THURSDAY, JANUARY 29, 1885

THE STABILITY OF SHIPS[1]

A Treatise on the Stability of Ships. By Sir E. J. Reed, K.C.B., F.R.S., M.P. (London: C. Griffin and Co., 1885.)

II.

IN simplifying the mode of presentation of the scientific principles which govern the stability of ships, Sir E. J. Reed touches upon a very important point—the defects of nomenclature. The technical nomenclature of naval architecture has gradually been formed in an unsystematic and often heedless and unintelligent manner; and it contains many inconsistencies and inaccuracies. Attention has previously been called by ourselves and others to the subject. Sir Edward Reed refers to the confusion that is sometimes caused by giving the name "metacentre" to points upon two curves which are quite distinct from each other. One of these curves indicates the variation in the height of the metacentre with draught of water when the ship is upright; and the other is that formed by the intersections of consecutive normals to the curve of buoyancy as a ship becomes inclined from the upright. These two curves are entirely different in character, and have only one point in common—viz. the metacentre for the upright position corresponding to the draught of water for which the curve of intersections of consecutive normals is constructed. The latter curve is, of course, the evolute of the curve of buoyancy. Sir Edward Reed proposes to call the intersections of consecutive normals to the curve of buoyancy at all angles of inclination from the upright "pro-metacentres," and to restrict the use of the term "metacentre" to indefinitely small inclinations from positions of equilibrium.

The points described as "pro-metacentres" are centres of curvature of the curve of buoyancy. They are but of little importance to practical naval architects, and are probably never regarded by them. To persons who may be pursuing investigations in which such points require to be dealt with, such a term as "pro-metacentre" may be of use. Sir Edward Reed truly says that the points in question "are not 'meta-centres,' except in a very strained, misleading, and wholly exceptional sense." They do not enter into any of the considerations by which the stability of a ship is judged of or calculated; and their positions are not determined, nor even known, in practice.

If Fig. 2 represents the section of a ship, $B\,B_3$ the curve of centres of buoyancy, and $M\,M_3$ the curve of intersections of consecutive normals to $B\,B_3$, or the evolute of $B\,B_3$, then the points M_1, M_2, and M_3 will be the "pro-metacentres" corresponding to those angles of inclination at which $M_1\,B_1$, $M_2\,B_2$, and $M_3\,B_3$ are respectively vertical. M is the point corresponding to the position of equilibrium when the vessel is upright, and is the metacentre proper. Such points as M_1, M_2, and M_3 have sometimes been miscalled metacentres, and the curve $M\,M_3$ the metacentric evolute. Sir E. J. Reed proposes to call these points "pro-metacentres," and the curve $M\,M_3$ the "curve of pro-metacentres." M_1, M_2, and M_3 are centres of curvature of $B\,B_3$ at the points B_1, B_2, and B_3; and the curve $M\,M_3$ is the evolute of $B\,B_3$.

Sir Edward reminds us that the points where the lines $M_1\,B_1$, $M_2\,B_2$, and $M_3\,B_3$ intersect the vertical axis of equilibrium through B, have sometimes, in this country, been called "shifting metacentres"; and he considers that although this term has a "measure of justification, its use is not very desirable, and is, indeed, likely, unless great care is taken, to introduce misconceptions into the subject." It is true that the term "shifting metacentre" was suggested for application to these points, even by so eminent an authority as the late Prof. Macquorne Rankine; but it has failed of its purpose, and passed so completely into oblivion that if Sir Edward had not referred to the circumstance few of his readers would have remembered it. There is little probability of the term "shifting metacentre" now coming into use.

The most natural mode of treating these points is doubtless to class them all in the category of "metacentres," without any qualifying adjective of a general character, such as "shifting." In France the term metacentre includes the point M—which we regard as being the metacentre proper—and Prof. Rankine's shifting metacentres. It is natural to regard the intersection of $M_2\,B_2$

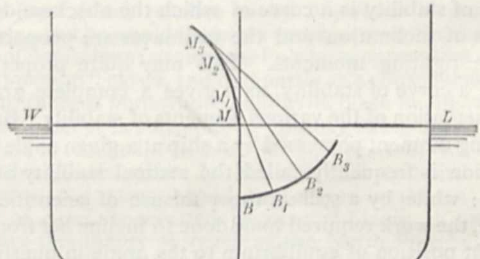

FIG. 2.

with the vertical axis of equilibrium as the metacentre for the particular angle of inclination to which $M_2\,B_2$ relates. This is quite consistent with Bouguer's original definition of the metacentre, viz. "la terme que la hauteur du centre de gravité G, ne doit pas passer, et ne doit pas même attendre." This point constitutes the limit above which the centre of gravity cannot be raised without causing the ship to move farther away from the upright, whether the angle of inclination be great or small. It is convenient, and need not be ambiguous, to call these points metacentres for the particular angles of heel to which they relate. Thus the intersection of $M_1\,B_1$ with the vertical axis of equilibrium through B is the metacentre at 10° of inclination, if 10° be the angle at which $M_1\,B_1$ is vertical; and the same for any other angle.

These points are really of importance to the naval designer, as the distance from such a point to the centre of gravity at any angle of inclination, say 30°, is equal to the length of the ship's righting lever divided by the sine of the angle of inclination. If this distance be zero the righting lever vanishes, and there will be no resistance to further inclination. If the metacentre at 30° fall below the centre of gravity the ship will tend to incline still

[1] Continued from p. 240.

farther; but if it be above the centre of gravity she will tend to return towards the upright position. Sir Edward Reed objects to calling these points metacentres when the angles of inclination are large, because they really have "nothing to do with limiting the height to which the centre of gravity can be raised without disturbing the upright position of the ship." We do not see that any such property is implied by calling the metacentre for a certain angle of inclination the metacentre belonging to that inclination, which is what the French do. There is no doubt that the French method is a natural and useful one. It is also one which has been adopted by many in this country, and is likely to become general. M. E. Bertin, of Brest, says that the nomenclature adopted throughout France for many years past has been such as to leave no room for difficulties of interpretation. But while Sir Edward Reed objects to the French practice in this respect, as well as to Prof. Rankine's "shifting metacentre," he does not propose a substitute for either.

There are other matters connected with the nomenclature of this branch of science which might have been profitably dealt with by the author. Take, for instance, the common use of the term stability. The stability of a floating body is determined by the forces which resist its angular motion from a position of equilibrium, and by the angular distance over which such forces operate. What is called the curve of stability is a curve of which the abscissæ denote angles of inclination and the ordinates are proportional to the righting moments. This may quite properly be called a curve of stability, as it gives a complete graphic representation of the various elements of stability. But the righting moment possessed by a ship at a given angle of inclination is frequently called the statical stability at that angle: while, by a still stranger misuse of scientific language, the work required to be done to incline her from the upright position of equilibrium to the angle in question is called the *dynamical stability* at that angle. Stability exists only at positions of equilibrium; and it is absurd to speak of foot-tons of stability at a given angle of inclination from one of those positions, as is frequently done. Such mistakes can only be due to the confusion which exists in many minds between stability and righting moment. Prof. Osborne Reynolds called attention to the point at the meeting of the British Association in 1883. Whether any intelligible meaning is supposed to be conveyed by the words "dynamical stability developed during inclination," we do not know; at any rate, we cannot discover what it is. Sir E. J. Reed has done good service by approaching the question of mistaken and ambiguous terms in naval architecture. We are only sorry that he has not dealt more thoroughly with it.

Sir Edward gives numerous illustrations of curves of metacentres, and curves of stability, for various types of ships; so that the effect upon them of variation in the proportions and form, and also in the loading, of various types of vessels, may be studied. These curves are given for broadside armour-clads, low freeboard turret-ships, and armoured cruisers of our own and other navies; and for passenger and cargo steamers. The latter include examples which show the character of the stability that many vessels of the "well-deck" type possess.

The subject of longitudinal stability is fully dealt with; and the effect of admitting water into a watertight compartment is discussed. The method of determining the height of the longitudinal metacentre is explained; and also the moment required to alter the trim of a given ship by a fixed amount. The changes of trim produced by putting weights into or taking weights out of a ship are clearly described. The stability of a vessel fitted with watertight compartments, and having water admitted into one or more of them by collision, or otherwise, is investigated with great fulness of detail. The following distinct conditions are considered: (1) When a closed compartment is completely filled with water; (2) when a closed compartment is partially filled with water; and (3) when a compartment contains water in free communication with the sea, and in which the water maintains the same level as the sea for all inclinations. In dealing with this subject Sir E. J. Reed substantially follows the lines laid down by Mr. F. K. Barnes, of the Admiralty, in papers read before the Institution of Naval Architects in 1864 and 1867. Mr. Barnes has very ably and lucidly explained the effect upon the metacentric height which is produced by laying a central compartment in a ship open to the sea and filling it with water; and also the effect produced by thus filling compartments which are formed by longitudinal bulkheads. The results are given, in both cases, for compartments of various sizes and proportions.

Sir Edward devotes a chapter to the consideration of "dynamical stability," and gives the views that have been put forward respecting it by the late Canon Moseley and by MM. Moreau, Bertin, Risbec, and Duhil de Benazé. He also quotes an interesting and ingenious investigation by M. Guyou, of the French Navy, which includes a somewhat novel treatment of the problem of dynamical stability. We have already objected to the use of the phrase "dynamical stability." The author explains that what is called the dynamical stability at a given angle of inclination is the work done by an inclining force in heeling the ship from the upright position of equilibrium through that angle. The "total work is the dynamical stability." Dynamical stability is consequently spoken of as being "developed during the inclination of the ship from one angle to another." Resistance is overcome, and work is done, in inclining a ship from one angle to another against the action of righting forces; but we cannot understand why such work should be called "dynamical stability."

The work done in inclining a ship from one angle to another is, of course, the resistance to such inclination multiplied by the distance through which the resistance is overcome. This resistance is constituted by the weight of the ship acting vertically downwards through its centre of gravity, and an equal and opposite force acting vertically upwards through the centre of gravity of the displaced water. Therefore the total work performed during an inclination is the weight of the ship multiplied by the vertical increase of distance between the centre of gravity of the ship and the centre of gravity of the displaced water.

This treatise contains an instructive chapter upon M. Amsler-Laffon's mechanical integrator. The ordinary pivot-planimeter, which is a more common and very valuable instrument, is not referred to; but the integrator which combines appliances for computing areas, moments, and moments of inertia of plane curves is described. This instrument has lately been introduced into ship-drawing offices, and is highly appreciated for the saving of time and labour which can be effected by its use, and for its comparative freedom from error. Complicated calculations can be made with this ingenious piece of mechanism by less highly-skilled draughtsmen than are required for performing the ordinary arithmetical calculations. This is a very important matter in mercantile shipyards, where the supply of scientifically-trained draughtsmen is not great. In referring to this point Sir E. J. Reed says that "in most private shipbuilding establishments these lads (drawing-office apprentices) are now required to pass an examination similar to that which candidates undergo for apprenticeship in Her Majesty's dockyards." We do not understand that this is so. It may be the case with one or two firms, but the system is a very exceptional one. Sir E. J. Reed gives a mathematical investigation of the properties of the integrator, and explains how to take off the readings for areas, moments, and moments of inertia. We notice an omission in connection with the figures given for the various constants that require to be applied as multipliers to these readings, for the purpose of converting them into actual units of measurement. The particular instrument to which the constants apply is not fully stated. The constant for areas, given as 15, and that for the area term in the expression for moment of inertia, given as 240, relate to instruments formerly supplied by M. Amsler, which had a different diameter of area wheel from those now made. We believe that the circumference of the area wheel is now 2·5 inches; so that the two constants which depend upon the size of the area wheel would, in that case, be 20 and 320, instead of 15 and 240.

The final chapters of the treatise deal with general questions relating to the rolling of ships at sea, and the effect of wind-pressure upon stability when ships are sailing among waves. The method of obtaining by experiment the vertical position of a ship's centre of gravity, and the precautions which have to be adopted in order to ensure fairly accurate results, are described.

The few omissions and defects we have pointed out are but of minor importance, and do not appreciably affect the general value of this very important treatise. It is not only the largest that has ever appeared in this country, but also the most intelligible, instructive, and complete exposition of the principles of stability. It forms a most valuable addition to the science of naval architecture, and one that has long been needed. Till now we have been unable to refer persons desirous of studying the various problems connected with the stability of ships to any work in which they would find the subject treated in a clear and comprehensive manner. Sir E. J. Reed has supplied a want that has long existed. We strongly recommend his book to all who are interested in the subject, and particularly to those whose connection with ships requires them to know upon what conditions stability depends, and how it is affected by all the various circumstances of construction and loading which may arise. Such a treatise should be especially welcome to students.

OUR BOOK SHELF

In the Lena Delta; a Narrative of the Search for Lieut.-Commander De Long and his Companions, followed by an Account of the Greely Relief Expedition and a Proposed Method of Reaching the North Pole. By G. W. Melville; Edited by G. Melville Philips. (London: Longmans and Co., 1885.)

THE sad story of the *Jeannette* Expedition has already been very fully told in the two volumes of journals left by Capt. De Long. Still, we do not object to this more detailed narrative of the experiences in the Lena Delta of those who managed to reach it, by the one most qualified to speak of them. It was by the strenuous exertions of Engineer Melville that the bodies of Capt. De Long and his companions were discovered, and that the few survivors were rescued. Concerning the physical and biological conditions of the great swamp formed about the mouths of the Lena, Mr. Melville does not tell us much more than we knew already; but his continual journeys to and from between the delta and such towns as Yakutsk, Tiumen, and others in this part of Siberia necessarily furnish us with many details of interest. As a story of remarkable adventures the book is certainly interesting. Mr. Melville's arctic enthusiasm was not in the least damped by the *Jeannette* misfortunes. Not only does he describe in the present volume his experiences as a member of the Greely Relief Expedition, but he means evidently to attempt to reach the Pole, if for no other reason but that it "may prevent other fools from going there." Mr. Melville's plan takes for granted that Franz Josef Land reaches to 85° N., which is probable enough; and he would therefore propose to utilise this as a basis of operations; around the Pole he supposes that a partial "vacuum" exists, and that partly as a consequence the ice-cap there is immovable, held in its place by the islands which he believes surround it. As to getting back when the Pole is reached, Mr. Melville believes that this could easily be effected either by Nova Zembla or Spitzbergen. Of course, the retreat would be secured by the establishment of carefully-selected depots. "Finally, I propose to prove this theory of reaching the North Pole by *going there myself.*" Every one will wish him God speed; and there can be no doubt that the best arctic authorities are agreed that the next expedition should seriously try the Franz Josef Land route.

Stanford's Compendium of Geography and Travel—Europe. By F. W. Rudler, F.G.S., and G. W. Chisholm, B.Sc. Edited by Sir Andrew C. Ramsay, LL.D., F.R.S. With Ethnological Appendix by A. H. Keane, M.A.I. (London: Stanford, 1885.)

THIS many-authored and much-edited volume is the last of the series of Stanford's well-known "Compendium," the first volume of which was issued some six years ago. That first volume dealt with Africa, and was edited, it may be remembered, by Mr. Keith Johnston, who shortly after publication lost his life attempting to explore the continent which he had so well described. There have been subsequent editions of that volume edited by Mr. E. G. Ravenstein. The succeeding volumes were South America, by Mr. H. W. Bates; Australasia, by Mr. A. R. Wallace; Asia, by Prof. Keane and Sir Richard Temple; and North America, by Drs. Hayden and Selwyn. It will thus be seen that Mr. Stanford has been fortunate in his choice of editors for the several volumes. The Compendium professes to be based on Hellwald's German work, but it may throughout be regarded as virtually original. The various editors have put so much of their own into their several volumes, and given to the whole an orientation so essentially English, that it would be difficult to tell which is Hellwald and which the "editors." In the present volume the editors and authors (or one of them, for the title-page is awkward) have wisely retained what Hellwald says concerning the English people.

The volume is quite equal to the best of its predecessors. The physical geography of Europe occupies quite one-half, and while necessarily of the nature of a summary, seems to us carefully and accurately written. The second part of the volume is devoted to what is known as "political" geography, while Mr. Chisholm has collected into an appendix a very useful series of statistical tables. As usual we have Prof. Keane's valuable ethnological appendix, occupying some thirty pages. Though Europe is the best-known of the Continents, its ethnology is more difficult to deal with than that of any other part of the world. "Races" and languages have become so mixed up and interchanged, that it is a matter of great difficulty to distinguish between the various elements. Mr. Keane has some difficult problems to face, but probably no one is more competent to solve them. His sections on "pure races" and "mixed languages" are of special interest; he rightly concludes that in Europe we have neither the one nor the other, nor probably will they be found in any part of the world. These ethnological appendices are quite worthy of being collected and extended and published separately as a useful manual of ethnology. The maps in the present volume are many, and of much scientific value. This "Compendium" as a whole may be accepted as a really trustworthy and manageable geographical reference-book.

Nine Years in Nipon; Sketches of Japanese Life and Manners. By Henry Faulds, L.F.P.S. (London: Alexander Gardner, 1885.)

THE author of this beautiful and entertaining volume is a missionary doctor who, in the course of his nine years' residence in Japan, has, as he tells us, mixed with every class in the country except the very highest. He has visited most of the usual sights, such as Fuji, Nikko, and the inland sea, but otherwise his professional duties appear to have kept him very close to Tokio. To make up for this he has seen the lower and middle classes of Japan as few other Europeans have had the opportunity of seeing them, and after all he is able to say that the land is not all barren. He stands up bravely against the redoubtable Miss Bird for the much-maligned morality of the Japanese people. He thinks that brilliant lady's dictum that the nation is sunk in immorality extremely harsh and erroneous. The recent intellectual progress of the Japanese is, he believes, very striking, though not as yet so general as many have supposed; their political progress is unprecedented, but he thinks that on the whole the moral elevation of the mass of the people within the last decade has been still more striking and noteworthy. A considerable portion of the volume is made up of bright, lively sketches of scenes by the way in Tokio, and along the roads in the interior. These are very well done, but they might almost be equally well done by an ordinary tourist with some literary gifts and graces. It is in the last half of the volume that we come on the real student and acute observer of Japan. It is only an old resident, whose familiarity with the everyday sights and sounds around him had never blunted his original sense of their picturesqueness and strangeness, that could have written the chapters on the Japanese philosophy of flowers, Japanese art in relation to nature, and how the Japanese amuse themselves. In connection with the universal spread of education throughout Japan (the author can only recall one or two clear instances in his experience of Japanese people being unable to read or write), he makes an observation which we do not remember to have seen or heard before, viz. that the cause is Buddhism. The effect of what he calls the new and genial enthusiasm of humanity, which came from India, taught everywhere the unity and brotherhood of man, and so literature could no longer be maintained as the peculiar possession of any caste of mere priests or princes. "My Garden and its Guests" is a delightful chapter of popular natural history. In an introductory chapter, in which he surveys the canvas on which he is about to draw his sketches, he has a few words to say on the ethnology of the Japanese. He says that the Ainos, "in spite of a great deal of crude writing on the subject" (to which, it should be stated, Mr. Faulds has added his mite, though not in this book), cannot show any claim to be considered the aborigines; they are not necessarily older in their occupancy than the Japanese themselves. This heterodox statement is thrown off with a *nonchalant* air, as of one making a common matter-of-fact observation; but it would be interesting to know the author's grounds for it. The shell-heaps (to take only a single instance) which have been found near Tokio, and even farther south, and which resemble in every respect heaps formed, or in process of formation, outside Aino villages in Yezo, form a strong argument the other way; we were under the impression, also, that history told us of the existence of Ainos on the spot on which Ota Dokan built himself the fort which afterwards grew into Yedo in the fifteenth century. But it seems waste of time to refer to such matters in the case of a man who has the hardihood to confess that he does not know exactly what a Mongol is, and that he thinks it only deepens our ignorance immensely to call another race Mongoloid. To make up for this, however, and by way of washing his hands clear of the matter, he gives all the original theories by which science, aided by tradition, accounts for the original migration of the Japanese people. As there are six points of the compass (zenith and nadir being added) in far-eastern cosmography, so there are theories of migration from each one of these six points :—(1) the soil (Buddhist view); (2) America; (3) China, or Accadia; (4) Africa, or the Malay Peninsula, or the Southern Isles of the Pacific; (5) Saghalin, or Kamtschatka; (6) the celestial regions of the Sun; with which comprehensive category Mr. Faulds takes leave of ethnology. For the rest, the book is as charming in all externals as in its contents. It should take its place in the front rank among popular books on Japan; indeed, since Mitford's "Tales of Old Japan," we cannot recall a more interesting volume on the country, or one which should be more read in England.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Krakatoa

BY the return from the Caroline Islands, on the 25th inst., of the *Jennie Walker*, I am enabled to supply a few additional details about the westward progress of the equatorial smoke stream from Krakatoa in September 1883. In NATURE, October 2 (p. 537), is my extract from Miss Cathcart's journal describing the obscuration of the sun at Kusaie, or Strong's Island, on September 7, 1883. The Rev. Dr. Pease and wife came as passengers by the *Jennie Walker*. They state that, while they were dressing their children on the morning of September 7, the natives came anxiously asking what was the matter with the sun, which rose over the mountains with a strange aspect. It was cloudless, but pale, so as to be stared at freely. Its colour Dr. Pease called a sickly greenish-blue, as if plague-stricken. Mrs. Pease's journal described it as "of a bird's-egg-blue, softened as this colour would be by a thin gauze." Around the sun the sky was of a silvery gray. At the altitude of 45° the sun appeared of its usual brightness, but resumed its pallid green aspect as it declined in the west.

