AMONG recent additions to the Manchester Aquarium are the following:—1 Smooth Hound or Skate-Toothed Shark (*Mustelus vulgaris*); 2 Topers or White Hound (*Galeus canis*); 2 Picked Dog-fish (*Acanthias vulgaris*); 4 Lesser Spotted Dog-fish (*Syllium canicula*); 4 Greenland Bullheads (*Cottus grænlandicus*); 3 Gemmeous Dragonets (*Callionymus lyra*); 5 Cat or Wolf-fish (*Anarhicus lupus*); 2 Tadpole Fish (*Raniceps trifurcus*); Zoophytes—*Actinoloba dianthus*, *Sagartia bellis*, *S. nivea*, *S. viduata*, *S. miniate*, *Tealia crassicornis*.

THE additions to the Zoological Society's Gardens during the past week include a Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Captain Webster; two Rhesus Monkeys (*Macacus erythræus*) from India, presented by Mr. W. Dunn; a Chinese Turtle Dove (*Turtur chinensis*), from India, presented by Major F. Gildea; a Canadian Beaver (*Castor canadensis*) and a Virginian Deer (*Cervus virginianus*), born in the Gardens; a Lanner Falcon (*Falco lanarius*), from east Europe, purchased.

SCIENTIFIC SERIALS

Transactions of the Norfolk and Norwich Naturalists' Society, 1873-74 (Norwich: Fletcher & Son).—This Society is now in the fifth year of its existence, and is in a satisfactory condition as to members. The chief features of the present number of its "Transactions" are Parts IV. and V. of the "Fauna and Flora of Norfolk," which the Society has undertaken to publish. Part IV., by Dr. John Lowe, embraces a list of the fishes known to occur in the Norfolk waters; and Part V. (forming a separate supplement), the Norfolk Lepidoptera, by Mr. C. G. Barrett. Both lists appear to have been done with great care and caution, and we should think that Dr. Lowe and Mr. Barrett have left very little to be added. The catalogues reflect the greatest credit both upon the compilers and on the Society, a few of the wealthier members of which have contributed the greater part of the expense of printing the present supplement. The next instalment of this important work of the Norfolk Society will contain the flowering plants, by Mr. H. D. Geldart. The president's address gives a *résumé* of the year's work of the Society, and discusses the question of Biogenesis.—Mr. F. D. Wheeler contributes a paper On breeding Lepidoptera in confinement, giving the results of the author's own experience; and Mr. F. Kitton one On Empusca and other micro-fungi.—In a short paper by Mr. J. B. Bridgman On the nidification of the Prosopis, the author concludes that this bee forms its "nest in any suitable situation, whether in soft earth or wood, not even despising ready-formed holes, and that it collects and carries home pollen in its mouth, after working it up in a pellet."—Mr. John Quinton contributes notes On the meteorological observations recorded at Norwich during the years 1870 73.—A variety of interesting miscellaneous natural history notes conclude the number. Altogether this Society must be congratulated on its year's work; its first object is "the practical study of natural science," which it seems to be carrying out with considerable faithfulness.

Proceedings of the Bath Natural History and Antiquarian Field Club, vol. iii. No. 1. 1874. This Society, to judge from this number of its "Proceedings," seems to devote itself mainly to antiquarian research, "Natural History," though it comes first in its title, seeming to find but small favour among the members. This defect the secretary animadverts strongly upon in his "Summary of Proceedings," stating, moreover, that the club was originally started for the purpose of botanical research. We do not undervalue antiquarian research, but we think it a pity that a club containing so many intelligent and well-educated members should fritter away almost its entire time and strength in a department that could be very satisfactorily worked by a small proportion of its members, to the almost entire neglect of the rich field presented by the district around Bath for Natural History investigation. We hope that the next number of its Proceedings will show that the suggestions of the secretary have been adopted. The only two natural history papers in this number are by Mr. C. E. Broome, F.L.S., On some of the fungi found in the Bath district, the present paper including Order 10, Myxogasters, and a short note by the Rev. Leonard Blomefield, F.L.S., On the occurrence of the Land Planaria (*Planaria terrestris*) in the neighbourhood of Bath. Dr. Bird was the first to discover this animal (supposed to be the only species of Land Planaria in western Europe) in the Bath district, and Mr. Blomefield is inclined to believe it to be carnivorous, making a prey of the smaller land molluscs. The secretary gives an extremely interesting summary of the meetings and excursions of the Society during 1873-74.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, June 1.—The observations of M. Marié Davy on the diminution of certain river waters in France are here closed with a discussion on the influence of different kinds of vegetation growing in their basins. It is shown that waste open land evaporates the least amount of rain-water, and forests less than corn or other farm produce. The increase of high farming and artificial meadow-land, absorbing and evaporating much moisture, must diminish the size of streams by robbing them of part of their supply, and to keep up the summer flow of a river it might be thought desirable to plant its upper basin with forests. Comparison of different rivers shows, however, that no valuable addition would thus be gained. Whatever be the origin of the river, geological conditions are alone effective. Therefore, although as a measure of national economy, for fixing soil on slopes, mitigating floods and changes of level, and providing cheap fuel, the maintenance of forests would be beneficial, we must look forward to a time when the art of storing some of the excess of winter rainfall to supply the needs of summer will be adopted in agriculture.—Among the "Kleinere Mittheilungen," Prof. Prestel deduces from twenty years' measurement of ozone a result similar to that of Herr Karlinski at Krakau, showing a minimum in November or December and a maximum in the spring.—The work of Herr Edlund on the mean temperature of Sweden, and a delicate form of Goldschmidt's aneroid, are here noticed.

