THURSDAY, NOVEMBER 8, 1883

ZOOLOGY OF THE NORTH ATLANTIC EXPEDITION

The Norwegian North Atlantic Expedition, 1876-1878. Zoology: *Holothurioidea*. By D. C. Danielssen and Johan Koren. With Thirteen Plates and One Map. *Annelida*. By G. Armauer Hansen. With Seven Plates and One Map. (Christiania: Printed by Grondahl and Son, 1882.)

THESE two volumes comprise Nos. VI. and VII. of the results of the Norwegian North Atlantic Expedition. The first, which deals with the Holothurians, contains an interesting account of several new genera (5) and species (6). Of the new forms *Kolga hyalina* is perhaps the most interesting; it has been placed in the family Elpididæ, of the order Elasmopoda, instituted by Dr. Théel for some of the Holothurians collected during the *Challenger* Expedition. Kolga is a small Holothurian (the largest specimen dredged measuring 50mm. in length, 15-20mm. in height, and 12-15mm. in width) with the oral disk facing the ventral, and the anal orifice the dorsal, surface, and having a dorsal collar bearing sucker-like contractile papillæ at the anterior extremity. These papillæ, unlike ordinary pedicels, were found to communicate with the perivisceral cavity by means of spaces formed within the collar.

After referring to lateral and terminal conical suckers, the translucency of the skin, and cutaneous cellular glands, the authors give a careful description of the water vascular system, dwelling especially on the sand canal, which is especially interesting, for instead of hanging free in the perivisceral cavity, as in the ordinary Holothurian, it opens directly to the exterior in front of the collar. The larval condition thus persists, the circular vessel retaining its communication with the exterior through a simple membranous tube. In two other Holothurians from this Expedition, constituting the new genera of Trochostoma and Irpa, the sand canal has the outer end attached to the skin but not in communication with the exterior, and in each case there is a madreporic plate developed on the canal within the point of attachment. In Elpidia there is a similar arrangement, but the madreporic plate is rudimentary or wanting, hence the authors think that Elpidia approximates more closely than Trochostoma and Irpa to the larval stage so perfectly maintained by Kolga. With respect to the blood-circulating system, Kolga differs from the general plan in which the dorsal and ventral vessels originate between the stomach and the intestine, for in Kolga they open from a ring encircling the œsophagus, and as this ring has thicker and more muscular walls than the vessels proceeding from it, it is suggested that it may function as a heart.

Of the five nerve trunks which emanate from the oral nerve ring, the two dorsal furnish an offshoot to each of a pair of large vesicles containing otoliths, and the two lateral ventral cords send branches to numerous successive auditory vesicles. Each vesicle contains from 20 to 130 otoliths. Kolga, which is diœcious and in which there is no respiratory tree, may thus be considered to be a very primitive member of the Holothurian group, near which comes Elpidia, the authors disagreeing in this respect with Dr. Théel, who, taking into consideration the bilateral form of Elpidia, gave it a high place amongst Holothurians.

Prof. Steenstrup's and Dr. Lütken's account of *Myriotrochus Rinkii*, St., has been supplemented in the above report from numerous specimens found at Spitzbergen; and *Myriotrochus brevis*, Huxley, is considered to be identical with *Oligotrochus vitreus*, described by Sars in 1865.

In describing the new genus Trochostoma (instituted for *Molpadia boreale*, Sars, *Molpadia oolitica*, Pourtales, *Haplodactyla arcticum*, and a new form, *T. Thomsonii*) the authors discuss at considerable length the function of the respiratory trees, and conclude that they are in all probability secretory organs belonging to the intestines. After dealing with another new genus (Ankyroderma) this very valuable and interesting memoir concludes with a list of the Holothurians collected by the Expedition, and a table showing the depth, temperature, bottom, &c., where each was procured.

The descriptive text is illustrated by thirteen excellent lithographed plates, and a map showing the position of the zoological stations where the various specimens were obtained.

In the memoir on the Annelids collected by the Expedition, Hansen commences by entering a protest against the number of genera instituted in this class by Malmgren, and he especially considers that the distinction on which Malmgren lays so much stress, viz. the difference between the bristles of different members of the class, is not in reality present. The scales, on the other hand, are considered by the author to be much more distinctive specific features, and from the character of the scales accordingly he opposes the wholesale heaping together by Möbius, and after him by Tauber, of proposed genera and species into a single specific group. Of a large number of Annelids procured a description is given only of new species—about 28—and of a few others which are little known. The description of these forms is almost limited to their external characters, especially to the form and structure of the scales.

The Annelids collected are divided into two groups, first, those found in the warm, and next, those from the cold, area. The list containing those from the warm area gives the depth, temperature, &c., at the various stations, but in addition a useful column is added containing their geographical distribution as far as known. A further list appears of the Annelids collected in the cold area arranged under their respective families, from which it appears that most of them are represented in the frigid area, and most of the species occurring there are also found in the fjords and temperate ocean tracts. The author states that there are few indications that the deep bottom-current off the coast of Norway in which the temperature is below zero (C.) should be characterised by a fauna of its own. "Of one Annelid only, *Polynoe globifera*, G. O. Sars, can we infer with comparative certainty that its favourite, if not its sole, habitat is confined to the cold bottom-strata."

