in mind that, from the continual action of denudation, the existing sedimentary rocks only represent a fraction of the whole thickness of sediments that have been deposited. Taking the denudation of the area of the Mississippi as a guide, he estimates the wearing down of the land at one foot in 6,000 years, and the matter thus removed spread over the bottom of the ocean would produce a deposit one foot thick in 14,400 years. Taking the maximum thickness of British sedimentary strata as calculated by Prof. Ramsay, namely, 72,000 feet, to represent the mean thickness of all the sedimentary rocks which ever have been formed, the author thus gets 1,036,800,000 years as the age of the stratified rocks. Mr. Croll also notices the conditions of the deposition of the sediment carried from the land, and his remarks upon this subject are all worthy of consideration. The editor, Mr. H. Woodward, describes and figures a new Myriopod from the Scotch coal-measures, under the name of *Euphoberia Brownii*, and also some new palæozoic Phyllopod Crustacea, namely *Ceratiocaris ludensis*, a gigantic species from the Lower Ludlow of Leintwardine, *C. oretonensis* and *C. truncatus*, from the yellow carboniferous limestone of Oreton and Farlow in Worcestershire, and *Dithyrocaris Belli*, from the Middle Devonian of Gaspé. He also figures a specimen of *D. tenuistriatus*, McCoy. Mr. De Rance communicates a paper on the occurrence of two distinct glaciations in the Lake District; Mr. John Aitken notices some curious faults occurring in drift at Stockport in Cheshire; and Mr. S. C. Perceval describes the occurrence of Websterite at Brighton.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 16.—"Description of *Ceratodus*, a genus of Ganoid Fishes recently discovered in rivers of Queensland, Australia." By Dr. Albert Günther, F.R.S. We shall return to this communication.—"On the Formation of some of the Subaxial Arches in Man." By George W. Callender.

