ters in the classification of the higher mammalia. In *Cholœpus hoffmanni* the placenta is dome-like, multilobate and genuinely deciduate, more like that found in the Primates and Man than in any other order, so much so that the author remarks "from the point of view of the descent hypothesis, it is possible that between the Sloths and the Lemurs genealogical relations may exist," and "now that I have called attention to the evidence of affinity with these higher mammals it is not improbable that other features of resemblance may in time be recognised."

BESIDES the ornithological papers which the late Mr. H. D. Graham contributed to the *Naturalist*, he left in the form of manuscript notes the larger and more interesting portion of the ornithological work which he had undertaken in the islands of Iona and Mull during the latter part of his life. These, together with the papers referred to, are being prepared for publication by Mr. R. Graham, to whom the whole of Mr. Graham's ornithological correspondence was originally addressed.

WE learn from the *Times* that M. Giard, Professor of Natural History at Lille, has been making an interesting inquiry into the zoology of the French shore of the Straits of Dover. Many uncommon species of crustaceans, ascidians, and mollusca have been obtained, which will be fully described before the Scientific Congress which is to be held at Lille during the ensuing summer.

WE are glad to see that Government have at last begun to carry out their agreement with the Trustees of the Bethnal Green Museum, by laying out the vacant space around the Museum in gardens for the recreation of the people.

IN the House of Commons, on Tuesday, Mr. Cowper-Temple obtained leave to bring in a Bill to remove doubts as to the powers of the University of Scotland to admit women as students, and to grant degrees to women.

THE month of April is a famous one in the annals of the French Academy for centenary anniversaries. M. Biot was born in April 1774, almost the same day when Louis XIV. died. M. Biot was a member of the Academy of Sciences and Academy of Inscriptions. It was also in this month that Maupertuis published the first French mathematical essay in which the Newtonian theory of attraction was accepted. Lavoisier was engaged in making observations on solar heat with an immense lens at the cost of one of the richest financiers of the time.

THE last (received) number of *Annales Hydrographiques*, contains details of the navigation of the Magellan Straits by the corvette *L'Atalante*, with tabulated meteorological observations made during the 13 days of the passage.

THE continuation of Adolph Schaubach's "Deutschen Alpen" (pp. 641 to 850) is brought up to the end of the Trias. The writer is Dr. H. Emmrich.

THE last number of the *Annales des Sciences Géologiques* contains a continuation of M. Oustalet's researches on the fossil insects of the Tertiaries of France. This second instalment of 112 pages is devoted to Aix-en-Provence.

THE recently published Report of the Department of Mines of Nova Scotia shows that the total produce during the year from collieries was 1,051,467 tons. Of these 264,000 tons were sold to the United States, 6,000 to Great Britain, 214,000 were used in Nova Scotia, and the rest were sold to Quebec, New Brunswick, Newfoundland, Prince Edward Island, West Indies, and South America.

A STAINED glass window has just been placed in the parish church of Folkestone to the memory of Dr. William Harvey, the discoverer of the circulation of the blood, who was born in the town in 1578. It is the gift of the medical profession, more than 3,000 of whom have contributed towards the cost.

IN view of the great economical value of the fur seals of Alaska, and of the importance of a thorough knowledge of their habits and movements, with reference to the command of the market of the world, it is proposed by the United States Treasury Department to send some one to the North Pacific Ocean for the purpose of obtaining materials for an exhaustive report on the subject. It will be remembered that these seals, almost to the number of millions, visit the St. George and St. Paul islands of the Pribylov group every summer season for the purpose of bringing forth their young, and that on this occasion a company chartered by the United States is allowed to capture 100,000 annually. What becomes of these seals after they leave the islands is entirely unknown, although congregated there in such numbers for several months. A few are taken in the spring and fall as they pass along the coast of British Columbia and Washington Territory, but whether these are related to the Pribylov army or not is uncertain. The same species is found to a limited extent on the Asiatic side of the ocean, but no very extensive captures are made. Should this commission be appointed, it is to be hoped that some of these problems may be solved, and that we may not remain longer in ignorance of the general natural history of so important an animal, which furnishes a revenue to the United States of about 300,000 dols. a year, while a profit of almost millions is made by the company which has charge of the interest.