From a specimen of Serpula, *Protula arctica*, procured from a depth of 1163 fathoms, temperature $-1^{\circ}\cdot 1$ C., bottom biloculina clay, it is inferred that the Serpulidæ do not absolutely require solid matter on which to construct their shells. From a specimen of *Hydroides Norvegica* met with on a muddy bottom with the tube not, as is usually the case, twisted but straight, it is inferred that in such cases the tubes penetrate the mud like those of many other tube-forming Annelids.

In referring to colour and sense organs, the author says that an *Onuphis hyperborea* brought up from 299 and 412 fathoms, "a greater depth than that to which light and vegetable life are supposed to penetrate," was nevertheless vividly coloured and provided with eyes.

This volume also is illustrated by several plates and a map. The letterpress of both volumes is printed in English and Norwegian in parallel columns. They together form a solid contribution to our knowledge of two groups which are becoming more and more interesting to the zoologist.

A BUSHEL OF CORN

A Bushel of Corn. By A. Stephen Wilson. (Edinburgh: David Douglas, 1883.)

THIS little book is full of originality and force. It appeals it is true to a class, but a large class. The title is happy and suggestive, and is a sufficient text for every paragraph between the covers. It is true the subject is not exhausted, for much more might doubtless be said concerning "a bushel of corn."

But it is with a *bushel* of corn that Mr. Wilson deals. He introduces us to the bushel as an absolute measure of volume, traces its origin, mentions its varieties, discusses its merits, weighs it in the balances of justice, and dismisses it as inadequate, misleading, and impossible as a corn measure. The interest of the reader is at first excited with regard to the evolution of the bushel from terms of Roman *sextars*. Whether statistician, antiquary, historian, miller, or farmer, he must feel his interest awakened and kept alive. The bushel is seen altogether from a new aspect. Light beams out beneath and around it, and it becomes an object of respect and veneration. It is with regret that we find the fact gradually forcing itself upon us that this archetypal standard of volume, this absolute multiple of the typical wheat grain, this original bond of union between volume and weight in "merrie England," is after all as a gauge of value, and an indication of variations in price with regard to corn, an impostor. This is, however, the conclusion to which we are irresistibly driven, and Mr. Wilson, while he fondles and beams upon his bushel, is in reality dealing it its death wound. Never before has such a blow been levelled against the quarter as a measure of value in wheat.

Let any member of Parliament or of a constituency read this volume and he will rise convinced that the bushel is really doomed, and that the *cental* is the only alternative. Or let any one who is imbued with an idea in favour of the French metric system read it, and he will find that we have in England a much sounder system of quantifying than he imagined, and he will think twice before he gives up his English grain for the French gramme, or the English pint for the French litre.

The work naturally divides itself into two parts. First, an interesting inquiry into the historical origin of the bushel. Secondly, an attack upon the bushel as a means of quantifying corn. We propose to look at both these aspects. First, then, in the language of the author, "What is a bushel of corn?" The chief interest in the answer to this question lies in the fact that the bushel is based upon a unit—namely, an increment of wheat. The French have taken distilled water at 4° C. as the medium for connecting weight and volume. The Romans appear to have taken wheat for a similar purpose. The supposed base of the corn measures was not the money sterling of 24 grains used in weighing gold and silver, but the commercial or tron sterling of 32 grains used for heavy goods. In the book known as "*Fleta*" we are told that "in the English kingdoms the king's measure was made from the penny called the sterling, which is made round; that this sterling should weigh 32 grains of average wheat: that twenty pennies make an ounce, and that twelve ounces make a pound of twenty shillings weight and number; that the weight of eight pounds of wheat makes the measure of one gallon; that eight gallons of wheat make the bushel, eight of which constitute the common quarter." The sextar pint of the Romans held one London pound of twenty shillings or 7680 grains of wheat of the quality giving 64 lbs. to the bushel. A bushel was 64 sextars, and hence a London pound of really good wheat and a sextar pint united the ideas of weight and measure. According to this view a bushel of good wheat ought to weigh 64 lbs. and to hold 64 pints. The latter statement is true at the present day, and in certain cases the weight may be 64 lbs. also. Mr. Wilson, however, considers that the typical bushel of wheat was not considered to be 64 lbs., which is unusual, but 60 lbs. And, still further, that the ideal bushel of 60 lbs. was probably 60 lbs. *avoirdupois* and not London. In working out this very interesting point, Mr. Wilson shows that, according to "*Fleta*," a sack of wool was always considered to be of equal weight with a quarter of wheat. Now wool was quantified by tron weight, and if the assumption is correct that wheat was quantified by avoirdupois we can readily see if we can bring the two into accord. "'*Fleta*' tells us that $12\frac{1}{2}$ merchants' pounds of 15 ounces made a stone of wool, and that 28 stones made a sack of wool equal in weight to a quarter of wheat." The weight of the sack of wool would therefore stand thus:—

Tron oz.	=	640 grs.
		15
Tron lb.	=	9600 grs.
		$12\frac{1}{2}$
Wool st.	=	120,000 grs.
		28
Sack of wool		3,360,000 grs. = 480 lbs. avoirdupois.