Geological Society, March 8.—Mr. Joseph Prestwich, F.R.S., president, in the chair. Lieut. Lewis de Teissier Prevost and Mr. John Haines were elected Fellows of the Society; and Dr. C. Nilsson, was elected a foreign member of the Society. The following communication was read:—(1) "On the Red Rocks of England of older date than the Trias," by Prof. A. C. Ramsay, LL.D., F.R.S., V.P.G.S. The author stated that the red colour of the Triassic beds is due to peroxide of iron, which encrusts the sedimentary grains as a thin pellicle. This could not have been deposited in an open sea, but rather in an inland salt lake or lakes. The peroxide of iron, which stains the Permian, Old Red Sandstone and Cambrian rocks, is believed by the author to have been deposited in the same manner, in inland waters, salt or fresh. Agreeing with Mr. Godwin-Austen, the Old Red Sandstone was of Lacustrine origin. The absence of marine shells helps to this conclusion. The fish do not contradict it, for some of their nearest living congeners live in African and American rivers. The life of the Upper Silurian deposits of Wales and the adjoining districts continued in full force up to the passage-beds, which mark the change from Silurian to Old Red Sandstone. In these transition strata, genera, species, and individuals are often few, and dwarfed in form. Near Ludlow and May Hill the uppermost Silurian strata contain seeds and fragments of land plants, indicating the neighbourhood of land, and the poverty of numbers and the small size of the shells a change in the condition of the waters. The fish of the Old Red Sandstone also indicate a change of condition of a geographical kind. The circumstances which mark the passage of Silurian into Old Red Sandstone were as follows:—First, shallowing of the sea, so that the area changed into fresh and brackish lagoons, afterwards converted into great freshwater lakes. At the present day marine species are occasionally found living in fresh water, as for example in the Swedish lakes. The same may have been the case in the Old Red Sandstone period. The Old Red Sandstone waters at their beginning are comparable to the Black Sea, now steadily freshening; or the Caspian, once united to the North Sea, if by a change of amount of rainfall and evaporation it freshened by degrees, and finally became a freshwater lake. The Permian strata, to a great extent, consist of red sandstones and marls in the greater part of England; and the Magnesian Limestone of the north of England is also in less degree associated with red marls. These do not occur in the same districts of England, excepting in Lancashire, where a few beds of Magnesian Limestone are interstratified with the marls. The sandstones and marls being red, the colouring matter is considered to be due to peroxide of iron, possibly precipitated from carbonate of iron, introduced in solution into the waters. Land plants are found in some of the Permian beds, showing the neighbourhood of land. No mollusca are found in most of the red beds, except a brachiopod in Warwickshire, and a few other genera in Lancashire, in marls associated with thin bands of Magnesian Limestone. The traces of amphibians are like those found in the Keuper Sandstone, viz., *Dasyceps Bucklandi* and labyrinthodont footprints in the Vale of Eden and at Corncockle Moor, printed on damp surfaces, dried in the sun, and afterwards flooded in a way common in salt lakes. Pseudomorphus crystals of salt and gypsum help to this conclusion. The molluscous fauna of Lancashire, small in number, in this respect resembles the fauna of the Caspian Sea. The fauna of the Magnesian Limestone of the east of England is more numerous, comprising thirty-five genera and seventy-six species, but wonderfully restricted when compared with the Carboniferous fauna. The specimens are generally dwarfed in aspect, and in their poverty may be compared to the Caspian fauna of the present day. Some of the fish of the Marl-Slate have strong affinities to carboniferous genera, which may be supposed to have lived in shallow lagoons, bordered by peaty flats; and the reptiles lately described by Messrs. Howse and Hancock have terrestrial affinities. Besides the poorness of the Mollusca, the Magnesian Limestone seems to afford other hints that it was deposited in an inland salt lake subject to evaporation. Gypsum is common in the interstratified marls. In the open sea limestone is only formed by organic agency, for lime, in solution, only exists in small quantities in such a bulk of water; but in the inland salt lakes carbonates of lime and magnesia might have been deposited simultaneously by concentration of solutions due to evaporation. Some of the Magnesian Limestone strata have almost a tufaceous or stalagmitic aspect, as if deposited from solution. The Cambrian strata also show some evidence of not being true marine deposits. They are purple and red, like the other strata previously spoken of; and the surfaces of the beds sometimes exhibit sun-cracks and rain-pittings. The trilobite *Palæopyge Ramsayi* is considered by the author to be an accidental marking, simulating the form of a trilobite; and the fossils of St. David's are found in grey beds, which may mark occasional influxes of the sea, due to oscillations of level. The foregoing reasonings, in the author's opinion, lead to the conclusion that a continental area existed more or less in the northern hemisphere from the close of the Silurian to the end of the Triassic epoch, and that this geographical continuity of land implies probable continuity of continental genera. There is therefore no palæontological reason why the *Hyperodapedon*, *Telerpeton*, and *Stagonolepis* of the Elgin country should be considered of Triassic age, especially as the beds in which they occur are stratigraphically inseparable from the Old Red Sandstone. Finally, terrestrial and marine European epochs were rapidly reviewed. 1. The Cambrian epoch was probably fresh water. 2. The Old Red Sandstone, Carboniferous, Permian, and Trias were formed during one long continental epoch. This was brought to an end by partial submergence during the Jurassic epoch; and by degrees a new continental area arose, drained by the great continental rivers of the Purbeck and Wealden series, as shown in various parts of Europe. 3. This continent was almost entirely swallowed up in the Upper Cretaceous seas. 4. By subsequent elevation the Eocene lands were formed, and with this continent there came in a new terrestrial fauna. Most of the northern half of Europe since then has been continental, and its terrestrial fauna essentially of modern type. If according to ordinary methods we were to classify the old terrestrial faunas of North America, Europe, Asia, and probably of Africa, a Palæozoic epoch would extend from Old Red Sandstone to Wealden times, and a Neozoic epoch at least from the Eocene period to the present day. The Upper Cretaceous strata would at present remain unclassified. The marine epoch would also temporarily be divided into two, Palæozoic from Laurentian to the close of the Permian times, and all besides down to the present day, would form a Neozoic series. The generic gaps between the two begin already to be filled up. The terrestrial and the marine series at their edges at present overlap each other. The great life-gaps between the two terrestrial periods may some day be filled up by the discovery of the traces of old continents containing intermediate developments of structure as yet undiscovered. Prof. Huxley was pleased to find that