On the 8th the sun appeared as usual. They did not notice the red glares until some days after.

Strong's Island is in lat. 5° 20′ N., long. 163° 10′ E. Their 7th is our 6th, one day later than the tremendous display of colours in the Honolulu skies on September 5.

Dr. Pease reports a considerable drift of pumice-stone landed for several months past upon the *west* shore of Kusaie. Many pieces are from twelve to sixteen inches thick, and loaded with barnacles. I have now before me a piece of pumice presented by Dr. Pease, with small barnacles attached. Dr. Pease also reports many large trees landed there of late. They are up to five feet in diameter, with huge buttressing roots, much pumice jammed in the roots, their wood as light as cork. This species of tree is unknown in Micronesia. Are these corky trees, as well as the pumice, part of the wreckage of Krakatoa? Dr. Pease states that this year, as happened once before, the prevailing westerly current has been exchanged for one running easterly. Drift-logs of redwood from California frequently land on Kusaie, as they do here.

On the passage hither between Kusaie and Jaluit Dr. Pease saw large tracts of floating pumice in a comminuted state. The Rev. E. T. Doane of Ponape (lat. 6° 47′ N., long. 158° 20′ E.) writes me that large quantities of pumice are floating around that island. Capt. Holland, of the *Jennie Walker*, states that all the way between Jaluit and Ruk or Hogolen, some 1500 miles, he encountered vast tracts of pumice. Many pieces were as large as hats. He met five or six large trees in the same regions. One with its branches was mistaken for a boat. This association of floating trees with pumice seems very suggestive of Krakatoa, especially as all have been long floating in the sea.

I send herewith a small slab of the pumice from Strong's Island, hoping that you will have it compared with known Krakatoa ejecta.

During the past month of December the sky-glows have doubled in brightness. A like augmentation of brilliancy took place at the same period in 1883, as reported by me in your columns. Permit the suggestion that the winter cold enlarges the concretions of ice around the dust-nuclei in the upper atmosphere, thereby multiplying their reflecting power. I see no reason to believe that any addition has been made to the original diffusion of dust from Krakatoa. The whitish corona which first appeared around the sun in September, 1883, has always and continuously been conspicuous since that time. It is one and the same continuous phenomenon which began here with that tremendous dust-cloud of September 5, 1883.

S. E. Bishop

Hawaiian Government Survey, Honolulu, Dec. 29, 1884

Recent Earthquakes

En relation possible, mais non probable, avec les tremblements de terre d'Espagne j'ai à vous signaler les secousses suivantes observées en Suisse :—

25 décembre, 1884—à Zernetz, Engadine, secousses à 8h. 17′ S., et 11h. S., heure de Berne.

(8h. 17′ heure de Berne correspond à 7h. 32′ heure de Madrid. La première de ces secousses a donc eu lieu 20m. avant la grande secousse de Grenade du 25 déc. à 8h. 52′ soir.)

1 janvier, 1885—2h. matin, légère secousse, signalée à Lausanne par un seul observateur.

21 janvier, 1885—Entre oh. et 1h. matin, secousse à Ennenda, canton de Glarus.

Dans les Alpes françaises.

le 5 janvier, 1885, à 3h. matin à Chambéry (Savoie).

,, ,, à 5h. 50′ matin à Embrun (Hautes Alpes).

Agréez, Monsieur, l'expression de mes sentiments très distingués.

F. A. Forel

Morges, 24 janvier

On Thursday evening last, at a time which is variously stated from 8.30 p.m. to shortly before 9, a rumbling noise, accompanied by a sensible trembling of the earth, and in some instances by a slight "rocking" of cottages, was heard and felt over several parishes in this neighbourhood. I have already had independent testimony of it from West Buckland, Bradford, Nymhead, and Langford, in a line from north-west to south-east across the upper part of the Vale of Taunton. Some observers state that the noise and motion seemed to come from the north-west. There can be but little doubt but that this was a slight shock of an earthquake. It would be interesting to know whether anything of the same kind had been observed elsewhere at the same time.

W. A. Sanford

Nymhead Court, Wellington, Somerset, January 24

The Lexden Earthquake

The earthquake alleged to have taken place near Colchester on Sunday night, Jan. 18, and mentioned in the "Notes" of Nature last week, on the authority of the *Standard* newspaper, turns out on inquiry to have been reported on very doubtful authority. The place referred to as "Leden" is evidently meant for Lexden, which is really a suburb of Colchester. Immediately after seeing the newspaper paragraph I communicated with some of the residents, asking them to obtain particulars for me, as the occurrence of another shock so near the district which was skaken in April of last year, would have been of considerable interest in connection with the report upon this last earthquake, which I am about to present to the Essex Field Club. It seems, however, according to the results of these inquiries, confirmed by a paragraph in the *Colchester Gazette* of January 21, that the shock was said to have been felt by one person only, the postman, and nobody else in the place heard or felt anything, nor was any crockery shaken or any vibration experienced in any other house. One gentleman, who was out of doors at the time mentioned (midnight), states that he heard a peal of thunder, but felt no shock, and he suggests that this might have awakened the postman, upon whose authority the newspaper paragraph appears to have been founded.

The statement that the shock was felt at Aldeburgh rests also on the authority of one person only, and it shows with what caution such statements should be received in the absence of instrumental records.

R. Meldola

21, John Street, Bedford Row, January 24

Barrenness of the Pampas

Mr. Edwin Clark overlooks, I think, an important factor in the present treeless condition of the Pampas (of the La Plata, so far as my own knowledge extends only), and of the difficulty of establishing trees on those plains. North of Monte Video, for some hundreds of miles, the leaf-eating ant is omnipresent. I have seen streams of them running along the beaten paths to their nests, each ant carrying the yellow petals of some plant similar to the buttercup. When I first noticed, from my horse, this procession of golden leaves, I was greatly astonished. Familiarity, however, soon dispelled this. The *opima spolia* was being carried to their nests and taken under ground, no doubt as a provision for the winter. The ants were about a quarter of an inch in length, and of a beautiful steel-blue colour. Those I picked up for examination demonstrated their powers by shearing off the hard cuticle of my thumb or fore-finger with their mandibles. Subsequently, I made the acquaintance of a gentleman, well known in the Banda Oriental, the owner of the "Estancia Sherenden." He showed me a splendid grove of about two acres of *Eucalypti* of several species—the "blue" and "red" gum chiefly. These he had reared from seed, their enemies being these ants. As soon as the first leaves of his cherished plants appeared, the ants cut them off. He then got a drum of gas-tar sent up from town, and made a circle round each plant. The ants objected to this, and all the trees made a start. For three years in succession he carefully painted the stems with tar, and eventually they got so far away as to be able to supply the wants of their foes and still flourish. When I saw these trees they bore finer foliage than I ever met with in the Australian bush during four years' experience. They were then eight years old. Many were forty feet high, and thirty-six inches round at some three feet from the earth.

I think none of the animals mentioned by Mr. Clarke, *certainly not any of the rodents* in his list, would be likely to touch gum trees, and the repugnance to them of sheep, oxen, and horses in Australia is well known.

Maize grows freely in the Banda, but it grows too fast for these ants to destroy it. The attacks of those from nests within marching distance are powerless on an acre of Indian corn.

When I examined the *Eucalypti* at "Sherenden," many ants were coming down the trees with cuttings of the leaves in their mandibles.

If you will allow me a word of suggestion in addition, I would say to every one who establishes trees on the Pampas

Seek out the nests of these ants within a quarter of a mile (that would be enough), light a good fire over them in winter, when the inhabitants are at home, and after that there would be no difficulty in gradually covering the ground with plantations. The dried stems of the ubiquitous thistle, cow-dung, corn-cobs, or "paja" grass, would burn out these pests.

ARTHUR NICOLS

Cross-Breeding Potatoes

IN the interesting account of the latest successful attempt at raising hybrid potatoes by crossing with different species instead of, as heretofore, by varieties, it is taken for granted the new production will be disease-resisting. Until, however, time has tested the powers of the plant after cultivation, stimulated with all the appliances the potato-growers have at their command, it is rather premature to trust to this. Forty years ago I saw potatoes growing from seed imported direct from South America, and after three years' cultivation they all went with disease in the year 1848. The species I could not tell. The same varieties which go off with disease in this country are never affected in Tasmania, Australia, or New Zealand. At present the newer sorts in cultivation grow so sound and healthy that champions of fine quality over all the east of Scotland are now offering wholesale at three pounds for one halfpenny, and cannot find buyers. The results of the experiments in crossing referred to, while most interesting, will only prove beneficial if a disease-resisting plant is produced having all the table qualities of the old Regent, as well as its great reproductive power, which, with its ability to resist disease, it has now lost.

JAMES MELVIN

43, Drumsheugh Gardens, Edinburgh, January 19

PROTOPLASM[1]

THE fact of a direct continuity between the protoplasmic contents of adjacent cells is an important factor in plant histology. The history of this subject is briefly as follows:—

The individuality of the plant-cells, defended by Schleiden,[2] was first criticised by Hofmeister,[3] and more positively and later by Sachs.[4] For Sachs and also for Strasburger[5] the plant is only one cohering protoplasmic entity. Nägeli[6] has also in a recent work supposed that the protoplasm of each cell is in direct communication with that of the others, by means of delicate protoplasmic filaments.

So far the theoretical side of the question. The first *direct* observation was made in the year 1854 by Theodor Hartig, and not by Sachs as Walter Gardiner[8] states. We find in Hartig's paper the following description of the continuity of sieve-tubes, "Behandelt man in Wasser macerirte Siebröhren mit Schwefelsäure, so erfolgt häufig eine völlige oder theilweise Trennung der beiden Endflächen, in welchem Falle genau zwischen den correspondirenden Ptychodearmen sich Fäden *ausziehen*, die durch Tod dieselbe Färbung und Structur zeigen wie die Ptychodearme selbst. Fig. 18 stellt einen solchen Fall dar."

After Hartig's discovery, confirmed later by Hanstein and Sachs: Mohl, Nägeli, De Bary, Dippel, Wilhelm, Tauczewski, Russow, &c., examined the sieve-tubes and their plasmic connection. For a long time the connection of the sieve-tubes remained the only known fact, until Bornet[1] and E. Perceval Wright[2] in 1878, J. G. Agardh[3] in 1879, and Schmitz[4] in 1883 (the connective filaments were seen), and further, in 1884, Th. Hick[5] and Kolderup-Rosenvinge[6] published some accounts of the communication between adjacent cells in the Florideæ. It seemed to me very probable that in the Cyanophyceæ also communications between the adjacent filament-cells would be found. At least the drawings that Wille[7] gives put one in mind of similar phenomena.

After J. G. Agardh,[8] Tangl,[9] in 1880, succeeded in proving the direct communication in phanerogamous plants between the endosperm cells. In the various papers of Russow,[10] Gardiner,[11] and Hillhouse,[12] these communications are stated in many cases to occur in the bast-parenchyma, the phloem-ray cells of numerous plants, in various pulvini, in the cells of the leaf of Dionæa, in the cells of the stamens of Berberis, in a great number of endosperm cells, and in various cortical tissues.

Finally, Terletzki[13] gave a brief account of the plasmic communication of the parenchyma-cells in the stem of some ferns. I have published also myself[14] a brief account of this interesting object, and described briefly the observations made during the summer of the past year. After Terletzki's paper I was induced to publish my observations, with the full details.[15] The physiological significance of the communication was, in the first instance, not understood; it was believed to be chiefly for the conduction of stimulus in the sensitive organs. But, after numerous observations, there was little doubt that the occurrence of communications between neighbouring protoplasts is not the exclusive privilege of the sensitive organs, and I further claimed the universality of the communication (at least in tissues) in my first paper.[16] This universal occurrence is since confirmed by recent researches.

I have in my second paper[17] given the results of my investigations made on various vegetative tissues. It is superfluous to say anything of the importance of the methods employed in such investigations. For fixing

[1] "On the Continuity of Protoplasm, and on the Protoplasm of the Intercellular Spaces and the 'Middle Lamellary' Protoplasm, with special reference to the Loranthaceæ and Coniferæ," by Dr Jules Schaarschmidt, *privat-docent* of Cryptogamic Botany and the Anatomy of Plants, Assistant at the Botanic Institute and Gardens, Royal Hungarian University at Kolosvár. Contributed by the author.

[2] Schleiden, "Grundzüge der wissenschaftlichen Botanik," i. anfl., 1842-43

[3] Hofmeister, "Die Lehre von der Pflanzenzelle," Leipzig, 1867.

[4] Sachs, "Vorlesungen über Pflanzenphysiologie," p. 102, Leipzig, 1882.

[5] Strasburger, "Ueber der Bau und das Wachsthum der Zellhäute," p. 246, Jena, 1882.

[6] Nägeli, "Mechanisch-physiologische Theorie der Abstammungslehre," p. 41, München und Leipzig, 1884.

[7] Hartig, "Ueber die Querscheidewände zwischen den einzelnen Gliedern der Siebröhren in *Cucurbita pepo*," *Botanische Zeitung*, xii. col. 43, 1854.

[8] W. Gardiner, "On the Continuity of the Protoplasm through the Walls of Vegetable Cells." Sachs, *Arbeiten des bot. Instituts in Würzburg*, iii. i p. 52, 1884.

[9] Hartig, *l.c.*, col. 43.

[1] Bornet. *Vide* Thuret et Bornet, "Études phycologiques," Paris, 1878.

[2] Wright, "The Formation of the so-called Siphons, and the Development of the Tetraspores in Polysiphonia," *Quart. Journ. Mic. Science*, July 1878; *Transactions* of the Royal Irish Academy, xxvii. 1879.

[3] Agardh, "Florideernes Morphologi," *Stockholm Vet. Akad. Handl.*, xv. p. 140, 1879.

[4] Schmitz, "Untersuchungen über die Befruchtung der Florideen," *Sitz. Ber. d. Rgl. Akad. d. Wissensch.*, p. 219, Berlin, 1883.

[5] Hick, "On Protoplasmic Continuity in the Florideæ," *Journal of Botany*, xxii. p. 33, 1884.

[6] Kolderup-Rosenvinge, "Bidrag-til Polysiphonia's Morfologi," *Saertryk af Botanisk Tidsskrift*, xiv. p. 9, 1884, f. 10-14, 26-28, 72, 75.

[7] Wille, "Ueber die Zellkerne und die Poren der Wände bei den Phycochromaceen," *Ber. d. Deutschen Botan. Gesellsch.*, i. vi. p. 245, 1883, and *Bidrag-til Sydamerikas Algflora*, i.-iii., *Bihang till k. Svenska Vet. Akad. Handlingar*, viii. No. 18, p. 6, 1884.

[8] Agardh, *l.c.*

[9] Tangl, "Ueber offene Communication zwischen den Zellen des Endosperms einiger Samen," *Pringsheim Jahrb. f. wissenschaftl. Botanik*, xii. ii. p. 170, 1880.

[10] Russow, "Ueber Tüpfelbildung und Inhalt der Bastparenchym und Baststrahlenzellen der Dikotylen und Gymnospermen," *Sitz. Ber. Dorpater Naturforschergesellsch.*, p. 350, 1882.

[11] Gardiner, "On Open Communication between the cells in the pulvinus of *Mimosa pudica*," *Quart. Journ. Microsc. Sci.*, New Ser., xxii. p. 365, 1882.

"Some Recent Researches on the Continuity of the Protoplasm through the Walls of Vegetable Cells," *Ibid.*, xxiii. p. 301, 1883.

"On the Continuity of Protoplasm through the Walls of Vegetable Cells," *Proceed. Roy. Soc.*, p. 163, 1883.

"On the Continuity of the Protoplasm through the Walls of Vegetable Cells." Sachs, *Arbeiten d. Bot. Instit. Würzburg*, iii. i. p 52, 1884.

[12] Hillhouse, "Einige Beobachtungen über den intercellularen Zusammenhang von Protoplasma," *Botanisches Centralblatt*, xiv. p. 86, 1883.

[13] Terletzki, "Ueber den Zusammenhang des Protoplasmas benachbarter Zellen und über das Vorkommen von Protoplasma in Zwischenzellräumen," *Ber. Deutsch. Botan. Gesellsch.*, ii. iv. p. 169, 1884.

[14] Schaarschmidt, "A protoplastok összeköttetésenek sa sejtközi plasma elöfordulásánat nehány esetéröl," *Magyar Növénytani Lapok*, viii. No. 84, p. 17, February 1884; see Referate in the *Botanisches Centralblatt*, xviii., No. 18, 1884.

[15] Schaarschmidt, "A protoplastok összeköttetéséröl és a sejtközi plasmáról különös tekintettel a Loranthaceákra és Coniferákra," *Ibid.*, No. 87, p. 65, July.

[16] Schaarschmidt, *Botanisches Centralblatt*, xviii. No. 18, 1884.

[17] Schaarschmidt, *Magyar Növénytani Lapok*, viii. p. 77, July 1884.

the freshly-collected materials I used alcohol, osmic or picric acid; all the observations described below were made upon fresh material, treated, after fixing for a few minutes, with strong or dilute sulphuric acid, so as to swell the cell-walls.[1] The fresh material was first cut in alcohol (or osmic or picric acid); the sections were then for a short time placed in a drop of sulphuric acid, and washed rapidly in a watch-glass with distilled water. After washings in several watch-glasses, the sections may be stained. For staining I first used the saffranine, and later solely the eosine (from Dr. Th. Schuchardt, Görlitz, Silesia). The eosine has a great and admirably defined selective staining power. It is a very excellent negative reagent for the cell-wall, and when employed with some precautions colours only or almost only the protoplasm. It is however requisite that a dilute solution of the dye should be made (1 part of eosine to 50-60 parts of water), and that the stained sections should be washed carefully (for ten to fifteen minutes) in water.

That the phenomena detailed below are not artificially produced by reagents is proved in certain instances. The presence of the connecting protoplasmic filaments in the *intact* (not swollen) *normal cell-wall or pit-closing membrane* was witnessed in the medullary cells of the mistletoe, the sections of which were merely mounted in water and stained with eosine.

I now proceed to give an account of the results I obtained with the various tissues in which the continuity of protoplasm was shown to exist.

Epidermis. Glaucium Fischeri gave the first results. In the leaf-epidermis the connecting processes of the protoplasms, many in number (one for each pit), are well defined; the same is the case in that of Viscum and Loranthus, but in the latter plants the fine connecting-threads were also visible. From the protoplasms of the epidermis-cells radiate numerous processes towards the pits, and in any two neighbouring cells the processes from the one protoplast are exactly opposite those proceeding from the other. *All the epidermis-cells*, as in *Ficus elastica*, are in direct communication with one another and with the "guard-cells" of the stomata. The same is also the case *in epidermis composed of several layers*. The connection is very difficult to make out, though visible after a moderate swelling in the *collenchymatic-hypoderm* (Rhus, Cotinus, *Cucurbita pepo*, Solanum, Liriodendron, &c.).

