tion, capable of giving resistances from 24 to 62,000 ohms.—M. Bourbouze, new models of hygrometers. In these instruments, which are modifications of the dew-point hygrometer, the formation of the first film of dew is observed by causing the deposit to be made on thin glasses which form the sides of the ether-chamber, when, on viewing a candle or other luminous point through the glass, coloured halos are visible.

## SOCIETIES AND ACADEMIES

### LONDON

**Royal Society,** December 10, 1885.—"On the Relation of the Reptiliferous Sandstone of Elgin to the Upper Old Red Sandstone." By Prof. John W. Judd, F.R.S., Sec.G.S.

The question of the geological age of the yellow sandstones of the district lying to the north of the city of Elgin has been, as is well known, the subject of very animated discussions among geologists. Some have even gone so far as to assert that the evidence on the question, which has been adduced by stratigraphists, is absolutely incapable of reconciliation with that relied upon by palæontologists.

After detailing the successive discoveries of fossils in these beds from 1844 to 1877, in which latter year Prof. Huxley published his well-known monograph on *Stagonolepis*, the author proceeds :—

In the year 1884 I saw in the Elgin Museum the cast of a skeleton which had recently been obtained from the new quarry near Elgin, to be more particularly referred to in the sequel. This fossil appeared to me to be so different from all the remains hitherto found in the formation, that I obtained an impression of it and submitted it to Prof. Huxley, who recognised in it certain characters distinctive of the Dinosauria. From the same quarry a skeleton apparently belonging to another lizard, distinct both from *Telerpeton* and *Hyperodapedon*, with portions of the skeleton of the last-named genus, were also obtained.

Returning to Elgin in the autumn of the present year, I was told by my friend Dr. Gordon that another reptilian specimen, including the skull and some other parts of the skeleton, had been found in the same quarry. On examining this specimen I at once saw that it exhibited the characteristic features of *Dicynodon*, and my opinion on the subject was confirmed by my friend Dr. Traquair, F.R.S., of Edinburgh, who, at my request, proceeded to examine the specimen. A second example of the same genus has since been discovered, and I trust that ere long a full account of this interesting form will be given by Dr. Traquair.

In addition to these facts, I may add that casts of teeth, undistinguishable from those of *Ceratodus*, were some time ago obtained from the Spynie quarries.

The present state of the palæontological evidence concerning the age of the beds then is as follows. The strata have yielded the remains of no less than *four* orders of reptiles, all of them belonging to forms very different from any which have been found in Palæozoic rocks. The Lacertilia are represented by *Telerpeton*, *Hyperodapedon*, and an undescribed form ; Crocodilia by *Stagonolepis ;* Dinosauria by an undescribed skeleton, and possibly by *Dasygnathus ;* and Dicynodontia by two individuals of the type genus. In addition to these we have a great number of footprints differing so greatly in form or size that they must probably have been made by creatures of very different proportions and organisation.

It will be seen from this summary that the palæontological evidence in favour of the Triassic age of the Elgin sandstones is now absolutely overwhelming. Besides the remains of *Hyperodapedon* and *Dicynodon*, genera which appear to be confined to Triassic strata, in districts so widely separated as South Africa, India, the Ural Mountains, and the British Islands, we have *Stagonolepis*, a crocodile with Mesozoic affinities, the highly organised lizard *Telerpeton*, and Dinosaurs ; the last-mentioned having never been found in any rocks older than Trias. *Ceratodus*, too, has usually been regarded as having commenced in the Trias, though it must be admitted that difficulty may exist in separating the cast found at Spynie from *Ctenodus*, which occurs in the Carboniferous, or *Dipterus*, which occurs in the Devonian.

Let us now inquire what is the nature of the stratigraphical evidence which has been regarded as opposed to the palæontological arguments in favour of the Triassic age of this formation. At the outset it is necessary to bear in mind two very important circumstances. First. The exposures of the Reptiliferous Sandstone and of the Upper Old Red in the district are more or less isolated, the greater part of the country being thickly covered by drift and other superficial deposits. Secondly. The whole of the rocks in the district exhibit evidence of having undergone great disturbance ; this is shown by their steep inclinations, and by the foldings and fractures which can often be recognised in the quarries opened in them.