Schriften der Naturforschenden Gesellschaft in Danzig, 1873.—The history of the population in the eastern provinces of Prussia is still involved in much obscurity, while that of the remaining provinces is pretty accurately known. In one of the papers in this volume Dr. Marshall considers the evidence obtainable from early writers—Pliny, Tacitus, &c.—from names of persons and places, and more especially from the archæological collections, of which there are two, imperfectly arranged, in Königsberg. From a study of grave-relics, Dr. Marshall is led to the conclusion that, at one time, in these eastern provinces two distinct races lived together. Several races having come from the east and settled in the coast-lands of the Baltic, more than 1,000 years B.C., this land was, later, overrun by Goths from central Russia, many of whom pressed on to Scandinavia and the Danish Islands, and to western and southern Europe; but a number remained on the amber coast, especially in the Weichsel region, and became fused with the Aestian or Wend race, already there; they were together known as *Pruzzen*.—Among the papers is another giving an account of a chemical analysis (made by direction of Dr. Friederici) of certain empty grave-urns of the ancient Prussians, the significance of which has not been clearly ascertained. Dr. Friederici thinks they were in themselves sacred vessels; they are made not from clay, but from ashes, firmed probably with blood of animals killed in sacrifice. In heating, the blood and the carbon particles at the surface had been turned to ashes, presenting a reddish-yellow appearance, while the internal substance was merely carbonised, and darker in colour.—Dr. Lissauer gives an account (with excellent photographs) of some more of those curious face-urns that have been found in large numbers in certain parts of Pomerania; and M. Kasioki describes a number of antiquities of various kinds discovered in Pomerania during 1872.—Dr. Lebert, who has been experimenting on the fluorescence of some specimens of Sicilian amber, finds the phenomenon in these much more marked and frequent than in Prussian amber; in the case of the latter he has observed, with strong sunlight, not only the existence, but the manifold character of the cone of light.—A valuable paper on new and extended employment of the level for astronomical and geodetic measurements is contributed by M. Kayser, and M. Menge continues a list and description of Prussian spiders.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 18.—On the Forces caused by Evaporation from and Condensation at a Surface, by Prof. Osborne Reynolds, of Owens College, Manchester.

It has been noticed by several philosophers, and particularly by Mr. Crookes, that, under certain circumstances, hot bodies appear to repel and cold ones to attract other bodies. It is my object in this paper to point out and to describe experiments to prove that these effects are the results of evaporation and condensation; and that they are valuable as evidence of the truth of the kinetic theory of gas, viz. that gas consists of separate molecules moving at great velocities.

The experiments of which the explanation will be given were as follows:—

A light stem of glass, with pith-balls on its ends, was suspended by a silk thread in a glass flask, so that the balls were nearly at the same level. Some water was then put in the flask and boiled until all the air was driven out of the flask, which was then corked and allowed to cool. When cold there was a partial vacuum in it, the gauge showing from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch pressure.

It was now found that when the flame of a lamp was brought near to the flask the pith-ball which was nearest the flame was driven away; and that with a piece of ice the pith was attracted.

This experiment was repeated under a variety of circumstances, in different flasks and with different balances, the stem being sometimes of glass and sometimes of platinum; the results, however, were the same in all cases, except such variations as I am about to describe.

The pith-balls were more sensitive to the heat and cold when the flask was cold and the tension within it low, but the effect was perceptible until the gauge showed about an inch, and even after that the ice would attract the ball.

The reason why the repulsion from heat was not apparent at greater tensions was clearly due to the convection currents which the heat generated within the flask. When there was enough vapour, these currents carried the pith with them; they were, in fact, then sufficient to overcome the forces which otherwise moved the pith. This was shown by the fact that when the bar was not quite level, so that one ball was higher than the other, the currents affected them in different degrees; also that a different effect could be produced by raising or lowering the position of the flame.

The condition of the pith also perceptibly affected the sensitiveness of the balls. When a piece of ice was placed against the side of the glass, the nearest of the pith-balls would be drawn towards the ice, and would eventually stop opposite to it. If allowed to remain in this condition for some time, the vapour would condense on the ball near the ice, while the other ball would become dry (this would be seen to be the case, and was also shown by the tipping of the balance, that ball against the ice gradually getting lower). It was then found when the ice was removed that the dry ball was insensible to the heat, or nearly so, while that ball which had been opposite to the ice was more than ordinarily sensitive.