The *bark-parenchyma* is one of the most favourable objects for investigation, and even when the cell-wall has been very conspicuously swollen or dissolved, the connection is unaltered (Loranthus, Viscum, *Abies alba*, *Picea excelsa*, *Gingko biloba*, &c.). When no *hypoderm* exists, the protoplasts of the epidermic-cells should be directly connected with those of the bark-cells. Such is the case in Viscum and Loranthus. The epidermal cell-walls of these plants may have undergone considerable swelling, and so the connective processes become very extended, but the fine connective threads are still conserved. In the *leaf-parenchyma* (Viscum, Loranthus) the connection is very distinct also in the cotyledons of *Phaseolus multiflorus*. It is very difficult to prove the communication in leaves where the parenchyma has been doubly differentiated, viz. into chlorenchyma and into pneumo-enchyma. The *medullary-parenchyma* of Loranthus or Viscum furnish excellent objects for such investigations; the fine bent threads (five to eight in number) can be very *distinctly examined* after a feeble swelling of the cell-wall. In the Coniferæ I find only the connective processes distinct (Gingko, &c.). In the Loranthaceæ the communication is to be directly seen between the *medullary-ray-cells* and *xylem-cells*, between the *phloem-ray-cells* and *bast-parenchyma*; finally between the *medullary-ray-cells* and the *sclerenchyma-cells* [these last are found in the neighbourhood of the xylem (primary) vessels in Viscum.]

The *bast-fibres* of Viscum, Loranthus, are in direct communication with one another, and in Viscum the fibres of the inner-phloem also communicate with the medullary-cells. The communication between *cambium*, *young bast-fibres*, and *bast-parenchyma*, in the Coniferæ can be demonstrated only with high powers. The communication and connection of the *soft-bast* protoplasts is eminently remarkable. These protoplasts remain in connection even after total dissolution of their cell-walls (Cucurbita, Coniferæ, Loranthaceæ, &c.). I investigated also the sieve-tubes, and have found that these in their entire length are connected with *neighbouring sieve-tubes*, or *bast-parenchyma-cells*, or *collateral cells* (*Nebenzellen*) (Viscum, Loranthus, *Ficus elastica*, &c.). The connective threads are often strongly developed in Cucurbita. They assume the figure of a compressed sphere.

Xylem.—I may remark that the details of the xylem communications are very difficult to observe. In general I have studied the communication of the xylem elements best in the Loranthaceæ, and especially in Viscum. The xylem of the mistletoe is composed of libriform cells, compensating cells (*Ersatzzellen*), and vessels. The cell-walls of the libriform cells are very much thickened, and bear pits only on the middle part of the cell. These cells are variously curved and bent, and offer favourable conditions for investigation—but then the communication of the *libriform cells with one another*, *libriform cells + compensating cells*, and of the latter together can be easily seen. In the Coniferæ the communication of the xylem elements is only clear in the younger states. In the *young tracheides* the distinct threads could be very clearly seen. In the *older tracheides* merely a striation (caused by the threads) could be detected through the pit-closing membrane). As regards the occurrence of a direct continuity, the *xylem vessels* gave generally a negative result. Although in many instances the occurrence of protoplasm in the great xylem vessels could be demonstrated, still direct communications seemed to me to be extremely rare. I could find this direct connection in one instance in Loranthus. The great (but only the pitted) vessels were here connected with the adjacent cells.

Finally, the protoplasts of the secretory cells are also in direct communication with the neighbouring protoplasts, such as in the resin-cannel cells. The cells of the resin-cannels are, in the Coniferæ, directly connected with the adjacent leaf- or bark-parenchyma, or phyllogen-cells. In the bark of Gingko I was also able to confirm the communication of the crystal-bearing cells (crystal-glands) with the bark-parenchyma cells. I have no doubt that the same structure would be equally well demonstrated in the various secretive cells and vessels. In all the observed cases the communication of adjacent protoplasts is effected by delicate wavy protoplasmic threads. The connective thread either in a roundabout way traverses the sieve-pore pit-closing membrane, or directly traverses the cell-wall when the membrane is unpitted or the pits feebly developed. From a physiological point of view the pits form one of the most important arrangements.

The protoplasts are also in direct connection with the intercellular protoplasm. The intercellular plasm which fills the intercellular spaces was first observed by J. G. Agardh[1] in the Florideæ, and by Russow[2] (1882) in various phanerogamous plants. I have (1883) also studied (first in the bark of *Liriodendron tulipifera*) its occurrence in many phanerogamous plants and published my observations in 1884.[3] At this time also Berthold published a paper[4] in which he confirmed its occurrence

[1] See, for details of my method, *Zeitschrift für wissensch. Mikroskopie*, &c., i. ii. p. 301, 1884.

[1] *L. c.*, p. 140 &c. [2] *L.c.*, p. 350 &c.
[3] In the *Magyar Növénytani Lapok*, viii. 1884, pp. 19, 74.
[4] Berthold, "Ueber das Vorkommen von Protoplasma in Intercellularräumen," *Berichte der deutschen botan. Gesellsch.*, ii. 1884, i. p. 20.

in many plants, and later Terletzki[1] gave some details. The observations of these authors established the occurrence of protoplasm between the parenchyma cells in a small number of plants, but as I have stated this is not a rare phenomenon, but one of general occurrence, and I have found that the intercellular spaces of the true prosenchymatic tissues may also contain protoplasm.

I have investigated the plasma of the intercellular spaces in various collenchymatic, parenchymatic, and prosenchymatic tissues. For the investigation it is very important to use the reagents (absolute alcohol, picric acid, or osmic acid) very shortly before cutting the sections. Between the larenchyma cells, in the intercellular spaces protoplasm will always be found (bark and medullary parenchyma of the Loranthaceæ, Gingko, &c.). In longitudinal sections made of thick (2½ cm.) branches of Viscum the connection between the medullary parenchyma cells and the protoplasm fillingt he intercellular spaces is also clearly to be seen. On the contrary, between the thin-walled cells which contain little protoplasm the intercellular plasm cannot, or in very rare instances, be detected (medulla of Phaseolus, Cucurbita, Sambucus, &c.). In the prosenchymatous tissues, *e.g.* in the bast-fibre of Viscum—after moderate swelling with sulphuric acid—the intercellular protoplasm, when stained with eosine, is clearly to be observed. The connection of this intercellular protoplasm with the protoplasts of the fibres is easily seen. We find intercellular protoplasm also in the xylem, *e.g.* in *Rhus cotinus*.

Most important is a fact which I have discovered in the course of my investigations, namely, the occurrence of inter-lamellar protoplasm. This was present very constantly in the leaves of mistletoe. The sections prepared with dilute sulphuric acid and stained, very exactly showed the fine plasmatic threads, corresponding in their disposition exactly to the middle lamella. This middle-lamellary "protoplasm" surrounded the protoplasts as a frame the picture, and ended in the protoplasm of the intercellular spaces. The threads are thicker at these points. The greatest precautions must be taken in the investigation of this middle-lamellary plasma: all very strong acids, &c., should be kept away from the prepared sections. When the cell-wall is very vigorously swelled the fine processes which bind the protoplasts together appear penetrating into the plasma-frame. This plasma-frame surrounds each cell, and in a section the framework of lamellæ occur in all planes and in all successive sections, and all the various constituent threads appear to intersect one another at all angles; it is consequently clear that the middle-lamellary plasm forms a *plasmatic mantle* round the protoplasts which is increased at each edge with the pillar-form (of three to four sides) intercellular plasm portions.

The intercellular plasm preserves its vitality, and in some instances we observe that some changes take place in the intercellular spaces. The intercellular plasm may be observed to cover itself with a special cell-wall; this membrane is the product of the intercellular plasm. This protoplasm can transform itself into a true new cell. In many cases in various tissues we have found this new mode of cell-formation, thus in the collenchymatous tissues (hypoderm of Liriodendron, Ficus, Sambucus, Solanum, Cucurbita, &c.), or in the xylem (*Rhus cotinus*), in the common parenchymatous bark (Viscum, Loranthus, &c.), in the medulla, &c. These newly formed cells grow very fast, and are only in their form and appearance different from the older cells. This cell-formation is very rapid, and it appears at first sight that the number of the tissue elements is by these "intercellular cells" (*Interstitial-celler* of J. G. Agardh,[2] who has observed this metamorphosis in the Florideæ), or "between-cells" (*Közti-sejtek* in Hungarian), considerably increased. A consequence of this great and fast growth is the formation of new "secondary" or "tertiary" intercellular spaces round the newly formed or transformed cells.

[1] *L. c.*, p. 169. [2] *Botaniska Notiser*, 1884, p. 130.

General Results.—I will now briefly conclude with a statement of the general results of my investigations upon the communication of the protoplasts, and upon the intercellular and middle-lamellary plasm.

(1) The protoplasts of all the tissues in united cells are in direct connection by means of finely attenuated protoplasmic threads.

(2) The connective threads traverse the pit-closing membrane (which is of a sieve-plate structure), while in unpitted cells they traverse directly the cell-wall. By these threads is the communication between the connective processes which occupy the pit-cavity from both sides directly established.[1]

(3) The intercellular plasm occurs not only in the intercellular spaces of the parenchymatic tissues, but also in those of true parenchymatic tissues.

(4) This intercellular plasm contains, in many cases, chlorophyll-granules[2] (Viscum).

(5) The intercellular plasm is in direct connection with the adjacent protoplasts.

(6) Corresponding to the middle lamella around the cells, we find a plasmatic frame; the sides of this frame end in the "intercellular" plasma. This plasmatic frame forms a veritable mantle round the protoplasts, and is increased at each edge by an intercellular plasm portion, which latter has a pillar form.

(7) The connective threads of the protoplasts traverse this "middle-lamellary" plasma; both are also connected.

(8) The probable origin of the intercellular plasma is this. During the cell-division, when the division was almost ended, little cytoplasmic portions become included in the young cell-wall, and it is also very probable that the connective threads, in many instances, are the remainder of the "nuclear connective threads," and that the middle-lamellary protoplasm is the remainder of the "cell-plate." All these plasma portions are by the thickened cell-wall much compressed together, and therefore only visible or distinctly visible by the swelling of the cell-wall.

(9) The intercellular plasm can cover itself with a cell-membrane, and in this way we find at the place of the intercellular spaces veritable new cells. About these new cells appears later new secondary or tertiary intercellular spaces.

(10) The protoplasm of the crystal-bearing cells (crystal glands) and that of the resin-cannel cells is also in communication with the adjacent cells.

The protoplasts of the plants (composed from tissues) form a higher unity, one synplast.

COLLECTING DESMIDS

IN his recently published "Desmids of the United States" the Rev. T. Wolle gives the following directions for collecting Desmids:—

The outfit need not consist of more than a nest of four or five tin cans (tomato or fruit), one within the other, for convenience of carriage, ten or twelve wide-mouthed vials, and a small ring-net made of fine muslin at the end of a rod about four feet in length. After selecting what seems to be a good locality, drag the net a few feet among the grasses and mosses, allow the bulk of the water to drain through the muslin, and then empty the residue into one of the cans; repeat this process as often as may be desirable. Ten or fifteen minutes after the cans have been filled most of the surface-water may be poured off, and the remainder transferred to a glass vial, where the solid contents will gradually sink, and the superfluous water can be again poured off, and the vessel

[1] Gardiner has also observed this fact in the plants investigated by him: for this reason we give this in the first place.

[2] J. G. Agardh has also observed endochrome granules in the intercellular spaces of the Florideæ. See *Botaniska Notiser*, 1884, p. 103.

filled up with deposits from other vials. In shallow places *Sphagnum*, *Utricularia*, *Myriophyllum*, or other finely cut-leaved water-plants should be lifted in the hand, and the water drained or squeezed from them into a tin can, to be subsequently treated in the same way. A few drops of carbolic acid in each vial, just enough to make its presence perceptible, will preserve the contents for months, and even years, from deterioration; the chlorophyll may fade, but this, in the case of Desmids, is of little importance; nevertheless, when practicable, always examine the materials when fresh. When dried on paper for the herbarium, the specimen can still, after being moistened with water, be examined under the microscope, but not with the best results, since the drying up is apt to collapse or otherwise distort the cells.

The collector will not know the value of his find until it has been brought, drop by drop, under the microscope; and out of the entire mass he may discern nothing to reward his labours. This, however, should not discourage him, as one or two failures are to be expected before meeting with an adequate reward. Sketches ought to be made, which should, of course, be very exact; and for this purpose the microscope should be provided with an eye-piece micrometer. It is so difficult to separate Desmids from their accompanying foreign matters, that it is seldom amateurs can mount them satisfactorily on slides; and this method of preserving specimens cannot therefore be recommended.

RELATIVE FREQUENCY OF STORMS IN THE NORTHERN HEMISPHERE[1]

THE portion of the northern hemisphere selected by the Signal Office of the United States for this discussion is necessarily that part for which the data required are available, and it may be considered as comprising a broad belt of from 30° to 40° of latitude in width, extending from the Pacific sea-board of America, through the United States, Canada, the Atlantic, and Europe, with the North of Africa, eastward into Western Siberia. It thus embraces some of the more important regions of the globe, including the great routes of commerce across the Atlantic. The thirteen charts, which show graphically the relative storm frequency for each month and for the year, have been constructed from data referring to 134 months in all, extending from 1863 to 1883. Of the storms which occurred in this extensive region from January 1876 to August 1881, the history of 2730 is briefly summarised. Of these 413 began and ended in America; 589 began in America and ended in the Atlantic; 190 began in America and crossed the Atlantic; 326 began and ended in the Atlantic; 655 began in the Atlantic and ended in Europe; 491 began and ended in Europe; and 66 began in America and crossed the Atlantic and Europe. The important bearing of these facts on the telegraphing from America of forecasts of storms about to strike the coasts of Europe scarcely needs to be referred to further than to remark how essential it is for the usefulness of such a service that it be placed in the hands of some competent and responsible central authority in the United States, as was suggested by us in 1879 (NATURE, vol. xx. p. 359), and which, we believe, has been carried out.

The chart for the year shows that the region where storms occur with greatest frequency is a long belt in America of about 200 miles in width, extending from the head waters of the Red River, about 95° W. long., eastwards through the Great Lakes to the mouth of the St. Lawrence, about 70° W. long. Surrounding this is a more extensive region where the number of storms, though not so large, is still a good way above the average; and again, surrounding this latter, is a still wider region, stretching from 105° W. long. eastward through the States and Cañada, and through the Atlantic as far as 20° long. W. This is one of the most important regions of the globe as regards storms or cyclones. The excessive frequency of storms is probably due to a prevalence, during a large portion of the year, of the south-east trades, with a continuation of easterly and southerly winds into and through the Caribbean Sea and Gulf of Mexico, by which, from the superabundant vapour thus poured northward and eastward over the United States by upper and lower currents, frequent storms are originated.

Another region of considerable storm frequency extends from the south of Greenland, through Iceland and Farö, to the north of Sweden. Over this region it may be assumed that a more extended and exhaustive discussion of the storms occurring there than it has been possible to make, will reveal a greater frequency than is indicated on the chart, a supposition rendered highly probable by the frequent and extensive fluctuations of the barometer which occur in Iceland during at least three of the four seasons of the year. Of great interest is the less frequency of storms in the Spanish Peninsula and north-eastwards, through Central Europe, as far as Berlin; and the increased frequency to the southward over the northern half of the Mediterranean and the Black Sea, pointing to the important *rôle* played in the storms of that region by the evaporation from these seas.

This is substantially the distribution of frequency during the colder months of the year, when the larger number of storms occur. In the spring and summer months the distribution is materially altered. Thus, in April the regions of greater frequency extend further to southward in the United States and the Atlantic. It is in Europe, however, where this southing of the tracks of cyclones is most decidedly marked. At this season a broad patch is seen to overspread Ireland and England, and extend thence southward over the north of Spain, and then eastwards over nearly the whole of the south slope of Europe to near the Caspian Sea. As directly connected with the greater prevalence in spring of cyclones in Southern Europe are the east winds, which acquire at this season their greatest virulence over the south-western part of the Continent. In summer, on the other hand, the coloured patches marking the regions of greater storm-frequency lie further to the northward than at any other season. Thus, in August, immediately to the north of 50° N. lat., there is an extensive region of greater storm-frequency, of about 900 miles in breadth, extending from about 45° W. long. to eastward as far as St. Petersburg. In this season the south of Europe is practically rainless, and storms are of extremely rare occurrence.

From the charts, the tracks usually taken by storms in different parts of the wide region under review cannot be ascertained, but can only be guessed at inferentially. It would be a great improvement if, in subsequent issues of the paper, these tracks were entered on the charts. This was done in 1882 in the "Physical Atlas of the Atlantic Ocean," prepared under the direction of Dr. Neumayer, of Hamburg. It was there shown from centres of the most frequent occurrence of low barometers, that to the west of the Mississippi is the region where most of the United States storms originate; that many of the Atlantic storms have their origin in the Gulf of St. Lawrence; and that the storms of North-Western Europe chiefly originate in mid-Atlantic and to the south-west of Iceland. The centres of low pressure also pointed to a retardation in the onward course of storms on advancing on large masses of land, as happens when storms approach the south of Greenland, the south of the British Islands, Denmark, and the Lofoten Isles. Of all storm-tracks approximately known in the northern hemisphere

[1] Charts of Relative Storm Frequency for a Portion of the Northern Hemisphere. Prepared, under the direction of General W. B. Hazen, Chief Signal Officer of the Army, by John P. Finley, Sergeant, Signal Corps, U.S.A. (Washington: Signal Office, 1884.)

the most frequently taken is that by the storms of the United States, which pursue an easterly course through the lakes to the Gulf of St. Lawrence. A considerable number advance from Nova Scotia to Davis Straits, but the greater number take a north-easterly course through the Atlantic towards Iceland and the North Cape. Among other tracks less frequently followed, but of great importance commercially and otherwise, are these: from New Orleans, along the east coast of the United States, towards Nova Scotia; from mid-Atlantic to the south of Ireland, and thence through Europe to the northern shore of the Mediterranean, and from the Atlantic about 42° lat. and 40° long., in a north-easterly course, quite outside, but at no great distance from, the British Isles, and thence towards the North Cape. Of the tracks more immediately influencing British weather, are one from Iceland in a south easterly direction through the North Sea and Germany, and three tracks starting from near Sicily, one eastward through the north of Germany, the second to the north-east to Christiania, and the third through Ireland and the Hebrides, these being the storm-tracks which chiefly give the British Islands their easterly and northerly winds. Gen. Hazen's charts suggest valuable hints as to the times of the year when these and other important routes are most frequently taken by storms.

THE U.S. FISH COMMISSION AT WOOD'S HOLL[1]

THE summer head-quarters of the United States Fish Commission is located at Wood's Holl, a village situated on the south side of Cape Cod, Mass., north of Martha's Vineyard. The coast scenery is pretty, and inland the country is undulating and partially clothed with forests of pines and other trees, which have mostly been planted within the last forty years. Wood's Holl and the neighbourhood is an increasingly favourite locality for the summer residences of the inhabitants of Boston, New Haven, New York, and other large towns in that part of the country, and already a colony of scientific men is making its appearance. Excursion steamers run [illegible] in the summer for the day trip from Newport and other [illegible]. As in the whole of that region of North America, the surface-soil is a thick deposit of glacial drift containing numerous boulders.

The site was selected on account of the purity of the water, owing to the absence of all fresh-water streams and presence of strong tidal currents which ensure a circulation of well-aërated water close to the shore, and also on account of the physical conditions which lead to a remarkable variety in the marine fauna being procurable within a short distance.

The warm current of the Gulf Stream, which sweeps up the eastern coast of the States, here becomes diverted by Cape Cod, and passes out into the Atlantic. This causes the pelagic fauna to be well represented, and were the local conditions of the coast more favourable it would cause the littoral fauna to be particularly rich. The cold currents from the north extend down the coast as far south as Cape Cod, which practically forms the southern limit of the Arctic littoral fauna. The narrow neck of the Cape thus separating two entirely distinct assemblages of animal forms. Lastly, the deep sea offers its peculiar fauna.

The site occupied by the Commission consists of a small spit of land, which was purchased by public subscription, and which has since been increased by reclamation.

At the present time the buildings of the Fish Commission are in a transition state. Formerly, the various officers had to severally obtain what accommodation they could in the village. Last August, however, the staff moved into the residence-house which has been built for that purpose. The residence-house is a red brick, gabled structure, with plenty of outside woodwork, a style of architecture which is very common in New England. On the ground-floor is a large central hall, into which open Prof. Baird's office, the sitting-room, dining-hall, reading-room, and other offices. A portion of the first floor is reserved for Prof. Baird and his family, the remainder is devoted to the bedrooms of the married officers who have brought their wives—families to the extent of one baby only are allowed! The bachelors' rooms are on the second floor. The whole building is most comfortably furnished. All the staff take their meals together with the ladies.

