pleura, which covers the interior of the chest, and the peritoneum, which lines the abdomen, and embraces the intestines in its folds.

Bichat informs us, that it was this distinction that induced him to engage in the beautiful researches which compose his Treatise on the Membranes, the first work of that celebrated physiologist, and that of which his General Anatomy is in some measure only a development. Amidst these testimonies which we bear to the services rendered by M. Pinel, it would be a great omission to forget that of having excited the genius of such a pupil.

These were the principal bases of the *Nosographie* of Pinel. The author did not, as has been supposed, admit occult cases or metaphysical affections, if we may so speak; he by no means contended that diseases have not a marked situation and an internal cause; but he kept out of view that cause, and often even the seat of the disease, because he thought the determination of them beyond our reach, and he limited himself to the history of the disorders which diseases produce, and to the kind of order to which these very disorders themselves, in their succession, are still subjected.

From this manner of regarding diseases, it is easy to understand what was his method of treatment *. It was, in general, that named the Expectant Method, consisting in the observation of the progress of a disease, and in aiding the internal movement by which those conservative powers, that are indispensable to the continuance of organization, seem to desire to oppose it, but in refraining from any imprudent interposition in this kind of struggle, in which, too often, the physician does not know whether he be helping nature, or whether, in his blindness, he

* *La Medicine Clinique*, &c. Clinical Medicine rendered more precise and accurate by the application of Analysis; or a Collection of Observations on Acute Diseases, made at the Salpêtrière. 1 vol. 8vo. 1802. The 3d edition was published in 1815.

be seconding the disease. Without doubt, on these principles, the object of a physician is less to administer salutary remedies than to prevent the taking of those that are hurtful; and the vulgar commonly expect from him more. It seems to them, that studies carried on for so many ages, under so many circumstances, by so many persons, and which end in only teaching us coolly to view the progress of a disease, and to class its species in our systems, are efforts of mind to which their results are by no means proportionate. We can hardly find fault with those complaints, or refrain from hoping that, should we be able to ascend to the origin of causes, it might be possible to oppose at once to each disease some obstacle of a contrary nature. We can hardly, therefore, avoid the fear, that, by thus attending to these nosographical descriptions, we shall always remain at a great distance from the true end of the medical art, which, after all, is to give relief. But, on the other hand, are we not obliged to confess, that, even to the present day, all theories have been overturned by each other? The coctions and the humours, the strictum and the laxum, the fermentations of the acids and alkalies; the action of the rational soul, which seeks to preserve the body without being perceived by it, and which is so often thwarted in its anxiety; the vital principle, that other kind of soul, which is neither material nor spiritual, and on which is laid all that cannot otherwise be explained, have successively moved off to the region of chimeras. Will those ingenious systems be more fortunate that have been invented by some physicians of our own day, the results of a new physiology, founded on a single principle, and combined with so much ingenuity? Time will soon shew, but what it will teach us it is not in our power to foresee.

It had long been proposed to determine the efficacy of each method, by tables, establishing, in numbers, the degree of probability of success, whether by the various treatments, or by having no treatment at all. This idea would naturally be seized by a geometer, who had become a physician; and, in fact, it strongly engaged M. Pinel's attention. In particular, he made a happy application of it to the diseases of the mind, the class of infirmities that had attracted his earliest notice, and which, more strongly than any others, attest the wretchedness of man. The two hospitals in which he was successively employed, exhibited to him those maladies, in all their varieties, and in all their changes. He framed tables in which their predominant and occasional causes, the series of their phenomena, according to age and sex, and their various terminations, were carefully stated; and from these tables he derived the most valuable results. The chief was the certainty that, in many cases, mania is a transitory disease, which cures itself like fever, if it be not disturbed in its progress; whence it was easy to perceive the necessity of instantly reforming the barbarous methods which, till that time, had been employed against it. It seemed, in fact, that, on this point, medicine had continued stationary since the twelfth century. In many hospitals, the physicians had disdained the treatment of maniacs, and had left it to monks, charitable no doubt, but uninformed, and obstinately attached, like all men of their class, to what their society had formerly practised. From the first attack, the unfortunate patients were tormented by cruel modes of treatment, which aggravated the evil. If the mental alienation was prolonged, chains, dungeons, and the most frightful usage, ended in rendering it incurable. One might have said that so many criminals were delivered over beforehand to the punishments of hell, and yet this darkened and enfeebled reason is scarcely ever altogether extinguished; the insane have not always lost the sense of justice, nor that of kindness. These cruelties, which they have not deserved, exasperate them: they see in them only an unwarrantable abuse of power, and too often the mistrust and hatred with which they are inspired are the greatest obstacles to their cure. Wherever M. Pinel had any influence, he abolished these violent measures; patients enjoyed all the liberty compatible with the safety of those about them. Endeavours were made to learn the moral cause of the disease, and to oppose it by means of the same nature. More frequent cures were soon obtained, and when the disease could not be overcome, the barbarity at least was discontinued of treating harmless men like ferocious beasts. The different kinds of alienation were separated, cleanliness and order every where prevailed; in many cells quietness succeeded to fury; the unhappy victims found rest, and even moments of enjoyment. It has often happened that strangers have gone through almost the whole apartments of La Salpêtrière reserved for cases of mental alienation, and still asked if they were soon to be taken there, so tranquil are the patients, so much engaged in their ordinary occupations, walking about singly or together; in a word so much does their life there resemble that of rational creatures.

The history which M. Pinel has given of so many unfortunate beings *, is not only an important medical book, but a first rate work in philosophy, and even in morals. Nowhere can the irresistible influence of the organs on the faculties be better learnt; but a still more useful knowledge that may be derived from it, is that of the influence of the passions on the organs. In his treatise, we see that more than half of the cases of alienation take their rise in passions, which an enlightened reason has not kept within just bounds; that madness is but the passions themselves carried to a monstrous excess, and that even in most of the alienations which are supposed to be attributable to physical causes, it is not certain whether these causes had not merely developed a disposition generated by former passions and feelings.

In the Academy, M. Pinel belonged not to the medical section, but to that of anatomy and zoology. Too desirous of having him, to wait till a place should become vacant in the first of these sections, the society found him sufficiently entitled to the second, as the writer of his essays on the Mechanism of Animals, and elected him as a zoologist, when, in 1783, one of the members of that section was raised to the situation of perpetual secretary. His publications on these subjects, though not numerous, evidently shew that he would have taken great interest in zoological investigations, had he not been obliged to relinquish them, when he devoted himself entirely to the teaching of medicine. In a memoir on the Zygomatic Arch †, he shewed that its curvature upwards is so much the stronger the firmer the support it has to afford to the muscles that close the jaws. This is what takes place in carnivorous animals. The herbivora have it nearly straight, and sometimes in the glires it is bent downwards.

* Traité Medicale, &c. Medical and Philosophical Treatise on Mental Alienation or Mania, one vol. 8vo. 1800. The second edition was published in 1809.

† Journal de Physique, t. xli. p. 401.

Another memoir explains the mechanism, by which lions and other animals of the cat tribe, without fatigue, keep their claws raised, when they do not need to use them. In a third memoir *, he endeavours to account for the extraordinary form of the head of the elephant, and especially for the double convexity of its occiput, the object of which is to furnish more extensive attachments to the muscles destined to support the head, clumsy enough of itself, and made still more so by the proboscis and tusks peculiar to that animal. He also wrote several papers on the mechanism of the different luxations †.

It would seem that these are the only remains of his first labours, and that he did not even preserve in manuscript any sketch of the plan, which, without doubt, he had formed. His capacious and geometrical head did not need this resource. The whole of science was there strongly imprinted, and he detached at will these kinds of fragments, as if to shew the extent of his powers.

Who would have thought that an understanding so enlarged, and faculties so perfect, were themselves destined to furnish an example of the weakness of our nature? It is but too true, that towards the end of his life, M. Pinel felt the gradual approach of a state which he had often found to be incurable. He saw that his duty was thenceforth to live in repose, and await with resignation the moment when his physical existence would share the fate of his intellect. His life, though from that time less valuable to himself and to the public, was still dear to those by whom he had been beloved. It was now only a recollection, but it was the recollection of a fine genius and a worthy man. Their tender and respectful cares smoothed, as much as it was possible, his mournful transition. He quietly fell asleep on the 25th October 1826, at the age of eighty-one years.

His place in the Faculty had been disposed of on the new organisation which took place in 1823. That which he occupied in the Academy was given to M. Frederick Cuvier.

* Journel de Physique, t. xliii. p. 47.

† Journal de Physique, t. xxxiii. p. 12; t. xxxiv. p. 350; t. xxxv. p. 457.

On the Ergot in Maize, and its Effects on Man and Animals. By M. Roulin *.

It has long been known that rye, affected with the ergot, when taken as food, gives rise to convulsive and gangrenous diseases. It is also known, that, when properly administered, it exercises a particular action upon the uterus; and its efficacy, as a medicine, seems now sufficiently proved. It was supposed from analogy, that the ergot developed similar properties in all the gramineæ which it attacks, but hitherto the accuracy of this supposition has not been proved by any direct experiment.

During a residence in America, M. Roulin had occasion to observe the ergot upon a cereal plant which has never been attacked by it in Europe, the *Maize*, which, in all the warm parts of Columbia, forms a principal article of food to the lower classes. The symptoms much resembled, in some respects, those produced by rye in the same state, but in others differed materially.

In Columbia, maize, thus altered, is called *Maïs peladero*, that is, maize which causes the hair to fall off. In fact, it produces this effect, which is so much the more remarkable in a country where baldness is almost unknown even in old persons. Sometimes, also, but more rarely, it causes looseness and falling out of the teeth; but the author never saw it produce gangrene of the limbs, or convulsive diseases.

The accidents produced by maize affected with the ergot, appear, therefore, in Columbia less terrible, than those which, in our climates, result from rye in the same state. May this difference depend upon the circumstance that the American peasants, who, in many cases, use the banana in place of bread, make but a very limited use of maize? Should the cause be sought for in the difference of composition of the two kinds of grain, maize not containing gluten, a substance highly putrescible? This the author does not decide.

In *hogs*, which make use of the spoiled maize, the hair is

* M. E. Roulin's Memoir was lately read to the French Academy of Sciences, but is not yet published.

seen in a few days to fall off; and, at a later period, the hind legs of the animal waste, and are hardly able to support it. M. Roulin had no opportunity of observing the further effects that might result in this animal, from the prolonged use of maize in this state, for the moment it began to waste, it was killed for the sake of its flesh. He never heard that the use of this food was followed by accidents.

Mules make no difficulty in eating maize affected with the ergot, the use of which, however, produces in them depilation, swelling of the feet, and sometimes the casting of the hoofs.

Poultry which eat of it pretty frequently lay eggs without shell. According to M. Roulin, this circumstance, which at first appears so singular, is to be explained, by conceiving that the ergot excites contractions in the organs destined for the expulsion of the egg, which drive it from the oviduct, before it has had time to be invested with its earthy envelope.

On this subject M. Roulin announced his opinion respecting the possibility of abortions being produced in women, by the use of rye affected with the ergot. Without doubt, the dose necessary for determining the expulsion of the fetus, would require to be greater when the woman was not near her term; but it would seem that the criminal abuse which might be made of this substance cannot be denied. "If it had not been observed," said he, "that the use of infected rye, mixed with the food, produced premature delivery, one does not see what could have led people to administer it, for the purpose of hastening labour at the full term."

It is known that infected rye never acts more powerfully than when newly gathered. This is also the case with infected maize, only with this difference, that the poison seems more active before the seed has acquired its full maturity.

Maize, from the period when it begins to enter into the ear, to the time when it is cut down, is surrounded by numerous enemies. Beasts and birds are equally fond of it, and it is only the most active watching that can keep them off. When the crop is spoiled by the ergot, there is commonly a relaxation in this fatiguing guardianship. The animals then gorge themselves day and night with this bad grain, which acts upon them with frightful rapidity. It is not rare to see monkeys and parrots fall as if inebriated in the midst of the field, without the power of ever rising again. Wild-dogs and deer, which are equally fond of maize, but which only come to feed upon it in the night, sometimes experience the same fate: in the morning they are found in the thickets about the plantation, and the flight of the gamurros points out the place where they have crept to die.

After what has been said above, could it be believed that a substance capable of causing death so suddenly could in a short time lose its deleterious qualities, and become susceptible of being used as food? Yet this is what seems to be proved by a concurrence of disinterested testimonies. Many credible persons have assured the author, that when the *Mais peladero* has passed the *Paramos*, high mountains covered with perpetual snow, it is found destitute of all noxious quality. This at least is certain, that it is frequently carried to the villages of the Cordillera, situated on the opposite declivity, and is there purchased by men who are ignorant of the danger which it would have caused them in the place where it grew.

Might not this fact account, in a certain degree, for the differences which are observed in the action of infected rye, when it is employed as a medicine? It would be interesting to determine, whether the grain, which is found to be without efficacy, may not have been exposed in some magazines not well secured against the colds of winter; while that which still acts with energy may have been kept in a place the temperature of which is subject to little variation, in a cellar, or in an apartment constantly heated.

On Hibernation, and the Action of Cold upon Animals.

On the 15th June 1828, M. Flourens read to the French Academy of Sciences, a Memoir *On some Effects of the Action of Cold upon Animals**. The author commenced with general remarks on the influence of the unequal distribution of heat upon the economy of the world. It is it that determines the dif-

* The Memoir, of which the above is a condensed view, is not yet published.

ferences of climate, upon it the seasons depend, and from it the climates and seasons derive the infinite variety of vegetable and animal productions, by which they are characterized and distinguished. It is not only in determining the general distribution of beings upon the surface of the globe that cold acts; it also acts upon each organ, and upon each function; it has even a special or proper effect upon each of these organs and functions.

One of the most singular effects of cold is *hibernation.* This name is given in natural history, to the state of torpidity and lethargy in which some mammifera of our climates, the marmots, for example, pass nearly the whole of the cold season. Let one figure to himself animals, cold, insensible, incapable of motion, rolled up in the form of a ball, passing three or four months together without eating, drinking, or breathing, and with their circulation almost stopped. Let it then be remarked that these animals, subject to hibernation, differ in scarcely any thing from other animals very nearly allied to them, which are not subject to it; that beside the dormouse, the lerot, the muscardine, &c. for example, which hibernate, we find the rat, the mouse, the squirrel, and twenty other animals of the same family, which do not hibernate; that, on the other hand, the hibernating animals are, as it were, dispersed, and vaguely distributed among families the most unlike each other; in those of the insectivora, as the hedgehog, the bat, &c.; in that of the glires, as the dormouse, the hamster, the marmot, &c. Lastly, Let it be remembered that, if in our climates it is during winter that all these animals experience their lethargy, under the torrid zone, which also has its sleeping animal, the *taurec,* it is, on the contrary, during the period of the greatest heats, that this animal becomes torpid; and, after all this, one would still have but a very feeble idea of all the curious details, and unusual effects, and almost inexplicable difficulties, which this astonishing phenomenon presents.

The author then gave an idea of the inquiries made with respect to hibernation, whether with the view of determining the phenomena connected with it, or with that of explaining them. The ancients scarcely did any thing with reference to it. Pallas and Spallanzani were the first who applied the method of observation and experiment to the examination of hibernation; but it was especially towards the commencement of the present century, that important researches were made into this phenomenon, in consequence of the recommendation of the Academy of Sciences. M. Flourens cited in Germany the works of MM. Herold and Raffin; in Italy, that of M. Mangili; in France, those of MM. Saissy, Prunelle, &c. M. Flourens' own experiments form a supplement to those of these able observers.

They were made in France, and on the *Lerot*, a small animal of the dormouse family. The author began with briefly describing the entire state of the torpid animal, and the conditions of its resuscitation, two circumstances respecting which the observers who preceded him left little to be desired. During the lethargy, the animal has an orbicular and regularly bent position, the muzzle applied against the belly, the hind-feet carried forwards, the fore-feet placed against the breast, the ears lying upon the sides of the head, the eyes firmly closed, the whole body drawn together in a lump, and the tail rolled all round the body. A slight excitement does not waken the animal, but a powerful one does. The phenomenon of hibernation presents two distinct degrees of lethargy. In the one, the *imperfect lethargy*, the respiration is suspended, and renewed by turns, every three, four or five minutes, for example. In the other, the *perfect lethargy*, respiration entirely ceases. M. Flourens has often seen this cessation last for whole hours.

After the example of Spallanzani, he submitted several torpid animals to the action of various mephitic gases, and the results at which he arrived agree with those of his illustrious predecessor, inasmuch as they place beyond doubt the total suspension of respiration in the *perfect lethargy*. In this kind of lethargy the circulation is suspended as well as the respiration. At first there is no beating in the arteries of the limbs. If a vein or an artery is opened, either no blood at all issues, or it comes slowly, of a dark colour, and in drops. If the heart be touched, it is only found to offer some obscure and rare motions.

The temperature of hibernating animals, which, like that of others, is in their ordinary state at 38 centigrade degrees (100° Fahr.), descends in the lethargic state to 5, 4, and even 3 degrees.

The author then spoke of the external circumstances which induce torpidity. Cold, at least in our climates, is the first condition, to which is to be joined the deficiency of excitement on the part of the external agents. It has been said that light prevents torpidity, and the same has been said of food. The experiments made by M. Flourens have demonstrated to him that the influence of these two causes (at least in the lerot) is either null, or very limited.

I come now, continued the author, to the internal or organic conditions. It will be perceived of how much importance it is first to determine upon what organ or what organic modification lethargy depends, and, in the second place, what is the mechanism of this phenomenon. Now, on these two points, science possesses as yet nothing but conjectures; and, with respect to the first, there is scarcely any organ to which these conjectures have not been directed. But the two organs which have figured most in this respect, are the brain and the thymus gland: the brain, to which physiologists have long been in the habit of referring all that they could not otherwise explain; and the thymus, a glandular body, situated on the fore part of the body, penetrating into the thorax, and on which the mode of its development seemed to confer peculiar rights to perform the chief part in torpidity. In fact, this organ is in the highest degree of development at the moment when the animal becomes lethargic, it shrivels at the period of its awakening; and, in the other mammifera, it disappears almost entirely in adult age, and is only developed in the fœtus, whose state in the uterus approaches in many respects to that of the lethargic animal.

These two conjectures required to be subjected to experiment, especially at the present day, when the experimental method has already localized so many other phenomena, and when, to speak here only of my own experiments on the brain, it has succeeded in determining in it a distinct organ for the sensations, an organ for the locomotory motions, and an organ for the motion of preservation; and when it has even found a point in it, scarcely a few lines in extent, to which it is sufficient that any given part be attached to enable it to live, from which if it be detached it dies, and which thus constitutes the central and vital point of the economy.

The carotids having been laid bare in a lethargic lerot, and by an operation which might have been supposed to be painful, but which the animal scarcely felt, I found that they did not beat, even after the operation, more than nine or ten times in a minute. Some time after, the animal tending more and more to awake, and the respiration to recommence, they beat twenty, then thirty, then forty-five, then a hundred, and lastly a hundred and ten pulsations in the minute, when the respiration was perfectly re-established.

Having then subjected this lerot to the action of cold, I saw its respiration gradually weaken, and its carotids beat at first only a hundred, then sixty-five, then fifty, then forty-seven, then thirty, then twenty, and, lastly, eight or nine pulsations still in the minute, when the respiration again entirely ceased, and the animal became perfectly torpid.

It was thought curious to see if the artificial suspension of respiration might not induce a result similar to that which lethargy had just produced. Respiration was therefore artificially suspended in a lerot, in its ordinary state. The blood of the carotids presently became black, and the pulsations diminished in number. In four minutes they were only thirty-two. Half an hour later they ceased; the heart alone beat eight or nine times in the minute, which was precisely the number I found it to beat in the former animal when in perfect torpidity. By suspending the respiration, in this experiment, I had reproduced the state of the circulation in the lethargic condition itself; for, with the state of the circulation, that of the rest of the economy always corresponds.

Respiration was then successively suspended in different lerots, more and more intensely torpified, and I observed the following results. In all of them, the circulation survived the respiration a certain time; in all of them, this time was so much the longer the deeper the torpidity was, and the temperature fitted for the lethargic state. At length I succeeded, by alternately interrupting and continuing the suspension of the respiration, in rendering the animal lethargic, under degrees of cold less than those which would have been requisite to produce that effect were the respiration free. Every thing, therefore, shews that *it is by the respiration, and by means of modifications which it impresses upon the function, that cold acts in lethargy.*

I now pass, continued M. Flourens, to another order of experiments; and to the curious results which have just been seen, I hasten to add some results more immediately useful. Here the author made reference to his experiments on the influence which cold exercises upon some animals, particularly on birds. It is well known that M. Flourens has drawn from these experiments this inference, that the *exposure to a prolonged cold is the most powerful of the causes which may induce pulmonary consumption,* and that, on the contrary, living in a warm place is so powerful a remedy against that disease, that it is of itself sufficient to cure it in all cases where the evil has not reached its highest degree. The author, in mentioning this important result, obtained by his experiments on animals, insisted on the advantage that might be derived, with reference to human pathology, from the observation of the diseases of animals. In animals, the various diseases observed in man might be excited and developed, and in them might be studied, in all their phases, and in all their forms, under the action of the most diversified medicines.

Buffon has said, that, *if no animals existed, the nature of man would be still more incomprehensible.* This is especially true of the nature of his diseases; and it would be worthy of a nation which has given the first example of so many other useful institutions, to give also that of a truly experimental study of the evils which afflict humanity, and realize the view of the great Baglivi, who, so early as the seventeenth century, demanded establishments, in which the diseases of animals might be studied, with the view of throwing light upon, and improving, the study of human diseases. Baglivi added, that from such establishments alone a rapid and continued progress could be ensured to science.

To form an idea of all that medicine might one day owe to experiments on animals, we have only to consider what physiology already owes to it. Is it not from the experiments of Harvey, Hunter, Haller, Reaumur, Spallanzani and Bichat, that there have resulted the not less wonderful than unexpected discoveries of the circulation of the blood, the course of the lymph, the property which the nerves possess of transmitting sensibility, the property which the muscles have of contracting, the action of the gastric juice in digestion, the opposite qualities of the red and black blood, &c. ? " I speak not of the twenty discoveries made in our own day ; it is well known that a discovery, before it can be admitted, must be of old date, and, as father Malebranche said, must have a venerable beard."

There is every reason to hope, said M. Flourens in concluding, that the ideas which I have just thrown out with respect to the improvement which human medicine may expect from experiments made on animals, will not be despised in our days ; for no person is now ignorant that every thing is connected in the animal economy, the diseases, the functions and the organs, that we can only act upon the diseases by the functions, on the functions only by the organs, and that thus therapeutics is founded upon physiology, and physiology upon the economy.

General Observations on Univalves. By Charles Collier, Esq. Staff-Surgeon at Ceylon. Communicated by Sir James Macgrigor, Director-General of the Army Medical Board, F. R. S., &c. &c.

It was my intention, at one time, to propose an arrangement and a nomenclature of shells, founded rather on the features and structure of the inclosed mollusca, than on the shells themselves. The difficulties to be encountered in the execution of such a design are, however, too many and too great to render it conducive to any useful result, or availing for the furtherance of general knowledge. Many mollusca, alike in form and structure, inhabit shells so essentially different in character, as to render the union of the two modes of distinction impossible. Besides, it deserves consideration, even if this union could be effected, that Conchology will always be studied by many who take no interest in the comparative structure of animals, and who could derive little advantage from the knowledge of shells, were it necessary to be acquired with the anatomy of the inhabitant.

Subjoined are a few facts derived from my own research, which seem to authorise the separation of the shell as an object of Natural History, from its occupant. It may be observed, *in limine*, that all the animals, excepting the *tubiform*, are fixed by muscular attachment, and cannot of course quit the shell. What has been reported of the *cowrie* and others, in opposition to this, is fabulous *.

The *mantle* has been represented by some authors as displaying the designs and colours of the shell; but a much greater resemblance has been attributed than is warranted by facts. It does, indeed, occasionally represent the exterior, but in a faint degree; and not unfrequently it has no resemblance at all. In general, it is pale, excepting at the edge, or *fringe*, which is sometimes spotted, sometimes uniformly coloured. The *Cypræa mauritania*, and *C. exanthema*, are instances of the first of these cases. In the former shell, the edge of the mantle is of a dark hue, the latter has scattered yellowish spots; and such, it may be worth noting, is sometimes the case with the *Argus* †, and sometimes not. The *Bulla Ovum*, and *Cypræa Talpa*, are instances of the second case. In the former shell, it is black, with white points of a granular appearance; in the latter greyish, and raised here and there, as in the spotted shells. All the families present instances of this latter case.

The *operculum* is affixed to the foot. It varies in strength, form, and point of attachment; being thick, firm, leathery, pyriform, affixed to the summit, and closing more or less completely the aperture, in the species of *Strombus*, *Murex* ‡ (excepting the fusiform), and in *Buccinum spiratum* and *patulum*; thin, flexible, horny, circular, plane or concave, in the species of *Trochus*, the fusiform shells of all genera, in *Turbo delphinus*,

* This remark is applicable to the *Bulla ampulla*, although its connexion, like that of the operculum in the *Aplysia*, is by a duplication of the skin embracing the pillar. It may be observed here, that this animal is, by its structure, a species of the Aplysia, and consequently differs from all other mollusca with testaceous coverings.

† A circumstance caused perhaps by difference of age or season.

‡ It may be observed here, before proceeding further with the features, that the *Bulla Terebellum*, and a species of *Conus* (the *Figulinus*, I believe), are inhabited by mollusca the same in form and structure as those within the shells which belong strictly to the genus Strombus. It will be unnecessary, therefore, when alluding to this family, to repeat, that such appearances belong also to these species.

and many of the *Helices* and *Neritæ;* thin and flexible, but narrow, short, and attached to the posterior parts, in the species of *Conus*, and some species of *Buccinum* (as *B. vibex*, *B. Cassis*); rocky and convex in some *Turbines;* irregular in *Serpula lumbricalis.*

The operculum is not found in the genera *Cypræa*, *Voluta Haliotis*, *Patella*, nor in certain species of other genera such as *Bulla Ovum*, *B. ampulla*, *B. Ficus; Buccinum Harpa*, and its varieties, *B. Dolium ;* nor in *Serpula aquaria* *.

That muscular mass which serves for the support and protection of the more important organs of the animal, for motion, and for changing the possition of the shell, is denominated by naturalists, without reference to the literal signification, the *foot.*

It contains the mouth, brain, œsophagus, and auxiliary glands, and is the part by which the animal attaches itself, as with a sucker, to other objects, or creeps along by its muscular contractions. In the *Strombus*, the extremity of the operculum is a *point d'appui*, from whence the shell is jerked forward on the smaller foot, or thrown over upon its aperture. In the *Murex*, the shell is whirled round upon its back, as upon a pivot, with the aid of the operculum; or when its aperture is placed downwards, the animal creeps slowly forwards, by means of the sucker only.

It is of a circular or oval form, and exterior to the operculum in the genera *Murex*, *Turbo*, *Helix*, *Nerita;* in some *Buccina* (as *B. patulum* and *spiratum;)* and all fusiform shells, including *Trochi.* It is double, by a process, serving for adhesion, coming off from that which bears the operculum, in *Strombus;* oblong or oval, in *Conus*, and in *Buccinum Vibex* and *Cassis.*

* The assertion extends only so far, of course, as my opportunity of knowing. I have never seen one species of the *Argonauta*, *Nautilus* or *Dentalium*, with the animal in it, nor several of the other genera, as *Bulla Zebra* and *Volva; Voluta Glans*, *Papalis*, and *Auris-midæ; Turbo anguis* and *Scalaris; Trochus zizyphinus* and *dolabratus; Helix columna;* nor many *Neritæ.* It may also be observed here, that most fusiform species of all families, (for example, *Buccinum strigilatum; Strombus palustris*, *Trochus Turritus*, *Turbo terebra* and *exoletus)*, are connected by structure, and therefore often differ from those with which they are associated by the form of the shell. *Buccinum maculatum*, however, is somewhat like *B. Vibex.*

In the genus *Cypræa* and in *Bulla Ovum*, the foot is like that of the *Coni ;* in *Bulla Ficus* and *Buccinum Dolium*, more circular; in *Bulla ampulla*, the genus *Voluta*, and in *Buccinum Harpa* and its varieties, it is extended anteriorly and posteriorly beyond the shell; in *Haliotis* and *Patella* flat, and of the dimensions of the disk; in *Serpula aquaria*, a thick white mass, against the summit of the shell.

The colour of this part also varies; blackish red in the *Murices* generally, green in *Strombus*, and some species of *Trochus*, black in *Bulla Ovum*, deep red with faint designs, like those of the shell, in *Conus Tulipa*, *Marmoreus*, and its varieties; spotted in *Buccinum Harpa*, bright yellow in *B. Cassis*, mottled in *Oliva*, and deep brown from spots in some species of *Voluta*.

The *tentacula* *, on which the eyes are borne, cannot be designated by any general term employed for those processes or the palpi in entomology. The most common form is tapering, from a quarter to half an inch in length, with the eye in the middle, and disproportionately thicker on the lower portion. In the *Strombi* the eyes are on the summits of tentacula from one to two inches long, of the same thickness, and which branch off from the smaller foot, like the process containing the mouth. They are short, thick, and bear the eyes on the outer side, near the summit, in the *Murices* generally; double, placed above the mouth, with eyes at the base of the exterior, in *Trochus niloticus*, and *Turbo delphinus ;* short and slender, with eyes close to the apices, and placed at the sides, or extremities of the covering of the tube, in *Conus*, some species of *Buccinum*, in *Bulla Ficus* and *Serpula lumbricalis ;* in *S. aquaria* I could not detect them.

The *mouth* is fleshy, or tubular and fleshy, or tubular only. In the first case, it is composed of strong red muscular fibres, uniting cartilaginous mandibles, in form not unlike narrow blades of scissars. The next kind is a fleshy mouth within the summit of the tube. The last is the tube opening directly into the œsophagus, without triturating power, or tongue.

* These processes in *Voluta* are like those of *Cypræa*, but, in some species, as *V. oliva*, and a brown specimen, I could not discern eyes; these organs are situated at the base of the lower tentacula, in *Bulla ampulla*, as in *Aplysia*.

The *tube* is muscular, cylindrical, varied in colour, capable of elongation from, and retraction within itself, like many tentacula of mollusca and insects. The elongation is produced by the successive contractions of the circular fibres, and the retraction by the agency of the longitudinal fibres, which arise from the inner surface, and are attached to the foot. The length and thickness vary. In most species of *Murex*, *Conus*, and *Buccinum*, it has been compared to the proboscis of the elephant; in others, as in certain species of *Voluta* and *Conus*, and in *Bulla Ovum*, it is shorter and less rigid. In the former description of tube, the œsophagus passes along, to be affixed to its apex, embracing a fleshy mouth (generally without mandibles) and tongue, and adapted, of course, for its changes of dimension. In the latter sort, the tubes open directly into each other.

The *tongue* is much alike, excepting as to length, in all: pointed at the extremity, or dart-shaped, and serrated in the middle, it passes, as in some reptiles, through the back of the mouth, and lies extended along the œsophagus. After the species of *Haliotis* and *Patella*, and some *Neritæ*, (in which it greatly exceeds the length of the animal), it is longest in the *Cypræœ;* in the others it does not far surpass the mouth.

The fleshy mouth belongs to *Cypræa*, *Bulla ampulla*, *Trochus*, *Turbo*, *Strombus*, *Helix*, *Nerita*, *Haliotis*, *Patella*, *Serpula*, and the pyriform species of *Buccinum* and *Murex;* the tube, with mouth and tongue, to *Murex*, *Voluta*, *Buccinum spiratum*, *B. Cassis*, *B. Patulum*, *B. Dolium*, and varieties; the tube simply to *Conus*, *Bulla Ficus*, *Buccinum maculatum*, and a few others.

The *brain* is formed of two ganglia (generally of a red colour, sometimes, as in *Strombus* and *Cypræa*, rather of a pale yellow hue), which form one mass, with a small intervening white substance, or, being separate, are connected by nerves. Whatever the colour may be, it is as a centre, if united, with the nerves for radii; or it forms, if separated, various figures, according to the number of centres and connecting filaments. It is single in *Cypræa*, *Strombus*, *Trochus*, *Murex*, *Voluta*; of two ganglia, one above and another below the œsophagus, in *Conus;* of three in *Bulla Ficus;* of five in *B. ampulla*.

The *œsophagus* is enlarged into a *crop* or first stomach, in all the species of *Cypræa*, in *Bulla Ficus*, *B. Ovum*, *B. ampulla*, and some species of *Buccinum*, *Strombus*, and *Murex* *. In most species of *Conus*, and in *Buccinum Cassis* and *Vibex*, the walls are peculiarly strong, with corrugated, internal, longitudinal fibres. In some species of *Murex*, (as *Tulipa*, *longicauda*, *ramosa*, and *saxatilis*), this tube is so narrow and delicate throughout, that, considered in relation to the bulk of the animal, it is worthy of physiological notice.

The *lung* † forms the roof of the pulmonary cavity, and is extended along the inferior surface of the mantle, with the heart at its lower surface, or contiguous to the liver, and the intestine parallel with its base. It is a single membrane, with the pulmonary vessel along its summit, whose ramifications, being arranged horizontally, like the teeth of a comb, constitute the fifth order, *Pectinibranches*, of Cuvier's System. This organization belongs to all the families, excepting *Haliotis*, *Patella*, and the *Tubicines*. These differ by an approximation, in the character of those parts, to bivalves; and these by the colour of the circulating fluid.

The *liver* is generally of a dark green aspect. In the genus *Conus* it is brown, or reddish-yellow. The stomach lies commonly on its outer surface, but is sometimes, as in *Strombus*, *Haliotis*, and *Patella*, imbedded within its substance.

There is an organ, the *crystalline stiletto* ‡, confined, erro-

* One species (Aluco ?) has the crop of a beautiful red colour, variegated by the ramifications of the nerves.

† In most individuals, there is a small additional membrane, of a dark colour, placed above the larger, and towards the fringe of the mantle, which receives a branch from the pulmonary vessel. As connected with this organ, it may be observed that mollusca do not support want of water, and removal from their habitats alike. The species of *Voluta* and *Buccinum* generally (particularly *B. oliva* and *B. harpa*), die in a few hours; those of *Strombus* and *Murex* survive thirty-six, forty-eight, and even sixty hours; *Trochus niloticus* and *turritus* live yet longer; and *Strombus palustris* will live several days. Excepting *Trochus turritus* and *Strombus palustris*, none have lived many days in water, though changed once in twenty-four hours; and those individuals which die so soon in the air, scarcely ever live beyond the second day, removed from their usual habitat.

‡ Dans d'autres, il y a un veritable second estomac separé, une espece de cœcum près du pylore. Ce que ce canal a de plus singulier, et meme d'absolument propre à certains acéphales, c'est une partie remarquée depuis long

neously, by a celebrated naturalist, to bivalves, which is found in every species of *Strombus*, in *Trochus turritus*, and a species (vertagus?) of *Murex*. It is inclosed in a sheath that passes parallel to, and by the side of, the œsophagus, to the stomach, into which the stiletto enters, leaving its covering. That end which lies within the stomach is obtuse, laminated, and fixed by a hook of similar substance to its situation. The upper portion is circular, homogeneous, slightly tapering, transparent, of gelatinous consistence, and resembling somewhat a pistil, with its stigma.

In every species of the genus *Conus* (excepting that like *Strombus*), and one species of *Murex* (*M. Colus*), there is found within the cavity containing the proboscis or tube, a bulbous crescent-shaped body (not unlike, and of the dimensions of, a bean), having a cavity* and a duct, five or six inches long, curiously contorted, coming off from its apex. This duct penetrates the œsophagus, just at its commencement, close to the brain, through a mucous gland, and a thick white fluid escapes when it is divided. The cavity of the body is empty in general.

The opportunities of observing individuals of the genus *Serpula* are unfrequent at Trincomali, and mine have been confined to a very few specimens of the species *lumbricalis* and *aquaria*. These are not, as is observed by M. Cuvier, attached by muscles to their covering. The former resides rather like a parasitic inhabitant, within its narrow tube; the latter is closely connected to its shell, by adhesion to a thick membrane, which lines it throughout. The *lumbricalis* is furnished with an operculum†, small slender tentacula, a fleshy mouth, a short serrated tongue, a delicate œsophagus, passing, as in mollusca, to the stomach; the liver of a greyish appearance. The *aquaria*, in two specimens, did not correspond with the supposition of M. Cuvier‡.

tems par Willis, Swammerdam, et d'autres, mais que M. Poli a décrite plus en detail, sous le nom de *Stylet Crystallin*.—Cuvier, Anat. Comp. t. iv. p. 123.

* This cavity is longitudinal as to the body, small at either end, and dilating towards the centre.

† Regne Animal, t. ii. p. 522.

‡ The operculum has an appearance, as if formed by irregular depositions, differing from any other.

The perforated disc was closed within by the lining membrane of the shell, and by that mass which has been alluded to as the foot. There were no tentacula observed by me, and none, certainly, passing through the perforations. The mouth was fleshy, and the œsophagus to be traced into a soft black mass, which formed the greater part of the animal. Beyond these facts, from the exceeding difficulty experienced in the examination, I hesitate to speak. The membrane passed to the open extremity, and it there contained fluid; it resembled an air-vesicle of fishes.

Were it not decided by the high authority of M. Cuvier, I should have concluded, from my opportunity of observation, that the circulating system was the same as in mollusca. The muscular system of both these species was of a very pale white, and the red muscles of the mouth less florid than in that class.

This brief review of the features of mollusca shews them to be often different among individuals of the same family, considered as to the form of the shell, and to be always so intermingled as not to afford generic distinctions.

The annexed table displays the assemblage of organs in the different families; and, on consideration of the facts, it seems impossible to select generic features capable of being discriminated and cognizable in a system*.

If the inference be granted, it follows that the shell must be considered alone; and it is to be regretted that so able a naturalist as Linnæus did not transfer to this science the principles of arrangement and nomenclature which he adopted so successfully in botany. To facilitate the acquisition of knowledge in any branch of natural history, the generic name ought to designate the part or condition in which the distinction as a family rests; and this part or condition ought to exist through all the individuals. The intention of all system is to arrange and to generalize isolated facts, so that, by abstraction of what is particular, one family may be separated from another of the same order, and the order, in its turn, from another of the same class.

What applicability is there in any one of the terms now em-

* This table was wanting in the accompanying MS.—Edit.

ployed for the genera? Who, taking up a murex, or cypræa, or strombus, or buccinum, or bulla, could, from the application, be led to the generic features of the shell? Who is not forced to charge his memory with this, as with the specific name?

By *parts* or *conditions* peculiar to univalves, I propose to distinguish and nominate families: to divide into sub-genera or sub-families such as are distinguished by an uniform state * of the more general feature, and to separate into individuals such as, with this peculiar state, have additional parts, or modifications of such parts. To simplify the nomenclature, and render it more perspicuous, I suggest Latin derivations exclusively, and these to be adjectives, and of one termination. Were this base considered substantial, a correction of the individuals might also be made; for these, like the genera, are diffuse and vague, the same principles might determine their denomination from essential distinguishing features †; next, from difference of colour or size; lastly, these failing, from similitude with other objects.

The parts and conditions chosen for generic distinction and denomination are: *Cavity, lip, columella, rostrum* or *beak, spire, open, tubular.*

1. The coverings of cephalopodous mollusca ‡ assume, anteriorly, a locular or chambered form, with or without, to use the language of conchology, dissepiments; that is, in *one*, or divided into *more cavities.* It may be objected to the adoption of this latter, that the fact cannot be known without a section of the shell; but the transparent walls of the smaller species (*Lituus spiralis*) allow examination, and inference may thus be made, besides knowledge of the fact, that the structure within

* *Rostratum.* The generic appellation for all shells furnished with a *rostrum*, divided into three sub-genera from the state of that feature; *a*, straight out; *b*, turned to the right, or from the columella; *c*, turned to the left, or with the columella.

† The first of the conditions is well exemplified in Murex *Tribulus*, aptly named after its *thorny processes.* The second is neither commonly or rigidly fulfilled: Murex *Gigas*, Buccinum *patulum.* The last is, and sometimes happily, employed: Turbo *scalaris*, Cypræa *Caput-serpentis*, Bulla *Ovum*, &c.

‡ Division Testacés: Fam. Céphalopodes: Cinquieme Tableau, Cuvier.

2

the *Pompilius* is the same. This shell is doubtless, as has been observed, exterior to its inhabitant, but the exact connexion between them is yet a desideratum for science. It is asserted by Rumphius *, that the animal is in part lodged in the last cell; has the sac, eyes, parrot-bill, and tunnel of other cephalopoda, the mouth surrounded with many circles of numerous little tentacula, without suckers. A ligament arising from the back passes through the syphon, and forms its attachment to the shell. But if by *last*, this author means the upper and largest cell, how can there be communication from without? The only opening exteriorly is the narrow syphon, and this, walled throughout, does not open into the chambers, unless into the *last* and *smallest*. If it inhabit the space above the chambers, then what may be the use of these, large and regularly formed as they are †? The shell of the nautilus is always found on the beach, deprived of its inhabitant, in an injured and decaying state; it is probable, therefore, that when in life, it remains at sea, or stays beneath deep water. The argo (*Argonauta*) is sometimes met with on the coasts of Ceylon, of large size, but the species generally of this family are smaller, and less delicate, than those found to the eastward, and at New South Wales.

I propose *Cameratum* for the generic term, chosen the rather because significant of ships, to the form of which these shells have some resemblance: Divisions, *one*, *many*.

2. The *lip* is chosen as a generic feature, when, losing the more common form, it is rolled over upon itself, or, if the term express the fact, *voluted*; this adjective to the feature designates the family. The divisions are formed from the *toothed* or *radiated processes*, and distinguished as they are, *both on the columella and lip*, as in *Cypræa*; or *on the lip alone*, as in *Bulla Ovum*, or *on neither*, as in *Bulla Volva*. The generic feature is applicable only in the perfected shell, for the *lip* in young Cypræa and Bulla (*B. Ovum*) is of exceeding tenuity, and the *processes* but partially, or not at all formed. But it is

* On the authority of M. Cuvier. Regne Animal, t. ii. p. 366.

† As fluid is formed in every specimen, probably it may be a means of facilitating descent and ascent.

understood, in every system of natural history, that distinctions are drawn from the perfected individuals.

This arrangement breaks up, if the expression be allowed, the Linnæan *Bullæ;* but a slight acquaintance with conchology will shew that this affords no solid objection, considering that very dissimilar shells are comprised under it.

3. The difference between *Conus* and *Voluta* is but in degree, and not so essential as to constitute a generic separation. The inner windings of the *pillar* of the former are as cylindrically rolled or voluted as those of the latter, and the *bases* in some individuals of both are alike, or nearly so *. If these be united by an adjective to the feature of assimilation *(Columno-volutum)* the genera repose upon the minor distinctions of *furrowed* or *plain* condition of that feature.