THE additions to the Zoological Society's Gardens during the last week include a Vigne's Sheep (*Ovis vignei*), from Asia, presented by Capt. Archibald; a Sambur Deer (*Cervus aristotelis*) and an Axis Deer (*Cervus axis*), from India, presented by the Hon. Justice Jackson; two Cut-throat Finches (*Amadina fasciatus*) and two Paradise Whydah Birds (*Vidua paradisea*) from West Africa, presented by Lieut. J. H. Hearne, R.N.; a Rufous-necked Weaver Bird (*Hyphantornis textor*) from West Africa, presented by Mr. Hincks; two Negro Tamarins (*Midas ursulus*) from Rio de Janeiro; a Common Rhea (*Rhea americana*) from Buenos Ayres; a Brazilian Teal (*Querquedula brasiliensis*), and a Bahama Duck (*Pœcilonetta bahamensis*) from South America, purchased.

THE PHYSICAL HISTORY OF THE RHINE*

THE attempt to unravel geological history, as far as the stratified rocks are concerned, and all the igneous rocks connected with them, simply resolves itself into this:—an effort to realise the physical geography of different geological epochs, to make out the relations of the sea and of the land with its plains and mountains during these periods, the history of the rivers and lakes of the time, and to know as much as may be known of all the creatures and of all the vegetation which inhabited the water and the land.

I am now going to attempt to explain the history of that great historical river the Rhine. Every river has a definite history, if we could clearly make it out. Every river has had a beginning, and it is quite possible—if we have the skill—to find out when, by special changes in physical geography, such and such a river began to flow, and why it flows in such and such a direction.

In various publications I have attempted to show what is the history of some of the rivers of England; as, for example, the history of the Severn and of the Thames, and I think I have been able to prove that the Severn is a much older river than the Thames; and, on similar principles, I now propose to attempt to reveal to you the history of the Rhine and its

* A Lecture delivered at the Royal Institution on Friday evening, March 27, by Prof. A. C. Ramsay, LL.D., V.P.R.S., Director-General of the Geological Survey of the United Kingdom, &c.

valley from early times to the present day. For many years I had an ambition to work out the history of the Rhine. I have known it now for more than twenty years; going often up and down the river, and sometimes for weeks—once for months—living on its banks. For the last thirteen years, unfortunately, I never was able to return to it, but the problem I had marked out for myself remained in my mind, and last year I went, and worked it out, with the result which is now to be explained.

First, with regard to the great main features of the Rhine valley; it has its sources, as every one knows, in the mountain regions of Switzerland, one of which is in the valley of the Vorder Rhine, and the other in that of the Hinter Rhine, both glacier regions. The ground where it rises is from 7,000 to 8,000 feet above the level of the sea. From thence it passes to the Lake of Constance, 1,305 feet above the sea; and beyond, in a westerly direction, by Schaffhaussen to Basel, where, at the bridge, the level of the water has an average height of about 803 feet above the sea. Thence it flows down the great upper plain of the Rhine northerly between the Schwartzwald and the Vosges to Mainz, where the height of the river is about 531 feet above the level of the sea, thus showing a fall between Basel and Mainz of about 272 feet, which gives an average slope for the running of the river of about 3 ft. 1½ in. per mile. Beyond that, proceeding to the north, we come to the deep gorge of the Rhine, passing between high cliffy banks, which begin at Bingen and continue down to Rheineck in the neighbourhood of the Siebengebirge, for a distance of from 60 to 70 miles, according as you take into account all the windings or omit them. Beyond the Siebengebirge there is a plain, partly formed of the delta of the river, which gradually merges into the great flats that extend all the way from Calais to the Elbe.

Now the main question I have to bring before you is, first, what is the origin of the great upper plain that lies between Basel and Mainz? and, secondly, what is the origin of the gorge between Mainz and Rheineck? Why are they there, and by what means have this plain and this gorge assumed their present forms?