If the flask were dry and the tension of the vapour reduced with the pump until the gauge showed $\frac{3}{8}$ of an inch, then, although purely steam, the vapour was not in a saturated condition, and the pith-balls which were dry were no longer sensitive to the lamp, although they would still approach the ice.

From these two last facts it appears as though a certain amount of moisture on the balls was necessary to render them sensitive to the heat.

In order that these results might be obtained it was necessary that the vapour should be free from air. If a small quantity of air was present, although not enough to appear in the gauge, the effects rapidly diminished, particularly that of the ice, until the convection currents had it all their own way. This agrees with the fact that the presence of a small quantity of air in steam greatly retards condensation and even evaporation.

With a dry flask and an air-vacuum, neither the lamp nor the ice produced their effects; the convection currents reigned supreme, even when the gauge was as low as $\frac{1}{4}$ inch. Under these circumstances the lamp generally attracted the balls and the ice repelled them, *i.e.* the currents carried them towards the lamp and from the ice; but by placing the lamp or ice very low the reverse effects could be obtained, which goes to prove that they were the effects of the currents of air.

These experiments appear to show that evaporation from a surface is attended with a force tending to drive the surface back, and condensation with a force tending to draw the surface forward. These effects admit of explanation, although not quite as simply as may at first sight appear.

Although there must always be reaction corresponding to the visible motion, whenever vapour is driven off from a surface, this visible motion is too small to account for the forces under consideration. But, although it appears to have escaped notice so far, it follows as a direct consequence of the *kinetic* theory of gases that whenever evaporation takes place from the surface of a solid body or a liquid, it must be attended with a reactionary force equivalent to an increase of pressure on the surface, which force is quite independent of the perceptible motion of the vapour. Also condensation must be attended with a force equivalent to a diminution of the gaseous pressure over the condensing surface, and likewise independent of the visible motion of the vapour. This may be shown to be the case as follows:—

According to the kinetic theory the molecules which constitute the gas are in rapid motion, and the pressure which the gas exerts against the bounding surfaces is due to the successive impulses of these molecules, whose course directs them against the surface, from which they rebound with unimpaired velocity. According to this theory, therefore, whenever a molecule of liquid leaves the surface henceforth to become a molecule of gas, it must leave it with a velocity equal to that with which the other particles of gas rebound—that is to say, instead of being just detached and quietly passing off into the gas, it must be shot off with a velocity greater than that of a cannon-ball. Whatever may be the nature of the forces which give it the velocity, and which consumes the latent heat in doing so, it is certain, from the principle of conservation of momentum, that they must react on the surface with a force equal to that exerted on the molecule, just as in a gun the pressure of the powder on the breech is the same as on the shot.

The impulse on the surface, from each molecule which is driven off by evaporation, must therefore be equal to that caused by the rebound of one of the reflected molecules (supposing all the molecules to be of the same size), that is to say, since the force of rebound will be equal to that of stopping the impulse from a particle driven off by evaporation will be half the impulse received from the stopping and reflection of a particle of the gas. Thus the effect of evaporation will be to increase the number of impulses on the surface; and, although each of the new impulses will only be half as effective as the ordinary ones, they will add to the pressure.

In the same way, whenever a molecule of gas comes up to a surface and instead of rebounding is caught and retained by the surface, and is thus condensed into a molecule of liquid, the impulse which it will thus impart to the surface will only be one-half as great as if it had rebounded. Hence condensation will reduce the magnitude of some of the impulses, and hence will reduce the pressure on the condensing surface.

This explanation is then put in a mathematical form, and the paper proceeds.

Applying these results to steam, we find that at a temperature of 60° the evaporation of 1 lb. of water from a surface would be sufficient to maintain a force of 65 lbs. for one second.

It is also important to notice that this force will be proportional to the square root of the absolute temperature, and consequently will be approximately constant between temperatures of 32° and 212°.

If we take mercury instead of water, we find that the force is only 6 lbs. instead of 65; but the latent heat of mercury is only $\frac{1}{30}$ that of water, so that the same expenditure of heat would maintain nearly three times as great a force.

It seems, therefore, that in this way we can give a satisfactory explanation of the experiments previously described. When the radiated heat from the lamp falls on the pith its temperature will rise, and any moisture on it will begin to evaporate, and to drive the pith from the lamp. The evaporation will be greatest on that ball which is nearest to the lamp, therefore this ball will be driven away until the force on the other becomes equal, after which the balls will come to rest, unless momentum carries them further. On the other hand, when a piece of ice is brought near the temperature of the pith it will be reduced, and it will condense the vapour and be drawn towards the ice.