4. Those shells which are furnished with a *rostrum* or *beak,* seem classed in nature, and may be expressed by the term *rostratum.* The direction of this feature constitutes the divisions. This arrangement is proposed partially by M. Cuvier in his fifth table, but so mixed up with spiriform shells, and so connected with the consideration of the animals, that it does not interfere with this system.

5. The spiral *form,* being a permanent feature, constitutes the essential character of, and therefore unites many univalves. This, adopted as significant of a family, embraces *Trochus, Turbo, Helix, Nerita.*

These shells present great difficulties, it is true, in the attempt at more perfect arrangement and nomenclature, and they shew the impossibility of equalizing, in an artificial system, the profusion and individuality of nature. The generic feature seems to belong to all, and thus to constitute them a *family;* but the minor qualities are not so apparent, nor so capable of discrimination. The *turbinated* shape, which is assumed in an ordinary acceptation by *Trochus* and *Turbo,* being, after the spiral, the more general characteristic, is a *first* division. The existence of *two lips,* or the double margin (formed by the edge of the columella), which is now the diagnosis of *Nerita*

* The spires and apices are also similar in respect to their variety in both; the former sometimes *exserted* or *retuse,* the latter *acute* or *papillary.*

from *Helix*, is a *second.* The *single lip*, caused by the concealment of the columella from the roll of the body, is a *third.*

There are individuals of *Strombus*, *Murex*, and *Buccinum*, as strictly spiral as these, but their possessing the rostrum, a more peculiar and therefore more distinguishing part, are classed after it.

Shells that are open, partially or completely, and of a flat form, present, under such simplicity of construction, no feature for association; and hence a condition must be chosen. This, perhaps, is a departure from the precision and perspicuity which are the objects of all system, and make its chief value. But, next to the perfect arrangements, based on essential organs, must be reckoned that which is modelled from the *assemblage* of the whole, or from the *peculiarity* such may present compared with others. An essential condition is selected, when objects are thus contrasted, and the line, if not drawn by Nature herself, may be assumed as a circumscribing limit. This is raised far above that which is drawn from relation to other objects, and it is as much removed from opinion as such modification will allow.

Some systems of modern date tolerate this license of comparison, from the failure of discriminating features. The term *Pachydermata* is taken from a relation of one part only, and a relation which, literally considered, is not universally true. *Rapaces*, among birds, is from a mere quality, which, exposed as it is to opinion and opportunity of observation, is only a conventional term, and obviously an artificial bond of union.

The shells, then, of the Linnæan *Haliotis* and *Patella*, united by a distinguishing condition *(apertum)*, may be formed into sub-genera by the presence or absence of the only secondary qualities which belong to them, namely, the presence or absence of a *margin.*

7. Although the inhabitants of tubular shells are not, on the authority of M. Cuvier, constituted like those of *Testacea*, yet, as calcareous productions, they have been considered within the province of the conchologist. This shape, being the common feature, forms the family, and unites, of course, *Serpula*, *Dentalium*, *Sabella*, and *Teredo.* The divisions arise from peculiarities which well enough designate the individuals, and may

be comprised under three heads: *a*, straight and open; *b*, straight and closed; *c*, contorted.

Having objections to the Linnæan classification and principle of nomenclature, I beg to submit the above, as at least preferable, though not perhaps the very best which the subject will admit of.

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*An Account of the Inundation of a Coal-work at Beaujonc, near Liege, belonging to Messrs Colson and Company, and of the remarkable escape of a number of the Miners *.*

On Friday the 28th of February 1812, about half past 10 in the morning, the colliery situate in the parish of Ans, near the Brussels road, about a mile and a quarter from Liege, was inundated by a body of water, which forced itself past one side of the frame-dam, constructed in the Rosier seam of the Triquenote pit, which lies about a furlong off that at Beaujonc.

The water coming from the Rosier seam, flowed over that of Petsay, and from this fell down the Beaujonc pit into the Marias seam, in which 127 men were at that time at work. The fall of water was therefore nearly 87 yards, which is the distance between the Petsay and Marias seams. The serrement, or frame-dam, is a sort of wooden dike, made to keep back the weight of the water which collects between the two estates, and especially in the seams which have been wrought out. The bure-pit or shaft is a great oblong well, having its angles usually rounded off. The seams are more or less thick, as well as the distances between them. The corf is a strong square box, which is borne by chains at the four corners. These are hooked to a great chain, which is moved by ten horses yoked to the machinery.

The moment a full corf had been drawn up, Matthew Laybeye, the filler, observed the water falling down the shaft, which, from the surface, is 185 yards deep. His fellow-workmen for a moment thought that the pipes of the steam-pump were choked, and that the water thus prevented from being drawn to day,

* The above interesting and affecting narrative is extracted from a French pamphlet, published at Liege, and communicated to us by Mr Bald.

fell down the pit. He, however, dispatched Mathieu Lardenois in search of the oversman, Hubert Goffin, who was then in a mine about 540 yards off. He was almost immediately on the spot, and perceiving the danger to be real, his first care was to seek his son Mathieu Goffin, aged twelve years. No person had yet been drawn up: the water was not considerable, and Goffin might still have escaped the danger. He had even one leg in the corf, and his son standing close to him, when he exclaimed, "If I ascend, my workmen will be lost: I am determined to leave this place the last—to save them all, or to perish with them." So saying, he jumped out of the corf, and put Nicholas Riga, a blind man, into his place. The corf ascended rapidly, but, being suspended only by two of the four chains, it fell to one side, and some of the men not able to keep their position, fell into the water, out of which they were drawn by Goffin and his son, who had not left him.

The corf reached the bottom a second time, and the workmen rushed towards it in a crowd, but the force of the fall of water threw a part of them down, some of whom, by the depth of the water at the bottom, and the assistance of the brave Goffin, his son, and John Bernard, were saved. The horses of the machine being rapidly whipped round, the corf once more returned. The men had only a moment allowed to lay hold of it. Goffin perceived their danger; they, however, rashly disregarded him, clung to the corf, and in their ascent most of them fell and perished in the pit, which is two yards six inches deeper than the place of filling, where the water was already breast high.

Not a moment was now to be lost. Escape by the pit became impracticable, the water having nearly reached the roof of the galleries. Goffin continued collected. The devotion of this father of seven young children had electrified Nicholas Bertrand, Mathieu Laybeye, and Melchoir Clavir, who, though they could have ascended, remained beside him. He had ordered N. Bertrand to make an opening in the air or upcast shaft, in order that the workmen coming from the dip or lowest part of the mine might turn round the downcast, and pass through the upcast shaft, to gain the rise-boards or galleries on the ascending part of the strata from the pit, every other way of escaping death being impossible. The upcast shaft is a pit of the same depth as the principal shaft, having a chimney raised from it thirty-three yards high.

M. Laybeye was directed to secure all the candles, and to place the lighted ones against the props of the mothergate or main gallery of the mine, that the miners might see from a distance that they could no longer get to the shaft. Every excavation ought to be propped; that is, when the coal has been taken away, the roof should be supported by pieces of straight wood, to prevent falls. M. Clavir remained with Goffin, and assisted him in assembling the workmen, and in forcing them to the side of the rise-boards.

In the first place, Bertrand executed the order to unstop the bore-hole, which, from the reservoir of the steam-engine, leads to the workings that dip or incline downwards from the shaft. By this measure the workmen in the more distant boards were enabled to save themselves while the lower parts were filling with water. This disposition, in fact, saved the lives of many men who had time to join their brave leader. Unfortunately, some of them, deaf to his entreaty, remained in the filling place, near the shaft, in hopes of reaching the corf; these perished, victims of their imprudence. The corf descended several times in vain. The ladders placed for the use of the fire-engine seemed to offer another way of safety, but the unfortunate men who attempted to profit by it were thrown down by the violence of the waterfall.

The men and boys being drawn together, Goffin repeatedly said to them, "Lambert Colson will not abandon us; let us turn towards the Roisse; we shall go up the boards, he will understand where we shall be; and if we cannot escape hence by Beaujonc, we shall by Mamonster." The Roisse is a gallery which cuts the boards obliquely.

Only imagine the situation of these unfortunate creatures, buried in the bowels of the earth, at 185 yards deep—grouped together in a narrow space—deprived of food, and almost of vital air—with only a vague hope, and fearing to be drowned in the water which they saw increasing. It is only after having visited several coal-mines that we can form a just idea of the danger of the miners, who all their days traverse these labyrinths, where, often, they can only creep, are deprived of air, in danger of being scorched by inflammable gas, of being drowned in subterranean lakes, and crushed by falls.

M. Mathieu, chief engineer of the mines, and Migneron, his deputy, as soon as they heard of this accident, hastened to the spot. Already the lamentations of the women and children filled the air, and in this scene of distress orders were given to bring all necessary assistance. The water, which rose on the following days to the height of twenty-eight yards above the level of the bottom of the shaft, was at this moment fifteen yards. All hopes of deliverance by Beaujonc was therefore at an end.

It was impossible to raise in a little time this immense and increasing quantity of water. The inundation might even reach the highest parts of the rise-boards, or, at least, confine the workmen to so small a space as to suffocate them by want of air. Shall we despair like the surrounding multitude, we said? or dare to undertake works of which the history of the country about Liege, where coal has been wrought for eight centuries, furnishes no example?—or shall we leave these men, who have given us such a lesson of courage and constancy, to perish in the mine? No, certainly! Our first care is to reduce the water, in order that the works may not be inefficacious, which the engineers and Mr Colson, after inspecting the places, have agreed to commence in the Mamonster pit, distant from Beaujonc about 190 yards. Immediately, besides the fire-pump, the power of the *machine à lamotte* was added. The directors of the collieries were informed of the disaster, and sent 100 horses. Every thing was instantly in motion, and the dispositions that had been made insured 6000 cubic yards of water being drawn up in twenty-four hours.

The fire-pump has a stroke 78.74 inches, and the diameter is 11.77292 inches. It makes at least twelve strokes in a minute. We cannot dissemble that the *machine à lamotte* is of little use in such extraordinary cases as this. A few casks of water are of trifling importance, but it was necessary to animate the public by complying with its sentiments. Besides, the tubs in falling agitated the water, and compressed the air in such a manner, that globules of it might reach the men, and favour their respiration. If the tubs, seven of which were left at the bottom, had failed us, we had proposed to throw great stones down, to produce the same effect. Goffin afterwards told us, that this concussion of the water did them great service. A detachment of the military of the department came to keep back the multitude, lest they should prevent the working of the engines; and Mrs Hardy, with the most praiseworthy sensibility, put the pit of Mamonster, its workmen and horses, at the disposal of the engineers.

The headway of this colliery, at the extremity of which they were to open a drift, being fallen in, the air had to be carried 131 yards along a narrow and dangerous passage, covered with large blocks of stone. M. Migneron boldly ventured through it, though his clothes were much torn in the enterprize. Malaise, the conductor, followed him with several courageous workmen, whose size permitted them to follow the same example. M. Lambert Colson stuck at the mouth of the passage, and had to be drawn out backwards. Migneron, at the head of the workmen, went towards the east, and began to open out a drift in a seam less than 39.37 inches thick, bearing on the 28th point of the compass.

Only two men at a time, lying on their sides, could work in this narrow space; but, on the least exhaustion of their strength, each shift or company of twenty men, was relieved every four hours. On account of the hardness of the seam they only penetrated about eighty inches in three hours. Every attempt was made to draw the attention of the unfortunate men to the inner board of the Beaujonc mine. They blasted the rock, and fired in small cannon; but the night of Friday and the morning of Saturday the 25th of February passed without a hope.

At this moment the level of the water was three yards higher than on the preceding evening, in spite of every effort; but the public were not acquainted with this circumstance. At eight o'clock in the morning of Saturday a distant noise was heard, which gave us the satisfaction of knowing that our plans were understood, and that the men themselves were at work in the interior.

It, however, became necessary to hasten the progress of the drift, for the water in the course of the day rose above seven yards higher; and it was also indispensable to stop the force of the water at the dam of the Triquenote pit, which the carpenters at length effected on the morning of Sunday the 1st of March, by fastening pieces of wood in the havage, which is a technical term for the earth, sand, clay or rock which separates two seams. From this moment the water began to diminish.

Our workmen, deceived by the effect of sound, now wished to take another direction. In the night of Saturday and Sunday, through excessive zeal, they opposed M. Migneron. In vain he told them that, if they persisted in their plan, they were in danger of holing into water. In despair, he also learnt that the women and children, at the bank of the pit, were murmuring; considering, therefore, the responsibility that lay upon him, he yielded, for a few hours, to the will of the workmen. At this moment we came to the pit, determined to descend and re-establish order; when the engineer himself came up, and assured us that the men had acknowledged their error, and come back to the first drift, and that the sound from the interior was much more distinct.

On the 2d of March we were still unable to judge of the distance to be excavated, as the sound was not loud enough to make us quite certain of its direction, for it sometimes appeared to come from a place higher than our drift. M. Mathieu went down and joined his colleague; and they held a consultation with M. Colson, Stephen Bernard, the night oversman, in the Beaujonc colliery (whose son was one of those in the interior of the mine), and Ernest le Clerc, the foreman of Mrs Hardy's colliery, and it was determined that the work should proceed in the direction first commenced, which, on the 28th point of the compass, would lead to the fifth rise-board of the Beaujonc pit *. When M. Migneron came to the surface, he traced on the ground a plan of the subterraneous operations, more to tranquillize the impatience of the public, and to convince the miners, than to verify his own calculations. The whole of Sunday, Monday, and part of Tuesday, passed in the torment of hope constantly deceived. The workmen kept up their spirit, but some of them made no progress. On

* This circumstance shews the absolute necessity and great importance of having accurate plans of all mining operations. This cannot be too strongly enforced.—Ed.

Monday the drift was only twenty-six yards long, and no exact plan of the workings was to be found. They had no data to calculate the distance, which might be twice as great as they supposed, even taking into account that the immured men, whom on good reason they judged were deprived of light, could continue to work.

In this anxiety, each owner of pits was required to furnish six of his strongest miners, only two of whom could work at a time. The air, too, was so much rarefied and deprived of oxygen, as to be scarcely fit for respiration; it was therefore proposed to open a second drift parallel with the former; but still to continue that with the greatest activity. This I insisted upon, and wrote to M. Migneron. The advice was adopted, and entrance into the pit positively forbidden to every one but such as were absolutely necessary.

In a short time the two drifts were united, to form only one, and to conduct the air more regularly. The 3d of March arrived. The dam at the Triquenote pit continued to hold, the water lessened, and the noise of the men within was more distinctly heard; but nothing yet indicated that the direction of our drift went precisely to the desired point. The boring-rod made no discovery, and the varied effect of the sound kept up an illusion which made us afraid we were going farther from the unhappy men, who, plunged in darkness, might be equally deceived. The miner scarcely breathing, and dropping down with sweat, can make use of the pick only for a few minutes; another, however, takes his place; the work advances, and we begin to entertain a hope of breaking down the barrier in the night.

Filled with this hope, I gave order that a messenger should be dispatched to me as soon as the boring-rod should pierce into the interior, and returned to town a quarter after four o'clock in the afternoon, with the principal engineer M. Mathieu. I had scarcely reached the prefecture, when M. Engineer Migneron recalled me to the spot, and told me we were in communication with the interior of the mine. It was about six o'clock. I called upon M. Mathieu and Dr Logens, and set off, taking with me M. Asiaux *junior*, a surgeon. A new detachment of military, necessary to keep order, was already on the way ; one messenger after another was dispatched by the zealous M. Pague, the mayor of Ans; all the inhabitants were at their doors with torches in their hands. On my arrival, I learnt that the boring-rod, after passing obliquely through fourteen yards, had met an old holing, which, though indirectly, opened a communication with the unfortunate sufferers, sinking with fatigue and hunger, and deprived of light during four successive days. But at what point the boring-rod had entered the old holing, or what was the exact length of the hole, it was then impossible to determine. Had the seam or bed declined vertically, the boring-rod would have hit the top, and been useless. How should we afford the men any support? Our desire to introduce liquids to them, through tubes of block-tin, was impracticable; yet, ere another day should elapse, many of them might cease to live. Happily we were sure to pierce the barrier in a few hours. The work seemed to proceed with vexatious slowness; we imagined we could hear the expiring groans of the men, and wished to have hold of the pick to hasten their deliverance.

At length they themselves pointed out a better direction for the rod, which reached them in a direct line at two o'clock, when our workmen called to them, and they desired that the hole might be stopped, as they were not able to bear the pressure of the air, which rushed in impetuously. All precautions were now taken against fire, and the necessary dispositions made for re-animating men, exhausted through want of light, air and food, during five nights and days. The light in our drift was kept at a distance from the workmen, and the fire-keeper had orders to step backwards, when the flame of the candle indicated the presence of inflammable gas. Broth, wine and clothes were taken down the pit, and the women and the children removed from the surrounding buildings. Wretched creatures! ye are yet ignorant that many of you have to weep for a husband, a father, or a son. Sensibility certainly does not enervate; for during these five days our hearts have been wounded with a sight the more afflicting, because the families of colliers being numerous, are all reduced to the most frightful misery when they lose their head.

Messieurs Georgen, colonel of the Gendarmerie, De Rouveroy, auditor under the prefect, and other distinguished persons, came in the night to offer their service. Every where intense anxiety was displayed, and the men at work, desirous of the merit of rescuing their companions, refused to be relieved. At seven o'clock in the morning of the 4th March, the workmen, equally impatient as ourselves, let off a blast, the smoke of which incommoded them This mode of expediting the drift was therefore forbidden, because its effects in the interior might kill those whom we were endeavouring to save, and, by igniting the hydrogen gas, destroy our own workmen. Besides, we were now certain of the existence of all those who followed the brave Goffin, and as we are come to the moment of their being rescued, we shall relate the occurrences in the interior according to the simple narrative we received, not altering it, but for the sake of perspicuity.

We left Goffin in the midst of the miners, whom he had collected near the upcast shaft, after all hope of escape by the Beaujonc pit was done away. Some of the men remained to watch the progress of the water; others betook themselves to the galleries of the mine on the rise side of the pit, which they reached in the most deplorable condition. The boys crying bitterly, crowded about Goffin, exclaiming, "Dear master, how shall we escape!" "My God, must we die so young!" He ordered silence, and consoled them with promises that they should all escape. He then distributed his people in the different rise-boards, from the 4th to the 7th board, and which communicate with each other by the headway (par la Rousse). The most robust and courageous workmen he allotted to the 7th board, where a drift was commenced under the persuasion that the workings of the Mamonster pit might be penetrated from thence. Though it was impossible that more than two men could work at a time, yet by constantly relieving each other, the work proceeded. The feeble carried away the excavated materials into the dip. They had proceeded about seven and a half yards, and hoped to be soon in the bosom of their families. Every stroke of the pick returning a heavier sound, shewed that they were near a waste; but what was their disappointment, when they holed the old workings of the abandoned pit of Martin Wrey, out of which the crouin, or inflammable air, issued with a horrible noise, and would certainly have destroyed them all, had not Goffin immediately stopped the hole. The workmen seized with stupor, fell upon the deille of the seam, i. e. the floor of the seam, or schiste, upon which it rests; some of them were desirous of continuing the work in the same place, but this Goffin opposed, saying, "When we have nothing further to hope for, I will bring you back here, and then our work will be readily finished." Their despair seemed to be at the height. All exclaimed that their death was inevitable. They uttered the saddest cries. The boys begged their father's blessing, and those who had none, implored Goffin, on their knees, to give them his. The men bewailed the lot of their wives, children, and parents. Their groans made them desperate; they demanded of their master what was to become of them. This brave man, who never ceased to encourage them, informed them that there was still a resource in the fifth board, to which he wished to conduct them; but no one rose or answered. They uttered fresh cries, and seemed to refuse to undertake any new operation; "Well," says Goffin, "since you refuse to obey me, we will die." He then took his son in his arms, and the most faithful of his friends gathered round him, wishing to testify to those who might find their dead bodies, that they had preserved their attachment to him to the last. They embraced each other, and were praying to God, when, O prodigy of courage! a child of feeble being, as if inspired, rose up and said with a loud voice and firm tone, "You act like children; follow the orders of my father. We must persevere in our work, and shew to those who shall survive us that we have had courage even in death. Has not my father told you that Lambert Colson will not abandon us." This youth was Mathew Goffin, the oversman's son, 12 years old, who is of little stature, and has the bone of his leg crooked inwards, as most of the miners have, who begin to work too young. He advanced a step, and all, as if struck by some sudden inspiration, felt a return of confidence, rose and followed the elder Goffin, and began to undertake an opening in the fifth board. They had scarcely reached the spot, when, with inexpressible joy, they heard a strange noise, which they recognized to be that of persons working to save them, and which increased their hope as they began to distinguish the different operations of kerving, nicking, judding, boring, and blasting *. This, according to our calculation, must have been on the Sunday night, when they had been thirty-six hours in the pit, and, exhausted by the fatigue they had in the seventh board, and the labour of contending with the water at the time of its irruption, they again refused to work, saying, " That they had as soon die one way as another." In this extremity, the heroic Goffin treats them as cowards, declaring that he will hasten his death, and take from them all hopes of safety, by drowning himself and his son, whom he seized hold of. They all threw themselves down before him, and again promised to obey him. But the air no longer containing sufficient oxygen, the two candles which lighted the workmen went out, and a third left in the head-way, in reserve, and which to them was sacred fire, was overturned at the same time by accident. From that time profound darkness destroyed the little courage by which they had been animated, and they again refused to work. Goffin became desperate. The first man he could find he seized, and, though without arms, threatened to stab him if he refused to work. Dark as it was, he conducted them back to their post, and though his hands, unaccustomed to use the pick, were covered with blood, he always set the first example. The young hero his son, too, frequently came to him, and clapped him on the back, saying, " Courage, father, all goes well."

In this dreadful anxiety, some promised to make nine days' vows, and others pilgrimages on naked feet. Two orphans, 12 or 14 years old, flattered themselves they should not perish, because their father, who was gone to Heaven, prayed for them. One of these offered his brother a piece of bread, which he refused, and gave to another boy, who devoured it immediately. The young Goffin wept not: he was occupied only with the thoughts of his mother, sisters, and brothers: " Father," says he, " you and I only earned money: how are they to live? Must they beg? Dear father, I know that you have hid some

* *Haver* to kirve, is cutting the coal from its bed; *couper* to nick, is hewing the seam on each side in order to force down a *jud* or block of coal; and *hottle* to jud, is forcing the jud from the roof with iron wedges.

money in the cow-house, how will my mother be able to find it?" "And you, my boy, where have you hid yours?" "I have only a crown which my sister has." Two workmen disputing were beginning to fight; let them alone, said a third, "if one of them be killed he will serve us for food," this ended the quarrel. Some of them ate candles which they had hid, and others drank their urine in preference to the extremely nauseous water. Bertrand, Labeye, and Clavir, whose courage prompted them willingly to follow the fate of their leader, frequently said, "Dear Goffin, we must love a man with whom we had rather see death than abandon him." Another used this reproach, "If you had not called me, perhaps I might have got up in the fourth corf." In this manner, this most generous of men was doubly afflicted. Still such is the versatility of the imagination that a scene quite comic succeeded to the most hideous views of death. One of the men complained, on entering the drift for the first time, that the heat was insupportable, and that he had no hole in his nose, at which his companions burst into laughter; he was therefore dismissed, and his work dispensed with. This absence of mind, however, this forgetfulness of misfortune, was of short duration. Those especially who could not work, found the most urgent want of subsistence. A little time back, fearing to be drowned, they only went to the edge of the water to judge of its height, now deprived of light they crept there, in hope of finding the body of one of their companions to serve as food at the last extremity. But the only aliment they could find was the infected water, which they brought to the workmen in their hats (callotes) and in their candle box. These hats are bad, and have very small brims in which they fix the candle with clay. The perspiring workmen promised Goffin only to moisten their lips in the water, but they drank the last drop, without quenching their thirst. "We have drunk," said they, "the blood of our friends who perished under their burdens," others, losing their senses, asked their way home. They complained they were left to perish without light or food. Among other proofs of insanity, they asked for sallad and cabbage, and rose into violent passions against Goffin, who unceasingly endeavoured to calm them with the assurance that he would conduct them back, and give them all they wanted. He called them all by their names, and hoped those that did not answer, had ascended to the light of day. He often mentioned Anthony Hallet, who, in seizing the chain of the bell that hung at the top of the pit, gave the first alarm; but this man being taller than the rest, and hoping to have time to ascend, gave place to others, who, on account of their stature, might be drowned sooner than himself, and thus fell a victim to his generosity. Five days and nights of misery had now gone by, but having no idea of time, they supposed it to be Monday, when it was Wednesday, so true it is, that even when affliction is of long continuance, the moments seem to glide rapidly by, because the mind is altogether taken up with its calamities. (Here ends Goffin's Narrative.)

A passage was now made 51 yards long, in a seam 35.43390 inches thick, by which we reached the desired spot in the precise direction of the 28th point of the compass. The men in the interior had wrought 12 yards in the 5th board, and nearly 8 yards in the 7th, making a total of about 71 yards. All arrangements were made for receiving them. They heard us distinctly, and each endeavoured to press before his comrade. It was the 4th March, and 12 o'clock. But because too much eagerness might cause an explosion, the last operations were performed in the dark. As soon as the barrier was finally penetrated, the air, in regaining its equilibrium, produced a sort of report like thunder, which, though foreseen, alarmed the men, and put a part of them to flight. Order being established, the unfortunate men crawled through the drift, which circumstance was announced at the surface to a great number of distinguished personages assembled in the inside of the buildings. Some repose was, however, necessary to accustom men just rescued from the grave to the air and light. Every thing, by the kindness of Mrs Hardy, had been in preparation for two hours. M. Mathieu and Dr Asiaux were now informed of the proceedings. Each of the men was wrapped in a blanket, and received in the pit a basin of broth and a little wine. They were then placed successively in the corf, and accompanied to day by four miners, one at each corner. We reckoned them over several times; but our happiness was incomplete. Of the 91 persons who were shut up in the mine, only 70 were restored to their friends; of the whole number 127 who were in the pit at the irruption of the water, 33 saved themselves by the corf, 22 were drowned, 70 escaped by the drift. Goffin and his son ascended the last, with M. Migneron, who had been 24 hours in the pit, and conducted himself with a zeal worthy of the highest recommendation *. The air was now rent with acclamations of joy; but in this moment of strong feeling it was necessary to prevent the relatives of the persons restored to life from rushing in upon them in a body. The Colonel of the Gendarmerie was everywhere exerting himself to restrain the imprudent populace. M. Mathieu, who had attended most of the operations, and shared the responsibility of the recovery of the men, partook of the blessings of the multitude. Migneron and myself returned to town at 4 o'clock; but M. Mathieu remained on the spot till 8, giving directions about another visit to the pit; but the air, already highly impregnated with noxious gas, did not permit the men to go, even without a light, beyond the scene of our labour.

Such is the faithful account of events which has caused so deep an interest in all ranks of society. The difficulty of obtaining information from common workmen, who cannot speak in French, the desire to meet the impatience of the public, my constant occupation, and want of time, must be my apologies for any defect in style; but facts have been collected with scrupulous care, the deposition of every workman having been separately taken; yet we give but feebly the energetic expressions of veneration which the workmen have for Goffin.

Sir Frederick Mohs, *Professor of Mineralogy, in Vienna.*

Frederick Mohs, formerly Professor of Mineralogy in the Mining Academy at Freyberg, and Counsellor of Mines, was born in the beginning of the year 1770, in a little town in the

* The king of the Netherlands bestowed the decoration of the Legion of Honour on the active, energetic, and noble-minded Hubert Goffin.

Dukedom of Anhalt-Bernburgh. He was very young when he lost his father, who was a merchant; and he also was designed to follow the same profession, but was prevented by his inclination to science, particularly to mathematics. The arrangements of those schools in which he received his early education, obliged him to walk about five miles two or three times a-week, to receive an hour's mathematical instruction. In 1796, he entered the University of Halle, where he studied science and philosophy under his countrymen Klugel and Gren; and two years after, went to Freyberg, where he became a devoted disciple of the celebrated Werner. Dissatisfied with the geological theories of the old naturalists, he was forcibly struck with the opinions of Werner upon geology; particularly because they were founded on observation, and required that knowledge should precede explanation.

Practical mining engaged much of his attention, and he soon received an appointment in his native country, which he shortly afterwards abandoned, to take a charge in the foundation of a scientific institution projected in Dublin by Kirwan, which was soon broken up, owing to the death of those persons who possessed the chief influence in it. About a year after, he returned to Freyberg, where he became acquainted with Jameson, then prosecuting his studies at that place, and now Professor of Natural History in Edinburgh; and wrote an admirable description of the mine of Himmelfurst, which was published some years afterwards. In 1802, he went to Vienna, where he enlarged his acquaintance with the literati of that place; and undertook a description of the mineralogical collection of the Banker von der Nüll. In this work (Vienna 1804), are contained the elements of those views of natural history which he has since developed. At the same time, he also wrote single essays on various mineralogical subjects, which made their appearance in the "Ephemerides" of Baron Von Moll.

His enthusiasm for geognosy and mining caused him to undertake very extensive excursions into Stiria, Saltzburg, Carinthia, Carniola, Hungary, Transylvania, &c. In 1810 he was appointed by the Austrian Government to examine the districts in Austria and Bohemia, where porcelain earth is dug up, and where hopes were then entertained of finding this mineral. A number of the results of these investigations have been published in the Transactions of the Polytechnic Institute of Vienna, and have given rise to several new manufactories in Bohemia. He became known to the Archduke John, who at that time contemplated the establishment of the Johanneum at Gratz. At the suggestion of the Archduke he undertook another journey into Stiria, upon which the State of that place appointed him Professor of Mineralogy in the Johanneum. In the extensive and excellent mineralogical collection in the Institute, the whole of which, together with the apparatus, was a donation from the founder, he had an opportunity of proving and applying his principles and opinions regarding mineralogy.

In 1812 he commenced his lectures on mineralogy, in which he considered the natural history of the mineral kingdom, and at the same time attempted an elementary method for determining the natural arrangement of the mineral species. In these lectures he always expressed the highest esteem for his celebrated instructor Werner, without, however, generally following his views. The arrangement and distribution of the mineral collection according to natural principles, met with great applause; and Professor Mohs himself, in his later writings, mentions this arrangement as a principal cause of the rapid progress of his pupils. His attempts to make out the specific differences that characterize the divisions of his natural system being at first attended with great difficulties, obliged him to make innumerable experiments on the hardness and specific gravity of minerals. In mineralogical writings he found these characteristics entirely omitted, or if they were mentioned, it was but very inaccurately. This induced him to draw out a scheme of his scale of hardness, and of a system of crystallography, which should be more fundamental than that generally prevalent in Germany, and at the same time simpler and more agreeable to nature than that of the celebrated French mineralogist Haüy. In 1816 Mohs wrote an essay to Professor Jameson in Edinburgh, with the design of communicating a general explanation of his natural mineralogical method, which this gentleman printed in the Edinburgh Philosophical Journal.

Mohs, by his lectures, had attracted many students from the Imperial States to Gratz. Count Brunner, Hereditary Chamberlain of Austria, was among the number. He engaged in the subject with peculiar enthusiasm, and invited the Professor to accompany him in a tour through England and France, a proposal which met with the concurrence of the Archduke John and the State of Stiria. The travellers arrived in London in the beginning of January 1818, went to Cornwall, and then from London to Edinburgh. Here Mohs found his friend Professor Jameson occupied with views similar to his own regarding the natural history of the mineral kingdom. They soon agreed as to the principal points; and Mr Jameson, who was then engaged in revising the third edition of his "System of Mineralogy," adopted part of the views of Professor Mohs.

Mohs first published his "Characteristick" in German and English merely as a fragment. In the following year appeared "Jameson's Manual of Mineralogy," in which the author adopted the natural method, with but few alterations in the nomenclature, and thus introduced it into England.

Mohs, upon his return to Edinburgh from an excursion to the Highlands, found an invitation to the chair of his immortal instructor Werner, which he accepted, provided the consent of the Archduke John could be obtained. This he received in a letter written by the Archduke himself, from Dresden, and he entered into his professorship in the autumn of 1818. The above mentioned "Characteristick," which was published in 1820, passed through a second edition in the following year, accompanied with an explanatory introduction. In 1822, Mohs published the first part, and in 1824, the second part, of his Elements of Mineralogy, the most remarkable work on mineralogy which has appeared in our time. Three or four years ago, Mohs was invited by the Emperor of Austria to Vienna. He accepted the offer of Professor of Mineralogy there, and has been succeeded in Freyberg by Nauman, the celebrated mineralogist, from Halle.

Extraordinary Case of Atmospheric Refraction. By John Cruickshank, Esq. Professor of Mathematics in the Marischal College, Aberdeen. Communicated by the Author.

Marischal College, Aberdeen,
15*th August* 1829.

Sir,

Having been informed lately by my friend, the Rev. Dr Forbes of King's College, that you were desirous of collecting facts respecting extraordinary cases of terrestrial refraction, I send you the subjoined account of phenomena which I observed here on the 10th June 1826. I am, &c.

John Cruickshank.

To Professor Jameson, &c. &c.

On the morning of the 10th June 1826, there was a thick fog at Aberdeen, with a slight breeze of wind about south-east by east. Between eight and nine A. M. the fog vanished from the land, and bright sunshine succeeded, which continued till late in the afternoon; but fogs, apparently dense, remained at a distance on the sea, and occasionally extended to the shore at some points till after mid-day. From the observatory of Marischal College at noon, the rocks about Slains Castle, on the Buchan coast, and distant about twenty-four miles, attracted my attention, by appearing more elevated, and with much greater distinctness of parts, than usual. Places beyond Slains Castle, which are not visible from Aberdeen in ordinary states of the atmosphere, were at some instants distinctly seen. The rocks, and the adjacent land, to the distance of about two miles, west of them, seemed to vary in altitude almost every ten seconds, the whole tract appearing alternately to rise gradually to three or four times its ordinary apparent height above the level of the sea, and subside again into itself. Thus far the phenomena were observed with the naked eye, and during the space of about five minutes. But, upon examining the same tract of country with a telescope, a three and a half feet achromatic with a low power, I found the appearances presented by smaller objects to be still more interesting, particularly those objects which were at some distance from the sea, and distant from Aberdeen about twenty-one miles. Various objects, which at some instants appeared only as small roundish spots, seemed often to rise perpendicularly to four or five times their usual height; at other times, while these objects themselves appeared to remain of a fixed altitude, exact copies of them appeared above them, and often second or third copies above the first. Taller objects, as the ends of farm houses, sometimes appeared to shoot up into lofty pillars, but without having their appearances repeated, like those above mentioned.

One rectangular object, of a light yellow colour, and which was soon discovered to be the thatched roof of a farm house, strongly illuminated by the sun, attracted more attention than any other, from its being very well defined. It appeared as a perfect rectangle, its base being horizontal, and equal to about twice its perpendicular. This object sometimes seemed to grow up to about five times its ordinary height, and again to sink down to its natural dimensions. Sometimes an exact copy of the object appeared above it; and sometimes a second copy above the first, forming three equal and similar rectangles. The apparent distances between these rectangles were different at different instants, varying from mere dark lines to spaces about equal in breadth to the object's extent in altitude, as seen in ordinary circumstances. The two or three rectangles were sometimes formed by a sub-division of the object when extended in apparent height; at other times the first copy appeared to be drawn up, as it were, off the object, and the second copy to be drawn off the first; and at other times, while the object appeared to retain its natural dimensions, the copies of it began to appear above it as horizontal yellow lines, which rapidly increased in breadth. In no case did the lowest rectangle appear of less dimensions than in ordinary states of the atmosphere: and in no case did its extended figure, or the figure formed by the three rectangles and the intervening spaces, appear to exceed five times the ordinary height of the object; but with these limitations, almost every conceivable variety of appearance was exhibited, which could be presented by three rectangles perpendicularly above each other, varying in their vertical dimensions, and uniting and separating by turns. The distance of this object was from twenty to twenty-one miles. The straight line joining it and Aberdeen, passes above the land for about a mile and a half, reckoning from Aberdeen, and about half a mile on the Buchan coast. The remainder of the line passes over the sea; and its greatest distance from the shore is about a mile and a quarter. The sands of Belhelvie occupy the greater part of the intervening coast. The observations were continued for half an hour, by the end of which those extraordinary phenomena had become less striking, and could not so easily be observed, owing to increased tremor in the atmosphere. There was no fog in the direction of the object during the observations. The atmosphere was rather warm; but I regret that I have no record of the state of the barometer or thermometer at the time. At eight in the morning and nine in the evening of the same day the thermometer was at 56° of Fahrenheit.

Analysis of Galena, fron Castleland Hill, near Inverkeithing. By Mr A. Robertson *junior*, Inverkeithing. Communicated by the Author.

This ore is partly massive, and partly in very regular octahedral crystals, some of them almost as large as a pullet's egg. It is found very near the surface, at the foot of a small hill, in a piece of ground, which, till the drain was cut, which at present carries off the water, must apparently have been a marsh, or perhaps the bed of a small lake. It is contained partly in greenstone, partly in a quartzy sandstone, both belonging to the coal formation. It appears to have been disposed in a vein, not in a bed, or irregularly intermingled with the neighbouring rocks.

This vein was first discovered, about seventy years ago, in cutting a road, and was wrought at that time, but without advantage. The working of it was resumed about thirty years since, when nearly fifty tons of ore were raised, which, however, did not pay the expense. It was abandoned shortly afterwards, in consequence of a pretty extensive sliding in the greenstone and sandstone of the strata, at a fissure between, which closed up the greater part of the mine.

Some of the crystals were carefully cleaned, and reduced to a very fine powder, a hundred grains of which were digested in three hundred grains of pure nitric acid, considerably diluted with distilled water. When the action of the acid had ceased, it was poured off, and replaced by two hundred grains of the same acid similarly diluted, and the digestion was continued for some hours longer. The two solutions, and the water with which the undissolved matter was washed, were mixed together.

This residuary matter, after being well washed with distilled water, was dried by exposure to the air, and gently heated for some time by warm water placed under the vessel containing it. The sulphur was then burnt off, and the loss of weight accurately noted. The mean result of five experiments, from which none of them varied two-tenths of a grain, was 12.37 grains.

After the sulphur had been dissipated, there remained a whitish powder, which, from several of its properties, was recognized to be sulphate of lead. This had been formed, during the analysis, owing to the oxidation of a small portion of the sulphur by the nitric acid, although every precaution had been taken to prevent it. A quantity of this, collected in the different experiments, was decomposed by boiling on it a solution of carbonate of soda. The weight of sulphate of barytes which this alkaline solution yielded, was nearly proportional to the quantity of sulphuric acid, which, by calculation, the sulphate contained; and the carbonate of lead which was formed, dissolved completely with effervescence in diluted nitric acid, with the exception of a little undecomposed sulphuret of lead. When a solution of sulphate of soda was poured into this solution, it afforded a quantity of sulphate of lead, only 4 per cent. less than that of the original sulphate. After this had been separated, the solution being supersaturated with carbonate of soda, a slight pink tint appeared, which seemed to indicate manganese; and when tincture of galls was added, it also gave slight, though unequivocal, traces of iron. The average weight of this sulphate of lead, in the three experiments from which the weight of the lead was deduced, was eight grains, equivalent to ·84 of a grain of sulphur, and 5.47 grains of lead.

The nitric acid solutions gave no trace of silver with muriate of soda. From one of them the lead was precipitated by carbonate of ammonia, the precipitate being afterwards reduced;

but the reduction was evidently incomplete, so that a portion of lead was lost. A plate of zinc put into another threw down metallic lead, but this was accompanied by a quantity of what appeared to be a whitish oxide, so that this experiment also failed. The remaining three solutions were neutralized by carbonate of ammonia, and a solution of sulphate of ammonia was poured in, in sufficient quantity to precipitate the whole of the lead which they contained. The mean weight of the three parcels of sulphate of lead thrown down, after these had been well washed and heated to low redness, was 115.7 grains, equivalent to 79.16 grains of lead. From this none of them varied half a grain.

Carbonate of ammonia, and carbonate of soda, threw down nothing farther from these solutions.

As no trace of silver was observed in these solutions, to determine this point with greater accuracy, 1000 grains of the ore were cupelled, until reduced to about twenty grains of lead. These were dissolved in nitric acid. The solution did not lose its transparency on the addition of a solution of muriate of soda, and therefore contained no silver.

Through the nitric acid solutions, from which the lead had been separated, and which had been afterwards supersaturated by an alkaline carbonate, sulphuretted hydrogen gas was transmitted. A little of a brown precipitate subsided. About half a grain of this, on charcoal before the blowpipe, gave out a bluish flame, seemingly that of sulphur, and a globule resembling fused oxide of iron remained. The most remarkable feature was the very strong odour which it communicated to the air of a pretty large apartment, and which was retained for several hours. This smell was pungent, and, so far as could be judged from recollection, bore some resemblance to that smell of horse-radish which is stated to be the indication of selenium. The presence of this substance, however, must be doubtful, as in recognizing substances in this way there is very considerable room for fallacy from various causes.

To discover whether any iodine might be contained in the ore, an ounce of it, reduced to a fine powder, was distilled in a strong heat with an ounce of concentrated sulphuric acid. A little sulphuretted hydrogen was first evolved, then some sulphur was sublimed, and a large quantity of sulphurous acid gas came over. About three drams of a fluid also condensed in the receiver. This was poured on black oxide of manganese, and again distilled. No purple tint could be observed, and a little liquid which came over gave no blue colour with solution of starch.

Statement.

Sulphur	12.37 .84	13.21
Lead	79.16 5.47	84.63
		97.84

Notice of a large Greenstone Boulder in the Pentland Hills. By James D. Forbes, Esq. Communicated by the Author.

Colinton House,
3d *August* 1829.

Dear Sir,

I now send you specimens of the boulder at the foot of the Pentland Hills, in which, from my description, you took an interest. It is situated at the opening of a valley named Haw Dean, which lies between the hills of Allermuir and Cape Law, and at a short distance behind the house of Dreghorn. By a mean of two observations with the sympiesometer, on July 31. and August 1. the stone lies at 333 feet above my room here, which is 415 feet above the *mean* level of the sea, giving 748 feet for the elevation of the boulder above the latter point. Though now in two pieces, it seems formerly to have been united in one, and the mode of separation is easily explained; being composed of greenstone, with a tendency to globular decomposition, the coats of one of these nuclei beginning to fail from the action of the weather, the projecting part which had a different concretionary structure was detached, since the equilibrium of the whole mass depended greatly on the portion of the nucleus, which still remains buried; and the other portion not being completely supported at its own centre of gravity, fell a little over, leaving the division which now exists between them This is rendered obvious by the first of the rough outlines in pen and ink which I have annexed, the correspondence of the forms being there distinctly seen exactly as they appear in nature, and likewise proving, by the spherical form of the fracture, the globular structure already mentioned in the left hand portion.

