M. M. Pattison Muir. The author has examined the trichloride, tribromide, and the so-called bismuthic acid.—On bismuthiferous tesseral pyrites, by W. Ramsay. The formula of this mineral appears to be (Ni, Co, Fe)(As, Bi)$_3$.—On the occurrence of native calcium chloride at Guy's Cliffe, Warwickshire, by John Spiller.—The decomposition of alcohol and its homologues by the joint action of aluminium and its halogen compounds, by Dr. J. H. Gladstone and Alfred Tribe. Aluminium and its iodide have no action upon methyl alcohol. Ethyl alcohol is energetically decomposed by a mixture of these substances, hydrogen gas being evolved in large quantities and a pasty residue being left, which the authors consider to be aluminic iodo-ethylate. Heated to 275° C. this residue fuses and undergoes decomposition thus :—

$$Al_2 \left\{ \begin{matrix} (C_2H_5O)_3 \\ I_3 \end{matrix} \right. = Al_2O_3 + 3 \left\{ \begin{matrix} C_2H_5 \\ I \end{matrix} \right.$$

The authors have likewise obtained evidence of the existence of aluminic ethylate. Amylic alcohol is decomposed also by these substances. A mixture of the chloride with the metal has no action upon alcohol; the bromide has a decided action.—Ethyl-phenyl-acetylene, by T. M. Morgan. This substance has been obtained by the action of ethyl iodide upon the sodium compound of phenyl-acetylene the two substances being mixed with ether and heated in sealed tubes.—Narcotine, cotarnine, and hydrocotarnine, by G. H. Beckett and Dr. C. R. A. Wright. The authors have studied the action of water upon narcotine hydrochloride, the action of ethyl iodide on hydrocotarnine, narcotine, and cotarnine, and the action of acetic anhydride on all three of these bodies. Dr. Wright adds an appendix on the structural formulæ of narcotine and its derivatives.—Note on incense resin, by Dr. J. Stenhouse and C. E. Groves. This resin is the produce of *Icica heptaphylla*, Aubl., a native of British Guiana. The essential oil contains a hydrocarbon of the empirical formula $C_5H_8$, which the authors propose to call conimene. To the crystalline resin the authors assign the formula $C_{46}H_{76}O$, and propose the name *icacin*.—On certain sources of error in the ultimate analysis of organic substances containing nitrogen, by G. S. Johnson. These errors are: first, increase of weight by the absorption of oxygen by *nitrite* contained in the solution in the potash bulb owing to the passage of unreduced nitrous anhydride over the ignited copper. Secondly, the presence of occluded hydrogen in the metallic copper reduced in this gas, which is given off on the application of heat and reduces the surface film of oxide, producing water which adds to the weight of the chloride of calcium tube.

## SOCIETIES AND ACADEMIES

### LONDON

Royal Society, March 16.—Preliminary Reports to Prof. Wyville Thomson, F.R.S., Director of the Civilian Scientific Staff. I. On the true Corals dredged by H.M.S. *Challenger* in deep water between the dates Dec. 30, 1870, and Aug. 31, 1875, by H. N. Moseley, Naturalist to the Expedition.

The author gives a list of the corals dredged in a depth of 50 fathoms and upwards, with notes on each. The whole is necessarily preliminary, on account of the impossibility of sufficient comparisons being made, and references obtained. The results embody great additions to our knowledge concerning the bathymetrical range of corals. Only one coral has been obtained from a greater depth than 1,600 fathoms; it is *Fungia symmetrica*. Only three other corals have been obtained at as great a depth as 1,500 fathoms. Only about twenty-seven genera of corals have as yet been proved to exist in a depth of 250 fathoms and upwards; of these a list is given, to which is added those obtained by the U.S. Coast Survey and the *Porcupine*, making forty-two genera in all. Of these twenty occur in the fossil state. No coral in any way allied to the Rugosa has been dredged by the *Challenger*.

II. On work done on board the *Challenger*, by Mr. John Murray, Naturalist to the Expedition. This Report includes the preliminary notice on oceanic deposits, describing specimens of the sea-bottoms obtained in the soundings, dredgings, and trawlings, over 300 in number, during the years 1873–1875, between England and Valparaiso. The deposits may be classed as follows :—

1. *Shore Deposits*—
   (*a*) Blue and green muds.—Met with near the shores of most of the great continents and islands.
   (*b*) Grey muds and sands.—Met with chiefly near oceanic islands of volcanic origin.
   (*c*) Red mud.—Met with on the eastern coast of South America.
   (*d*) Coral mud.—Met with near coral reefs.
2. *Globigerina Ooze*.—An abundant oceanic deposit not met with south of latitude 50° S.
3. *Radiolarian Ooze*.—An oceanic deposit met with only in the Western and Middle Pacific.
4. *Diatomaceous Ooze*.—An oceanic deposit met with only south of 50° S. latitude.
5. *Red and Grey Clays*.—The most abundant oceanic deposit.

