fossil which appears to be nearly allied to *Necrocarcinus*, is figured on a plate accompanying the paper. Mr. C. Lapworth communicates a note on the Graptolitic black shales of the south of Scotland, in which he reiterates his opinion that there si but a single group of these shales, divisible, however, into three divisions—the Lower, Middle, and Upper Moffat shales. The first he regards as of Lower Llandeilo age, the second as equivalent to the Upper Llandeilo of Builth, and the third as Caradoc.—From Mr. S. Allport we have a valuable paper on the microscopic structure of the pitchstones and felsites of the island of Arran, in continuation of a former note published in the *Geological Magazine*. The number also contains a reprint of an interesting paper by Dr. Carpenter on the temperature and other physical con dltions of inland seas, in their relation to geological inquiry.—Among the reports, &c., we find Mr. Woodward's sixth report on fossil crustacea, presented to the last meeting of the British Association. This contains a geneal-logical tree of the Crustacea.

Annalen der Chimie und Pharmacie, Nos. 11 and 12, 1872.—This double number contains a paper by Dr. Abeljanz on bichlorether, in which some of Lieben's results are called in question. The writer discusses chiefly the preparation of bichlor-ether, the action of pentachloride of phosphorus upon it, and its decomposition by water and by alkali.—In an essay on diphtalyl, Dr. Ador describes the preparation of this substance, through the action of finely-divided silver on dyphtalyl chloride. It has the formula $C_8 H_4 O_2$. It is insoluble in water, and soluble largely only in heated phenol and cold concentrated sulphuric acid. It fuses at 300°. The action of alkalies on dyphtalyl, dyphtalyl acid, its salts, and capability of oxidation, action of pentachloride of phosphorus and bromine on diphtalyl, and some of the by-products of preparation are among the points taken up.—J. Wislicenus communicates some observations on the so-called anhydrides of lactic acids. He finds that before all the water is evaporated from a solution of lactic acid, some anhydride is al-ways present (with the acid), the quantity of which increases with the decrease of the water, and that, therefore, pure lactic acid of the formula $C_3 H_6 O_3$ does not exist. Further, that when lactic acid is kept in a dry atmosphere at ordinary temperature, there is formed not only the so-called anhydride, but also a lactide. —Th. Zincke and A. Franchimont describe nonylic acid, a colour-less oily fluid, having the formula $C_9 H_{18} O_2$, boiling about 253; specific gravity at 17·5° = 0·9065. It is little soluble in water, but distils slowly over with the vapour of boiling water. At a low temperature it solidifies to a crystalline mass, and it melts at + 10°.—Among the remaining papers in this number are lengthy monographs on some of the cyanogen derivatives of aceton, by Dr. F. Urech, and on the reduction products of silicic acid ether and some of its derivatives, by A. Ladenburg; also notes on the action of sodium on dibrombenzol, by Dr. Riese, and the constitution of sodium ethylate, by A. Laubenheimer.