The reason why Mr. Crookes did not obtain the same results with a less perfect vacuum was because he had then too large a proportion of air or non-condensing gas mixed with the vapour, which also was not in a state of saturation. In the experiments the condensable vapour was that of mercury, or something which required a still higher temperature, and it was necessary that the vacuum should be very perfect for such vapour to be anything like pure and in a saturated condition. As soon, however, as this state of perfection was reached, then the effects were more

apparent than in the corresponding case of water. This agrees well with the explanation; for, as previously shown, the effect of mercury would for the same quantity of heat be three times as great as that of water; and besides this, the perfect state of the vacuum would allow the pith (or whatever the ball might be) to move much more freely than when in the vapour of water at a considerable tension.

Of course the reasoning is not confined to mercury and water; any gas which is condensed or absorbed by the balls when cold in greater quantities than when warm would give the same results; and as this property appears to belong to all gases, it is only a question of bringing the vacuum to the right degree of tension.

There was one fact connected with Mr. Crookes' experiments which, independently of the previous considerations, leads me to the conclusion that the result was due to the heating of the pith, and was not a direct result of the radiated heat.

In one of the experiments exhibited at the Soirée of the Royal Society, a candle was placed close to a flask containing a bar of pith suspended from the middle; at first the only thing to notice was that the pith was oscillating considerably under the action of the candle; each end of the bar alternately approached and receded, showing that the candle exercised an influence similar to that which might have been exercised by the torsion of the thread had this been stiff. After a few minutes observation, however, it became evident that the oscillations continued instead of gradually diminishing, as one naturally expected them to do; and, more than this, they actually increased, until one end of the bar passed the light, after which it seemed quieter for a little, though the oscillations again increased until it again passed the light.

The explanation given is that, owing to the slowness with which the pith takes in and gives out heat, its ends will on the whole be hotter while receding from than while approaching the candle, and hence the force, as a mean, will be greater on that end which is receding, and there will be a continual oscillation.

Since writing the above paper, it has occurred to me that, according to the kinetic theory, a somewhat similar effect to that of evaporation must result whenever heat is communicated from a hot surface to gas.

The particles which impinge on the surface will rebound with a greater velocity than that which they approached, and consequently the effect of the blow must be greater than it would have been had the surface been of the same temperature as the gas.

And in the same way whenever heat is communicated from a gas to a surface the force on the surface will be less than it otherwise would be, for the particles will rebound with a less velocity than that at which they approach.

It is then shown mathematically, that for every English unit of heat communicated to steam at a temperature of 60°, the reaction on the surface is equivalent to ·38 lb. acting for one second; and in the same way for air the force is equivalent to ·55 lb. It is also pointed out that since the diffusion of heat within a gas is inversely proportional to its density, the amount of heat communicated from a surface to the surrounding gas is independent of the density of the gas, and hence, that the reaction on the pith in Mr. Crookes' experiments would remain constant as the vacuum improved, while the counteracting forces would diminish and leave the balls more free to move. It is therefore assumed that the results obtained in those experiments might have been at least in part due to such forces.

Linnean Society, June 19.—Dr. G. J. Allman, F.R.S., president, in the chair.—Mr. D. Hanbury, treasurer, exhibited branches of olive grown in the open air at Clapham, some bearing flowers, others nearly ripe fruit; also a specimen of *Rheum officinale* Baill., now grown in this country for the first time, the source of the true medicinal Turkey rhubarb, and pointed out the characters in which it differs from other species of the genus.—Dr. Hooker made a communication on the subject of some India *Garcinias* to the effect:—(1) That the *G. indica* Chois. (*purpurea* Roxb.), had been placed in a wrong section in Anderson's review of the genus in the "Flora of British India." (2) That the plant described in the same work as *G. griffithii* is proved to be the true Gamboge plant of Siam, *G. pinella*, var. *pedicellata* of Hanley, which Dr. Hooker regards as a distinct species, and proposes that the name of *G. hanburyi* should be given to it. (3) That the *G. brevirostris* of Scheffer is identical with *G. eugeniæfolia* of Wallich. (4) That the name of *G. ovalifolia* Hook. f., must give place to the previously published *G. ovalifolia* of Oliver's "Flora of Tropical Africa;" and the Indian plant must take the name of *spicata*, it being a form of *Xanthochymus spicatus* W. et A.—Prof. Thiselton Dyer exhibited a young oak-plant with three cotyledons, which had been sent to him by Mr. Cross, of Chester; also a pitcher-like development of a leaf of the common cabbage, from Harting, Sussex, sent by Mr. H. C. Watson to the Kew Museum.—Mr. A. W. Bennett exhibited drawings of the style, stigma, and pollen-grain of *Pringlea antiscorbutica* Hook. f., describing the remarkable manner in which the pollen of *Pringlea* differs from that of other nearly allied Crucifers, being much smaller and perfectly spherical, instead of elliptical with three furrows. This he considered a striking confirmation of Dr. Hooker's suggestion that we have here a wind-fertilised species of a family ordinarily self-fertilised, a hypothesis which is again confirmed by the total absence of hairs on the style of *Pringlea*.—An extract was read of a letter from Mr. Harry Bolus to Dr. Hooker, F.RS., dated Graaf Reinet, April 4, 1874, in which he comments adversely on some of the reasonings contained in Grisebach's "Vegetation der Erde" in favour of the theory of "independent centres of creation." Grisebach, relying chiefly on an observation of Burchell's, makes the Orange river the boundary between the Cape and Kalahari provinces, a boundary which Mr. Bolus shows to be untenable, at least in certain portions. Grisebach unites the Kanoo flora with that of the Cape province; while Mr. Bolus doubts whether it does not differ more from this than from the Kalahari. The Roggeveld, and indeed the whole Kanoo, by its predominance of shrubby Compositæ, seems to incline more to the desert type of plants than to the richer Cape flora.—The following papers were then read, viz.:—On the resemblances between the bones of typical living reptiles and the bones of other animals, by Harry G. Seeley.—On the Auxemmeæ, a new tribe of Cordiaceæ, by J. Miers.—A revision of the sub-order Mimoseæ, by G. Bentham, LL.D.—On some fungi collected by Dr. S. Kurz in Yomah, Pegu, by F. Currey.—Notes on the letters from Danish and Norwegian naturalists contained in the Linnean correspondence, by Prof. J. C. Schiödte, of Copenhagen.