When you stand above Bingen, or, better still, if you ascend the Taunus and look southerly, and consider the narrowness of the gorge and the great hilly barrier of rock that must once have extended at Bingen across the lower end of the plain, the impression is irresistibly conveyed to the mind that before that gorge was opened a vast lake must have reached all the way from that barrier to where Basel now stands, covering the great plain that lies between the mountains of the Vosges and those of the Schwartzwald. And so thoroughly has this idea taken possession of the popular mind, at least of those who have at all considered the subject, that we find this statement made in some of the Guide Books of the time, and notably by Baedeker, where it is stated that a lake must have covered the whole of that vast plain, 170 miles in length, at a comparatively recent period. It is a very obvious theory and has much to recommend it, for it seems so clear that, before the gorge was opened, all that plain must have been covered with a sheet of water, and it is hard to realise that such has not been the fact. When I first entered on the subject I was impressed with this idea, and I began to cast about and endeavour to find a reason for the scooping out of the gorge, and for the consequent drainage of the supposed lake.

Having years before written a paper on the origin of the lake basins of Switzerland, North America, and other parts of the world, and having attributed the formation of many of these, but by no means all of them, to the action of glacier-ice during the glacial period, my first impression was that ice might have had at least something to do with the scooping out of the great valley that lies between the north flanks of the Jura, the Schwartzwald, the Vosges, and the Taunus. But while slowly passing up the river, and searching for proofs which might either confirm or contradict this view, I was soon obliged to give up the idea that glacier-ice had anything to do with scooping out the great hollow. For on one side—that of the mountains of the Schwartzwald—I found that none of the glaciers of that region (and there are proofs that glaciers once existed there) even extended well down into the valley of the Rhine. And on the opposite side of the Rhine Valley, that of the old glacier region of the Vosges, I found no proof that they ever extended down so far as the plain. There is also no proof that the glaciers of the great glacial epoch of Switzerland ever extended as far north as Basel. Neither are there any signs of erratic blocks or other kinds of moraine matter on the plains or hill-slopes about Bingen, which one might expect to find there had the whole of the great plain of the Upper Rhine been once filled with glacier-ice. Therefore this theory, which I had not definitely formed, but which I surmised might possibly have had something to do with the subject, entirely melted away, and other hypothetical views along with them, and I was obliged to begin anew.

Accordingly I went to Switzerland, and with the help of friendly Swiss geologists, examined part of the Miocene or Middle Tertiary rocks between the Oberland and the Jura.

To make the rest of the subject clear, I must now say a few words about the origin of mountain chains. Most people are familiar with the outlines of the nebular hypothesis. The whole solar system was once in a nebulous state, and as this nebulous mass revolved in space, portions of it were thrown off, and one of these consisted of the matter which, by and by, resolved itself into the present earth. This nebulous fluid, in virtue of gravity, by degrees condensed more and more, and, passing through what we may call the molten state, in the course of time began to assume a solid form, and a hard outer crust was at length produced which enclosed a highly-heated fluid mass within. This crust, which continued to thicken in consequence of radiation of heat, because of the law of gravitation, was ever drawn towards the centre of the earth. By this process the circumference of the earth necessarily became less, and that consolidated rocky sphere which formed the outer shell of the earth was forced to readjust itself so as to occupy a diminishing area. Thus it happened that while some parts sank, other parts of the crust were crumpled, and relatively raised higher than other portions of the crust that still retained their original curves as part of a sphere.

This hypothesis, which, as far as I know, was first propounded by Elie de Beaumont, may be looked upon as the origin of mountain chains. What began in the earlier and prehistoric times of geological history, seems to have been going on steadily down to the present day, and thus it happens, that geologists can prove mountain chains to be of very different ages, and that, of whatever age they may chance to be, the strata that compose them are found to be bent and contorted. This contortion of strata took place simply from that shrinking of the earth's crust which was the natural result of radiation of heat into outer space. Portions of the crust more or less gave way to lateral pressure, while other parts of the great spheroidal curve more or less retained what we call horizontal or nearly horizontal position.