Nos. 3 and 4 of the *Proceedings of the Swedish Academy of Sciences* for the present year, contains the proceedings of the Academy for March and April. The first paper is an account of an experimental investigation upon the electromotive and thermo-electric forces of certain metallic alloys in contact with copper, by M. A. F. Sundell. The alloys employed in these experiments consisted of bismuth and tin, and bismuth and antimony in various proportions, and of a white metal (*Nysilven*) the composition of which is not given. The action of bismuth is lessened in proportion to the amount of tin, and also by $\frac{1}{32}$ of antimony, but increased by $\frac{3}{32}$ of the latter metal. Iron is very low in the scale, which is similar for the electromotive and thermo-electric powers of the different metals and alloys.—Dr. C. Stäl communicates a synopsis of the European genera of Pentatornidæ in Latin, from which, curiously enough, the Cydnina are omitted.—Dr. H. D. J. Wallengrew furnishes a further contribution to the Lepidopterous fauna of South Africa, founded upon a small collection sent home by M. Akerberg, Swedish Consul at the Cape. His list, which includes species belonging to the groups from the butterflies to the Crambidæ, numbers seventy-one species, several of which are described as new, whilst descriptions and notes on synonymy are appended to many of the others. A new genus of Lycœnide butterflies, *Arrugia*, is proposed for *Zerythis basuta* Wall, *protumnus* Lin. The new species are all Geomitrina,—they are *Conchylia pacto-laria, Camptogramma quaggaria, C. sylvicultrix, Macaria grimmia, M. getula, Tephrina nemoriwaga, Panagra platyrhyncata, P. octomaculata and Mesotype textilis*.—A new species of mica called Manganophyll, from the iron and manganese mines of Paysberg in Wermland, is described by M. L. J. Igelström,—It contains 21·40 per cent. of protoxide of manganese, and varies from bronze to bright copper colour.—Prof. Angström enumerates and describes some mosses and Hepaticæ collected by Prof. N. J. Anderson, during the voyage of the frigate *Eugenie*, in 1851-53. The specimens are from Port Famine, from near Wollongong in Australia and from Honolulu. A great many of them are described as new species, and these belong to the genera *Gymnostornum, Orthotricum, Dicranum, Tortula, Bartramia, Gottschea*, and *pungermanina* (from Port Famine), *Thamnium* and *Lejeunia* (from Wollongong) *Hypnum, Plagiothecium, Omalia, Campylopus, Macromitrium, Fissideus, Jungennanina, Shagnœcetis, Lejeunia* and *Frullania*, (from Honolulu). M. C. A. F. Sädbour notices the nocturnal migratory habits of *Myodes schisticolor* Lilljeb. The number concludes with a report by the secretary on the activity of the Academy during the year 1871-72.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 13, 1872.—"Researches in Spectrum Analysis in connection with the Spectrum of the Sun."—No. I. By J. Norman Lockyer, F.R.S.

The author, after referring to the researches in which he has been engaged since January 1869 in conjunction with Dr. Frankland, refers to the evidence obtained by them as to the thickening and thinning of spectral lines by variations of pres-sure, and to the disappearance of certain lines when the method employed by them since 1869 is used. This method consists of throwing an image of the light-source to be examined on to the slit of the spectroscope.

It is pointed out that the phenomena observed are of the same nature as those already described by Stokes, W. A. Miller, Robinson, and Thalen, but that the application of this method enables them to be better studied, the metallic spectra being clearly separated from that of the gaseous medium through which the spark passes. Photographs of the spark, taken in air between zinc and cadmium and zinc and tin, accompany the paper, showing that when spectra of the vapours given off by electrodes are studied in this manner, the vapours close to the electrode give lines which disappear from the spectrum of the vapour at a greater distance from the electrode, so that there appear to be long and short lines in the spectrum.

Maps of the following elements have been mapped on this method:—Na, Li, Mg, Al, Mn, Co, Ni, Zn, Sr, Cd, Sn, Sb, Ba, and Pb, the lines being laid down from Thalen's maps, and the various characters and lengths of the lines shown.

In some cases the spectra of the metals, enclosed in tubes and subjected to a continually decreasing pressure, have been ob-served. In all these experiments the lines gradually disappear as the pressure is reduced, the *shortest lines disappearing first, and the longest lines remaining longest visible.*

Since it appeared that the purest and densest vapour alone gave the greatest number of lines, it became of interest to ex-amine the spectra of compounds consisting of a metal combined with a non-metallic element. Experiments with chlorides are recorded. It was found in all cases that the difference between the spectrum of the chloride and the spectrum of the metal was, that under the same spark-conditions all the short lines were obliterated. Changing the spark-conditions, the final result was, that only the very longest lines in the spectrum of the metallic vapour remained. It was observed that in the case of elements with low atomic weights, combined with one equiva-lent of chlorine, the numbers of lines which remain in the chloride is large, 60 per cent. *e.g.*, in the case of Li, and 40 per cent. in the case of Na; while in the case of elements with greater atomic weights, combined with two equivalents of chlorine, a much smaller number of lines remain—8 per cent. in the case of barium, and 3 per cent. in the case of Pb.