The comparison with the weight of a quarter of wheat would stand thus:—One bushel of 60 lbs. avoirdupois = 420,000 grs., and 8 bushels or 1 quarter = 3,360,000 grs. = 480 lbs. avoirdupois. The true solution of this difficulty therefore seems to be arrived at, namely, that the bushel of 2218·192 cub. in. is equal to 64 Roman sextars and to 64 English pints. It holds 8 gallons or 64 pints of wine, and 8 gallons or 64 pounds of really good wheat. It is equal in size to the old Scots or Linlithgow firlot, and holds 80 avoirdupois or Roman pounds of water.

The idea of a system of weights and measures based on a sound unit like a sextar pint of twenty shillings, invests our system with a halo of antiquarian interest derived from the standards of Imperial Rome. "I can see," says Mr. Wilson, with well-timed enthusiasm, "the spirit of the old Scots measures standing in an empty Linlithgow wheat firlot, with a wreath of golden ears around his brows, and looking ineffable scorn upon the statutes which affect to abolish his reign and his dynasty."

Those who want to know more must read the book. We next proceed to take a rapid glance at the objections to the bushel as a corn measure, or as a means of quantifying corn. These objections may be summarised as follows. First, the bushel lends itself easily to misrepresentation. It can be "shaken together, pressed down, running over." However exact as a measure of fluids it is not suitable for a compressible substance. The height from which a bushel is filled affects its amount; a blow upon its side during filling causes evident settlement, and finally we are not certain as to whether a heaped bushel or a struck bushel is always meant. Such is one class of objections. Another arises from the fact that, contrary to general opinion, Mr. Wilson holds, and we think proves, that weight per bushel is not an indication of quality. Samples may be readily "sweated," rubbed, beaten, or dressed, until the weight per bushel is not a fair indication of quality. Again, corn which has been swollen with exposure to rain does not return to its former bulk but remains permanently enlarged. Lacunæ or hollows filled with air remain, and the bushel is rendered lighter, although we cannot hold in such cases that the quality of the flour has been injured. Again, the shape of the grain has its effect in allowing some to pack closer together in the bushel while others lie looser. Lastly, in oats the proportion of kernel to husk varies immensely, and yet this is not indicated at all by weight per bushel. A very strong point is made with reference to moisture. We have generally considered, and with some truth, that the drier a sample of wheat is the heavier will it weigh in the bushel. This it appears is not to be relied upon, and in numerous experiments it was found that after moisture had been artificially driven off the "measure weight" or weight per bushel was less than before! Thus in one case "the measure weight with no moisture in the grain was nearly 4 lbs. less than at first, with 9·35 per cent. of moisture"! This is not by any means contrary to what might be expected. As long as wheat contracts in volume as it dries, so long will it increase in specific gravity. When, however, it reaches a stage at which the moisture evaporated is replaced by air occupying the spaces previously occupied with water—then will the weight per bushel suffer. Hence a very strong case is made out against the bushel and the quarter as standards for quantifying corn.

The question has a retrospective as well as a prospective interest. The bushel weighs differently every year. Thus, according to evidence laid before the Fiers Court in Aberdeenshire, the weight of a bushel of wheat was, in 1856, 57·02 lbs.; in 1857, 60·3 lbs.; in 1858, 61·32 lbs.; in 1860, 55·95 lbs.; and in 1868, 62·29 lbs. A bushel of wheat then between 1856 and 1868 was found to vary in weight by 6·34 lbs., or 50·72 lbs. per quarter of 8 bushels.

If wheat weighs 50·72 lbs. per quarter less one year than another, it will be found that as a standard of value the quarter is misleading. A quarter of 430 lbs. is 10 per cent. in weight less than one of 493 lbs. Now if in a bad year the lighter wheat is quoted at 48*s.* per quarter, while in a succeeding good year the heavier wheat is quoted at 52*s.*, wheat is said to have gone up 4*s.*, whereas according to weight the prices are the same in both years.

Wheat may be dearer per quarter and yet be really selling at less money per cental. Hence the calculations made by statisticians as to the fluctuations in the wheat market have up to now all been made on a false basis. It would take us to undue length if we were next to show from this little volume why the *cental* is a better means of quantifying wheat than the bushel or quarter. That it is so we have no doubt whatever, and therefore consider that the book before us has done much to inaugurate the use of the *cental* and the abolition of the quarter in our corn markets.

JOHN WRIGHTSON

OUR BOOK SHELF

Catalogue and Handbook of the Archæological Collections in the Indian Museum. Part I. Asoka and Indo-Scythian Galleries. By John Anderson. (Calcutta, 1883.)