The stone is excessively hard, except where it has begun to disintegrate; even with a very heavy hammer, it was not without great labour that I succeeded in obtaining specimens of a considerable size. I send some of the disintegrated portions, which are from the concentric lamellæ of the western half of the boulder. You will be the fittest judge of the precise nature of the stone (which appears to be greenstone, pretty highly crystallized, and containing a little iron pyrites), and what may be the most probable site of its parent rock. To one fact relating to the theory of boulders, and the period at which they were deposited, I would call your attention, from the peculiar situation in which this mass lies, and of which, in the sketches, I have attempted to give some idea. Being placed upon the actual declivity of a small but steep ravine, it seems physically impossible that, had that valley existed at the time of its journey, it should not have been precipitated to the bottom of it. If it came from the last, it is not credible that it should have crossed the channel of the streamlet, and ascended half way up the western bank; and it is equally beyond explanation that, by any power short of a miracle, had it come from the west, the course of so enormous a mass (the weight of which I shall endeavour to estimate), should have come to a stand under the influence of the tremendous impetus, of whatever kind, by which it was moved, in the middle of a short and steep descent of this description. I therefore consider the induction undeniable, that the excavation of the valley must have taken place subsequently to the deposition of this boulder.

In order to form a rough estimate of the size of the fragment, after an attentive inspection by the eye, I conceived the western portion, as far as it is uncovered, to be a semicylinder seven feet long, and three and a half in diameter; and the eastern, a parallelopiped, having a mean of six feet, four and a half feet, and two and a half feet, for its three dimensions. From these assumptions, which must be considered merely as rough approximations, I computed the former fragment to contain about 33 cubic feet, and the later 67. Allowing a half of the bulk of the former for the portion buried, we shall have about 117 cubic feet for the whole.

To gain some idea of the weight of the mass, I took, with great accuracy, the specific gravity of a fresh fractured portion, which I found to be 2.90 *; whence the weight of a cubic foot will be 181 ℔., and the whole mass near 200 cwt., or about 10 tons. Its enormous momentum may therefore be conceived, when it was transported to its present situation from a distance *certainly* of some miles. From the spontaneous decomposition of the greenstone, it is not easy to determine whether it suffered much from attrition in its transportation; but I am disposed to think it has not, from the angular form of the eastern fragment, which now exhibits scarcely the least tendency to disintegration, forming a striking contrast to the other portion with which it has been so closely united.

The argument of the excavation of valleys subsequent to the deposition of boulders might, I believe, be inferred from numerous cases, though this is the strongest I have met with. They are often placed in such insulated situations in mountainous countries as to intimate the degradation of the surrounding soil.

I fear I may have extended my remarks beyond the importance of the subject. But as you were very particular in your inquiries when we last met, I collected such observations as you might consider interesting.

* Weight in air, . 7586 grains.
in water, 4966

Hence sp. gr. $= \frac{7586}{7586 - 4966} = 2.895$. In minute accuracy this should be increased by $\frac{1}{840}$.

To Professor Jameson.

Notice of Earthquakes on the Mississippi. By Mr Flint.

From all the accounts, corrected one by another, and compared with the very imperfect narratives that were published, says Mr Flint, I infer that the shock of these earthquakes, in the immediate vicinity of the centre of their course, must have equalled, in their terrible heavings of the earth, any thing of the kind that has been recorded. I do not believe that the public have ever yet had any adequate idea of the violence of the concussions. We are accustomed to measure this, by the buildings overturned, and the mortality that results. Here the country was thinly settled. The houses fortunately were frail and of logs, the most difficult to overturn that could be constructed. Yet, as it was, whole tracts were plunged into the bed of the river. The grave-yard at New Madrid, with all its sleeping tenants, was precipitated into the bed of the stream. Most of the houses were thrown down. Large lakes, of twenty miles in extent, were made in an hour ; other lakes were drained. The whole country to the mouth of the Ohio, in one direction, and to the St Francis in the other, including a front of three hundred miles, was convulsed to such a degree, as to create lakes and islands, the number of which is not yet known, to cover a tract of many miles in extent near the Little Prairie, with water three or four feet deep ; and, when the water disappeared, a stratum of sand, of the same thickness, was left in its place. The trees split in the midst, lashed one with another, and are still visible over great tracts of country, inclining in every direction, and at every angle to the earth and to the horizon.

They described the undulations of the earth as resembling waves, increasing in elevation as they advanced ; and, when they had attained a certain fearful height, the earth would burst, and vast volumes of water and sand and pitcoal were discharged, as high as the tops of the trees. I have seen a hundred of these chasms, which remained fearfully deep, although in a very tender alluvial soil, and after a lapse of seven years. Whole districts were covered with white sand, so as to become uninhabitable.

The water at first covered the whole country, particularly at the Little Prairie; and it must have been indeed a scene of horror, in these deep forests, and in the gloom of the darkest night, and by wading in the water to the middle, to flee from these concussions, which were occurring every few hours, with a noise equally terrible to the beasts and birds as to men. The birds themselves lost all power and disposition to fly, and retreated to the bosoms of men, their fellow-sufferers in this scene of convulsion. A few persons sunk in these chasms, and were providentially extricated. One person died of fright; one perished miserably on an island, which retained its original level, in the midst of a wide lake created by the earthquake. The hat and clothes of this man were found. A number perished, who sunk with their boats in the river. A bursting of the earth, just below the village of New Madrid, arrested this mighty stream in its course, and caused a reflux of its waves, by which, in a little time, a great number of boats were swept by the ascending current into the mouth of the Bayou, carried out and left upon the dry land, when the accumulating waters of the river had again cleared their current. There were a great number of severe shocks, but two series of concussions were particularly terrible, far more so than the rest. They remark, that the shocks were clearly distinguishable into two classes; those in which the motion was horizontal, and those in which it was perpendicular. The latter were attended by the explosions and the terrible mixture of noises that preceded and accompanied the earthquakes in a louder degree, but were by no means so desolating and destructive as the other. When they were felt, the houses crumbled, the trees waved together, the ground sunk, and all the destructive phenomena were more conspicuous. In the intervals of the earthquakes there was one evening, and that a brilliant and cloudless one, in which the western sky was a continued glare of vivid flashes of lightning, and repeated peals of subterranean thunder seemed to proceed, as the flashes did, from below the horizon. They remark that this night, so conspicuous for subterranean thunder, was the same period in which the fatal earthquakes at Caraccas occurred, and they seem to suppose these flashes and that event parts of the same scene.

The people, without exception, were unlettered backwoodsmen, of the class least addicted to reasoning. And it is remarkable how ingeniously and conclusively they reasoned from apprehension sharpened by fear. They remarked, that the chasms in the earth were in direction from south-west to north-east, and they were of an extent to swallow up, not only men but houses, and these chasms occurred frequently within intervals of half a mile. They felled the tallest trees at right angles with the chasms, and stationed themselves upon the felled trees. By this invention all were saved; for the chasms occurred more than once under these trees.

Silliman's Journal, January 1829.

On the Circumstances which appear to have accompanied the Deposition of the Tertiary Formations. In a Letter addressed to M. ADOLPHE BRONGNIART, by M. MARCEL DE SERRES.

THE observations recently made by M. Elie de Beaumont, on the fossil vegetables of the anthracite or glance coal deposites of the Alps, and the notes which you have added to them, appear to me so important, and seem to coincide so well with the facts which I have observed in the South of France, that they induce me to submit to you the following reflections, even before publishing the facts on which they are founded:—

You observe, and, as it seems to me, with perfect reason, that although, from the identity, or extreme similarity of the vegetables of the coal formation, in all parts of the globe, it is probable that the same kind of vegetation existed over the whole earth at the period when that combustible was deposited, it ought not to be inferred from this, that the same circumstance existed at the periods when the lias formation, the oolites, the chalk, or the Paris formations, were deposited, and that the vegetation was then the same over all parts of the globe.

I agree with you in thinking, that, in proportion as the earth became covered with a greater number of vegetables, and was inhabited by a greater variety of animal species, it tended more and more towards the settled state at which it has now arrived, and that thus the differences of climate beginning to be established, or becoming more decided, different vegetables must have grown in the different zones of the earth, and different animals have peopled a soil, whose vegetation was no longer the same.

But if at the time of the deposition of the lias the earth was already divided, as it now is, into different zones, each of which was characterized by animals and vegetables peculiar to itself, ought it not equally to be concluded, that the geological times were less remote from the present epoch than has hitherto been supposed? In fact, the crystalline deposites, which seem to have been solidified anteriorly to the appearance of living beings upon the globe, and which alone are of any importance with reference to the solidity of our globe, are probably only the result of the diminution of the earth's temperature; or, in other words, a pure thermometrical effect, while the deposites which contain remains of organised bodies enter into the effects produced within the limits of causes at present in action. The terrestrial globe has undergone modifications in its formation, as the other planetary bodies probably have; but it has not undergone great and numerous revolutions, unless the name be given to the last inundation, which has scattered the *diluvium* over a considerable extent of the lower part of our planet.

What at least appears certain, is, that the distinctly stratified tertiary deposites have been produced by causes which had nothing violent or irregular in their action, and that all have taken place in the bosom of the same fluid, whatever diversity there may have been in the habitation of the animals and vegetables, whose remains they contain *. It also appears certain, that the

* This opinion is also that of M. Constant Prevost, who announced it long ago; but it is not admitted by all geologists, and it can only as yet be considered as a theory possessed of more or less probability. We hope to be able shortly to publish an article in which this opinion will be carefully examined, and in which the facts that are favourable or contradictory to it will be comparatively discussed and weighed. For the present we shall merely observe, that we are far from adopting the theoretical opinions considered as positive facts by the author of this memoir; and that, in general, we are desirous of collecting in these annals the most discordant opinions, and those most foreign to our own ideas, when they are deserving of being submitted to the general examination of naturalists.—Editor.

seas were already separated when they were formed; the seas and the ocean having the place which they now occupy, and the continents a configuration nearly the same as that which they have at the present day.

This last fact results from the observation of the numerous differences which are remarked among the tertiary basins depending upon the Ocean and the Mediterranean; and from the striking similarity which exists between the tertiary deposites and the fossils which they contain in basins depending upon the same seas, or upon different seas not at great distances from each other. This does not prevent some particular basins, depending upon the ocean, from having yet communicated with the Mediterranean, or with other seas, when the tertiary depositions took place, especially when their level was low, and coincided with their line of inclination towards the other seas. It is probably on account of this latter circumstance that we find recurring, in the two basins of Lower Austria and Hungary, the formations of the Subappenine Hills and Languedoc, or the marine sands, the calcaire mœllon, or second tertiary limestone, associated with the Swiss nagelflüh, which, representing the middle fresh-water formations, covers the first tertiary limestone, these basins possessing the characters of both oceanic and Mediterranean basins at the same time.

A proof of it will also be found in a multitude of other facts, which we shall proffer in another memoir on the tertiary formations of the south of France, and which is at this moment in the press. It especially results from the constant position of these tertiary deposites in the bottom of valleys never rising to the height of the counterforts, when these attain any considerable elevation. This position of the tertiary deposites, formed in the ancient sea at the foot and base of the secondary counterforts, and without rising with them, is so constant in the tertiary basins dependent upon the Mediterranean, that, in proportion as we rise toward the culminating point of a counterfort, the secondary formations are alone seen, while the tertiary deposites are again found on the opposite side of the same counterfort, which separates two contiguous tertiary basins. This fixed situation at the foot and on each side of the counterforts which separate the contiguous tertiary basins, proves that if the tertiary deposites are not raised higher, it is because, during the time of their precipitation, the waters of the Mediterranean which produced them in each basin, did not rise to the height of the counterforts, and that, in proportion as that sea withdrew within the limits which it now occupies, the mass of its waters, flowing towards its present basin, gradually diminished. It would also appear that the tertiary deposites precipitated in the basin of the ancient sea did not rise in the south of France to a height of more than 400 yards above the present level of the Mediterranean *.

The tertiary formations, with the exception of the upper fresh-water deposites (comprehending the deposites of lacustrine and fluviatile limestone, with the marls and lignites peculiar to this system, in which marine fossils are never seen, unless those which may have been detached from previously existing formations and from the diluvium), being the last relics of the seas, when the Ocean and the Mediterranean were already separated, seem so much the older the more distant they are from the present seas, and so much the newer the nearer they are to them. They appear, moreover, to have this peculiarity, that most of those depending upon the ocean are older than the tertiary deposites depending upon inland littoral basins.

One is involuntarily led to this inference, on observing the difference of position which the marine rocky banks occupy in the two orders of these basins. In fact, the tertiary rocky marine limestones of the oceanic basins are in general inferior to the gypsum containing bones, while those of the inland basins are for the most part not only superior to the gypsums, but also to the subappenine blue marls. Both are as distinct in respect to their geological position as in the fossils which they contain,—a fact on which we have insisted in our papers on the calcaire moellon.

Thus, setting out from the positive fact, that the second tertiary limestone of the South of France is newer than the calcaire grossier, or the first tertiary limestone, since the calcaire

* The tertiary formations deposited after the retreat of the seas from our continents, are the only ones which rise to all kinds of levels, and which rest indiscriminately upon rocks of the most discordant ages.

moellon always occurs superior to marls, which, in the oceanic basins, and particularly in that of Paris, are themselves above the calcaire grossier, there results that, if two parallel series be established, representing the tertiary beds of the Paris basin, and those of the Mediterranean basins, and proceeding from the common term A, *blue clayey marls*, we should have in the Paris basin, A *blue marls*, A′ *upper marine sands*; while, in the Mediterranean basin we should have A *blue marls*, A′ *calcaire moellon*, A″ *marine sands*; a series which, having for its last or upper term, a more elevated stage, indicates, in consequence, that the sands of the Mediterranean formations have been deposited posteriorly to the sands of the Paris basin, or at least that they have followed the deposition of calcareous rocky banks, and have immediately succeeded the blue marls.

But it is remarkable, that, while the second tertiary limestone is wanting in most of the organic basins, and, in particular, in that of Paris *, the first, or that lying under the bone gypsum, seems not to have been deposited in the basins of the south of France. In fact, most of those which are observed there, and we might almost say all, belong to the second tertiary marine limestone, or calcaire moellon. It is of this limestone that nearly all the towns of the south of France are built †, of which it will suffice to mention Marseilles, Nimes, Montpellier, Beziers, and Narbonne; and that the most remarkable monuments, whether ancient or modern, such as the triumphal arch of Orange, the Pont du Gard, a portion of the Arenæ of Nimes, and the beautiful aqueduct of the Peyrou, near Montpellier, have been con-

* This assertion of M. Marcel de Serres is not correct, if we admit the facts, such as they have been represented by the authors of the geological description of the neighbourhood of Paris; for the beds of solid limestone, worked at Nanteuie-le-Haudouin, are considered, in that work, as belonging to the marine formation lying above the gypsum containing bones; and it has not yet been proved that these naturalists have been deceived in this determination, although some geologists appear inclined to consider the limestone in question as the upper part of the calcaire grossier.

† It appears to be the same in Italy and Spain, where the calcaire moellon, as well as the fresh-water limestone, are largely employed in building. It would be useful to observe the different materials used in building, in order to form a correct idea of the extent and development of the various formations of a country.

structed. This deposite is so necessary for the purpose of building in that district, that when it happens to be wanting, or becomes sandy, as in the neighbourhood of Perpignan, the inhabitants are reduced to the necessity of building their houses, and even their monuments, of brick.

If, in our large memoir on the tertiary formations of the south of France, we have admitted the existence of the first tertiary limestone, it is because we were deceived by the presence of green grains in the lower beds of the second tertiary limestone; but, since we have found that these grains also exist in the tertiary marine sands, we have perceived that we there gave the green grains a geological importance which they do not possess.

From these facts, it would appear not only that the seas were already separated at the time when the tertiary formations were deposited, but also that the ocean retired within its present limits sooner than the Mediterranean; a fact which seems equally to result from the geological comparison of the Mediterranean and oceanic tertiary basins, as well as from historical monuments. Thus, the more recent geological times are connected with the historical times; for the period which refers to the tertiary deposites is probably not remote from the present times, as may be presumed, we repeat, from the numerous species identical with those at present existing, which are found in the newer tertiary strata.

If the tertiary deposites have been successively produced, at no great interval from each other, and in proportion as the seas retired, it cannot be admitted that the strata, of which they are composed, and whose organic remains announce different habitations in the beings which they contain, have been precipitated by different fluids, or by successive retreats and refluxes of the waters of the sea, upon our continents. The facts which announce the reverse are so numerous, that, for the sake of brevity, I shall only mention one that has not yet been published, although the basin, in which we observed it, has been visited by numerous geologists.

In the bottom of the valley of Aix (Mouths of the Rhone), and to the south-west of that city, near St Jerom's Mill, there are observed under the diluvium,

1*st*, Tertiary marine sands, characterized by numerous remains of marine shells, mixed with fresh-water *Mussels*, large *Helices*, and *Cyclostomæ*.

2*d*, A hard calcaire moellon, with numerous marine shells, small oysters, and some individuals of *Ostræa crassissima*.

3*d*, A marly fresh-water limestone, with small paludinæ, in contrasting position with reference to the calcaire moellon which lies above it.

The most remarkable thing about this limestone, is its being perforated *in situ* by modioli, and other boring shells. Now, as the connection between the calcaire moellon and the fresh-water limestone is as intimate as direct, both must have been deposited in the same fluid, that is to say, in the basin of the ancient sea; for, were it otherwise, there would be found on the fresh-water limestone some deposite produced during the retreat of the Mediterranean, while this basin was occupied by fresh water only, and inhabited by land animals. No trace of continental surface existing between these two deposites, and the second marine limestone being mingled or alternating with the fresh-water limestone, as, for example, in the basins of Pezenas (Herault), and Lasfoux (Gard), it must be admitted that both have been precipitated in the same fluid, inasmuch as the marine deposites often contain fluviatile and terrestrial organised bodies, as the fresh-water deposites contain marine fossils, the latter being even occasionally perforated by sea-shells, whether *in situ*, as at Aix, or rolled, as at Montpellier.

To recapitulate, and, at the same time, having reference to your observations, it appears to me,

1*st*, That at least, after the deposition of the lias, the climates being already separated, there existed on the earth different zones, inhabited by peculiar animals, and covered with vegetables, to which the temperature of these zones corresponded.

2*dly*, That, when there has been no transportation of animals and vegetables from one zone to another, their remains are still found in the places which they originally occupied; but that when there has been displacement, a mixture has been produced of the remains of organic bodies belonging to one zone, with those belonging to another.

3dly, That the tertiary deposites produced in the basin of the ancient sea (with the exception of the diluvium and the upper fresh-water formations formed after the retreat of the seas), are so much the older, the more remote the basins in which they are observed are from the present seas, and so much the newer, the nearer these basins are to our seas.

4thly, That the tertiary deposites of the basins depending upon the ocean seem older than the same kinds of deposites of the littoral basins of the Mediterranean, since the second tertiary limestone is almost the only one that occupies a great extent in the Mediterranean basins, while the first occupies almost the whole extent of the oceanic basins.

5thly, That the tertiary deposites have been produced by causes similar to those still acting, although with less energy, and that the great number of species, similar to ours, which they contain, indicate that their depositions have not much preceded the present geological period.

The interesting nature of the subject to which these observations refer, will perhaps induce you to pardon their length. You will judge better than any one how far the geological phenomena accord with the causes which are still acting; and it should not be forgotten how much the progress of geology has been retarded by the idea, generally admitted, that these phenomena could only be accounted for by supposing them produced by causes that have ceased to operate. In consequence of this manner of considering the modifications which the terrestrial globe has undergone, the extinct volcanoes have been looked upon as effects of a different nature from those which our present volcanoes exhibit; and it has been refused to see in the crystalline beds, and the heavings which have raised them above their original level, proofs of the elevated temperature which the now solid crust of our globe possessed at its commencement.

On Pasturages, their importance and their extent, in the different countries of Europe.

M. Moreau de Jonnes read, a few months ago, to the French Institute, a memoir entitled, *Statistical inquiries respecting the extent and the nature of Pasturages in the different parts of Europe.*

The author commenced with shewing the defects of the systems of cultivation in which the subsistence of nations is left dependent upon the uncertain chances of the harvests of cereal vegetables. The frequent famines to which all the countries of Europe have for many ages been subject, sufficiently attest the unavoidable danger attendant upon the use of these systems.

A new system of cultivation has been lately introduced and progressively improved among different nations, and particularly in England, where it has produced the most happy results. Not only has the proportion of land devoted to pasturage been extended, but this land has been rendered incomparably more fertile of vegetables adapted for the food of cattle. The influence of this happy modification appears to have been immense. To give an idea of its extent and power, M. Moreau de Jonnès, passing in review the different nations of Europe, shewed that the agricultural and commercial prosperity and well-being of the inhabitants are everywhere in direct proportion to the extent of land left for pasturage, whether in improved natural meadows or in artificial meadows. In these respects, England is at the head of the European countries, while Spain, in which the cultivation of artificial meadows is entirely unknown, is the lowest in the scale.

The author particularly compared England and France. There results from important documents that, with respect to the latter country, agricultural improvement is at the point at which the former was a century ago; and that, to equal England, France would have to make the immense progress which, since that time, has more than doubled the agricultural prosperity and well-being of that country.

England not only surpasses France with reference to the number of cattle, but the animals are also finer, and their flesh is of better quality; so that the inhabitant of England may employ for his food a quantity of animal substance nearly double that which France supplies to each of its inhabitants, and has the further advantage of having it of better quality.

From the very numerous facts contained in his memoir, M. Moreau de Jonnès draws the following conclusions:—

1. That the pasturages, being the condition of existence of cattle and sheep, are one of the necessary elements of the well-being of men, the agricultural and commercial riches of states, and the civilization of nations.

2. That they become eminently productive, only through the assiduous and persevering cares of human industry; and that they abound in species adapted for pasturing animals only by their conversion into artificial meadows, or by the destruction of useless or pernicious plants, which in all countries overrun the natural meadows.

3. That when these means of prosperity are not employed, there is a loss of three-fourths in the development and fat of pasturing animals, and that then, as in the provinces of France, the mean quality of flesh furnished for consumption by a hectare of pasturage, does not exceed 98 lb. in place of rising to 400 lb.

4. That, on the contrary, by the use of these means, 300 lb. of animal food are obtained from a hectare of improved natural meadows, and 400 lb. from the same extent of artificial meadows.

5. That calculating only at the rate of 30 per cent. the pound of flesh, and the products of cattle and sheep, hides, wool, butter, milk, and cheese, the revenue of the hectare is 49 francs when in unreclaimed pasture, 150 francs when in improved pasture, and 200 francs when in artificial pasture.

6. That, consequently, the 5,775,000 hectares at present abandoned in France to pasturing animals, produces only a nett revenue of 282,000,000 francs, while, if they were converted into improved meadows, they would yield 863,000,000, and into artificial meadows, a third more.

7. That such an increase of revenue, rendered attainable by attention to the pasturage, raises to the first rank of economical

and agricultural improvements those from which so important results might be expected.

8. That the improvement of pastures, which is the necessary condition of this increase, requires a complete investigation of the geographical distribution of pasture plants, and careful inquiries for discovering by what secret operations nature peoples the meadows with useful or noxious plants, and by what means the multiplication of the former may be favoured, and the invasion of the latter opposed.

With this twofold object, the author announced that he had made inquiries by means of experiment and observation respecting the following questions:—

1. What are the local causes of the diversity of pasture plants, in the different natural meadows of the same country?

2. What are the original causes of this complicated phenomenon?

3. What are the means by which the indigenous flora of pastures may be improved?

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*Biography of M. Bosc.** By Baron Cuvier.

M. Bosc was of a family belonging to the Cevennes, which, although formerly flourishing, had suffered greatly in consequence of religious wars, and its firm attachment to Protestantism. He was at first intended for the military service, and the powerful interest which his family still possessed seemed to hold forth the promise of brilliant success in that career. But his genius impelled him in another direction.

He had scarcely begun to walk, when the observation of natural objects became his only passion. He collected stones and caught insects, before he knew to write; and he himself has said that he did not remember ever to have had other amusements. This natural inclination was farther strengthened by domestic occurrences. M. Bosc d'Antic, his father, married again, but his second wife shewed little kindness toward the offspring of a

* The above is a sketch of a beautiful memoir of the celebrated Bosc, read to the French Academy in June 1829, but not yet published.

first union. He was allowed to pass his days in the woods, and the love of solitude with which he was there inspired clung to him so long, that, at the age of fifteen, and protestant as he was, the idea of giving himself up entirely to it, joined with that of cultivating a small garden, had nearly induced him to yield to the suggestions of a Chartreux, who was anxious to draw him into his order.

On being placed in the college of Dijon, M. Bosc retained his former tastes, notwithstanding the efforts of his masters to induce him to renounce them, and attach himself to the study of mathematics, which his friends were desirous that he should cultivate, as calculated to contribute to his success in the military career, for which he was still intended. It would appear that he was rather a bad scholar, and that he did not distinguish himself until he was at length permitted to attend a course of lectures on botany.

Reverses of fortune at length induced M. Bosc's father to renounce his design. The young naturalist obtained a situation in the post-office department. In this employment, so little suited to his inclinations, he was yet taken notice of for his accuracy and intelligence, and in a short time obtained an advancement, which left him a little more leisure, and allowed him to return to his favourite studies.

At this period the precise and methodical school of Linnæus, supported in France by a small number of partisans, was struggling against the more attractive but less rigorous direction which had been given to the natural sciences, by the surprising discoveries of Reaumur, the profound researches of Bernard de Jussieu, and especially the bold conceptions and lofty eloquence of Buffon. M. Bosc was one of the first and most ardent sectaries of the Linnean school. His admiration for the works of Fabricius procured for him the acquaintance and friendship of that celebrated man, who, until his death, remained his devoted friend.

M. Bosc, who was one of the founders of the Philomathic Society, also founded at Paris a society in imitation of the Linnean Society of London; but it did not long exist, the political disturbances of those times having quickly brought about its dissolution. He had hitherto retained his situation in the post department, but could not long escape the tempests of the revolution. He had been the intimate friend of Roland, and nothing was able to prevent him openly shewing his attachment to him after his fall; he had visited Servan at the Conciergerie; he had always openly seen Madame Roland, whether at it, or in the different prisons. The day on which she was arrested, she had confided her daughter to him, and it was in his hands that she deposited her manuscripts. Roland himself had found an asylum in a small house which M. Bosc rented at the bottom of the wood of Montmorency, and it was from it that by winding paths he betook himself to Rouen, where he was concealed by two friends. This was more than enough to make him lose his employment, and had he remained in Paris it is probable that he would have shared the fate of his friends. Fortunately he had the idea of retiring to that very solitude which had afforded an asylum to Roland. The distance at which he there was from frequented places and roads, the coarse clothes which he wore, and his labouring with his own hands, prevented his neighbourhood from suspecting what he was, and especially from imagining the connexions which he had.

In this retreat he learned, with inexpressible grief, that Madame Roland had perished on the scaffold, and that on receiving the news her husband had killed himself. He thought himself lost one day when on a walk he met Robespierre face to face, whom he heard pronounce his name quite low. But neither grief nor danger could induce him to repel the unfortunate persons who still came to ask an asylum of him. One shudders when he thinks of his concealing in a small garret one of the deputies condemned to the scaffold, at the very moment when chance had brought about his house some of the agents employed in seeking out proscripts. With this unfortunate person he sometimes had nothing better to share than snails and wild roots, and in his sickness nothing to offer but the eggs of a single hen, which, at length, was one day killed by a hawk. This very deputy, issuing from his place of concealment, after the 9th Thermidor, saw himself in the course of a few months at the head of that Directory, which, in the fulness of its quickly acquired power, made Germany tremble, conquered Italy, dethroned the Pope, the King of Sardinia, and the King of

Naples, humbled the King of Spain, and forced Austria to sign a peace which added a fourth to the extent of France, and left her almost mistress of the south of Europe.

It might naturally be supposed that M. Bosc should be raised to affluence by the man whose life he had so recently saved, and who had now become one of the masters of the state. This, however, was not the case: M. Bosc was too proud to allow himself to do good for the purpose of benefiting himself. It was intended to restore to him his office, but it was at the same time necessary for him to become the colleague of those who had reduced him to destitution. Nothing in the world could have induced him to do this, and his great protector had not the power to reinstate him on any other conditions. All the favour he was able to shew him was to come sometimes and walk with him at the little house which had furnished him an asylum.

He experienced another keener disappointment. The young lady, whom a dying mother had confided to his care, inspired him with a passion which she did not return, and nothing could quiet it but a long and great separation. It had been promised to him, that, on the first vacancy, he should be appointed consul to the United States. His friend, Michaux, at that time directed a botanic garden in Carolina; from him he was sure of a good reception, and he determined to go and wait his promotion on the spot. M. Bosc's voyage was attended with many disagreeable circumstances. The absence of M. Michaux, who passed him on his way to Europe; a long adjournment of his hopes; the coolness at first, and then the rupture between the government of the United States and that of France, disturbed the tranquillity which he enjoyed in America, and were sad compensations for the happiness which he at length had, in living a life according to his taste, devoted to the study of the natural sciences.

When, in 1800, the broils between France and the United States had risen to such a pitch that it became impossible for French agents to remain in America, M. Bosc found himself in a condition to carry contributions to all the naturalists in Europe. In fact, always generous, if he had new insects, they were for his friend Fabricius, or for Olivier; if fishes, he gave them to Lacepede; birds, to Desmarest; reptiles, to M. Latreille. Whoever laboured in any department of natural history, was sure to obtain from M. Bosc all that he possessed, and of learning all that he knew. It was only after enriching so many writers with the fruits of his labours, that he determined to profit by them himself.

M. Bosc, on returning to France, found every thing there reduced to peace. The men with whom he was connected in friendship and fellowship of sentiment were in credit, and the places which he had occupied could not fail to be restored to him. However, tired of being balloted from one ministry to another, and frightened at the idea of becoming dependent, he accepted, with joy, the situation of inspector of the gardens of Versailles, which Count Chaptal obtained for him, and to which he fixed himself.

M. Bosc's principal writings are to be found in the *Dictionnaire des Sciences Naturelles.* Any other would have preferred employing his rich materials for a work which was not collective; but here, as in every other case, M. Bosc looked only to utility, and took no care of the interests of his self-love. For the same reason he held his *Cours d'Agriculture* in greater estimation than all his other works. The second edition of that collection appears especially to have occupied his whole attention. "I have not read a book," he writes, "I have not assisted at a society meeting, nor taken a walk in the gardens or fields, without taking notes; and these notes have been arranged so as in a few days to be intercalated in the articles to which they refer."

This was his constant method of labouring. Every one may have seen the beautiful collection which he formed near the Luxembourg of our principal varieties of vines. The kingdom produces upwards of 1400. To compare them, determine their permanent characters, ascertain the circumstances best adapted for their thriving, and then propagate by preference the most advantageous with reference to each kind of soil, exposure and latitude, would be a labour of the highest importance, and one whose advantages might be immense with respect to our territorial riches.

M. Bosc had undertaken this task. Already in three years he had described, or caused to be drawn, more than 400 of these varieties; but he would have required ten years,—and in France it is very seldom that a project which is only useful meets with ten years' continued encouragement from the higher administration. It would be necessary that the chief should be possessed of as much knowledge as his subordinate, or that he had the modesty not to interfere with the direction,—and while he possessed one or other of these rare qualities, it would be required that he should remain ten years in place. The concurrence of these three conditions, however, every one will perceive to be impossible.

It was in the course of the journeys which he made, in order to complete his undertaking, that M. Bosc caught the germ of the disease which shortened his days. He always performed these journeys on foot, as in his youth. Being overtaken by a violent storm in the Department de l'Ain, the cold and wet to which he remained for a long time exposed, produced a serious interruption of his health, which led him slowly to the grave.

In his latter years he experienced great disappointments. M. Thouin's place having become vacant in the Jardin des Plantes, M. Bosc became a candidate for it. Notwithstanding the numerous titles which he had to obtain this place, the majority of votes was against him. It was not that the professors did not do full justice to his merits, but that the greater number thought it improper to charge an infirm old man with functions which had already been but too long performed by an old man. Another was, therefore, placed on the list. The higher authority, however, chose M. Bosc, not from any interest felt for him, but from dislike to the candidate who had obtained the majority of votes. This disposition of the authority towards him was presently rendered evident by the suppression of the place, on which he saw that he had only been appointed to it for the purpose of preventing another from getting it. It cannot be denied that the mortification which M. Bosc experienced, in consequence of this affair, hastened his end by embittering his days. M. Bosc was born at Paris on the 29th January 1759, and died on the 10th July 1828, aged sixty-eight years.

M. Cuvier's discourse was frequently interrupted by applauses. M. Bosc's eloge appears in all respects worthy of occupying a place among those which form the interesting collection of which three volumes have already been published by Cuvier.

On the Land Crabs of Jamaica. By Alexander Barclay, Esq.

Crabs abound in the eastern part of Jamaica, at all seasons, but are considered to be best in the months the names of which contain the letter R. They are most plentiful in May, the season at which they deposite their eggs, or *run*, as the Negroes express it, and when the earth is literally covered with them. At this season it is impossible to keep them out of the houses, or even out of the bed-rooms, where, at one time scratching with their large claws, and at another rattling across the floor, they make a noise that would not a little astonish and alarm a stranger. Occasionally they will lodge themselves very snugly in a boot, and if a person puts his foot upon them inadvertently, he has quick intimation of the intruder, by a grasp of his nippers. For a few weeks in this season, they may be gathered in any quantities, and the Negroes sometimes hurt themselves by making too free use of them. Even the hogs catch them, although not always with impunity, as a crab sometimes gets hold of one of them by the snout, from which he is not easily disengaged; and the terrified animal runs about squeaking in great distress.

At other seasons, and when more valuable, they are caught by torch light at night, and put into covered baskets. Crowds of Negroes from the neighbouring plantations pass my house every evening with their torches and baskets, going to a crab wood on the other side, and return before midnight fully laden. Their baskets will contain about 40 crabs, and the regular price is a five-penny piece, our smallest coin, equal to about 3½d. Sterling, for five or six crabs. At this rate a Negro will make 2s. 6d. currency in an evening; and the more improvident, who will not cultivate provision grounds, depend, in some measure, upon catching crabs, and selling them to the others. A hundred plantains, usually sold at five shillings, will purchase from sixty to seventy crabs, and two of these eaten with plantains or yams, make an excellent meal. I have seen upwards of a hundred Negroes pass my house in an evening, and return with their baskets on their heads, not only full of crabs, but with quantities of them fastened by the claws on the tops of the baskets. I make but a moderate computation, when I suppose they must have had, at the very least, three thousand crabs. Almost every Negro family has an old flour barrel pierced with holes, in which their crabs are kept. They are fed with plantain skins, &c. and taken out and thrown into the pot as wanted.

There is a great variety of crabs in Jamaica, of which two only are eaten. The black is the finest, and has ever been esteemed one of the greatest delicacies in the West Indies, not excepting even the turtle. These live in the mountain forests, on stony ground, and feed on the fallen dry leaves of the trees. The white crab, as it is called (although rather purple than white) used principally by the Negroes, but by the white people also, is larger, and more resembles in taste the lobster of this country. These are amphibious, and are found in the low lands, principally in the woods, where, as I have already said, they are caught at night with torches. But they are numerous also in the cultivated fields, and in some of the low lying estates frequently do considerable damage to the planters in dry weather, when vegetation is slow, by nipping off the blade of the young canes and corn, as it shoots through the ground. In situations of this kind, the Negroes have a somewhat singular method of catching them: they know from the appearance of a crab hole if there be a crab in it, and dig down with a hoe through the soft loam, till they come to water (about eighteen inches or two feet); and then close the hole firmly with a handful of dry grass. In this manner a Negro will shut up two or three dozen of holes in a morning. About four hours after, he returns, and his prisoners being by this time *drunkened* (half drowned), they tumble out along with the plug of grass, and are caught.

In the year 1811, there was a very extraordinary production of black crabs in the eastern parts of Jamaica. In the month of June or July of that year, I forget which, the whole district of Manchioneal (where the great chain of the Blue Mountains, extending from west to east, through the centre of the island, terminates on the east coast) was covered with countless millions of these creatures swarming from the sea to the mountains. Of this singular phenomenon, I was myself an eye witness, having had occasion to travel through that district at the time. On ascending Quahill, from the vale of Plantain-Garden River, the road appeared of a reddish colour, as if strewed with brick-dust. I dismounted from my horse to examine the cause of so unusual an appearance, and was not a little astonished to find that it was owing to myriads of young black crabs, about the size of the nail of a man's finger, crossing the road, and moving at a pretty pace direct for the mountains. I was concerned to think of the destruction I was causing in travelling through such a body of useful creatures, as I fancied that every time my horse put down a foot, it was the loss of at least ten lives. I rode along the coast a distance of about fifteen miles, and found it nearly the same the whole way, only that in some places they were more numerous, and in others less so. Returning the following day, I found the road still covered with them the same as the day before. How have they been produced in such numbers, or, where are they come from? were questions that every body asked, and no one could answer. It is well known the crabs deposite their eggs once a year, and in the month of May; but, except on this occasion, though living on the coast, I never saw a dozen of young crabs together, and here were millions of millions covering the earth for miles along a large extent of sea coast. No unusual number of old crabs had been observed that season; and it is worthy of remark, that this prodigious multitude of young ones were moving from a rock-bound shore, formed by inaccessible cliffs, the abode of sea birds, and against which the waves of the sea are constantly dashed by the Trade-wind blowing directly upon them. That the old crabs should be able to deposite their eggs in such a part of the coast (if that, as would appear, is the habit of the animal) is not a little extraordinary. No person in Jamaica, so far as I know, or have heard, ever saw such a sight, or any thing of the kind, but on that occasion: and I have understood, that, since 1811, black crabs have been abundant farther into the interior of the island than they were ever known before.—*Barclay's View of Slavery in the West Indies.*

Of the Red Pigment called Carucru or Chica. By John Hancock, M. D. Communicated by the Author.

This is a fecula procured in the manner of indigo, from a species of Bignonia. The plant producing it is chiefly found towards the head of Essequibo, Parima, and Rio Negro, where it is known by the name of Chica.

There is one of these, a large extended vine, growing in Tapacoma; and that is the only one I know of on the eastern part of Guiana. It there grows extremely frondose, and climbs to the tops of the highest trees. This shews that it might be cultivated in Guiana to any desirable extent.

When you break a branch, the leaves, on drying, become almost of a blood red; and it yields its paint or fecula, I believe, in tolerable quantity, or in greater proportion, than is got off indigo from the Anil.

The chief manufactory of the carucru is amongst the Tarumas, a numerous and industrious tribe of Indians, who inhabit the eastern branch of the Essequibo, near its source.

According to the description given us by the Caribs, who are great travellers, and well acquainted with the Tarumas, the plant is manufactured much in the manner of indigo. The leaves are pounded and infused in water till a fermentation ensues. The liquor is next poured off and left to deposite a sediment. This sediment is collected, and forms the carucru paint.

It is seldom mixed with impurities. I believe the carucru, which is produced by the Tarumas, at the head of Essequibo, is usually much finer than that which comes down the Orinooko from the Rio Negro.

They put it up very neatly in little caskets made with palm leaves *. Hence, it is carried by the Atorayas and the trading

* The same Indians (the Tacumas) are the fabricators of those curious Cassada graters, which are considered superior to all others by those acquainted with them. They are made of a very hard wood, studded over with pointed silicious stones, and fixed by a kind of cement and varnish of surprising durability; the substance being at the same time a strong cement and

Caribs over all Guiana. Very little, however, reaches the eastern shore, unless by the way of the Orinooko.

The fracture of this substance is smooth, of a soft cochineal crimson shade, diffusible, but insoluble, in water, unless by heat, which I have not tried. When once fired, it burns without flame until completely incinerated, leaving a grey cinder, nearly equal in bulk to the portion burnt. This cinder is quite insipid, containing, it seems, little or no alkali; and is probably a combustible substance, combined with an earthy base.

The Carucru or Chica is an article in great demand amongst the interior Indians as an ornamental paint. They employ it chiefly as a pigment for the face, while they stain the other parts of the body with Arnotta. They also apply the carucru on the cheeks and about the eyes, and variegate the countenance by marking the forehead, and along the facial line, with their coomazu, a yellow clay or ochre which is abundantly found near the residence of the Carib chief Manarawa.—This manner of painting produces a singular and striking contrast, and gives them a very strange and furious appearance.

From the scarcity of this pigment, however, its employment is almost exclusively confined to their chiefs and higher orders, their nobility. The rest must be contented to decorate their persons with Arnotta or Poncer mixed with the oil of Carapa, a portion of which, with the balsam of Aracousiri (from a species of Amyris), mixed with these paints, imparts to them a very fragrant and agreeable odour.—The toilet, therefore, of these rude tribes is simple as their manners and mode of life, their chief material being perfume, and all being carried in a little gourd.

It is not a little extraordinary that such a species of manufacture as this would be carried on by such a tribe, like those of the interior of Guiana. It seems to indicate, at least, that great advantages are derivable from it, since they are such as to fix the attention of savages. I am not aware that indigo was found prepared by the Indians of America.

a transparent varnish. These Cassada graters are scarcely, if at all, known on the coast, or in the European settlements; and those who may hereafter visit these parts will do well to inquire after this manufactory.

Hitherto very little of the chica, I presume, has reached Europe; and very few experiments have been tried for the solution and application of the colouring principle. I feel strongly prepossessed, however, that the carucru might be applied to useful purposes in dyeing, but I can say nothing positive on this point, having made no experiments with it as a dye,—nor having discovered its chemical properties any farther than above mentioned.

It would be extremely interesting, by proper chemical agents, to find a solvent which should not injure the colour, and also a method of applying it either with or without a mordant—with a view to employ it like indigo as a dye, as well as a pigment.

It is certain that it might be abundantly procured by planting and manufacturing it in Guiana, where the specimens I have alluded to prove the soil to be most congenial to its growth, or by sending it up the Essequibo. In the mean time, the finest quality may be had of the Taruma Indians.

The chica is not merely esteemed as a pigment, but is considered in the Orinooko as the most sovereign remedy for erysipelas, where that complaint is very prevalent. I never, indeed, witnessed its use myself; but, from the strong terms in which I have heard many people speak of its efficacy in their own cases and those of others, I cannot but consider it as a remedy well established, and worthy of further attention. It is simply made with water into a paste, thinly spread on old linen or cotton, and applied as a plaster, so as to entirely cover the inflamed part. They say that one application is sufficient, unless the disease be far advanced.

I have also heard it mentioned as an internal remedy, but in what case or what complaint I do not now remember.

Report on the Impression made on the Ground by the Foot of the Sow. By Messrs Robert Spittal and Robert Stevenson junior.

In compliance with a wish expressed at the last meeting of the Wernerian Society, that the question as to the impression made on the ground by the foot of the sow, in relation to Dr Fleming's remarks on that subject, be decided by experiment, I beg to lay the following remarks, containing the conclusions which my friend Mr Robert Stevenson junior, and I, from experiment and observation, have come to on this topic. The common domestic pig was the subject of our observations.