Hitherto the summer work of the naturalists has been carried on in two roughly-fitted barns. One serves mainly as a storehouse for the trawls, collecting implements, and jars and bottles for preserving specimens. Here also is the laboratory where the chemical investigations on the water obtained at various depths and from different localities are carried on.

The other building, which is on the wharf of the Lighthouse Board, is mainly devoted to the temporary storage of the zoological collections and to the work-tables of the naturalists, all the fixtures are of a very simple character, and call for no special mention. It is here that the material brought in by the steamers is finally sorted and, as far as possible, determined and catalogued; the material collected, however, affords more than enough occupation for the winter months.

A commodious new laboratory is being built close to the residence house, which is expected to meet all the requirements of this most important section of the Commission. It will be a plain three-storied brick building, in the basement of which will be large tanks. The ground-floor will be thrown open to the public as a general aquarium, in which will be tanks of various sizes for the illustration of the marine fauna and for the breeding of fish, much as in our ordinary aquaria. The first floor will be devoted to the laboratories of the working naturalists, to which of course the general public will not be admitted. The second floor will be divided between the physical and physiological laboratories, photographic room, and other work rooms.

Between this building and the residence-house is the pumping-station, by means of which fresh and salt water can be continuously circulated throughout either building.

On the sea-frontage several large open basins or tanks are nearly completed, in which fish-hatching will be carried on on an extensive scale. Cod-hatching is to be tried next season. The tanks are large enough to breed sharks, were they required. The water in these tanks rises and falls with the tide, owing to the porosity of the outer walls and the existence of small gratings; the latter are, however, under perfect control. Prof. Verrill has suggested that it would be desirable to have a kind of iron and glass cage or diving-box made, which, while open above, could be let down into the largest tank, and in which a person could observe and sketch the marine life around him under the most favourable conditions.

A long wharf has also been constructed for the use of the steamers of the Commission, and which also serves as a breakwater.

The general scheme of the buildings leaves little to be desired, and doubtless many improvements and additions will suggest themselves from time to time.

Not far from the Commission buildings is a plot of ground, which has been secured for the purpose of building a teaching and research laboratory, to be supported by those universities and colleges which do not possess any similar facilities of their own. This appears to be a very wise provision, and doubtless the Commissioner

[1] Originally spelt and still pronounced "Wood's Hole." The name was changed by order of the Postmaster General in 1875.

will afford every possible facility to those who may work them.

Not less complete are the arrangements for the collection of specimens and for the observations on depth, surface and bottom temperatures, and other physical features.

Two steamers have been built for the Fish Commission —the *Fish Hawk* in 1880, and the *Albatross* in 1883.

The *Fish Hawk*, a steamer of 484 tons of displacement and 205·71 tons measurement, was built particularly for use in the hatching of shad-eggs. Although unsuitable for long voyages or rough weather, she has proved a valuable boat for short trips and for dredging down to a depth of about 700 fathoms, having been well furnished with modern apparatus. Already much important work has been accomplished in the vessel in her subsidiary capacity, as is proved by the publications of the Fish Commission and Prof. Verrill's articles in *Science*, &c. (*Science*, vol. i. 1883, pp. 443, 531, and vol. ii. 1883, p. 153).

Last year the new steamer *Albatross* was specially constructed for deep-sea trawling. The extreme length of the vessel is 234 feet, the breadth of beam, moulded, is 27½ feet; the registered net tonnage is 400 tons, and the displacement, on a 12-foot draught, 1000 tons. She is most perfectly fitted with all those improvements in collecting and observing tackle which considerable experience has proved to be the best; but improvements and adaptations are continually being suggested. A full and illustrated account of the vessel is given by Mr. R. Rathbun in *Science*, vol. ii. 1883, pp. 6, 66. Suffice it now to mention that the comfort of the staff is as well provided for as their scientific necessities, and a complete system of electric lighting enables the laboratory work to be carried on at all hours. The main laboratory is 20 feet long, 26 feet wide, and 7 feet 10 inches high, and is situated amidships: above this is a well-lighted deck laboratory.

So far we have very briefly detailed the mere appliances for the collection and preservation of specimens. A short sketch of the mode of work might prove interesting.

The steamers are manned by naval officers and crew, a plan which serves the double purposes of lessening the expenses of the Commission and of spreading an interest in marine zoology throughout the navy. The officers have proved themselves to be most zealous in the work, and have cordially assisted the civilian staff in every possible manner; several important improvements in dredging and sounding apparatus have originated from some of them.

The sailors, too, take a personal interest in their occupation, and occasionally bring rare forms to the naturalists, which they have themselves caught in a hand-net.

Before an expedition, Prof. Baird consults with Prof. Verrill on desirable localities to explore, and instructions are given to the Commander, who also has charge of the mechanical portion of the dredging operations.

Mr. Benedict is the naturalist in charge of the vessel, and he is responsible for the specimens directly they arrive on deck; usually one or two naturalists work under his directions, the arrangement being that each is responsible for one or more groups of animals.

The contents of the trawl are subjected, immediately on their arrival on deck, to a process of sifting through a series of sieves of different sized meshes, and most of the animals are forthwith preserved. Numerous methods of conservation have been tried, but it is found that, under the special circumstances, alcohol is the best for general purposes. In some instances the jars have to be kept in ice to preserve the tissues whilst the alcohol is slowly penetrating; picric, chromic, osmic, and other acids and reagents, are used when deemed necessary. As a general rule, pelagic forms are killed by picric acid. All but the largest and smallest animals are put into glass-capped "butter-" and "fruit-jars," which are secured by a screw-down metal cap. Various devices are resorted to for large specimens; the smallest are placed in homœopathic vials.

Each dredging "station" has its serial number, and a full record of the position, depth, bottom and surface temperatures, with other details, is kept, and a label, bearing the number of its station, with certain other information, is put into each bottle of specimens. Mr. Benedict has a small hand-press on board, and he often prints such labels whilst the trawl is out. So far as opportunity presents, the species or groups are roughly sorted on board, and are then ready for identification in the laboratory. Excepting in the case of large quantities of common species, all the specimens from each haul are retained. Surface skimmings are similarly treated.

All the material so obtained passes through Prof. Verrill's hands, and he distributes certain groups to specialists to be worked out after he has described those forms which interest him. The zoological work of the Commission is so well known that it would be superfluous to even enumerate the naturalists on the staff.

After having been duly entered, the specimens, if properly named, are broken up into sets, of which the first naturally goes to the National Museum at Washington, the second to Prof. Verrill, the third to the Museum of Practical Zoology at Harvard University, Cambridge, Mass., and the remaining sets are variously distributed or kept in the stores as duplicates.

The Marine Laboratory is only officially open during the summer months. During the remainder of the year most of the officers are at Washington employing their time in identifying specimens, drawing up reports, and other routine work.

The biological portion of the work of the Commission is not merely restricted to the collection and identification of species; careful drawings are being made of every form collected, with a view to illustrating the entire fauna of that coast. The numerous papers of Prof. Verrill, Dr. Ryder, and others, prove that anatomical and embryological investigations are not neglected; life-histories are studied, and all possible data are collected on the influence of environment on organisms. It is intended, when the new building is completed, that the physiology of marine forms shall receive a due share of attention.

One object of the Commissioner is to thoroughly study the fauna of the American waters, fresh and salt, and encouragement and facilities are given to all the officers to follow their personal bent, of course paying a due regard to routine work. Naturally, at present, the officers are more engaged in the recording of species, since this pioneering work is the necessary precursor to morphological investigation; but the lines of the Commission are laid on too broad a scale to limit the original research of any officer.

ALFRED C. HADDON

ANCIENT AIR-BREATHERS

WHILE the records of the life of the sea have been preserved in abundance from early geological periods down to the present time, the chronicles of the living things of the land are comparatively scanty. The early history of land-animals has therefore a peculiar interest, heightened by the rarity of the evidence from which the history must be compiled. Considerable progress, however, has recently been made in this department of investigation. Within a few years, discoveries of the remains of scorpions and insects have successively been made in older and older strata, till now they have been disentombed almost simultaneously from older Palæozoic rocks in three different countries of the old world Scorpions, which appear to be the most ancient type of air-breathing arachnids, have been found to be comparatively abundant in the lowest Carboniferous strata. The first Palæozoic scorpion which came to light was described by Count Sternberg, in 1835, from a specimen obtained by him from the coal-formation of Chomle, near Radnitz, in Bohemia, which, in 1836, was named *Cyclopthalmus senior* by Corda.[1] Three years later Corda gave an account of another scorpion, from the same locality, under the name of *Microlabis*. From that time till 1866 these were the only Palæozoic scorpions known, but in the latter year Messrs. Meek and Worthen described two new genera from the Coal-measures of Mazon Creek, Morris Grundy County, Illinois, under the names of *Eoscorpius* and *Mazonia* respectively.[2] In 1873 Dr. Henry Woodward showed that scorpion remains, referable to the genus *Eoscorpius*, occur both in the Coal-measures of England and in the Carboniferous Limestone series of Scotland.[3] In 1881 the present writer had the privilege of studying and describing a large suite of scorpion remains belonging to the Geological Survey of Scotland, and obtained by their officers from the lowest Carboniferous rocks of the Scottish Border. The results were published in the *Transactions* of the Royal Society of Edinburgh, where several species belonging to the genus *Eoscorpius* were described and figured.[4] In that paper the following conclusion was announced:—"Although there seems to be sufficient reason to separate the genus (*Eoscorpius*) from any recent one, these ancient scorpions appear not to differ in any essential character from those now living. As far as the horny test, the only part now preserved to us, is concerned, they were as highly organised and specialised towards the beginning of the Carboniferous period as their descendants at the present day. It is unfortunate on that account that Messrs. Meek and Worthen should have chosen the name *Eoscorpius*, for the dawn of the scorpion family must have been at a much earlier period, and we may hope that their remains will yet turn up in the Devonian and Silurian plant-beds when these come to be thoroughly searched." The subsequent study of a much

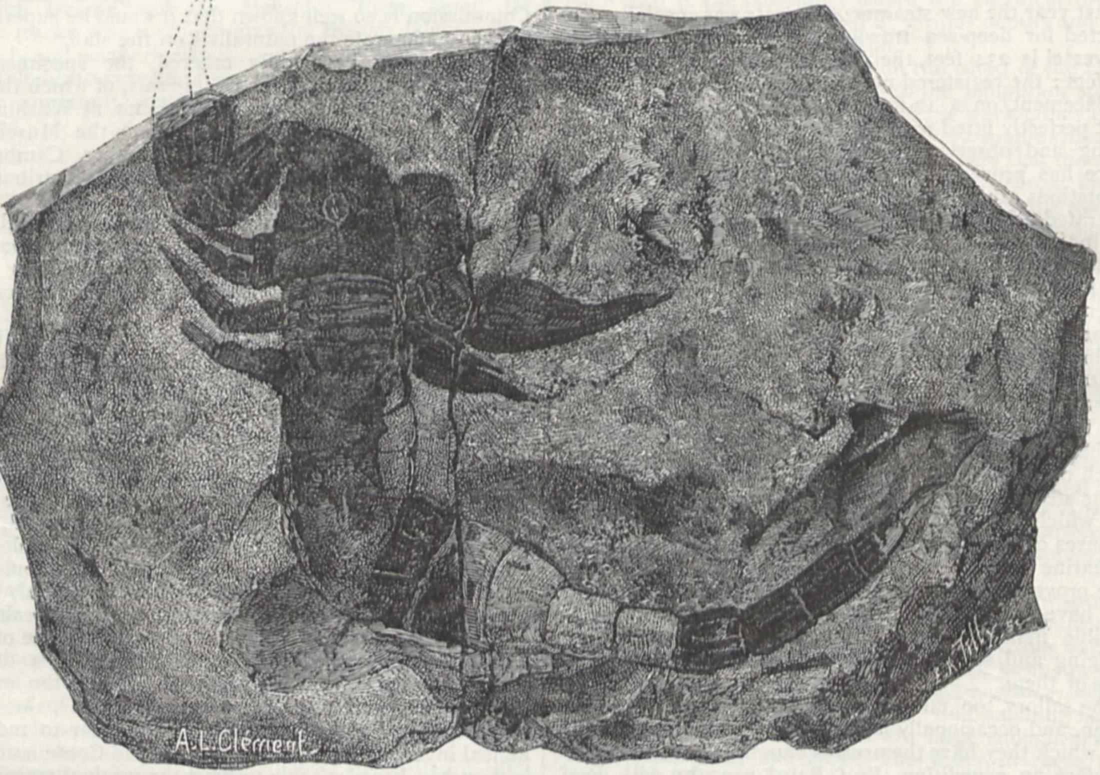

FIG. 1.—Fossil scorpion found in the Silurian rocks of the island of Gothland (Sweden). From the photograph sent by Prof. Lindström to M. Alph. Milne-Edwards (from *La Nature*).

finer collection from the same rocks has fully confirmed the conclusion as to the essential identity of structure between the living and the Palæozoic forms. The hope also expressed in the passage just cited has now been realised by the discovery of scorpions in the Upper Silurian beds of Scotland and Sweden, in the former by Dr. Hunter of Carluke, who obtained one from Lesmahagow in Lanarkshire in June 1883, and in the latter by Prof. Gustav Lindström, of the Swedish Academy of Sciences, Stockholm, who got his last summer (1884) from Wisby in the Swedish Island of Gothland. Prof. Lindström shows that his was a land animal and a true air-breather, and though of a more lowly type than the Carboniferous and recent scorpions, was yet to be placed among the members of that ancient family. Writing to M. Alphonse Milne-Edwards on November 24, 1884, he says:—

"The specimen is in sufficiently good preservation, and shows the chitinous brown or yellowish brown cuticle, very thin, compressed and corrugated by the pressure of the superposed layers. We can distinguish the cephalothorax, the abdomen, with seven dorsal laminæ, and the tail, consisting of six segments or rings, the last narrowing and sharpening into the venomous dart. The sculpture of the surface, consisting of tubercles and longitudinal keels, entirely corresponds with that of recent scorpions. One of the stigmata on the right is visible, and clearly demonstrates that it must have belonged to

1 Corda, in *Böhmischen Verhandlungen*, 1836, and Wiegmann's *Archiv.*, 1836, vol. ii. p. 360. Figured in the *Transactions* of the Bohemian Museum.

2 *American Journal of Science*, 2nd series, vol. xlv. p. 25. "Geological Survey of Illinois," vol. iii. pp. 563-565.

3 *Quart. Journ. Geol. Soc.*, vol. xxxii. p. 57.

4 *Transactions* of the Royal Society of Edinburgh, vol. xxx. pp. 397-412, Plates XXII., XXIII.

an air-breathing animal, and the whole organisation indicates that it lived an dry land. In this scorpion, then, which we have named the *Palæophoneus nuncius*, we see the most ancient of land-animals. In the conformation of this scorpion there is one feature of great importance, namely, four pairs of thoracic feet, large and pointed, resembling the feet of the embryos of several other tracheates and animals like the Campodea. This form of feet no longer exists in the fossil scorpions of the Carboniferous formation, the appendices belonging to which resemble those found in the scorpions of our own day."

To Prof. Lindström is thus due the honour of first announcing the discovery, and it was not till Dr. Hunter had received a photograph of the Swedish specimen, together with a preliminary notice of his find from Prof. Lindström, that he became fully aware of the importance of his own discovery. On receipt of the photograph and the notice, Dr. Hunter showed the Scottish specimen to the present writer (December 1884), with whom he has agreed to describe the geological and zoological aspects of the find.[1] In the meantime, a short preliminary description for comparison with the Swedish animal may not be out of place here. The rocks from which the Scottish example was obtained are the well-known Upper Silurian beds of Dunside, Logan Water, Lesmahagow, Lanarkshire, which have yielded such a magnificent suite of Eurypterids, and supplied a great part of the materials for Dr. Henry Woodward's work on the Merosomata. The animal in this specimen is about an inch and a half long, and lies on its back on the stone. Its exposed ventral surface shows almost every external organ that can be seen in that position, and in this way serves to supplement the evidence supplied by the Swedish specimen. As in the northern individual, the first and second pair of appendages of the cephalo-thorax in the Scottish example are chelate, but the palpi are not quite so robust. The walking-limbs, though not so dumpy as in *P. nuncius*, also terminate each in a single claw-like spike. The arrangement of the sternum shows a large pentagonal plate (metasternite), against which the wedge-shaped coxæ of the fourth pair of walking-limbs abut. The coxæ of the third pair bound the pentagonal plate along its upper margins, and meet in the mid-line of the body, where they are firmly united. The coxæ of the first two pairs, as well as the bases of the palpi, are drawn aside from the centre line of the body, showing that, as in recent scorpions, these alone were concerned in manducation, or rather the squeezing out of the juices of the prey. From the circumstance of these being drawn aside, the medial eyes are seen pressed up through the cuticle of the gullet, and a fleshy labrum (camerostome) appears between the bases of the chelicerae.

Behind the pentagonal plate and the coxæ of the hindmost limbs there succeeds a space shaped like an inverted V, where the test is thin and wrinkled in the line of the long axis of the body. It is just along this line that the trunk or abdomen most easily separates from the cephalo-thorax in recent scorpions, and it is at once apparent that the trunk in this case is as far separated from the cephalo-thorax as it can well be without being detached. Similar longitudinally-wrinkled skin is seen to unite the dorsal and ventral scutes up the whole right side of the trunk. At the interior angle of the inverted V there hangs downwards a narrow bifid operculum flanked on each side by the combs, which have each a broad triangular rachis set along its lower edge with the usual tooth-like filaments. The combs almost hide the first of the four ventral sclerites, which bear the breathing apparatus in recent scorpions, notwithstanding which all four of these exhibit on their right side undoubted slit-like stigmata at the usual places. The fifth ventral scute of the trunk suddenly contracts posteriorly, and to its narrow end is articulated a long tail of five joints and a poison-gland with a sting. These joints are all constructed on the same principle as those of recent scorpions, and as the articular surfaces are more highly facetted on the dorsal than on the ventral aspect (a portion of the tail of the specimen lying sideways allowing of these observations), there can be no doubt that the animal was in the habit of carrying the tail over the head (so to speak) and stinging in the same manner as its recent congeners.

The above characters are shown in the accompanying woodcut (Fig. 2) on nearly the same scale as that of the figure of the Swedish example, viz. about twice the natural size, taken from a drawing made by the writer. From it and the description it becomes apparent that the animal was a true air-breather and a land-animal.

The presence of the remains of these ancient murderers

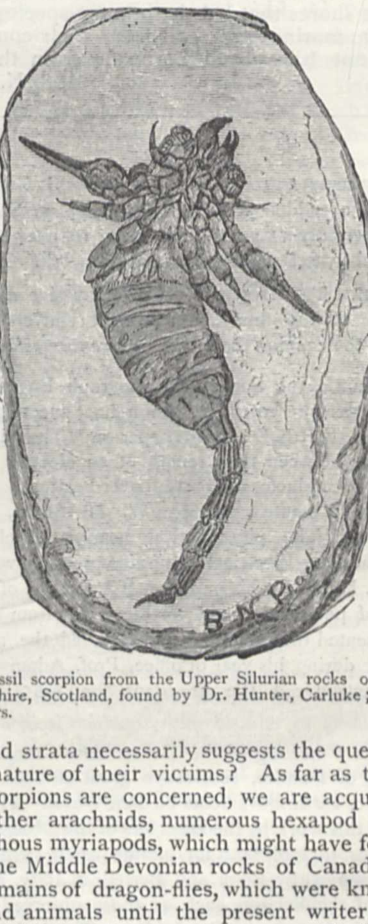

FIG. 2.—Fossil scorpion from the Upper Silurian rocks of Lesmahagow, Lanarkshire, Scotland, found by Dr. Hunter, Carluke; magnified two diameters.

in such old strata necessarily suggests the question, What was the nature of their victims? As far as the Carboniferous scorpions are concerned, we are acquainted with several other arachnids, numerous hexapod insects, and chilognathous myriapods, which might have formed their prey. The Middle Devonian rocks of Canada have furnished remains of dragon-flies, which were known as the oldest land animals until the present writer showed, in 1882, that chilognathous myriapods were far from uncommon in the Lower Old Red Sandstone of Forfarshire in Scotland,[1] and the *Gyrichnites* of the Lower Devonian of Gaspé are doubtless the casts of such animals.[2] It is but a short step from the Lower Old Red Sandstone of Scotland to the Upper Silurian. The lowest part of the Lower Old Red Sandstone, which is a lake-formation, may be represented elsewhere by marine strata, which would undoubtedly be called Upper Silurian, and, in fact, high up in the Lower Old Red Sandstone of Lanarkshire, which contains *Cephalaspis*, a band of shale occurs,

[1] It has been erroneously stated in the *Annals and Magazine of Natural History*, p. 76, and elsewhere, that the specimen was sent to me in 1883. The above statement is the correct one.—BEN. N. PEACH.