THIS is a model of what a guidebook to a museum should be. The antiquities described by Prof. Anderson are of the highest interest, and the fullness and clearness of his description is worthy of them. The Indian Museum, though only founded in 1866, now contains a mine of wealth for the Indian archæologist. The collections of the Asiatic Society deposited in it have been enriched by the sculptures from Bharhut, the Gândhâra bas-reliefs, the Buddha Gayâ discoveries of the Archæological Survey, and the casts from the early temples of Orissa. A flood of light has been thrown on the history of ancient Buddhist art and belief, as well as upon the relations of Buddhist India with Greece and the west. The dome-shaped Stupa of Bharhut belongs to the second century B.C., and is adorned with sculptures representing scenes from the legendary life of Buddha; the ruins of Buddha Gayâ have been excavated near the site of the famous Bodhi tree under which Buddha sat, and which was visited by the Chinese pilgrim Hiouen Thsang in 637 A.D., while the rock-cut temples of Orissa carry us back to a period still earlier in the life of Buddhism than that of Bharhut. In the Indo-Scythian Gallery the most interesting remains are those from Mathura (or Matra) and Gândhâra. Here, too, the sculptures are partly Buddhist, though also partly Jain—Jainism itself being but an older form of Buddhism, if we are to believe Mr. Thomas. The chief interest attaching to them is due to the fact that many of them owe their inspiration to Græco-Roman—if not even Byzantine—art. The dress of several of the figures represented in them is also interesting as pointing to a northern climate. The same may be said of a group of figures at Sanchi, which have bandages round the legs like those still worn in Afghanistan.

In looking through this catalogue we cannot fail to be struck by the contrast between the care now taken by the Indian Government of the antiquities of the country, and the official neglect to which the ancient monuments of our own islands are exposed. To say nothing of the Archæological Survey, which has already done so much to bring to light the hidden treasures of early Indian art, no pains seem to be spared to protect the memorials of the past which are scattered over the surface of the soil. It is a pity that some little of the intelligent interest taken by the Indian Government in the historical monuments of India cannot be reflected on our rulers here. It is true that, fortunately for archæology, India is still governed by a small body of educated men, while an extended franchise implies a majority which cares nothing for science and much "for the rights of property" and the prospect of increased dividends; nevertheless even the majority is willing to follow the leaders it has chosen, and the leaders will lose nothing if they remember that we have duties to perform towards the past as well as towards the present.

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.*]

The Green Sun

THE appearance of a bright green sun for several days in succession seems to be a phenomenon sufficiently rare to deserve notice in your columns, so I send you the following notes on the subject:—

On Sunday evening, September 9, the sun for some time before setting appeared perfectly rayless and of a bright silvery-white colour, quite different from anything that I have ever seen before. On the following morning I did not observe it particularly, but in the evening I watched it carefully from about five o'clock till sunset. At first it had the same silvery-white appearance as on the previous day, and this continued till 5.30, when it was lost behind a bank of cloud; on its partial reappearance, however, at 5.43, the part visible between the clouds was of a bright pea-green colour. On Tuesday morning it was rather cloudy, but the appearance, when seen at all, was the same as on the preceding night. In the evening, however, it was a magnificent spectacle, and attracted the notice of every one. The silvery sheen was visible early in the afternoon, and the brightness of the sun rapidly faded, till by about five o'clock one could look at it directly without any difficulty. At this time there was a distinct tinge of green in the light when received on a sheet of white paper, while shadows were very prettily tinted with the complementary pink. As the sun sank towards the horizon the green became more and more strongly marked, and by 5.30 it appeared as a bright green disk, with a sharply-defined outline. In fact the definition was so good that a large spot (about 1′ long) was a conspicuous object to the naked eye. On this occasion the sun was lost in a bank of clouds near the horizon, but on another occasion, when I was able to see it actually set, the colour got yellow rather than green close to the horizon. Similar, but less marked, were the appearances both at sunset and sunrise for several days, and before sunrise and after sunset the cloud effects were such as I have never before witnessed here. These cloud effects were chiefly remarkable for the brilliancy of the colouring and for the length of time that they were visible, being seen for nearly an hour after sunset. The moon and stars, when near the horizon, showed the same green colours as the sun.

On the 22nd the green sunrises and sunsets began again and continued for three days. I carefully examined the spectrum on every possible occasion with my zodiacal light spectroscope, as well as with a small direct-vision one. The spectrum showed clearly that aqueous vapour played a large part in the phenomena, for all the atmospheric lines usually ascribed to that substance were very strongly developed. But in addition to this there was a very marked general absorption in the red. Even an hour before sunset, and often longer, the absorption was complete as far as B, and the dark shade gradually crept up till it reached C, and at times even that line was invisible, while the absorption was clearly marked up to W.L. 621. At the blue end nothing could be seen beyond W.L. 428, and even that only with a very wide slit, but a photograph showed the lines clearly *nearly* as far into the ultra violet as on ordinary occasions. The phenomenon was visible over a large area of country, from Ceylon to Vizagapatam, and as far west as Aden. It was not, however, observed at all at the Bombay Observatory.

I am at present collecting information from various sources, and so do not care to enter into many details at present.