The deepest sounding (4,475 fathoms) was a Radiolarian ooze.

In the early part of the cruise many attempts were made by all of the naturalists to detect the presence of free protoplasm in or on the bottoms from the soundings and dredgings, but with no definite result. It was undoubted, however, that some specimens of the bottom preserved in spirit assumed a very mobile or jelly-like aspect, and also that flocculent matter was often present.

At this point Mr. Buchanan determined that the flocculent matter was simply the amorphous sulphate of lime precipitated by spirit from the sea-water associated with the ooze. Subsequently a number of experiments were made, in conjunction with Mr. Buchanan, upon the behaviour of this amorphous precipitate when precipitated with different quantities of spirit, and when treated with colouring solutions. The precipitate was also examined alone and mixed up with some of the ooze. The ooze was examined at the same time, and in the same manner, but without having been treated with spirit. The results were shortly these :—

"When sea-water is treated with twice its volume of spirit or less, nearly the whole of the amorphous precipitate assumes the crystalline form in a short time.

"When treated with a great excess of spirit the precipitate remains amorphous, and assumes a gelatinous aspect.

"This gelatinous-like sulphate of lime colours with the carmine and iodine solutions, and when mixed with the ooze has, under the microscope, the appearances so minutely described by Haeckel.

"The ooze washed with distilled water, or taken just as it comes up, and treated in the same manner with colouring solution, does not show these appearances."

When it is remembered that the original describers worked with spirit-preserved specimens of the bottom, the inference seems fair that *Bathybius* and the amorphous sulphate of lime are identical, and that in placing it amongst living things the describers have committed an error.

A preliminary report on vertebrates is then given, containing a list of all the fishes taken in the trawl or dredge. New forms necessitate modifications in the definitions of some families, but it has not been found necessary to establish any new families. The deep-sea and oceanic forms belong to the families—*Stenoptychidæ*, *Macruridæ*, *Ophidiidæ*, *Scopellidæ*, *Stomiatidæ Pediculati*, *Halosauridæ*, *Notocanthi*, *Muraenidæ*, and *Trachinidæ*.

Of the Petrels and Penguins very extensive collections have been made, as skins and as spirit specimens. Two or three skeletons of very large specimens of the Sea-elephant have been preserved.

III. On observations made during the earlier part of the voyage, by the late Dr. R. von Willemöes-Suhm, naturalist to the Expedition. This report is on the Atlantic fauna only. Among the most interesting results obtained may be mentioned briefly the facts that shrimps in great depths are liable to be attacked by considerably large Gordiaceous worms; that a curious intermediate form between Priapulids and Sipunculids has been discovered; that relations of the famous Jurassic Eryonidæ are still living in the great depths, where they are (in the Pacific at least) by no means rare.

March 23,—"On the Force caused by the Communication of Heat between a Surface and a Gas; and on a New Photometer," by Prof. Osborne Reynolds, communicated by B. Stewart, F.R.S., Professor of Natural Philosophy in Owens College, Manchester.

This paper contains an account of an experimental investigation undertaken with a view to support, by absolute measurements, the theoretical arguments by which the author endeavoured to prove the existence of reactionary forces or "heat-

reactions, whenever heat is communicated from a surface to a gas, and *vice versâ*, and the connection between these forces and the motion caused by heat and light falling on bodies *in vacuo*.

Having obtained one of the beautiful little "Light-Mills" constructed by Dr. Geissler, of Bonn, the author was in a position to make quantitative measurements of the effects produced, and of the force producing them.

In the first place, with regard to the sufficiency of the residual air to cause the motion. It was found that this air is, with the exception of the friction of the pivot, which is found to be so small as to be inappreciable, the sole cause of the resistance which the mill experiences, of the limit which is imposed on its speed for such intensity of light, and of the rapidity with which it comes to rest when the light is removed. The law of resistance, as determined by careful measurements, is found to agree perfectly with the resistance which highly rarefied air would offer to its motion; and this law is distinctly special in its character, being proportional to the velocity at low speeds, and gradually tending towards the square of the velocity as the speed increases.