[1] *Transactions* of the Royal Physical Society, 1882, vol. vii. pp. 177-188, Pl. II.

[2] *Transactions* of the Royal Society of Canada, vol. i. Pls. xi., xii.

which proves that marine conditions recurred for a short time, and brought again into the lake basin such marine Silurian forms as *Beyrichia*, *Orthoceras*, and even *Graptolites*.[1] We are not left to conjecture the nature of Silurian insect-life, for Mr. Charles Brongniart intimated to the Paris Academy of Sciences (December 29, 1884), through M. Alphonse Milne-Edwards, the discovery of a fossil insect, the rock containing which is the Silurian sandstone of Calvados, and which is even more ancient than the strata containing the Swedish and Scottish scorpions. The specimen consists of the wing, the characteristics of which are those of the wings of Blatta.

It may be that, as recent scorpions feed extensively on the eggs of various Invertebrates, the Silurian species also visited the shores for the eggs of animals left bare by the tides, among which *Parka decipiens*, the eggs of its marine allies, the Eurypterids (if the latter had the habits of their near relation, the recent king-crab), would form a *bonne bouche*. If this suggestion should prove to be well founded, we may suppose that it was this habit of frequenting the shores that led the present specimens to be imbedded in marine strata, as from their completeness they could not have been borne far from their native shores.

BEN. N. PEACH

[1] A. Geikie, "Explanation of Sheet 23 of Geological Survey of Scotland," 1873, p. 14.

NOTES

WE greatly regret to record the death of Dr. J. Gwyn Jeffreys, F.R.S., from a sudden attack of apoplexy, on Saturday last, at the age of seventy-six years. We hope to refer at length, in our next number, to Dr. Jeffreys's scientific work.

SIR WILLIAM THOMSON will on Monday give an address at the opening of the fine laboratories at University College, Bangor. In the evening there will be a *conversazione*.

THE premium of the Society of Telegraph Engineers and of Electricians was presented, at the annual meeting, to Prof. George Forbes, F.R.S.E., for his paper on "The relation which should subsist between the strength of an electric current and the diameter of conductors to prevent over-heating." The Fahie premium was presented to Mr. W. H. Stone, M.A., for his paper on "The physiological bearing of electricity on health." The Paris Electrical Exhibition premium was presented to Mr. H. C. Mance for his paper on "A method of eliminating the effects of polarisation and earth-currents from earth-tests." Having presented the premiums and thanked the members for their support during his year of office, Prof. Adams vacated the chair and introduced the president for 1885, Mr. C. E. Spagnoletti.

AT the recent meeting of the Government Grant Committee, Prof. Ewing, of Dundee, received a grant of 100*l*. to institute observations of earth movements on Ben Nevis. He was asked to undertake this work by the Directors of the Observatory there, and he intends to look both for minute earth tremors, such as have been observed by Rossi and Bertelli in Italy, and for slow movements of the horizon, such as those observed by Messrs. G. H. and H. Darwin at Cambridge. The isolated position of the Ben Nevis Observatory makes it particularly well suited for observations of this kind.

SIR JOSEPH LISTER, Professor of Clinical Surgery in King's College, London, has been appointed by the German Emperor a Knight of the Order Pour le Mérite for Science and Arts.

WE have received from the Fine Art Society a "remark" proof of a very fine etching, by Mr. Flameng, of Mr. Collier's portrait of Prof. Huxley, which attracted so much attention at the Royal Academy Exhibition two years ago. Doubtless many of our readers will remember the leading features of the portrait, the etching of which will form a suitable companion to that of Mr. Darwin by the same engraver, also from a painting by Mr. Collier.

THE first arrangement for supplying private houses with electricity is now in working order in Paris. It has been placed in the Passage des Panoramas, Galerie Vivienne, for the use of all the houses in this extensive block. The motor being a gas-engine, the use of which is legal in cities, the proprietors of this lighting establishment have nothing to do with civic authorities and regulations. Six or seven shops are now lighted by about 100 Woodhouse and Rawson incandescent lamps.

THE Russian Government are preparing an expedition to Western Siberia, for the purpose of examining some sulphur deposits recently discovered there. The natives have for many years had knowledge of these deposits, but the Government have only recently been made cognisant thereof, through a report by Lieut. Kalityn. According to the statement of M. Konschin, a mining engineer, one of the deposits contains upwards of five million pood of sulphur, the number of the former being ten. Europe has hitherto been supplied with this article from Sicily, and it is hoped that the Russian deposits may compete with the mines in that island. In Russia sulphur has hitherto only been found at Tchirkota, not far from Petroffsk, in Daghestan, which has chiefly been delivered to the powder-mills. The expedition in question will leave St. Petersburg next month.

MR. H. CECIL writes to us with reference to our note on the British Museum lectures last week. "To some of us," Mr. Cecil writes, "it is a source of no little astonishment that the materials of these lectures, some of them of such surpassing interest, should not be made accessible to students and the general public in some full, substantial, and permanent form. Besides, it would surely pay. The hunger of men never was keener for every single seed-corn of threshed-out verity; and I am myself constantly asked with reference to the subjects of these very lectures: Where can I find this in accurate form, vouched by the writer's name, and open to the examination and judgment of all men?"

A MICHIGAN paper gives an account of a phenomenon that was witnessed in Orion and vicinity on the evening of December 20:—At Marshall a bright luminous ball of large dimensions, tinged with a deep green, apparently lit up the whole heavens. The light was instantly followed by a loud noise, somewhat resembling distant thunder, which continued for about one minute. The general opinion is that it was an aerolite. At Jackson the vibration was preceded by a vivid flash in the heavens, resembling lightning. The phenomena were noticed in several portions of the city. To the south it was felt quite strong. Near Hanover and Horton the quaking of the earth was observed, while the heavens for an instant were lighted by an instantaneous flash, followed by a loud report. Buildings were slightly jarred, and the people noted the motion of their houses.

THE Rev. H. Sumangala, High Priest of Adam's Peak, Ceylon, has recently contributed to the *Orientalist*, a magazine published at Kandy, a short summary of the views of Hindu astronomers on the form and attraction of the earth. The theory of Bhāskara, who flourished in the twelfth century of our era, was that the terrestrial globe, which is composed of earth, air, water, space, and fire, is of a spherical shape, and being surrounded by planets, such as the Moon, Mercury, Venus, the Sun, Mars, Jupiter, and Saturn, and by the orbits of stars, stands firm in the midst of space by its own power, without any other aid. This, he says, is a well-ascertained fact. Like the pollen in the Kadamba flower, on its surface are countries, mountains, gardens, and buildings, where Rākṣasas, men, Devas, and Asuras dwell. He refutes the theory that the earth cannot stand of itself without any support by arguing that, if there be a material support to the earth, there must be another upholder of that, and again another of this, and so on; then there will be no limit, and if, ultimately, self-support must be assumed, why not assume it in the first instance? Is not the earth one of the forms of Siva? As by nature heat is in the sun and fire, coldness in the moon, fluidity in water, hardness in stone, so mobility is in the air, and immobility in the earth. Each object has its own faculty, and "wonderful indeed are the faculties implanted in objects." As to the attraction of the earth, Bhāskara observes that the earth, possessing an attractive force, draws towards itself any heavy substance situated in the surrounding atmosphere, and that substance appears as if it falls. But whither, he asks, can the earth fall in ethereal space, which is equal and alike on every side? He ridicules the Buddhists for holding that the earth descends in unbounded space. An astronomical work anterior to Bhāskara's time says the terrestrial globe possesses Brahma's most excellent power of steadiness, and remains in space. The succession of day and night is said to be caused by the rising and setting of stars, the planet, and the zodiac. Arya Bhatta, in the sixth century, maintained the existence of a diurnal rotation of the earth round its own axis. The sphere of the stars, he states, is stationary, and the earth itself, making a revolution, produces the daily rising and setting of stars and planets.

MR. HOFFMANN, of Washington, has addressed a letter to the Anthropological Society of Paris, stating that in various ancient burial places in Southern California, and in the islands of Santa Cruz, Santa Rosa, and San Miguel, he has found instruments which he believes to be those employed in tattooing. The natives here do not tattoo themselves now, with the exception of the Haida Indians of Queen Charlotte's Island; they only paint their faces, but still many individuals bear traces of tattooing. Mr. Hoffmann found vessels containing red ochre and cakes of a black substance, composed apparently of the hydro-oxide of manganese, as well as some very sharp needles of bone, wood, and the fins of fish. These needles are still preferred, by tribes which practise tattooing, to those of steel, which they could procure easily.

THE publications of the Russian Geological Commission succeed one another rapidly, each of them containing some important contribution to the geology of Russia. The third fasciculus of its *Memoirs*, just published, contains a monograph by M. Tschernyschen, on the Devonian deposits of Russia. The interest awakened by the recent explorations in the Ural Mountains, where deposits quite analogous to those of the Hartz and the Eifel have been discovered, induced the author to describe some of the old collections of the Palæontological Museum at the Mining Institute at St. Petersburg, namely, that of Meglitzky and Antonoff, from the shores of Lake Kotluban, in the Southern Ural. These fossils proved to be Upper Devonian, and many of them quite new for the Ural region; they also enabled the author to give the following scheme of the Devonian deposits of the Ural mountains:—The Lower Devonian is represented by schists and sandstones, with numerous remains of *Atrypa hatilingius*, Schmer, and by the limestones of Nyaze-Petrovsk and Yurezan (upper part of the Lower Devonian), which are akin to the Greifenstein limestones and the Wissenbacher schists of Germany. The Middle Devonian consists of sandy limestones and unfossiliferous marls, which appear on the Ay and Yurezan rivers from beneath dolomites. The rich fauna of the former corresponds to that of the Eifel. And, finally, the Upper Devonian is represented by the limestones of Lake Kotluban, of Murzataeva, River Vilva, the mouth of Sulema, &c.; it corresponds to the Cuboides and Goniatites schists of the Eifel and Hartz, and is covered by the Clymenia limestones of Verkhneuralsk, which appear, in the Hartz, above the so-called *Intumenscens-stufe*. Comparing further the Devonian deposits of the Ural with those of the Petchora, as described by Keyserling, of the Government of Orel, according to his own observations, and of North-Western Russia, the author arrives at the following interesting conclusions:—On the Petchora we have Lower Devonian deposits of the Vol and Ukhta rivers, akin to the Middle Devonian of the Ural and Western Europe; and an upper layer (on the Middle and Lower Ukhta) which corresponds to the Goniatite schists of the Ural and the *Goniatites intumescens* deposits of the Rhine. The Middle Devonian of the Ural and Petchora correspond to the dolomitic limestones of Livonia and to the lower deposits of the south-east, which are rich in corals and tentaculites. For several interesting details we must refer, however, to the paper itself, which is followed by a *résumé* in German (twenty-four quarto pages), and is accompanied by three plates representing Devonian fossils.

THE geological map of Russia, prepared by the Geological Commission, is well advanced, and during this year we expect the appearance of three sheets including a part of the Ural Mountains, the government of Kostroma, and the Volga-and-Don region. As to the last issue of the *Izvestia* of the Commission, we notice in it a paper by M. Mikhalsky on the structure of the Kielce Mountains and the surrounding region. Its chief features were already known from the explorations of Pusch and Rœmer, but the very age of the deposits of this region (Devonian, Trias, Jura, and Chalk) had to be determined with more precision. The Trias reaches a great development, and M. Mikhalsky confirms Prof. Rœmer's affirmation that all three chief subdivisions of the German Trias are found in Poland. The Jurassic formation is also represented by three different deposits: one of them closely corresponds to the Jurassic deposits of Southern Germany, namely, to those of Bavaria, as already indicated by Ludwig Ammon. Another, which contains the *Exogyra virgula*, together with *Gryphæa dilatata* and *Pecten inæquicostatus*, seems to be an intermediate deposit between the Oxfordian and Kimmeridge deposits of England. As to the Oolite, its fossils are more like those of France and Middle Germany, but substantially differ from those of South Germany. A series of Jurassic deposits at the Peklo village is interesting, as it affords a remarkable mixture of the Upper Jurassic fauna of Middle Europe with the Jurassic fauna of Russia. It contains the ammonite *Perisphinctes virgatus*, which has been found only in the Russian Jurassic formation. As to the Chalk, it is represented in the south-west by much dislocated deposits containing *Inoceramus Crispii* and *I. striatus*, both characteristic of the Senonian subdivision. The whole is covered with thick deposits of Boulder Clay, containing Scandinavian and local boulders; one boulder of granite has been observed on the summit of the northern chain of the Kielce ridges, and, judging from the general character of the glacial deposits, the author believes in the extension of the Scandinavian ice-sheet as far as the Kielce ridge.

Science states that the U.S. Bureau of Navigation of the Navy Department reports that 145 compasses with the four-needle card have been issued to ships during the past year, and that they have given general satisfaction, the behaviour of the improved compasses used by the Greeley relief expedition in high latitudes being especially commended. This expedition gathered considerable data concerning the variation of the compass in high latitudes, but, owing to its speedy return, none were obtained concerning the magnetic force and dip. The data concerning compass variations, collected by the Department during the past year, are in course of preparation for publication. Professional paper No. 17, entitled the "Magnetism of Iron and Steel Ships," is in the press; and No. 18, on "Deviations of the Compass in U.S. Naval Vessels," is nearly ready. Preparations have been made for a careful examination of the magnetic character of the new steel vessels, and a compass station is to be established in Narragansett Bay. The instruments for a compass testing-house are now in the possession of the Bureau, and a building will be erected when the appropriation is made. In view of the probable necessity of compensating the compasses of these new vessels, a binnacle has been designed in the Bureau for this purpose, and it will be placed in the *Dolphin* to be tested.

IN accordance with a recommendation of the recent Geodetic Conference, we learn from *Science* a series of observations for latitude is to be made at the U.S. Naval Observatory, which, taken in connection with a similar series made elsewhere, and compared with observations made after an interval of some years, will assist in determining whether there are any slow changes taking place in latitudes upon the earth. Lisbon, which is very near the same parallel as Washington, is expected to co-operate with the Naval Observatory. The observations will be made with the prime vertical instrument; and at Washington a line officer of the navy will be detailed for the work, which will probably require several years.

AT University College, London, Dr. J. A. Fleming will commence a course of lectures and demonstrations on Modern Applications of Electricity in the Arts, on Friday, February 6, at 4 p.m. The first lecture will be open to the public without payment or tickets.

THE *Revue Scientifique* now publishes a weekly supplement containing reports of the proceedings of the Paris scientific societies; this supplement may be obtained separately.

THE additions to the Zoological Society's Gardens during the past week include a Moose (*Alces machlis*) from Russia, presented by Mr. Evelyn Hubbard; a Goshawk (*Astur palumbarius*), British, presented by Mr. W. H. St. Quintin, F.Z.S.; a Pink-footed Goose (*Anser brachyrhynchus*), British, presented by Major W. H. Fielden, C.M.Z.S.; two Yaks (*Poephagus grunniens*) from Tibet, six Dunlins (*Tringa alpina*), British, purchased.

GEOGRAPHICAL NOTES

AT the meeting of the Paris Geographical Society on the 9th inst. M. Maunoir read a paper on the explorations of Capt. Aymonier in Indo-China in 1883 and 1884, during which he collected many epigraphical documents and notes on Northern Laos and the basin of the Mouna. On December 10 the traveller was to leave Saigon for Binh-Thuan, in the extreme south of Annam, to study the monuments left behind by the Cham. It is wholly new ground. A letter was read from the French Consul at Zanzibar giving the latest geographical news from Eastern Africa. M. Deloncle summarised his recent exploration in Malacca. M. Paul Fauque, who is charged by the Ministry of Education with a scientific mission to Sumatra, described the results of his journey, and gave more details on the character, manners, and customs of the natives of the Siak country and of the Kingdom of Acheen. He added much valuable information on the geography, natural history, and mineralogy of this great island. His collections are to be distributed amongst various museums in France. The following medals were awarded:—A gold medal to M. de Foucauld for his journey in South Morocco and his exploration of the southern extremity of the Atlas Mountains; a gold medal to Dr. Neis for four journeys in Indo-China and in the hitherto unexplored parts of Laos; the La Roquette prize to the Danish summary of geological and geographical enterprises in Greenland (*Meddelelser om Grœnland*); the Jernard prize to M. Leroux, the publisher, for the volume of documents on the history of geography from the thirteenth to the sixteenth century; and the Echard prize to M. Dumas Vorzet for maps and cartographical labours. M. Allain referred to the defectiveness of geographical education in some public educational establishments, and advised that all the State libraries in Paris should be provided with as complete a collection as possible of geographical works.

THE editor of *Petermann's Mittheilungen* has issued a circular with the January number of his journal, giving notice that in future the monthly parts will consist of three main sections: (1) Original papers, as heretofore; (2) a monthly report of the advances of geographical discovery and colonisation in countries outside Europe; (3) a literary section referring to recent geographical and cartographical works, with the exception of pure travels, which will be dealt with in the second section. The valuable supplementary parts (*Ergänzungsheften*) will be continued as before.

THE report has been published of a journey by four French officers among the Muongs of the Black River, which enters the Red River of Tonquin a little below Sontay. These tribes are described as more civilised than the Moïs of Cochin China; they are practically independent, although the Annamites profess to appoint their chiefs; they are very warlike, intelligent, and industrious, making their own arms, which are sometimes very beautiful. After having acquired all the information they could as to Muong silk and silk manufactures, the travellers explored the mountainous regions among the district. There are gold mines in the hills worked by Chinese, but at some of them they have armed themselves in great numbers since the recent troubles, and will allow no one, French or Muong, to approach them. The members of the expedition, however, saw enough to convince them that the district is rich in minerals, especially gold.

THE Argentine expedition to the Chaco will, it is stated, have the result of adding a large territory to civilisation and agriculture. This forms for the most part the basin of the Rio Bermejo, or Red River, which flows down from the Andes, and commences to be of importance towards the 61st degree of longitude. Soon after it receives the waters of the Tenco, and should be navigable unless its bed is obstructed by the trunks of trees and if it does not traverse lagoons where its channel will be difficult to find. It flows in a south-westerly direction, and enters the Rio Paraguay after a course of about 500 kilometres. The districts through which it flows are well-wooded; they are inhabited by tribes of Indians, whose favourite weapon is the arrow, and who, when they do not live by hunting and fishing, exist on the locusts which abound and on the cattle which they can contrive to steal from the Argentines. The number of inhabitants of this part of the Chaco is estimated at 10,000.

Globus publishes a letter from Dr. Claus, a member of the Steinen expedition into one of the most unexplored parts of Brazil. It was for some time doubtful whether the expedition was examining the Xingu, or some other neighbouring tributary of the Amazon. It appears now that the Xingu was the river explored. On May 26, 1884, the expedition left Cuyabá, the capital of the Brazilian province, Matto Grosso, arrived on July 20 at Rio Batovy, and in the end of October at Pará, at the mouth of the Amazon. Dr. Claus writes that they completely carried out their programme. After a journey of two months from Cuyabá, they sailed in canoes down a small river, which, according to the maps, should belong to the Xingu region. The districts around the source of this river are inhabited by numerous tribes who have never met with white men, and who use only implements of stone and bone. At the 12th parallel they came on the Xingu. The cataracts caused the travellers the utmost difficulty, and they also suffered much from hunger. For a whole month they had nothing but beans to eat. During part of the descent of the Xingu, also, they met with the same troubles and privations; but towards the end of their journey they fared much better, passing along from one Indian village to another. On October 15 they arrived at the first Brazilian settlement on the 4th parallel. The head of the expedition has a large collection of Indian objects, and the collections of the others, though much damaged by water, are otherwise safe.

