through an approved course of practical training lasting four months, either at a mine or in engineering works. The subjects that may be offered are:—(*a*) mathematics for applied science; (*b*) physics and chemistry; (*c*) French and German translation; (*d*) engineering principles and machine drawing; (*e*) surveying; (*f*) geology; (*g*) mineralogy; (*h*) mining and engineering, hygiene and mine-ventilation; (*i*) electricity; (*j*) assaying. For the ordinary diploma candidates will be required to pass in (*a*), (*b*), and (*c*), and in not less than three of the remaining subjects, provided that (*f*), (*g*), and (*i*) are not taken together without one or more of the others. Candidates who propose to become colliery managers and desire to obtain exemption from two of the five years' underground work required by the Home Office as a qualification for a certificate as colliery manager, must obtain a special diploma by passing in the subjects (*a*), (*b*), (*c*), (*h*), and three (not being *f*, *g*, *i*) of the remainder, and by taking their four months' course of practical training at a mine.

PROF. W. JAMES, of Harvard University, has accepted, *Science* reports, the acting professorship of philosophy at Stanford University. He will lecture at Stanford during the second half of the next academic year, and will organise a department of philosophy for the university.

A GENERAL meeting of the Association of Teachers in Technical Institutes will be held on Saturday, March 25, at the Regent Street Polytechnic, London, when an address, to be followed by a discussion, will be delivered by Mr. W. J. Lineham, head of the engineering department, Goldsmiths' Institute, entitled "Technical Training—a Teacher's Views."

IN connection with the International Exposition to be held at Liége, Belgium, from April to November during the present year, it is proposed to hold an International Congress of Childhood on September 17–20. The congress will be organised in four sections, as follows:—(1) education of children; (2) study of children; (3) care and training of abnormal children; (4) parents' associations, mothers' clubs, and other supplementary agencies for the improvement of youth.

THE council of Liverpool University has accepted an offer from the president, Mr. E. K. Muspratt, to provide for an extension and equipment of the chemical laboratories at an estimated cost of 10,500*l*. The following contributions for the extension and maintenance of the chemical department have also been acknowledged by the council:—100*l*. per annum for five years from the United Alkali Company, Ltd., 100*l*. each from Mr. George Wall, West Kirby, and Mr. T. Threllfall, London.

A NEW technical college and secondary school at East Ham was opened by the Prince and Princess of Wales on Saturday. The building has been erected and equipped at a cost of about 24,000*l*., towards which the Essex County Council has contributed 6000*l*., and the remainder has been made up by the East Ham Corporation. The accommodation includes a botanical room, chemical class-room and laboratory, physics laboratory, carpenter's shop, and provision for the pursuit of various crafts—plumbing, metal-work, brickwork, &c. In replying to the address presented by the Mayor of East Ham, the Prince of Wales said:—It is difficult to realise that only ten years ago these crowded streets were green lanes, that your population has multiplied nearly twentyfold in the last thirty years, and that within your borough one industry alone employs more than 10,000 men. You have very rightly recognised that this remarkable growth carries with it serious responsibilities. The vast and rapidly increasing population of the borough necessitates the provision of suitable secondary and technical education, and in this institution you are furnishing that educational equipment for the rising generation which is indispensable if we intend to maintain our place in the great struggle for commercial supremacy. My heart is with you in all such undertakings as that which we are about to inaugurate, and I trust that every success may attend your useful and patriotic efforts.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 16.—"Further Observations on Slip-Bands.—Preliminary Note." By Walter **Rosenhain.** Communicated by Prof. Ewing, F.R.S.

The paper describes what the author believes to be a novel method of investigating the micro-structure of metals, and some preliminary results obtained by its aid. The method was devised in order to throw further light on the true nature of slip-bands, and the preliminary results relate mainly to this question.

A direct means of examining the surface configuration of a piece of metal upon which slip-bands have been produced would be presented by a transverse section of such a specimen, provided that the section could be produced with an absolutely sharp edge, but no useful result can be obtained by cutting the specimen through and simply polishing the exposed section. The edges of specimens prepared by the usual methods of polishing are always rounded off, so that it becomes impossible to focus upon any definite edge with high-power lenses; and even apart from this defect, there would be no guarantee that the edge represented a true section of the pre-existing surface.

FIG. 1.—Transverse Section of Slip-bands. Vertical illumination × 1000 diameters.