Most people ascribe the phenomena to the recent great eruption in Java, but there are difficulties in the way of accepting this view, which I have not yet been able to get over, and the similar appearance of a blue sun over Europe and America in 1831 seems to make this explanation unnecessary, besides it is well known that the sun appears green under certain circumstances when seen through steam or even in a mist (Lockyer). On the other hand, observations referred to in NATURE, vol. xviii. p. 155, tend to show that very fine dust might produce the observed effects.

Can any of your readers refer me to Dr. Schuster's original papers?

It may not be without interest to add that on both occasions the green appearance was preceded by abnormal electrical conditions of the atmosphere. The potential of the air was strongly negative for a number of days in succession from about 9.30 a.m. to 2.30 p.m., with a clear sky and no rain within 100 miles. C. MICHIE SMITH

Madras, October 10

I INCLOSE a letter giving an account of the green sun, which may be of interest to your readers. My correspondent is the wife of General Tremenheere, formerly in the Indian army.

WARREN DE LA RUE

73, Portland Place, W., November 3

Spring Grove, Isleworth, November 2

IT may interest you to hear that my daughter, writing from Bellary, tells me that a gentleman who was at Ootacamund, in the Neilgherries, was on one of the higher peaks when the phenomenon of the sun took place in September, and he first distinctly saw a *green, cloud-like mist* pass across the sun, and *then one of a reddish colour*, and the sun took the colour of each of these clouds or mists. People at Ceylon were terribly alarmed at the unusual appearance of the sun. S. S. T.

MR. GREAVES has the pleasure to forward to the Editor an extract from a letter just received from Mr. Beardmore at Madras, referring to the phenomenon of the green sun now being discussed in NATURE.

Sunhill, Clevedon, November 2

Harbour Works, Madras, October 10

WE have had the sun here for some weeks past in the mornings and evenings a most curious greenish blue colour, and generally casting a bluish beam of a most pretty tint. Mr. Pogson thinks it due to volcanic dust and sulphurous gases from the great eruption in Java. Another astronomer, Mr. H. Smith, thinks it due to a great amount of aqueous vapour.

NATHL. BERNARD BEARDMORE

The Division of the Circle

ALLOW me to point out an oversight in NATURE (vol. xxviii. p. 598), where, in explaining the divisions of a circle the following passage occurs: "In quite recent times it has been suggested that 400 parts should be taken in place of 360, but that is a suggestion which up to the present time has not been acted upon."

We probably owe our degrees either to the earlier supposed year of 360 days, or to the fact that this number has many divisors, although such divisors afford no practical advantage. When trigonometrical functions were subsequently discovered, it was found that the natural unit is not the circle, but the quadrant or right angle. Our system of numeration being decimal, it was then most convenient to divide the quadrant decimally, and the circle is thus considered as composed of 4, 40, 400, &c., parts according to the degree of exactness required. This was proposed by Briggs when preparing his logarithms, which are based on decimals, but unfortunately it was then set aside. Revived a long time after by Lagrange, it was acted upon by Laplace in his "Mécanique Celeste," being thus much more than a mere suggestion. Nowadays decimal divisions of the quadrant are the only ones used by French geodesists.

Facts are the grand supporters of argument. Will you kindly quote the following? After grumbling on the necessity of using the only circle at his disposal because it was divided decimally, a French civil engineer would afterwards employ no other: he found the decimal circle much more convenient. A special experiment had been already made in Italy, where two geodesists, carefully interchanged and inspected, had been instructed to observe and calculate in both systems the same large lot of angles. It was then found that the use of decimals gave a saving of two-sevenths of time either in observation or in calculation. This result was unknown to Sir George Airy, the ablest astronomer of our time, but he judged rightly that the conversion of all sexagesimal angles into decimal ones would materially lighten his labours, and he actually did so when calculating all the lunar observations previously made at Greenwich. This was the largest quantity of reductions ever made by one astronomer, and they were abridged by the use of decimals. The real supporter of sexagesimal divisions is routine, that sly enemy of progress.

Abbadia, November 2 ANTOINE D'ABBADIE

Christian Conrad Sprengel

IT has now become a standing topic that C. C. Sprengel's treatise on the structure and fertilisation of flowers "after well nigh a century of oblivion has come to be recognised as one of the most interesting books, and his theory of the adaptation of flowers to fertilisation by insects is one that will ever be associated with his name" (NATURE, vol. xxviii. p. 513). Some writers go so far as to speak of a rediscovery of Sprengel's treatise by Darwin. But it should be acknowledged that Darwin himself says only ("Cross Fertilisation," p. 5): "His discoveries were for a long time neglected." So it seems to be true that Sprengel's and Koelreuter's works were unknown to English naturalists, though Kirby and Spence, at the end of Letter IX., published 1815, and in all subsequent editions till 1867, have given a very fair report in their masterly manner. Not only the facts, but also the importance of these discoveries, are fairly expounded.