The Reptiliferous Sandstone makes its appearance at the surface in two parallel ridges, ranging from north-east to south-west for a distance of about nine miles. The most northerly of these ridges extends from Brandenburgh to Burghead. Although the rocks are well exhibited both in sea-cliffs and in reefs on the shore, the only fossils obtained from them are the footprints of the Cummingston and Hopeman quarries, near the south-western extremity of the ridge, and the remains of *Stagonolepis*, *Telerpeton*, and *Hyperodapedon*, found in a single bed at Lossiemouth, at its north-eastern end. A tract of about three miles wide, thickly covered by superficial deposits, completely isolates the northern or coast ridge from the southern one, which is known as the Quarrywood ridge. In this Quarrywood ridge the Reptiliferous Sandstone is only found along its northern face for a distance of about three miles. The southern slope is composed of the ordinary rocks of the Upper Old Red Sandstone, containing *Holoptychius nobilissimus*, Ag., with species of *Glyptopomus* and *Pterichthys*. There is no evidence of the occurrence of Triassic strata, either along the southern slopes of the Quarrywood ridge or in the district lying still further south about the city of Elgin. The localities in which the sandstone containing reptiles has been found along the northern slope of the Quarrywood ridge are as follows :—At Spynie, which may be regarded as a north-eastern prolongation of the Quarrywood ridge, the deep quarries have yielded *Telerpeton*, *Hyperodapeton*, and *Ceratodus*. At Findrassie Wood, a mile and a half further to the south-west, a quarry, now abandoned, has yielded *Stagonolepis* and *Dasygnathus*. Lastly, the quarry near the top of the ridge, above New Spynie Church, and a mile and a half still further to the south-west than Findrassie, has yielded *Hyperodapedon* and another lizard with a Dinosaur and a Dicynodont.

In both the coast ridge and the Quarrywood ridge, as was well pointed out by Dr. Gordon, the Reptiliferous Sandstone is seen to be covered by a very peculiar and easily-recognisable deposit, known as the "Cherty rock of Stotfield." It has been frequently suggested that the preservation of these two sandstone ridges, and thus of the whole peninsula between Burghead Bay and Spey Bay, was in all probability due to the presence of this remarkable rock, which offers such resistance to the ordinary agents of denudation.[1] The rock consists of a more or less intimate admixture of siliceous and calcareous materials, including also crystallised patches of galena, blende, and pyrites ; it has yielded no trace of organic remains. Sir Roderick Murchison compared the "Cherty rock of Stotfield" with the Cornstones of the Old Red series, with which, however, they have but little in common ; and some confusion appears to have arisen from bands of true Cornstone, which occur in Upper Old Red Sandstone to the south of Elgin, with the Cherty rock of the Trias.

Prof. Harkness in 1864 was able to show that the positions in which the Cherty rock and the Reptiliferous Sandstone occur in the neighbourhood of Elgin are such as can only be explained by the existence of great faults. At a later date I showed how numerous are the indications of disturbance in the district—evidence of tilting of the beds, of actual contortion, and of fracture occurring in many of the quarries. On the north of the coast-ridge I have shown that beds of Inferior Oolite are found faulted against the Trias at Stotfield,[2] and probably also at Burghead. In the great "Scars," or reefs, which lie off this coast red sandstones are seen, and I have been assured that scales of *Holoptychius* occur in them. The presence of these great lines of dislocation is unquestionable, and in the paper referred to I have endeavoured by means of dotted lines to indicate the approximate position of some of them. It must be remembered, however, that in a country so deeply covered by drift as Northern Morayshire, the working out of the relations of the rock-masses by tracing their outcrops at the surface is an almost hopeless task.

As throwing an entirely new light on the age and relations of

[1] *Quart. Journ. Geol. Soc.* vol. xx. (1864), p. 424.
[2] *Ibid.* vol. xxix. (1873), p. 128, &c.

the Reptiliferous Sandstone of Elgin, I was able to show in the year 1873 that strata identical in character with that deposit and with the Cherty rock of Stotfield occur on the northern as well as on the southern side of the Moray Firth. At Dunrobin, in Sutherland, the yellow sandstones are seen covered by the Cherty rock, and this in turn is overlain in apparently conformable sequence by the various members of the Lias and Oolite. The whole of the Mesozoic strata of Sutherland are seen to be thrown by a great fault against the Lower Old Red and the crystalline rocks of the Highlands.

Although it is certain, however, that some of the cases of juxtaposition between the Old Red and the Triassic strata must be due to faulting, yet there were reasons for believing that the latter strata lie directly and unconformably upon the former. But, as was remarked by Dr. Gordon in 1877, "the district is so covered by drift that no junction of the Holoptychian and the Reptiliferous strata has been laid bare."