The application of these observations to the solar spectrum, to elucidate which they were undertaken, is then given.

It is well known that all the known lines of the metallic elements on the solar atmosphere are not reversed. The author states what Kirchhoff and Angström have written on this sub-ject, and what substances, according to each, exist in the solar atmosphere. He next announces the discovery that, with no exception whatever, *the lines which are reversed are the longest lins.* With this additional key he does not hesitate to add, on

the strength of a small number of lines reversed, zinc and aluminium (and possibly strontium) to the last list of solar elements given by Thalen, who rejected zinc from Kirchhoff's list, and agreed with him in rejecting aluminium. It need scarcely be added that these lines are in each case the longest lines in the spectrum of the metal.

The help which these determinations afford to the study of the various cyclical changes in the various solar spectra is then referred to.

Geological Society, Dec. 18.—Mr. Warington W. Smyth, F.R.S., vice-president, in the chair.—The following communications were read:—"Further Notes on the Punfield Section," by C. J. A. Meyer. This paper was supplementary to one read before the society by the author in March of the present year (see "Quart. Journ. Geol. Soc." xxviii. p. 245), and contained the results of a fresh examination of the section at Punfield, and of the Wealden and Neocomian strata of the Isle of Wight. He described the section exposed at his visit to Punfield as presenting:—1, True Wealden beds; 2, a grit-bed with limestone and paper-shales, containing fish-bones and Cyprides; 3, apparently argillaceous beds; 4, a thin band of hard ferruginous sandstone with Atherfield fossils; 5, a clay bed, the upper part regarded as representing the "Lobster Clay" of Atherfield, the lower sandy portion containing an abundance of marine fossils belonging to common Atherfield species; 6, the so-called "marine band;" and 7, laminated clays and sands with lignite. The author indicated the accordance of this arrangement with what is observed elsewhere, and maintained that the grit-bed (No. 2), with its limestone and paper-shales, containing *Cypris* and *Cyrena*, was really to be regarded as the passage-bed between the Wealden and the Neocomian.—"On the Coprolites of the Upper Greensand Formation, and on Flints," by W. Johnson Sollas. The first part of this paper was principally occupied in an endeavour to explain the perfect fossilisation of sponges and other soft-bodied animals. It was shown that the hypothesis which considered that sponges had become silicified by an attraction of their spicules for silica was altogether untenable. Mr. H. Johnson's supposititious reaction, according to which the carbon of animal matter is directly replaced by silicon, was shown to be inconsistent with the known facts of chemistry. The author's explanation was not intended to be final. The first fact pointed out was the very remarkable way in which the silica or calcic phosphate of the fossils under consideration followed the former extension of organic matter. This was explained for silica by the fact that, when silicic acid is added to such animal matters as albumen or gelatin, it forms with them a definite chemical compound; and it was assumed that in process of time this highly complex organic substance would decompose, its organic constituents would be evolved, and its silica would remain behind. In such a way flints might be produced, and dialysis would lend its aid. The same explanation was applied to account for the connection between calcic phosphate and animal matter in the case of the "Coprolites." The Blackdown silicified shells were next explained, and it was reasoned that the state of their silica offered arguments tending to prove a passage of silica from the colloidal to the crystalline state. The second part of the paper discussed the Coprolites specially; their exterior appearance is extremely sponge-like, almost exactly resembling some species of modern sponges. They are marked by oscules of peculiar characters. The so-called "pores" of palæontologists are well marked. Spicules, triradiate, hexradiate, sinuous, defensive and connecting, have been observed. They are siliceous in composition. On dissolving the coprolites in acid, the spicules are set free, associated with *Polycystina* (*Haliomma hexacantha*, &c.) and *Xanthidia* (*N. furcatum*). The genera and species of coprolites described were as follows:—*Rhabdospongia communis*, *Bonneyia bacilliformis*, *B. cylindricus*, *B. Jessoni*, *B. scrobiculatus*, *B. verrongiformis*, *Acanthophora Hartogii*, *Polycantha Etheridgii*, *Retia simplex*, *R. costata*, *Ulospongia patera*, *U. calyx*, *U. Brunii*. The external appearance of these forms, which constitute a vast number of the coprolites, their curious oscules and siliceous spicules, were said to leave no doubt as to ther spongious origin.