In Germany these discoveries were well known to every naturalist during the whole century. In 1829, when a mere boy, my father began to instruct me in entomology. Many times he took Sprengel's work from the shelves in his study, and explained to me the discovery of fertilisation of plants by insects with the help of the plates in Sprengel's book. I have never forgotten the interest and the scientific enthusiasm of his exposition. I was told that we are indebted to a mere chance for this discovery. A rather dangerous irritation of Sprengel's eyes had the result that he was entirely forbidden indoor study by his physician, and was therefore obliged to spend his days in the field, where he was gradually led to the observation of plants, followed by his remarkable discoveries. Certainly between 1830 to 1840 at every university in Prussia the same facts were taught as well known facts of the highest importance, and of course known by every student. Prof. C. F. Burdach has related them in his large "Physiology," vol. i. p. 322, 1826, and given his conclusions. H. Burmeister, "Handb. d. Entomologie," vol. i. p. 303, 1832, speaks about them at some length also as well known and of the highest importance. Not only scientific publications, but merely popular works have the same statements. Pierer's "Universal Lexicon" (first edit. 1836, fourth, 1851, vol. ix. p. 942) gives a fair report. H. A. HAGEN

Cambridge, Mass., October 23

"Challenger" Zoological Reports

IT seems to me that the reviewer of my Report on the Pelagic Hemiptera collected during the voyage of the *Challenger* (NATURE, vol. xxix. p. 3) is too hypercritical.

I refer, of course, to the paragraph in which he blames me for alluding to species under their trivial names only; and as the paragraph in question is calculated to convey a wrong impression, I should be obliged if you will kindly allow me to say a word on the subject.

It is true that some writers upon insects (or rather upon Lepidoptera only) have the very bad habit of alluding to species (of different genera) by their specific names only, and the law that forbids the practice is a good one; but it may be applied too stringently, and not altogether in the sense that its framers intended.

In my Report I had to deal with two genera, and a reader of the review who had not seen the Report itself would be justified in concluding from the words of the reviewer that I have used the specific names indiscriminately, without indicating the genus to which the species belonged. In point of fact this is not the case. The two genera are treated of separately, and where I have mentioned the trivial without the generic name, it has only been when the generic name governed the paragraph, and, when, consequently, no doubt could possibly exist as to the genus. In doing so I may have broken the *letter* of the law, but not, I think, the *spirit*; and were the work to be done over again, I think I would be inclined to follow the same course.

F. BUCHANAN WHITE

[The idea of a generic term governing a paragraph did not strike me. I had no wish to be over-critical, and I am glad to find that in all essentials Dr. Buchanan White agrees with the views expressed.—THE WRITER OF THE NOTICE.]

Barytes from Chirbury

A NUMBER of crystals of barytes have lately been acquired by Mr. Henson from Chirbury, Salop, which seem to deserve some description. The crystals vary from one to four inches in length and from one-half to two inches in breadth; they are very bright and clear, and are elongated in the direction of the brachydiagonal, resembling in appearance the barytes from Dufton; they are mostly doubly terminated, and some contain included crystals of copper pyrites. They were at once detected by Mr. T. Davies as being peculiar in form; and the reflecting goniometer revealed the existence upon them of four very well-defined forms which have not been hitherto found upon barytes, besides two more doubtful planes to which it is difficult to assign definite symbols.

The crystals are almost all a combination of the forms—

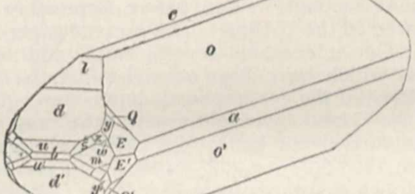
o {101} $\breve{P}\infty$	E {412} $2\breve{P}4$
d {012} $\frac{1}{2}\bar{P}\infty$	y {212} $\breve{P}2$
m {110} ∞P	z {111} P
l {014} $\frac{1}{4}\bar{P}\infty$	ξ {232} $\frac{3}{2}\bar{P}\frac{3}{2}$
u {011} $\bar{P}\infty$	ω {432} $2\breve{P}\frac{4}{3}$
a {100} $\infty\breve{P}\infty$	
b {010} $\infty\bar{P}\infty$	
c {001} $0P$	

On some crystals were also observed—

μ (214) $\frac{1}{2}\breve{P}2$ between d and o
r (112) $\frac{1}{2}P$ between d and y
Z (034) $\frac{3}{4}\bar{P}\infty$ between u and d.

The general appearance of the crystals is shown in the annexed figure.

Of the above faces ξ, ω, E, and Z are new. ξ lies with parallel edges between the faces $d\,m$ and $z\,b$, and is very dull: ω lies between $y\,m$ and $z\,o'$; E between $y\,a$ and $o\,z'$.



Several of these crystals have also a small dull face Q lying with parallel edges between o and y, and on one this is accompanied by another small dull face Y between o and m. By oiling these faces it was possible to determine approximately their inclination to o. The measurements lead to the complicated symbols (15.1.15) for Q and (19.1.18) for Y.

The new faces, and especially E, are very characteristic of these specimens, and it is somewhat curious that faces with the simple symbols of ξ, ω, E, Z, have not hitherto been noticed among the sixty-six recorded forms of barytes.