The author has adopted the principle sometimes used in optical work of supporting the surface, which in section becomes the edge, by means of an adherent layer of hard material; but the conditions which such a layer must satisfy for the purposes of metallography are very stringent. In order to satisfy them, the author uses a deposit of another metal obtained by electrolytic means, and this method has proved satisfactory.

The specimens used consisted of strips of the mildest steel, and after preparation an electro-deposit of copper was applied to them. By first bending the strips into a flat **U** shape, short portions of their length could be polished in the usual manner for microscopic examination; subsequently the strips could be readily strained in tension. The slip-bands and other features of the specimens having been satisfactorily observed, electro-deposition was proceeded with, care being taken to avoid chemical action on the prepared surface by the preliminary use of a bath of copper cyanide.

The specimens were then cut across. In order to obtain a satisfactory polish, the ordinary method of polishing had to be modified; it was found that polishing with rouge rapidly eroded a deep groove between the copper and iron,

thus defeating the object of the method. A satisfactory polishing medium for this and other purposes where surface erosion is undesirable was found in calcined oxide of magnesium, the magnesia powder being used in the same way as rouge.

The section, when polished by means of magnesia, is not yet ready for examination, as it is found that a considerable amount of metal is smeared or dragged over the surface, more or less obliterating the true boundary line which it is desired to examine. To overcome this obstacle, it is arranged that the last rubbing on emery paper shall be done in a direction approximately parallel to the boundary of the two metals; the direction of rubbing during the final polishing should then be at right-angles to the boundary, the unavoidable tendency to drag or smear then being such as to draw the iron over the copper on the side where the boundary is to be examined.

The film of metal smeared over the boundary in these circumstances is extremely thin, and can be removed by slight etching with picric acid. This treatment leaves a clearly defined boundary line appearing under a certain incidence of "vertical" illumination as a narrow black line, and under other illumination being visible merely by the colour-contrast between the iron and copper.

When a previously polished and etched specimen of iron which has had slip-bands developed upon its surface by strain is treated and examined in this way, the boundary line shows well-marked steps or serrations, readily visible under a magnification of 1000 diameters. To show that these steps were not due to any of the processes gone through by the specimen, such as the initial etching of the prepared surface or the electro-deposition itself, a series of test specimens was prepared and treated in a similar manner, except that either the preliminary etching, or the deformation, or both, were omitted. The stepped boundary was always found in specimens where slip-bands had been produced, but not otherwise.

The author therefore feels justified in concluding that the steps seen in transverse sections of strained specimens are the sectional views of slip-bands. It will be seen that the steps, although very minute, are perfectly distinctive, and that they could not be mistaken for generally rounded foldings of the surface; they possess, in fact, a general geometrical character, which the author regards as conclusive evidence that they are caused by slip on cleavage or gliding planes of the crystals, and not by any folding or crumpling of the metal.

"The Effects of Momentary Stresses in Metals." By Prof. Bertram **Hopkinson**. Communicated by Prof. Ewing, F.R.S.

If a wire be hung from a firm and massive support, and if a falling weight strike a stop at the lower end of the wire, with a velocity V, it is easy to calculate the strain at any point in the wire at any subsequent time, if it be assumed to be perfectly elastic. When the weight strikes, a wave of extension starts up the wire and travels with a velocity $a = \sqrt{E/\rho}$, where E is Young's modulus, and ρ is the density. For steel a is about 17,000 foot-seconds. When the wave reaches the top end, it is reflected down the wire. The history of the strain at any point of the wire is as follows:—When the wave reaches it, the strain, which was zero, suddenly becomes V/a; it then diminishes as the wave passes over it, according to an exponential law, until the reflected wave reaches it, when it again increases by V/a. Each bit of the wire is, therefore, subjected to strain which rises suddenly, and then very rapidly diminishes. The maximum strain at any time or place occurs at the top of the wire, where it is $2V/a$ at the moment when the wave arrives there. For a height of fall of 10 feet, and an iron wire, $2V/a$ is 0·003, and the corresponding stress is about 42 tons per square inch, so that momentary strains greatly exceeding the elastic limit may be produced in this way.