the author, on physical grounds, extended some views which he himself had, from other reasons, brought before the Society. He mentioned that there had lately been found in the fresh-waters of Australia a remarkable fish, which had been described, he thought erroneously, as a *Ceratodus*, but which, in many essential characters, was a *Dipterus*, though allied in some respects to *Phaneropleuron*. In other respects it was connected with *Lepidosiren*. It was about to be described by Dr. Günther. The dentition of this fish is curiously similar to that of the Devonian *Dipterus;* and its existence, he thought, corroborated Prof. Ramsay's argument. He agreed with the author as to his views respecting the terrestrial fauna of ancient times, and was quite prepared for the discovery of mammalian remains in earlier formations than those in which they are at present known. He did not so cordially agree with his views as to the marine fauna. He would carry back the forms from which those of the present day are immediately derived to Cretaceous rather than Eocene times. Between the Cretaceous and the Liassic strata there was what appeared to be a middle group, succeeding the Palæozoic. Mr. Etheridge commented on the dwarfed condition of our Permian fauna, which corresponds in the main with that of the Continent, though with fewer genera and species. Prof. Rupert Jones protested against some of the reasons adduced for regarding some of the areas cited as having been inland lakes, though no doubt such lakes must have existed. He thought that mere colour could not be taken as a criterion. If it were, he inquired why the bottoms of the present lakes were not red? Many of the red rocks were, moreover, full of marine fossils. He contended for the true trilobite character of *Palæopyge Ramsayi*, and mentioned its occurrence and that of *Lingula ferruginea* in red Cambrian rocks as proving the marine character of the beds. The Magnesian Limestone he also insisted upon as a purely marine and open sea deposit. Prof. Morris thought the subject required further consideration before the whole of Prof. Ramsay's views were accepted. The Cambrian beds, for instance, containing great beds of conglomerate, seemed such as could only be due to marine action, and would derive their red colour from the decomposition of the old hornblendic gneiss from which they were derived. With regard to the Red Sandstone, he would inquire whether the colour might not be derived from the decomposition of rocks composed of hornblendic materials. The Old Red Sandstone beds, though in this country containing fishes which might be of freshwater genera, had in Russia the same fishes associated with marine shells; and much the same was the case in the Trias. Dr. Carpenter had been led to the conclusion that wherever there was an inland sea connected with the ocean by a strait even of moderate depth, there was a double current tending to preserve some degree of similarity between the waters of the two, the difference of specific gravity in the Mediterranean as compared with the Atlantic being about as 1·026 to 1·029. In the Red Sea, where so little fresh water came in, and there was an evaporation of nearly eight feet per annum, the water was but little salter than that of the ocean with which it was connected. In the Baltic there is an undercurrent inwards, which still keeps it brackish; for otherwise the influx of fresh water was so enormously in excess of the evaporation, that it would long ago have become perfectly fresh. Such facts bore materially on the speculations of the author. Capt. Spratt maintained that in the Dardanelles there was not a trace of such an undercurrent as mentioned by Dr. Carpenter. In the winter months, when the flow of the rivers into the Black Sea was for the most part arrested by ice, the salt water of the Mediterranean was carried into the inland seas, and these being much deeper than the channel of the Dardanelles, the salt water, by its greater specific gravity, remained in the bottom of the sea of Marmora, so that while the upper portion of the water and that on the shores were fresh, marine conditions existed in the deep centre of the sea. Dr. Duncan mentioned that in certain coral reefs intersected by freshwater currents, the corals still continued to be formed; so that the existence of dwarfed forms of corals in ancient times was quite consistent with modern facts. Mr. Forbes commented on the chemical features of Prof. Ramsay's views, and could see no reason why the beds containing iron should not have been deposited in the open sea. Many beds, for instance the Gault, contain more iron than those which are now red, though they may be grey or blue. In sands the grains are often coloured only superficially with iron, probably derived from sulphates. In other cases the sands consist of fragments of rocks already red. There was, in fact, no reason why the beds deposited in the open sea might not subsequently, by oxidation, become perfectly red. Prof. Ramsay replied to the remarks of the various speakers, and summed up by contrasting the usual colour of marine fossiliferous beds with that of the thick, almost non-fossiliferous rocks of which he had been treating