In this way it happened that at a certain period of geological history which preceded the formation of the Miocene rocks in the region now occupied by the Alps, a disturbance of the earth's crust took place, due to shrinkage of the general mass, of such a nature that the Alpine strata were thrown into highly-contorted forms, and a great mountain range of pre-Miocene age was the result. On the north of these mountains the Miocene strata began to accumulate in great lakes. But these lakes lay so near the level of the sea, that every now and then, by depression of the land, they sometimes sank a little below the sea, and the sea invaded the area formerly occupied by fresh water. The result was that in Switzerland, between the Oberland and the Jura, and much farther north, the Miocene strata which are hundreds and sometimes thousands of feet thick, are now found to consist of interstratifications of marine, brackish, and of fresh-water beds. At that time the Jura had no existence. It is the result of a later disturbance of the crust of the earth, and thus it happened that all the Miocene waters in which were deposited the strata that now lie between the Oberland and the Jura originally spread northwards far across the area now occupied by the Jura, and into the di trict of the present plain of the Rhine between Basle and Bingen.

It is hard to realise the scenery of that time; but partly by an effort of imagination, and partly by special knowledge of the fossils contained in the rocks, it is possible to form some conception of the appearance of the country.

On the east and west of the great valley were mountainous ranges now called the Schwartzwald and the Vosges, while far to the south rose the high mountains of the pre-Miocene Alps, more or less covered with a forest vegetation. On the banks of the lakes there grew in an early stage of the Miocene epoch vast numbers of forest-trees and evergreen shrubs, of genera such as are now characteristic of tropical and sub tropical countries; figs and vines, many species of Protoaceæ analogous to those that still grow in the Australian continent, together with cypress, sequoia, cinnamon, fan palms, and palmettoes, ferns, hornbeams, and buckthorns, all of genera still familiar, but mostly if not altogether of extinct species. At a later date this vegetation partly died out, and was replaced by plane-trees, poplars, elms, willows, and maples; while cinnamons, figs, vines, laurels, and Protoaceæ still continued to flourish. In the woods, on the meadows, and in the waters respectively, the *Mastodon angustidens*, the rhinoceros, Chæropotamus, Dichobune, deer, Dinotherium, hippopotamus, crocodiles, salamanders, fish, and numerous other creatures roamed at pleasure, while the air and the land were tenanted by dragon-flies, ants, beetles, and other insects, of which more than 800 species have been distinguished.

I now come to the chief part of this lecture, which is to account for the origin of the Rhine: for at that earlier time the Rhine had no existence in this valley, and indeed there is proof that instead of the main drainage of the area, flowing from south to north as it does now through this valley, the waters drained from north to south; and the pebbles of the Schwartzwald, instead of being carried north as they are now, were carried southward by minor rivers, and found their way into Switzerland, thus helping to form some of the conglomerate rocks of which the Miocene strata of Switzerland to a great extent consist.

Not only had the Rhine no existence then, but the romantic gorge of the river, with which so many are familiar, had no existence either. It has been customary sometimes to attribute the formation of that gorge to violent disturbance and fracture of the strata, by which the waters were allowed to escape from south to north. I have no belief in such violent disturbances having any place in the modern economy of the world, nor yet in such cataclysmal action having ever affected the ancient world, as far as it is in the power of geologists to trace back events from the present day to the oldest known geological periods.

After the Miocene epoch had lasted for a long period of time, there occurred another disturbance of the European region, and of much of the rest of the world besides, though it is only the Alpine region and the countries north of the Alps that we have now to deal with. This second disturbance of the Alps produced a great upheaval of the Miocene strata. All the Miocene lakes that occupied the old lowlands of Switzerland and extended far east into what is now the Austrian dominions and into Asia itself,—all that area, as far as the Alps are concerned, was gradually heaved up high above the level of the sea, and those beds of conglomerates, sandstones, and marls that form the lowlands of Switzerland, and all across what is now the Jura, were disturbed to such an extent that the strata now forming the Righi and Rosberg and other sub-Alpine hills were partly raised to a height of at least 5,800 ft. above the level of the sea, and probably much more. The lower parts of Central Switzerland, about the Lake of Geneva, the Lake of Constance, and Neufchatel, still stand at heights of from 1,200 ft. to 1,300 ft. above that level. Then the range of the Jura first rose up to form a mountain-chain, and this is the proof of these disturbances. First we know that the Miocene rocks originally lay all the way from the Alps to the Taunus in flat-lying strata. During that period a vast quantity of Miocene pebbles were carried into the lakes, which were by and by consolidated into an exceedingly coarse conglomerate. Anyone who has ascended the Righi will remember that nearly the whole of it is formed of this coarse conglomerate, proving the prodigious amount of waste that the Alps underwent during the Miocene period. When we consider the amount of this waste, even though the waters of the Miocene period lay but little above the level of the sea, still in my opinion it is probable that the Alps themselves were then quite as high, if not higher, than they are now. For the prodigious amount of waste proved by the conglomerate, indicates the removal of an enormous amount of material from the pre-Miocene Alps.