To ascertain the impression made by the feet of these animals, we with some difficulty caused them to walk across a board spread over with soft clay, to about three-eighths of an inch in thickness, and were satisfied, on subsequent examination of the marks made, that, at some places, these were bisulcated, but at others, they presented, besides the bisulcated impression, those of the two posterior toes; and indeed, this was the most frequent appearance. The board, in this case, was placed in a horizontal position, and we could not, owing to the unruly nature of the animals, succeed in making them walk along it while in the position of an inclined plane; but, what answered nearly the same purpose, the animals were let out into a court, the surface of which was generally uneven, hard at some places, and soft at others.

In this case, we observed, that while walking down a soft inclined surface, there were always four marks, and this was generally the case on soft level ground, where the yielding surface was deep, so that the animal's feet sunk deeper than they could have done on a shallow soft surface, thinly spread over an unyielding one; and on places of such a nature, we frequently observed bisulcated impressions, but more frequently with marks of the posterior toes added to these.

On observing the animals walking over an unyielding horizontal surface, it was quite evident that the two posterior toes generally touched the ground when the animals took long steps, and it is clear that this brings the posterior toes nearer to the ground, by causing the legs to form a more acute angle with it, than when shorter steps are taken,—the legs in the latter case forming more nearly a right angle with the ground, and resting entirely upon the two anterior toes, as is generally the case when standing upright. They thus leave on the ground a bisulcated impression, provided the surface be not too soft, or the yielding portion too deep, as mentioned above.

On ascending an unyielding inclined surface, the two posterior toes never touched the ground; on descending the same, they generally did so, however. From the foregoing remarks, then, it appears, that, on comparatively hard ground, where the impressions are slight, the marks made may be either bisulcated, or have in addition those of the posterior toes, on a horizontal surface; always bisulcated on ascending an inclined surface; but on descending the same, will generally present, in addition, the marks of the posterior toes; but this may or may not happen, according to the inclination of the surface.

The general conclusion to be drawn from these observations we think is, that the impressions made by the feet of the sow on the ground, vary according to the softness, depth, and position of the soil over which the animal may have passed; and though it seems to be true, that, in general, there are four impressions, viz. of the two anterior and two posterior toes, still it seems equally true that the same animal may, in certain circumstances, leave a bisulcated impression, or that of the two anterior toes only.

April 1829.

On the Tertiary Fresh-water Formations of Aix, in Provence, including the Coal-field of Fuveau. By Roderick Impey Murchison, Esq., and Charles Lyell, Esq. junior, Secretaries to the Geological Society; *with a Description of Fossil Insects, Shells and Plants, contained therein; by* John Curtis, *F. L. S.; J. De C. Sowerby, Esq. F. L. S., and* J. Lindley, *Esq., Professor of Botany in the London University.* Communicated by the Authors.

We are induced to offer the following sketch of the tertiary district around Aix, in Provence, from finding that several of the testacea and plants which we collected there last summer belong to species hitherto undescribed; and more particularly that we may point out the geological position of certain fossil insects, of which Mr Curtis has added some interesting figures, and a description. A portion of this district has already been described by M. Bertrand Geslin *, and as a still more detailed account of the whole country is shortly expected from the pen

* Sur le Bassin Gypseux d'Aix, &c. Mem. de Hist. Nat. de Paris, tom. i. part 2. p. 273.

of M. Elie de Beaumont, we shall confine ourselves to such a line of section as may illustrate the objects above alluded to.

The oldest and fundamental rock of this district, is a secondary limestone, comtaining Belemnites, Gryphites and Terebratulæ, which, in highly inclined and contorted strata, rises to the lofty and peaked summits of Mont St Victoire. This rock is referable to some member of the Jura limestone, and unconformably deposited thereon is the vast fresh-water formation we are about to describe.

The town of Aix is situated in the lowest part of a deep valley, running from E. to W., the immediate flanks of which are composed of this overlying deposit. On the northern side of the valley the strata rise to the height of many hundred feet above the town; and the high road from Paris descends over a denuded escarpment of strata, which may, for our present purpose, be grouped together in the following manner :—

Upper Beds.—White calcareous marls and marlstone, passing occasionally into a calcareo-silicious grit, used as millstones, with a band of resinous flint. This system contains a small and undescribed species of Cyclas, named *gibbosa* by Mr Sowerby, *Potamides Lamarckii*, *Bulimus terebra*, *B. pygmeus*, and a new species of *Cypris*. Below these beds, which form the cap of the range, are marls, both argillaceous and calcareous, containing many species of fossil plants, some of which, together with several others occurring in the inferior gypseous beds, have been examined by Mr Lindley, whose account of them will be found at the end of this memoir.

The amount of thickness of these overlying beds is at least 150 feet. Here the subjacent strata run out horizontally into a terrace, in which is placed the upper zone of gypsum, and which is reached by a highly inclined flight of steps sunk through beds of marlstone and marl. These gypsum quarries had long been celebrated for their prodigious number of fossil fish and plants, but the discovery of insects is of very recent date; and their occurrence was first made known to the scientific world by M. Marcel de Serres *. In our examination of the exact position of these remains we descended about 260 steps, through marls and marlstones, abounding in plants, fish, and an occasional shell; and, on reaching the gypsum gallery, we observed the following order :—

* Bulletin des Sciences, vol. viii. p. 181. (No. 15.)

		F	In.
1.	The roof called "Les Caniards"—a mass of spear-shaped crystals of gypsum, in a matrix of pulverulent marl, . .	2	0
2.	"La Noire"—dark green and white fine laminæ of marl, with some vegetables and crystals of gypsum, . . .	0	2½
3.	"La Figuette"—fine foliaceous marl, with some gypsum, .	0	5
4.	"La Feuille"—compact bituminous marlstone, light green colour, ...	0	2
5.	"La Feuille à Poisson," or Bed containing many Fish—a light brown finely laminated marl, with a polished upper surface, contains also several plants, including the Flabellaria Lamanonis? Ad. Brongniart, ...	0	2½
6.	"Feuille à Mouche," or Insect Bed.—This is a brown greenish, or light grey calcareous marl, effervescing briskly with acids, fetid under the hammer, very thinly laminated, and is the only bed in which insects have been found; with these are, however, associated an occasional Potamides, and leaves of plants,	0	2
	By the aid of the lens, it may be seen that there are sometimes more than seventy distinct laminæ in the thickness of an inch, being about as thick again as ordinary printing paper, often preserving a very uniform thickness, and sometimes one of them is equal to from five to ten of the others. Although the rock may be divided at almost any of these laminæ, it generally requires a sharp blow of the hammer. An impression of the form, together with different parts of the insect, is seen both on the upper and under laminæ, as in the case of the Monte Bolca fishes.		
7.	"Feuille de Diablon"—more compact, and passing below into gypsum, ...	0	2½
8.	"Le Diablon"—first good bed of hard workable gypsum, thinly laminated, of whitish brown colour, and containing an occasional nodule of silex, ...	0	6
9.	"La Premiere Blanche"—best quality of saccharoid gypsum, colour white and pink, with large stems and leaves of Flabellaria, &c.	0	9½
10.	"La Seconde Blanche"—saccharoid gypsum, less white than the above, ...	0	8
11.	"La Prime"—differs little from 9. and 10. . . .	0	5
12.	"La Rouge"—reddish tinge, contains amongst others leaves resembling those of *Laurus dulcis*, or cinnamon?		
13.	"Les Queirons"—with occasional silex, vegetable stems, and minute plants, ...	0	7½
14.	"La Soutanne"—gypsum becoming of bad quality, with an occasional Potamides, ... , .	0	6½
15.	"La Tuf"—fetid coarse gypseous marl, forms the bottom, and rests upon, ...	0	6
16.	"Pierre Froide," or Dead Bed—compact argillaceous marlstone.		
	Total of Gypsum Gallery,	7	5

By penetrating still further through marls and marlstones, to the depth of from thirty to forty feet, a second mass of gypsum is found, which, although of excellent quality, is less worked than the upper zone just described, as being less accessible. Fish of various sizes, and in great abundance, are also found in this part of the series. A third range of gypsum occasionally crops out on the denuded and fissured sides of the hills, but is said to be of inferior quality, and, from its ordinary deep-seated position, is rarely worked.

These ranges of gypsum and marl graduate downwards into a flesh-coloured limestone, highly charged with potamides (*Cerithium* of Lamarck), and two species of Cyclades, one of which is the *Cyclas gibbosa* above mentioned, and the other is a large and also a new species, and has been named *Cyclas Aquæ Sextiæ*. The limestone is, in some parts, highly contorted, passing into a sandy calcareous grit, in other localities into a red sandstone (molasse), and still lower into a calcareous breccia, very compact, the beds of which are separated by wayboards of argillaceous marl, the whole terminating in a coarse conglomerate of rounded pebbles (nagelflue.) In all the parts of this lower system which we examined, we found the beds much contorted, or inclined from 25° to 30° to the N. N. E., and hence they are rapidly lost under the marls and gypsums *.

The accompanying sketch (Plate V.) will give a general idea of the relations of this vast fresh water formation, shewing that, since the epoch of its deposite, all the deep valley in which the town of Aix stands, has been formed †.

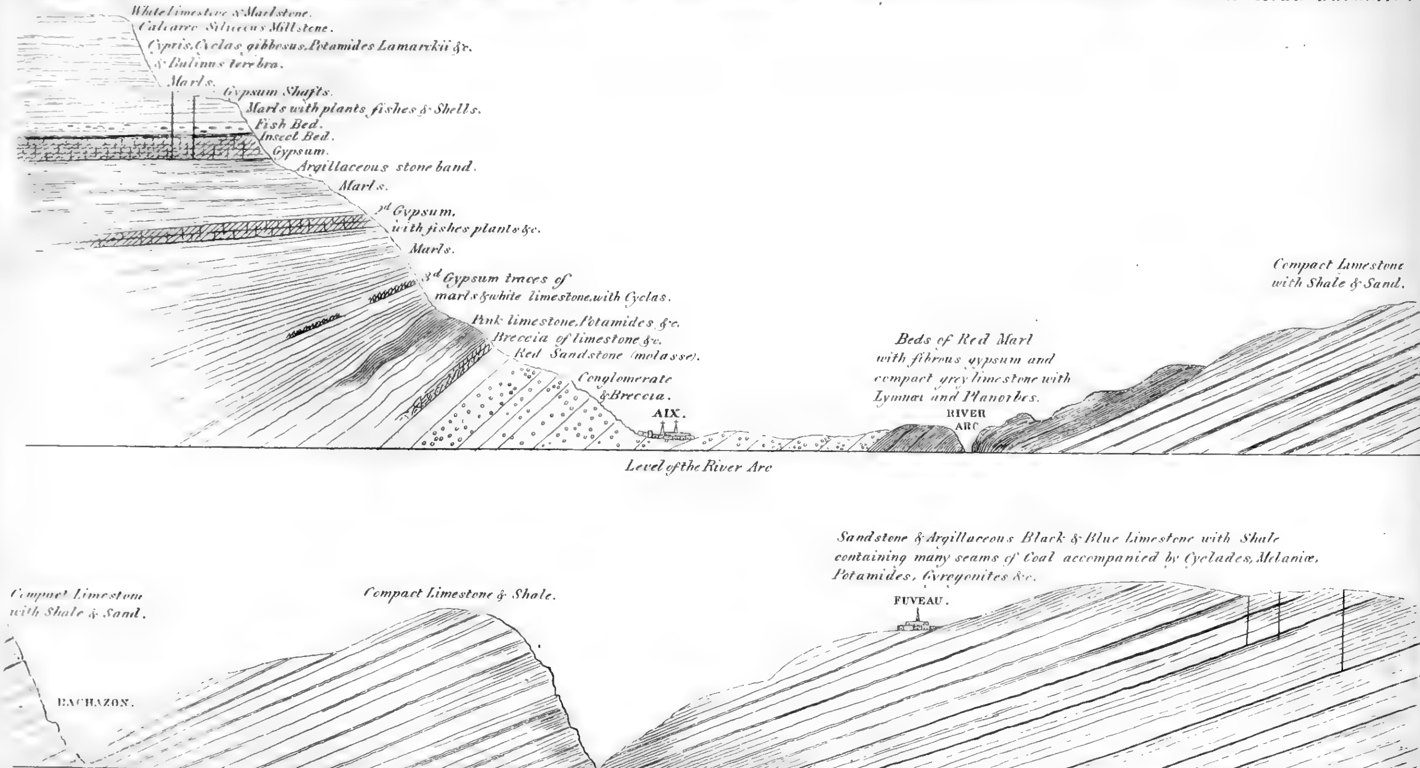
We have briefly described the strata forming the escarpment

* In an interesting article in the second number of the London Review (from the pen, we believe of Dr Daubeny), the frequent verticality and violent disturbance of the strata in the immediate proximity of hot-springs is pointed out. The contiguity of the baths of Aix to great dislocations of the strata, afford a good example in corroboration of his views.

† Upon the fresh water beds in the bottom of the valley are seen, in the immediate environs of Aix, a small deposite of marine sand, containing large oysters. These strata, as well as some insulated patches resting on the jura limestone, near Aix, must be referred to a formation *posterior* to the fresh water series described. To determine, with accuracy, the geological relations of these more recent strata, would require a more extensive investigation of this and the neighbouring districts, than our time enabled us to accomplish.

Edin.r new Phil. Jour. Vol. XII. p. 290.

Section from the Escarpment N.E. of Aix in Provence to the Coal field of Fuveau exhibiting a succession of TERTIARY FRESHWATER DEPOSITS.



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on the northern side of the valley; and we now proceed to those on the south flank. Here, to the south of the river Arc, we find a country extending for many miles in the direction of Toulon (intersected by a series of valleys having the same general direction, viz. from east to west, as the principal valley of Aix), composed of a great succession of fresh water strata, generally inclined to the north. This district is divided by depressions parallel to the principal valley of Aix, into several broad elevated ridges, the northernmost of which, containing the superior beds, exposes a considerable thickness of red marl, with gypsum of a fibrous silky texture, and therefore differing in character from the gypsum to the north of Aix. Interstratified with the above are beds of a very compact limestone, in which we found *Planorbis rotundatus*, and casts of a reversed limnea. In the succeeding ridges, solid strata of brown earthy limestone occur, with micaceous and calcareous sandstones, and party-coloured shales. In this limestone are numerous fragments of limneæ, associated with gyrogonites, the latter being very abundant, but as we could only procure casts of the interior of the seed-vessel, we cannot determine the species. It is of smaller size than any of those occurring in the Paris basin, but of the same spherical shape. Its magnitude does not exceed that of the seed-vessel of *Chara hispida*,—the recent species found fossil in the marl lochs in Forfarshire.

Still farther to the south, inferior beds of grey fresh water limestone, sandstone, and shale, crop out; and at length, to the south of Fuveau, is seen a great series of beds of blue limestone, and shale, with workable coal. The collieries visited by us are situated about two miles to the south of Fuveau, where the strata have been pierced to the depth of 500 feet and upwards. The dip is uniformly to the north, but the degree of inclination varies in different pits. The beds consist of blue argillaceous limestone, from three to five feet thick, of very regular stratification, and separated, for the most part, by thin way-boards of shale, about six inches thick. The principal coal seam is not more than from nine inches to a foot thick, and the united thickness of all the seams rarely exceeds five feet *. The

* M. Tholouzan, in the "Statistiques des bouches de Rhone," states

coal is bituminous, highly compact, and shining; does not soil the fingers, and serves for all the purposes of domestic use, as well as for those of the large iron factories of the arsenal of Toulon.

The various carboniferous strata are characterized by different groups of shells; and the workmen have availed themselves of these organic remains to distinguish the order of the beds. One stratum, in particular, is well marked by the presence of a large unio; others by planorbis (P. cornu ?), and a new species of melania, as also by two species of cyclas, hitherto undescribed, all of which have been named, and are now figured by Mr James Sowerby, as *Melania scalaris, Cyclas concinna*, and *C. cuneata*. The shells among which the cyclades are most abundant, form numerous thin laminæ, dividing the black coal by white lines parallel to the planes of stratification.

The charcoal between some of the laminæ of coal is fibrous, and in some cases made up of a fasciculus of minute dull black tubes, of a plant resembling *Endogenites baccillare* of Lobsann, in the Lower Rhine, and of Hörgen, near Zurich, and thus differs much in appearance from the satin-like lustre of the charcoal of old coal; whilst it is a most curious and novel fact, that we observed casts of the seed-vessels of charæ even in the coal itself.

In conclusion, we may remark that the general physiognomy of these lower members of the great tertiary deposite occurring between Aix and Fuveau, differs remarkably not only from the character of the beds of white gypseous marls, sandstone, and limestone on the north of Aix, but from any other fresh water formation examined by us in central France. The great thickness of the regular beds of blue limestone and shale, the quality and appearance of the coal, the large developement of the compact grey, brown, and black argillaceous limestones and sandstones, together with the red marls and gypsum, gives to the whole series the aspect of the most ancient of our secondary rocks; and it is only by the occurrence of fluviatile and lacustrine shells, and the seed-vessels of charæ, that the geologist is undeceived, and recognizes, from the unequivocal *specific* cha-

that the coal measures extend over an area of 10,000 French myriametres, from Trets, on the west, to the Etang de Berre, on the east.

racters of many of these remains, the comparatively recent date of the whole group. That the deposites of Fuveau and Aix are of the same epoch, may be inferred, not merely from the continuity of fresh water strata between those two places, and the absence of any interpolated marine formation, but also because, among the fossil shells, some of those which characterize the escarpment north of Aix, (as the *Potamides Lamarckii*, *Bulimus terebra*, and *B. pygmeus*); and others found near Fuveau, (as the *Lymneus ovum*, and *Planorbis rotundatus*), are all common to one and the same fresh-water formation in the Cantal *.

On the Koprolites of the Aix Deposite.

In the insect bed above Aix, we found an incurvated fossil body, somewhat resembling the larva of an insect, but, on examination, Dr Buckland has discovered that it is the fœx of some piscivorous or bone-eating animal, and consequently one of the species in his extensive and new-named family of *Koprolites.*

When examining the remains in the Fuveau coal, we were much struck with a kidney-shaped convoluted body, of a deep brown colour, and about one inch in length, which occurs in the shale alternating with the coal. We were wholly at a loss to know to what kingdom of nature we might assign this singular fossil, until our friend Dr Buckland solved the wonder, having arranged it in his family of *Koprolites* under the designation of *Fuscum Græcum* †.

Observations upon a Collection of Fossil Insects discovered near Aix in Provence, in the summer of 1828, *by* R. J. Murchison, *Esq. and* Charles Lyell Esq., *jun.* By John Curtis, F. L. S.

In the examination of this curious and interesting collection, one of the most striking facts that presents itself is, that the insects are all of European forms, most of them belonging, I believe, to existing genera. The greater proportion of those which have been submitted to my investigation are *Diptera* and

* See a memoir by Messrs Lyell and Murchison, read before the Geological Society of London, and now in progress of publication in the Annales des Sciences Naturelles, Paris.

† Dr Buckland will give figures of both these "*Koprolites.*"

Hemiptera; the next in number are the *Coleoptera*: there are a few *Hymenoptera*, and but one Lepidopterous insect. With the single exception of the Hydrobius, none of the species are aquatic.

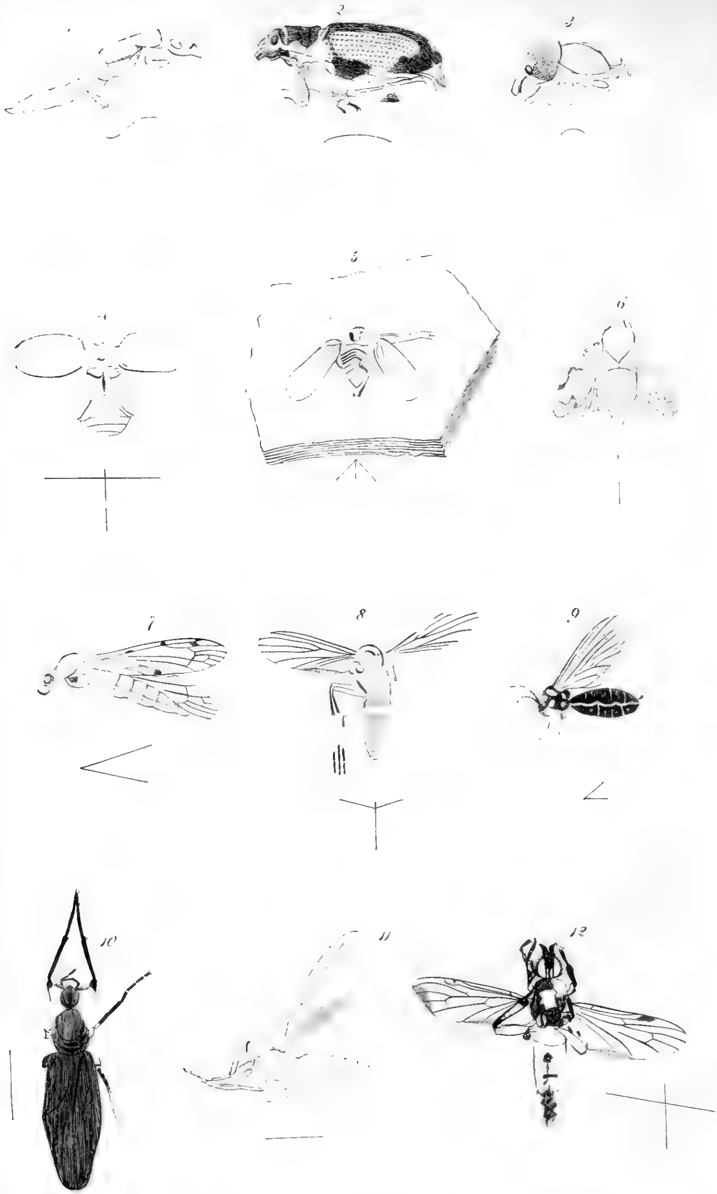
As in a larger collection of species the proportions of the different orders might be greatly altered, I forbear to draw any inference as to the climate from the present assemblage, particularly as I have not had the opportunities of M. Marcel de Serres of examining large collections of these fossil remains. I see nothing, however, in the character of the insects to warrant the supposition of a higher temperature than that of the south of France, although I am informed that some of the associated plants resemble those from tropical regions.

Several of the beetles have their wings extended beyond the elytra (Figs. 2. and 3.), as if they had been flying, and had dropped; and a *Chrysomela* (Fig. 4.) has the elytra expanded, from which it would appear that it had fallen upon the water, and been drowned. Other insects, however, (as in Figs. 7, 9, 10 and 11.), seem to have been imbedded whilst in repose, or when walking, and the dislocation of the members of some may have been caused in certain instances by violent pressure, and in others I should be more inclined to attribute it to decomposition.

On reviewing the whole collection, it appears probable that a great portion of the materials have been brought together from different localities by floods, mountain torrents, and rivers, although it cannot be denied that there is no insect amongst them that might not be found in a moist wood.

Although there are sufficient characters preserved to determine with certainty the genera to which many of the insects belong, the parts that would best accomplish this are very indistinct, the antennæ, the tarsi, and trophi, being generally very obscure or distorted; yet in a few the claws are visible, and the sculpture, and even some degree of local colouring, are preserved in several of them; but all pubescence seems to be obliterated, except on the head of a fly, (Fig. 12.)

I have not attempted to name the insects, as I question the utility. If, however, it should be deemed necessary, those naturalists who reside where the fossils are found will be the best able to assign to them their proper names, as they will have it



J. Curtis del. et sculp.

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in their power to institute a more full and accurate comparison between them and the local species.

In the accompanying figures, one insect is represented upon marlstone, to shew the nature of the subject; and the lines beneath each denote the natural size of the insects, all of them being magnified, to exhibit more distinctly the minuter parts, and the nerves of the wings.

I shall now proceed to arrange and enumerate the specimens, with occasional remarks for illustration.

Order COLEOPTERA.

Fam. Carabidæ.

1. *Harpalus*, with punctured elytra, perhaps an *Ophonus*. There is also the elytron of another species.

Fam. Hydrophilidæ.

2. *Hydrobius*, nearly as large as *H. fuscipes*, Linn.

Fam. Staphylinidæ.

3. *Lathrobium?* (Plate VI. Fig. 1.)

Fam. Ptinidæ?

4. *Ptinus?* about the size of *P. Lichenum*, Marsh.

Fam. Melolonthidæ.

5. *Cetonia*, resembling *C. hirtellus*.
6. ——— like *C. stictica*, Fab.

Fam. Curculionidæ.

7. *Sitona?* (Fig. 2.), The dark parts show the corneous covering which actually remains; and when it is peeled off, the impression of the sculpture is very perfect: the wings of this and of Fig. 10. are extended beyond the elytra, as if they had been arrested in their flight.
8. *Sitona?*
9. *Notaris?* underside.
10. *Liparus*, black, something like *L. anglicanus*, Marsh.
11. Ditto, like *L. punctatus*, Marsh. (Fig. 3.)
13. *Hypera*.

Fam. Chrysomelidæ.

14. *Cassida*, and cast, the size of *C. viridis*, Fab.
15. Ditto? ditto, *C. equestris*, Fab.
16. *Chrysomela*, and cast, scarcely so large as *C. Banksii*, Fab.
17. Ditto, under side (Fig. 4.)
18. Ditto? much smaller.

Order HYMENOPTERA.

Fam. Tenthrædinidæ.

19. *Tenthredo*, like *Sclandria fuliginosa*, Schr.

Fam. Ichneumonidæ.

20. *Ichneumon?* the wings are wanting; but, from the long ovipositor, it is probably allied to *Pimpla* or *Bracon*.

Fam. Formicidæ.

21. *Formica*, and cast, winged.
22. Ditto, apterous.
23. Ditto, ditto.

Order LEPIDOPTERA.

24. *Phalæna?* or it may be one of the *Noctuidæ*.

Order OMOPTERA.

Fam. Aphidæ.

25. *Aphis*, of the middle size.

26, 27. *Obs.* There are several small insects, some apterous, others with very short wings, which I thought Thrips; but the apex of the abdomen is too obtuse for that group; and, from the shortness of their legs, they cannot, I think, be the larvæ of any of the *Hemiptera*.

Fam. Cercopidæ.

28. *Tettigonia*, exceedingly like *T. spumaria*, Linn. (Fig. 6.)

29. *Asiraca?* or it may belong to some of the neighbouring genera, *Cixias*, *Delphax*, or *Cercopis* (Fig. 5.)

Order HEMIPTERA.

Fam. Coreidæ.

30. *Miris*, a small one.

31. *Lygæus*, allied to *L. Abietis*, Linn.

32. *Obs.* There are many examples of different divisions of the *Lygæi.*

33. *Corizus*, and cast not half the size of *C. Hyoscyami*, *Linn.*

Fam. Pentatomidæ.

34. *Cydnus*, the size of *C. albomarginatus*, Fab.

35. *Pentatoma?* or it may be a *Cydnus*, the corners of the thorax being rounded: in form it resembles *Tetyra*, but it has a smaller scutellum.

Order DIPTERA.

Fam. Tipulidæ.

36. *Limnobia*, female (Fig. 7.), allied to *L. sexpunctata*, Fab., apparently fixed whilst at rest.

37. *Gnoriste?* (Fig. 8.), either struggling on its back, or in the attitude of depositing her eggs.

38. Another species, or the other sex of the former one.

39. *Mycetophila?* (Fig. 9.), walking, black, articulations of the body distended by pressure.

40. *Mycetophila?* a pale one.

41. Nov. Gen. (Fig. 10.), allied perhaps to *Penthetria holosericea*, Meig.; but not being acquainted with the genus, I speak with uncertainty. There are several examples of this insect: the one represented seems to have been at rest; the hinder legs are broken off, and one of them is reversed, so that the tarsi nearly touch the thigh. The palpi are long, and very perfect, and the antennæ are remarkably distinct.

42. Nov. Gen.? another species, or the other sex of the last.

43. *Bibio*, male, and cast, allied to *B. venosus*, Meig.

44. Several specimens of a genus between *Bibio* and *Beris.*

Fam. Stratıonidæ.

45. Nov. Gen. (Fig. 12.), apparently allied to *Sargus;* but I am not acquainted with any genus of the family having the same nervure in the wings. The antennæ are no doubt distorted by pressure, but they are too robust and short to belong to *Beris* or *Xylophagus*. One of the halteres is discernible of this handsome and distinct insect, of which there is the cast.

Fam. Empidæ.

46. *Empis* (Fig. 11.), a female, and cast.

47. *Obs.* There are eight species of *Empidæ,* comprising apparently other species.

Messrs Murchison and Lyell having received another box of fossil insects from the same locality since the preceding observations were written, containing many totally different species, I hope at some future period to have the pleasure of resuming the subject; and I was happy to find, that the remarks I had ventured to make at the commencement of this notice were rather strengthened by this valuable addition to their collection.

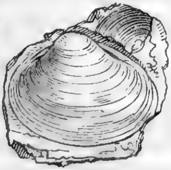
List of Fossil Shells in the Fresh-water Formations of Aix and Fuveau, in Provence. The new species of Shells named and figured by J. De C. Sowerby, Esq. F. L. S.

BIVALVES.	LOCALITIES.
1. *Potamides Lamarckii*, ...	Escarpment N. of Aix.
2. .... (*Cerithium gr.* of Deshayes),	Do. do.
1. *Bulimus terebra*, ...	Do. do.
2. .... *pygmæus*, ...	Porte Bellegarde, Aix.
1. *Neritina* (cast of), ...	Do. do.
1. *Lymnæus ovum*, ...	S. side of the river Arc, Aix.
2. .... new species (whorls reversed, *Physa* ?), ...	Do. do.
1. *Planorbis rotundatus*, ...	Coal of Fuveau, and limestone of Aix.
2. .... new species, somewhat resembling *P. rotundatus*.	
1. *Melania scalaris* (new species, Sowerby),	Coal, Fuveau.
2. .... new species, striated, too imperfect to be figured, ...	Do. do.

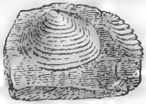
UNIVALVES.	
1. *Cyclas gibbosa*, new species, Sowerby, . .	Escarpment N. of Aix.
2. ...... *aquæ-sextiæ*, do. do. Sowerby (very large),	Porte Bellegarde, Aix.
3. ...... *concinna*, do. do. Sowerby, . .	Roof of coal, Fuveau.
4. ...... *cuneata*, do. do. Sowerby, . .	High above the coal, Fuveau.
1. *Unio*, a new and very large species, .	Roof of coal, Fuveau.
Cypris, (new species, Sowerby), . .	Escarpment N. of Aix.

Cyclas gibbosa.

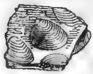
Cyclas aquæ-sextiæ.



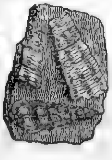
Cyclas concinna.



Cyclas cuneata.



Melania scalaris.



Description of the Plants alluded to in the preceding Memoir. By J. Lindley, Esq. F. R. S. F. G. S. L. S. &c. and Professor of Botany in the University of London.

M, Appears to be the terminal pinna of some articulated compound leaf. I have no doubt that it belongs to some *Leguminosa*, either of the tribe of *Loteæ*, or *Phaseoliæ* of M. De Candolle's arrangement. To what particular species, I am not at present able to state.

A, Is the leaf of *Podocarpus macrophylla?*

B, Is apparently the branch of some *Thuja*, nearly related to *Thuja articulata.*

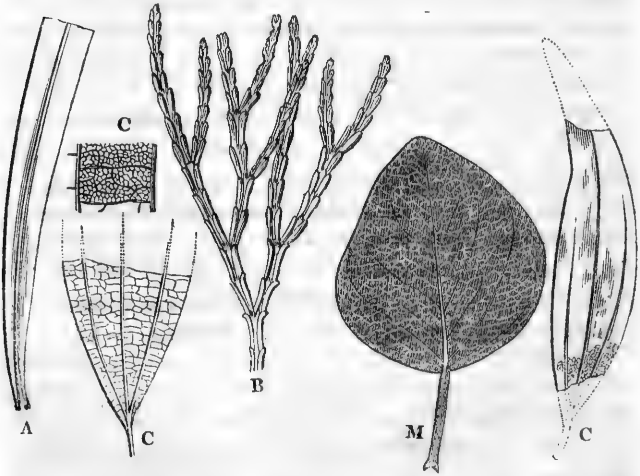
C, Are leaves of *Laurus dulcis?* or, if not, of a species of cinnamon that cannot be distinguished from it by these specimens. C* is the best specimen.

D, Is the fruit of some plant, but in too imperfect a state to be determined.

E, Is very like *Buxus Balearica;* but it is perhaps something else, and cannot be determined.

F, Is a leaf, but of so common a form, that it could not be safe to offer even a conjecture about it.

G, Is the stem of an herbaceous plant; but there is no evidence to shew what it was.



Of the recent plants referred to in the annexed memorandum, *Podocarpus macrophylla* and *Laurus dulcis* are natives of India, *Buxus Balearica* of the Mediterranean, and *Thuja articulata* of the coast of Barbary.

Inquiries respecting the Relative Age of Mountains.

M. Elie de Beaumont lately read to the *Academy of Sciences* of France, a memoir, entitled *Inquiries respecting some of the Revolutions of the Earth's surface, presenting different examples of the coincidence which appears to have existed between the raising of the beds of certain systems of mountains, and the sudden changes attested by the rapid variations of the characters which are observed among certain consecutive stages of the sedimentary deposites* *.

Geologists are generally agreed in thinking that the sedimentary beds which are frequently seen in mountainous countries inclined at very large angles or placed vertically, and of which certain parts even occur in a reversed position, could not have been formed in this position; but that they have, on the contrary, been placed in it through the effect of phenomena which took place after the first epoch of their deposition, and which, as the author remarked, must have happened at very different epochs in the different systems of mountains which appear upon the surface of the globe.

Other observations have been made by geologists who have carefully studied the sedimentary deposites depending upon the slow and more or less tranquil action of the waters, and by naturalists who have examined the remains of animals and vegetables which these deposites contain. They have generally remarked, that at different heights abrupt variations manifest themselves at once in the position of the strata, and in the animal and vegetable fossils which are contained in them.

Struck with the co-existence of these two parallel series of intermittent facts, and the analogies which seem to approximate them, the author has tried to bring them into mutual relation in the part of the history of the globe which is least remote from the present era.

His object has been to prove that the epochs to which several of the solutions of continuity which are observed in the series of sedimentary deposites correspond, have coincided with those of the convulsions to which are owing the raisings and disloca-

* This interesting memoir contains a view similar to one delivered some years ago, by the Professor of Natural History in Edinburgh.

tions of the strata which so many systems of mountains present to us, or, in other words, to shew by examples that the dislocation of a certain portion of the external crust of the globe has formed an essential integrant part of each of the abrupt changes of which zoologists and geologists have discovered the traces, and to which the labours of M. Cuvier have so strongly called the attention of the learned world.

M. Cuvier has shewn that the surface of the globe has experienced a series of sudden and violent revolutions. M. Leopold de Buch has pointed out precise and distinct differences between the various systems of mountains which are raised upon the surface of Europe. The present essay of M. Elie de Beaumont is a first attempt to establish a kind of alliance between these two ideas.

In the four separate chapters of which his memoir is composed, the author has successively considered four of the most marked solutions of continuity which the series of sedimentary deposites presents, and has tried to connect each of them with the raising of the sedimentary strata in a determinate system of mountains.

"To attribute," says he in concluding, "to slow and progressive modifications the whole of the changes that have been effected upon the earth's surface, and to overlook the traces of sudden revolutions which have almost periodically renewed the state of that surface, would be to suppress one of the most important and most striking features of its history. Every thing leads us more and more to divide the facts which the sedimentary formations present to our observation into two distinct classes; the one comprehending the facts relating to the tranquil and progressive course which the accumulation of each of the sedimentary deposites has followed, the other containing the facts relating to the sudden interruptions which have established lines of demarcation between the different consecutive deposites.

"After thus admitting violent and transitory phenomena, it is more easy to perceive the resemblance to the phenomena of the present period presented by those which were repeated on the surface of the globe during the different periods of tranquillity in the course of which the various sedimentary deposites were successively formed."

M. Elie de Beaumont announced further, that he had no intention whatever of searching into the causes of the violent and transient phenomena which produced the different cataclysms. The questions which he has proposed to himself to solve, are questions of epochs and of *coincidences of dates.*

The results at which he has arrived with respect to the epochs at which several systems of mountains received the principal features of their present form, are entirely independent of all hypothesis respecting the manner in which they have received that form. Admitting his results, one remains free to choose between the hypothesis of Deluc, who explained the raising of the strata by the sinking of a part of the earth's crust, and the hypothesis generally adopted by the most celebrated geologists of our epoch, and which consists in supposing that the secondary strata which are found raised in the mountain chains, have been thus elevated by the heaving up of masses of primitive rocks, which generally constitute their central axis and principal summits.

The coincidences of dates which the author thinks he has discovered are the following:—

1. In a small system of mountains of which the Erzgebirge in Saxony, the Côte-d'Or in Bourgogne, and Mount Pilas in Tores, form part, the raising of the strata has taken place at the epoch which has separated the period of the deposition of the Jura formation from that of the deposition of the greensand and chalk.

2. In a system of which the Pyrenees and Appenines form part, the raising of the strata has taken place at the epoch which saw the chalk deposite ended, and which was followed by the period of the deposition of the tertiary formations.

3. In the western part of the Alps, the raising of the strata has taken place at the epoch in which the tertiary formations were ended, and which preceded that of the deposites called *transported, rolled, diluvial* or *alluvial.*

4. A new revolution interrupted the deposition of these formations, leaving, as traces of its passage, the large alpine blocks transported to the Jura mountains, and the pebbles of the Crau, and this revolution has probably corresponded to the formation of certain fractures which cut up the ground in Provence, and to which is owing the existence of the mountains of Leberon, Sainte Baume, &c.; a system with which it is not impossible that the

mountains of the Balearic Islands, and of a part of Spain, as well as Atlas, Taurus, and the Himalayan mountains, may one day be connected.

"These first results, if they are correct, will form but a small part of those which may be foreseen, when it is considered how many other interruptions the series of sedimentary deposites presents, and how many other systems of mountains rise upon the surface of the globe.

"The few data which I have brought together, do not yet shew the date of the dislocations of several systems of mountains, very different as to their principal direction, such as those between which M. Leopold de Buch has shewn that the soil of Germany is divided.

"Several indications of interruptions in the series of sedimentary deposites are not perhaps so marked in the known parts of Europe, but because the systems of mountains to which they correspond send out no ramification.

"The appearance of a chain of mountains could have influenced very distant countries only by the agitation which it caused in the waters of the sea, and by a greater or less derangement in their level;—events of a nature similar to that of the sudden and transient inundation, of which indications are found in the archives and traditions of all nations.

If this historical event were nothing else than the latest of the revolutions of the earth's surface, one would naturally be led to ask, What is the chain of mountains whose appearance ascends to the same date? and perhaps it might be remarked, that the chain of the Andes, whose volcanic spiracles are still generally in activity, forms the most extended, the sharpest, and the least worn of any that the present exterior of the globe exhibits.

Observations on the Caymans or Alligators of Guiana.* By JOHN HANCOCK, M. D. Communicated by the Author.

In reviewing the Indian vocabulary, I find three of the crocodile kind mentioned, as follows:—

1*st*, The Poupou of the Caribs, i. e. the Cayman or common great alligator.

2*d*, The Akāri of the Caribs, Kykoty of the Arowaks, or common alligator.

3*d*, The Teriteriou of the Caribs, the largest of all. The Makusies and Akawais call it Atokary. The Porocotos call it Tiratirēma.

I may here give the names of the crocodiles of Guiana in several Indian dialects, viz.

	CARIB.	AKAWAI.	MACOSI.	ATTORIA.
The Common	Poupou.	Arāra.	Carātu.	Wahdu.
Great Cayman	Akāāri.	Takāāri.	Yakāāra.	Attori.
The Alligator	Teri-teri-ou.	Atohāri.	Teri-teri, or Duri-duri.	Attohari.

POROCOTOS.	ARAWAKOS.	WARROW.
Aroweima.	Cayman.	Niaribuca-ya.
Areewa.	Kaikooti.	Niaribuca.
Tiratireema		

The reader will observe that the Attoris give the name of their own nation to the alligator.—This is a most extraordinary language, if so it can be called. The above names in Attoria are only approximations to their strange sounds, which are uttered as it were entirely from the glottis, not moving the lips, with a clack of the tongue, however, which it is impossible to imitate, much less to convey on paper. They throw back the head in speaking, shewing that the utterance is difficult even to themselves; and it almost gives one pain to hear them talk. They inhabit about the southern branches of the Essequibo,

* It is curious to observe, that the term *cayman* means, in Spanish, cunning, subtle, sly; in Arowak, fierce, ferocious; but the name, I presume, must be entirely of Indian origin.

where the Teri-teri-ou are said to be most common. This accounts for the Ackawai and other tribes having borrowed their name for the animal.

The Mandavacas live on the Rio Negro and Cassiquiari or Casicari. It is singular that there are no large species of crocodile inhabiting those rivers, although the alligator is numerous there. They have not even a name for any other species. Mr Humboldt must have been strangely misinformed, when he speaks of the dangerous and ferocious crocodiles of the Cassiquiari; no species but the inoffensive alligator inhabiting there. This exception is the more extraordinary, as most of the other great rivers of Guiana, so far as I know, abound with the Cayman. Perhaps it may be owing to the porpesses which are numerous in the Cassiquiari and the Rio Negro.

The Spaniards call one (the second here described) Cayman Negro; another of the same size they call C. amarilla, or yellow; and a smaller, which they say inhabits the Lagunes, is called Baba or Babilla, of grey colour.

The Cayman is in length eleven feet three and a half inches, and in girth four feet. Teeth, thirty-six in the upper jaw, and the same in the under, not corresponding, but alternate; fore legs, fifteen inches long, with five toes, the two outer without nails; hind legs twenty-two inches, with four toes, three with strong nails, the outer ones without any. The belly and under jaw are white; the rest of the body black. Many caymans are killed for the sake of their teeth and fat, which lies in a deep oblong mass on each side the tail, or along the posterior part of the spine. The cayman runs fast in a straight direction, but cannot turn quickly. It travels far over land at night, to remove to other waters, for which it instinctively directs its course from great distances. In procuring its food, the cayman has the sagacity to lay the Fortuga on its back to prevent its escape, if not hungry. The large tigers (jaguar) fall sometimes a prey to the cayman in the water, but generally conquer on land. The strength of the tiger is so great, that he lacerates and lays open the side of the neck where the cayman is most vulnerable. The battle between them when they meet on the land is said to be tremendous. There the jaguar makes the attack; and the contrary, if they meet in the water. As the cayman lies basking his scaly carcass in the sun, his enemy often encounters him; on the contrary, if the tiger is seen swimming, the cayman plunges in after him, and pulls him under the water. The caymans, however, usually watch their prey in the water, submersing the whole body except the snout and eyes, which are prominent.