Chemical Society, Dec. 19.—Prof. Williamson, F.R.S., vice-president, in the chair.—Analyses of water of the river Mahanuddy, by Mr. G. Nicholson. The author finds that the water of this river contains less dissolved matter than that of any other river in India.—Researches on the polymerides of morphine and their derivatives, by Mr. E. Ludwig Mayer and Dr. C. R. A. Wright; an account of the various derivatives obtained from morphine by acting on it with zinc chloride, hydrochloric acid, and sulphuric acid respectively, and also of the physiological properties of the compounds produced.—Three communications by Dr. H. E. Armstrong, from the laboratory of the London Institution, were then read. Derivatives of β-dinitrophenol; note on the action of bromine in presence of iodine on trinitrophenol (picric acid); preliminary notice on iodonitrophenols. The last paper, by Mr. C. E. Groves, was on the formation of napthaquinone by the direct oxidation of napthaline, which the author effects by means of chromic anhydride.

Anthropological Institute, Dec. 17.—Dr. Charnock, vice-president, in the chair. A paper was read by Mr. C. Staniland Wake on the origin of serpent-worship. After referring to various facts showing the existence of serpent-worship in many different parts of the world, the paper proceeded to consider the several ideas associated with the serpent among ancient and modern peoples. One of its chief characteristics was its power over the wind and rain. Another was its connection with health and good fortune, in which character it was the *Agathodæmon*. The serpent was also the symbol of life or immortality, as well as of wisdom. It was then shown that that animal was viewed by many uncultured peoples as the re-embodiment of a deceased ancestor, and that descent was actually traced by the Mexicans and various other peoples from a serpent. The serpent superstition thus became a phase of ancestor worship, the superior wisdom and power ascribed to the denizens of the invisible world being assigned also to their animal representatives. When the simple idea of a spirit ancestor was transformed into that of the Great Spirit, the father of the race, the attributes of the serpent would be enlarged, and it would be thought to have power over the rain and the hurricane, which provide the moisture requisite for life. Being thus transferred to the atmosphere, the serpent would come to be associated with nature, or solar worship. Hence we find that the sun was not only a serpent-god, but also the divine ancestor or benefactor of mankind. Seth, the traditional ancestor of the Semites, was the serpent-sun-god, the *Agathodæmon*, and facts were cited to establish that the legendary ancestors of the peoples classed together as Adamites was thought to possess the same character. It would appear to follow from this and other facts mentioned in the paper that serpent worship, as a developed religious system, originated in Central Asia, the home of the great Scythic stock from which the civilised races of the historical period sprung, and that the descendants of the legendary founder of that stock, the Adamites, were in a special sense serpent-worshippers.—Major W. H. Godwin-Austin contributed a paper "On the Garo Hill Tribes." The Garos occupy the extreme west point of the range of hills south of the Brahmaputra, and which terminate with the great bend of that river on long. 90° east. The paper entered into a comparison of the Garos with the kindred tribes of Duars, Kackari, and Kopili; and gave detailed descriptions of the physical characteristics, religious rites, manners, and customs, and peculiar dwellings of that people.