After the disturbance which raised the Jura and the Miocene strata of the lowlands of Switzerland, this is what took place. Along with the contorted secondary strata of the Jura, the Miocene beds that previously covered them were thrown into a number of anticlinal and synclinal curves, and the greater part of the Miocene material over that area having since been removed by denudation, only a few outlying fragments of these strata remain, left in those wonderful upland basin-shaped hollows of the Jura, which still attest the original continuity of the Middle Tertiary deposits all the way from the base of the pre-Miocene Alps to the northern base of the Taunus.

When the post-Miocene disturbance of the whole of this area took place the general effect was, that much of the Swiss Miocene area was contorted and raised high into the air, while between the Jura and the Taunus, the equivalent strata were simply heaved up and tilted so as to form a long inclined plain sloping northerly and lying between the Vosges and the Schwartzwald, and the surface of which may have been about 1,200 or 1,300 ft. above the present level of the sea where Basel now stands, and about 1,000 to 1,100 ft. high where the opening of the gorge now begins near Bingen.

Before this wide-spreading disturbance took place, the Rhine had no existence, for up to that time such small rivers as occasionally ran in the more ancient Miocene valley flowed partly south. But when the inclined plain was fairly completed, the result in the long run was that for the first time the great general drainage of the area began to run from south to north, and the Rhine was established flowing at a height which we may roughly speak of as having been 500 ft. higher than now, because at that time all the great valley between Basle and Bingen was filled to that height with Miocene strata. We know this to be a fact by an examination of the valley on the right hand and the left, from Bingen towards Basle, for every here and there, we find table-shaped hills formed of flat-lying Miocene strata, which border the present alluvial plain of the Rhine and abut upon the more ancient mountains on either side. The history revealed by this fact is plain to anyone accustomed to reason on geological phenomena. The strata forming scarped slopes on opposite sides of the valley were once united, and their early continuity has been destroyed, simply by long-continued watery waste and denudation. They are indeed only the relics of an older phase of the physical geography of the district, when the surface of the plain stood about 500 ft. higher than it does at present.

Now when the Rhine first began to flow, the river then passed through a high upland valley with gently sloping sides that lay between the Taunus and the Hundsruck, and which in no manner resembled the precipitous cliffs that now bound the Rhine in the gorge below Bingen. The bottom of part of this old upland valley still forms a narrow terraced plain, immediately above and beyond the edge of the cliffy gorge of the Rhine. It is not always continuous on both sides of the gorge, but enough of it remains to attest its original continuity at heights of from 400 to 500 ft. above the present level of the river. Now what I wish to persuade you of is this, that the Rhine flowing in this valley by degrees began to cut out its own gorge, and that it was not produced by fracture. Every running river is busy eroding its channel, especially where the ground is at all steep. That is one of the main functions of running waters. They are constantly deepening their channels and carrying the sediments so formed from higher to lower levels, till in the course of time they find their way into lakes or the sea.

When we first enter the gorge of the Rhine, going southward, one feature that strikes the geological observer is the constant recurrence of this old terrace backed by the hilly country beyond. On the left bank, overlooking Bingen, the flat-topped spur of the Rochus-berg, about the same height as the tops of the neighbouring Miocene tabular hills, first strikes the eye. When fairly within the gorge below Niederheimbach, beyond its upper edge the old river plain is seen gently sloping to the north, while the sides of the gorge itself is seamed by numerous gullies worn by occasional torrents since the great ravine—a kind of canon—has been cut down to its present level.