A terrible encounter ensues when the cayman and camaiduor, or great water serpent, meet. Their tumbling and splashing may be heard at a great distance. The serpent, when they meet on the brink of the water, avoiding the enormous jaws of the cayman, rapidly throws itself about his body, is often untwisted in the struggle, lashing the water with tremendous violence, and returns like lightning to the *gripe*, till he completely squeezes his antagonist to death, unless the cayman succeeds in getting his jaws to bear upon him, in which case the battle is quickly decided. Mr James Fraser, being in the river Waieny, on a tour to the Orinooko, in 1826, heard some loud noises, seemingly like the discharge of great guns at a distance; and all his Indian attendants said it was caused by the tail of a camudi thrashing the water in a battle with the cayman.

The porpess is the natural enemy and entire master of the cayman, so much so, indeed, that the natives enter the water without fear when the tonina (porpess) is in sight. It attacks the cayman wherever they meet. The cayman is driven into the water by other enemies, as the tiger; but it is made to scamper ashore by the porpess. The ideas of the ancients respecting the dolphin's attachment to man, seem to be in some measure realized in this species of delphinus. It is well known that they accompany ships to considerable distances, as does the shark, but with different motives. This is doubtless a distinct species from the common porpess or the D. Phocæna of naturalists, Phokaina of Aristotle. We even saw them in the Rio Maou and the Parima, whence they must make a journey of many hundred miles to reach the ocean.

Two caymans in combat make a dreadful noise, standing up chopping together their jaws, tumbling down, and thrashing the water with great violence.

An instance is related of an Indian caught by a cayman at the Lake of Marawareta, procuring his release by having the presence of mind to stab the cayman in the eyes with a knife, the water being shoal. This manœuvre is inculcated from their infancy. This, or a similar occurrence, is related by Humboldt while at Angostura.

At Metanza, the caymans are more shy than those of the Essequibo, and take to the water before one can approach them. These animals have become incomparably more bold and ravenous than formerly in the Orinooko, since the feasting they have had on human flesh during the carnage of the late war. Before that time, they were scarcely dreaded, and up the Essequibo they would rarely attack a man, or endeavour to shun him, being, in those solitary retreats, quite unmolested. They were so numerous, that my travelling companion, Mr Sertema, at the same time, and without changing place, stood and counted thirty caymans at a stagnant pool or lagune on the Repoononie, the animals lying just below the water, and their snouts projecting above it. Travelling, in 1811, in the vicinity of the Takotu with some Portuguese, we had several times occasion to swim across the smaller rivers and pools. To frighten away the caymans, we had only to throw ourselves into the water with violence, beat and cause a great splashing. Such experiment in the Oronooko would now be a very dangerous one, as they overthrow small corials, and instantly seize any person in the water.

The cayman, it is said, does not strike, as generally supposed, with its tail, but with its head, and that suddenly and with tremendous force. The alligators do the same.

The cayman of Orinooko takes its prey both on land and in the water indifferently; but it can devour it only on land, as it cannot swallow under water without letting it in, such is the formation of the glottis. The larynx is provided with a valve which excludes the water by shutting over the orifices both of the œsophagus and trachea. It cannot, however, bear long exposure to the sun.

The cayman swallows stones in considerable quantities. Some think this is to satisfy hunger; others, to assist digestion; while others believe it arises from an instinctive faculty to render the body specifically heavier, and to enable the animal to sink in the water. I found, in a young cayman, two pieces of lead as well as stones. The harder pebble stones, of the agate and crystal kinds, are frequently found in the stomach.

In opening one to determine this fact, I found the stomach and intestines membranous; the former consisting of an extended canal, very thick in its coats and narrow, and having a small quantity of half digested animal and vegetable substances within it. Below this, in a large paunch or perhaps second stomach, were found 4 lb. or 5 lb. of pebble stones of various sizes, from that of a pea to that of a walnut. Nothing else was found within it except a bit of indigested skin of some animal.

As to the incubation of the cayman, if any one stoops over the nest, places his ear close, and strikes over it,—if ready to come out, the young fry will be heard croaking. It is said the cayman takes this method of trial. The cayman waits about its eggs laid in the sand, places itself to the landward, and when the little ones are rising from the ground, it devours all that run that way: the others go clear and find their way to the water.

The cayman is not known above the falls in the Rio Caroni, as the people there think from inability to ascend the falls; but this is a great misconception. This river, above the falls, is quite unfit for its abode, being shallow, rapid, and full of rocks. It seems rather strange, however, that they are not found in the River Pomeroon, which is very deep, still, and dark-coloured; but some of the natives have a fancy that they are deterred by the camuduors, the great water serpents, which inhabit this river, for these are inveterate enemies, and the deep black water of this river must give a decided advantage to the water serpent.

It is asserted that the animal buries itself in the mud, to pass the summer or dry weather, when the water of the lakes is drying up. Jose Yustre, however, says that the cayman and great serpents do not inter themselves in the ground, as represented by Humboldt; that they do not roar; and that the tiger always kills the cayman in combat, the latter being so inflexible that he cannot get a grasp of the tiger, who springs upon his back and gores the neck. He confirms the story that the cayman ever avoids the porpess.

A cayman was killed, in 1815, before the house of Mr Loranda at Angostura: I examined and found it measured eleven feet. It had a series of thin cartilaginous appendages on both sides of the back, extending to within 18 inches of the extremity of the tail. The head was long and narrow. It had soft crescent-shaped nostrils near the end of the snout. There were 19 teeth on one side of the upper jaw, 20 on the other, and 15 on each side the lower jaw. The two fore-teeth in the lower jaw projected through the upper. There were 5 toes on the fore feet; and 4 on the hind ones. Its colour was black, except the belly. Internally, there was a folding membrane, valve-like, before the gullet, but no tongue. This was a young female, and had small eggs the size of pistol bullets.

A Carib called it Acàrou, or Acaàru, in his language.

There is a large species of crocodile inhabiting the interior rivers, which is quite unknown to naturalists, and even to the littoral tribes of Indians; but all the inland tribes recognise it by a distinct name. The Macosi Indians call it Teri-teri-ou. They described it as having an appendage or extension of the skin along each side of the belly, and a forked or divided tail. It is said to grow near the size of the cayman of Orinooko; but to be less dangerous than it. Some Arowaks say the Teri-teri-ou is second in size, and inhabits deep waters. I should doubt the existence of this last, were it not that all the inland nations have a name for it distinct from that of the cayman and alligator. The united testimony of so many tribes renders it certain that such an animal does exist.

Don Francisco Yustre, an intelligent Savanero, says there is another smaller species of baba, yellow, with short head, and nose turned up.

William and Johnson, two Arowak Indians, say there is a white kykoty; and both agree in representing it as about 18 inches long.

Researches in regard to the Ancient History of our Domestic Animals, and our Common Plants. By M. DUREAU de la Mallu.

I. The Cat. *Felis.*

THERE is much obscurity respecting the native country of the cat, and the period at which it was first domesticated.

Baron Cuvier, in the last edition of his *Regne Animal* *, and Frederick Cuvier, under the word *Chat* †, in the *Dictionnaire des Sciences Naturelles*, affirm, the former, that the cat (which it is true sometimes occurs wild in France) is a native of our forests; the latter, that the period at which the cat was domesticated, does not seem to be very remote, and that the Greeks were little acquainted with it, &c. ‡

These assertions of two very able zoologists have seemed to me to require examination, not being confirmed by positive testimony.

It is evident, in the first place, that the Greeks were acquainted with the cat from the most remote antiquity. The mummies of that animal found in the sepulchres of Thebes, and the figures sculptured on monuments on which we read the names of the Pharaohs, concur with the Sacred Scriptures to prove that, in the earliest ages, it existed in Egypt and Palestine in the domestic state.

Herodotus describes it under the name of Ἀιλουρος. The manners of this animal carefully observed, the habit which the male cats have of eating their young, related by the father of history, and confirmed by modern naturalists, the terror inspired in it by fire, the honours which were rendered to cats, their being embalmed, and their mode of sepulture, facts confirmed by the numerous mummies of cats that have been brought from Egypt, and which, moreover, positively determine the species;—all these circumstances together remove all doubts, 1*st*, respecting the identity of the species known to the Greeks under the name of αἰλουρος, and worshipped and embalmed in Egypt;

* Tom. i. p. 165. † Tom. viii. p. 206. Levrault's edition.
‡ Ibid. p. 210.

2dly, respecting the native country of this animal, which must at least be extended to Africa and Asia; for to limit it to the forests of France, as the Cuviers have done, would render it necessary to suppose, that, in the times of the Pharaohs, frequent communications were established between Gaul and Egypt, and that it was in consequence of these communications that the cat was imported into the latter country.

According to Bochart †, who passes for a good Hebrew scholar, wild and domestic cats occurred in Palestine and Babylonia. *Feles erant palatiis eorum* ‡, says Hosea; Isaiah has the words *ulubant feles in palatiis eorum* §; and Jeremiah adds, *et occurrent cercopitheci felibus* ||. The Hebrew name of the cat is *Tsigem*, and the Chaldean name is *Sinnaur*, which, as well as the Chinese word *Mao*, being derived from the cry of that animal, designates it of itself. This word has passed into Arabic, and Pastel regards it as an onomatopeia.

Mount Hermon was named *Sener* by the Amorrheans, or the *Mountain of Cats*, a name evidently derived, according to Bochart, from the word *Sinnaur*, which signifies cat in Arabic, or from the Chaldean *Sunar*.

The cat is also named by the Hebrew authors *golden cat* ¶, an epithet which I imagine designates the three-coloured variety, commonly known by the name of *Spanish* or *Tortoise-shell cat*, in which the red is very bright and approaches the colour of gold. Angora has also furnished a variety remarkable for the length, fineness and silkiness of its hair. Here, then, we have Egypt, Syria, Palestine, Asia Minor, and Babylonia, in which the cat occurred in both the wild and domestic state. But the native country of the cat is not so limited; it was common in India, and has there been reduced to domesticity from the most remote antiquity. It is very frequently mentioned in the Sanscrit, and among other books in the *Itobades*, the original of the fables of *Bidpay*: It is named *Acoubouk*, eater of mice,

* II, 66. † Hierozoic, p. 859. ‡ Hosea, ix. 6.

§ xiii. 22; xxxiv. 14. || L. 39 and 11.

¶ Thargum. Esther, 1, 2.

or *Margara*, the gay, in the Sanscrit language. For this valuable testimony I am indebted to the politeness of M. Chezy.

An express passage in Diodorus Siculus proves the existence of the cat in the wild state in the north of Africa *. He says, that Agathocles, after taking Phillena, Mischela, and Hippaci, cities of Numidia, and lastly Miltene, led his army over high mountains which were 200 stadia in breadth, and were filled with wild cats," αἰλουρων. "There," says he, "no kind of bird makes its nest, whether in trees or in the ravines, on account of their hatred for the cats." It was more on account of the attacks to which they were exposed from these animals. The fact is well observed; it expresses one of the habits of the cat, which, whether wild or tame, is a hunter, and lives on prey. The circumstance of accounting for the absence of nests, by the hatred of the birds towards the cats, is defective. After passing this chain, Agathocles found himself in a country full of monkeys, πιθήκων, from which these villages derived their name, and might, says Diodorus, be literally translated into Greek by the word πιθηκέσσας.

The poet Memesian †, who lived at Carthage, names the wild cat as an object of his huntings, with the fox, the wolf, the ichneumon and the hedgehog.

> Nos timidos lepores, imbelles figere damas,
> Audacesque lupos, vulpemque captare dolosam
> Gaudemus; nos flumineas errare per umbras
> Malumus, et placidis ichneumona ‡ quærere ripis,
> Inter arundineas segetes, felemque minacem
> Arboris in trunco longis præfigere telis,
> Implicitumque sinu spinosi corporis
> Erem ferre domum.

M. Abel Remusat has supplied me with this valuable document. The cat has been known in China for a great number of centuries, under the name of *Mao* §, derived from the cry

* xx. 58. † Cyoregetic, v. 51.

‡ It is seen that the ichneumon then existed near Carthage.

§ The cat, in Chinese, *Mao* or *Miao*, in Japanese, *Negoma*. Its Chinese name is derived from its cry. It is a small quadruped which takes rats. There of the animal, and which, like that which in French expresses its plaintive cry, is a true onomatopeia.

Having determined the native country, or at least the *habitation* of the cat, I shall pursue the history of its manners and habits, and bring together the various traits which form the true portrait of the species. The circumstances of the copulation of cats, the number of their young, the duration of their life, and their pursuing birds, related by Aristotle, along with the name Αἰλουροι *, positively designate the same animal of which Herodotus has painted the manners, and to which he has applied the same name.

In the first place, however, I shall give the etymology of the different names of the cat. That of Αἴλουρος is founded upon one of the most striking habits of the animal, which is continually moving and bending its tail. I would derive it from αἰολλω and ουρα. The cat was, therefore, with the Greeks the *move-tail*.

According to Saumaise †, the name αἴλουρος comes from the

are of them yellow, black, white and spotted. It has the body of the fox and the face of the tiger, the hair soft, and the claws sharp. The best are those which have the tail long, the reins short, the eyes like gold or silver, and many hairs above the eyes. Its pupil may serve to mark time; it is like a thread at 11 in the evening, 11 in the morning, and 5 in the morning; like a jujubier nut at 1 in the morning, 1 afternoon, 7 in the morning, and 7 in the evening; and like the full moon at 3 in the morning, at 1, 9 and 8 in the evening. The tip of its nose is always cold, excepting on the day of the summer solstice, when it becomes lukewarm. This animal fears cold and seeks heat; it feeds according to the months, and eats rats in the first and last decade of each lunation. Its head and tail resemble those of the tiger. The duration of its gestation is two months, and at one birth it produces several young; but some cats eat their young. There are persons who think that the female can conceive of herself, by the rubbing of a bamboo brush on the back, &c.—*Japanese Encyclopædia*, xxxviii. 19.

Mention is made of the cat in the *Choue-wen*, a dictionary of the period of our era.

In the *Li-Ki*, one of the five *Kings*, which Confucius revised in the sixteenth century, before our era.

In the *Eul-ya*, a dictionary the antiquity of which some authors carry back to the twelfth century before Christ, but of which the authenticity is contested.

In the *Chi-king*, a collection of odes made by Confucius, but of which the different parts are much more ancient than that philosopher.

* *Hist. Anim.* v. 2, vi. 20, 35, and ix. 6. † Pliny, *Exercit.* 710, B.

old Greek word αἰλος, flatterer, with the Æolic digamma Fαιλὸς, from which the Latins formed the word *Felis*; from αἰλὸς comes αἴλουρος, flattering with the tail. This etymology seems to me false; it is not founded upon the manners of the animal, which is by no means addicted to caressing or flattery. It would apply better to the dog, which is both, and which employs its tail to express these sentiments.

Suidas * adds to the common names of the cat, αἴλουρος and γαλῆ, those of κέρδω and ιλαρια, which seem to be two epithets, *the cunning* and *the gay*, and are derived from the manners of the animal. Kuster corrects, erroneously in my opinion, ἱλαρια into αἰλουρος, for the first of these names is given to the cat by Artemidorus, and the playfulness of young cats has become proverbial.

The word *Catus*, with the signification of cat †, first occurs in Palladius; but the adjective *Catus*, which signifies sharp or piercing, is employed by Ennius: *Cata signa* sonitum voce dare parabant. Varro, who quotes it, considers it as a word of the Sabine language. At a later period, the word took the acceptation of *solers*, *callidus*, *acutus*, as Cicero informs us ‡. The word *Catus* or cat, from which the Greeks of the Lower Empire took their word Κaττος §, and the Arabians their name *cat*, unless this word be derived from a more ancient source, is therefore taken either from the sharp cry, or insidious, prudent and wary character of the animal, like the αἰλὸς of the Greeks and the *felis* of the Latins.

I am ignorant of the roots or etymology of the names *hir*, *dsaiwan*, *ginda*, *chittal*, and *dim*, which the Arabians have given to the cat; but the very variety of these names seems to indicate that the animal was either common in the country, or long domesticated there.

I now pursue the description of the manners and organiza-

* V. αἴλουρος. † III. 9. (37 Varro, lib. v. iii.)

‡ De Leg. i. 16.

§ Κάττος ὁ κατοικίδιος αἴλουρος. This name is employed in the Schol. of Callimachus. *H. ad Cer.*, iii.; in a Latin poet (in Catalog. Pith. l. iv.) Catus in obscura capit pro sorice picam. Sextus Platonicus (*De Medicina Animal*, part i. c. xviii.) employs the word *catum* for *felem* four times. See Werheik ad Antonin. Liber xxviii. p. 186.

tion of the cat, known among the Greeks from the time of Herodotus under the name of αἴλουρος.

Ælian accurately describes several of the habits and manners of the cat, which he calls αἴλουρος. "The male," he says, "is very lascivious; the female a very tender mother. It flees the approach of the male, for the seed of the latter is said to be very hot, and to burn the genital parts of the female like fire. It is for this reason that the male kills the young immediately after they are brought forth, for the desire of having other young ones forces the female to submit to the desires of the male. It is said that cats abhor all kinds of bad smell, and it is for this reason that they dig the earth to bury their excrements in it."

This description of Ælian, like many others of the ancients, contains facts accurately observed, and a false explanation of these facts.

The female cat does not flee from the male for the reason assigned; but she avoids him, dreads him, and suffers from him, because the glans of his penis is covered with very sharp horny papillæ. This is the cause of the piercing cries of the female during copulation.

It is neither from cleanliness nor from the dislike of bad smells that cats bury their excrements, but from an instinct of distrust resulting from their wild state, which rebels against the feeling of domestication, because the strong smell which their excrements emit might reveal their retreat, the abode and asylum of their young, which are to remain concealed.

A trace of this habit, and of the distrust from which it springs, common to the wolf and other wild animals, still appears in the dog, which, although much more completely domesticated than the cat, throws up a little earth upon its excrements.

If the date of the fables attributed to Æsop might be referred to the period at which that fabulist lived, it would be certain that the cat was known at a very ancient epoch in Greece and Asia Minor. Its domesticity, its manners, its character, and the circumstance of its being employed in houses to destroy rats and mice, are described in four of these fables, in which the name of αἴλουρος is given to it.

The fable of the cat in ambush, which, to get at the rats, pretended to be dead, and got itself powdered with meal, ought, in my opinion, to be applied to the cat, and not to a species of Mustela, although Phædrus * has, on this occasion, translated the word αἴλουρος by that of *Mustela.*

La Fontaine, indeed, who has translated Æsop, makes a true cat the hero of his apologue, and it is a somewhat remarkable thing that the French poet should have better determined the sense of the Greek word and the kind of animal than the Latin translator.

The other fable of Æsop's, in which an officious αἴλουρος, at a time when the poultry-yard was attacked by an epidemic disease, disguises itself as a physician, and goes to offer its services with the design of devouring them, paints in a very natural manner the perfidious manners and treachery of the cat, and at the same time proves, in opposition to the assertion of the naturalists above mentioned, that the animal in question must have been subjected for some time to domestication before its tricks, its habits, and its character, could have been observed.

Now, if I have proved that the cat was known in Egypt, China, India, Judæa, and Chaldea, at the most remote period, it becomes probable that Greece and Asia also possessed that animal; but they then imposed upon it another name γαλῆ, a generic name which they, in like manner, gave to several species of *Mustela* and to a *Viverra.* It is my object now to unravel the confusion caused by this homonomy, to distinguish in the descriptions of the ancients the different species of γαλῆ or Mustelæ, to recognize the cat under all these names by the characteristic traits which are peculiar to it; and I trust, if some attention be lent to me, I shall succeed in solving the riddle.

When agriculture and civilization advanced, and men became sensible of the inconveniencies resulting from the too great multiplication of a species, they would naturally devise means of destroying it, and guarding themselves against its attacks.

Rats, mice, and other glires of a like nature, appear from the earliest times of history, and even of fable. Poisons, traps, and machines adapted for destroying these noxious animals were not yet invented, and there were then more forests, copses, and retreats for them than now. Man would naturally employ ani-

* iv. 1. 1.

mals for enabling him to get rid of this pest. How should he not have sought to tame the cat, which is their cruelest enemy, and which could not fail to be the most powerful auxiliary of man in this active, perpetual, and daily warfare?

The mythological traditions * which relate, that, during the war of Typhon, the gods fled into Egypt, and metamorphosed themselves into various animals; Apollo into a hawk, Diana into a cat, Latona into a mouse, confirm the antiquity of the existence of the cat and of glires in Egypt and Greece.

But, as I have said, the cat at this period bore the name of γαλῆ. This is the opinion of Henri Etienne † and Coray, who, nevertheless, err in applying it only to the weazel and cat, while it also designates generically various species of canivorous animals of the genus *Mustela*, tamed by the ancients and associated by them with the cat in the destruction of glires.

We have seen that Herodotus, Aristotle, Ælian, Diodorus, and the fables of Æsop give the name αἴλουρος to the cat, whether wild or tame. At a later period, when the Latin name *catus*, κάττος, prevailed among the Greeks, as designative of the domestic cat, the name αἴλουρος was applied to the wild cat. At a little later period, the domestic cat resumed the name of γαλῆ, which had been its original name at the commencement of literature.

The word γαλεῆ, which occurs three times in the *Batrachomyomachia* ‡ must, in my opinion, have been applied to the cat, and even to the domestic cat. This is also the opinion of Henri Etienne and Barnes §, who have been combated by Perizonius ||, Perotto, Philonenus Conradus and Lycius.

The synonymy of the words γαλέη and αἴλουρος, and the designation of the cat by Homer under the name of γαλέη, will be fixed by comparing a verse of Callimachus ¶ with another of the Batrachomyomachia, of which the former is an imitation, or to which it evidently alludes.

Homer makes one of his rats say, πλεῖστον δὲ γαλέην περιδείδια, it is the γαλεη that I fear most; and Callimachus says, "that

* Apollodor. I. vi. 3. Hygin. cap. 196. Ovid. Met. v. 330. Anton. Liberal, cap. 28.

† Under the word γαλῆ. ‡ 9, 51, 113. § Batrach, l. c.

|| Apud Ælian, xiv. 4. ¶ H. ad Cer. iii.

Erysichton, in his horrible hunger, devoured his mules, oxen, horses, κὰι τᾶν ἄιλȣρον, τᾶν ἔτρεμε θηρία μικρα, *the cat dreaded by small animals*, in short, all that was in Triopas's house."

We also find under the name of γαλέη, in a proverb cited by Theocritus, the cat, which his cotemporary Callimachus calls ἄιλȣρος. The common saying, ἁι γαλέαι μαλακως χρήζονται κατεύδην, *cats like to sleep on soft beds*, retraces one of the habits of the cat most frequently observed. It seeks soft beds, pillows, and couches *.

Some learned men have applied this proverb to the weasel, but it does not paint the habits of that wild species which lives in the bushes, thorns, and heaps of fire-wood, and whose nests, which I have several times found, are in trunks of trees, and formed of straws, hay, or hard and dry plants. Buffon's experiment of the weasel †, which, being shut up in a cage with some cotton, squatted whenever one went near it, does not prove that that species naturally seeks a soft bed, like the cat, but is accounted for by the distrust innate in these feeble carnivorous animals, which leads them to conceal themselves and seek shelter, whenever they see the approach of an enemy stronger than themselves.

Observations connected with the Migration of the Herring and Mackerel, as noticed in the British Channel. By Major W. M. Morrison. Communicated by the Author.

Hastings, from its peculiar situation, is well suited for a fishing station, and has, in consequence, for a considerable period, employed many vessels in this particular branch of commerce. Each vessel is furnished with from one hundred to one hundred and twenty nets, each net being forty feet in length. They can be joined to each other with great facility; and, when in the sea, present a curtain from fourteen to sixteen feet in depth. These the fishermen, when at any distance from the land, always shoot or place north and south, or as near that direction as can be done conveniently, in order that they may drift with the flowing and ebbing of the tide, which takes the

* Dict. d'Hist. Nat. viii. 208. † Hist. Nat. Anim. art. *Belette.*

direction of east and west in this part of the British Channel. I have been particular in noticing this latter circumstance, as there is a singularity attached to the capture of both the herring and the mackerel, which is, that those fish which are encumbered with roes, while caught in great numbers on the east side of the nets, are not met with in a greater proportion than one in about one hundred without roes on the west side; a fact which (abstractedly from other sources of information on this subject), affords evidence, that not only the herring, but also the mackerel, reach this part of the Channel, for the purpose of depositing their roes, from the eastward.

When the nets are arranged for the mackerel, the upper parts are always supported on the surface by small kegs and corks; but when placed for the taking of herrings, they are not always left near the surface, but are sunk at various depths when there is little or no wind, from within a yard of the bottom upwards, according to the judgment of the fishermen, but they generally prefer placing them near the surface when there is a brisk breeze.

The herrings generally appear off Hastings about the beginning of November. Their approach, however to this latitude is earlier in some seasons; if, for instance, the wind sets in from the north-west in the beginning or middle of October, which naturally occasioning smooth water along the eastern coast of England, greatly facilitates the advances of the herrings southward; and should the wind continue in the same point for some time after the close columns of these fish reach the Channel, this insures a profitable season to the fishermen of this place. But should a south or south-east wind come on and prevail for some time, while the herrings are on their passage to the Channel, the swell often produced from these points disturbing the fish, operates powerfully towards changing their direction in seeking shelter on the coasts of Holland and France, and avoiding the southern coast of England. This was the case last season, which proved very unsuccessful to those engaged in the fishery. During the presence of the herrings and mackerel in this latitude, their eggs may, during a calm, be seen floating on the surface of the water like saw-dust, amidst an appearance like the wake or track of a vessel, from which the course of the fish may be traced.

The herrings generally disappear in this part of the Channel about the beginning of December, and during their transit along this coast, are subject, as well as the mackerel, to a very formidable enemy in the dog-fish, which have greatly encreased within the last thirty years. One column of herrings may be assailed with these in great numbers, while other columns may be without them. The fishermen, however, consider the dog-fish too constant in their attendance on these occasions, as they frequently know to their cost, from having their nets greatly injured by their quick-cutting teeth.

The dog-fish, like the shark, turns on its side when it seizes its prey, and greatly resembles that ravenous fish in many respects; and whenever it finds itself entangled in the net, disengages itself in a few seconds, by making a large incision, and passes through, liberating probably many herrings at the same time.

The dog-fish, in attacking the herrings, devour them to repletion. They then disgorge what they have swallowed with such voracity, which being completed, they lose no time in recommencing seizing and swallowing the herrings with as much avidity as if it had been their first repast after a long abstinence, 'till they are again full, when their stomachs are again speedily relieved, and this filling and emptying has continued with such perseverance as to exhaust the patience of the most curious observer. This process, when carried on by numbers of the dog-fish about the nets, occasions a white shining appearance on the surface of the sea, accompanied with a smoothness, as if a quantity of oil had been strewed on it, emitting a rank oleaginous smell, which may be detected at some distance.

An idea may be formed of the numbers of the dog-fish which too frequently visit this part of the Channel, when it is stated, that, in the latter end of October, in the year 1827, some fishermen proceeded to a small sand-bank, which is situated about four miles to the eastward of Hastings, and two miles from the land, in quest of cod-fish, and for this purpose shot lines, to which four thousand hooks were attached, over the ground. These, at the expiration of about half an hour, were examined, when, with very few exceptions, there was a dog-fish secured by every hook. A large cod had also been caught at the same time, but only the strong cartilages and bones of the head, with part of the vertebræ remained, the rest having been swept away by the dog-fish, and this was probably the work of only a few minutes after its capture. But the effects of their rapacity did not extend to their own species in the same situation, the whole of which were hauled in uninjured. These insatiable fish are assisted in their ravages by the sepiæ or cuttle-fish, which, with their hard mouths, resembling parrots' bills, cut up the mackerel and herrings with great adroitness. The sepiæ are in their turn sometimes attacked by the dog-fish, but they are generally enabled to frustrate attempts of the kind, by ejecting a liquid resembling ink, which, rendering the water turbid and obnoxious, affords them an opportunity of making their escape.

The mackerel first met with off Hastings in the season, which generally commences about the month of March, come from the German Ocean, to which they are supposed to belong, and appear to be of a different species from those caught off Mountsbay, in Cornwall, the latter being longer, with the edges of the pectoral fins of a pink-colour, and not so thick in proportion to the former, which are of less weight, with the edges of the pectoral fins of a blue colour, and are considered of a superior quality.

The mackerel always appear off Mountsbay earlier than those off Hastings, and come from the Atlantic. The mackerel continue off Mountsbay about a month or five weeks, during which time some decked fishing boats from Folkstone, near Dover, proceed thither, and continue until the fish have disappeared. The crews of these boats, under an impression that the mackerel had moved eastward along the coast, have endeavoured repeatedly on their return to meet with them off the Praul-point, Portland-race, and off the Isle of Wight, without success. But after an interval of about a month, mackerel, corresponding in every respect with those from the Atlantic, appear off Hastings; by which it has been inferred, that, after they have disappeared off Mountsbay, they take a south-east direction until they approach the coast of France, when they proceed to the east or north-east. But as the French fishing boats, whose range of fishing ground is very extensive, have never, in the interval alluded to, met with the Atlantic mackerel, which, before they make their appearance off this station, are invariably met with off Yarmouth and the Northforeland, this circumstance appears sufficiently conclusive, that these fish proceed north about. Whether they pass through the Pentland Frith, or take a wider circuit in the course of their passage hither, is a point which I must leave to my friends situated more to the northward to determine. The early mackerel are frequently accompanied by a few red mullet (the salmonet of the Mediterranean); and whenever these nearly, if not altogether, equal the mackerel in number, the circumstance is generally the presage of the approach of great shoals of mackerel.

The season for mackerel at Hastings generally terminates about the end of June or the beginning of July, although many have been caught in the middle and latter end of September, corresponding in appearance with those which appear off this place about the commencement of the spring; and as these are taken on the west side of the nets (the general direction or position of which has been already mentioned), it is concluded they are on their return to deep water in the German Ocean, leaving, however, some stragglers behind, which have been met with in the Channel the whole year.

HASTINGS, SUSSEX,
August 1829.

On the Naturalization of the Cashmeer Shawl-Goat in England. By C. T. TOWER, Esq. of Weald Hall, Essex*.

SEVERAL attempts have been made to introduce and to naturalize, in the British Islands, the goat of Cashmeer, that variety of the common goat, or perhaps a peculiar species, the fine wool of which is the material of the so-called Indian shawls.

These fabrics, in fineness of fibre, lightness, and warmth, are

* From vol. xlvi. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its large Gold Medal to Mr Tower for a shawl.

unrivalled by those of any other material. It has, therefore, been considered a very desirable object to introduce the shawl-goat, for the purpose of ascertaining whether the climate of Europe is suitable to it; and whether, under these circumstances, the fine wool given it by nature, as a protection against the winter cold of its own country, will be produced unimpaired in the fineness of its staple.

A few years ago some shawl-goats were introduced into Scotland; but the experiment did not succeed, as they died without any progeny.

From France two agents were sent to Persia, under the patronage of the Emperor Napoleon, for the purpose of making purchases of goats of the genuine Cashmere breed, in the province of Caspahan. A considerable number of these animals was procured; and although many of them died in their long march to the coast of the Euxine, and in their passage thence by sea to Perpignan, yet a certain number survived, and were brought to Paris by M. Terneau, in the year 1823.

Mr Tower happening at that time to be in Paris, purchased four of them, two males and two females, and succeeded in conveying them safely to his residence in Essex.

The soil of the park at Weald Hall, where they have been kept ever since, is moist, and the situation is much exposed. The animals have, nevertheless, continued in health, and have multiplied rapidly, so that his present flock consists of twenty-seven, including the four original ones. Of these latter, a polled female, which was old when purchased by him, has every year produced at least one kid, and has twice had twins. Those individuals of which the horns cross are in Persia esteemed the best; and one of Mr Tower's last-year kids has this peculiarity. They shew no impatience of cold, and are very healthy, requiring only the occasional shelter of a shed in very rough weather. In spring, summer, and autumn, they graze like sheep; and during winter have been fed with hay, and refuse vegetables from the garden; but their favourite food is gorse (*Ulex Europæus*), which they devour eagerly, without being annoyed by its prickles. They damage young plantations, but not more than other goats or deer will do. They breed very early;

three of Mr Tower's goats this year produced kids before they were themselves a twelvemonth old.

A few produce brown wool, but that of far the greater proportion of the goats is white: and this latter is more valuable than the other.

The coat is a mixture of long coarse hair, and of short fine wool: this latter begins to be loose early in April; and is collected easily and expeditiously, by combing the animals two or three times with such a comb as is used for horses' manes. A good deal of the long hair comes off at the same time, but the manufacturer has found no difficulty in separating it *. The produce of a male is about four ounces, and of a female about two ounces. Two pounds of wool, as it comes off the goat's back, may be estimated to make one shawl fifty-four inches square. It will therefore require ten goats, male and female, to furnish materials for one shawl.

Mr Tower has this year had three shawls made of his wool, one of which was examined by the Committee of Manufactures. The yarn was spun by Messrs Pease, of Darlington; and was woven by Messrs Miller and Sons of Paisley. Mr Tower's shawl was compared with one made in Scotland, of French shawl-goat wool, to which it was evidently far superior. It was also compared with a shawl of M. Terneau's own make; and was considered by very competent judges to be superior to this also.

On the German Polish for Wood.

We were the first to publish any accurate information on the *French Polish* for wood, now become so universally employed, in our *Technical Repository*, from information derived from Mr Joseph Clement, the celebrated engineer; and have continually added, from time to time, such further particulars thereon as have come to our knowledge.

* A considerable quantity of rough Cashmeer wool was imported from India a few years ago, and baffled the attempts of the manufacturers to disentangle the wool from the hair; probably from the wool having become felted, in conveying it from Cashmeer and shipping it from Calcutta.

Our scientific friend, Mr J. I. Hawkins, however, having lately returned from Vienna, where he saw this process performed by an excellent workman in the cabinet-making line, and where it was invented forty years since, has kindly furnished us with such valuable information on their superior method of performing it, that we lose no time in communicating it to our readers.

The wood having been plained flat, and finished with the steel scraper, as in the usual processes for the French polish, has its surface evened as follows: Two pieces of pumice-stone, having been previously rubbed flat, are then to be oiled, and rubbed against each other, until they have acquired an uniform or even surface. The wood is then to be well rubbed with these, first longitudinally, then across, and, finally, in a spiral or circular manner, always obliterating or removing the scratches or marks made by the former rubbing, before finishing the succeeding ones; in this manner the surface of the wood will likewise receive an uniform surface, and will become ready for the application of the varnish.

The Germans never use any other varnish than a rather dilute solution of seed-lac, or shell-lac, in alcohol, for their polish; and, indeed, the addition of any other material would only injure the great hardness of the lac varnish. If the varnish be required of a lighter colour than usual, in this case the clearest grains of lac ought to be selected in preference.

The varnish is applied in the following manner: A piece of sponge being wetted with the varnish, is to be laid upon five pieces of linen rag, the borders or edges of them being gathered together at the back, to serve as a handle to this rubber. When the varnish has penetrated all through these different thicknesses of linen cloth, a little linseed oil must be applied in the midst of the varnish. The whole extent of one surface of the article to be polished must then be gone over at once with this rubber; the varnish being also applied, first in straight lines, crossing each other, and then in spiral or circular ones, in the same manner as in the evening the surface of the wood; and fresh oil must be applied to the centre of the rubber, whenever a tackiness or adherence of the varnish is beginning to take place. If there are four or five different articles to be polished, each should be gone over in succession, in the above manner, and thus afford time for the varnish to acquire consistence before applying another coat of it upon the former ones. In this way the process must be continued, with the usual care and precaution, until it is thought that nearly enough of varnish has been applied to the surfaces. One of the linen rags is now to be taken off, and the varnishing continued with the remaining four, with a renewed surface, and the application of the oil upon the outer one; this again is then to be removed in its turn, and the process carried on towards completion with four thicknesses only; then with three; with two; and finally with one thickness of linen only.

Should the varnish be required to be of any other colour than that afforded by the lac, it may be reddened by filing a little Brazil wood, and sprinkling the sponge over with the dust; changed yellow by treating turmeric root in the same manner, and so with other tinging woods, the colour of which is capable of being brought out by the action of alcohol upon them.

Should, however, it be required that a still more durable polish be given to the wood; then the above process must be repeated at the end of two days after the first polish has been given to it; next, in the course of a week; again at the end of a month; and, lastly, at the end of three months; thus always allowing due time for the previous coats to become sufficiently hard before applying the succeeding ones. In this manner, instead of having to lament the quick disappearance of this beautiful polish, as in the ordinary French method of doing it, we may calculate upon its enduring for years.

The German cabinet-makers do not merely content themselves with polishing the exterior of their works, but extend this beautiful improvement to the drawers, partitions, and every other part of their interior fittings also, with great addition to their value; and, indeed, they also take much more care in the finishing of their woods generally than we are in the habit of doing.—*Gill's Technological and Microscopic Repository for August* 1829.

Inquiries respecting certain Changes observed to have taken place in Domestic Animals, transported from the Old to the New Continent. By M. Roulin, M. D *.

During a residence of six years in Columbia, I have collected a certain number of observations with respect to some points in natural history, but more particularly with respect to quadrupeds, (mammifera), and birds, which I propose to submit successively to the judgment of the Academy.

Of the large quadrupeds which at present occur in that country, the most numerous are those which have been transported from the Old Continent. As they are at the same time the most useful, their existence in these countries has been much attended to in an economical point of view; but, in a scientific point of view, they seem to have been utterly neglected. Perhaps it is supposed that they have been sufficiently studied in Europe, to render any further attention to them in this respect unnecessary.

But the introduction into the New World of animals which have, in some measure, been substituted for the indigenous species, forms an epoch the history of which certainly deserves to be studied. Has their establishment been accompanied with no remarkable circumstance or phenomenon? Once naturalized in the country, have they remained what they were in Europe; and, if they have undergone some durable change, may not this transformation throw some light on that which they formerly experienced, in passing from the wild to the domestic state? These are points which deserve to be cleared up, but which can only be so, in a complete manner, by bringing together observations made in different parts of this vast continent. I now present those which I have myself made in New Grenada, and in a part of Venezuela, from the third to the tenth degree of north latitude, and from the seventieth to the eightieth degree of west longitude.

Although this space is rather limited, it presents a favourable field for observation, being traversed, in its whole extent, by the great Cordillera of the Andes, which is, in this part, divided

* In a former Number of the Journal, we gave a short notice of this memoir. We now lay before our readers the whole of Roulin's interesting inquiries.

into three principal chains; so that, in the space of a few leagues, the same animals may be examined, some living in a mean temperature of 56° F. (10° cent.), and others in one of 77° F. (25°) or 86° (30°).

The quadrupeds which have been transported from the Old to the New Continent are, the hog, the horse, the ass, the sheep, the goat, the cow, the dog, and the cat.

The first hogs were carried to America by Columbus, and established in the Island of St Domingo the year following its discovery, in November 1493. In the succeeding years they were carried successively to all the places where the Spaniards had a mind to settle; and, in the space of half a century, they were found established in the New World, from the latitude of 25° north, to the 40th degree of south latitude. They nowhere seemed to suffer from the change of climate; and, from the commencement, propagated with the same facility as in Europe.

Most of the hogs that are consumed in New Grenada come from the warm valleys, where they are reared in great quantities, as their food costs little there, and in certain seasons is almost entirely composed of wild fruits, and especially of those of different species of palms.

Wandering all day in the woods, this animal has lost nearly all the marks of servitude: its ears have become erect, its head broadened, and raised at the upper part, and its colour has been rendered permanent. In the adults, the colour is entirely black, but the young have yellowish lines on a dark ground. Such are the hogs that are brought to Bogota from the valleys of Tocayma, Cunday, Melgar, &c. Their hair is thin, and they present the appearance of a wild boar of the same age (from twelve to eighteen months).

The wild boar itself may undergo this alteration; and very recently I have had occasion of observing it in France, on a farm near Fougères, where seven or eight of these animals were reared. One of them, about two years old, was fed in the stable from the commencement of spring, in order to be fattened for killing. Although it was not a prisoner in this place, the food which it constantly found there kept it from going out for two months. Its hair, from the effect of the heat, had almost entirely fallen off, and it presented the most perfect resemblance to the Melgar hogs, which I have just described, only that two longitudinal grooves on the sides of the muzzle were more strongly marked, and gave it a more ferocious aspect. On the other hand, the hog of the *Poramos*, that is to say, of the mountains which have an elevation of more than 2500 yards, assumes much of the aspect of the wild boar of our forests, from the thickness of its hair, which becomes curled, and in some individuals even presents a kind of wool on the under parts. The hog which is found in these places, however, is small and dwarfish, in consequence of the deficiency of food, and the continued action of an excessive cold.

In some warm parts, the hog is not black, like that which I have described above, but red like the Pecari, in its early age. At Melgar itself, and in the other places which I have mentioned, the hog is not always entirely black, some being found which are called *Cinchados*, from their having, under the belly, a broad white band, which commonly extends on either side to the back, so as to meet there, sometimes becoming narrower, and sometimes retaining the same breadth.

The young individuals in this variety have the same markings as in those which are entirely black.

The only hogs that are seen in Columbia, resembling those of France, have been imported only twenty years ago. They do not, however, come from Europe, but from the United States of America. It is right to observe, that, in the neighbourhood of New York, where this race has existed for a long time, it had a climate very like our own, and was, as among us, the object of the constant care of its masters.

The establishment of black cattle in America dates, like that of hogs, from Columbus's second voyage to St Domingo. They there multiplied rapidly; and that island presently became a kind of nursery from which these animals were successively transported to various parts of the continental coast, and from thence carried into the interior. Notwithstanding these numerous exportations, in twenty-seven years after the discovery of the island, herds of 4000 head, as we learn from Oviedo, were not uncommon, and there were even some that amounted to 8000. In 1587, the number of hides exported from St Domingo alone, according to Acosta's report, was 35,444; and, in the same year, there were exported 64,350, from the ports of

New Spain. This was in the sixty-fifth year after the taking of Mexico, previous to which event, the Spaniards who came into that country, had not been able to engage in any thing else than war.

So long as the cattle were in small number, and grouped around the dwellings, they thrived equally well in all places; but, when they had multiplied, it was perceived that, in certain places, they could not dispense with the assistance of man. This arose from the circumstance, that a certain quantity of salt in their food was absolutely necessary for them; and, if they did not find it in the plants, the waters, or in certain soils of a saltish taste, common in many parts of America, they required to be supplied with it directly, failing which they became lean, many of the females died, and the herd quickly perished.

Even in places where cattle can exist without this assistance, it is found advantageous for large herds to distribute salt to the animals at fixed intervals. It is a means of drawing them towards the place where they have customarily been visited; and their avidity for salt is such, that after it has been given them two or three times in the same place, they are seen running to it the moment they hear the horn which the herdsmen blow, beating the bushes at the same time.