Having established the fact that there is sufficient air in the mill (and Mr. Crookes's behaves in the same manner as this mill) to balance, by its resistance, the force which moves the mill, it is argued that all question as to the sufficiency of the air to cause the forces is removed. What the air can prevent it can cause.

As regards the possibility of the motion being in any way the direct result of radiation. This supposition the author had previously shown to be directly contradicted by the fundamental law of motion that action and reaction are equal. A cold body runs away from a hot body, while, if free to move, the hot body will run after the cold body, showing that the force does not act from body to body, but that each body propels itself through the surrounding medium in a direction opposite to its hottest side, the effect of one body on the other being due solely to the disturbance which it causes in the equilibrium of temperature.

Besides proving that the force acts between the vanes of the mill and the medium immediately surrounding them Dr. Schuster's experiments furnish a quantitative measure of the actual force. From this measure it is shown on theoretical grounds that the difference of temperature on the two sides of the vanes necessary to cause heat-reactions of this magnitude could not be less than 1°·7, while the probability is that it is considerably more.

In order to apply this test and see how far the actual difference of temperature in Dr. Schuster's experiments correspond with that deduced from the theory, a new photometer was devised by the author with an immediate view of measuring the difference of temperature caused by light on a black and a white surface.

Of two thin glass globes, 2½ inches in diameter, connected by a syphon tube ⅛ inch internal diameter, one was blackened with lamp-black on the inside over one hemisphere and the other was whitened with chalk in a similar manner, the two clean faces of the globes being turned in the same direction. Oil was put in the tube and the globes were otherwise sealed up. Any light which enters through the clean faces is received on the black and white surfaces, and the air in the globes expands in accordance with the difference of temperature which they attain, moving the oil in the tube. A motion of ½ an inch on the part of the oil shows a difference of 2°·2, in the temperature of the air within the globes.

The instrument so constructed is exceedingly delicate, and will show a difference in the intensity of light sufficient to make one revolution per minute difference in the speed of the mill.

Measured with this instrument, the difference of temperature caused by the light necessary to give the mill 240 revolutions per minute does not exceed 24°, and is probably less than this, which shows that the theoretical difference of heat necessary to cause the heat-reactions is well within the difference as actually measured, leaving an ample margin for error in the methods of approximation used in the calculation.

In concluding the paper the author claims to have set at rest the only point respecting the explanation of the motion caused by heat, which remained doubtful after he had discovered that, according to the kinetic theory, the communication of heat to a gas must cause a force reactionary on the surface, viz., whether this reaction was adequate in amount to cause the results seen to take place.

He adds a suggestion as to a new form of light-mill to have vanes inclined like the sails of a windmill, and not having one side white and the other black, like the light-mills at present constructed. Arguing that the forces act perpendicularly to the surface, and in a direction independent of that from which the light comes; so that such a mill would turn like a windmill with the full and not merely the differential effect of the light. Such a mill, he concludes, would furnish another test as to whether or not the force is directly referable to radiation.