MR. WM. CAMERON, F.G.S., an indefatigable explorer of Malayan countries, has just prepared, at Singapore, a large and elaborate map, on a scale of half an inch to the mile, of districts recently explored by him in Selangor, Ulu Selangor, Sungei Ujong, and other parts of the Malay Peninsula. The map is said to be excellently drawn up, and to be a valuable acquisition to our existing geographical knowledge of the Malay Peninsula, which is somewhat limited.

A GEOGRAPHICAL conference is about to be held in Melbourne on the occasion of the first annual meeting of the Victorian branch of the Geographical Society of Australia. Members of the general council of the Society, as well as of the local councils of the New South Wales and Victorian branches, are invited. Among the subjects to be discussed are the necessity of defining the exact meaning of the geographical term Australasia, the compilation of a reliable work on the geography of Australia for Australian schools, the exploration of New Guinea, and the discovering and defining of the exact boundaries of what may now be termed British New Guinea.

ASTRONOMICAL PHENOMENA FOR THE WEEK

1885, FEBRUARY 1-7

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on February 1

Sun rises, 7h. 40m. ; souths, 12h. 13m. 53·2s. ; sets, 16h. 47m. ; decl. on meridian, 16° 58′ S. : Sidereal Time at Sunset, 1h. 35m.

Moon (2 days past Full) rises, 18h. 22m.* ; souths, 1h. 23m. ; sets, 8h. 12m. ; decl. on meridian, 8° 21′ N.

Planet	Rises	Souths	Sets	Decl. on Meridian
	h. m.	h. m.	h. m.	° ′
Mercury	6 31	10 33	14 35	22 3 S.
Venus	6 37	10 39	14 41	22 3 S.
Mars	7 52	12 24	16 56	17 21 S.
Jupiter	18 34*	1 37	8 40	11 28 N.
Saturn	12 14	20 17	4 20*	21 32 N.

* Indicates that the rising is that of the preceding, and the setting that of the following nominal day.

Occultations of Stars by the Moon

Feb.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to left
			h. m.	h. m.	° °
1	B.A.C. 3529	6	4 16	5 20	90 292
1	*d* Leonis	5	20 1	20 57	31 218
2	B.A.C. 3836	6	3 29	4 41	76 276
2	75 Leonis	5½	5 26	6 28	116 267
2	76 Leonis	6	6 29	7 25	81 312
5	B.A.C. 4591	6	3 13	4 11	95 199

Phenomena of Jupiter's Satellites

Feb.	h. m		Feb.	h. m.	
1	5 46	I. tr. ing.	3	23 41	I. occ. reap.
2	2 33	I. ecl. disap.	4	0 9	II. ecl. disap.
	5 15	I. occ. reap.		3 49	II. occ. reap.
	6 6	II. tr. ing.		18 38	I. tr. ing.
	22 8	IV. ecl. disap.		20 57	I. tr. egr.
3	0 12	I. tr. ing.	5	19 13	II. tr. ing.
	2 31	I. tr. egr.		22 8	II. tr. egr.
	6 25	IV. occ. reap.	6	2 37	III. tr. ing.
	21 1	I. ecl. disap.		6 13	III. tr. egr.

Saturn, February 1.—Outer major axis of outer ring = 44″·5 ; outer minor axis of outer ring = 20″·1 ; southern surface visible.

February 1, 7h.—Jupiter in conjunction with and 4° 9′ north of the Moon.

SCIENCE IN VICTORIA

THE President of the Royal Society of Victoria devoted a considerable portion of the presidential address contained in the last published volume of the Society's *Transactions* to a review of the progress of science in the colony. It might at first sight be supposed that, in young communities like those of the Western States of America or of our own Australasian colonies, the struggle to develop their resources to the utmost, which occupies every one, and the total absence of a leisured class, would be an insurmountable obstacle to scientific work, or indeed to work of any kind for its own sake. But the numerous and valuable publications which we constantly receive from scientific societies formed among young English-speaking communities all over the globe—in Japan, China, the Straits, Ceylon, Australia, Canada, the United States, the Cape, and many other places—show that this impression is wholly incorrect, and that the members carry with them into scientific work the energy and perseverance which they exercise in their ordinary avocations.

The first sign of progress which Mr. Ellery had to chronicle in his address was that the Royal Society had grown too large for its building, and consequently the more spacious rooms of the Melbourne Athenæum had to be selected for the annual address. The number of members has increased annually, and the financial condition of the Society is satisfactory. During the year under review there has been "a vigorous and healthy progress," but the young body, having outgrown its juvenile garments, must provide itself with more capacious ones in the shape of considerable additions to the Royal Society house. In the several national scientific and technical departments the year has been one of active labour, and their progress, in common with that of the Society, has been considerable. There is, the President reports, an undoubted and general increase in the desire for knowledge in the various pure and applied sciences, and especially as applied to technical training and to the daily requirements of life. New societies for the prosecution of study and research, more especially in the natural sciences, have come into existence in the provinces, and the older societies and schools are increasing in their influence and usefulness. The School of Technology and the technological museums at Melbourne are growing rapidly. An example of the great economic benefits of such institutions was afforded during the year under review by the opening of a new trade between Victoria and India wholly on account of the knowledge derived in Melbourne from the museum collection of Indian woods, and it is anticipated that a like result will accrue from a collection of colonial economic woods sent to Calcutta. In Ballarat and Sandhurst the schools of mines are important centres of teaching in the arts and in applied and natural sciences. In Melbourne itself the Medical and Pharmaceutical Societies, the Microscopical Society, and especially the Field Naturalists' Club, have partaken in the general progress.

The President then comes to the question of what has actually been done in Victoria during the year towards the advance of natural science. The first person referred to in this connection is Baron Mueller, to whose research is due a large proportion of what is known of Australian botany. He succeeded in getting the Colonial Government to purchase for the Botanical Museum the collection of Dr. Sanders of Hamburg, a leading authority on algæ, and on European and North African botany. Valuable additions, illustrative of the flora of the western coast districts of Australia, were made to the same museum, which has really been formed by Baron Mueller himself from his collections, extending over nearly forty-four years. Among new publications of the year were additions to the "Fragmenta Phytographia Australis," a continuation of the "Systematic Atlas of the Eucalypti," a new edition of a work on "Select Plants for Industrial Culture," and "A Systematic Census of Australian Plants." A second volume of the vegetable fossils of the auriferous drifts was completed, and in its pages are described and compared most of the fossil fruits of the Pliocene period. A vast field of investigation still remains in the fossil foliage of the Miocene deposits. With a reference to the work of the Melbourne Observatory during the year the president closes that portion of the address with which we are specially concerned here. At the end of the address he argues that the Royal Society is broad enough in its constitution to embrace all sciences, and that, therefore, various sections in connection with it should be formed rather than new societies for each science. The community is not, he thinks, yet large enough to maintain, in an effective state, a number of scientific societies ; and if all in Victoria interested in the progress of science, or engaged in her various byways, were to unite together, not only would more useful work be done, but the work would be more valuable, on account of being subjected to a wider criticism. All the colonial scientific societies combined would form a strong body, capable of fostering and even subsidising scientific research. In one respect, perhaps, the wheels of the Society might run more smoothly. The volume (a rather small one) of the *Transactions* for 1883 was not issued till May 30, 1884, and was not delivered in London until more than six months later.

THE KILIMANJARO EXPEDITION

AT a meeting of the Royal Geographical Society held on Monday night, Mr. H. H. Johnston gave a description of his visit to Kilimanjaro, on the slopes of which he spent more than five months in the summer and autumn of last year.

Mr. Johnston began by explaining the circumstances in which, as appointed leader of the expedition projected by the joint Kilimanjaro Committee of the British Association and the Royal Society, he found himself on arriving at Zanzibar without any trained collectors to assist him. Giving a lively and picturesque narrative of his adventures during his stay with Mandara, chief of Moshi, a person of remarkable character, who rules a small tract on the lower slopes of Kilimanjaro at an altitude of about 6000 feet, and is at war with all the surrounding potentates, Mr. Johnston told how, after some difficulties, he began the ascent of the mountain with forty carriers and some guides provided by another chief, Maranga. They crossed the cultivated zone, which ended at about 5500 feet in that part, entered a healthy district with pleasant grassy knolls and many streams of running water, and encamped beside a lovely fern-choked brook at 6500 feet, the whole ascent being very gradual. The following day they passed through stunted forest, not unlike an English woodland, where the trees, however, were hung with unfamiliar ferns and creepers, and where deliciously-scented parasitic begonias trailed their pink flower-bells from branch to branch. The dracæna, which is cultivated by the Wa-Chagga to form hedges, here grew wild. Tree-ferns were abundant and handsome. Above 7000 feet the orchilla moss draped the forest trees in long gray festoons. Tracks of elephents were very numerous. The other noticeable inhabitants of the forest were dark blue touracoes and tree-hyraxes. Wart-hogs were occasionally met with up to 8000 feet. At 9000 feet they encamped for the night by a small spring of water in the midst of a grand bit of forest, not of that stunted character which marked the lower woods. He caught a chameleon and many beetles here, and also shot touracoes and pigeons. The next day they walked several miles eastward to find a good place for settlement close to water, and not too high up, so that his shivering followers might not suffer unreasonably from cold. He selected an admirable spot on a grassy knoll rising above the river of Kilema, which takes its source near the base of Kimawenzi. The altitude of this spot was nearly 10,000 feet. Having seen every one carefully installed and protected from the—to them—severe cold (for the thermometer descended every night to one or two degrees below freezing-point), he transferred his own quarters to a higher elevation, and began industriously to collect. His first excursion was to the base of Kimawenzi. The terrible hurricane of wind, however, that raged round this jagged series of lava peaks, prevented him from continuing the ascent, although he doubted if it were possible for any one to reach the summit, owing to the want of foothold. The snow varied very much in quantity on Kimawenzi. Sometimes the whole peak would be covered down to the parent ridge, with only the precipitous rocks peeping blackly through the mantle of white. At other periods the snow would be reduced to an insignificant patch, and the reddish sand which filled the crevices and glissades between the lava rocks would be left exposed to view. This change from an almost complete snow-cap to nearly no snow at all might be effected in twelve hours. His great object, however, was to reach the snows, and, if possible, the summit of Kibô. To do this it would be necessary to sleep on the way. He had therefore to induce a few followers to accompany him to carry impedimenta. Starting at 9, he walked upwards with few stoppages until 1.30. At first they crossed grassy undulating hillocks, the road being fairly easy. Then they entered a heathy tract, scorched and burnt with recent bush-fires; but higher up, where the blaze had not reached, the vegetation was fairly abundant and green. Small pink gladioli studded the ground in numbers. At an altitude of nearly 13,000 feet bees and wasps were still to be seen, and bright little sun-birds darted from bush to bush, gleaning their repast of honey. A little higher they found warm springs, the thermometer showing the temperature of the trickling mud to be 91° F. Mounting high above the rivulet the scenery became much harsher. Vegetation only grew in dwarfed patches as they passed the altitude of 13,000 feet, and the ground was covered with boulders, more or less big, apparently lying in utter confusion, and without any definite direction. They were not very difficult to climb over, and even seemed to act as irregular stone steps upwards. In their interstices heaths of the size of large shrubs grew with a certain luxuriance. About 13,700 feet he saw the last resident bird, a kind of stonechat apparently. It went in little cheery flocks, and showed such absence of fear that he had to walk away from it before shooting to avoid shattering his specimen. After this, with the exception of an occasional great high-soaring kite or great-billed raven, he saw no other bird. On reaching a height a little above 14,000 feet he stopped again to boil the thermometer and refresh himself with a little lunch. Throughout this ascent, which was easy to climb, he suffered absolutely nothing from want of breath or mountain sickness, although his three Zanzibari followers lagged behind, panting and exhausted, and complained much of their lungs and head. "Mounting up a few hundred feet higher than the last stopping-place," Mr. Johnston said, "and rounding an unsuspected and deep ravine, I arrived close to the base of a small peak which had been a continual and useful point to aim at during the whole journey from my station. I was now on the central connecting ridge of Kilimanjaro, and could see a little on both sides, though the misty state of the atmosphere prevented my getting any good view of the country. This ridge, which from below looks so simple and straight, is in reality dotted with several small monticules and cut up into many minor ridges, the general direction of which is, on the southern side, from north-east to south-west. To the eastward I could see the greater part of Kimawenzi rising grandly with its jagged peaks and smooth glissades of golden sand. Westward, I still looked vainly in the piled up clouds, for the monarch of the chain still remained obstinately hidden, and I was at a loss as how to best approach his awful crown of snow. At length, and it was so sudden and so fleeting that I had no time to fully take in the majesty of the snowy dome of Kibô, the clouds parted, and I looked on a blaze of snow so blinding white under the brief flicker of sunlight that I could see little detail. Since sunrise that morning I had caught no glimpse of Kibô, and now it was suddenly presented to me with unusual and startling nearness. But before I could get out my sketch-book and sharpen my chalk pencil, the clouds had once more hidden everything, indeed, had inclosed me in a kind of London fog, very depressing in character, for the decrease in light was rather alarming to one who felt himself alone and cut off at a point nearly as high as the summit of Mont Blanc. However, knowing now the direction of my goal, I rose from the clammy stones, and, clutching up my sketch-book with benumbed hands, began once more to ascend westwards. Seeing but a few yards in front of me, choked with mist, I made but slow progress; nevertheless, I continually mounted along a gently-sloping hummocky ridge, where the spaces in between the masses of rock were filled with fine yellowish sand. There were also fragments of stone strewn about, and some of these I put into my knapsack. The slabs of rock were so slippery with the drizzling mist that I very often nearly lost my footing, and I thought with a shudder what a sprained ankle would mean here. However, though reflection told me it would be better to return to my followers and recommence the climb to-morrow, I still struggled on with stupid persistency, and at length, after a rather steeper ascent than usual up the now smoother and sharper ridge, I suddenly encountered snow lying at my very feet, and nearly plunged headlong into a great rift filled with snow that here seemed to cut across the ridge and interrupt it. The dense mist cleared a little in a partial manner, and I then saw to my left the black rock sloping gently to an awful gulf of snow so vast and deep that its limits were concealed by fog. Above me a line of snow was just discernable, and altogether the prospect was such a gloomy one, with its all-surrounding curtain of sombre cloud and its uninhabited wastes of snow and rock, that my heart sank within me at my loneliness. Nevertheless, I thought, 'only a little further, and perhaps I may ascend above the clouds and stand gazing down into the crater of Kilimanjaro from its snowy rim.' So, turning momentarily northwards, I rounded the rift of snow, and once more dragged myself, now breathless and panting, and with aching limbs, along the slippery ridge of bare rock which went ever mounting upwards. I continued this for nearly an hour, and then dropped exhausted on the ground, overcome with what I suppose was an ordinary attack of mountain sickness. I was miserably cold, the driving mist having wetted me to the skin. Yet the temperature recorded here was above freezing-point, being 35° F. I boiled my thermometer, and the agreeable warmth of the spirit-lamp put life into my benumbed hands. The mercury rose to 183°·8. This observation when properly computed, and with the correction added for the temperature of the intermediate air, gives a height of 16,315 feet as the highest point I attained on Kilimanjaro. I thus came within a little more than 2000 feet of the summit, which is usually estimated to reach an altitude of 18,800 feet." He made other ascents during the month he was in high altitudes. The footprints and other traces of buffaloes were seen up to 14,000 feet, but he never caught sight of one of the creatures, nor did he see any of the big antelope, who also wander up to the snow line. At a height of 13,000 feet he saw three elephants, and at night the shrill trumpeting of these animals could be heard round the station. On October 18 he found himself, most unwillingly, obliged to leave the elevated settlement and return to Taveita. The relatively great cold they had experienced had reacted very unfavourably on his men's health, and he feared that a longer delay might render them quite unfitted to carry burdens. He intended, however, to make his return journey entirely through a new and hitherto untraversed country, and this project somewhat consoled him for leaving the summit of Kilimanjaro still unconquered. Their downward journey, part of the way through trackless bush and dense dank forest, was not without adventure and some reward in scenery of great beauty. The average elevation of this country was between 8000 and 7000 feet, and the temperature consequently almost cool, ranging from 43° at night to 70° in the mid-day warmth. After some four hours' walking from their camp they crossed the long ridge that marked the southern flank of Kimawenzi, and began to descend the eastern slope of the mountain. Soon they emerged on a kind of heath-like country, and then looked forth on a splendid view stretching from Mwika to the mountains of Bura and Ukambani (the Kiulu range), with Jipe on one hand and the River Tzavo on the other. After some enjoyable excursions from his settlement at Taveita, finding that his funds would not support the expedition beyond the end of November, he made a rapid journey to the coast by way of Pare, Usambara, and the Rufu river to Pangani. At Zanzibar, finding there were no fresh funds to enable him to return to Kilimanjaro, he paid off the last of his faithful followers, many of whom had accompanied Thomson on his great journey, and took his passage on the British India steamer to Suez in quite a sulky frame of mind, as sorry to leave his beautiful mountain as many people are to quit England. Travelling overland from Suez, he arrived in London not much more than six weeks after he had caught his last glimpse of the snows of Kilimanjaro.

A SCANDINAVIAN LAND OF OPHIR

WE learn from *Naturen* that the little island in the Hardanger Fjord, known as Bömmelöen, which two years ago was an uninhabited and desolate spot, is now a busy scene of extensive gold-digging. Numerous English artizans and Norsk bricklayers and carpenters have for months been actively engaged in boring and sinking shafts into the rock, and in preparing houses and shelter for the men and machinery that have been drawn hither by the report of the discovery in 1882 of gold in the Storhangen mine. This discovery had been anticipated in 1862 by the find of a piece of pure gold, which was at once deposited in the mineralogical museum of Christiania, where it has since remained apparently unheeded, although the place and time at which it was found are duly marked on the corresponding label. After twenty years gold was again found in 1882, at the Storhangen mine, which was then being worked for copper ore. The result of this discovery was the purchase, in 1883, of the works by an English firm, trading under the title of the Oscar Gold Mining Company, which is worked under the scientific direction of Mr. Murchison. Considerable amusement seems so have been created among Norsemen by a somewhat ambiguous statement, set forth in the Company's circulars, which oracularly announces that "the gold finds at Bömmelöen are either Nature's greatest success or her greatest illusion"!

The geological formation of Bömmelöen is similar to that of other auriferous rocks, the gold being found in quartz, which occurs in strata never more than six feet thick, although of considerable extent, and generally underlying green (chloritic) schist. The greenstones of the island differ from those found in other parts of Norway, and contain glass and various typical vulcanic products.

The operations of the Oscar Mining Company have given a new stimulus to the search for gold in Norway, and we learn that Herr Bakke, Inspector of Mines at Trondhjem, has officially reported the discovery of virgin gold in a piece of chloritic slate from Stegen in Nordland, while it is authoritatively stated that gold has been found within the last year or two at Sveen in the Bergen-Amt, and also near Stavanger. In the latter case the discoverer, Nils Berg, an old experienced Australian gold-digger, washed the gold from the mud remaining at the bottom of a shaft that had been sunk in a copper mine.