In the experiments described in the paper, the momentary extension in the top 20 inches of the wire, produced by a blow, was measured by electrical means, and compared with that given by the elastic theory. Where the two agree, and not much permanent extension is left, it follows that the theory is correctly applied, and that the material is substantially elastic up to the maximum stress, so calculated, if applied for the time given by the theory. In this way it is proved that a metal wire will stand a load, momentarily exceeding that which (steadily applied) would break it, with but very small permanent extension. In the case of the iron wire, the elastic limit was 17.8 tons per square inch, and the breaking stress 28.5 tons; and it was found that a load reaching 33½ tons, and exceeding the elastic limit for 1/1000 sec., produced very little permanent extension. Similar results were found for copper wire.

February 23.—"On a New Rhabdosphere." By George **Murray**, F.R.S.

The author refers to the interest which the rhabdospheres and coccospheres possess, not only to naturalists, but to geologists and students of deep-sea deposits. He names it *R. Blackmaniana*, after Mr. V. H. Blackman, his fellow author in an exhaustive study of such organisms (*Phil. Trans.*, B., vol. cxc., 1898). It was obtained by Mr. Murray on the outward voyage to the Cape of the *Discovery*, in lat. 28° 25′ S., long. 23° 56′ W., and differs from the only other forms, two in number, known to science in possessing tapering, acute, spinous processes in contrast to the trumpet-shaped and club-shaped processes of the two known species. No sign of the new form has yet been detected in the deep-sea deposits or geological formations, Mr. Murray accounting for this by the minuteness and extreme tenuity of the spines.

March 2.—"Further Researches on the Temperature Classification of Stars, No. 2." By Sir Norman **Lockyer**, K.C.B., F.R.S.

The paper contains a discussion of the more recent photographs obtained with a calcite-quartz prismatic camera. Each negative contained the spectra of two stars, obtained under identical conditions of altitude, exposure and development, the relative temperatures of which were estimated by comparing the relative intensities of their ultra-violet and their red radiations. The term "temperature" is understood to include the possible effects of electrical variations. In a previous paper, communicated to the society in February, 1904, the author showed that by thus comparing the relative temperatures of those stellar genera which were placed on different levels of the chemical classification temperature curve, their arrangement on that curve was vindicated. In the recent research the relative temperatures of the genera placed on the *same* horizons, but on the opposite sides, of the curve were similarly compared, with the result that their equality of temperature, as suggested by the chemical classification, was confirmed. The results also indicate that *specific* differences exist which will necessitate the subdivision of the previously proposed "genera" into "species."

Entomological Society, March 1.—Mr. F. Merrifield, president, in the chair.—*Exhibitions.*—(1) An example of *Oxypoda sericea*, Heer, taken in Dulwich Wood, June 17, 1904, a species new to Britain; (2) *O. nigrina*, Wat., with a type lent by Mr. E. A. Waterhouse, to demonstrate that it is not synonymous with *sericea* as stated on the Continent; (3) *O. exigua*, which is also regarded there as synonymous with *nigrina*: H. St. J. **Donisthorpe**.—Series of *Colias edusa*, with var. *helice*, bred from one ♀ *helice*, sent by Dr. T. A. Chapman from the South of France, to show the proportion of type and variety obtained: H. **Main** and A. **Harrison**. The results of similar experiments with *Amphidasys betularia*, bred from a ♂ var. *doubledayaria*, and a type ♀ taken in cop. at Woodford, Essex, in 1903, were also shown.—Specimen of *Helops striata*, showing an abnormal formation of the right antenna, which was divided into two branches from the fifth joint: R. **Priske**.—(1) Examples of *Hydrotaea pilipes*, Stein, ♂ and ♀, the latter sex being previously unknown; (2) several specimens of *Hydrotaea tuberculata*, Rond, not hitherto recorded as British, captured in various localities; P. H. **Grimshaw**.—Cocoons, and perfect imagines of hybrid Saturniids, including ♀ and ♂ of *S. pavonia*, L., × *S. pyri*, Scheff., with added specimens of both sexes of the parent forms for comparison, the cross product resembling a large *S. pavonia* rather than a small *S. pyri*. The exhibit further included three ♂ ♂ and three ♀ ♀, of which the ♀ parent was *S. pavonia*, and the ♂ parent a