If it be neglected to bring the herd together from time to time, and the country supply the quantity of salt necessary for their existence, they become entirely wild in a few years. Such an occurrence has happened, to my own knowledge, in two places; the one in the province of San Martin, on a tract belonging to the Jesuits, when these people were expelled; the other in the province of Mariguita, at Parama de Santa Isabel, after the abandonment of certain gold mines. In the latter place, the animals have not remained in the places where they had been stationed, but have ascended into the Cordillera in search of the region of gramineæ, and live in a nearly constant temperature of from 48° to 50° Fahr. The peasants of the villages of Mendez, Piedras, &c. situated in the plain, sometimes go out to hunt them; they catch them by means of nooses, driving the small herds into the places where the snares are laid for them.

When they have managed to render themselves masters of one of these animals, it is often impossible for them to take it alive from the mountain, not on account of its resistance, which, after a certain time, diminishes, but because the animal frequently, after seeing the uselessness of its efforts, is seized with a general trembling over its whole body, presently falls, without its being possible to make it rise again, and dies in a few hours. The want of salt, the distance from inhabited places, and the roughness of the roads, prevent them from deriving any other benefit from their enterprize than that obtained from the flesh, which is eaten on the spot. For these reasons, the hunting of these animals is of rather rare occurrence. The hunters also are always in dread of being surprised by snow, which sometimes falls in these places, and which, when it lasts several days, causes these unfortunate creatures to perish, they being habituated to constantly warm climates.

When they have succeeded in taking one of these animals from the mountain, it is not very difficult to tame it, by keeping it near the farm, giving it salt frequently, and accustoming it to see men. I have never had an opportunity of seeing any of them alive, but I have eaten of the flesh of a cow that was killed the day before my arrival. It did not seem to differ in any thing from the flesh of the domestic cow. The skin was remarkably thick, but of the ordinary size; the hair long, thick, and ill laid.

In the province of San Martin, I have seen the wild bulls feeding in the *llanos* among the domestic cattle. These animals pass the morning in the woods, which cover the foot of the Cordillera, and come out only about two in the afternoon to feed in the savanna. The moment they perceive a man, they gallop off to the woods.

Before the revolutionary war, when the domestic cattle were more numerous, the wild cattle were not pursued, being much more difficult to be got up with. When one of them is snared, it is immediately killed, for it would be difficult, in the midst of those plains, to prevent it from resuming its habits of independence.

The skin of the wild cattle did not appear to me to differ in any respect from that of the domestic cattle, which are found in the same places. Both are always much lighter than those of the cattle reared upon the plain of Bogota, and the latter are inferior in this respect as well as in the thickness of the pile, to the wild cattle of the Paramo de Santa Isabel.

I have seen in the warmest parts of the province of Mariguita and Neyba, horned cattle, whose hair is extremely thin and fine. They are called *pelones.* This variety is reproduced by generation, but the people are not desirous of propagating it; for, as part of the cattle reared in these places is destined for the consumption of the towns of the Cordillera, where they are to remain to be fattened before being killed, the pelones, which do not bear cold well, are not adapted for exportation.

In the same places there are also frequently produced individuals named *calungos*, whose skin is entirely naked, like that of the Turkish dogs. These animals being weaker and more delicate, it is usual to kill them before they are capable of propagating.

None of these naked animals are ever seen in the cold parts.

In Europe, where the milk is an important article in the produce of black cattle, the cow is generally milked from the time of her first calf till she ceases bearing. This practice, constantly repeated on all the individuals during a long series of generations, has ended in producing durable alterations in the species. The teats have acquired a greater size than usual, and the milk continues to flow into them even after the calf has been removed. In Columbia, a new rural system, the abundance of cattle in proportion to the number of inhabitants, their dispersion in pasturages of too great an extent, and a multitude of circumstances, which it is not my object to mention, have interrupted these habits. It has required but a small number of generations to reduce the organization thus freed of restraint to its normal state. At the present day, therefore, if a cow is intended to give milk, the first care is to let it have its calf, which must be left all day with it, and be allowed to suck as it pleases. They are only separated in the evening, that the milk which collects through the night may be procured. If the calf dies, the milk immediately ceases.

The ass, in the provinces in which I have had opportunity of observing it, appears to have undergone scarcely any alteration in its form or habits. It is common at Bogota, where it is employed for transporting building materials. It is ill cared for, being left exposed to the inclemency of the weather, without sufficient nourishment being given it. It is on this account of small size, and is covered with a very long and ill combed pile. Deformities are frequent, not only in the adults, which are too soon put to labour, but even in the young at the moment of birth. Perhaps this circumstance depends upon the bad treatment which the mothers receive during gestation.

In the low and warm parts, where jackasses are required for obtaining mules, this animal is less neglected. In these places, at least, it has a sufficiency of food, and it is accordingly larger and stronger, and its hair becomes shorter and smoother.

When a jackass and stallion happen to be among mares in a pasture of limited extent, there is a perpetual war between them. Notwithstanding his inferiority in strength, it is the ass that oftenest comes to the charge. He does not at all seek to defend himself against the bites of the horse, otherwise than by withdrawing the head and neck, on which the latter commonly makes his attack; he does not reply to his kicks by other kicks; he has but one object, which is to seize his antagonist by the organs of generation, and not unfrequently, after persevering for several days, he succeeds in taking him by surprize, and castrates him by a single bite.

In none of the provinces which I have visited, had the ass returned to the wild state.

The case is different with the horse. There are wild horses in several parts of Columbia, and I have seen small birds in the plains of San Martin, between the sources of the Meta, the Rio Negro, and the Umadea. Their number being inconsiderable, and the space in which they are confined much smaller, and more frequented by men than the plains of Paraguay, they have not assumed all the habits which have been so well described by M. d'Azara; nor have I seen them in great herds formed of small families. I have seen these families consisting of an old stallion, five or six mares, and some filleys, completely isolated from all the others. So far from approaching caravans to entice the domestic horses, they take to flight the moment they perceive a man, and never stop till out of sight, the motions of these animals are beautiful, especially those of the chief of the troop, but their form, although not clumsy, is generally deficient in elegance.

In the hatos of the llanos, the horses are almost entirely left to themselves, being only brought together from time to time to prevent their becoming entirely wild, as well as for the purpose of ridding them of the larvæ of œstri, and of marking the foals with a hot iron. In consequence of this independent life, a character belonging to the unreduced species, the colour becomes uniform, chesnut being not only the predominant, but nearly the only, tint observed among them. I imagine something of the same kind may happen in Spain, among such of these animals as are left to wander in the mountains (cavallos cerreros), for in Spanish proverbs the horse is often designated by the name of *el bayo*, as the ass is by that of *rucio.*

In the small hatos that occur on the platforms of the Cordillera, the effects of domestication are more perceptible; the colours of the horses are there more varied; there is more difference in their size, that is to say, there are many among them smaller, and some a little larger; their hair, so long as they live in the fields, is pretty long and tufted, but a few months' stabling is sufficient to render it short and glossy. The race of these horses is in part renewed by stallions which are brought from warmer climates, and especially from the valley of the Cauca. It appeared to me, that in certain places where this practice was neglected, the horses had become perceptibly smaller, although in other respects the pastures were celebrated for their goodness. Their hair had grown extremely long, but they had scarcely lost any of their useful qualities, and those of a certain district were even distinguished for their speed.

When a horse is brought from the llanos of San Martin or Casanare, to the platform of Bogota, it must be kept in the stable until it becomes habituated to the climate; for if let loose at first in the fields, it falls off, is covered with scab, and often dies in a few months.

The pace which is preferred in saddle horses, is the amble and *le pas relevé.* They are trained to them at an early age, and when ridden, are carefully prevented from using any other pace. At the end of a certain time, the legs of these horses commonly *s'engorgent.* Then, if they are of a fine form, they are left in the hatos as stallions. There results from this a race in which the amble is the natural pace in the adults. These horses are named *aguilillas.*

Dogs, as is well known, were the auxiliaries of the Spaniards in their military expeditions in the New World, and that from the commencement. Columbus was the first who employed them. At his first battle with the Indians, his band, as we learn from his own memoirs, consisted of two hundred infantry, twenty horsemen, and twenty bloodhounds. Dogs were afterwards employed in the conquest of various parts of the Continent, especially in Mexico and New Grenada, and in all places where the resistance of the Indians was prolonged. Their race has been preserved, without apparent alteration, on the platform of Santa Fé, where they are employed for hunting deer. In this they display an extreme degree of ardour, and employ the same mode of attack which formerly rendered them so formidable to the natives. It consists in seizing the animal by the belly, and overturning it by a sudden effort, taking advantage of the moment when its body rests only upon the fore legs. The weight of the animal thus thrown over is often six times that of the dog.

Without having received any education, the dog of pure breed brings to this kind of chase certain dispositions, of which hunting dogs of a superior kind that are brought from Europe are destitute. For example, it never attacks a deer from before while running; and even when the latter, not perceiving it, comes directly upon it, it steps aside and assails the deer on the flank. Another dog does not use these precautions, and is often killed on the spot, the vertebræ of its neck being dislocated by the violence of the shock.

Among the poor inhabitants of the banks of the Magdalena, the dog has become deteriorated, partly by mixture, and partly by the want of sufficient food. In this mongrel race, a new instinct seems to have become hereditary. It has been for a long time almost exclusively employed in hunting the white-lipped pecari. The address of the dog consists in restraining its ardour, and in attaching itself to no animal in particular, but in keeping the whole herd in check. Now, among these dogs, some are found, which, the very first time they are taken to the woods, are already acquainted with the mode of attack. A dog of another breed starts at once, is surrounded, and, whatever may be his strength, is devoured in a moment.

The cat has undergone no perceptible change in America, excepting that it has ceased to have any more particular season of love in the year than another. This fact, which may easily be conceived in a climate where the temperature undergoes no great change, is equally observed with respect to all the other animals of which I have made mention; but the case is different as to those of which I have yet to speak, the goat and sheep; for, although kids and lambs make their appearance at all seasons of the year, there are two periods at which the number of births is greatly increased, viz. about Christmas and Whitsunday.

The sheep which was carried from Spain is not of the Merino breed, but of the kind called *de lana burda y Castra.* It is very common on the Cordillera, from the height of 1000 m. to that of 2.500 m. It nowhere seems to seek to escape from the protection of man, nor has any change taken place in its manners, the only difference exhibited by it being a slight diminution of size.

Within the limits which I have pointed out, the sheep propagates easily, and without requiring almost any care; but the case is different in the warm countries. It appears that, in the plains of Meta, it is very difficult to rear sheep, as, although their skins are very much in request there for making a kind of chabraque, and although one of them sells as high as an ox's hide, no sheep are to be seen from the river to the foot of the Cordillera. In the valley which separates the eastern from the middle chain, there are some indeed to be seen in a few places, but always in small numbers, the females being unprolific, and the lambs difficult to bring up.

Their existence in these places is worthy of attention, inasmuch as it gives rise to an extremely curious phenomenon. The wool on these lambs grows much in the same manner as on those of temperate climates. If, after attaining a certain thickness, it is cut, it immediately begins to sprout again, and things go on in the usual order; but if the proper time for depriving the animal of its fleece is allowed to pass, the wool thickens and becomes matted, and ends with coming off in patches, which leave under them, not a new wool, nor a bare skin in a diseased state, but a short, shining and well-laid hair, very similar to that which the goat assumes in the same climates. In the places where this hair has once appeared, no wool ever grows.

The goat, although its form is altogether that of a mountain animal, accommodates itself much better to the low and burning valleys than to the elevated parts of the Cordillera.

In the climates which agree with it, it multiplies well, there being commonly two, sometimes three kids, at each birth; but never six, as some have chosen to assert. Its size is small, but in form it has gained much: its body is more slender, its head more elegant, better placed, and generally less loaded with horns. The agility of this animal, and its propensity for climbing and leaping, are also singularly developed. I have often amused myself with seeing the goats in the public place of a village leap more than four feet high upon the cymaise of the pilasters of the church, the projection at the point where they placed their feet being only three inches. They remained in this difficult position for hours together, without any other apparent object than that of warming themselves in the sun, which, however, shone as well below as above.

The most evident sign of domestication in our European goat, the great size of the udder, has entirely disappeared in the American goat.

I have not reckoned the camel among the quadrupeds carried to the New World, because the species has not been preserved there. It has, however, been repeatedly transported from the Canary Islands, but always at the period of great political disturbances. Perhaps, in more tranquil times, it might have been got to propagate. The like has happened in the cases of other animals, which for a long time refused to propagate in certain places, and are now as productive there as in other places, as I shall shew in speaking of the domestic fowls.

The domestic fowls that have been carried to the West Indies, are, the common fowl, the goose, the duck, the peacock, the pigeon, and the Guinea-fowl.

The two last species have undergone no change. The pigeons present all the varieties which are observed in those of Europe.

The peacock is absolutely the same as in France. It is rather rare in Columbia, but this arises from the circumstance that little importance is attached to its propagation, for the female lays about the same number of eggs as with us, and the young are reared without much difficulty. The case was different at first; and Gomara informs us, that, although much greater pains were bestowed then, much less success was obtained.

The goose, which was introduced twenty years ago, presented the same difficulties on the plains of Bogota. It laid but a small number of eggs at long intervals, and scarcely the fourth part were hatched. Of the goslings more than the half died in the first month. Those which escaped formed a second generation, which had become more familiarized to the climate; and, at the present day, the species, without being yet as prolific as in Europe, is evidently approaching to the same point.

With respect to the common fowl, the same thing happened at Cuzco and in its whole valley, as Sarcilasso informs us; and more than thirty years passed before chickens were obtained, although at Y-Ucai and Muyna, only four leagues from the town, they were procured in abundance.

At the present day the race originally introduced is everywhere prolific; but the English breed, which has been imported within these few years, for the purpose of obtaining game-cocks, has not yet arrived at this degree of fecundity; and in the first year the proprietor of a flock thought himself fortunate if he obtained two or three chickens from the whole.

When the chickens of either race are observed in the warm districts, curious differences are remarked in them. The Creole chicken, whose parents have lived for ages in a temperature which never descends below 20°, comes from the egg with a small quantity of down, which it presently loses, and remains completely bare, with the exception of the wing-feathers, which grow in the ordinary way. The chicken of the English breed, on the contrary, makes its appearance with a thick covering of down, which falls off only as the feathers take its place. It is still clothed as if intended to live in the country whence its parents have been but lately brought.

The facts which I have above related were observed without the preconceived idea of attaching them to any theory; but on examining them, one is naturally led, I think, to the following inferences:—

1*st*, That, when certain animals are transported to a new climate, it is not the individuals only, but the races, that require to be naturalized.

2dly, That when this naturalization takes place, there are commonly produced in these races certain durable changes, which bring their organization to a state of accordance with the climates in which they are destined to live.

3dly, That the habits of independence soon make the domestic species resume the characters of the wild species from which they have sprung.

On the Action of the Spinal Marrow in Respiration. By M. Flourens.

Every body knows the opinion of the celebrated Legallois, who was led by a series of experiments, then entirely new, to place the seat of the principle of the motions of the heart in the spinal marrow.

M. Flourens shewed, in 1823, 1*st*, That the circulation, which, in adult animals, is instantly stopped by the destruction of the spinal marrow, on the other hand, survives its destruction a certain time in new-born animals: *2dly*, That, even in adult animals (and this had already been determined by Dr Wilson Philipp) the circulation survives the destruction of the spinal marrow, provided the respiration be kept up by insufflation. Thus, in the young animal, in which respiration is less necessary to the circulation, the spinal marrow is also less necessary. It is therefore especially because it is subservient to respiration, that the spinal marrow is subservient to circulation.

Whence it follows, that, if there were an animal in which the respiration might be completely disconnected, at least for a certain time, from the spinal marrow, the circulation might also be completely disconnected from it.

This animal is the fish. "I have shewn," said M. Flourens, "by previous experiments, that the spinal marrow may be entirely destroyed in fishes, without destroying the respiration; seeing that it is no longer from the spinal marrow, as in the other classes, but from the medulla oblongata alone, that in these animals the nerves of the respiratory mechanism take their origin."

The spinal marrow may equally be destroyed in fishes without destroying the circulation.

"I successively destroyed, in several carps and barbels, the whole spinal marrow, without touching the medulla oblongata. In all these fishes, the respiration and circulation continued for a long time; the motions of the trunk and appendages alone disappeared, but the head and the region of the opercula continued to move as usual; and the circulation still went on, even at the extremity of the trunk, more than half an hour after the total destruction of the spinal marrow."

On the other hand, the author always found in the other classes the circulation survive the destruction of all the parts of the spinal marrow, which the respiration survived; the destruction in birds, for example, of the lumbar portion, and that of the lumbar and costal portions in quadrupeds.

Thus, therefore, 1. There may be destroyed, without detriment to the circulation, all the parts of the spinal marrow, which may be destroyed without detriment to respiration; and when the spinal marrow may be entirely destroyed without injuring the latter, as in fishes, it may be entirely destroyed without injuring the former.

2. The spinal marrow has therefore but a relative and variable action upon the circulation as upon the respiration.

3. It is therefore especially because it exerts an influence upon the respiration, that the spinal marrow influences the circulation; and it is by the same parts that it acts upon each.

4. It is not in it, therefore, that the sole principle of the circulation exists.

Where, then, does this principle reside? The author intends, in a future memoir, to point out the parts in which his experiments have led him to place it, and to shew the mode according to which it is distributed in them.

On the Vision of the Mole. By M. Geoffroy Saint Hilaire.

Does the mole see? Aristotle and all the Greek philosophers believed it to be blind. Galen, on the contrary, maintained that it sees, affirming that it is possessed of all the means of vision. The question has again been taken up in our days: naturalists have discovered the eye of the animal. It is very small, being at the most not larger than a grain of millet-seed; its colour is deep black; it is hard to the touch, and is with difficulty depressed by squeezing it between the fingers. Besides the eyelid which covers it, it is defended by long hairs, which, crossing each other, form a thick and close fillet. Such an eye ought to be destined for seeing, but anatomists have found no optic nerve in it. What could be the purpose of an eye destitute of the nerve which, in the other animals, transmits the visual sensations to the brain? This consideration naturally leads back to the opinion of Aristotle and the Greeks, and would induce us to think that the mole, although it has an eye, does not see with it, and that, consequently, this eye is nothing but a rudimentary point without use.

Direct experiments, however, made at the request of M. Geoffroy St Hilaire, demonstrate, in the most incontestible manner, that the mole makes use of its eyes, since it turns aside to avoid the obstacles that are placed in its way. But, if the mole sees, how happens it to have no optic nerve? M. Serres thought that the optic nerve was supplied by an upper twig of the fifth pair, that which may be considered as analogous to the ophthalmic branch of Willis.

According to M. Geoffroy St Hilaire, the transference of function to a nerve which is not naturally destined to perform it, does not exist. The mole sees by means of a particular nerve; but this nerve not being able, on account of the too great extension of the olfactory apparatus, to follow the course along which it directs itself, in the other animals, to the tubercula quadrigemina, follows another direction, and anastomoses with the nerve of the seventh pair.

The observation of certain monstrosities furnishes examples of anomalies of precisely the same nature.

It is a fact well known in science, that each organ of sense is necessarily provided with two kinds of nervous systems, a special and *principal* nerve, which imparts life to the apparatus, and maintains it, and an *accessory* nerve. These nerves are, for the sense of smell, the *olfactory* and *nasal* nerves; for that of sight, the *optic* and *ophthalmic;* and for that of hearing, the *acoustic* nerve and the *branch of the cochlea.*

The mole also possesses its two ocular nerves, the *principal* and *accessory*, that is to say, the *optic* and *ophthalmic*. For the two nervous actions attributed to these two nerves, being contrary in direction, and yet simultaneous, could not be accomplished by a single branch. Now, in the mole, independently of the nerve which occupies the bottom of the eye, and which this position ought to induce us to consider as the optic nerve, there is another which occupies at its commencement a point of the circumference of the eyeball. This latter seems to come from a mucous or glandular tissue; or, perhaps, it even issues from a true lacrymal gland. The two nerves of the eye of the mole are inclosed in a common sheath, in the same neurilema.

Colours which different Substances communicate to the Flame of the Blowpipe. By M. Buzengeiger.

I use a lamp constructed after the model indicated by Berzelius in his Treatise on the Blowpipe. It is of great importance that one see in a distinct manner the conical blue flame, and the transparent blue vapour which envelopes and terminates it. I produce this effect by cutting the wick obliquely, the highest part being to the right, and opening it longitudinally, in order to introduce the point of the blowpipe. I made use of common lamp-oil. Oil that has been purified by sulphuric acid ought to be rejected for experiments with the blowpipe, as it always retains a little of the acid, and then deteriorates the wick, and changes the colour of the external vapour. This oil is immediately known, because one is obliged to cut the wick frequently, on account of its becoming transformed into a dirty matter, presenting the reaction of sulphur. The wick ought to be formed of raw cotton thread, because the bleaching is often performed with chloride of lime, which communicates a reddish-yellow tint to the external vapour, which must be avoided, as the blue colour is necessary to the success of the experiments.

As to the manner of blowing, it is necessary to acquire the power of keeping up the blue conical flame well developed and of constant length, without the yellow flame becoming mixed with it. The external blue vapour is then perceived, at least when the daylight is not too strong. The experiments should therefore be made in the evening in a dark room.

To make the experiments, the assay piece is seized with a platina forceps; and, when the flame is in a suitable state, it is introduced from beneath upwards, within the external vapour, before the blue point. The form of the assay piece depends upon particular circumstances. It may be in bits of various sizes, wedge-shaped, acicular, or in small laminæ.

It is often necessary to pulverize it. It is then made up into paste in the hollow of the hand, spread out upon a bit of charcoal, properly shaped; and, lastly, heated until it acquires sufficient consistence to be held with the platina forceps.

The following phenomenon is what usually takes place. When the assay piece is immersed in the blue vapour before the blue cone, the former is immediately replaced by a reddish-yellow atmosphere, the extent and intensity of which depend upon the nature of the body submitted to trial. By degrees the atmosphere diminishes and disappears. Another phenomenon is then produced: the blue vapour bathes the body without being altered, and remaining hardly visible, or it assumes a colour which varies with the nature of the body which is volatilized at this stage of the experiment.

Only three substances are yet known which present the red colour, these are Strontian, lime, and lithion. The shade is that of deep carmine.

Carbonate and sulphate of Strontian present at the first moment a feeble atmosphere, which is presently replaced by a beautiful red, which is permanent. The mixture of barytes makes the reaction of the Strontian disappear.

Iceland spar and arragonite give a colour somewhat less intense than that produced by Strontian, as soon as the carbonic acid is expelled. The impure limestones and dolomites do not colour the flame red, or colour it but very feebly. Fluorspar gives an intense red colour; sulphate of lime produces but a weak one; and phosphate and borate of lime do not give rise to it.

When there is barely introduced into the blue flame an acicular fragment of a substance which contains lithion, immediately after fusion, their appears a purplish red streak of great intensity; but the colour quickly disappears, and does not recur unless there be introduced into the flame a particle of the assay piece which has not yet been heated. The petalite of Uto, which contains much lithion, yields, however, but a very feeble red.

The outer flame of the blowpipe is rendered pale blue by arsenic; a little deeper by antimony; and beautiful sky-blue by lead. With antimonial galena, the blue is at first pale, and afterwards becomes sky-blue.

I am acquainted with only three substances which give a green colour to the flame: they are boric acid, barytes, and oxide of copper.

Boric acid, natural or artificial, yields a fine green. Borate of lime, datolite, and botryolite, give a less distinct green colour. Borax produces a strong reddish atmosphere, and only shews the green colour when it has previously been sprinkled with sulphuric acid.

To discover the presence of boric acid, I have tried the flux described by Dr Turner, which is composed of fluate of lime and bisulphate of potash; but these trials did not succeed, probably from want of habit. Be this as it may, all the minerals mentioned by Dr Turner, as colouring the flame green on being mixed with his flux, have yielded me the same re-action on being introduced with some caution into the blue flame, without being previously mixed with any re-agent.

All the minerals which contain barytes colour the flame pale green, tinged with white; the re-action is very distinct; the colour only shews itself when the matter begins to melt, but it gradually becomes more beautiful, and lasts a long time.

Most minerals which contain copper, even in very small quantity, yield a beautiful green colour at the point of the blue cone. The lead ores, which contain a little copper, produce a flame of a beautiful blue colour, with the extremlty green.

Annales des Mines, t. v. p. 36.

Description of several New or Rare Plants which have lately flowered in the neighbourhood of Edinburgh, and chiefly in the Royal Botanic Garden.

10th Sept. 1829.

Alstrœmeria pallida.

A. *pallida;* caule erecto-flaccido; foliis lanceolato-linearibus, denticulatis, subamplexicaulibus; petalis exterioribus obovatis, lateralibus latioribus, interioribus longioribus, lanceolatis; pedunculis unifloris.

Description.—*Stem* simple, slender, flaccid, round, as well as the leaves glauco-pruinose, several rising from the same root. *Leaves* scattered, sessile, half stem clasping, sparingly denticulate, lanceolato-linear, flat above, keeled behind, and with several parallel ribs, of which one on each side is stronger than the others. *Flower*, in the only specimen which has yet blossomed, solitary, terminal; the leaves are, however, crowded towards the base of the peduncle, and there seems little reason to doubt, that, from the axils of these, in a more vigorous state of the plant, several flowers will spring. *Perianth* of six unequal segments, attenuated, succulent, and channelled and nectariferous at the base; four outer segments of uniform, very pale rose colour, much reticulated, nearly of equal length, obovate, the lowest the narrowest and most pointed, and much the least attenuated at the base, the two lateral the largest, denticulated, all slightly acuminated in the middle; the two inner segments longer than the others, lanceolate, having denticulate wings towards their bases, of the same colour as the outer segments at their apices, lower down with reddish veins, above the middle on a yellow, below it on a pink ground, at the lower part of which there are a few oblong orange spots. *Stamens* six; filaments as long as the outer segments of the perianth, and of a similar colour, flattened, at the base triangular and glanduloso-pubescent, twisted when decaying; anthers erect, large, cordate, flattened, mucronulate; pollen pale brown, discharged as in the genus. *Stigmata* 3, revolute, pink; *style* 3-cornered, tapering upwards from its greenish persisting base, colourless below, becoming pink towards the stigmata; *germen* as in *A. pelegrina.*

This remarkably beautiful species, the colours of which harmonize more than in any other in cultivation, flowered in the collection of Mr Neill at Canonmills in July last. We have the same species at the Botanic Garden, raised from seeds sent by Dr Gillies from South America, but it has not yet flowered.

Mr Neill has a plant which in habit very much resembles this, but has spathulate undulate leaves, which are rather less stem clasping, and have a greater number of nerves. It is probable that when it flowers it will prove to be a variety of this.

Arabis retrofracta.

A. *retrofracta;* villosa, caule stricto, foliis subintegerrimis basi sagittatis, inferioribus spathulato-linearibus, superioribus acutis; pedicellis secundis, retrofractis, hirsutis.

Description.—*Root* branching, fibrous. *Stem* erect, scarcely branched, hoary, especially below, where also purplish, green above. *Leaves* soft and hoary on both sides, revolute in their edges, sessile, dilated at the base and stem, clasping; the lower leaves most hoary and purplish, entire or slightly toothed at the apex only, spathulato-linear, higher up lanceolato-linear, and towards the top subulate, entire, and sagittate, those lower on the stem having small round auricles. *Raceme* terminal, elongating while flowering; *pedicels* opposite, but frequently solitary (from abortion ?), bent down, with a very acute angle at their origin, turned to one side, hairy, hairs branched. *Calyx* yellowish-green, leafets elliptical, edges membranous, adpressed, half the length of the pedicel, sparingly covered with similar hairs. *Corolla* nearly as long as the pedicel, white, or with a very faint purple tinge; *petals* spathulate, somewhat oblique at the apex, and slightly emarginate. *Stamens* rather longer than the calyx, the longer exceeding the shorter by the length of the anthers; filaments colourless, smooth; anthers pale yellow. *Pistil* rather shorter than the stamens; germen linear, slightly swollen at its base, slightly compressed, much elongated before the flowers fall; style nearly awanting; stigma very small, blunt, simple, glandular only on its upper surface. Seeds arranged in a single row in each loculament, bordered; cotyledons flat, embryo applied to their edges.

Raised at the Botanic Garden from seeds collected in Captain Franklin's last expedition. The station of the species is stated by Dr Richardson to extend from Hudson's Bay to the Rocky Mountains, and from Canada to Lat. 68° at Mackenzie's River.

Draba muricella.

D. *muricella;* cæspitosa, perennis; foliis obovato-oblongis, integerrimis, pube stellata, cæsio-incanis, pedunculis elongatis, subfoliosis, petalis retusis, styli brevi, siliculis ovatis glabris.

"Draba nivalis, *Liljebl.* Vet. Acad. Hanbl. 1793, p. 208.; Ibid. Nov. Act. Ups. vi. p. 47. t. 2. f. 2." Fid. *Wahlenb.*

Draba hirta, *Œder*, Fl. Dan. t. 142.

Draba muricella, *Wahlenb.* Fl. Lapp. n. 318. t. 11. f. 2.; Ibid. Fl. Suec. 400.—*De Cand.* Syst. ii. 340.; Ibid. Prodr. i. 168.—*Br.* Ross's Voyage, App. cxliii.—*Richardson*, Franklin's Narrative, App. p. 16.

Draba Liljebaldii, *Wallm.* Sprengel Syst. 2. 874.

Description.—*Plant* perennial, cæspitose. *Leaves* (2 lines long) crowded upon the extremities of the shoots, obovato-oblong, entire, veinless, but marked by a central rib, which is prominent behind, covered on both sides with stellate pubescence, giving them a greyish colour. *Peduncles* (2 inches long) opposite to the leaves, solitary, near the extremities of the branches, elongated, covered with stellate pubescence, and having generally 2, sometimes 3, ovate leaves distantly placed, and smaller upwards, with a bud in the axil of each, but only distinctly evolved in the lower. *Flowers* small, subcapitate; pedicels short, and like the peduncle. *Calyx* pubescent, hairs longer and more simple than on the leaves or peduncles. *Corolla* white; petals retuse, longer than the calyx. *Stamens* and *stigma* included; *style* almost awanting; *silicle* ovate, naked.

Plant raised at the Edinburgh Botanic Garden from seeds presented by

Mr Drummond in February 1828, after his return from the last expedition under the command of Captain Franklin. A specimen presented by Dr Richardson to Professor Jameson shews that it is the plant which he gathered in the first expedition, in the barren ground between Point Lake and the Arctic Sea, under the name of *D. muricella.* Flowers in April.

Eryngium comosum.

E. *comosum;* foliis omnibus bi-pinnatifidis, apice reflexis laciniis subtrifidis spinosis, proximis minoribus; caule trichotomo; involucris trifidis patentibus; capitulis cylindricis, concoloribus, folio inciso coronatis.

Eryngium comosum, *De la Roche.*

Description.—*Stem* (1½ foot high) erect, obscurely angled, slightly rough, red at its base, above green, twice trichotomous, there being at each division a pair of opposite leaves. *Radical leaves* petioled (with the petiole 6 inches long), spreading, pale green, and marked on the back with white shining ribs, which are parallel, and rarely branched, twice pinnatifid, bent back at the apex; rachis and petiole broadly channelled, segments awl-shaped, rigid, spinous, erect, smaller towards the plant, petiole red on the inside towards the base. *Stem leaves* like those from the root, but sessile, alternate. *Branches* axillary, trichotomous. *Peduncle* (1–1½ inch long) terminal, as well as the branches with many obscure grooves. *Involucrum* green like the leaves and upper part of the stem, spreading at right angles, with one or two spreading teeth above the middle, *Capitulum* cylindrical, (9 lines long, and 4½ broad) green, and crowned by a green incised leaf, whose segments are erect. *Chaffs* awl-shaped, green, concave colourless and winged at the base, subexserted. *Calyx* segments erect, ovate, blue, terminated with a rigid white prickle. *Petals* lanceolate, cleft at the apex, blue, white along the middle, strongly keeled on the inside, equal in length to the calyx, but being involute they seem shorter, edges bent back, erect. *Stamens* somewhat spreading; filaments twice the length of the calyx, slightly tapering, purplish towards the base; anthers oblique, ovate, bilobular, bursting at the sides, greenish; pollen yellow. *Stigmata* minute; *styles* longer than the calyx, but shorter than the stamens, slightly spreading, colourless; *germen* compressed, the commissure being in the shortest diameter, covered with a dense white tomentum.

This species was raised from seed sent from Regla in Mexico to P. Neill, Esq., and flowered in the open air in the beginning of the present month in his singularly interesting collection at Canonmills, and also in the Royal Botanic Garden, a seedling plant having been received from Mr Neill.

Mitella pentandra.

M. *pentandra;* scapo erecto piloso; floribus pentandris, petalis pectinatis; foliis cordatis, lobatis crenato-serratis, setaceo-pubescentibus.

Mitella pentandra, *Bot. Mag.* 2933.

Description.—*Root* perennial, fibrous. *Scape* erect, elongated, sparingly hispid, more so towards the top. *Leaves* all radical, cordate, undulate, 5-lobed, serrato-crenate, sparingly hispid, paler behind; *petioles* longer than the leaves, rather more hispid, channelled; leaves and petioles together scarcely exceeding a quarter of the length of the scape. *Flowers* in a loose spike; pedicels very short, at first spreading, afterwards erect. *Calyx* 5-cleft, as well as the pedicels glanduloso-pubescent, segments acute, reflexed, herbaceous, persisting, tube adnate to the germen. *Petals* 5, yellow, pectinate, reflected, segments 3 or 4 on each side. *Stamens* 5, opposite to the petals, and alternate with the segments of the calyx; filaments very short, adnate with the inner surface of the calyx, and connivent from the base of the petals; anthers short, blunt, cordate, bilobular, yellow, the lobes furrowed on their outer edges. *Stigmata* two, sessile, persisting, bilobular, blunt, spreading. *Germen* obconical, almost entirely united to the calyx, unilocular, bivalvular above, opening and spreading wide as in *M. trifida*, so as to shew the green ovules long before they have attained the full size. *Seeds* dark brown, shining, crowded upon two parietal receptacles.

The capsule in this genus is generally described as bivalvular, but certainly in *M. pentandra*, *M. trifida*, and I believe in the other species, the capsule is only bivalvular in the upper half, the lower part forming an entire cup. Linnæus, in the *Genera Plantarum*, calls the germen bifid, but he afterwards adds, that the capsule is bivalvular. Nuttall says the capsule is subsemibivalve.

The present species was raised in the Botanic Gardens of Edinburgh and Glasgow from seeds gathered by Mr Drummond in the Rocky Mountains during the last expedition under the command of Captain Franklin. The form and colour of its corolla is like *M. nuda*, but this *(M. nuda)* is easily distinguished from our plant by its ten stamens, rather longer filaments, procumbent stem, and rounder less acutely-jagged leaves, and by the whole plant being smaller.

While this article was going to press, I received the number of the Bot. Mag. for September, in which the plant is admirably figured; and I readily adopt the specific name of my friend Dr Hooker, though equally applicable to *M. trifida*, to which indeed I was about to apply it when this plant came into flower, and prevented me at the time from giving it to either. *M. pentandra* flowered with us during June. I agree entirely with Dr Hooker that this plant ought not to be separated from the genus *Mitella*. Its habit and structure belong so exactly to that genus, that the number of the parts, the chief particular in which they differ, could only form an artificial character, quite sufficient, however, to form a pentandrous division of the species.

Monarda menthæfolia.

M. *menthæfolia;* caule piloso; foliis cordatis acuminatis, serratis, undique pilosis, breviter petiolatis; floribus capitatis; involucris herbaceis venis purpureis.

Description.—*Stem* erect, tetragonous, purple, thickly covered with white pubescence. *Leaves* ($1\frac{1}{2}$ inch long, $10\frac{1}{2}$ lines broad) spreading, decussating, on short petioles, cordate, acute, pale green, pubescent on both sides, especially below, acutely serrated, strongly veined, the uppermost pair closely embracing the capitulum, and having immediately within them four bracteæ, two on each side, similar to themselves, but rather softer, of paler green, with red veins; within these, and surrounding the capitulum, are many unequal, subulate, ciliated, green bracteæ. *Flowers* in a dense terminal capitulum. *Calyx* tubular, slightly curved, nerved, smooth, except at the base of the teeth where there is a whorl of spreading hairs; teeth short, acute, equal. *Corolla* lilac; tube clavate, curved, very slender colourless and smooth at its origin, every where else on the outside covered with short dense tomentum, smooth within; upper lip straight, subulate; lower lip 3-lobed, the central lobe the longest, linear, narrow, inflected, and cleft, the two lateral rounded, with erect edges. *Stamens* as long as the style, smooth; anthers transverse, flat, their upper edge deep purple, closely applied to each other, and embracing the stigma; filaments and style of the same colour with the corolla. *Stigma* unequally bilobed. *Germen* 4-lobed, erect, yellow, small.—Perfume of the whole plant like mint.

The species of *Monarda* are certainly in great confusion, and it is after some hesitation that I have ventured to describe this as new, but I do not find any described or in cultivation which I can believe to be the same. It is nearly allied to *M. oblongata*, but is distinguished from it by its much more hairy stem, its harsher and less acuminate leaves, and shorter petioles. It was raised in the Botanic Garden, and in the garden of Mr Neill at Canonmills, from seeds collected by Mr Drummond between Norway House and Canada, and flowered freely in August. When very luxuriant in cultivation, the stem is ascending and less hairy, and very rarely it is continued through the capitulum. Even the native specimens vary in the degree of hairiness, and the number and depth of the serratures of the leaves, which also differ in their breadth at the base, and are more or less elongated. The appearance of the less vigorous cultivated plants exactly resembles the few which are in Mr Drummond's herbarium.

Pentstemon glaucum.

P. *glaucum ;* caule herbaceo, subglabro; foliis glabris, glaucis, radicalibus lanceolatis in petiolam attenuatis integerrimis, caulinis lineare lanceolatis acuminatis parce serrulatis; pedunculis elongatis, decussatis, multifloris, pedicellisque compositis calyce corollaque puberulis, filamento sterrilo barbato.

Description.—*Stem* erect, glabrous below, slightly pubescent towards the top. *Leaves* all glabrous, glaucous; root-leaves lanceolate, attenuated at the base into petioles shorter than themselves, quite entire; stem-leaves ovato-lanceolate or linear-lanceolate, acuminate, dilated at the base, and stem clasping, distantly serrulate, smaller upwards and passing into ovato-acuminate entire bracteæ at the base of the peduncles. *Inflorescence*, as is common in the genus, axillary peduncles collected in form of a panicle at the extremity of the stem, peduncles elongated, as well as the compound filiform pedicels calyx and corolla glanduloso-puberulent. *Bracteæ* ovate, acuminate, gradually becoming smaller from the leaves, and two placed opposite to each other at each subdivision of the peduncle. *Calyx* 5-parted, segments ovate, acute, spreading, the upper the broadest and shortest. *Corolla* rather pale lilac above, and at the apices of its lobes, yellow with purple veins below; upper lip of two, lower lip of three segments; upper surface of lower lip with long yellowish hairs. *Stamens* included; filaments ascending; anthers cordate, lobes spreading, purple on the outside, whitish within; barren filament dilated at its base, and adhering to the upper side of the corolla, above which it dips to the lower side of the corolla, along which it is laid, densely covered with yellow hairs on its upper side for more than half its length. *Pistil* rather shorter than the barren filament; germen conical; style straight; stigma small, entire.

The seeds of this species, which flowered at the Botanic Garden during the greater part of the summer, were received from Mr Drummond after his return from the second journey to British North America.

Pentstemon procerum.

P. *procerum ;* caule herbaceo, ramoso, glabro; foliis ovato-oblongis, integerrimis, pedunculis glabris, multifloris, axillaribus terminalibusque; floribus congestis: calyce glabro, segmentis subulatis membrano lacerato alatis.

Pentstemon procerum, *Douglas*, MSS.

Description.—*Root* perennial. *Stem* (a foot high) ascending, subangular, smooth, green, at the base often red branching and twiggy. *Lower leaves* (1½ to 2 inches long, 6 to 9 lines broad) bright green, quite entire, decurrent upon petioles half their own length, opposite, decussating, folded forwards at the middle rib, which is strongly keeled behind, glabrous, shining, veined, veins oblique. *Upper leaves* (2½ inches long 9 inches broad) similar to the lower, but longer, less attenuated at the base, sessile, stem clasping. *Peduncles* (the lower 2 inches long, the upper almost awanting) adpressed, many-flowered, becoming gradually shorter upwards, and the leaves degenerating into bracteæ the whole inflorescence acquires the appearance of a dense, terminal spike, slightly verticelled. *Flowers* purple, striated, collected into bracteate capitula upon the top of the peduncle; bracteæ subulate, entire, green, one at the base of each pedicel, and longer than it. *Pedicels* of equal length, round, smooth, green. *Calyx* segments green, subulate, longer than the pedicels, bordered to their middle by a colourless, lacerated, obcordate membrane. *Corolla* (5 lines long) drooping, plicate, 2 upper segments erect, acute, 3 lower subequal, spreading, obtuse, hairy, and white on their inner surface near the base; every where else the corolla is glabrous. *Stamens* included; filaments smooth, curved, colourless, the two next the sterile stamen shortest, and yellow at the base; anthers dark, lobes spread very wide; pollen white; sterile stamen as long as the longest filaments, laid along the lower side of the corolla, purplish, nearly straight, at its apex spathulate, and having on the upper side a tuft of orange hairs, decurrent for a very little way only. *Stigma* small, simple. *Style* shorter than the stamens, purplish, slightly compressed, and grooved on each side near the germen. *Germen* ovate, subcompressed, green, purple at the apex, bilocular. *Ovules* very numerous, obovate, mutually impressing each other, attached to a large receptacle projecting from the centre of the dissepiment into each loculament.

This very handsome species of *Pentstemon* was raised at the Botanic Garden, Edinburgh, from seeds gathered by Mr Drummond. It was also found by Mr Douglas on the north-west coast of America, and received from him the MS. name here adopted, as I find from a specimen sent to Dr Hooker, though no such species appears in the list of his Pentstemons, published in this month's number of the Botanical Register. It flowered in the Botanic Gardens of Edinburgh and Glasgow in June last.

Saxifraga ferruginea.

S. *ferruginea;* scapo glanduloso-villoso, paniculato, ramulis divaricatis, inferioribus capitatis; foliis subcarnosis, elliptico-ovatis, planis, serrato-crenatis, infra ferrugineo-tomentosis, supra glabris, petiolatis; petalis calycem superantibus, stamina æquantibus.