Geological Society, June 10.—John Evans, F.R.S., president, in the chair.—The following communications were read:—On the occurrence of Thanet-beds and a crag at Sudbury, Suffolk, by William Whitaker. After referring to some passages in papers by Mr. Prestwich, in which the probable existence of Thanet-beds in North Essex is mentioned, the author described certain sections near Balingdon, on the right bank of the Stour, which exhibit sands belonging to this series. The crag-beds described by the author are found on the left bank of the Stour, in Suffolk, and consist of ferruginous dark reddish-brown sand, with layers of ironstone, slightly false-bedded, with here and there light-coloured grit with broken shells.—Notes on the phenomena of the Quaternary Period in the Isle of Portland and around Weymouth, by Joseph Prestwich, F.R.S. Commencing with the oldest drift-beds, the author showed that the remains of one, formerly more extensive, had been found in the Isle of Portland at a height of 400 ft. above the sea; that it contained the remains of the *Elephas antiquus*, *Equus fossilis*, &c.; and that he found in this bed a number of pebbles of sandstone and ironstone of Tertiary age, and of chert from the Greensands, whence he inferred that, as such pebbles could not now pass over the plain of Weymouth, they must have done so before that area was denuded, and when bridged over by the Portland and Purbeck beds; for the pebbles are derived from beds which are only *in situ* to the north of the Weymouth district, and at a distance of eight to ten miles from Portland. Further, this transport must have taken place before the elevation of the north end of Portland, and when the slope from the Bill to the Ridgeway was uniform and gradual. The anticlinal line, which has elevated the intermediate area, must be of later date than the drift-bed. The author next proceeded to notice the raised beach at the Bill of Portland, in which he had, with the assistance of Mr. Jeffreys, determined twenty-six species of shells, two of them not now living in the British Channel, and one new. This beach contains pebbles of the Devonshire and Cornwall rocks. The raised beach Mr. Prestwich found to abut against an old cliff that had been swamped at a later geological period by a land-wash, which had levelled it and the old sea-land with the adjacent land-surface. The mass which had thus swamped the cliff and buried the beach consisted of loam and angular *débris*, the latter being in larger proportion at top. In the loam he found several species of land and fresh-water shells and fragments of bones. The angular *débris* consisted of pieces of the local rocks, together with a number of specimens, which by their organic remains were