VIENNA

I. R. Geological Institute, Nov. 19.—The first meeting of the winter season was opened by the director, Fr. v. Hauer, with the report on the progress of the geological survey made during last summer. It was carried on in three different regions in the north-western part of Tyrol and Vorarlberg, including also the dominion of Prince Liechtenstein, on the Carlstadt military frontier, and in the south part of Bukowina. The exact investigation of the limestone chain in the first region, by Dr. v. Majsisovics, gave very unexpected results; not only did he discover Silurian (Grauwacke) strata and dyassic strata (Schwatz-limestone and Gröden-sandstone) unknown hitherto in the Rhäticum, but he stated also that the large limestone range of the Drusenflah, Salzflah, and Weisplatten belongs to the cretaceous formation—a very important fact, which changes essentially our ideas as to the geological structure of the curious region which separates the eastern and western Alps. Not less important are the observations of Dr. Stache on the crystalline rocks of the Oetzthal massive. He denies the existence of any more recent and eruptive "Central Gneiss" in this region, and asserts that strata of the so-called rock alternate regularly with mica-schist, amphibolic schists, &c. in the middle part of the massive as well as towards its outer margins. In the southern part of Bukowina, a region very little known till now, Mr. Paul stated that the crystalline schists, forming the basis of a series

of sedimentary formations, are divisible into two members; the lower, consisting chiefly of quartz-slates and quartzites, contains ores of copper and iron; the upper, formed by mica-slates, red gneiss, calcareous and amphibolic slates, includes the so-called black iron ores and manganese ores of Takobeni and Dorna. The sedimentary rocks are red sandstone, triassic limestone, lower and upper Neocomian, Cenomanian, Nummulitic rocks, and higher up the large masses of Carpathian sandstone. Besides the regular survey, almost all the members of the Institute made particular inquiries in different parts of the empire, partly for exclusively scientific purposes, but chiefly for the solution of questions of practical interest. An important discovery was thus made by Dr. Stache; he found in the slates south of the Gaiethal in Carinthia numerous Graptolites, the first certain proof of the existence of Silurian rocks in the southern Alps.

PARIS

Academy of Sciences, Dec. 16.—M. Faye, president, in the chair. The president of the Institute informed the Academy that its first general meeting for 1873 would be held on January 8, and wished the Academy to appoint a member to represent it as reader on that occasion.—General de Cissey, Minister of War, announced that his department had decided on the re-determination of the French meridian which has at present many errors, as it is advisable that the French section of the great line extending from Shetland to the Sahara should equal in accuracy the English, Spanish, and Algerian portions. Captain Perrier is to have charge of the work, and the Academy is asked to appoint a committee of revision.—The president then read an addition to his physical theory of the sun explaining the nature of the spots He defends his theory against some recent criticisms of Messrs. Spencer and Kirchhoff. He regards the spots as produced by cyclones which form a funnel-shaped cavity in the photosphere. Round the edge of this hole the photosphere and chromosphere are heaped together, and into it masses of cooler atmosphere are drawn by the vortex, and they then exert their absorptive power.—M. Jamin read a note on the distribution of magnetism.—M. Belgrand then read a second note on the floods of the Seine.—M. Daubrée read a note on a meteorite which fell near Bandong, Java; the governor of the Dutch Indies had sent a portion to the museum. An analysis has been published in the Archives Néerlandaises of Haarlem, vol. vi. 1871, by Mr. Von. Baumhauer. The meteorite contains iron, nickel, cobalt, chromium, manganese, magnesium, aluminium, sodium, potassium, calcium, oxygen, sulphur, and silicon.—M. Fréd. Kuhlmann then read an account of a search for iodine and bromine in some phosphatic minerals, iodine was distinctly recognised, but bromine if present was only there in inappreciable quantities.—M. F. Perrier read a note on a new determination of the French meridian.—The *Phylloxera* Commission presented extracts from two papers by MM. Max Cornu and E Duclaux: they also asked permission to present their report at an early date. Notes on the same subject were received from MM. R. Shore and Alderly.—M. de Wissocq presented a paper entitled "A Study of the Works required to prevent the Floods of the Loire.—M. Sacc sent a letter on the preservation of food, which was referred to the commission on that subject.—M. F. Perrier read an answer to a note of M. Laussedat on the prolongation of the Spanish meridian into Algeria. The answer related partly to questions of priority as concerns the proposed prolongation.—M. F. Lucas presented some observations on a note on mathematical physics, by M. Quet.—M. Gernez sent a note on the supposed action of thin films of liquids on supersaturated solutions. The author asserts that Tomlinson and Van der Mensbrugghe are deceived in their idea that films cause crystallisation. M. Gernez states that this is not caused by a film *per se*, but by crystalline particles contained in it.—M. A. Trève read a note on magnetism, which was followed by a note by MM. Troost and Hautefeuille on some derivatives of the oxychlorides of silicon.—M. A. Boillot read a note on a new method of preparing ozone by means of carbon. The carbon is employed as the conducting film on the surface of the ozoniser. M. Gérardin presented a note on the amount of oxygen dissolved in rain water and in that of the Seine. Fine and persistent rain contains less oxygen than that of heavy and short showers.—Next came a note from M. Lortet on penetration of *leucocytes* into the interior of organic membranes.