It was therefore with the greatest interest that in the summer of 1884 I learned from that veteran geologist, whose important services to science have extended over a period of more than half a century, that the bones of reptiles had at last been detected in the same quarry with the remains of *Holoptychius*. On repairing to Elgin, I found evidence that a somewhat coarse variety of the Reptiliferous Sandstone is seen passing downwards into a bed of conglomerate from three to four feet thick, which is known to the workmen as the "pebbly-post."

It was also found that the "pebbly-post," which in its lower portion becomes more perfectly conglomeratic, and contains pebbles of white and purple quartz up to the size of the fist, rests on beds of pink and red sandstones, very finely laminated, and exhibiting evidence of much false-bedding. These beds are strikingly different in character from the coarse-grained white sandstones lying above the "pebbly-post," in which the bedding is usually indistinct and imperfect. The stone lying below the conglomerate was found to be unsuited for building purposes, and the trial shaft, after being carried to the depth of thirteen feet in the bottom-rock, was abandoned; very fortunately, however, the last blast which was fired in it revealed a remarkably fine specimen of *Holoptychius*, which has been identified by Dr. Traquair as *H. nobilissimus*, Ag., and is now in the Elgin Museum.

These facts all point to the conclusion that the Reptiliferous Sandstone of Elgin passes downwards into a bed of conglomerate, which rests unconformably upon the strata of the Upper Old Red.

The Royal Society long ago testified its sense of the importance of determining the age and relations of the remarkable strata of Elgin, by appointing a Committee and making a grant from the Donation Fund to aid in securing new specimens of the fossils. Seeing, then, that an opportunity offered itself for determining the exact relations of the Reptiliferous to the Holoptychian beds, I preferred a request to the Council of this Society for a grant to be applied in excavations directed to uncovering the line of junction between the two beds.

My request having been granted, I had the great advantage of the aid and judicious counsel of Prof. T. G. Bonney, F.R.S., President of the Geological Society, in examining the section laid bare, and he permits me to state that he fully concurs in the following statement.

We were able to observe that, while the conglomerate of the "pebbly-post" graduates insensibly into the overlying Reptiliferous Sandstone, it is sharply divided from the red sandstones below. It was unfortunately found that, owing to the imperfect bedding of the upper series and the prevalence of oblique lamination in the lower one, it was impossible to obtain decisive evidence of a discordance of dip between them. But the line of junction between the two sets of strata showed every appearance of being an eroded one. We came to the conclusion that while the upper series having the "pebbly-post" for its base, is certainly perfectly distinct from the lower one, there can scarcely be the smallest doubt that the former rests unconformably upon the latter; in other words, the evidence points to the conclusion that during the vast periods of the Carboniferous and Permian, the Upper Old Red Sandstone of the Elgin area was upheaved and denuded, and the Upper-Trias beds were deposited unconformably upon their eroded surface.

The paper concludes with a *résumé* of all that is known of this formation, which has proved of such interest both to geologists and to biologists, and a comparison with the strata of the same age in other parts of Scotland and in Scandinavia.

**Zoological Society**, Jan. 19.—Prof. W. H. Flower, V.P.R.S., President, in the chair.—A letter was read from Dr. C. S. Minot (25, Mount Vernon Street, Boston, U.S.A.), calling attention to the Elizabeth Thompson Science Fund for the advancement and prosecution of scientific research, and inviting applications for assistance from it.—A communication was read from the Rev. T. R. R. Stebbing, containing descriptions of some new Amphipodous Crustaceans from Singapore and New Zealand.—Mr. Howard Saunders exhibited an adult specimen of the Sooty Tern (*Sterna fuliginosa*), caught alive near Bath, October 1885, and pointed out that only two examples of this species had as yet occurred in Great Britain.—Mr. H. J. Elwes read a paper on the butterflies of the genus *Parnassius*, having special relation to the development, functions, and structure of the horny pouch found in the females of this genus. He described the habits, distribution, and variations of twenty-three species which he recognised in the genus; and illustrated his remarks by the exhibition of a very complete collection of specimens and drawings. The paper was supplemented by Prof. Howes's remarks on his examination of the anatomy of the *Parnassius apollo*, and by Mr. Thomson's notes on the habits of the insects as bred in the Society's Gardens in 1885.—Mr. Oldfield Thomas, F.Z.S., read a paper containing a list of the specimens of mammals collected in various parts of India and presented to the British Museum by Mr. A. O. Hume, C.B. The series consisted of about 400 specimens, nearly all in excellent condition and with accurate localities attached to them. A new mouse from Tenasserim was proposed to be called *Mus humii*. A new Flying Squirrel from the Malay Peninsula was named *Sciuropterus davisoni*.—A communication was read from the Rev. Canon Tristram, containing the description of an apparently new species of duck (*Dafila*) from Sidney Island of the Phœnix group in the Central Pacific, which he proposed to name, from its extreme simplicity of plumage, *Dafila modesta*.—A communication was read from Mr. A. G. Butler, containing a description of the larva, pupa, and imago of a butterfly (*Aporia hippia*) from specimens bred in the Society's Gardens.