hybrid between *S. pavonia*, ♂, and *S. spini*, ♀, viz. the cross product to which Prof. Standfuss has given the name *S. bornemanni*: Dr. F. A. **Dixey.**—(1) Groups of synaposematic Hymenoptera and Diptera captured by Mr. A. H. Hamm, of the Hope Department, Oxford University Museum; (2) three much worn specimens of *Papilio hesperus*, taken at Entebbe in 1903, by Mr. C. A. Wiggins, to show that the tails of a Papilio, if untouched by enemies, can endure a great deal of wear; (3) Nymphaline butterflies from northern China, apparently mimetic of the male *Hypolimnas misippus*, which is not known to occur in this region: Prof. E. B. **Poulton,** F.R.S.—Examples of *Pyrameis atalanta* and *Aglais urticae*, illustrating the effects of cold season breeding by Mr. Harwood, of Colchester, some of them lent by Mr. R. S. Mitford: the **President.**—*Papers*:—Butterfly hunting in British Columbia and Canada: Mrs. De la B. **Nicholl.**—On three remarkable new genera of Microlepidoptera: Sir George **Hampson.**—Descriptions of some new species of diurnal Lepidoptera, collected by Mr. Harold Cookson in northern Rhodesia in 1903–4. The Lycænidæ and Hesperiidæ described by Hamilton H. Druce: H. **Druce.**—Descriptions of some new species of Satyridæ from South America: F. Du Cane **Godman.**—Additions to a knowledge of the homopterous family of Cicadidæ: W. L. **Distant.**

Faraday Society, March 6.—Recent developments in electric smelting in connection with iron and steel: F. W. **Harbord.** The paper embodies the principal results of the investigations made by the commission sent to Europe last year by the Canadian Government for the purpose of reporting upon the different thermoelectric processes for the smelting of iron ores and the manufacture of steel at work in Europe, together with some additional information bringing the subject up-to-date. The author acted as metallurgist to that commission. The following general conclusions are stated in the paper:—(*a*) Steel, equal in all respects to the best Sheffield crucible steel, can be produced even in this country, either by the Kjellin, Héroult, or Keller proceses, at a cost considerably less than the cost of producing a high-class crucible steel, assuming electric energy to cost 10*l.* per E.H.P.-year. (*b*) At present, structural steel, to compete with Siemens or Bessemer steel, cannot be economically produced in the electric furnaces, and such furnaces can be used commercially for the production of only very high-class steel for special purposes. (*c*) Speaking generally, the reactions in the electric smelting furnace are similar to those taking place in the blast furnace. By altering the burden and regulating the temperature by varying the electric current, any grade of iron, grey or white, can be obtained, and the change from one grade to another is effected more rapidly than in the blast furnace. (*d*) Pig iron can be produced on a commercial scale at a price to compete with the blast furnace, only when electric energy is very cheap and fuel very dear. Under ordinary conditions, where blast furnaces are an established industry, electric smelting cannot compete; but in special cases, where ample water-power is available, and blast furnace coke is not readily obtainable, electric smelting may be commercially successful.

Zoological Society, March 7.—Dr. W. T. Blanford, F.R.S., vice-president, in the chair.—Pictures of the zebra in "Aldrovandus" (1640) and the "Commentarius" of Ludolphus (1691): H. **Scherren.** In the course of his remarks Mr. Scherren said that in the seventeenth century zebras (now known as *Equus grevyi*) had been sent by the ruler of Abyssinia to the governor of the Dutch East India Company at Batavia, and to the Sultan of Turkey, so that the species was seen in Europe two centuries before the type of *Equus grevyi* reached France in 1882. In proof, passages were cited from Philostorgius Ludolphus, Jean de Thévenot, and other writers.—A series of spirit-specimens of fishes from Lake Chad and the Chari River, collected and presented to the British Museum by Captain G. B. Gosling: G. A. **Boulenger.**—Exhibition of hybrid ducks bred at Cambridge: J. L. **Bonhote.** The crosses exhibited dealt chiefly with four species, of which the following were shown:—*Anas boschas* × *A. poecilorhyncha*, *Anas boschas* × *A. poecilorhyncha* × *Dafila acuta*, *Anas boschas* × *A. poecilorhyncha* × *A. superciliosa*, *Anas boschas* × *A. poecilorhyncha* × *A. superciliosa* × *D. acuta*.—Œcology and deposits of the Cape Verde marine fauna: C. **Crossland.** The author pointed out that so far as the Cape Verde group was concerned there was no evidence of any common tropical marine fauna, though certain species were found in both the Atlantic and Indian Oceans. Reef animals were remarkably few in number, the fauna in their place having a considerable subtropical constituent. Rock simulating coral-rag was formed at the low-tide level by serpulid tubes fused together by Lithothamnion, and by the latter and Foraminifera between 5 and 20 fathoms. The absence of reefs might be due in some degree to the remarkably steep coasts of the islands, but it was more especially owing to the extraordinary dominance of boring sponges, worms, and molluscs. Beach sandstone was formed by the deposition of calcareous cement where the fresh water met the salt; it was only found in certain situations, and was everywhere being slowly eroded away by the sea.—A revision of the South-American cichlid genera, Crenacara, Batrachops, and Crenicichla: C. Tate **Regan.** Twenty-three species were described, four of them new to science.—A new antelope from British East Africa: Captain R. **Meinertzhagen.**