DIARY

FRIDAY, JANUARY 3.

GEOLOGISTS' ASSOCIATION, at 8.—On the Cambrian and Silurian Rocks of Ramsey Island, St. David's: Henry Hicks.—On the Diplonidæ of the Moffat Shale: Charles Lapworth.

SUNDAY, JANUARY 5.

SUNDAY LECTURE SOCIETY, at 4.—The next Transit of Venus, and the measurement of the distances of the Planets from the Sun: W. J. Lewis.

MONDAY, JANUARY 6.

LONDON INSTITUTION, at 4.—On Air, Earth, Fire, and Water: Prof. Armstrong (Holiday Course, II.)
ENTOMOLOGICAL SOCIETY, at 7.
SOCIETY OF BRITISH ARCHITECTS, at 8.
MEDICAL SOCIETY, at 8.
VICTORIA INSTITUTE, at 8.

TUESDAY, JANUARY 7.

PATHOLOGICAL SOCIETY, at 8.—Anniversary.
ANTHROPOLOGICAL INSTITUTE, at 8.—The Atlantean Race of Western Europe: The late J. W. Jackson.—The Kojahs of Southern India: Dr. John Shortt.—Primordial Inhabitants of Brazil: M. H. Gerber and Capt. Burton.
SOCIETY OF BIBLICAL ARCHÆOLOGY, at 8 30.
ZOOLOGICAL SOCIETY, at 8.30.—Contributions to a general History of the Spongiadæ (Part IV): Dr. Bowerbank.—Report on a Collection of Sponges found at Ceylon, by E. W H. Holdsworth: Dr. Bowerbank.—On the Value in Classification of a peculiarity in the anterior margin of the Nasal Bones of some Birds: A H. Garrod.
ROYAL INSTITUTION, at 3.—Juvenile Lectures—On Air and Gas: Prof. Odling.

WEDNESDAY, JANUARY 8.

GEOLOGICAL SOCIETY at 8.—On the Secondary Rocks of Scotland.—Part I. The Strata of the Eastern Coast: J. W. Judd.—Observations on the more remarkable Boulders of the North West of England and the Welsh Borders: D. Mackintosh.
GRAPHIC SOCIETY, at 8.
ROYAL SOCIETY OF LITERATURE, at 8.
ARCHÆOLOGICAL ASSOCIATION, at 8.

THURSDAY, JANUARY 9.

ROYAL SOCIETY, at 8.30.
SOCIETY OF ANTIQUARIES, at 8.30.
ROYAL SOCIETY CLUB, at 6.
MATHEMATICAL SOCIETY, at 8.—On Parallel Surfaces: S. Roberts.—Summation of certain Series: Prof. Wolstenholme.
ROYAL INSTITUTION, at 3.—Juvenile Lectures—On Air and Gas: Prof. Odling.

BOOKS RECEIVED

ENGLISH.—Faith and Free Thought: S. Wilberforce (Hodder and Stoughton).—A Series of Botanical Labels for Herbaria: J. E. Robson (Hardwicke).—The Coal-Fields of Great Britain. 3rd edit.: E. Hull (Stanford).—Reprint of Papers on Electrostatics and Magnetism: Sir William Thomson (Macmillan & Co.).

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