At Welmich, below Niederheimbach, looking down the river, the edge of the terraced plain is seen receding northward in long perspective, and at Salzig, still further down, the features so well shown near Niederheimbach are again reproduced. The same outline occurs again and again all down the river between Bingen and Coblenz, and equally below Andernach, as for instance at Rheineck. Finally, above the Siebengebirge, just about the mouth of the gorge, looking up the river, the long eastern hills sloping to the river end in a terrace corresponding in general height and outline to those already mentioned. The general conclusion to be drawn from these observations is that at heights of from 450 to 500 ft. above the present river this ancient river terrace has a persistent gentle slope from south to north which approximately corresponds to that of the existing river.

The inference is plain: that formerly throughout the length of what is now the gorge the river flowed at that high terraced level, at a time when the plain above the gorge was so deeply filled with Miocene strata that the level of the river, where Mainz and Bingen now stand, was as high as the upland terrace that crowns the gorge between Bingen and Rolandseck. By degrees the river began to excavate the gorge, and slowly cutting deeper and deeper, and at the same time winding and ever changing its channel through the great plain between the Jura and the Taunus, by slow gradation it wasted away the surface of that plain more and more, and the matter won from that surface was carried down through the gorge to be added to the old delta of the river. At last the major part of the Miocene rocks that partly occupied the plain were worn away and the plain has been reduced to its present temporary level; while the terraced hills on either bank still remain to attest the amount of watery degradation that the area has undergone.

So much for the scooping out of the valley. But there is another point which I would like to impress upon you. On each side of the Rhine there are important tributary rivers. Thus, for example, above the gorge we have the Maine, the Neckar, the Kinzig, the Elz, and other streams, flowing through deep steep-sided valleys; and these rivers have from a very early period been tributaries of the Rhine. It follows, then, that when the level of the Rhine was 400 or 500 ft. higher than at present the levels of the bottoms of these rivers must also have been 400 or 500 ft. higher than at present; and therefore, just in proportion as the great valley of the plain of the Rhine was being cut down and lowered, so in proportion must the valleys in which these rivers run have gradually been deepened. When we come to the gorge the same kind of argument applies to the Moselle and other tributaries of the Rhine.

I have elsewhere attempted to show that at one time the Moselle ran as high as the top of the table-land that now bounds it on each side. Everyone who knows that river is aware that, though it looks so hilly when we go up the stream in a steamboat, as soon as we reach the edges of the slopes on either side we are on the top of a great table-land intersected by numerous valleys, so that before the gorge of the Rhine was formed the Moselle ran at as high a level as the ancient Rhine; and just as the gorge of the Rhine was being deepened, so the Moselle was by degrees also enabled to deepen its channel. The same was the case with other rivers, right and left of the Rhine; and by applying this principle to the other great rivers of Europe we may hope in the long run to explain the physical history of all the systems of drainage of all parts of the continent.

One other point remains to be stated with regard to the physical history of the Rhine. Geologists well know that in older times the glaciers of Switzerland were on an immensely larger scale than at present. Large as they appear to us at the present day, they are of pigmy size when compared with their magnitude at a comparatively late period of the world's history. The Rhone glacier then spread across all the area now occupied by the Lake of Geneva, till it abutted on the Jura; and the old Rhine glacier extended all over the Lake of Constance, and reached at least half way from Schaffhaussen to Basle. The body of water which flowed directly from such glaciers must have been very great, and enormous must the moraines have been that were shed from the ice-sheets. From an examination of the pebbles that form the superficial gravel on the present plain of the Rhine below Basle, it is certain that a large portion of them have come from the Alpine regions. Such a great moraine as was shed from the western edge of the old glacier of the Rhine was constantly being attacked by the waters that flowed from its end, and thus by degrees pebbles were carried onward into the plain. The result is that a large part of the gravels of the Rhine is simply the waste of old moraines shed from the glaciers of Switzerland, added to by material carried down by the streams of the Vosges and the Schwartzwald, also partly derived from he moraines of ancient glaciers on a smaller scale.