Royal Astronomical Society, March 10.—Mr. W. H. Maw, president, in the chair.—Description of the spectroheliograph of the Solar Physics Observatory: Dr. W. J. S. **Lockyer.** The complete instrument consists of a siderostat to throw the solar beam in a horizontal and southerly direction, a lens placed in this beam to form the solar image, and the spectroheliograph itself to photograph in monochromatic light the image thus formed. The apparatus was fully explained and illustrated by photographs on the screen. Specimens of results obtained were also exhibited, the photographs of the sun showing the fine network covering its surface, becoming thicker and more agglomerated in middle and low latitudes to form the calcium flocculi. The sun-spots appear to be closely related to these flocculi, but the prominences bear no relation to them, though they give brilliant images in the "K" or calcium light.—The large sun-spot of January 29 to February 11, and the contemporaneous magnetic disturbances: **Astronomer Royal.** A series of photographs, taken at the Royal Observatory, Greenwich, was shown on the screen.—Spectroscopic observations of the recent great sun-spot and associated prominences: A. **Fowler.** The paper dealt with the reversed lines, the widened lines, &c., and the spectra of the chromosphere and prominences overlying the spot on the western limb.—Observations of the great sun-spot made at Stonyhurst, and photographs of the spectra: Father **Cortie.**—Reply to criticisms of a paper on sun-spots and the associated magnetic disturbances: E. W. **Maunder.**

Physical Society, March 10.—Dr. R. T. Glazebrook, past-president, in the chair.—On direct reading resistance-thermometers, with a note on composite thermocouples: A. **Campbell.** The paper describes two methods by which the reading of a resistance-box in connection with a platinum resistance-thermometer gives directly the actual temperature without the use of any formula or table.—On the stresses in the earth's crust before and after the sinking of a bore-hole: Dr. **Chree.** In NATURE, October 20, 1904, there appeared letters by Mr. G. Martin and the Hon. C. A. Parsons dealing with the size of the stresses in the earth's crust and speculating as to what would happen if a hole were bored to a depth of 12 miles. The present paper discusses the subject, treating the earth as an elastic solid, and points out the various uncertainties that exist. Solutions are presented of a number of mathematical problems having a bearing on one or other of the possibilities discussed. The principal novel case considered is that of a composite earth, consisting of a core of incompressible material and of a crust which may be compressible or incompressible.—On the lateral vibration of bars of uniform and varying sectional-area: J. **Morrow.** Lord Rayleigh has given a method by which the approximate period of vibration of a rod can be calculated without the use of transcendental equations. The question has recently been further discussed by Mr. Garrett and Dr. Chree. The object of the paper is to show that, by assuming a type of vibration consistent with the conditions obtaining at the ends of the bar, the period can be obtained approximately

in a simple manner, and that by a process of continuous approximation the period and the type of the vibration may be determined, in a large number of cases, with great accuracy.