SCIENTIFIC SERIALS

Wiedemann's Annalen, vol. xxiv. January 1885—O. Lehmann, on the melting-points of bodies in contact, and on the electrolysis of solid iodide of silver. A remarkable paper, accompanied with an elaborate plate describing phenomena of crystallisation observed chiefly with microscope at limiting edge of two crystallisable liquids or solutions. Iodide of silver presents certain closely-related phenomena under electrolysis, both in molten and in solid condition. Regular crystalline iodide of silver conducts an electric current, the silver being carried in the direction of the negative current through the crystal without its structure being disturbed. In its electrolysis, however, there appears a streaking in the direction of the flow of the current.—W. von Bezold, on a new kind of cohesion-figures. These experimental researches relate to the quasi-dendritic forms observed when one liquid descends through another.—L. Boltzmann, on the possibility of founding a kinetic theory of gases on attractive forces alone. This is an attempt to dispense with Maxwell's hypothesis that molecules repel one another in the inverse fifth power of the distance, which he framed to account for the apparent perfect elasticity exhibited by molecules of gases. Boltzmann proposes a new theory, based on attraction, very similar to that recently independently propounded by Sir W. Thomson (NATURE, August 28, 1884).—O. Chwolson, on the calibration of the plug-rheostats of Siemens and Halske. This discusses corrections for the resistance of connecting-pieces, &c.—F. Kohlrausch, the electric conductivity of water distilled *in vacuo*. A column of pure water 1 metre long and of 1 square millimetre section has a resistance of about 4×10^{10} ohms.—G. Kirchhoff, on the change of form which an elastic body experiences when it is magnetically or dielectrically polarised. This paper, originally published in the *Proceedings* of the Berlin Academy, deals analytically with the phenomenon of electrostriction investigated by Lorberg and others.—A. Schuster, on the discharge of electricity through gases. Treats of certain points in dispute between the author and Profs. Goldstein and E. Wiedemann. The author pronounces in favour of the view that all the phenomena of effect of magnetism, &c., upon the discharge of the negative electrode may be explained if it be admitted that the negatively-charged portions of the gaseous molecules are driven off from the kathode.—E. Goldstein, on electric conduction in the vacuum. Discusses some experiments in which a carbon filament lamp was employed; the filament forming one electrode, a platinum wire being inserted through the glass to serve as another electrode for the discharge, which was obtained, without an induction-coil, with electromotive forces of about 300–350 volts.—Werner Siemens, contributions to the theory of magnetism. Describes experiments on partially-closed magnetic circuits of iron, giving rise to the opinion, that the harder a specimen of iron is, the greater is the value of the magnetising force at which the maximum of permeability is observed. Also, the magnetic resistance of air is from 480 to 500 times as great as that of iron.—H. Hertz, on the dimensions of unit of magnetic pole strength in different systems of measurement.—E. Ketteler, the optical constants of magnetic media. Develops equations relating to Kundt's recent magneto-optic observations.—E. von Fleischl, the double refraction of light in fluids. Proves that in optically-active liquids the rotation is due to the existence of double refraction. Double-refracting liquids have no optic axis, and the wave-surface consists of two concentric spherical sheets.—W. von Voigt, on the measurement of the refractive indices of absorbing media. Recommends the prism method as more accurate than the total-reflection method.—W. von Voigt, on the theory of reflection and refraction at the boundary of crystalline media. New equations based on the author's theory of the reactions between matter and ether in transparent media, and leading to same conclusions as Kirchhoff's older theory.

Journal de Physique, November, 1884.—J. Jamin, on hygrometry. The author proposes to substitute for the "relative humidity" a new coefficient termed the "hygrometric richness," which is the ratio of the actual pressure of aqueous vapour of the air to the difference between the total atmospheric pressure and the actual vapour pressure. The substitution appears to be both rational and instructive.—Ch. Rivière, essay on cooling power of gases. Confirms formula of Dulong and Petit up to 400° C., but above that temperature the observed values are lower than the theoretical. Also appears to prove that at very low pressures cooling power is independent of the chemical composition of the gas.—C. Decharme, imitation of the phenomena of electricity and magnetism by means of liquid and gaseous currents. Summarises number of experimental researches.—A. Kundt, electromagnetic rotation of plane of polarisation of light transmitted through films of iron, cobalt, and nickel; an abstract from the Berlin *Berichte*.—E. Bazzi, on the heat developed by a current during the variable period. Experiments show Joule's law still to hold good, assuming Helmholtz's equations true. It has been remarked by Blaserna that this is not incompatible with the existence of oscillations in the extra-current, for Helmholtz's expression, though only a first approximation which omits the terms that would express these oscillations, is probably not far from the mean result.—The remainder of this number consists of abstracts of papers by Amagat, Baille, H. Becquerel (on infused rays), Cornu, Witz, and by Berthelot and Ogier from the *Annales de Chimie et de Physique*.

December, 1884.—E. Villari, new researches on the electric figures of condensers. The ramifications observed in the dust-figures are believed to be due to partial internal discharges.—E. Villari, microscopic researches on the traces of electric sparks engraved on glass, and on the diameter of these sparks. Tinted zones are observable where these sparks have passed over the surface of the glass. These traces vary with the glass, not with the nature of the electrodes; they are not removed by acids, and are probably due to heat. The cross section of the spark is, for a constant potential, proportional to the charge which produces it.—E. Villari, on the total heat developed by one or more sparks generated by the discharge of a condenser.—E. Villari, singular mechanical effect of the electric discharge. Glass plates, even strong thick ones, are easily broken by the spark of a Leyden battery, provided one face be silvered.—A. Righi, on a recent interpretation of Hall's phenomenon. Bidwell's theory of Hall's phenomenon appears to fail in the case of bismuth, in which Hall's phenomenon exists most markedly. It is also to be remarked that the variation of the electric resistance of bismuth, when subjected to the magnetic field, is greater than that of any other metal.—R. Weber, the electric siren. This instrument produces tones in a receiving telephone by causing rheotomes having different numbers of peripheral contacts rotated at a uniform speed to interrupt the circuit of a battery. The author draws a number of conclusions relatively to the partial and resultant tones, which are hardly justified when one considers the non-sinusoidal character of the variations of the current.—F. Melde, acoustical experiments, abstracted from *Wied. Ann.*—P. de Heen, determination of the general law governing the dilatation of any chemically definite liquid. The author assumes that the molecules attract one another in the inverse seventh power of the distance. Whatever may be thought of the hypothesis, there is an interesting coincidence running through his figures.—The remainder of the number is filled with abstracts of papers from the *Nuovo Cimento*, the most important of them being by E. Wiedemann, on the density of the luminiferous ether, and by Profs. Bellati and Romanese, on some remarkable thermic properties of the iodides of silver and copper.

Rendiconti del Reale Istituto Lombardo, December 11, 1884.—Report on the results of the International Medical Congress held at Copenhagen during the month of August, by Prof. G. Sangalli.—On the influence of high temperatures on the development of microbes, by Prof. L. Maggi.—A study of the earthquake which occurred at Ischia on July 28, 1883, by Prof. Giuseppe Mercalli.—On the secular variation in the elements of terrestrial magnetism at Como, by C. Chistoni.—Descriptive catalogue of sixty-three hitherto unpublished Pontifical coins and medals in the Royal Numismatic Cabinet at Milan, by E. B. Biondelli.—The paintings of the Italian masters in the public museums of Europe, in connection with Senator Morelli's recent work, by Prof. G. Mongeri.—Critical notes on the fourth book of the pseudo-Theophilus, by Prof. C. Ferrini.—Meteorological observations made at the Brera Observatory, Milan, during the months of November and December 1884.

Journal of the Russian Chemical and Physical Society, vol. xvi. fasc. 7.—On the heat of combustion of organic matters, by W. Longuinine; being a description of the methods resorted to by the author in his series of determinations preliminary to the subsequent publication of the results obtained. The paper is accompanied by several plates.—Analysis of a saltpetre earth from Turkestan, by N. Lubavin. It is taken from the ruins of Kunya-Urgench, the climatic conditions being altogether very favourable for its formation, and its abundance explains the cheapness of gunpowder at Khiva. It contains 6 per cent. of azotic anhydride. The remarks of the author as to the connection between the formation of saltpetre and the inundations of the Amu are worthy of notice.—Review of the Russian chemical literature for the year 1883 and first quarter of 1884.—We notice the appearance of a fifth edition of the excellent manual of analytic chemistry by M. Menshutkin, as also of his lectures on organic chemistry (lithographed), which are now in print; a third edition of P. Alexeyeff's organic chemistry, and a second edition of the principles of chemistry, by A. Potylitsin, not to speak of several translations. As to separate monographs, besides those already mentioned by NATURE, the following are worthy of notice:—The organic compounds in their relations to the haloid salts of aluminium, by G. Gustavson—a work which has obtained the premium of the Chemical Society; on the relations between the compositions and refractory power of organic compounds, published at Kazan, which has raised a serious and useful discussion between Russian chemists; and an inquiry into the atoms and the measurement of their size, by O. Troyanovski (Warsaw).—On the electrical discharge in gases, by M. Goldhammer; being a series of experiments for determining the temperature in Geissler tubes. When rarefied air is taken for the experiment, its heating does not depend on its elasticity so long as this last remains within the limits of 8·4 to 38 millimetres; but it decreases with the decrease of the electrical current. The distribution of temperature on the surface of the tube is shown by a series of curves. An interesting observation made by the author is that phosphorescent light on the surface of the glass, such as Prof. Crookes considered as appearing only at pressures equal to millionth parts of an atmosphere, appeared also at pressures from 1·3 to 0·8 millimetres, the glass of the tube not belonging to the category of uranic glass, and the phosphorescent light appearing invariably on the calode, even when the direction of the current has been changed.—Preliminary report on the influence of compression of iron and steel on their magnetisation, by P. Bakhmetieff.—On the hail of July 11, 1884, at Kharkoff, by N. Piltchikoff—a description, with figures, of the hailstones.—On the shock of absolutely rigid bodies, by N. Joukovsky; being a mathematical critique of the theories advanced on this subject by MM. Matson, Prof. Shiller, at Kieff, and M. Garrigou-Lagrange.—On the dilatation of liquids, by M. Avenarius, against Prof. Mendeléeff's formula and in favour of the expression $v = a + C \log. (T - t)$.—On the regular forms taken by powders, by Th. Petrushevski.

SOCIETIES AND ACADEMIES

London

Royal Society, January 8.—"Experimental Researches in Magnetism." By Prof. J. A. Ewing, B.Sc., F.R.S.E., University College, Dundee. Communicated by Sir William Thomson, F.R.S.

The paper describes in detail experiments of which preliminary notices have already been published in the *Proceedings* of the Royal Society, vol. xxxiv. p. 39, and in the *Philosophical Magazine*, November, 1883. The experiments relate to—

(1) The magnetic susceptibility of iron and steel, the form of the magnetisation curve, and the changes of magnetism caused by cyclic changes of magnetising force.

(2) The influence of vibration on magnetic susceptibility and retentiveness.

(3) The influence of permanent strain on magnetic susceptibility and retentiveness.

(4) The energy expended in producing cyclic changes of magnetisation.

(5) The ratio of residual to total induced magnetism.

(6) The changes of induced and residual magnetism caused by changes of stress.

(7) The effects of constant stress on magnetic susceptibility and retentiveness.

(8) The changes of magnetism caused by changes of temperature.

(9) The effect of temperature on magnetic susceptibility.

The experiments were conducted on pieces of metal which gave as near an approach to the condition of uniform magnetisation as is practically attainable.

Curves are given which show the behaviour of iron and steel in various states of temper when subjected to a first application of magnetising force, and also to subsequent cyclic changes of magnetising force, such as complete or partial removal and re-application, or reversal. The curves are drawn by plotting either $\mathfrak{I}$, the intensity of magnetisation, or $\mathfrak{B}$, the magnetic induction, in relation to $\mathfrak{H}$, the magnetising force: the characteristics of these curves and their relation to the physical state of the piece under examination are pointed out. Curves so drawn invariably exhibit the static lagging action to which the author (in a former paper) gave the name "hysteresis," any cyclic change of $\mathfrak{H}$ giving rise to a more or less nearly closed *loop* in the curve. Attention was previously drawn to these loops by Warburg, who also anticipated the author in pointing out their important physical meaning, namely, that the area of a loop, or $-\int \mathfrak{I} d\mathfrak{H}$, is the measure of the energy expended in performing the cycle of magnetisation which the loop describes. In the present paper numerous absolute measurements of this energy are given, especially of the energy which is thus dissipated in each reversal of the magnetism of a piece of iron or steel. These show that while the dissipation of energy by reversal of magnetism is very much smaller in soft iron than in hard iron or steel, even in the latter its amount is very trifling, so that the principal part of the heat which is produced in the cores of electro-magnets must be due chiefly to other causes than this static hysteresis, and is, in fact, due almost wholly to the induction of so-called Foucault currents in the cores. The relation of this hysteresis to Weber's theory of molecular magnets, as extended by Maxwell, is discussed, and the insufficiency of Maxwell's extension noticed.

By vibrating a piece of soft iron during the application and removal of magnetising force, the effects of hysteresis are almost entirely removed, and the iron is then found to possess almost no retentiveness. But when the application and removal of magnetising force are effected without mechanical disturbance, the retentiveness of soft iron is found to be even greater than that of steel. In some cases 93 per cent. of the whole induced magnetism of a piece of annealed iron was found to remain on the complete removal of the magnetising force. It is pointed out that there is no discrepancy between this result and the well-known fact that a *short* iron core of an electro-magnet retains almost no magnetism when the current in the magnet is interrupted. In that case the ends of the magnet itself, after the interruption of the current, exert a sufficient reversed magnetising force to destroy almost entirely the residual magnetism. But when tested under the conditions which give uniform magnetisation and avoid the demagnetising influence of the ends, soft annealed iron is more retentive than even the hardest steel.

Examples are given showing that the influence of permanent set in the curve of magnetisation is so marked as to give a criterion by which a strained piece may be readily distinguished from an annealed piece of metal, and that strain diminishes very greatly the magnetic retentiveness of iron.

Numerical values of the coefficients of permeability (μ) and of susceptibility (κ) are given for a number of samples of iron and steel, and the relation of these coefficients to $\mathfrak{B}$ and $\mathfrak{I}$ is exhibited graphically after the manner of Rowland. The greatest value of μ refers to soft annealed iron while under mechanical vibration, and is about 20,000.

The next part of the paper deals at great length with the effects of stress (consisting of longitudinal pull) on the magnetic susceptibility and retentiveness of iron; and the last part deals more briefly with the effect of temperature on magnetism, a subject already largely treated by G. Wiedemann and others.

The experiments, which have been of a very extended character, were made during 1881-83 in the laboratory of the University of Tokio, Japan, with the help of Japanese students, Messrs. Fujisawa, Tanakadate, Tanaka, and Sakai, to whom the author is indebted for much valuable assistance. The results have been, almost without exception, reduced to absolute measure, and are for the most part presented graphically in curves which accompany the paper.

January 22.—"On the Origin of the Proteids of the Chyle and the Transference of Food Materials from the Intestine into the Lacteals." By E. A. Schäfer, F.R.S.

The most important result obtained by the author is the establishment of the fact that, during absorption of food from the intestine, the lymph corpuscles migrate in large numbers into the lacteals, and for the most part become disintegrated and dissolved in the chyle. This is the case not only after a meal containing fat, but also after feeding with substances devoid of that alimentary principle; it is, therefore, a phenomenon of general occurrence during absorption, and the carrying of fatty particles into the lacteals after a meal containing fat by the immigrating leucocytes, must be regarded as merely incidental to a more general function.

The immigration and solution of numerous leucocytes in the contents of the lacteals must be the means of conveying a large amount of proteid material, derived from their dissolved protoplasm and nuclei, into the chyle. And any other material which may be mechanically or otherwise incorporated with their protoplasm must also be set free. In this way the fatty particles which they contain during absorption of a meal containing fat become released and suspended in the chyle, and it is probable that amyloid matters are also in part thus conveyed to that fluid.

A fuller account of the whole subject, furnished with illustrations and containing the necessary references to other articles dealing with the same question, will appear in the forthcoming number of the *Monthly International Journal of Anatomy and Histology*.

Geological Society, January 14.—Prof. T. G. Bonney, F.R.S., President, in the chair.—Ewan Cameron Galton, Henry Brougham Guppy, Henry G. Hanks, and William Elliott Howe were elected Fellows of the Society.—The following communications were read:—The metamorphism of dolerite into hornblende schist, by J. J. Harris Teall, F.G.S.—Sketch of the geology of New Zealand, by Capt. F. W. Hutton, F.G.S., Professor of Biology in the Canterbury College, University of New Zealand. The paper commenced with some general remarks on the importance and variety of the geology of New Zealand, and on the progress made in the investigation of the islands. The author then proceeded to the question of the classification of the sedimentary strata, which the author arranges in the following local systems:—

Systems	Probable age
Recent	Recent
Pleistocene	Pleistocene
Wanganúi	Newer and Older Pliocene
Pareóra	Miocene
Damarú	Oligocene
Waípara	Upper Cretaceous
Hokanúi	Lower Jurassic and Triassic
Maítaí	Carboniferous
Tákaka	Silurian and Ordovician
Manapoúri	Archæan

Most of these systems are divided into several local series. The general geological structure was then treated. The south island of New Zealand was shown to be traversed from near the southern extremity to Tasman's Bay by a curved anticlinal, convex to the westward; and the strata to the east of this axis are thrown into secondary folds, which mainly affect the beds older than Tertiary. A great north and south fault occurs west of the anticlinal. The north island is very different. It is traversed by a narrow ridge, the country northward of which is broken by three great volcanic cones, Mount Egmont, Ruapehu, and Tongariro near the centre of the island. The oldest rocks seen south of Cook's Straits are not repeated to the north, and a fault may traverse the Straits. The rock systems up to the Hokanúi, inclusive, are similar in lithological character throughout New Zealand, and appear to have been formed on the shore of a continent with large rivers. The higher systems, with the exception of a few coral-reef limestones, are locally variable, and may be considered insular. The relative distribution of sedimentary and eruptive rocks was briefly noticed, and the occurrence of some useful minerals mentioned. No workable coal is found below the base of the Waípara system. A description of the different systems and of the series into which they are divided followed, commencing with the oldest. The distribution, lithology, and thickness of each system were noticed briefly, and lists of the most important fossils were added. The eruptive rocks associated with each system were next noticed in the same order, and the paper concluded with notes on the distribution of volcanic rocks in the north island, on hot springs, and on the minerals found in New Zealand.—The drift deposits of Colwyn Bay, by T. Mellard Reade, F.G.S.

Zoological Society, January 20.—Prof. W. H. Flower, F.R.S., President, in the chair.—Mr. Sclater called attention to the breeding of a pair of the Chinese Blue Magpie in the Society's Gardens in 1884, and exhibited specimens of their eggs.—Prof. Bell exhibited some models illustrating the paper of Rathke on the development of the great blood-vessels in the

Vertebrata.—Mr. Tegetmeier exhibited a specimen of the Wild Cat (*Felis catus*) from Donegal, and an example of a singular variation in plumage of the Black Grouse (*Tetrao tetrix*).—A paper was read by Dr. P. Pelseneer on the coxal glands of *Mygale*. Dr. Pelseneer's observations had been made on a large specimen of *Mygale* of the subgenus *Theraphosa* received from the Society's Gardens. The form and position of this organ in the Arachnides had not been previously described or figured.—Mr. E. J. Sidebotham read a description of the muscular system of the Water-Opossum (*Chironectes*), as observed in a specimen of this Marsupial which he had recently dissected.—A paper was read by Mr. G. A. Boulenger containing the description of a new species of Frog from Asia Minor, belonging to the section *Ranæ temporariæ*. This was proposed to be called *Rana macrocnemis*.—A communication was read from Dr. O. Boettger containing the descriptions of five new species of shells of the genus *Buliminus*. The specimens upon which these descriptions were based had been collected by Vice-Admiral T. Spratt in various parts of the Levant.—A communication was read from Mr. J. H. Thomson, C.M.Z.S., containing the description of a new species of Mollusk of the genus *Hyalina*, obtained at the island of Vaté, New Hebrides, by Mr. E. L. Layard, F.Z.S., which he proposed to call *Hyalina* (*Conulus*) *layardi*.—Dr. Gwyn Jeffreys, F.R.S., F.Z.S., read the ninth of his series of papers on the Mollusca of the *Lightning* and *Porcupine* Expeditions. This part included the representatives of the families from Ianthinidæ to Cerithiopsidæ, with seventy-five species, of which twenty-three were new to science. One new genus (*Stilus*) was also described.

Anthropological Institute, January 13.—Prof. Flower, F.R.S., President, in the chair.—The election of Daniel Wilson, LL.D., of Toronto, as an honorary member, and of W. E. Darwin and M. A. Rouffignac as ordinary members, was announced.—The President exhibited the photograph of a "tailed" boy from Saigon. The child was about eight years old, and the appendage from six to eight inches long.—Dr. Garson exhibited, on behalf of Dr. Arthur Thomson, some composite photographs of skulls.—Mr. Oldfield Thomas read a paper on a collection of skulls from Banks, Mulgrave, and Dauan Islands, Torres Strait, recently received by the Natural History Museum from the Rev. S. McFarlane, who obtained them from a sacred skull-house on Jervis Island. The skulls were shown to be of the most pronounced Melanesian type, being characterised by their elongated shape, heavy frowning brow-ridges, low orbits, long, narrow palates, and exceeding prognathism. The various numerical indices showing these points were fully worked out and compared with those of the Fijians, Australians, and other allied races. A new index, the "naso-malar index," was proposed to show the relative prominence of the central as compared with the lateral parts of the face, and the terms *pro-opic*, *mesopic*, and *platyopic* were suggested for skulls or races showing various degrees of development in this respect. Full measurements of the thirty-eight adult skulls in the collection were given, and the averages both of the measurements and indices were worked out in detail.—The Director read a paper by Mr. A. L. P. Cameron on some tribes of New South Wales.