shown to belong to the Middle Purbecks, a part of the series not now existing in Portland. A similar bed, but much thicker, was then described at Chesilton, in the north of the island. It is there 60 ft. thick, and contains large blocks of Portland stone and Portland chert, the greater number of which are in the upper part of the deposit, which is here on the sea-level, and 400 ft. lower than the Portland escarpment which rises above it. This loam and angular *débris* the author was disposed to attribute to a temporary submergence of the land to a depth exceeding the height of Portland, and by which the land as it emerged was swept, and its *débris* carried down to the lowest levels, with the remains of its land-animals and land and fresh-water shells, which latter, where protected by large masses of loam and suddenly entombed, have been preserved uninjured. To this deposit, which is common over the raised beaches on the south coast, the author proposed to apply the term "land-wash." The paper concluded with a short notice of the drift-beds formed subsequently to the denudation of the Weymouth district, and therefore never on the high-level Portland drift.—On the character of the diamantiferous rock of South Africa, by Prof. N. Story Maskelyne, F.R.S., Keeper, and Dr. Flight, Assistant, of the Mineralogical Department, British Museum. In this paper the authors confirmed certain statements made by one of them from a superficial examination of specimens brought to this country by Mr. Dunn. The specimens examined and analysed by Dr. Flight were obtained from various diggings and from different depths, down to 180 ft. in the case of one mass from Colesberg Kopje. Their characters throughout are essentially the same. The rock consists of a soft and somewhat pulverulent ground-mass, composed of a mineral (soapy to the touch) of a light yellowish colour in the upper, and of an olive-green to bluish-grey colour in the lower parts of the excavations. Interspersed in the mass are fragments of more or less altered shale, and a micaceous-looking mineral of the vermiculite group, which sometimes becomes an important constituent of the rock, which also contains bright green crystals of a ferruginous enstatite (bronzite), and sometimes a horn-blendic mineral closely resembling smaragdite. A pale buff bronzite occurs in larger fragments than the green form of the mineral; and in the rock of Du Toit's pan an altered diallage is present. Opaline silica, in the form of hyalite or of hornstone, is disseminated through the greater part of the rock-masses, and they are everywhere penetrated by calcite. The analyses of the component minerals (given in detail in the paper) show that this once igneous rock is a bronzite rock converted into a hydrated magnesium silicate, having the chemical characters of a hydrated bronzite, except where the remains of crystals have resisted metamorphism. Except in the absence of olivine and the small amount of augitic mineral, it might be compared with the well-known Lherzolie rock. The diamonds are said to occur most plentifully, or almost exclusively, in the neighbourhood of dykes of diorite which intersect the hydrated rock, or occur between it and the horizontal strata through which the igneous rocks have been projected. The authors compare the characters of the diamonds found in different positions, and come to the conclusion that their source is not very remote from that in which they are now found. The mineral above-mentioned as resembling vermiculite is described by the authors as a new species under the name of Vaalite.—Note on a modified form of Dinosaurian ilium, hitherto reputed scapula, indicative of a new genus, or possibly of a new order of reptiles, by J. W. Hulke, F.R.S. The author re-examines Mantel's "Scapula of an unknown reptile" = Owen's "Scapula of Megalosaurus?" and adduces reasons for considering it to be a modified Dinosaurian ilium. He describes two new examples of the bone in Dr. Wilkins's collection, contrasts them with undoubted scapulæ of sundry Dinosaurs and existing reptiles, and proves their essential correspondence with the ilia of known Dinosaurs.—Note on a reptilian tibia and humerus (probably of *Hylæosaurus*) from the Wealden formation in the Isle of Wight, by J. W. Hulke, F.R.S. In this communication the author describes two saurian limb-bones, remarkable for the great expansion of their articular ends, and the shortness and smallness of their shaft. The features of the tibia are more like those of the tibia of *Hylæosaurus* than of any other Dinosaur. This resemblance, and the suitability of the humerus to the very massive articular end of the Hylæosaurian scapula, dispose the author to refer the bones to this saurian.

Royal Horticultural Society, June 17.—Scientific Committee.—Dr. J. D. Hooker, C.B., P.R.S., in the chair.—Specimens of *Puccinia malvacearum* (the hollyhock disease) were exhibited from Mr. Fish.—Dr. Masters showed a large slab of the wood of the Encine (*Quercus humilis*).—Mr. Worthington Smith exhibited a woodcut block of ebony which he pronounced nearly as good as box, but objectionable on account of its dark colour.—Dr. Denny showed flowers of a scarlet Pelargonium raised by him, in which the petals were remarkably persistent. He had obtained this horticulturally desirable quality by continuous breeding and selection from a variety originally manifesting it in a smaller degree.

General Meeting.—W. A. Lindsay, secretary, in the chair.—Prof. Thiselton Dyer commented on the interesting series of lilies exhibited by Mr. Barr, which illustrated four distinct geographical races all belonging in a wide sense to the same species. *Lilium bulbiferum*. *L. bulbiferum* proper was wild in Austria and Sweden; *L. croceum* in France, Switzerland, and North Italy; *L. davuricum* in Siberia, *L. thunbergianum* in Japan. It could not be doubted that these were all derived from a common parentage, and had been gradually differentiated as they migrated in different directions and became isolated.—He also described the coffee blight of Ceylon and South India (*Hemileia vastatrix*). A dried bush exhibiting the effects of the disease was shown on the table.—Dr. Hooker illustrated in some detail the light which the theory of a common parentage threw on the geographical distribution of closely allied species, varieties, or forms. He pointed out as particularly striking cases the cedars and the 5-leaved pines. As to the *Hemileia* it could not be doubted that it was a most serious enemy for the planters to contend with. He thought, however, that there was some hope that particular kinds of coffee might be found to be less liable to its attacks than others, and at Kew he had been making great efforts to procure and raise from seed the remarkably large-seeded West African kind with a view to its transmission to Ceylon.