H. A. MIERS

Mineral Department, British Museum, October 25

"Anatomy for Artists"

I THINK perhaps if it were known to Dr. Marshall that his "Anatomy for Artists" is not used in cases where it otherwise would be, because of his decision to omit letters of reference in the illustrations of the bones, he might think it better to alter this in a new edition.

Dr. Marshall admits that his plan may be a strain, but perhaps he does not know how great a strain it is when students are not studying leisurely but in the limited time given in schools of art to an anatomy course. Even if he disapprove of any haste in study, he would surely be sorry to hinder rather than help those who have to be quick.

I heard recently a lecturer on anatomy refer his pupils to books inferior to Dr. Marshall's, regretting, he said, to set aside the best book they could have, but adding that, from the want of reference letters, many of the students would simply be puzzled, discouraged, and confused.

I have only Dr. Marshall's book, and although the illustrations are too good to allow of any great difficulty arising, still I have found the use of it a strain. I doubt, too, if the plan secures a "more accurate knowledge of the forms," as Dr. Marshall hopes it may. Perhaps so, after a little knowledge has been gained, but in the first struggle the student has an uncomfortable haziness as to whether he has found the right groove or prominence upon a bone, which prevents his forming a definite picture of it in his mind.

Certainly letters spoil the illustrations, but might there not be small key drawings beside the larger more finished ones.

AN ART STUDENT

Meteor

I WAS just now startled by what appeared to be a vivid flash of lightning out of a perfectly cloudless sky, a fluttering flash that lit up everything brilliantly. On turning to the south-east I was just in time to see the broad path of fire that a splendid meteor had left behind it; the meteor was falling behind some trees, and I saw it very imperfectly, but it seemed very large, and indeed *must* have been from its light. I had been looking out from time to time for shooting stars all the evening, and had seen three fine ones and four or five small ones, all in the east, and appearing to come from the neighbourhood of the Bull. The sky is covered with the lovely light that always appears with shooting stars, and which I think is sometimes called homogeneous aurora.

J. M. HAYWARD

Sidmouth, November 4

THE JAVA ERUPTION AND EARTHQUAKE WAVES

FOR the following facts the writer is indebted to the kindness of Herr Emil Metzger, formerly Director of Surveys in the Dutch Government service in Java. His original account, written before September 12, has just appeared in the *Globus*. The present paper is based upon that, but it contains several small additions and corrections which have been received directly from the author. Most of the geographical details here given are based on the Trigonometrical Survey of the coast of Java, which was carried out under Herr Metzger's immediate direction in 1868-69.

A line drawn eastwards from Flat Point (Vlakke Hoek, Tandjong Blimbing, or Rata), the south-western extremity of Sumatra, would touch the south coast of that island only in two points,—Tandjong Tikūs and Tandjong Tūwa, or Varkens Hoek. Between these promontories are the bays of Semangka and Lampong.[1] The opposite coast of Java follows generally a north-easterly direction almost to Anjer. Along this stretch it deflects, however, more than once towards the south and the east, and forms Seagull, Welcome, and Pepper Bays. Midway in the channel of the Straits, and on a straight line drawn from Tandjong Tikūs (the western side of Lampong Bay), to the western head of Pepper Bay, lies the Island of Krakatoa (called also Krakatau, Rakata), with several smaller islands near it. Sebuku and Sebisi are two islands situated between Krakatoa and the south-eastern extremity of Sumatra. About half way between Anjer and Point St. Nicholas, and only separated from the mainland by a narrow belt of water, is the Island of Merak (Pulu Merak). On the opposite mainland were the extensive quarries of Merak, which have now totally disappeared. Further, in the narrowest part of the navigable channel, lay a group of islands, of which the largest, Thwart-Way or Sunghian (Dwars in den Weg), has been rent into five pieces.[1]

From the manner in which Sebisi (the peak 2818 feet high) and Krakatoa (peak 2700 feet) rose immediately from the waves, and from the great depth of the sea around them, Junghuhn was led to conclude that Sumatra and Java, in spite of the corresponding configuration of their approximating coast-lines, and the fact that they are both volcanic, do not belong to one continuous formation. The Island of Krakatoa, considered by Junghuhn to be a continuation of the mountain system on the adjoining coast of Java, was about five miles long by about three broad; and close at its foot were the two small islands Verlaten and Long, on the west and east respectively. The Trigonometrical Survey of 1868-69 fixed the position of the cone of Krakatoa as 105° 26′ E. long, and 6° 8′ S. lat. Like most of the islands in the Sunda Straits, Krakatoa was clothed from base to summit with a luxuriant growth of forest and of tropical vegetation. When in the course of the survey the northern face of the mountain was visited in the latter year, several warm springs were found—a common enough thing, however, in these islands. Moreover, Krakatoa, as well as Sebisi, was at that time totally uninhabited, being only visited occasionally by the inhabitants of the neighbouring coasts for the sake of the products yielded by the woods.