Royal Meteorological Society, March 15.—Mr. Richard Bentley, president, in the chair.—The growth of instrumental meteorology: **President.** After briefly touching on the historic and non-instrumental era of meteorology, reference was made to the seven great weapons of meteorology—the thermometer, and of later years the heliograph, for temperature, the hygrometer and rain-gauge for moisture, the barometer for pressure, and the anemometer and kite for the study of the upper air—and of the great foundation of instrumental meteorology laid by Galileo, Torricelli, Wren and Hooke. The president, in dwelling upon our indebtedness to Italy in science (as well as in art) from Galileo to Marconi, pointed out that the theory of rainfall was correctly enunciated as early as the beginning of th fourteenth century by Dante. He also dwelt on the great services rendered to the community by meteorologists, largely by volunteers at their own expense, and referred to the close observation kept by rain-gauges on the steadily diminishing water supply of the country, by anemometers protecting the traffic over some of our lofty and more exposed railway viaducts, by the use of the barometer for storm warnings and for the safety of miners in our pits, by the heliograph with relation to the ripening of fruits and crops, and regretted how much of the immense mass of information daily accumulating had still to be analysed and put to use. It was disappointing to find in so wealthy a country as this, and where the results could not fail to be of the greatest practical utility to the nation, that the means of digestion of this vast data are so meagre, and the aid given by the Government is so slender as to be a constant source of reproach when compared with the large provision made for the same purpose in other countries for their own benefit.

DUBLIN.

Royal Dublin Society, February 21.—Dr. W. E. Adeney in the chair.—(1) On the transmissibility of tuberculosis of the monkey to the ox and goat; (2) on the use of tuberculin in the detection of tuberculosis: Prof. A. E. **Mettam.** (1) The tuberculous material was obtained from a drill monkey. After passage through guinea-pigs, emulsions of the organs of the latter were inoculated into a bull and into a goat. Both animals have been infected with tuberculosis, though free from the disease prior to injection, local lesions having been established and reaction to tuberculin being pronounced. (2) Experiments were carried out with the object of determining if an increased dose of tuberculin would reveal tuberculosis in an animal which had already a short time previously received a dose of tuberculin, and if any immunity to tuberculin was established as to how long it lasted. It was shown, as Vallée maintains, that a double dose of tuberculin would reveal tuberculosis even if the animal had received a prior dose a few days before, and that the immunity to an ordinary dose was evident for ten days to a fortnight after injection.—Secondary radiation and atomic structure: Prof. J. A. **McClelland.** Every substance gives off a secondary radiation of β particles when acted upon by the β rays of radium. The intensity of this secondary radiation, in the case of elementary substances, depends on the atomic weight; the greater the atomic weight the greater is the secondary radiation. This very general law has been found to hold true for all the elements tested, which were twenty-one in number. The paper further discusses this result from the point of view that all atoms are groups of similar electrons.

Royal Irish Academy, February 27.—Prof. R. Atkinson, president, in the chair.—A list of the Irish jelly-fishes, corals, and sea-anemones: being a report from the R.I.A. fauna and flora committee: Jane **Stephens.** This is a catalogue of all the species of Cœlenterata hitherto recorded for the coast of Ireland. The list, containing about 250 species, includes the fresh-water hydroids. In a prefatory note a short account of the Irish Cœlenterates is given; there is also a bibliography of the papers (which date back to the year 1755) dealing with the subject.—Notes on the homotaxial equivalents of the beds which immediately succeed the Carboniferous Limestone in the west of Ireland: Dr. Wheelton **Hind.** The counties of Clare and Limerick contain the Carboniferous sequence of the west of Ireland in the form of a basin, the western side of which has been cut off by the sea, and consequently the geological structure is well seen in the line of cliffs from Black Head, co. Clare, to Ballybunion, co. Kerry. In the north of Clare the beds dip gradually at 5°, and there are few or no faults. In the south of the county and in co. Limerick there have been stronger earth movements, and faulting is more frequent. The sequence shows Coal-measures (Foynes coalfield), olive grits, flags and sandy shales, black shales with bullions, Carboniferous Limestone without shales or detrital beds. The whole series is conformable and fossiliferous. The Carboniferous Limestone is characterised by the same fossils as occur in the Carboniferous Limestone and Yoredale rocks of England, and at the top of this series is a great faunal change. The black shales with bullions, which overlie the Carboniferous Limestone, contain *Posidoniella laevis, P. minor, Posidonomya membranacea, Pterinopecten papyraceus, Glyphioceras diadema, G. spirale, G. davisi, G. reticulatum, Dimorphoceras gilbertsoni, G. descrepans, Nomismoceras spirorbis,* and many others which characterise the Pendleside series and the Lower Culm of England. The marine bands intercalated in the olive grit and flag series, and the shales, recall the marine bands in the Millstone Grits. Hence it is interesting to find the same faunal sequence in the west of Ireland as exists in the midlands of England, and it is erroneous to classify the beds which succeed the Carboniferous Limestone in the west of Ireland as either Yoredales or Coal-measures, but they are the homotaxial equivalents of the Pendleside series and Millstone Grits.