Anthropological Institute, June 23.—Prof. Busk, F.R.S., president, in the chair.—Mr. Robert Dunn read a paper On ethnic psychology. The author dwelt on the importance of carefully studying the cerebral organisation of the typical races as the only way of elucidating the psychological differences which exist among them. Notwithstanding the labours of Gratiolet in that field of inquiry, a vast deal remained to be done. The author's convictions rested on the postulate that the brain is the instrument of the mind, and the consequent corollary was that the distinguishing psychical differences existing between various peoples depend greatly, if not altogether, on the structural differences of their brains.—A paper, by Mr. Rooke Pennington, was read, On the relative ages of cremation and contracted burial in Derbyshire in the Neolithic and Bronze ages. The object of the paper was to show that the impression that stone implements and contracted burial, bronze implements and cremation, are usually associated is quite erroneous as tested by the results of barrow-opening in the Peak of Derbyshire. The researches of Messrs. Bateman and Carrington on being tabulated proved that. Of "finds" containing stone implements, 65 per cent. were cases of contracted burial, 34 per cent. were burnt. In the Bronze, 58 per cent. were contracted, 38 per cent. were burnt. It was clear that those who deposited stone implements in the graves of the dead, and those who placed there articles of bronze, shared pretty equally the differences of custom in the interment of the body: so that out of 150 contracted entombments, 50 per cent. were accompanied by stone only, 12 per cent. by bronze; and out of 86 burnt cases, 46 per cent. afforded stone only, 14 per cent. bronze. The conclusion was fully borne out by examination of the contents of each tumulus. Several instances were given as showing that the Neolithic and Bronze peoples alike used both modes of burial.—A paper, by Miss A. W. Buckland, was read, On mythological birds ethnologically considered. The chief object of the author was to prove that in tracing the bird-legends to their sources, valuable ethnological results might be obtained, and a clue afforded to the migrations of man in Prehistoric times.—The president took the opportunity on this, the last ordinary meeting of the session, of announcing that the appeal of Council to the body of members at the anniversary had been so successful that the Institute was now out of debt.

Geologists' Association, June 5.—Henry Woodward, F.R.S., president, in the chair.—On the lower cretaceous beds of Folkestone, by F. G. H. Price, F.G.S. The town of Folkestone is situated upon the Folkestone Beds of the Upper Neocomian. These the author divides into four lithological groups, commencing with a sandy bed, which contains many phosphatic

nodules, and which he considers to form the true division between the Folkestone and underlying Sandgate beds. The *Rhynchonella sulcata* bed, an important fossiliferous zone, lies at the base of the latter. The general character of these Folkestone beds is that of a loose yellowish sand parted by seams of coarse calcareous sandstone. Masses of branching sponge are especially plentiful in these rocks. The last bed of the Folkestone series is a very remarkable one, consisting of an irregular seam of large nodular masses, composed of coarse grains of quartz, glauconite, jasper, lydian-stone, and phosphatic nodules. Four feet of loose sand succeeds, capped by a band of pyritous nodules; and then occurs a seam of dark greensand (containing two lines of phosphatic nodules), largely charged with *Am. interruptus*, and other fossils in the form of rolled casts. The argillaceous beds of the lower gault, which follow, are frequently very dark in colour, and more or less parted off by lines of nodules, marking certain zones of life. The thickness of this sub-formation is about 28 ft. From the grey marl or upper gault it is separated by a nodule or passage bed of much importance; as this nodule bed marks the extinction of lower-gault forms and the introduction of others. The base of the upper gault may be known by the large quantities of *Inoceramus sulcatus*. The upper fifty feet consists of a pale grey marl, of which the portion subjected to analysis yielded 26 per cent. of lime carbonate.—On a collection of fossils from the U.G.S. of Morden, Camb., by H. George Fordham, F.G.S.

Entomological Society, June 1.—Sir Sidney S. Saunders, president, in the chair.—Mr. McLachlan exhibited specimens of the White Ant (*Calotermes* sp.), recently bred at Kew from a sample of the wood of the tree (*Trachylobium hornmannianum*) that produces the gum-copal of Zanzibar.—Mr. Stainton read a letter he had received from the Rev. P. H. Newnham, of Stonehouse, Devon, stating that he had taken two living specimens of *Deiopeia pulchella* on the Cornish side of the River Tamar. Mr. Stainton remarked on the early period of the year when the insects were captured as very unusual.—Mr. C. O. Waterhouse sent for exhibition a living specimen of a Mantid (*Empusa pauperata*) in the larva or pupa state, brought from Hyères by the Rev. Mr. Sandes of Wandsworth.—Mr. W. D. Gooch communicated a detailed account of his experiences with regard to the Longicorn Coffee-borers of Natal. Dr. Horn, of Philadelphia, stated that European Conifers, Limes, &c., planted in a public park at Philadelphia, were all killed by the larvæ of native species, such as *Callidium antennatum* and *Monohammus dentator*, though apparently in a healthy condition, whilst the native trees were not perceptibly affected. He was inclined to believe that the insects attacked healthy trees, but Mr. McLachlan stated that, according to the observations of most European entomologists, the European species of Longicorns did not attack living wood in a perfectly healthy state.—Mr. Butler communicated a paper On new species and a new genus of diurnal Lepidoptera in the collection of Mr. Druce.—Mr. Smith read a revision of the Hymenopterous genera *Cleptes*, *Parnopes*, *Anthracias*, *Pyria*, and *Stilbum*, with descriptions of new species of the genus *Chrysis*, from North China and Australia.