Geological Society, March 22.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—Frank Campion, Henry J. Gardiner, Henry Percy Holt, Lord Rosehill, Harold Underhill, Frederick Thomas Whitehead, and Thomas Wrightson were elected Fellows of the Society.—On the Triassic strata which are exposed in the cliff sections near Sidmouth, and a note on the occurrence of an Ossiferous zone containing bones of a *Labyrinthodon*, by H. J. Johnston Lavis. The author described the base of the cliffs east of Sidmouth as composed of the marl which is the uppermost subdivision of the Trias in South Devon, capped in Littlecomb Hill and Dunscomb Hill by greensand and chalk, and in Salcombe Hill by greensand alone. In the valley of the Sid it is largely exposed at the surface. Close to the mouth of the Sid the upper sandstone crops out beneath the marl, forming a cliff overhanging the river. To the west of Sidmouth there is a low projecting cliff, the Chit rock, formed also of the upper sandstone, and at the western end of this is a fault which has given the Chit rock an upthrow of at least 40 and perhaps of 80 feet, since it has no marl capping it, and in its lithological character it resembles the middle part of the Upper Sandstone. To this point the dip is to the east; but westward of the fault the dip is at first to the west for about half a mile, when the sandstone reappears with an easterly dip, having formed a synclinal curve. It is overlain by marl and greensand in Peake and High Peake Hills, which are capped with chalk gravels. West of High Peake Hill the sandstone forms the whole cliff. The author described the general characters presented by the Triassic beds in the section under notice, and mentioned the occurrence at about 10 feet from the top of the sandstone of a peculiar series of beds, composed of coarse sandstone, containing scattered nodules of marl from the size of a pea to that of a hen's egg, together with numerous fragments of bone, some of which, belonging to a species of *Labyrinthodon*, would be described by Prof. Seeley. The author mentioned that he had received from the Rev. S. H. Cooke some fragments of bone obtained by him twenty years ago from this same "Ossiferous zone." Mr. Whitaker's specimen of *Hyperodapedon* was also obtained from the upper sandstone.—On the posterior portion of a lower jaw of *Labyrinthodon* (*L. lavisi*) from the Trias of Sidmouth, by Mr. Harry Govier Seeley, F.L.S., Professor of Physical Geography in Bedford College, London. After referring to the doubtful position of the Labyrinthodontia in the system, and expressing his doubts as to the occurrence of the genus *Mastodonsaurus* in Britain, the author proceeded to describe in detail the posterior part of the right ramus of the lower jaw of a Labyrinthodont, obtained by Mr. Lavis from the ossiferous zone of the Trias near Sidmouth, the position of which was described by that gentleman in the preceding paper. The specimen, which is 13 inches long, and perfectly free from matrix, shows that the lower jaw in Labyrinthodonts not only contains articular, angular, and dentary elements, as hitherto supposed, but also separate sphenial and surangular elements, and probably a distinct coronoid bone. These bones were described in detail, and the author remarked that although they are somewhat reptilian in aspect and arrangement, they are not very suggestive as to the affinities of *Labyrinthodon*. They surround a central hollow space, which no doubt received the primitive cartilage round which the bones were ossified; and the persistence of this character would seem to be a link rather with the lower than with the higher vertebrata. The jaw differs from the Batrachian mandible in possessing well-developed angular and surangular elements, and some reptiles, such as crocodiles and the marine Chelonia, present analogies in the perforations, the structure of the jaw, and the sculpture of the bones. In size the specimen is almost identical with that figured by Mr. Miall as belonging to *Labyrinthodon pachygnathus*, but the depths and outlines of the postarticular part of the jaw, and differences in the sculpture of the lateral subarticular ornament, furnish distinctive characters which lead the author to describe the present species as representing a new species, which he names, in honour of its discoverer, *Labyrinthodon Lavisi*. The author briefly noticed several other bones and fragments obtained by Mr. Lavis in the same locality, some of which probably belonged to the same skeleton.—On the discovery of *Melonites* in Britain, by Mr. Walter Keeping, communicated by Prof. T. M'Kenny Hughes. The author described a specimen from the carbo-