Description.—*Scape* (7 inches high), covered with a close, short, soft, glandular pubescence, which on the upper part and on the pedicels is tipped with an adhering purple globule, but below is rusty. *Leaves* (1½ inch long, 9 lines broad) all radical, spreading, elliptico-ovate, somewhat fleshy, serrato-crenate, flat, dark green, and naked above, paler below, and partially covered with loose rusty tomentum, decurrent into flat petioles, nearly their own length, middle rib strong behind, veins obscure. *Panicle* terminal; lower peduncles long, capitate; upper much shorter, with longer divaricated pedicels. *Bracteæ* 3 at the origin of each peduncle, 1 below the peduncle, the others opposite, and arising from its sides immediately above its origin, spathulate, acute, or towards the top linear. *Calyx* spreading, unequal, sparingly ciliated, otherwise naked, wrinkled, pale green. *Corolla* white; petals rotundato-ovate, concave, spreading, nearly twice the length of the calyx, on short claws, faintly marked with a middle rib. *Stamens* inserted into the receptacle, unequal, as long as the corolla; filaments colourless; anthers erect, short, cordate, orange. *Germen* conical, green; *styles* at first crossing each other, colourless; *stigmata* capitate, smooth, shining.

Raised at the Royal Botanic Garden from seeds presented by Dr Richardson in 1827, and flowered in September 1829. One specimen produced its flowers in a capitulum, sessile in the middle of the leaves.

Tiarella colorans.

T. *colorans;* foliis cordatis, acute lobatis, dentatis, ciliato-mucronatis; caule subaphyllo; panicula terminali, floribus nutantibus.

Description.—*Root* perennial, fibrous. *Stem* erect, filiform, panicled, pubescent, especially at the top. *Radical leaves* (1¼ inch long, 1 inch broad) bright green, edged with red when fading, petioled, cordate, acute, subpubescent on both sides, sharply 5-lobed, and sharply inise-serrated, 5-nerved, and reticulato-veined, the nerves and their primary divisions prominent on the back, serratures mucronate. *Petioles* spreading, as long as the leaves, subpubescent, reddish, auricled at the base; auriculæ ciliated, especially at the upper part. *Cauline leaves* very small, sessile, alternate, lanceolate, ciliated, subdentate, auricled, auricles similar to those on the root leaves, and sometimes exist when the cauline leaf is awanting; higher up, the auricles having nearly disappeared, the cauline leaves degenerate into small, red, lanceolate, ciliated bracteæ, placed at each subdivision of the panicle, and at the base of the pedicels. *Pedicels* spreading, pubescent. *Flowers* nodding. *Calyx* obovate, pubescent, having 5 connivent, pointed teeth, yellowish-green. *Petals* 5, lanceolate, unguiculate, revolute, white, inserted into the margin of the calyx, alternate with the teeth. *Stamens* 5, exserted, arising from the base of the calyx, opposite to its segments; filaments colourless, pointed; anthers cordate, orange. *Germen* bivalvular, unilocular, green. *Styles* 2, colourless, longer than the germen, straight, tapering. *Stigmata* minute, ovules very numerous.

This pretty little plant flowered in the open border at the Botanic Garden in June and July, having been raised from seeds collected by Mr Drummond in the Rocky Mountains, probably on the west side; for Dr Hooker informs me he has it from thence by Menzies, Scouler, and Douglas, differing from our cultivated plant only in being much larger. Mr Douglas considered it *T. Menziesii*, Pursh, which I had at first marked it; but the expression "racemo filiformi subspicato," in the definition of this writer, afterwards induced me to consider it distinct.

Turritis patula.

T. *patula;* caule erecto, glabro; foliis radicalibus utrinque pilis ramosis aspersis, petiolatis; petiolis pilis simplicibus ciliatis; siliquis secundis patentibus, pedicellum octuplicatum æquantibus.

Description.—*Stem* erect, branched, smooth, shining, green. *Radical leaves* (7½ lines long, 3½ lines broad) lanceolato-elliptical, distantly serrato-dentate, sprinkled with branched hairs on both sides, petioled; petioles ciliated with simple spreading hairs longer than those on the leaves. *Cauline leaves* entire, linear, lanceolate, smooth, sagittate at the base, and stem clasping. *Raceme* terminal, greatly elongated while flowering. *Pedicels* of the flower erect, green, smooth; pedicels of the fruit spreading, elongating from the bud, but not after the flowers are fully expanded. *Calyx* shorter than the pedicel, smooth, green, edges of the leafets colourless and transparent. *Corolla* scarcely larger than the calyx; petals spathulate, white, slightly notched, and somewhat oblique at the apex. *Pistil* equal to the longest stamens; *germen* linear, flattened; *style* awanting; *stigma* very small, glandular only on the upper surface, and pitted in the centre. *Siliquæ* (1½–2 inches long) spreading wide, almost straight or bent a little near the apex, linear, compressed, with a strong central rib, and several smaller ones along each valve. *Seeds* arranged in two rows in each loculament, flat, bordered, embryo applied to the edges of the cotyledons.

The seeds of this species were gathered in Captain Franklin's expedition at Hudson's Bay, in Canada, and on the Rocky Mountains; and by Dr Scouler and Mr Douglas at Fort Vancouver. It flowered in the Royal Botanic Garden in May.

Turritis stricta.

T. *stricta;* caule erecto, glabro; foliis omnibus glabris, subintegerrimis, radicalibus in petiolam attenuatis, caulinis amplexicaulibus, sagittatis; siliquis strictissimis, pedicello stricto, glabro, quadruplo longioribus.

Description.—*Root* branching, fibrous. *Stem* erect, smooth, branched, leafy. *Leaves* erect, all smooth, lanceolate, entire, or, oftener, very sparingly denticulate, the upper narrowest and most pointed, those at the root attenuated into petioles as long as themselves, both the leaf and petiole being ciliated with minute reflected hairs. *Raceme* terminal, moderately elongating; pedicels erect, filiform, elongating, and like every other part of the plant glabrous. *Flowers* erect. *Calyx* coloured or green, segments subacute, with membranous edges, half the length of the elongated pedicel. *Corolla* white; petals spathulate, with long claws, twice the length of the calyx. *Stamens* all longer than the calyx, the longer exceeding the shorter by less than the length of the anthers; filaments slightly tapering. *Germen* linear, afterwards dilated at its apex, central nerve more conspicuous than the others. *Stigma* sessile, small, entire, stretched along the blunt apex of the germen. *Capsule* much elongated, always erect and straight, subspathulate, many-seeded. *Seeds* arranged in two rows in each loculament, bordered; cotyledons flat, embryo applied longitudinally to their edges.

The species was raised from seeds collected by Mr Drummond in the Rocky Mountains, and flowered in the Botanic Garden in May.

The two new species here described are at first sight distinguished from each other by the direction of the pedicels and fruit, which in the first spread wide and are secund, but in the second are perfectly erect on all sides. They are distinguished, in a young state, by the root-leaves being hairy in *Turritis patula*, but glabrous in *T. stricta*.

Celestial Phenomena from October 1. 1829 *to January* 1. 1830, *calculated for the Meridian of Edinburgh, Mean Time.* By Mr George Innes, Aberdeen.

The times are inserted according to the Civil reckoning, the day beginning at midnight. —The Conjunctions of the Moon with the Stars are given in *Right Ascension.*

OCTOBER.

D.	H.	′	″		D.	H.	′	″	
1.	5	57	5	☌ ☽ ♀	15.	19	3	45	☌ ♀ δ ♏
1.	14	49	45	☌ ♀ 2 α ♎	15.	22	15	34	☌ ☽ α ♉
2.	2	3	16	☌ ☽ γ ♎	19.	14	11	8	☾ Last Quarter.
2.	11	46	7	☌ ☽ ϑ ♎	21.	6	52	53	☌ ☽ ♄
3.	4	20	21	☌ ☽ φ Oph.	21.	11	59	44	☌ ☽ ξ ♌
3.	5	37	40	☌ ♂ β ♍	21.	16	41	41	☌ ☽ ο ♌
3.	12	52	46	☌ ☽ ♃	23.	16	0	16	☉ enters ♏
5.	.	.	.	☿ greatest elong.	24.	0	39	45	☌ ☽ τ ♌
5.	23	26	26	☽ First Quarter.	24.	12	44	18	☌ ☽ β ♍
7.	9	7	1	☌ ☽ β ♑	25.	4	24	34	☌ ☽ η ♍
7.	10	33	57	☌ ☽ ♅	25.	16	55	34	☌ ☽ ♂
9.	9	57	54	☌ ☽ ϑ ♒	26.	6	51	10	☌ ☽ ϑ ♍
10.	21	6	48	☌ ♀ γ ♎	27.	19	23	49	● New Moon.
12.	1	9	32	☌ ♀ κ ♎	28.	0	54	–	☌ ☽ ☿
12.	15	11	13	○ Full Moon.	28.	14	12	48	☌ ♀ ♃
13.	0	40	37	☌ ☽ ο ♓	29.	0	34	–	Inf. ☌ ☉ ☿
14.	10	8	4	☌ ♀ λ ♎	29.	7	51	3	☌ ☽ γ ♎
14.	17	42	23	Em. I. sat. ♃	29.	16	29	35	☌ ☽ ϑ ♎
15.	15	38	37	☌ ☽ γ ♉	30.	9	56	9	☌ ☽ φ Oph.
15.	16	53	0	☌ ☽ 1 δ ♉	31.	9	10	46	☌ ☽ ♀
15.	17	21	46	☌ ☽ 2 δ ♉	31.	17	43	9	☌ ♀ ϑ ♏
15.	17	30	5	☌ ♂ η ♍					

NOVEMBER.

D.	H. ′ ″	
1.	11 52 26	☌ ♀ B Oph.
3.	15 24 7	☌ ☽ β ♑
3.	17 26 34	☌ ☽ ♅
4.	9 30 13	☽ First Quarter.
5.	18 1 9	☌ ☽ ϑ ♒
5.	19 5 50	☌ ♂ ϑ ♍
9.	11 24 23	☌ ☽ ο ♓
9.	22 10 22	Im. III. sat. ♃
11.	1 24 32	○ Full Moon.
12.	2 21 45	☌ ☽ γ ♉
12.	3 38 0	☌ ☽ 1 δ ♉
12.	4 3 20	☌ ☽ 2 δ ♉
13.	8 51 19	☌ ☽ α ♉
13.	9 50 43	☌ ♀ λ ♐
14.	. . .	☿ greatest elong.
14.	4 27 –	☌ ☿ κ ♍
17.	2 9 14	Im. III. sat. ♃
17.	19 26 51	☌ ☽ ξ ♌
18.	0 4 48	☌ ☽ ο ♌
18.	8 32 6	☾ Last Quarter.
18.	12 15 42	♀ near σ ♐
18.	17 3 18	☌ ☽ ♄
19.	6 16 2	☌ ♃ B Oph.
20.	7 41 13	☌ ☽ τ ♌
20.	19 45 55	☌ ☽ β ♍
21.	11 27 44	☌ ☽ ν ♍
22.	12 17 25	☌ ☿ ψ ♐
22.	12 26 32	☉ enters ♐
22.	13 56 49	☌ ☽ ϑ ♍
23.	13 38 47	☌ ☽ ♂
23.	22 22 49	☌ ☽ κ ♍
25.	2 46 –	☌ ☽ ☿
25.	14 43 32	☌ ☽ γ ♎
26.	12 14 41	● New Moon.
27.	21 7 10	☌ ☽ ♃
30.	6 19 31	☌ ☽ ♀
30.	18 36 –	☌ ☿ κ ♎
30.	20 48 10	☌ ☽ β ♑
30.	23 42 16	☌ ☽ ♅

DECEMBER.

D.	H. ′ ″	
2.	13 37 –	☌ ☿ λ ♎
2.	23 41 6	☌ ☽ ϑ ♒
3.	18 18 35	☽ First Quarter.
3.	21 32 22	☌ ♂ λ ♍
4.	13 37 –	☌ ☿ 1 β ♏
4.	13 41 –	☌ ☿ 2 β ♏
6.	19 52 29	☌ ☽ ο ♓
9.	12 23 0	☌ ☽ γ ♉
9.	13 37 8	☌ ☽ 1 δ ♉
9.	14 5 48	☌ ☽ 2 δ ♉
9.	14 45 53	☌ ♀ ♅
9.	18 57 56	☌ ☽ α ♉
10.	13 26 50	○ Full Moon.
15.	1 37 46	☌ ☽ ♄
15.	4 1 8	☌ ☽ ξ ♌
15.	8 34 10	☌ ☽ ο ♌
16.	2 50 –	☌ ☿ ϑ Oph.
16.	5 59 46	☌ ♀ ϑ ♑
16.	6 43 0	☌ ♂ 2 α ♎
16.	18 30 –	☌ ☿ β Oph.
17.	15 28 54	☌ ☽ τ ♌
18.	3 30 49	☌ ☽ β ♍
18.	5 56 49	☾ Last Quarter.
18.	14 21 –	☌ ☉ ♃
18.	19 12 19	☌ ☽ ν ♍
19.	21 48 44	☌ ☽ ϑ ♍
21.	6 26 39	☌ ☽ κ ♍
22.	1 4 58	☉ enters ♑
22.	11 13 27	☌ ☽ ♂
22.	22 59 37	☌ ☽ γ ♎
23.	7 33 6	☌ ☽ ϑ ♎
24.	0 42 5	☌ ☽ φ Oph.
24.	11 48 10	☌ ♀ γ ♑
25.	0 57 –	Sup. ☌ ☉ ☿
25.	16 25 41	☌ ☽ ♃
26.	. . .	♀ greatest elong.
26.	3 32 46	● New Moon.
26.	4 32 –	☌ ☽ ☿
28.	3 15 36	☌ ☽ β ♑
28.	8 50 14	☌ ☽ ♅
29.	19 14 7	☌ ☽ ♀
30.	5 3 54	☌ ☽ ϑ ♒

Times of the Planets passing the Meridian.

OCTOBER.						
	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	13 20	14 2	10 58	15 56	8 32	19 39
5	13 20	14 4	10 51	15 42	8 17	19 22
10	13 17	14 9	10 43	15 26	8 0	19 3
15	13 6	14 14	10 36	15 10	7 43	18 43
20	12 45	14 19	10 28	14 55	7 24	18 24
25	12 12	14 25	10 19	14 39	7 5	18 4

NOVEMBER.						
	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	11 15	14 34	10 10	14 18	6 40	17 38
5	10 52	14 39	10 3	14 5	6 24	17 22
10	10 36	14 45	9 55	13 50	6 5	17 3
15	10 32	14 51	9 47	13 35	5 47	16 44
20	10 36	14 58	9 40	13 20	5 28	16 25
25	10 44	15 3	9 33	13 5	5 8	16 6

DECEMBER.						
	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	10 56	15 8	9 24	12 47	4 44	15 43
5	11 6	15 12	9 18	12 35	4 29	15 28
10	11 18	15 15	9 11	12 20	4 9	15 9
15	11 32	15 18	9 5	12 5	3 49	14 51
20	11 47	15 19	8 58	11 51	3 29	14 32
25	11 58	15 20	8 51	11 27	3 8	14 13

On the 15th of October there will be an occultation of *Aldebaran* by the Moon.

	D. H. ′ ″		
Immersion,	15 21 13 28, at 46° to the Left	} of the Moon's centre.
Emersion,	– 21 35 14, at 3° to the Left	

On the 9th of December there will be an occultation of *Aldebaran* by the Moon.

	D. H. ′ ″	
Immersion,	9 17 39 57, at 89° to the Left	} of the Moon's centre.
Emersion,	– 18 31 19, at 40° to the Right	

SCIENTIFIC INTELLIGENCE.

NATURAL PHILOSOPHY.

1. *Influence of Electricity in the formation of certain inorganic bodies.*—M. Becquerel read lately to the French Academy a memoir on the part which electrical phenomena perform in various chemical combinations. The envelope of the earth, from its surface to the greatest depth that man has attained, consists of four distinct formations, which have been examined separately, both with respect to the minerals, and also the organic bodies which they contain. The mineral substances contained in the great masses have crystallized at the very moment when the latter were in a state of liquefaction. They are consequently of contemporaneous origin, and nothing can be known respecting the causes which produced them. But these same substances have been again dissolved and suspended in the waters, then deposited along with metals which must have since exercised electrical actions, whence probably may have resulted new compounds. The natural philosopher may, therefore, add greatly to our knowledge of the history of the earth, by attempting to determine the forces which have brought about these changes. Whatever be the origin of most of these substances, if it be proved that similar substances can be formed by the employment of very weak electrical forces alone, it will be rendered probable that the others have a similar origin. Now, this is precisely what M. Becquerel has done. To arrive at the object which he has in view, the author examines the electrical effects which are manifested in the chemical action of bodies in contact with each other, chiefly among fluids, and carefully analyses the nature of these effects. His memoir is divided into two parts. In the first, the author occupies himself with electro-chemical effects, chiefly produced in consequence of the contact of fluids with each other, or by the contact of these bodies with metals. The second part is devoted to the applications which may be made of the results obtained by the first. When a metal is attacked by an acid or a liquid, heat is disengaged. Then the formation of a compound takes place, which exercises a reaction, not only upon the metal, but also

upon the liquid which surrounds it, and with which it mingles. There are thus (including chemical action), four causes which concur in the production of the electrical effects, of which the result is shewn by the galvanometer. The action of saline solutions upon each other, or upon acids, being often one of the preponderating causes, when the chemical action is feeble, it is upon its examination that M. Becquerel first enters. He then gives an easy means of observing the electrical effect which results from the action of an acid or a liquid upon a metal, the reaction of liquids not being considered. The author then examines the effects which take place in a voltaic element, in consequence of the chemical action of liquids on each of the metals. To appreciate these effects, he takes a glass vessel, in the interior of which he places two leather partitions, to retard the mixture of the liquids contained in each of the cases. On trying different liquids, it is found that the maximum of intensity of the current takes place perceptibly when copper is immersed in a saturated solution of nitrate of copper, and zinc in a saturated solution of sulphate of zinc. From this he deduces a process for having in a voltaic couple electrical effects which exhibit very little variation during an hour. Several voltaic couples united lead to the same result. The electrical forces developed in the chemical action of liquids have been employed by M. Becquerel to produce combinations. Carbon, which is one of the most extensively diffused simple bodies in nature, and which performs a conspicuous part in its phenomena, is first submitted to investigation. The property which this body possesses of combining in various proportions with hydrogen, has enabled him to form chlorurets and insoluble metallic iodurets. If, for example, some hydrochloric acid, a plate of silver and carbon, are put into a tube, the silver being positive, the pole attracts the chlorine, with which it forms chloruret of silver, which crystallizes in octahedrons ; the hydrogen prevails over the carbon, combines with it, and the gaseous product is disengaged. To form double chlorurets and double iodurets, a tube is taken, bent in the form of the letter V, and filled at its lower part with sand or clay impregnated with water. A solution of nitrate of copper is poured into one of the branches, and into the other a solution of an alkaline or earthy hydrochlorate. The communication is then established with a plate of copper. The end, immersed in the nitrate solution, and which is the positive pole of the pile, becomes covered with copper in the metallic state; the nitric acid remains in the solution, and the oxygen alone goes to the other end to oxidize the metal. There are then formed on this side crystals of double chloruret. These crystals have been carefully analyzed. The hydrochlorates of ammonia, lime, potash, barytes, &c. yield, with oxichloruret of copper, crystals which belong to the same system of crystallization, and these salts have precisely the same atomic composition. This result affords a verification to the law discovered by Mitscherlich. Other metals were substituted for copper, and the solutions changed. At the first moments of crystallization, the crystal is complete; but, when the apparatus has wrought for a long time, truncations begin to appear on the angles and edges. To obtain the metallic oxides crystallized, another method is adopted. For the protoxide of copper, for example, there is poured into a tube a solution of nitrate of copper, in the bottom of which is placed deutoxide of copper; a plate of copper is then immersed in it; cubical crystals of protoxide of copper gradually form on the part of the plate which does not touch the deutoxide. The action which determines the formation of this substance has been developed with much detail, as well as the various circumstances which accompany it. The influence of light and the earth's magnetism are sometimes remarked in the above mentioned effects, notwithstanding its feeble intensity. M. Becquerel related an experiment which leaves no doubt on this subject. The author mentioned that the facts exposed in his memoir were the result of two years' experiments.

2. *Metallic Electricity.*—M. Auguste Delarive of Geneva, has constantly observed, that the action produced by the elements of a pile ceases completely when these elements are placed either in a vacuum or in a medium which exercises no chemical action upon them. On the other hand, M. Delarive has repeated with success the experiments of an English chemist, who produced electricity by means of a pile composed solely of zinc. Of the two surfaces of each plate, the one is rough and the other polished. These plates, which, when placed at a distance from one another, only communicate by means of the ambient air, yet develope an appreciable electricity even with-

out the assistance of the condenser. The consequences which result from these two series of experiments, with respect to the idea to be formed of the principal cause of the development of electricity in the pile, are evident, and appear to us to be of a nature to modify the ideas of the learned world respecting one of the most important facts in natural philosophy.

3. *Influence of Meteorological Phenomena on Dry Piles.*—M. Donné lately read to the Academy of Sciences, a memoir, entitled *Inquiries respecting the Influences which Meteorological Phenomena exercise on Dry Piles.* The dry piles invented by M. Zamboni had not hitherto been sufficiently studied with reference to the variations which their tension undergoes from the influence of meteorological phenomena. It was therefore of importance to determine, by experiments directed toward this object, what is the particular action of humidity, temperature, atmospheric weight, and electricity, upon that instrument, and then to observe it during a long period when under the influence of all these causes together. The first part of this memoir comprehends the result of these experiments: in the second it is inquired whether the dry piles may be compared to the voltaic pile, and if it is possible to make it produce some chemical action.—*Humidity.* Humid air acts only as a conducting body, by carrying off more or less electricity, and not by modifying the function of the pile.—*Atmospheric weight.* There is no relation between the variations of tension of the dry piles and the barometric heights. If a pile is placed under the bell of a pneumatic machine, and a vacuum is made, it experiences no diminution in its tension, even when the vacuum is kept up as exactly as possible for several days. This is in contradiction to the well known experiment, which tends to prove that air is necessary for forcing the electric fluid into the conductors; but the fact is constant, and has been verified by repeated experiments.—*Temperature.* Of all the atmospherical circumstances this acts in the most diversified and most immediate manner upon the dry piles, and its action is extremely complicated. In fact, experiment and observation have demonstrated, 1st, That its effects are different according as the variations are quick and instantaneous, or take place slowly and progressively. In the former case, the tension of the pile is considerably dimi-

nished, and may even be reduced to 0°; in the latter, this action is much more moderate. 2dly, Temperature acts mechanically in dilating or contracting the pile, and consequently in augmenting its energy by the greater pressure which the elements undergo when the pile elongates, or in diminishing it, when the contrary effect takes place. It also acts upon the function of the pile, by favouring the chemical action which electricity produces. 3dly, Temperature does not produce its effects suddenly, but only after a certain time. It does not act in an absolute manner; in other words, such a degree of tension does not answer to such a degree of the thermometer, but its action has relation to the temperature which has existed some hours before. 4thly, Heat frequently only increases the rapidity of the current, and not the quantity of the electricity produced.—*Atmospheric Electricity.* The question whether the electric state of the air and the other meteorological phenomena have a direct influence upon the tension of dry piles, is undoubtedly the most interesting and the most difficult to be solved. It is evident that the causes hitherto preferred are incapable of accounting for all the variations that are observed in the tension of the piles. It is in the electrical influences then that we are to seek the explanation of the anomalies which their action presents? On this subject experiment gives the following results: If, by means of the electric machine, positive electricity is made to arrive at the negative pole, the tension augments considerably at the positive pole, while, if it is at the positive pole that positive electricity is made to arrive, the tension is reduced to 0° at the negative pole. In a word, electricity arriving at the pole of the same name, reduces the tension of the other pole, and electricity arriving at the pole of the contrary name, augments the tension of the other pole. Now, the piles which are observed being commonly placed under a glass globe, and communicating by one pole with the reservoir, and the other being isolated in a medium little accessible to humidity, it is not therefore to the latter that the electricity can be transmitted, and its action can only be conceived by supposing that it comes from the earth. But does it not in fact happen, that when an electric cloud approaches the earth, a certain quantity of the natural fluid of the common reservoir is decomposed, and attracted by the opposite electricity? The earth's surface must thus present, at the place where a thunder-storm exists, a positive or negative fluid, which recomposes itself with the electricity of the clouds, when the rain furnishes it with a conductor. This fact may be verified by direct experiment, since it is sufficient, during a thunder-storm, to put a very sensible electrometer in connexion with the common reservoir, to obtain signs of electricity. It is true, that it is not during thunder-storms that the great changes take place in the variations of the tension of dry piles. But is it not possible that there may be thunder-storms in the bowels of the earth, as there are in the atmosphere? That in earthquakes especially, great decompositions of electric fluid take place, which respond at great distances, and which act upon our instruments much more powerfully than the thunder-storms of our atmosphere! But it will always be very difficult to arrive, in this matter, at a sure result, seeing it is impossible for us to know how the electric fluid is propagated and distributed in the strata of the earth, which are so diversified, and since an effect which is produced here may be very imperceptible elsewhere, besides that it must often happen that the effects of temperature are confounded with others. It appears demonstrated, however, that the earth being capable of furnishing electricity to the dry piles in certain cases, their tension may be augmented or diminished. May Zamboni's apparatus produce some chemical action, and may its action be compared to that of the Voltaic pile? A string formed of fifty-two dry piles, of a thousand plates each, gave strong sparks, but its chemical action was absolutely null. It was even impossible, by employing Wollaston's method, to decompose water, or change the colour of the weakest tinctures. It is not here that force is wanting to act chemically upon the bodies; it is that there is no current in the dry piles, as is understood to be the case with Voltaic electricity: their action is entirely that of tension, and not at all galvanic. To form a proper idea of the dry piles, they must not be compared to the Voltaic pile, but to an electrical machine, which is recharged of itself. The current which it produces is but a series of discharges, a series of sparks which follow each other, at very short intervals, and which, for this very reason, cannot produce any chemical effect.

METEOROLOGY.

4. *Remarkable Coldness of the late Spring.*—The cold and backward spring which we have had in this country has been the subject of general remark. Dr Forster, who has lately returned from the Continent, has made a corresponding remark abroad. The crops, and particularly the garden productions and flowers, have been nearly a fortnight later than usual, almost all over Germany and the northern parts of France. At Spa, the season was so cold and unpleasant that most of the visitants had left it to travel elsewhere, till there were some signs of summer; and there was ice on the water near Liege on the morning of the 8th of June. The thermometer during the day did not rise higher than 58° of Fahrenheit; and a cold dry wind seemed to threaten a total destruction of vegetation. Paris, however, we understand, was comparatively warm, and the climate seemed to change for the better on passing Arras into France.—*Annals of Philosophy*, Sept. 1829.

5. *Changes of Climate at Shiraz.*—Since the last earthquake, the climate of Shiraz has very much changed from its former salubrity. The water in the wells has risen very near the surface. Where formerly there were ten and fifteen yards of line, there are now only three or four; therefore the increased evaporation has, it is supposed, been the cause of a deleterious atmosphere in the plain.—*Alexander's Travels*, p. 125.

6. *Effects of the Aurora Borealis on the Magnetic Needle.*—When I first observed the luminous appearances of Tuesday, August 28th, at 10 P. M., I placed a horizontal needle, delicately mounted, in the window of my room, which was in the northern side of the house, and a dipping-needle about ten feet distant in another window. On examination, I found that neither would come to a state of rest. The mean of the extremes, in the horizontal needle, was at least 5° west of the magnetic meridian. After marking the extremes on a paper card, fixed in the window for the purpose, I left it. The dipping-needle, which oscillated from 64° to 75°, was in constant agitation, and very irregular in its motions; sometimes rising to nearly 60°, and remaining for a moment with a tremulous motion, and then sinking back to 75° or 76°, having a mean dip of 69½°, which

is, I believe, according to the best needles I have seen, $2\frac{1}{2}°$ above the true dip of this latitude. The greatest variation of the needles was at 10 P. M., when I first placed them in the window, and it constantly decreased. The brilliancy of the aurora increased till 10 o'clock 30 minutes, when its luminousness had entirely disappeared; though there was a bright aurora in the northern horizon. On examining the horizontal needle, I found it constantly in a tremulous motion, though it did not oscillate more than 2°, or perhaps somewhat less. On setting it to oscillating, however, a second time, it came to rest at 71°; the same was repeated with the same result, viz. 71°; whereas its ordinary dip is 72°. The luminous appearances of the 29th and 31st were less brilliant; and though I examined the needles to see if any effect was produced, nothing remarkable appeared during the aurora, except that the needles were seemingly a little longer than ordinary in coming to rest.—*Silliman's Journal*, New York, 21st April 1828.

7. *A Storm in the Mediterranean accompanied with Castor and Pollux Lights.*—On Friday the green shores of Sicily came in view, but the breeze was light, and we advanced slowly. On Saturday it left us altogether, and, when I turned in at night, the sea was smooth and bright as a mirror; the vast firmament seemed to descend below us; the ship appeared suspended in the centre of an immense sphere, and, if I may say so, one felt in awe and silence the majesty of space. About midnight I was awaked by a heavy swing of my coat, succeeded by a sudden dash to the other side: the water was pouring into our room, and I could hear it rush across the upper decks, where all was noise and rapid motion. I hurried on my clothes, and ran up. The gun-deck was clear; hammocks had already been lashed up and stowed; it was lighted up, and the lamps shewed it flooded in its whole extent. I ascended to the next. The rain came down in torrents, but I did not feel it, so deeply absorbing was the scene. The sky was in a constant blaze: the sea was not high, but the waves were broken, confused and foaming, and taking from the lightning an unnatural hue. Above me were the yards covered with human beings, thrown by each flash into strong outline, struggling hard to secure the canvas, and to maintain their precarious footing. The ship rolled tre-

mendously. And now, add the wild uproar of the elements, "the noise of many waters," the deep and constant roar of the winds, the cries of men aloft, the heavy and rapid tread of those below, the reiterated orders of officers, and the sounds of the trumpet rising above all; and then, add to this the heavy rolling of thunder, at times drowning all these sounds. The first lieutenant had the deck; he had sprung to it at the first alarm, and seizing the trumpet had called for Black, his favourite helmsman. The ship was soon under snug sail, and now dashed forwards at a furious rate, giving to the gale a yet wilder character. All at once a rocky island seemed to start up from the waters—but the next broad flash shewed a good offing, and we were safe; when suddenly came a loud shout from the forecastle, "A sail on the starboard bow,"—and then another, "A sail close on the larboard bow." I trembled then, not for ourselves, for we should have gone over them, and have scarcely felt the shock,—but for the poor wretches, whom it would have been impossible to save. The helm was put hard down; we shot by, and I again breathed freely, when some one bade me look up to our spars. I did so, and found every upper yard-arm and mast-head tipped with lightning. Each blaze was twice as large as that of a candle, and thus we flew on with the elements of destruction playing above our heads.—In about thirty minutes, the wind, which was from the south-west, changed suddenly to the south-east, and became as hot as air from the mouth of an oven. It was the Sirocco, and brought with it a quantity of fine sand. It lasted half an hour, and was a stiff, smacking breeze, but not near so strong as the one it had succeeded.——A similar electric phenomenon occurred to the ship in which Castor and Pollux sailed, in the Argonautic expedition, only the light appeared on the caps of the two heroes: the storm subsided, and they were received as patrons of sailors. In this way, too, they often appeared to the Roman armies, and were supposed to be leading them to victory. This was nothing more than the electric fluid on their spears. The late Mr Whitney of Newhaven, when riding on horseback, near East Rock, in the vicinity of that town, during a night thunder-storm of great severity, was astonished to find, all at once, his horse's ears tipped with fire. He alighted, but now discovered the same phenomenon at the end of his whip, stirrups, and every prominent object. His own person and that of an attendant were tipped in the same manner. Similar appearances, probably, suggested to Virgil the fiction of the flame about the head of Ascanius, the night on which Troy was burnt. —*Silliman's Journal.*

CHEMISTRY.

8. *Thorine, a new Earth.*—M. Berzelius has lately discovered a new earth, possessing all the properties of that which bore the name of Thorine, and which was only a phosphate of yttria. On account of this great similarity, he retains the name of Thorine for the new substance. It is white, and incapable of being reduced by charcoal and potassium. After being strongly calcined, it is no longer attacked by acids, excepting by concentrated sulphuric acid. Even after being treated by the caustic alkalies, the sulphate of thorine is very soluble in cold water, but nearly insoluble in boiling water, so that it cannot be freed from several other salts by washing the mixture with boiling water. Thorine dissolves very well in carbonate of ammonia. Elevation of temperature determines the precipitation of a part of the earth; but on cooling the precipitate disappears. All the salts of thorine have a very pure astringent taste, almost like that of tannin. The chloride of thorine treated by potassium, decomposes with a triple deflagration. There results a grey metallic powder, which does not decompose in water, but which above a red heat burns with a brightness which nearly equals that of phosphorus in oxygen. Thorine is feebly attacked by sulphuric acid or nitric acid. Hydrochloric acid, on the contrary, dissolves it with a keen effervescence. The oxide of thorine contains 11.8 per cent. of oxygen. Its specific gravity is 9.4. Thorine exists in a new mineral which has been found in very small quantities at Brevig, in Norway.

MINERALOGY.

9. *Notice respecting the presence of Websterite in the Plastic Clay of Auteuil, near Paris*; by M. Brongniart.—The author commences his notice with some reflections on a remarkable phenomenon which the geological history of a great number of mine-

ral substances, and in particular of Websterite, presents, that of the repetition of the same geognostical circumstances in deposites which are considered as being of the same formation, although situated at considerable distances from each other, even in those which are feebly and irregularly developed, as the deposite of the plastic clay. He then mentions all that is known of the mineralogical history of Websterite, and shews that the three varieties as yet known, those of Halle, Newhaven, and Epernay, agree in the two classes of characters which essentially constitute the mineral species, the composition and form, and in their geological relations; for they always occur in veins or nodules in the plastic clay, accompanied with gypsum and lignite, and lying above the chalk. It is also in the plastic clay of Auteuil, but in the upper part of the deposite, where the clay is yellowish and sandy, that the new variety occurs, rather in nodules than in veins. It is composed of a multitude of small rounded grains, closely compacted, although not to such a degree as not to leave interstices filled with greyish clay. These nodules present internally the appearance of an oolite, with very close white grains in a greyish paste or cement. M. Dumas's chemical analysis leaves no doubt respecting the true nature of this mineral. He found it formed of 23 parts of sulphuric acid, 30 of alumina, and 47 of water. It is therefore a variety of Websterite, to which the name of *oolitic* may be given.—*Annales des Sciences Naturelles.*

10. *Talc and Mica.*—Von Kobell, on examining, by means of polarized light, a specimen of large foliated chlorite, from Greiner, in the Zillerthal, found that it exhibited the coloured rings with the black cross, and consequently belongs to the rhombohedral system. He also examined some newly discovered varieties of talc from Greiner, and of lithion mica from Zinnwald and Elba, and found them all have the double axis.

11. *Native Sulphuric Acid.*—M. Egidi, apothecary at Ascoli, observed a violent disengagement of sulphuretted hydrogen in a spacious natural cave of the commune of Acquasanta. This gas, in contact with atmospheric air, gradually decomposes, gives rise to water, and to sulphur, which latter is deposited on the walls of the cave, and quickly forms, with the salifiable bases, sulphites, and subsequently sulphates, principally crystallized sulphate of lime; and, lastly, to sulphuric

acid, which flows upon the walls, carrying with it lime and other oxides which occur in its way. Several other examples are known of the daily formation of sulphuric acid, and consequently of the decomposition of hydro-sulphuric gas.

12. *Discovery of Iodine in an Ore of Zinc.*—It is well known that M. Vauquelin was the first who discovered iodine in the mineral kingdom. He found this simple substance in argentiferous ores of the neighbourhood of Mexico; and, according to M. Del Rio, these ores come from the province of Zacatecas. M. Bustamente afterwards found indications of it in a lead ore of a greyish-white colour, from the mines of Catorce. In the last place, M. Mentzel has just determined its presence in an ore of caduciferous zinc from Upper Silesia.

13. *Inquiries into the structure of Bodies which crystallize regularly;* by M. Savart.—In this investigation, the author has had in view to determine, by means of the sonorous vibrations, the elastic state of rock-crystal and carbonate of lime. As it would occupy too much time to expose the mode of experiment which M. Savart has employed to attain this object, we shall only say, that he has discovered in these two substances three systems of axes of elasticity, which refer to the primitive form of each of them. Thus, in rock-crystal, the small diagonals of the three rhomboidal faces which form the obtuse solid angle of the primitive rhomboid possess the same degree of elasticity; and each of these lines is the axis of greatest elasticity of each system, while the other diagonals of the same faces of the crystal are the intermediate axes, and the edges themselves of the rhomboid (parallel four to four, consequently reducible to three, as they are twelve in number), are the directions of less elasticity. M. Savart laboured particularly to bring out the differences and approximations which exist between the results to which his method leads, with respect to the intimate structure of bodies, and those to which the inquiries respecting light had led the observers who have preceded him. Thus, he shewed that the disposition of the nodal lines of a circular lamina of rock-crystal, inclined in a given manner with respect to the optical axis, is always intimately connected with the direction itself of that axis, or of its projection upon the plane of the la-

mina, while, on the other hand, he shewed that all the laminæ parallel to the axis do not possess the same properties with relation to sonorous vibrations, although they appear to act similarly with relation to light.—*Memoir read to the French Academy,—not published.*

14. *Glassy Felspar, now called Ryakolite.*—It results from some late measurements of G. Rose, in Poggendorf's Annals, that the angles of this mineral are different from those of adularia and the other species of felspar; that the specific gravity is 2.576, and its optical proportion different from those observed in adularia. This mineral occurs, as is well known, in Vesuvius, and in the lava of the Lacher Lake, &c.,—hence, from its occurrence in lava, Rose names it Ryakalite, from ῥυαξ lava, and λιθος stem.

GEOLOGY.

15. *Discovery of Iodine and Bromine in certain salt-springs and mineral waters in England.*—Dr Daubeny, in the number of the Annals of Philosophy for September 1829, announces, that he has found bromine in a separate state in the Cheshire salt-springs, and also iodine in two or three of them. He has also detected iodine in the springs of Cheltenham, Leamington, Gloucester, and Tewkesbury.

16. *Examination of a Limestone Deposite, by M. Vauquelin.*—In digging the foundations of a spinning establishment, in the parish of St Maclou, arrondissement de Pont-Audemer, department of the Eure, there was found a large deposite of limestone, having a porous texture, and presenting in some of its parts ramifications in the form of stalactites, more than a foot long, and of different diameters, hollow in the centre, and closed at one of their extremities. The colour of these stones is yellowish internally, and of a shining brown externally, like certain varieties of manganese. M. Vauquelin, on analyzing them, found products which satisfied him that this substance contained a great quantity of animal matter. The stalactites and other rudiments of crystallization which it presents, induce the author to suppose that it has been dissolved in water with the aid of carbonic acid. But what appears to him remarkable is, that the organic substance could have been preserved so long,

in the midst of water, with all its properties; for which he accounts by its not being in contact with the air. This difficulty offers nothing remarkable, as it equally occurs with respect to all the sparry fossils, and with respect to certain clays, which contain a sufficient quantity of animal substance to yield ammonia by analysis. It would have been desirable to have ascertained whether these supposed stalactites are not polyparia, for, in that case, the difficulty would vanish, as it is known that polyparia, as well as all calcareous envelopes, contain animal substance, even after the longest residence in water. The animal pellicle, in these substances, not only is combined with the lime, but is also encrusted and hermetically imprisoned by carbonate of lime, which lines its walls in a compact manner. From this moment the substance in question is guarded against all the agents of fermentation, in the same manner as an organic substance, cloth for example, becomes incombustible, when all its particles have been invested with phosphoric acid or phosphate of ammonia. It is for this reason that animal matter (membranes) remains incorruptible, not only in the shells of mollusca or zoophytes, which continue to grow in the waters, but also in the fossil shells, which have lain buried in the moist earth for ages.—*Ann. de Chimie et de Physique.*

17. *Bones of Palæotheria discovered in a bed of the Calcaire grossier or coarse Limestone formation, near Paris.*—M. Cordier communicated to the Academy of Sciences of Paris a fact connected with the theory of the geological formations in the vicinity of Paris. This gentleman, on being informed by Mr Robert, that bones of mammifera had just been exposed in some beds belonging to the coarse limestone formation, went to the place. It is one of the Nauterre quarries, known by the name of *Carrière des Moulins,* the third of those that occur in going to Nauterre by the Paris road. It is worked by M. Nerot, to whom it belongs. The bed which contains the bones is situated at the depth of five and a half metres, and from four to five decimetres thick. Nothing is more easy than to examine it, as it is worked from the surface. The bones are so brittle, and besides so firmly fixed in their matrix, that it is almost impossible to detach them without breaking them. Specimens of the rock have been submitted to the inspection of M. G. Cuvier, who has determined the

bones to belong to a large species of palæotherium. It appears that the quantity of bones is very great. The bed in which they occur already extends along a space of more than twenty metres, and there is no reason to think that it is nearly exhausted. From the facts which M. Cordier communicated to the Academy, he concludes, 1st, That the mammifera belonging to extinct species, of which so many remains have been found in the gypseous formation in the neighbourhood of Paris, and of which some bones have been recognized in a deposite of quartzy sandstone, which is intercalated between the siliceous limestone formation and that of the calcaire grossier, descend, moreover, into the calcaire grossier itself. 2d, That, consequently, these animals have lived at no great distance from the Paris basin, at a period more remote than is commonly supposed; Lastly, That the circumstances which have caused to vary in so remarkable a manner both the mineralogical nature of the different formations which compose the Paris basin, and the nature of the mollusca, whose remains these formations contain, probably exercised no considerable action upon the continental surfaces which surrounded that basin, since the paloætheria and the other mammifera belonging to similar genera, continued to propagate without any modification, at a time when the formations of the basin were undergoing the most remarkable change.

18. *Caves containing Human Remains.*—M. Cordier, in June 1829, read to the Academy of Sciences, part of a memoir addressed to him by M. de Christol, Secretary of the Natural History Society of Montpellier, relating to two newly discovered caves containing bones in the department of the Garde. These cases were discovered by MM. Dumas and Bonause, they are situated, the one at Pondre, the other at Jouvignargue, near Sommières. M. de Christol, after examining them with the greatest care, as well as the specimens obtained by digging, is convinced that they present the proof of an incontestible mixture of human bones with bones of mammifera belonging to extinct species. The remains of animals mixed with those of the human species belong, according to the author, to the hyena, the badger, the bear, the stag, the aurochs, the ox, the horse, the wild boar and the rhinoceros. Some of the bones

bear evident marks of the teeth of hyenas. Excrements of these animals were also found in the caves. The facts announced by M. de Christol appeared to M. Cordier to be of the greatest importance. If they are correct, they must be considered as more conclusive in favour of a mixture of human bones with remains of antediluvian animals, than those furnished by the examination of the Bize caves. It is in fact well known, that the inferences drawn from the examination of these latter have been contested.

ZOOLOGY.