Anthropological Institute, March 20.—Sir John Lubbock, Bart., M.P., president, in the chair. Mr. William Sloan and Mr. John Edward Brearey, of Madras, were elected members. After the adjourned discussion of Mr. Jackson's paper, "The Racial Aspect of the Franco-Prussian War," Mr. Hyde Clarke read a paper "On the Migrations of the Georgians, Circassians, and Amazons, and their connection with the Tibeto-Caucasian race," of which the following is an abstract:—By means of the application of the Georgian, Circassian, and other existing languages *in situ*, the existence of a previous Georgian or Caucasian population was shown, and that the extent of its area was much greater than could have been suspected. This Palæogeorgian language had a much nearer relation to the existing languages than the Hieroglyphic to the Coptic, or the Cuneiform to the Syriac and Persian, but it was in a different and earlier stage of comparative grammar than the Hebrew or Sanskrit, and to which the Caffre group presents some resemblances of structure. The connection of the language with the comparative mythology of the worship of fire and water, gives further evidence as to the diffusion of a population which had held empire over India and thence to the Atlantic shores and these islands. Accepting as a doctrine the conquest of Palestine from the Canaanites and other races identified with the Caucaso-Tibetans, the period of empire would range from 3,500 to 4,500 years ago, during which the germs of the existing civilisation were developed. This population belonged to the family which includes the Tibetan and Chinese stocks. Many portions of the Mosaic record, considered to have been interpolated during the Babylonian captivity, now appeared to be of the greatest antiquity. Many subjects, corollary to the main discoveries, were touched upon, including the connection of the Etruscan, the Phrygian, the languages of Asia Minor, the Akkaa with the Palæogeorgian, also the Lydo-Assyrian rock-cut monuments, the Cyclopean buildings, the so-called Druidic structures, the discovery of metals, &c.

Royal Geographical Society, March 13.—Major-General Sir Henry C. Rawlinson, K.C.B., vice-president, in the chair. The following new Fellows were elected:—Sir James Anderson; W. Blackmore; R. B. Jackson, Sir Donald F. McLeod, K.C.S.I., C.B.; Capt. James Nicol; G. Wm. Petter. The paper read was, "On Mr. Baines's Explorations of the Gold-Fields of South Africa," by Dr. R. J. Mann, and was founded on the voluminous journals, itineraries, astronomical observations, &c., sent home by Mr. Thomas Baines, who had been employed, since the end of 1868, in making a general survey of the gold-yielding country lying between the Limpopo and Zambesi rivers. Leaving the Limpopo at its north-western bend, near the Makloutse and Shapsa rivers, he traversed, with his companions, the range of highlands separating the basins of the Zambesi and Limpopo, in a north-easterly direction, for 300 miles, negotiating with the powerful Matabele chiefs, fixing geographical positions, investigating the mineralogy, and sketching, with his well-known artistic skill, the scenery and people. His farthest point to the north was 17° 30′ S. lat., and in one part of his route he was within 120 miles of the Zambesi. On the route, the heads of a great number of streams were struck, flowing on the one side into the Zambesi, and on the other towards the Limpopo or Indian Ocean, the high land (averaging about 3000 feet) forming the watershed in this part of Africa. The country was healthy, but rather barren and arid, especially on the western slope of the watershed. The chief of the Matabele came to an amicable agreement regarding the working of the gold, which was found very widely distributed over the region, but only in quartz reefs, not in alluvial washing. Many additional particulars regarding the country were given, after the reading of the paper, by Sir John Swinburne, who travelled over most of the same ground, and partly in company with Baines. He said the dry uplands were totally unfit for European settlement, but the well-watered northern and eastern slopes were fertile, and adapted for all kinds of tropical produce. The rich, well-wooded country on the eastern side, rugged with precipitous hills and deep valleys, was inhabited by a superior negro tribe, called *Mashonas*, totally distinct from the invading Matabele of the opposite (western) side of the uplands. Whilst the Metabele—a section of Caffres—follow no arts but those of war, and go nearly