niferous limestone of Derbyshire in the museum of the Geological Survey, which displays numerous plates belonging to the test of a large Echinoid, considered by him to be a new species of the genus *Melonites*, hitherto regarded as peculiar to America. The author proposed to call this species *Melonites Etheridgii*, and he described it as possessing a more or less spheroidal test, about seven inches in diameter, composed of very thick plates, arranged in five ambulacral and five interambulacral areas, all the plates being ornamented with minute tubercles for the support of spines. The interambulacral areas were probably about twice as broad as the ambulacral, and composed (at the equator) of about nine ranges of plates, the marginal ones pentagonal, the rest hexagonal, articulating with each other by faces varying from a right angle to one of 30°. The ambulacral areas were broad, each formed of two convex ribs separated by a meridional depression running from mouth to anus, and each rib (half-area) composed of six or seven ranges of irregular plates, each perforated by a pair of simple pores. The tubercles are minute, imperforate, without boss, and of two orders, the larger surrounded by a smooth areola, bounded by an elevated ring. The spines are small, tapering, coarsely sulcate, with a prominent collar round the articular end. A second specimen exists in the British Museum. The species differs strikingly from the North American *Melonites multiporus* in the characters of the ambulacral areas, which have 12–14 ranges of plates, and are divided by a meridional furrow in the new species, and only eight ranges of plates, with a median ridge formed of plates twice as large as the rest in *M. multiporus*.—Note on the phosphates of the Laurentian and Cambrian rocks of Canada, by Principal Dawson, F.R.S. The author described the mode of occurrence of phosphatic deposits in various localities in Canada. Dark phosphatic nodules, containing fragments of *Lingulæ*, abound in the Chazy formation at Allumette Island, Grenville, Hawkesbury, and Lochiel. Similar nodules occur in the Graptolite shales of the Quebec group at Point Levis, and in limestones and conglomerates of the Lower Potsdam at Riviere Ouelle, Kamouraska, and elsewhere on the lower St. Laurence; these deposits also contain small phosphatic tubes resembling *Serpulites*. The Acadian or Menevian group near St. John, New Brunswick, contains layers of calcareous sandstone blackened with phosphatic matter, consisting of shells and fragments of *Lingulæ*. The author described the general character of the phosphatic nodules examined by him at Kamouraska, and gave the results of analyses made of others from various localities, which furnished from 36·38 to 55·65 per cent. of phosphate of lime. A tube from Riviere Ouelle gave 67·53 per cent. The author accepted Dr. Hunt's view of the coprolitic nature of the nodules, and inclined to extend this interpretation to the tubes. The animals producing the coprolites could not be thought to be vegetable feeders; and he remarked that the animals inhabiting the primordial seas employed phosphate of lime in the formation of their hard parts, as had been shown to be the case with *Lingulæ*, *Conularia*, and the Crustaceans. The shells of the genus *Hyolithes* also contain a considerable portion of phosphate of lime. Hence the carnivorous animals of the Cambrian seas would probably produce phosphatic coprolites. With regard to the Laurentian apatite deposits, the author stated that they, to a great extent, form beds interstratified with the other members of the series, chiefly in the upper part of the Lower Laurentian above the *Eozoon* limestones. The mineral often forms compact beds with little foreign matter, sometimes several feet thick, but varying in this respect. Thin layers of apatite sometimes occur in the lines of bedding of the rock. Occasionally disseminated crystals are found throughout thick beds of limestone, and even in beds of magnetite. The veins of apatite are found in irregular fissures; and as they are found principally in the same parts of the seams which contain the beds, the author regarded them as of secondary origin. The Laurentian apatite presents a perfectly crystalline texture, and the containing strata are highly metamorphosed. The author's arguments in favour of its organic origin are derived from the supposed organic origin of the iron-ores of the Laurentian, from the existence of *Eozoon*, from the want of organic structure in the Silurian deposit described by Mr. D. C. Davies, and the presence of associated graphite in both cases, from the character of the Acadian linguliferous sandstone, which might by metamorphism furnish a pyroxenite rock with masses of apatite, like those of the Laurentian series, and from the prevalence of animals with phosphatic crusts in the Primordial age, and the probability that this occurred also in the earlier Laurentian. The position of the phosphatic deposits above the horizon of *Eozoon* is also adduced by the author as adding probability to the existence of organic agencies at the time of their formation.

PARIS

**Academy of Sciences**, April 3.—Vice-Admiral Paris in the chair.—The following papers were read:—On the displacement of lines in the spectra of stars, produced by their motion in space, letter from P. Secchi. The author tabulates a number of the observations made by Huggins, Vogel, and himself, and those at Greenwich Observatory, and shows there is considerable contradiction in the results. Might there not, he asked, be some cause of systematic error in the manner of observing or in the instruments? Comparing the dark line F of Sirius with the hydrogen line H $\beta$ from a Geissler tube, he got always the same result—a shortening of the Sirius waves (contrary to Huggins), when the telescope was carried along by the clock-work, and the assistant was at the seeker to keep it on a fixed point, and corresponding to the slit of the spectroscope; but if the clock-work stopped, or the assistant deranged the position of the star, the bright line was displaced and came into coincidence with the star line. Dispensing with clock-work, the line was found to be on one side or the other according as the star was looked at on one side or the other of the axis of the telescope. A change was also had on turning the spectroscope 180° on its axis. P. Secchi merely points out these possible sources of illusion without trying to explain them.—Observations of sun-spots made at the Toulouse Observatory in 1874 and 1875, by M. Tisserand. In 1874, 237 spots were observed; in 1875 there were only 88. Of the 76 spots observed at least three times in 1874, 41 were in the boreal hemisphere, 35 in the austral, with a mean latitude (+ or —) of 10°·5. Of the 29 observed three times in 1875, 17 were in the boreal, 12 in the austral hemisphere; the mean latitude was 11°·7. M. Tisserand tabulates his observations with reference to diurnal rotation.—Testing for vinic alcohol in mixtures, and especially in presence of wood spirit, by MM. Alf. Riche and Ch. Bardy.—On the spermatia of the Ascomycetes, their nature and physiological *rôle*, by M. Max. Cornu. The spermatia were at first considered by M. Tulasne as fecundating corpuscles; and in support of this was their apparent refusal to germinate in the same conditions as three other sorts of spores. M. Cornu says he has obtained a very complete germination of spermatia in certain cases. Some times the action of pure water will suffice to bring them to vegetation, more often it is necessary to add nutritive elements. The facts observed refute the old theory of fecundation, and the simplification introduced into the number of reproductive organs gives a grand unity to the polymorphism of Ascomycetes.

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