PARIS

**Academy of Sciences**, January 18.—M. Jurien de la Gravière, President, in the chair.—Memoir on M. de Saint-Venant and his scientific work, by M. Ed. Phillips.—On a new mercurial bath intended to deaden the vibrations of the ground, by M. Mouchez. This contrivance, at once simple and practical, has been invented by M. Gautier for the purpose of diminishing the vibrations of the ground at the Paris Observatory, caused by passing traffic. A cylindrical cast-metal basin containing the supply of quicksilver, has attached to the centre a wormed axis, to which is riveted a second and somewhat smaller basin furnished with a corresponding female-screw. The latter is pierced with a small aperture, through which the layer of quicksilver enters. This layer then becomes insensible to the vibrations, provided the screw be neither too tight nor too loose. The appliance has already yielded excellent results, for the first time enabling regular observations of the nadir to be taken at the Paris Observatory.—Remarks on MM. Paul and Prosper Henry's astronomical photographs, presented to the Academy by M. Mouchez. Since the proofs obtained of the Milky Way last June, MM. Henry have continued their labours with a success that has surpassed all hopes. The results already secured have been pronounced by competent judges the very perfection of astronomical photography, full of promise for the future of astronomy. Perfectly distinct images of several thousand stars down to the sixteenth and even the seventeenth magnitude have been obtained, as well as the nebula near Maia in the Pleiades and other objects absolutely invisible to the most powerful telescopes. Amongst other photographs presented are forty-two proofs of the Milky Way and various regions of the heavens; the neighbourhood of $\epsilon$ Lyræ showing some stars far smaller than the *debilissima* of Herschel, and below the sixteenth magnitude; the neighbourhood of Vega, with stars even feebler still than the foregoing, some of which have certainly never before been seen; the groups of Hercules, Sobieski, Ophiuchus, and Perseus, and over 600 images of double or multiple stars; a very successful photograph of the nebula of Orion and of several of the planets.—Note on the irreducible pure reciprocants of the fourth order, by Prof. Sylvester.—Note on an electric spectrum peculiar to the rare earths of the terbic group, by M. Lecoq de Boisbaudran.—Collection of plans or designs of ancient and modern vessels, with the elements necessary for their construction; third instalment.