naked, the Mashonas are well clothed, and practise the art of smelting and working iron in great perfection. He exhibited a specimen of gold, weighing 27 ounces, extracted by his men from the quartz reefs. Mr. Galton spoke of the great additions made by Mr. Baines, in this journey, to our topographical knowledge of Africa; and Mr. Dunlop stated that quartz had now been found in the country yielding eight and ten ounces of gold to the ton, and that the country was a suitable field for British enterprise.

Linnean Society, March 16.—Mr. G. Bentham, president, in the chair. Col. Grant was elected a fellow.—Prof. Oliver exhibited specimens of *Cupania cinerea*, Poepp. belonging to the order Sapindaceæ, from the Kew Herbarium, in which the seed, partially surrounded by an arillus, splits open, and the exalbuminous embryo falls out, leaving the testa and arillus on the tree, the only instance known of such dehiscence of the seed itself.—An extract was read from a letter from General Munro to Dr. Hooker, describing the vegetation of a little known part of the island of St. Vincent, in the West Indies.—Mr. Henry Reeks exhibited a series of forms of *Aspidium* from Woodhay in Hampshire, which he considered showed a regular gradation between *A. aculeatum* and *A. angulare* of authors.—Notes on *Capparis galeata* and *C. Murrayii*, by Mr. N. A. Dalzell, who believes that these two perfectly distinct species have generally been confounded with one another.—Dr. B. Seemann exhibited a lamellicorn beetle from Nicaragua, one of the largest Coleoptera yet found in America.