PARIS.

Academy of Sciences, March 13.—M. Troost in the chair.—On surfaces applicable to the paraboloid of revolution: Gaston **Darboux.**—On the laws of sliding friction. Paul **Painlevé.** A discussion and extension of a paper on the same subject by M. Lecornu.—On the pressures developed at each instant in a closed vessel by colloidal powders of different forms: R. **Liouville.** The work of M. Vieille on the explosion of gun-cotton powders in a closed vessel led him to conclude that the speed of combustion is proportional to a power of the pressure, about 2/3. On account of the difficulty introduced into ballistic calculations, it is usual to consider the speed of combustion as proportional to the pressure. An investigation is given showing the accuracy of Vieille's exponent, and indicating where further experimental work is required.—On the explosive wave: E. **Jouguet.** The numerical data given in a previous note were calculated on the assumption that the combustion was total in the explosive wave, and that the dissociation could be neglected. In the present paper the dissociation is taken into account, the formula of Gibbs being adopted. Figures are given for mixtures of oxygen with acetylene, cyanogen, and methane, and it is shown that the dissociation may be considerable without seriously affecting the velocity of the explosive wave.—On the emptying of systems of reservoirs: Ed. **Maillet.**—On the dangers of atmospheric electricity for balloons and the means of remedying them: A. **Breydel.**—On halation in photographs: Adrien **Guébhard.**—On the atomic weights of hydrogen and nitrogen, and on the precision attained in their determination: A. **Leduc.** The value obtained by the author for the atomic weight of nitrogen from his density measurements was 14·005, but the figure still adopted by the International Committee on Atomic Weights is 14·04. It is pointed out that the lower number is confirmed by the recent experiments of Guye and Bogdan, and Jaquerod and Bogdan.—On dextrorotatory lactic acid: E. **Jungfleisch** and M. **Godchot.** The preparation of *d*-lactic acid in a pure state from its salts is complicated by the tendency to pass over into the inactive acid and by the formation of lactyl-lactic acid. The precautions necessary to avoid both these changes are given in detail, and the properties of the pure acid described.—The action of magnesium amalgam upon dimethylketone: F. **Couturier** and L. **Meunier.** The chief product of the reaction is pinacone. By the dry distillation of the magnesium compound there is produced

acetone, isopropyl alcohol, pinacoline (the principal product), and mesityl oxide. The yield of pinacoline is 21 per cent., and this forms the most rapid and advantageous method of preparing this substance.—On oxyethylcrotonic acid and ethylerythric acid: M. **Lespieau.**—On a method for the volumetric estimation of hydroxylamine: L. J. **Simon.** The method is based upon the conversion of the hydroxylamine salt into the oxalate by the addition of sodium oxalate, and titration in neutral solution by potassium permanganate. The influence of dilution and of excess of the sodium oxalate has been studied.—The glycerophosphates of piperazine: A. **Astruc.** A description of the preparation of the acid glycerophosphate of piperazine, and a method for its estimation based on the use of two indicators, phenol-phthalein and methyl orange.—On the experimental bases of the reticular hypothesis: G. **Friedel.**—The requirements of the tobacco plant in fertilising materials: A. Ch. **Girard** and E. **Rousseaux.** The average amounts of lime, potassium, phosphoric acid and nitrogen required per 1000 kilograms of dried leaves are given.—The genesis of the gametes and anisogamy in Monocystis: Louis **Brasil.**—On the Alpheidæ of the Laccadive and Maldive Islands: H. **Coutière.**—Sterility and alopecy in guinea-pigs previously submitted to the influence of ovarian extracts of the frog: Gustave **Loisel.** The ovarian extracts of the frog contain a poison which acts by causing the atrophy of a certain number of ovules. Other effects of the poison are noted.—On the antidote to nicotine: C. **Zalackas.** Experiments on rabbits and guinea-pigs show that strychnine has not the effects as an antidote to nicotine usually attributed to it. The effects of eserine are more favourable, and an extract of *Nasturtium officinale* led to still better results, the effects of a mortal dose of nicotine being entirely removed by the injection of the latter substance.—On the lowering of the arterial pressure below the normal by d'Arsonvalisation: A. **Moutier** and A. **Challamel.** In certain cases the use of high frequency, high tension currents leads to a lowering of the blood pressure under the normal. It is therefore necessary to measure this pressure with great care when d'Arsonvalisation is being used therapeutically.—A modification of the spectrum of methæmoglobin under the action of sodium fluoride: J. **Ville** and E. **Derrien.**—On the Middle Eocene deposits in Senegal: J. **Chautard.**—On the phenomena of the deviation of water courses dating from the seventeenth, eighteenth, and the commencement of the nineteenth centuries, proved my maps: E. **Fournier.** In a series of five maps of a valley near Lons-le-Saunier, dated 1658, 1748, 1790, 1841, and the present day, the various changes undergone by the water courses can be traced.—The results of a year's study of the electrical conductivity of the water of the Rhone at Lyons: M. **Chanoz.** The water supply of Lyons, obtained from the Rhone, contains mineral matter in relatively constant amounts throughout the year, as indicated by the freezing point and electrical conductivity.