Royal Microscopical Society, January 14.—Rev. W. H. Dallinger, F.R.S., President, in the chair.—Mr. Beck exhibited a very simple electric light apparatus for microscopic work, the battery being very readily set up and worked, and the materials harmless and cheap. He also showed a simplified form of the Caldwell automatic microtome, by which long ribbons of sections were automatically cut and received on an endless band in their exact order, the new form being a little more than a third only of the price of the original.—Dr. Van Heurck sent photographs further illustrating his resolution of *Amphipleura pellucida* into "beads"; also specimens of the same object burnt on the slide and then coated with a very thin film of silver, both by Dr. A. Y. Moore's original process and by an improved method of his own. Dr. Moore also sent one of his slides.—Mr. Swift exhibited a condenser made in 1883, which he claimed to be identical with that of Dr. Wallich.—Mr. H. L. Brevoort desired information as to investigations on the fur of animals as distinguished from hair, it being a matter of great practical importance in the manufacture of felted goods to understand the method by which the fur-fibres act upon another.—Mr. H. G. Hanks announced the discovery at Santa Monica of a deposit of diatomaceous earth like the celebrated fragment found in 1876, and sent a portion for distribution.—Dr. Gray warned mounters against the use of balsam of Tolu, which formed crystals in a comparatively short time.—Dr. Anthony, in reference to Mr. Wright's note on a new structure in the tongue of the blowfly, showed that it was the same as that discovered by him in 1874.—Dr. J. D. Cox further criticised Dr. Flögel's researches on thin sections of diatoms, and stated that he differed from him (1) in finding a thin but indisputable film covering the outer surface of the hexagons of *Triceratium*, as well as on the inner surface; (2) he thinks there should be no doubt of the existence of a film on the outer convex surface of *Coscinodiscus*; the real dispute has been as to the "eye-spot" film, which is the inner one, Dr. Flögel reversing the relative positions of the two films. The idea of the existence of solid spherules must clearly be abandoned from any method of examination.—Mr. Cheshire described and exhibited the spermatozoa from the queen wasp and hive bee, and Mr. Curties exhibited his improved form of the Hardy collecting bottle and Abbe condenser as fitted to second-class English stands.—Mr. A. D. Michael read a paper on the life-histories of some of the little-known Tyroglyphidæ. In 1873 Riley published a report on the ravages of the apple-bark louse (*Aspidotus conchiformis*), and described an acarus which was supposed to destroy that pest, and which he thought might be the *Acarus malus* of Shimer. Riley only describes the female. Mr. Michael has found the Acarus in England under the bark of reeds, destroying the reeds, not feeding on any insect, and concludes that it is probably a feeder on various kinds of bark, not on animal life; he has traced the whole life-history. The male (previously unknown) presents the exceptional features possessed by *Tyroglyphus carpis*, discovered by Kramer in 1881, and the hypopial nymph has been figured by Canestrini and Fanzago in 1877, under the name of "parasite of an Oribata," but without explanation. Mr. Michael finds in the life-history of this hypopus a confirmation of his views that the hypopial stage is not caused by exceptional adverse circumstances, as Mégnin supposes, but is an ordinary provision of nature to insure the distribution of the species, which it is intended to call *T. corticalis*.—Mr. Michael also called attention to the prevalence of *Rhizoglyphus Robini* on Dutch bulbs imported into England in 1884, and to the destructive nature of that species and the damages it did to hyacinth, dahlia, and erecharis bulbs, &c., and recommended that imported bulbs should be carefully examined.—Dr. Maddox read a paper on some unusual forms of lactic ferment (*Bacterium lactis*), of which he showed drawings and photo-micrographs. Some of the chains had the different joints increased largely in size in different parts of the chain in an irregular manner, whilst in others some joints had become more or less globular, as well as very enlarged. Dr. Maddox inclined to consider the enlarged cells as the result of a generative effort (by which the organism can be tided over such conditions as would otherwise lead to its destruction) rather than as a degenerative state or return to a primary phase.—Mr. C. Thomas read a paper on a new species of *Acineta*, which, however, Mr. Badcock considered to be *Trichophrya epistylidis*. Mr. Crisp exhibited and described Robinson's photo-micrographic camera, Gibbe's membrane stretcher, live cell for keeping objects cool, and other apparatus.—The death was announced of Dr. F. Ritter v. Stein, the author of "Der Organismus der Infusionsthiere," and an Honorary Fellow of the Society.—The nominations for the new Council were read, the Auditors appointed, and five new Fellows elected.

Royal Meteorological Society, January 21.—Mr. R. H. Scott, F.R.S., President, in the chair.—The Secretary read the report of the Council, which showed the Society to be in a very satisfactory condition. The Council equipped a typical climatological station in the grounds of the International Health Exhibition, in order that persons desirous of organising a station might see one arranged in accordance with the regulations of the Society. A conference on meteorology in relation to health was arranged for by the Society, and held at the Health Exhibition on July 17 and 18. The Council have appointed committees to investigate the subjects of the brilliant sunrises and sunsets of 1883-84, and of the local phenomenon known as the helm-wind of Cross Fell, Cumberland. The observing stations of the Society now number eighty-five, the results from which are printed in the *Meteorological Record*. The whole of the stations in the south of England have been inspected during the year, and found to be generally in a satisfactory state. The number of Fellows on the roll of the Society is 552, of whom thirty-seven were elected in 1884. The President, Mr. R. H. Scott, then delivered his address, in which he stated his intention to treat of the general state of the science of meteorology over the globe as compared with the programme sketched out by Prof. James Forbes in the *Report* of the British Association, 1840. He said there were now six meteorological societies publishing journals, and, in addition, six periodicals almost exclusively devoted to the science. He went on to say:—"With all this wealth of literature there is one particular in which, in this country at least, our science labours under a great disadvantage. So far as I am aware, no instruction is given in it except at the Royal Naval College, Greenwich. In Germany, in the current half year, no less than eleven courses of lectures are announced at as many Universities or high schools." Mr. Scott exhibited a large map showing all the observing stations over the globe, and also the distribution of information as to ocean meteorology as contained in the Meteorological Office. He then alluded to the diffetent classes of observations proposed by Prof. Forbes for different classes of stations and the degree to which his suggestions had been carried out.—The next subject was the attempts which have been made by balloon ascents, mountain stations, &c., to gain a knowledge of the condition of the upper atmosphere; and Mr. Scott stated that, on inquiry from the various foreign institutions which possessed affiliated mountain stations, he had found that, except in the case of Mount Washington, none of the observations were practically much used in forecasting. No telegrams are received from Pike's Peak. In one particular all authorities are agreed, that no one has yet suggested any mode in which the barometerical readings could be used, owing mainly to the uncertainty about their reductions to sea-level from great heights. Mr. Scott concluded his address with a notice of the important work by Padre Viñes, S.J., of the Havannah, on the West Indian hurricanes of 1876 and 1877.—The following gentlemen were elected the Officers and Council for the ensuing year:—President: Robert Henry Scott, F.R.S.; Vice-Presidents: William Morris Beaufort, F.R.A.S., John Knox Laughton, F.R.A.S., Edward Mawley, F.R.H.S., Charles Theodore Williams, M.D.; Treasurer: Henry Perigal, F.R.A.S.; Trustees: Hon. Francis Albert Rollo Russell, M.A., Stephen William Silver, F.R.G.S.; Secretaries: George James Symons, F.R.S., John William Tripe, M.D.; Foreign Secretary: George Mathews Whipple, F.R.A.S.; Council: Edmund Douglas Archibald, M.A., George Chatterton, M.Inst.C.E., John Sanford Dyason, F.R.G.S., Henry Storks Eaton, M.A., William Ellis, F.R.A.S., Charles Harding, Richard Inwards, F.R.A.S., Baldwin Latham, M.Inst.C.E., Robert John Lecky, F.R.A.S., William Marcet, F.R.S., Cuthbert Edgar Peek, F.R.G.S., Capt. Henry Toynbee, F.R.A.S.

Sydney

Linnean Society of New South Wales, November 26, 1884.—C. S. Wilkinson, F.L.S., F.G.S., President, in the chair.—The following papers were read:—On a new and remarkable instance of symbiosis, by William A. Haswell, M.A., B.Sc. *Phoronis australis*, found by the author in Port Jackson, and briefly described in a preliminary note in the *Proceedings* of this Society (vol. vii. p. 606), forms colonies, the individuals of which inhabit chambers or tubes in a common soft matrix formed of fine felted filaments. The whole colony grows round a large sea anemone in such a way as to form a complete tube for it, the *Phoronis* doubtless profiting by the action of the thread-cells in the tentacles of the anemone, in killing or stunning any minute organisms that come in contact with them.—On the Pycnogonidæ of the Australian coast, with descriptions of new species, by William A. Haswell, M.A., B.Sc. In this paper, which is a review of all the Australian species, seven new species are described: *Nymphon validum* and *æquidigitatum*; *Nymphopsis armatus*, a new genus and species; *Ammothea longicollis* and *assimilis*; *Colossendeis tenuissima* and *Phoxichilidium tubiferum*.—Notes on the Port Jackson Crustacea, by Charles Chilton, B.A. Some new species are here described, and observations are made on the sexual and other peculiarities characterising certain genera.—Descriptions of Australian micro-Lepidoptera, by E. Meyrick, B.A.; No. xii. Œcophoridæ (continued). This paper continues the *Œcophoridæ* as far as the genus *Ocystola*; fifty additional species are described, of which forty-six are new to science.—A monograph of the Australian Sponges, Part iii., by R. von Lendenfeld, Ph.D. The author gives a complete description of the known Australian species of Calcareous Sponges, fifty-two in number. To the species described by Carter, Haeckel, Poléjaeff, and Ridley, numerous new ones are added. A new classificatory system is established in this paper. The Calcispongiæ as an order are divided into Poléjaeff's two sub-orders, the meaning of which has, however, been slightly changed. To Haeckel's three families and Carter's Teichonidæ three new families are added.—Notes on the direction of the hair on the back of some kangaroos, by N. de Miklouho-Maclay. The peculiarity of inverted hair on the back of some of the kangaroo tribe is traced by the Baron in the genera *Dorcopsis*, *Dendrolagus*, and in one species of *Osphranter* (*Osphranter rufus*). The paper also contains some remarks on the dentition of *Dendrolagus Dorianus*.—Note on *Tribrachycrinus Clarkei*, M'Coy, by F. Ratte, M.E. The previous descriptions of this fossil were taken from imperfect inner casts only. Mr. Ratte has now been enabled to describe thoroughly and illustrate this beautiful crinoid from an outer cast of the calyx in the Australian Museum. The most important additions to previous descriptions are the ornaments of the surface of the calyx, the attachment of the first brachial article, and the plates of the roof of the calyx.—On the larvæ and larva cases of some Australian Aphrophoridæ, by F. Ratte, M.E. This paper describes the larval state of some small species of *Rhynchota* closely allied to the genus *Aphrophora*, and belonging probably to the genus *Ptyelus*. They are as yet imperfectly known; but the description of their larva cases and of some of the larvæ discloses a feature probably quite new to the science of entomology. These cases, unlike those of insects generally, are true shells, containing at least three-fourths of carbonate of lime, and resembling in shape some fossil and recent serpulæ, some being conical, others serpuliform, or helicoidal. The conical shells are fixed on the branches of some species of Eucalyptus, the mouth turned upwards, the larva being placed in it with the head downwards. It introduces its suctorial apparatus into the bark of the stem, sucks the sap of the tree, and emits from time to time, by its anus, drops of clear water. This property of emitting water is possessed by all the family.

Paris

Academy of Sciences, January 19.—M. Bouley, President, in the chair.—On the approximate degree of accuracy of the differential formulas employed in Paris, Lyons, Kew, &c., in the reduction of the meridian observations, by M. M. Lœwy.—Remarks on the nervous system and embryonic forms of Gadinia Garnotii, by M. de Lacaze-Duthiers.—On the existence of glycyrrhizine not only in *Glycyrrhiza glabra* and *G. eclimata*, where it was first discovered by Robiquet, but also in *Polypodium vulgare*, and several other families of plants, by M. E. Guignet. From a protracted study of this substance the author infers that it plays a great part in the vegetable kingdom, and is associated with the principal series of organic chemistry.—On the oscillations occurring at long intervals in machines set in motion by hydraulic agency, and on the best means of preventing these oscillations, by M. H. Léauté.—Statistical studies on the cholera epidemic in the Paris hospitals, and especially on the circumstances attending the outbreak in the Asylum for the Aged in the Avenue de Breteuil, by M. Emile de Rivière. From November 4, 1884, when it made its first appearance, till January 15, 1885, when the last patient was discharged, there were recorded altogether 1080 cases, of whom 636 were males and 444 females. Of these, as many as 587, or 54·15 per cent., succumbed, that is to say, 340 males, or 53·46 per cent., and 247 females, or 55·63 per cent. But in the Asylum, out of 215 inmates 79 were attacked (55 men and 24 women), and of these 65 perished (47 men and 18 women), or 82·278 per cent. This excessive mortality is attributed mainly to the great age of the pensioners in the Asylum, ranging from 58 to 90 years.—On the advantage of destroying the winter egg of Phylloxera in vineyards infested by this parasite, by M. Balbiani. The paper is supplemented by a note on the employment of a wash of sulphate of iron, by M. Faudran, who finds this remedy extremely efficacious in destroying not only the winter eggs, but also the insects adhering to the plant.—On Encke's Comet; observations made at the Observatory of Algiers with the 0·50m. telescope, by M. Ch. Trépied.—Supplement to two preceding notes on the theory of the figure of the planets and the earth, by M. O. Callandreau.—On the last results of solar statistics, by M. R. Wolf. The paper is accompanied by a table and diagram showing the number of days in each month of the years 1883 and 1884 when it was found possible to take solar observations at the Observatory of Zurich.

The author considers that a careful study of these tables will suffice to convince the most incredulous of the intimate relation existing between the solar phenomena (spots, faculæ, &c.) and the oscillations of the magnetic needle.—On some new transformations of partially-derived linear equations of the second order, by M. R. Liouville.—On the laws of evaporation as determined by the measurements recorded with ordinary evaporometers at the various meteorological stations, by M. Berthelot.—On oxygenated water, by M. H. Henriot. The results are given of experiments made to distil oxygenised water under a reduced pressure of 3 cm. of mercury.—On an easy method of obtaining measurable crystals of the peroxide of cobalt, Co^3O^4, by M. Friedel. The method consists in submitting the liquid chloride to the action of a current of moi-t air in the same apparatus in which he has already succeeded in obtaining artificial hausmannite.—On the formation of the nitrate of tetramethylammonium, by MM. E. Duvillier and H. Malbot.—On a method for regulating the chemical action of solar radiation, the intensity of which is constantly changing on the surface of the earth, by M. L. Olivier.—On the origin of the Microzymas and of the Vibrionians everywhere present in the atmosphere, in water, and the ground, in connection with M. Duclaux's recent communication, by M. A. Béchamp. The author argues against M. Pasteur that these germs are to be sought originally, not in the air, where they are disseminated by the winds, but in the ground and water, where they are deposited by the disintegration of the neozoic and palæozoic rocks, and by decomposing animal and vegetable matter of all sorts. He holds this, not as a mere hypothesis, but as a conclusion actually determined by strict experiment, by facts discovered by himself, verified and controlled by former opponents of his views.—Note on the vitality of the germs of microbes preserved in the liquid in which they were developed, by M. E. Duclaux. The persistence of these germs for a period of twenty or twenty-five years is clearly determined by the author's researches.—On some physiological phenomena associated with the lesion of certain parts of the animal organism, by M. H. de Varigny.—Contribution to the study of the glands yielding byssus, and of the water-bearing pores in the family of the Lamellibranchidæ, by M. Th. Barrois.—Remarks on some new crepuscular glows recently observed in Central America, by M. F. de Montessus.—On some of the phenomena observed in connection with the recent earthquakes in the south of Spain, by M. A. Germain.—Observations collected on earthquakes during a residence of forty-six years in Chili, by M. Domeyko.—Observations on the earthquakes that occurred in Andalusia on December 25, 1884, and the following weeks, by M. F. de Botella.—Earthquake shocks felt at the Azores on December 22, 1884, by M. da Praia.

BERLIN

Physical Society, January 9.—Dr. Kayser reported on measurements of the electromotive force and of the resistance of an improved Noë thermo-generator, which in its essentials resembled the old Noë generator, differing from it only in that, instead of the wires connecting the bismuth alloy pieces with one another, strips of an unknown alloy were taken, which opposed greater resistance to heat than did the wires. The electromotive force of the generator increased proportionally with the quantity of the gas consumed for heating, that is, proportionally with the temperature. The curve of the electromotive force formed a straight line, and showed a bend only in proximity to the terminal temperature, where the metallic parts began to melt. The resistance of the generator, which, at the temperature of the room, amounted to about 0·9 Siemens unit, rose with increasing consumption of gas, reached a maximum of about 1·2 Siemens unit under a consumption of about 60 cc. gas per hour, and then, under a consumption of 100 cc. gas, sank below the initial value. On repetition of the measurement, the resistance was found to become less and the curve flatter. After a repose, however, of several days, the resistance again grew greater, without, however, reaching the value of the newly-examined battery. On a comparative estimate of the costs of generating electricity by means of a thermo generator and a Bunsen battery, it was ascertained that a current of 1 ampere per hour with the Bunsen battery cost about 3 pfennigs, but with the thermo-battery only somewhat over 1 pfennig. The current of the thermo-battery proved itself, in conclusion, highly constant, no change in the current having been observed in the course of twenty-four hours' uninterrupted heating with the Bunsen flame.—Prof. von Helmholz confirmed the last-mentioned fact. For the purpose of the electrolytic purification of quicksilver, he had made incessant use for a fortnight long of a thermo-battery, and on intercalating a galvanometer had discovered only inconsiderable variations in the current. He described the various methods he had made trial of, for the complete purification of quicksilver, all which, however, turned out ineffectual, till at last he adopted the electrolytic method, applying it in the following manner:—The impure quicksilver lay at the bottom of a glass vessel, and on the quicksilver swam a second vessel for the reception of the pure metal. An isolated platinum wire dipped into the quicksilver, connecting it with one pole of the battery, while the other pole was connected with a platinum plate placed in the empty vessel. The vessel then was filled with nitric acid, and the nitric oxide of quicksilver which was formed became decomposed by the current. The quicksilver separated itself, chemically pure, on the platinum strip, in the form of little globules, which dropped into the swimming vessel, and after covering the bottom in a cohering layer, it formed itself the electrode, at which the pure quicksilver further precipitated itself.—Prof. Neesen reported on a series of thermo-batteries and galvanic elements which had been quite recently patented for Germany, but which presented no innovations in principle. The only element deserving any special notice was Pabst's, consisting of carbon impregnated with oxide of iron, solution of chloride of iron, and iron, a material said to remain long constant for weak currents.—Prof. von Helmholz related that this cell had been sent to the Physical Institute, and for four months had proved itself pretty constant for weak currents. Following this up, he decribed the arrangement he had very recently given to the Daniell cell for the common purposes of the laboratory. At the bottom of a deep glass goblet lay a copper spiral connected with an isolated platinum wire in a glass tube. Above the spiral was placed a solution of blue copperas, which could be filled in by means of a funnel reaching to the bottom. On the solution of copper lay the lighter water-clear acid, or white sulphate of zinc, in which was placed the zinc cylinder. A siphon, the outer leg of which was directed from below upwards, dipped into the fluid as far as the bounding plane of the two fluids, so that, on filling in a fresh solution, only the solution of white vitriol immediately above the blue copperas, and contaminated by it, flowed off. This arrangement had the effect of keeping the upper fluid constantly water-clear, though, indeed, after a while, some copper was found precipitated on the zinc cylinder. The constancy, however, of the cell was not thereby perceptibly impaired.

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