19. *European Beaver.*—An interesting account of a colony of European beavers has lately appeared in the Memoirs of the Society of the Friends of Natural History of Berlin. This colony occurs in the forest district of Gruneberg, in Magdeburg, in Prussia. The habits and manners of these animals agree with what has been related by Hearne and Cartwright of the beavers of America. Like the beavers of the New World, they build dams, live on vegetable food, are deadly enemies to the otter,—hence useful in rivers in preserving fishes. They have been almost entirely extirpated from Eastern Prussia, but in Western Prussia, as at the Mone, near Arensberg, there are still considerable colonies of them.

20. *Original of the Cat and Dog.*—In Rüppell's interesting atlas to his Travels in Northern Africa, we find a description of several new species of cat and dog. Of the genus *Felis*, two species are figured and described; the *F. maniculata* and *F. chaus*, Lüld. For the discovery of the former of these, we are indebted to M. Rüppell, *who regards it as the original stock from which the domestic cat of the Egyptians was derived, and whence probably also sprung the house cat of Europe.* In this opinion he has been followed by M. Temminck. The character of the species, as given by Dr Cretzschmar, is as follows: "*Felis* colore griseo-ochraceo; genis colloque antico albis, hoc lineis ochraceis duabus cincto; planta pedum, metacarpi et metatarsi parte posteriore nigris; cauda gracili, æquali, ad apicem annulis nigris duobus." It was obtained in Nubia, on the western side of the Nile, at Ambukol. Not less than seven spe-

cies of *Canis* have been collected by M. Rüppell, the whole of which are here figured and described. Of these we shall mention two: *Canis famelicus.* "*Canis* capite ochraceo; fascia dorsali castanea; corpore supra ex griseo-flavescente, infra ex subflavo-albescente; auriculis permagnis erectis." This character is derived from the examination of seven specimens, collected partly in the deserts of Nubia, and partly in Kordofan. The species is nearly related to the Fennec, which it resembles also in its habits. It is probably the fox-like animal represented on the monuments of ancient Egypt; as the jackall, *Canis aureus*, Linn. does not appear to exist there or in the immediately adjoining countries. *Canis Anthus*, F. Cuv. "*Canis* capite crassiore; auriculis erectis, curtis; gutture et collo infra sordide albidis; corpore supra ex fulvo, albido, nigro et ochraceo vario, infra albido; cauda nigra, basi tantummodo inferne albido; pedibus ex fulvo ochraceis." This differs in some respects from the figure given by M. F. Cuvier; but M. Temminck, who has seen both specimens, considers them as belonging to the same species. It may be regarded as the wolf of Egypt and Nubia, where it is very rare, and resembles in the colour of its fur the European wolf. *Dr Cretzschmar appears disposed to believe that from it is sprung the now widely diffused house-dog*.

21. *On the prickle which exists in the tail of the Lion.*—Two lions which died some months ago in the menagerie of the King's Garden at Paris, have furnished an occasion of verifying a curious fact, mentioned in some old works, but which modern authors have generally omitted; it is, that there exists at the extremity of the lion's tail a small claw, concealed in the midst of the tuft of long black hairs which occurs there. It is a horny production, about two lines in length, which presents itself under the form of a small cone a little curved, and adhering by its base to the skin only, and not to the last vertebra, which is separated from it by a space of two or three lines. This small claw exists in both sexes. The commentators of Homer thought they could explain, by the presence of this claw, a curious and correct remark made by the author of the Iliad, which was, that the lion is the only animal which, when irritated violently,

agitates its tail, and strikes its sides with it. They imagined that the lion sought to excite himself by pricking his sides with the horny production in question. Blumenbach, some years ago, verified the existence of this prickle; but the pamphlet in which his observations were contained, has remained unnoticed by naturalists, and the curious fact of which we speak, might long have remained unknown, had not M. Deshayes happened to see the pamphlet in question, and engage the naturalists who more particularly study the department of mammalogy, to make some observations on the subject *. This prickle or spur, adhering only to the skin by the circumference of its base, is very easily detached. In general, no traces of it remain in stuffed individuals. It has not yet been observed whether it exists equally in the other large species of the genus Felis.

22. *Insufflation of Animals.*—M. Leroy has discovered that atmospheric air, strongly impelled into the trachea of certain animals, such as rabbits, goats, sheep, foxes, &c. causes sudden death. Other animals, dogs, for example, in which the pulmonary tissue is less delicate, resist this operation, but are more or less incommoded by it. Goats and sheep died under the eyes of persons appointed by the Academy to report upon the discovery, after air had been impelled into their lungs without the aid of a machine, but merely by the mouth of the experimenter. It would appear, that most commonly the air blown in lacerates the delicate tissue of the lung at the upper part. Insufflation being recommended as an efficacious means of restoring drowned persons to life, it is of the greatest importance to know if human lungs are similar to those of the sheep and goat in this respect, or if they are possessed of a power of resistance equal to that of the dog. If the former be the case, insufflation would prove mortal to suffocated persons. Direct experiments are wanting on this subject; but trials made on the dead body, shew that the human lung may be ruptured by insufflation. The lungs of very young children, on the contrary, resist the action of a very strong insufflation.—*Ann. de Chim. et de Phys.*

* A translation of the memoir of Blumenbach is inserted in a former volume of this Journal.

23. *Notice respecting a Pigeon which continued to live two days without Brain and upper part of Spinal Marrow.*—M. Desportes, a physician, lately sent to the Academy of Sciences of Paris an account of an observation in which he saw a young pigeon live for two days in its shell, of which it could not rid itself; as well as some time after, although the brain and upper part of the spinal marrow were wanting. The author of the letter, deceived by the accounts given in some journals, had imagined this observation to be in contradiction to what M. Flourens had announced with respect to the influence of the spinal marrow upon respiration. M. Flourens remarked, that the important fact observed by the author is in no degree opposed to the inferences deducible from his experiments. A report is to be made to the Academy respecting M. Desportes's observations.

24. *The Sprat not the young of the Herring and Pilchard.*—Mr Yarrell remarks in the Zoological Journal, No. xvi, that on comparing a sprat with a young herring of the same length, the sprat will be found to be considerably deeper, and the scales much larger; in this latter circumstance the sprat resembles the pilchard; but the pilchard, on the other hand, is not so deep a fish as the herring. The sprat and herring differ also in the number of rays in three of the fins out of the four they possess, and also in the tail, as the following numbers exhibit.

	Dors.	Pect.	Vent.	An.	Caud.
Sprat, -	17	15	17	18	19
Herring, -	17	14	9	14	20

There is also one other most material difference, the vertebræ in the sprat are 48 in number; in the herring there are 56.

25. *White Bait not the young of the Shad.*—Mr Yarrel has shewn in the Zoological Journal, that the white bait is not the young of the shad, or Clupea alosa, but a well-marked and distinct species, which he names Clupea alba. We have now five British species of clupea, viz. 1. Cl. Harengus (Herring); 2. Cl. Pilcardus (Pilchard); 3. Cl. alba (White Bait); 4. Cl. Alosa (Shad or Mother of Herrings), Cl. Spratus.

26. *On Squalus Maximus.*—Mr De Kay read in the Lyceum of Natural History, York, a description of a large species

of squalus lately captured on the American coast. The author observed, that the first descriptions of the S. maximus were so imperfect, that modern naturalists have considered it a doubtful species, and have accordingly described several large individuals of this genus as new species. Dr De Kay considers the *S. pelerin*, *S. gunnerianus*, *S. homianus*, *S. elephas*, and *S. rhinoceros*, as all belonging to the *S. maximus*, to which also he refers the individual under consideration. The *S. peregrinus*, Pinna anali nulla, is certainly a distinct species. The most striking peculiarity observed in this specimen, was the presence of true baleen. Each branchial opening was furnished with a fringe of baleen four inches in length. This was composed of a great number of distinct flattened fibres, a tenth of an inch wide at their origin, and tapering gradually to minute threads at their extremities. In colour, texture, and flexibility, this resembles very much the baleen of the Balæna mysticetus. The laminæ are extremely regular in their position; thirty of them are included within the space of an inch, and they extend the whole length of the branchial apertures. The author concluded by remarking, " That all inferences respecting the size of a shark, founded on the magnitude of the fossil teeth alone, must be erroneous, as the individual just mentioned was 28 feet long, and its teeth were only half an inch in length. There are fossil sharks' teeth in the cabinet of the Lyceum four inches long, which, by parity of reasoning, belonged to an animal 220 feet in length.—Silliman's *Journal, Jan.* 1829.

27. *On Killing Molluscous Animals.*—The difficulty of preventing mollusca from shrinking and withdrawing their organs when thrown into spirit, is scarcely removed by quickly dashing boiling water over the specimens; and in the testaceous genera the process is not sufficiently sudden to secure the object aimed at. Perhaps some zoologist residing on the coast, who has a good electrical machine, will make some experiments, with the view of killing the animals while in their natural attitude of creeping. A wire might be made fast round the shells, and the favourable moment easily seized for communicating the shock. The spire should be cracked or perforated to prevent putrefaction before the animal is preserved in spirit.—*L. Guilding, Zool. Journal,* No. xiv.

28. *Terrestrial Shell Animals may be carried alive great distances.*—The *Macroceramus signatus* was sent me by a friend who has taken great pains to put me in possession of the mollusca of the Virgin Islands, that I may examine them for publication. I find that the terrestrial testaceous mollusca will travel to a very great distance in a living state, even in the tropics, if packed in saw-dust. I have also lately dispatched tin boxes perforated on all sides, and filled with wet moss and mud, in which I hope soon to obtain alive the aquatic mollusca which swarm in the waters of the mighty Oronooko, and the canals and ponds of the neighbouring colonies.—*L. Guilding. Zool. Journal,* No. xiv.

29. *Formation of the shell of the Cypræa.*—Mr Samuel Stutchbury, who had an opportunity of examining many individuals of *C. Tigris* at the Pearl Islands, informed me that those cowries lived there in very shallow water, and always under rolled masses of madrepore. They never were to be seen exposed to the sun's rays. On lifting one of these masses, a tiger cowry was generally observed with its shell entirely covered by the large mantle, which was mottled with dark colours, the intensity of which the animal seemed to have the power of changing, for the colours varied in the same light in the same medium, after the manner of the spots on the Cephalopodous Mollusca, or, to use a more familiar instance, somewhat in the same way that the hues of a turkey's wattle vary. On touching the mantle, it was immediately withdrawn within the shell, which became exposed in all its brilliancy. So firmly did the soft parts adhere to the shell, that, in no instance (and the experiment was often made), did Mr Stutchbury succeed in extracting them by force, either during life or before decomposition took place. He was obliged to let the animal die, and suffer the soft parts to decay, in order to remove them.—*Zool. Journ.* No. xiv.

30. *On the Tape-Worms found in Water by Linnæus.*—In an excursion with the late Eysenhandt, in search of water-plants, says Dr Baer, we sailed up the Pregel, and landed on the north bank of the Frishe Haaf, at Margen, nine miles from Konigsberg. The first object brought to me was a tape-worm: we searched further, and soon found nearly a do-

zen was collected in the water. Four of them were alive, the others dead, or nearly so. This brought to my recollection Linnæus's Tænia, found in water. With exception of vast numbers of Gasteroceus pungitius, scarcely any other animal was observed in the water. Many of these fishes were taken, and, in all of them, the belly was much swollen. On opening them, a Bothriocephalus solidus was found, which, when extended, was longer than the fish in which it was contained. Every specimen of fish we opened contained a worm, and the fishermen assured us, that they were rarely met with without them. It is understood that these worms escape, or are forced from the fish into the water, in which they will live for a considerable time. Thus the observation of Linnæus, that tape-worms, which are true intestinal animals, sometimes occur externally, as in water, is confirmed.

31. *Comparative Analysis of the Bones of the different Classes of Animals.* By Fernandes de Barros.—De Barros found, in a thousand parts of bone, the following proportions of carbonate and phosphate of lime:

Sheeps' Bones,	Carbonate of lime, ...	193
	Phosphate of lime, ...	800
Hens' Bones,	Carbonate of lime, ...	104
	Phosphate of lime, ...	886
Fishes' Bones,	Carbonate of lime, ...	53
	Phosphate of lime, ...	919
Frogs' Bones,	Carbonate of lime, ...	24
	Phosphate of lime, ...	952
Lions' Bones,	Carbonate of lime, ...	25
	Phosphate of lime, ...	950

BOTANY.

32. *Rice Paper.*—Rice paper is the pith of the Tong-t-sao (*Calamus petræus*, Loureir), as M. Vallot has demonstrated in the *Memoires de l'Academie de Dijon*, 1820, p. 187–190, where he has given a full account of this substance.

33. *Method of Preserving Funguses.*—Mr Cooke, surgeon, Trinity Square, Tower Hill, having been very successful in his endeavours to preserve anatomical preparations in salt and water, was requested to try to preserve, in the same way, a specimen of *Clavaria muscoides*, supposing that it might answer for

funguses of some kinds. Mr Cooke, in a written account, says, "I put it into brine a little below saturation, suspending it by a delicate thread of silk, and closing the bottle by means of glass. Since that time it has remained in the solution, and, with the exception of having become a little deeper in colour, it is unchanged. As spirits are not only expensive, but usually deprive plants of all colour, the discovery of a cheap and effectual solution for the preservation of plants is a desideratum." The specimen was gathered at the latter end of October 1826, and was presented to the Linnæan Society in May last, with an account of the process. As many species of funguses may be expected to appear at the latter end of this month, and in the next, persons who are desirous of trying the before mentioned method of preserving such vegetables, will no doubt have an opportunity of doing so.—*Phil. Mag. Oct.* 1828.

34. *Germination.*—M. J. Pinot addressed a letter to the French Academy, containing the details of an experiment on germination. He stated, that in a memoir presented six months ago to the Academy, he had announced that the radicle of different kinds of seeds, which he had made to germinate upon mercury, had penetrated into the interior of that metal to a depth of eight or ten lines. These experiments were repeated by him at the King's Garden, in presence of two of the commissioners appointed by the Academy. But, as the weight of the seed, and the adhesion of the cotyledonary mass to the moist surface of the mercury might present some motives of explanation, the value of which it were important to determine, he made a new experiment on this subject. "I implanted," says he, "upon one of the extremities of a small silver needle suspended at its centre upon an extremely mobile axis, a seed of *Lathyrus odoratus*, of which kind of seed, as is well known, the cotyledons are not developed in germination. I then balanced the needle by means of a wax-ball, which I stuck upon the other end, and which I could shift at pleasure. I then placed it in a bell saturated with humidity, in such a manner, that the seed which it bore should be suspended at a distance of about two lines above a certain quantity of mercury, which was contained in a vessel placed under this part of the apparatus, and of which I had taken care to moisten the surface. Germination took place, but

more slowly than in ordinary circumstances, on account of the seeds being placed in an entirely gaseous medium; and the radicle, when it came to touch the surface of the mercury, pierced it and sunk into it, as in the case when the seed rests upon that metal.

35. *Notice by Mr R. Spittal, of a specimen of Bovista gigantea, remarkable for its great size.*—Through the kindness of my friend Miss Macdonald, Powderhall, I am enabled to give the following account of a remarkable specimen of the *Bovista gigantea*, found by that successful and zealous botanist. Along with the plant, which she kindly presented me with, I received a short history of it, in which Miss Macdonald states, that she found the specimen, 9th August last, on the borders of Plora wood, about a mile and a-half from the village of Innerleithen, Peeblesshire. When found, it was of a cream colour, shaded with brownish-yellow on the top. Apparently it had not attained its full size, and unfortunately the plant was pulled at that time. It lay for about two days after this, exposed to the wind and rain, before being measured, having, during that time, evidently lost considerably in size; its average diameter, however, was then upwards of eleven inches, the greatest circumference being three feet one and a-half inch, the least three feet. The plant was nearly globular in shape. Dr Hooker, in his Flora Scotica, and Dr Greville, in his Flora Edinensis, both refer to Lightfoot, who mentions that this plant has been found in the King's Park, Edinburgh; and also says, that it has been found in England "as large as a man's head." Dr Withering, in his Arrangement of British Plants, says, "sometimes as much as twelve or fifteen inches in diameter," and specimens of a much greater size are mentioned as having been found in foreign countries. The specimen described, then, is nearly as large as those of greatest diameter found in England, especially if the greatest diameter of these be that mentioned. It is the largest on record found in Scotland; and this fact, along with the new habitat which Miss Macdonald has discovered, may perhaps be interesting to the botanist.

36. *The Dahlia.*—It is not above twenty years since the name of Dahlia (or Georgina, as it is universally called on the Continent), was first heard of in this country as an ornamental flower. Being a native of Mexico, it was at first considered as a very tender plant, and its cultivation was regarded as troublesome and difficult. At this day it has become a common border and shrubbery flower, and a clump of the fine double flowers form one of the ornaments of every good garden. Its cultivation is now found to be comparatively easy; it being only necessary to keep the tubers among dry sand, and secure from frost during winter, and to cause them to vegetate slightly in a hot-bed, like sets of early potatoes, in the spring, before planting them out. There are, botanically speaking, two species of Dahlia; the *superflua* and the *frustranea*; all the varieties having large double flowers belonging to the former, and all the small brilliant orange-coloured single flowers to the latter. It has, within these very few years, become common among the curious to raise Dahlias from the seed of fine semi-double flowers in our Scottish gardens, and thus to procure numerous new varieties. Here, then, will be a good opportunity for observing whether the Dahlia, in the course of successive generations, or reproductions from Scottish seed, shall, according to the theory suggested by Sir Joseph Banks regarding the Zizania aquatica, acquire a somewhat more hardy character, better suited to the climate of Scotland.

37. *Caprification.*—Tournefort, in his Travels, mentions that, in Provence, the maturation of figs was hastened by pricking them at the open end with a straw dipped in olive oil. Colonel Thackery informs us that a similar practice prevails at Malta, and at other places in the Mediterranean; and he adds, what is of some importance in so precarious a climate as ours, that he has successfully followed the practice in Scotland.

STATISTICS.

38. *Influence of Indigence on the Mortality of Men in the different Countries of Europe, from the commencement of the Nineteenth Century.*—M. Dumeril made two reports to the French Academy, on two memoirs by M. Benoitson de Chauteauneuf, relative to questions in statistics. The author has

proposed to himself, in the first of his memoirs, to determine whether poverty, which exercises so terrible an influence upon human life at an early age, is equally fatal at an advanced age. For this purpose, he has compared the mortality of six hundred persons, placed in the highest classes of society, and already at an advanced age, with the mortality of persons immersed in the greatest indigence. He has found that the mortality in the latter was double what he found it to be in the former. M. de Chateauneuf's second memoir is upon the mortality in the different countries of Europe since the commencement of the nineteenth century. The author has made inquiries in the different departments of France, England, the Netherlands, Switzerland, and several governments of Russia. The constant result has been, that of a hundred individuals, twenty-five only in these different countries arrive at the age of sixty, and that it is after the age of seventy that man declines most rapidly. Mountainous countries, in whatever latitude they may be situated, are those in which the duration of human life is greatest.

39. *On the Distribution, by Months, of Conceptions and Births, in its relations to Seasons, Climates, &c.*—M. Frederick Cuvier, in May 1829, in the name of a committee, of which he was a member, together with MM. Fourier and Coquebert Montbret, made a report respecting a memoir by M. Villermé, entitled, *On the Distribution, by Months, of Conceptions and Births, in its relations to Seasons, Climates, &c.* The author has perceived that, to arrive at the general knowledge of the influence of the seasons on the phenomenon of conception, it was necessary to obtain the precise dates of a very large number of births, and this number amounts to nearly fourteen millions; that secondary causes might modify the influence of the seasons, and that unless his calculations could be established on the broadest basis, they would be liable to error. M. Villermé, in order to obtain a term of comparison, first collected from various parts of France, the births from 1819 to 1825, the number of which amounts to 7,651,437. He then brought them together, month by month; and, after reducing them to the total number of 12,000, in order to be the better able to compare them, he inferred, in an absolute manner, the proportional births of each month, and consequently the conceptions; but these births

not having all been obtained in the same populations, or under the same influences, and consequently yielding different results, according to these various influences, their numbers mutually change, and the means obtained from this heterogeneous mixture cannot afford accurate terms of comparison. This error occurs in nearly all the questions which M. Villermé treats, when, for that purpose, he is obliged to unite the births of several populations; and, in making up our report, we might perhaps have stopped here, had we not considered that the researches which we were examining, being all similar in this respect, might, to a certain degree, be compared together; and that, in consequence, the results at which M. Villermé has arrived, might be presented to the Academy, not so correct as they would have been had not this error existed, but as at least pretty probable. Besides, we had also to consider that this collection of fourteen millions of births formed the chief essence of our author's investigation, and that his calculations would always be susceptible of rectification, when the very regular tables which contain these dates should be published. The first general result obtained by M. Villermé is, that the six months in which there are most births present themselves in the following order:—February, March, January, April, November, and September; which refers the conceptions to the months of May, June, April, July, February, and March. Consequently, the greatest number of conceptions will take place, but without much regularity, during the six consecutive months, which commence between the winter solstice and the vernal equinox, and finish between the summer solstice and the autumnal equinox; in other words, during the time when the sun approaches our hemisphere, and rises upon our horizon. This general fact, therefore, confirms a truth, which has become trivial, in consequence of its being long observed, and which is the influence exercised by the sun, light and heat together upon the impulse to propagate. The images under which spring presents itself have been among all nations emblems of the power which reanimates life and renders it fecund. From this first fact, one might be led to think, that the months in which the sun lowers most upon our horizon, are the least favourable to conception; and yet this is not the case: the period of the smallest number of conceptions is the autumnal equinox. Is this to be attributed to the rest which, in each system of organ, seems to be the immediate consequence of a great activity? This we shall not decide, and would only remark, that this period of diminution of the generative faculty in the human species is precisely that in which the ruminating animals exhibit most power in this respect. This anomaly, presented by the period of the smallest number of conceptions, has naturally led M. Villermé to make inquiries respecting the other exceptions, and it was the influence of meteorological phenomena that first attracted his attention; for he has found, by his dates of births, that the years which have followed those in which the summers were cold and rainy, do not present the period of the minimum of births as in ordinary years, but that in them that period is retarded, and, consequently, the conceptions. From these meteorological influences, M. Villermé passes to those of climates, which afford him a full confirmation of the first. The minimum of births in the northern parts of France, is always manifested later than the mean term which we have mentioned above; and, in the southern parts, it shews itself earlier. Foreign countries also confirm the general fact. In Holland and Denmark, the period of the minimum of births is retarded, while in several cities of Italy, and at Buenos Ayres, it is advanced. Sweden, however, forms a very remarkable exception to this particular rule, and goes to confirm the general rule; and it is to be re marked, that, if the temperature of the summers exercises a great influence upon the conceptions, that of the winters does not appear to exercise any; at least M. Villermé has made this inference, from his observations respecting the winters of 1740–1741, 1775–1776, 1783–1784, and 1788–1789. It is in the deleterious influence of marsh air, that M. Villerme finds the principal cause of the period of the minimum of conceptions, and of its protraction in proceeding from south to north. In consequence of this, he directly searches for the effects of this influence in the tables of births, which have been furnished him by the departments and towns which are most exposed to it; and he has found that in fact *all the marshy countries are remarkable for the small number of conceptions, at the period* *when the marshes pour their dangerous miasmata into the atmosphere, that is to say, in autumn.* Thus, Aiguesmortes, which is situated in the midst of marshes, which render it very unhealthy, instead of 884 births, at the periods of their smallest number in France, in general, does not yield more than 628, which is the mean term of the minimum of births for thirty years in that town. Consequently, the marshes, as our author judiciously observes, do not diminish the population, by increasing the number of deaths alone, but also by attacking the fecundity; and it is by supposing that the early period at which the frosts commence in the north prevent the marsh exhalations, that he explains the exception which Sweden has presented to him in the delaying of the minimum of births. From the examination of natural causes, M. Villermé passes to that of the influence of some of our institutions; marriages, hard work, times of festivity, and abundant food, of scarcity of food, and of lent; and it is always in the same manner that he proceeds, that is to say, by consulting the tables of births, month by month. *His inquiries respecting marriage have led him to this remarkable result, that very few women conceive during the first weeks of their union, and the season appears to have no influence in this case. On the other hand, the periods of hard work, that of harvest, for instance, do not seem to be more unfavourable to conception than the other periods of the year; while the contrary is the case with respect to the periods of rest and abundance of food, especially in the northern countries.* But France, in one particular circumstance, has also afforded a striking example. The number of births greatly increased, and afterwards diminished, at the period of the revolution, when several imposts were suppressed, and the national lands were sold. From this result it might be inferred, and the inference has been confirmed by example, that the scarcity of food, as well as the periods of privation and penitence, would restrict the number of births. In fact, the years of dearth, and the periods of lent, exercise the same influence upon the conceptions, both being causes of diminution of strength. It is with these considerations that the memoir, of which we have given an account, concludes.

40. *Berlin Geographical Society.*—At the commencement of the present year, there was founded at Berlin a Geographical Society, which, however, is not yet so flourishing as that of Paris. It does not yet give prizes, nor publish a journal, but confines itself to its meetings, which, agreeably to the custom of the country, are concluded by a jovial banquet. The institution, however, is one that cannot but be productive of good, in such a country as Germany, where geography has hitherto only been cultivated by isolated individuals. Without doubt, the residence of M. Humboldt in his native country has been one of the principal causes of this establishment. At the head of its founders, and in the capacity of director, is Professor Charles Ritter, a gentleman whose works are well known in the learned world. He has already, for several years, lectured with great success at Berlin, upon general geography. His maps and his work on Europe, have long ago attracted the public attention towards him; but his more remarkable productions are the treatises which he has devoted to Africa and Asia. In place of reducing geography, as most of his predecessors did, to a mere list of technicalities, he has made it a complete and philosophically constructed science. The Society possesses other very distinguished members, who deserve praise for uniting their efforts in the cause of science *.

* A French translation of Ritter's two principal works is announced. The Professor is to furnish to the translator additional information; and Messrs Abel-Remusat, Klaproth, and Jomard, and other distinguished geographers, are to contribute illustrations. We have always considered the geography of Ritter, from its high merits, as deserving of being known by translation, to the geographers, and in the schools of this country.

NEW PUBLICATIONS.

I. *Elements of Veterinary Pathology, and Theoretical and Practical View of the Medical and Surgical Treatment of the principal Domestic Animals.* Paris, 1829.

In recommending this work to the attention of our readers, we may express our opinion respecting the immense advantages which might result to the study of the diseases of man, from observations and experiments made upon the diseases of animals. The most happy results would probably be derived from a union of medicine and the veterinary art in schools. The important advantages which have of late years resulted to physiology from the study of animals, may serve to shew how like advantages may be derived by medicine. It is not from human physiology alone, nor from veterinary physiology considered by itself, that these advantages have been obtained, but from general physiology. As there is but one physiology, so ought there also to be but one pathology; and it is upon this *general* and *comparative pathology* alone that the progress of veterinary medicine, and especially of human medicine, must henceforth depend.

II. *The Journal of a Naturalist.* Second Edition, 8vo. 1829.

This delightful volume, which may be placed alongside White's Natural History of Selborne, one of the most agreeable works of the kind in our language, having already made a triumphant round of the different reviews and journals, requires no particular notice from us. We cannot, however, refrain from extracting the following observations on Natural History, which we are sure will be read with pleasure:—" It is rather a subject of surprise, that, in our general associations and commixtures in life, in times so highly enlightened as the present, when many ancient prejudices are gradually flitting away, as reason and science dawn on mankind, we should meet with so few, comparatively speaking, who have any knowledge of, or take the least interest in, natural history; or, if the subject obtain a moment's consideration, it has no abiding place in the mind, being dismissed as the fitting employ of children and inferior capacities. But the natural historian is required to attend to something more than the vagaries of butterflies, and the spinnings of caterpillars; his study, considered abstractedly from the various branches of science which it embraces, is one of the most delightful occupations that can employ the attention of reasoning beings. A beautiful landscape, grateful objects, pleasures received by the eye or the senses, become the common property of all who can enjoy them, being in some measure obvious to every one; but the naturalist must reflect upon hidden things, investigate by comparison, and testify by experience; and, living amidst the wonders of creation, it becomes his occupation to note and proclaim such manifestations of wisdom or goodness as may be perceived by him. And perhaps none of the amusements of human life are more satisfactory and dignified than the investigation and survey of the workings and ways of Providence in this created world of wonders, filled with his never absent power: it occupies and elevates the mind, is inexhaustible in supply, and, while it furnishes meditation for the closet of the studious, gives to the reflections of the moralizing rambler admiration and delight, and is an engaging companion that will communicate an interest to every rural walk. We need not live with the humble denizens of the air, the tenants of the woods and hedges, or the grasses of the field; but, to pass them by in utter disregard, is to neglect a large portion of rational pleasure open to our view, which may edify and employ many a passing hour; and, by easy gradations, will often become the source whence flow contemplations of the highest orders. Young minds cannot, I should conceive, be too strongly impressed with the simple wonders of creation by which they are surrounded. In the race of life they may be passed by, the occupation of existence may not admit attention to them, or the increasing cares of the world may smother early attainments, but they can never be injurious, will give a bias to a reasoning mind, and tend, in some after thoughtful sober hour, to comfort and to soothe. The little insights that we have obtained into Nature's works, are, many of them, the offspring of scientific research; and, uncertain as our labours are, yet a brief gleam will occasionally lighten the darksome path of the humble inquirer, and give him a momentary glimpse of hidden truths.

Let not, then, the idle and the ignorant scoff at him who devotes an unemployed hour,

"No calling left, no duty broke,"

to investigate a moss, a fungus, a beetle, or a shell, in "ways o pleasantness, and in paths of peace." They are all the formation of Supreme intelligence, for a wise and a worthy end, and may lead us, by gentle gradations, to a faint conception of the powers of infinite wisdom. They have calmed and amused some of us worms and reptiles, and possibly bettered us for our change to a new and more perfect order of being.

III. *An Encyclopædia of Plants; comprising the Description, Specific Character, Culture, History, Application in the Arts, and every other desirable particular respecting all the Plants indigenous, cultivated in, or introduced to Britain; combining all the advantages of a Linnæan and Jussieuan Species Plantarum, an Historia Plantarum, a Grammar of Botany, and a Dictionary of Botany and Vegetable Culture. The whole in English; with the Synonyms of the commoner plants in the different European and other Languages; the Scientific Names accentuated, their Etymologies explained, the Classes, Orders, and Botanical Terms illustrated by Engravings; and with Figures of nearly Ten Thousand Species, exemplifying several individuals belonging to every Genus included in the Work.* Edited by J. C. Loudon, F. L. S. H. S. &c. (Complete in one large Volume 8vo. Price L. 4 : 14 : 6.)

Botany, as well as other branches of study, and of intellectual employment, is making rapid strides. Hitherto, however, it must be confessed that this delightful branch of natural history has, in consequence of the more valuable books on the subject being published in a dead language, been a sealed study to a very large portion of mankind. As far as the plants of our own country are concerned, the labours of Smith alone, by his introductory works, by his *English Botany* and his *English Flora*, have brought botany within the compass of the humblest capacity, without, at the same time, detracting from its scientific character. But if any one unacquainted with the Latin language, had wished to become conversant with the characters and properties of the plants that are cultivated in our gardens, there was no book that would aid him in so laudable a pursuit. We have, then, seen announced, with more than ordinary pleasure, an *Encyclopædia of Plants*, under the general direction of an active and enterprising gentleman Mr Loudon, whilst the determing the characters of the genera and species, and what number of them was to be introduced, were promised from the pen of Professor Lindley. Under such auspices, the execution could not fail to be such as would meet the wants and wishes of the botanical public; and its appearance we have now to announce. It must not be supposed that the work includes *all* the species of plants known to exist, whether in gardens or herbaria; for that would have extended it to a size, and incurred a cost, which would have precluded many for whose use the publication is intended, from becoming the purchasers. But, as the title-page expresses, it contains "the description, specific character, culture, history, application in the arts, and every desireable particular respecting all the plants, indigenous, cultivated in, or introduced to Britain." Yet even this is circumscribed to the vegetable productions of the fields and the gardens, for such has been the vast addition to our collections, consequent upon the peace, and such our communications with all parts of the world, that the number has extended to 2409 genera, and 16712 species. Now, if from these we deduct 2254, for the British *Cryptogamia*, which cannot be cultivated, we have the result 14,458 as the number at present actually in a state of cultivation, or which has been grown in our gardens. Yet, with the exception of such as are of British origin, and such as have appeared in the costly periodical botanical publications of this country, where, perhaps, upon the average, 4000 species may be included, there has existed scarcely a work in the English language in which they have been systematically arranged; without which method, all the endeavours of the student to determine any given species must often be in vain. We have stated above the number of plants which have been introduced to our gardens, as amounting to 14,458 known species. It is worth while to mark the progress of our collections within the space of thirty years; for no longer time has elapsed since the first edition of the *Hortus Kewensis* appeared; from which period we may date a desire in botanic gardens to cultivate plants generally, without reference to their variety or beauty; and the *Hortus*

Kewensis, as well as the *Hortus Cantabridgensis*, are considered to indicate, not merely the plants of their own respective establishments, but those of the gardens throughout the British empire. The first edition of the *Hortus Kewensis* (1789), under the direction of the elder Mr Aiton, contained 5600 species. (The first edition of the *Hortus Cantabridgensis*, published in 1796, includes, however, only 3809 species.) We have then, since 1789, an increase to our gardens of 8858 species. But even this, brought down as it is, to the period of appearance of the subject of this article, the *Encyclopædia of Plants* does not give a full and correct idea of the acquisitions that our collections have recently made; for, if we understand rightly a passage in the preface, the *Encyclopædia of Plants* embraces the state of the science, as connected with Horticulture and British Botany, so far down only as the year 1822, when the present work was commenced. Another publication is announced as in progress, under the charge of the same indefatigable editor, with the title of *Hortus Britannicus*, and which will contain a list of the names of cultivated and British plants, brought down to the year 1828. We should convey a very imperfect idea of the nature of the *Encyclopædia of Plants*, were we only to mention that it contained the generic and specific characters of 16,712 species of plants which have grown on British soil. These characters are accompanied by figures of nearly 10,000 of the plants engraved on wood. When we say that these are executed from drawings by Mr J. D. Sowerby, expressly for the work, it will be at once conceived that their execution is good. It is indeed excellent; and, considering the necessary smallness of the figures, they are highly characteristic. About one-fourth of every page is thus occupied with engravings; and, though many of them are so minute that, in the more difficult tribes, such as the *Heaths*, the *Labiatæ*, the *Umbelliferæ*, the *Mosses*, and the *Fungi*, there must be great difficulty in recognizing the identity of the species intended to be represented; yet, upon the whole, they cannot fail to be of great utility to the student, to further the cause of botany in a very eminent degree; and, by the very facilities which they afford to the pursuit, to create a desire for a more intimate acquaintance with the species and properties of the plants thus beautifully represented. Magnified dissections are, of course, incompatible with a work where it is intended to give as much useful information as possible, in as small a compass; yet, for the better illustration of the *Grasses*, they are accompanied by analyses of the flowers. The parts that struck us as being the least significant and the least useful, are the figures illustrative of the *Classes* and *Orders* of the *Linnæan System*, for these marks are confessedly artificial; and to him who knows what a *stamen* and what a *style* are, it is equally easy to call to mind the presence of *one* or *two* stamens, or of *one* or *two* styles, as to form the idea from their representation. The *Tables* of *Abbreviations* and *References* require perhaps too much study; and the old and highly characteristic signs of *Annual* and *Biennial*, &c. are sacrificed, we think, without any advantage being gained in their room. Both, we allow, require explanation; but many persons are acquainted with the old figures; and innovations, except arising from some adequate or superior motive, should be avoided. The arrangement of the whole genera and species is according to Linnæus. Following the *characters* of the genera, are the *enumerations* and *characters* of the *species:* the former (the enumeration) occupying the left hand page, accompanied by the initials of its author; the *English name, duration, period of flowering*, name of the *natural order* to which it belongs, *station, date of introduction*, reference to *figures*, &c. &c. the latter occupying the same line, and headed by the same number on the opposite page. Below the figures, a space is devoted to the *culture, uses, history, derivation* of the name, and a vast mass of useful observation and research, collected with great labour and no inconsiderable judgment. A sketch of the *Natural Arrangement*, also we presume from the pen of Professor Lindley, and a *Glossary of Terms*, conclude the work. The whole, we may confidently assert, form a book perfectly *sui generis*. The quantity of matter is truly astonishing; and the entire publication is offered at a price so moderate (four and a half guineas), that we can hardly dare to hope it will do more than cover the expenses of the public-spirited booksellers, who have spared no cost to render it, what we confidently pronounce it to be, the most useful and the most popular botanical work that has ever appeared in the English language.

List of Patents granted in England from 30th March to 19th June 1829.

1829.

Mar. 30. To J. Lambert, Esq. of Liverpool Street, London, for "an improvement in making iron, applicable to the smelting of the ore, and at various subsequent stages of the process, up to the completion of the rods or bars, and for the improvement of the quality of inferior iron."

April 11. To W. Prior, of Albany Road, Camberwell, for "improvements in the construction and combination of machinery for securing, supporting, and striking the top-masts and top-gallant masts of ships."

14. To J. Lihon, of Guernsey, but now residing at the Naval Club-House, Bond Street, a Commander in our Royal Navy, for "an improved method of constructing ship's pintles for hanging the rudder."

28. To H. R. Palmer, for "improvements in the construction of warehouses, sheds, and other buildings, intended for the protection of property."

To B. Cook, Birmingham, for "an improved method of making rollers or cylinders of copper and other metals, or a mixture of metals, for printing of calicoes, cloths, and other articles."

To J. Wright, Newcastle-upon-Tyne, for "improvements in condensing the gas or gases produced by the decomposition of muriate of soda, and certain other substances, which improvement may also be applied to other purposes."

To P. Pickering, Frodsham, Cheshire, and W. Pickering, Liverpool, merchants, for "having invented an engine, or machinery to be worked by means of fluids, gases, or air, on shore or on sea, and which they intend to denominate 'Pickering's Engine.'"

To J. Davis, Lemon Street, sugar-refiner, for "a certain improvement in the condenser used for boiling sugar in vacuo."

May 2. To G. W. Lee, Bagnio Court, Newgate Street, merchant, for "certain improvements in machinery for spinning cotton and other fibrous substances."

To H. Bock, Esq. Ludgate Hill, for "improvements in machinery for embroidering or ornamenting cloths, stuffs, and other fabrics."

19. To J. Dutton junior, Wotton Underedge, Gloucester, clothier, for "certain improvements in propelling ships, boats, and other vessels, or floating bodies, by steam or other power."

21. To M. Dick Irvine, Ayr, for "an improved rail-road, and for propelling carriages thereon by machinery, for conveying passengers, letters, intelligence, packets, and other goods, with great velocity."

1829.

May 23. To T. R. Williams, Esq. Norfolk Street, Strand, for "improvements in the manufacturing of felt, or a substance in the nature thereof applicable to covering the bottoms of vessels, and other purposes."

26. To T. Arnold, Hoxton, tin-plate worker, for "an improved machine or gauge for the purpose of denoting the quality or strength of certain fluids, or spirituous liquors, withdrawn from the vessel in which the same are contained; and which machine or gauge may be so constructed as to effect either of the above objects without the other, if required."

To W. Poole, St Michael on the Mount, Lincoln, smith, for "improvements in machinery for propelling vessels, and giving motion to mills and other machinery."

To C. T. Sturtevant, Hackney, for "improvements in the manufacturing of soap."

To J. C. Daniell, Limpley Stoke, Bradford Wilts, clothier, for "improvements in machinery applicable to the dressing of woollen cloth."

28. To R. Winans, Vernon, Sussex, State of New Jersey, North America, resident in London, for "improvements in diminishing friction in wheeled carriages to be used on rail and other roads, and which improvements are applicable to other purposes."

June 1. To W. Mann, gent. Effra Road, Brixton, for "having discovered that, by application of compressed air, power and motion can be communicated to fixed machinery, and to carriages, and other locomotive machines, and to ships, vessels, and other floating bodies."

To A. Gottlieb, Jubilee Place, Mile-end Road, for "improvements on, or additions to, locks and keys."

4. To J. Smith, Bradford, York, for "improvements in machinery for dressing flour."

To C. Brook, Meltham Mills, near Huddersfield, York, for "improvements in machinery for spinning cotton and other fibrous substances."

13. To R. Porter, Carlisle, Cumberland, for "improvements in the manufacture of iron heels and tips of boots and shoes."

19. To F. Day, Poultry, optician, and Auguste Munch, mechanic, of the same place, in consequence of a communication made to them by a certain foreigner residing abroad, and inventions by themselves, for "improvements on musical instruments."

To C. Wheatstone, Strand, for "improvements in the construction of wind musical instruments."

To M. Poole, gent. Lincoln's Inn, in consequence of a communication to him, made by a certain foreigner residing abroad, for "improved machinery for preparing or kneading dough."

List of Patents granted in Scotland from 1*st July to* 7*th September* 1829.

1829.
July 1. To Orlando Harris Williams of North Nibley, in the county of Gloucester, Esq. for an invention of "certain improvements in machinery or apparatus for propelling ships or other vessels on water, and which are also applicable to undershot water wheels."

1. To John Braithwaite and John Ericsson, engineers, of New Road, Fitzroy Square, in the county of Middlesex, for an invention of "a mode or method of converting liquids into vapour or steam."

8. To John Lihon of Guernsey, but now residing at the Naval Club House, Bond Street, in the county of Middlesex, Commander in his Majesty's Navy, for an invention of "an improved method of constructing ships' pintles for hanging the rudder."

Aug. 4. To James Milne of Edinburgh, architect, for an invention of "a machine or engine for dressing of stones used in masonry, by the assistance of a steam-engine, a wind, a horse, or a water power, whereby a great quantity of manual labour will be saved."

14. To Richard Williams of Tabernacle Walk, in the county of Middlesex, civil engineer, for an invention of "certain improvements in the application of elastic dense fluids to the propelling or giving motion to Machinery of various descriptions."

28. To Barnard Henry Brook of Huddersfield, in the county of York, civil engineer, for an invention or "improvement in the construction and setting of ovens or retorts for carbonizing coals for the use of gas works."

28. To Moses Poole of the Patent Office, Lincoln's Inn, Gent., in consequence of a communication made to him by a certain foreigner residing abroad, for "an invention for certain improved machinery for preparing or kneading dough."

28. To Peter Rigby Mason of the Middle Temple, Esq. barrister-at-law, for an invention of "a certain improvement in the article commonly called stick sealing wax."

Sept. 2. To William Ramsbottom of Manchester, in the county of Lancaster, journeyman shape-maker, for an invention of "certain improvements in power looms for weaving cloth."

2. To John Boase of Albany Street, Gent. and Thomas Smith of Augustus Street, both in the Regent's Park, for an invention of "certain improvements on machines or machinery for scraping, sweeping, cleaning and watering street-roads and other ways, which machines or machinery may be applied to other purposes."

7. To John Levers of the town of Nottingham, machinist, for an invention of "certain improvements on machinery for making lace, commonly called bobbin net."

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P. NEILL, PRINTER.