DIARY OF SOCIETIES.

THURSDAY, MARCH 23.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: The Reception and Utilisation of Energy by the Green Leaf: Dr. Horace T. Brown, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Report of Experiments carried out at the National Physical Laboratory: On the Effect of Heat on the Electrical and Mechanical Properties of Dielectrics, and on the Temperature Distribution in the Interior of Field Coils: E. H. Rayner.—*Discussion*: On Temperature Curves and the Rating of Electrical Machinery: R. Goldschmidt.

ROYAL INSTITUTION, at 5.—The Reasonableness of Architecture: Thomas G. Jackson.

FRIDAY, MARCH 24.

ROYAL INSTITUTION, at 9.—A Pertinacious Current: Sir Oliver Lodge, F.R.S.

PHYSICAL SOCIETY, at 5.—Note on the Voltage Ratios of an Inverted Rotary Converter: W. C. Clinton.—On the Flux of Light from the Electric Arc with varying Power Supply: G. B. Dyke.—The Application of the Cymometer and the Determination of the Coefficient of Coupling of Oscillation Transformers: Prof. J. A. Fleming, F.R.S.—Exhibition of Cymometers and other Instruments.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Wanki to Victoria Falls Section; Victoria Falls Railway: C. T. Gardner.—Design of a Double-Line Plate-Girder Railway-Bridge: H. S. Coppock.

SATURDAY, MARCH 25.

ROYAL INSTITUTION, at 3.—Electrical Properties of Radio-active Substances: Prof. J. J. Thomson, F.R.S.

MONDAY, MARCH 27.

SOCIETY OF ARTS, at 8.—Telephone Exchanges: H. L. Webb.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Liberia: Sir Harry Johnston, G.C.M.G., K.C.B.

INSTITUTE OF ACTUARIES, at 5.—Bonuses in Model Office Valuations and their Relations to Reserves: Dr. James Buchanan.

TUESDAY, MARCH 28.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Coolgardie Water-Supply C. S. R. Palmer.

ROYAL INSTITUTION, at 5.—Vibration Problems in Engineering: Prof. W. E. Dalby.

SOCIETY OF ARTS, at 4.30.—The Manufactures of Greater Britain—Australasia: The Hon. W. H. James.

WEDNESDAY, MARCH 29.

SOCIETY OF ARTS, at 8.—British Woodlands: Sir Herbert Maxwell, Bart., M.P.

THURSDAY, MARCH 30.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Observations of Stars made in some British Stone Circles (Preliminary Note): Sir Norman Lockyer, K.C.B., F.R.S.—On the Distribution of Velocity in a Viscous Fluid over the Cross-section of a Pipe, and on the Action at the Critical Velocity: J. Morrow.—The Direct Synthesis of Ammonia: Dr. E. P. Perman.—The Determination of Vapour Pressure by Air Bubbling: Dr. E. P. Perman and J. H. Davies.—Note on Fluorescence and Absorption: J. B. Burke.—The Determination of the Specific Heat of Superheated Steam by Throttling and other Experiments: A. H. Peake.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, MARCH 31.

ROYAL INSTITUTION, at 9.—The Scientific Study of Dialects: Prof. J. Wright.

SATURDAY, APRIL 1.

ROYAL INSTITUTION, at 3.—Some Controverted Questions of Optics: Lord Rayleigh.

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