presented to the Academy by Admiral Paris.—Considerations relative to the illumination of lighthouses by means of electricity, by M. Félix Lucas. It is shown that the voltaic arc presents two decided advantages over mineral oil: greater brilliancy and less expense. The only drawback is the somewhat capricious instability of its light, a defect so inherent in the nature of the voltaic arc, that at present it seems impossible completely to remove it.—Note on the solar statistics of the year 1885, by M. Rod. Wolf. The tabulated results of solar observations made at the Zurich Observatory, and of magnetic observations made at Milan, shows that the relative number and magnetic variation have both considerably diminished at about the same rate since the year 1884.—On hitherto unrecognised wave-lengths, by M. Langley. From his protracted researches the author concludes with some reserve that the radiations, whose lower limit was determined by Newton at 0·0007 mm., have now been extended to 0·0150 mm., that is to say, to over twenty times Newton's limit. Thus the great gap that existed between the lowest known vibration of light and the highest of sounds, has been partly filled up.—On the velocity of the flow of liquids, by M. Th. Vautier.—On the secondary or persistent luminous impressions, second note, by M. F. P. Le Roux. The author concludes for the present that the seat of the phenomenon, to which these persistent images are due, lies about the back part of the eyeball, and that probably one or more fluids play an important part in its production.—Action of the sulphur of antimony on the sulphur of potassium, by M. A. Ditte.—Note on a new synthesis of an inactive borneol, $C_{20}H_{16}(H_2O_2)$, by MM. G. Bouchardat and J. Lafont.—Action of high pressure on the animal tissues, by M. P. Regnard.—Influence of the anæsthesia produced by the inhalation of the protoxide of pure nitrogen on various functions of the animal system, by M. M. Laffont. This species of anæsthesia is not only more or less injurious in itself, but constantly causes functional disturbances, which may give rise to serious dangers, especially in certain physiological conditions.—Researches on the physiological and therapeutic action of acetophenone, by MM. Mairet and Combemale. From their experiments the authors conclude that acetophenone, which acts chiefly on the nervous system, is not a sedative, while its healing virtues appear to be very doubtful.—On the histogenesis of the elements contained in the ovaries of insects, by M. J. Perez.—A contribution to the study of the Eocene palms of West France, by M. Louis Crié.—Note on the Jurassic and Lower Cretaceous formations of the provinces of Grenada and Malaga, by MM. Marcel, Bertrand, and W. Kilian. These Andalusian formations appear to be of an essentially Alpine character, their composition resembling those of Sicily and South Tyrol. The upper layers also show strong analogies with the Balearic Islands, the Apennines and Alps of Lombardy.—Note on the photography of speech and its reproduction by oxhydric projection, by M. Léon Esquile. The author claims to have succeeded, by means of the photophone, in fixing on a photographic plate the modulations of the voice, afterwards reproducing the words by the telephone, projecting in oxyhydric light the positive image of the plate on Mercadier's selenium receiver.—The election was announced of M. Boussinesq as member of the Section for Mechanics, in place of the late M. Rolland.—The Academy was informed by the Mayor of Chamounix that the commune of Chamounix intended celebrating the centenary of the first ascent of Mont Blanc by de Saussure in the month of August 1887, when a monument erected to his memory will be unveiled. Subscriptions for the monument will be received by the Secretary of the Institute.

### BERLIN

**Physical Society,** November 20, 1885.—Dr. Gerstmann having given a report on the "Molecular Physics" of Herr Wittwer, Prof. Schwalbe delivered an address on wind-holes and ground-temperatures, a theme on which he has frequently before made communications to the Society. Notwithstanding that he had been engaged for years in the study of ice-cavities and wind-holes, the speaker had yet arrived at no conclusive judgment respecting the cause of them. Having been prevented in 1884 from instituting observations of his own, he had collected the literature of the subject, and had ascertained that ice-cavities and wind-holes were very widely diffused, but had not yet excited general interest to such a degree as to have become the subject of continuous observations. In the summer of 1885 Prof. Schwalbe made a searching investigation into the cold cavities and wind-holes in the neighbourhood of Questenberg, in the Southern Hartz. The gypsum here constituting the main mass of the soil showed very many cavities and wind-holes. The ice-cavity he had described on a former occasion, with its entrance by a smooth gypsum wall, was found by him this year entirely free of ice, and the temperature of the air in it was, on three different visits, always between 4° and 5° C. On the other side of the gypsum mountain he found a hole which, on former visits, was almost entirely filled with water, but was on this occasion quite dry, so that it could be examined to the interior extremity. Here, too, he found a low and uncommonly constant temperature of 5° in the proximity of the mouth, and of 4° at the far end. A large number of more or less small holes, whence cold air issued, was found on the same side of the mountain, which was almost bare, except for a few fruit-trees. Occasionally these holes were very close to the surface illumined by the sun, and yet their temperature, in all kinds of weather, was perfectly constant and low, mostly from 4° to 5°,—in one case 0°. Although, too, most of these cavities communicated by broader or narrower crevices with the interior of the gypsum mountain, yet nowhere in them could there be demonstrated any stronger current of air that might be claimed as the cause of a more powerful evaporation and cooling. Prof. Schwalbe, in conclusion, drew attention to two interesting phenomena he had observed in the gypsum strata of the Southern Hartz. These were the sinking of rivers, often accompanied by loud uproar, and the occurrence of intermittent lakes. The so-called "Bauerngraben" (peasants' ditch), near Rosslau, was, even in the last century, as the old contracts between the two neighbouring villages proved, sometimes a lake serving the one village for fishing purposes, and sometimes dry land, which was then tilled by the other village. Several channels at the bottom of the lake led to the interior of the gypsum rock, nevertheless the water, when it gathered here, stood for several years at a depth of from 10 to 15 metres, suddenly to disappear again. In the years 1876, 1877, and 1878 the "Bauerngraben" was filled with water, and since this last date it had been dry land. The meteorological conditions appeared to exercise no influence on this phenomenon. The cause of the sudden accumulation of water, and the just as sudden desiccation, was yet wholly unknown.

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