PARIS

Academy of Sciences, June 22.—M. Bertrand in the chair.—M. Dumas stated, in the name of the *Phylloxera* Commission, that after the theoretical researches of the Commission this body had commenced a practical study of the subject in the field. Agricultural police had been appointed for the preservation of those parts of France not yet invaded by the scourge.—The following papers were read:—Researches on solution, by M. Berthelot; a continuation of thermo-chemical investigations.—Presentation of some specimens of photography obtained with an apparatus constructed for the Japanese expedition, by M. J. Janssen. The photographs presented were of the sun taken with an objective (of 5 in. aperture and 2 metres focus), constructed of flint and crown glass in achromatic combination.—A mechanical note was presented by M. R. Clausius, entitled "On a special case of the Viriel."—Theory of the collision of bodies, with consideration of the atomic vibrations, by M. A. Ledieu.—Communication on the bitter lakes of the Isthmus of Suez, by M. Ferdinand de Lesseps. The author exhibited a block of salt cut out from the salt bank still existing in the centre of the great basin. This bank is calculated to have contained 970,000,000,000 kilogrms. of salt, and has now dissolved away to the extent of ⅙ since the admission of the water of the canal. The superficial area of the salt bank is about 66,000,000 square metres, and it is composed of horizontal layers varying in thickness from 5 to 25 centims. The bank is believed to have been formed by the evaporation of Red Sea water poured into the lake basin during successive inundations; the amount of Red Sea water evaporated is about 21,000,000,000 cubic metres. The lake basin contains 2,000,000,000 cubic metres of water, giving an annual evaporation of 200,000,000 cubic metres. Twenty years ago rain hardly ever fell in the isthmus, but now tiles are obliged to be sent from France to roof the houses there. The author holds out great hopes of the practicability of filling a great basin in the interior of Algeria. A valuable table of numerical results accompanied the communication.—Geological topography of the environs of Aigues-mortes, a letter from M. Ch. Martins to M. Elie de Beaumont.—Observations on the subject of the reply of M. Faye to the criticism concerning his addition to Pouillet's memoir on solar radiation, by M. A. Ledieu. The author insisted that there was still a difference in the *principles* of thermodynamics between him and M. Faye.—Analysis of twenty-one samples of salt water from the maritime canal of Suez, sent by M. F. de Lesseps, by M. Durand-Claye. While Mediterranean water contains a solid residue of about 40 kilogrms. per cubic metre, the canal water contains, in some parts, 75 kilogrms., and never falls below 65 kilogrms. This fact is explained by the solution of the great salt bank before referred to. At Port Said the water is less salt than in the Mediterranean (24 to 26 kilogrms.) owing to admixture with Nile water.—On the employment of phenic acid for the preparation of wood, by M. M. Boucherie.—On the Cycadaceæ of the Paris basin, a note by M. Robert. Among a number of rolled flints from the confluence of the Nesle and Aisne between Ciry-Sermoise and Chasemy, the author found a number of stems which he considers to belong to the order named.—On the systems of quadratic forms, by M. C. Jordan.—M. G. Darboux made an addition to his note read on June 8, On friction in the collision of bodies.—Hydrographic map of Algeria, a note by M. E. Mouchez.—Phenomenon of mirage observed in Yffiniac Creek (North coast), by M. J. Girard.—Action of heat on the isomeric carbides of anthracene and their hydrides, by M. P. Barbier.—Chlorobromides of propylene: normal propyl-glycol, by M. E. Reboul. Only one chlorobromide of propylene has been known up to the present time, viz. $CH_2Br-CHCl-CH_3$ (Friedel and Silva). The author now makes known the four others, $CH_2Br-CH_2-CH_2Cl$ (normal), $CH_3-CClBr-CH_3$, $CH_3-CH_2-CHClBr$, and $CH_3-CHBr-CH_2Cl$.

BOOKS RECEIVED

COLONIAL.—Report of Progress of Geological Survey of Victoria, &c.: R. Brough Smyth (Melbourne).—Report upon the Rainfall of Barbados, and its Influence upon the Sugar Crops: Governor Rawson (Barbados).

FOREIGN.—L'Astronomie Pratique et les Observations en Europe et en Amérique: C. André et G. Rayet (Gauthier Villars, Paris).—Die neue Sternwarte der Wiener Universität: Carl von Lithow.—Jahresbericht des Physikalischen Central Observatoriums for 1871-72: H. Wild (St. Petersburg).—Annalen des Physikalischen Central Observatoriums: H. Wild, 1872 (St. Petersburg).—Spectres Lumineux: M. Lecoq de Boisbaudran. 2 vols. 8vo. (Gauthier Villars).—Repertorium für Meteorologie Kaiserlichen Academie, Redigirt: Dr. Heinrich Wild. Band iii.—Bulletin de l'Academie Imperiale des Sciences de St. Petersbourg, t. xviii., Parts iii. iv. v.—Bulletin de l'Academie Imperiales des Sciences de St. Petersbourg, t. xix., Parts i. ii. iii.

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