Last year it was my lot to deliver here a lecture on the history of old continents, and I attempted to show that one old continent in particular retained its identity through a very long period of geological time; that from the close of the Upper Silurian period, all through the Old Red Sandstone and Carboniferous periods, through the Permian and New Red Sandstone epochs, over great part of what is now Europe, that continent, with many physical changes, still retained its identity. Such a vast continent remaining through all those geological periods implies a succession of epochs of time, which, as far as years and cycles of years are concerned, the mind has as yet only hints of data which some day may help us to grapple with such a problem, and not till astronomy comes more boldly to the help of geology, may we begin to hope for the solving of the problem of the actual value of geological time. However that may turn out, it is certain that during the long continental epoch alluded to there were, over and over again, many changes in physical geography far greater than that petty change which I have been endeavouring to sketch out to-night. The floras and faunas of the world in that old time changed, not in the minor degree I have been speaking of to-night, but were more completely remodelled again and again in great part, even generically. Mountain ranges rose, glacial periods intervened and passed away. Great lakes, sometimes fresh, sometimes salt, appeared and were obliterated by great terrestrial changes. At one time vast lakes, like those of the heart of Africa and North America, covered prodigious areas of land; at another, equal or larger areas were covered by salt lakes as large as the Caspian and the Sea of Aral. And when you think of the continental episode in the modern geological history of Europe to which I have drawn attention, you will see how small it really is, though it may look large to our minds, compared to the old continental epoch of which I spoke last year. This you may depend upon, that though to the superficial eye it may seem as if the world had always been going on just as it is doing now, and that through all time to come it will go on just the same, with its mountains, valleys, rivers, lakes, and seas, yet it is none the less certain that changes, such as I have described to-night, are but the forerunners of other mutations as great, aye, and far greater, that will take place in the future. Just as there is as yet no certainly measured limit to the geological time of the past, so also we know of no measurable limit to geological time to come. But why should I keep you with words such as these, when I may convey a whole chapter in physical geology, condensed into eight lines, by the greatest of our living poets :—

There rolls the deep where grew the tree.
O Earth, what changes hast thou seen!
There, where the long street roars, hath been
The stillness of the central sea.

The hills are shadows, and they flow
From form to form, and nothing stands:
They melt like mist, the solid lands,
Like clouds they shape themselves and go.

SCIENTIFIC SERIALS

IN the *Journal of Botany* for March, the editor, Dr. Trimen, commences a series of useful articles (which is continued in the April number) on the Botanical Bibliography of the British Counties, being a list of country and district floras arranged topographically. The other paper of greatest interest in this number is one of a kind of which this very useful journal has now published a considerable number, and which may ultimately throw considerable light on some of the problems connected with the distribution of plants, On the Flora of the Leeds and Bradford District, by J. A. Lees.—The number for April commences with an article of some importance in systematic botany, A Revision of the genera *Dryobalanops* and *Dipterocarpus*, by Prof. Thiselton-Dyer, in which a number of new species are described, including two belonging to the previously monotypic genus *Dryobalanops*, and illustrated by a plate (two more being promised in the next number). The editor also gives in this number one of the most valuable specialities of the journal, his list of New Species of Phanerogamous Plants in periodicals published in Great Britain during 1873.

THE *Scottish Naturalist* for April publishes a number of papers on almost every branch of Botany and Zoology, including one on Geology, of more or less interest to Scottish naturalists.—Mr. J. A. Harvie Brown proposes the establishment of a Natural History Publication Society, something on the model of the original plan of the Ray Society, for the purpose of publishing original papers on Natural History, principally on Mammalia and Aves, and for reprinting in fac-simile rare and useful tracts, pamphlets, &c., on the like subjects.—We have also further instalments of the lists of the Lepidoptera and Coleoptera of Scotland, by Dr. Buchanan White and Dr. D. Sharpe. This quarterly magazine seems to fill a most useful place in forming a channel of intercommunication between naturalists north of the Tweed.

Memorie della Soc. degli Spectroscopisti Italiani, December. This number contains a paper be G. Lorengoni, On the Observation of a partial eclipse of the sun in May last, observed by the spectroscopic and direct view methods. He discusses at length the advantages and accuracy of each method, and concludes that the former method is the best of the two.—G. de Lisa gives a table of spots on the sun, observed at Palermo in December, giving a mean of about eight spots each day.

The January number contains a note that a new Spectroscopic Station has been established at Turin, and an equatorial by Fraunhofer has been erected there.—Prof. Draper contributes a