Paris

Academy of Sciences, March 13.—A sharp discussion arose on reading the *procès verbal* of the last sitting. General Morin complained that it was stated by M. Sainte Claire Deville that science had not received proper application in warfare. He was obliged to confess that the French artillery was not up to the times, since they had no steel guns. Steel guns had been condemned as useless by the committee because His Majesty was a great artillerist.—The report of the death of M. Becquerel, sen., during the investment of Paris was stated to be incorrect. It was really M. Dumeril, the son of the celebrated electrician, who had died; M. Becquerel, sen., was not present at the sitting.—M. Leverrier was present at the sitting. M. Dumas read for the learned astronomer a long memoir on the Defence of the Rhone Valley, to which M. Leverrier was attached during the investment of Paris. He resided at Nîsmes and not at Marseilles, as had been said. The principal feature of this work is the construction of an apparatus for optical signalling. This apparatus can be used during day-time, and signals can be seen at a distance of eight miles by day with the naked eye.—M. Serret, President of the Scientific Delegated Commission at Tours and then at Bordeaux, read over a reclamation on behalf of M. Bouccarut, who claims a right to the invention of the instrument manufactured by M. Janssen for guiding aëronauts. M. Serret gave a certificate testifying that M. Bouccarut in the month of September communicated an instrument similar to M. Janssen's compass. If so why did the Delegated Scientific Commission keep the communication without warning the Government of National Defence at Paris, where the instrument was much wanted, as not less than ten balloons were lost, five of them in the sea, because aëronauts were unable to see their way? M. Delaunay read a declaration stating that he acknowledged that Mr. Hennessy had used the same arguments as himself against Mr. Hopkins' theory relative to the fluidity of the interior parts of the earth. But the adhesion given by Sir W. Thomson and other learned men to Mr. Hopkins' views is the reason why he did not regret having again raised this much controverted question.—M. de Fonvielle presented a paper explaining why the gas inside an aërostat very often suddenly increases in density. The phenomenon is common in warm weather when the gas is saturated with vapour from the water of the gasometer, and also when the balloon is rising at a quick rate. The increased density is owing to a quick refrigeration corresponding to the dilatation of the gas when the balloon is ascending to a higher level. It is an illustration of the law of equivalence of *force and heat*. It is the same experiment as is noted in Tyndall's special treatise on that subject, when damp air is placed under an air-pump worked at a certain rate. The movements of the balloon being able to be controlled, it is possible, through an aëronautical ascent, to come to a numerical conclusion.—M. Bouley delivered an interesting lecture on the cattle plague, which is one of the most important topics of the moment. He gave conclusive evidence that it was imported by the Prussian armies. The plague has had really terrific effects in the provinces. On a sea coast the carcasses of infected animals were so numerous that it was impossible to bury them. The authorities were obliged to fill with the putrid cargo old hulks, which were sunk by cannon balls from a distance. He said that infected animals were not unwholesome in their flesh. A secret committee was opened on the question, proposed by M. Sainte Claire Deville.

DIARY

THURSDAY, March 23.

Royal Society, at 8 30.—Experiments on the Successive Polarisation of Light, with the Description of a New Polarising Apparatus: Sir Charles Wheatstone, F.R.S.—On an Approximately Decennial Variation of the Temperature at the Observatory Cape of Good Hope, viewed in connection with the Variation of the Solar Spots: E. J. Stone, F.R.S.

Society of Antiquaries, at 8.30.—On Flint Implements and other Antiquities from Kent: J. Brent, F.S.A.—On Miscellaneous Antiquities from Leicestershire: Rev. Assheton Pownall, F.S.A.

Royal Institution, at 3.—Davy's Discoveries: Dr. Odling.

London Institution, at 7.30.—On the Colonial Question: Prof. J. E. Thorold Rogers, M.A.

FRIDAY, March 24.

Quekett Microscopical Club, at 8.

Royal Institution, at 9.—Colour: Prof Clerk Maxwell.

Royal College of Surgeons, at 4.—On the Teeth of Mammalia: Prof. Flower.

SATURDAY, March 25.

Royal Institution, at 3.—Spirit of the Age: Mr. O'Neil.

Royal School of Mines, at 8.—Geology: Dr. Cobbold.

MONDAY, March 27.

Royal Geographical Society, at 8.30.

Institute of Actuaries, at 7.—On the Equitable Appointment of a Fund between the Life-tenant and the Reversioner: Andrew Baden.

London Institution, at 4.—On Astronomy: R. A. Proctor. (Educational Course.)

Royal College of Surgeons, at 4.—On the Teeth of Mammalia: Prof. Flower.

TUESDAY, March 28.

Royal Institution, at 3.—Nutrition of Animals: Dr. M. Foster.

WEDNESDAY, March 29.

Society of Arts, at 8.—On Woman's Work, with Special Reference to Industrial Employments: Miss Emily Faithfull.

Royal College of Surgeons, at 4.—On the Teeth of Mammalia: Prof. Flower.

THURSDAY, March 30.

Royal Society, at 8.30.

Society of Antiquaries, at 8.30.

Royal Institution, at 3.—Davy's Discoveries: Dr. Odling.

London Institution, 7.30.—On Economic Botany: Prof. Bentley.

Chemical Society, at 8.—Anniversary Meeting.

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