On May 20 in the present year several shocks, accompanied by loud explosions and hollow, reverberating sounds, were observed at Batavia and Buitenzorg, each about 100 miles distant from Krakatoa. That these phenomena were not seismical was recognised at once; the magnetic needle of the magneto-meteorological observatory showed no deviation, only a trembling motion in a perpendicular direction. A few days later came the news that a volcanic eruption had taken place on the Island of Krakatoa, where nobody had once thought of looking for the seat of the phenomena. The captain of a mail steamer, however, which passed the island at about 6 p.m., has since reported that the needle on his ship was violently agitated, being spun round repeatedly.[2]

From the deck of another vessel which was passing about eight o'clock on the evening of the 22nd, a dome-shaped mass of vapour, mingled with smoke of a dark gray colour, was seen to rise from the lower part of the island. The first thing noticed was from ten to fifteen dark red "sheaves" of fire flashing up in rapid succession from the base of the column. These were followed by explosions, more or less loud, resembling discharges from artillery, so that the ship, which was sailing at no great distance, distinctly felt their influence. In the upper part of the volume of smoke appeared an uninterrupted series of flashes, differing in no respect from ordinary lightning flashes, except that they were discharged concentrically upon the column from the atmospheric clouds surrounding it. The heat emanating from the locality of the eruption was sensibly felt on the hands and face at a distance of nearly two miles away; the presence of a powerful marsh-gas was also easily detected. Several nautical miles past Krakatoa a thick shower of fine dark-gray sand continued to fall upon the ship for the space of

[1] See the map of the Sunda Straits in this journal, September 6, 1883, p. 444. With this compare the map given in *Globus* (vol. xliv. No. 15, p. 233), where also fuller geographical descriptions may be found than could be given here.

[1] The earliest telegrams spoke of a volcano Sungepan, which had been split into five craters. This appears to have been a mistake; there never was a volcano of this name in this place, nor is there now. It is only an island.

[2] See the Dutch *Natuur*, September 15, 1883, p. 262.

half an hour. An apparently illimitable cloud of drifting pumice was encountered at a distance of ten miles from the island, and twenty miles farther a second cloud of pumice, which was so thick that a bucket let down into the sea was filled with it before it reached the surface of the water, while the ship, although going at the rate of 10½ knots an hour, cut through the pumice with a noise like that made by a vessel breaking way through thin ice.

A short time afterwards a visit was made to the scene of the eruption by a party from Batavia, and as the account of this visit contains perhaps the latest description of the condition of Krakatoa before the great convulsion of August 26, a few words from it may be perhaps not devoid of interest.

The spectacle as seen from the north of Krakatoa was one calculated to have inspired the pencil of a Doré. From the devastated island a huge, broad pillar of smoke towered upwards as high as the clouds; and while Verlaten Island gladdened the eye with its profuse display of the glories of tropical vegetation, Long Island was completely withered up,—the leafless trees, bent, twisted, and torn, but not scorched, were left standing like naked spectres, as colourless as the soil, or rather enveloped in the same neutral tint of gray, from the pumice dust, as all the rest of the island. Between these two, and only separated from each by a narrow channel, rose, somewhat in the background, the lofty cone of Krakatoa, still covered with green foliage, and without any signs of activity. But in front of the volcano all was wrecked, covered, nay, completely buried, under pumice dust, which, when the sun shone upon it, became of a yellowish-gray colour, while thick masses of condensed vapour, accompanied by incessant fulminations, boiled up from behind the bare and gently sloping dunes. These masses of vapour were for the most part snowy white, others gray, and were closely intertwined, afterwards spreading out in continually widening circles. It was as if a gigantic spectral cauliflower were with incredible rapidity evolving its successive stages of growth before the spectator's eyes. The volumes of vapour were shot out with terrific force in a strictly vertical direction; the atmospheric pressure in the middle of them must have been something fearful. And from time to time immense funnels became visible, leading outwards, and into these many of the incessantly changing ravelled wreaths of smoke were sucked. The rest maintained their original form to a height of several thousand feet; then they slowly drifted eastwards, and, spreading out into mist, discharged their ashes downwards in black streaks like the dark fringes of rain-clouds seen on the horizon. Occasionally the bellowings became louder, and a thicker and larger volume of smoke was vomited forth. Soon afterwards it was noticed that the sky in the west, which was there as bright and clear as it was dark and heavy in the opposite quarter, was being thronged with small, dark bodies,—they were pieces of pumice, of no great gravity, hovering in the air as if upheld by the power of the fiery breath that was streaming upwards. On landing, the party found that they sank up to the ankles in ashes, and accordingly it was necessary to proceed with great caution. As they slowly ascended, the ground and the air both became warmer, the evidences of destruction amongst the trees more conspicuous, and pieces of pumice lay scattered more thickly on the ground. Arrived at a height of about 200 feet above sea level, they found themselves on the edge of a "caldron" of about 700 yards in diameter, probably a former crater. Thence they saw to the north-east the seat of the recent outbreak of May 20, the maximum length of which was about 100 to 110 yards. Here, besides the volumes of vapour and smoke and pumice dust, they also observed sulphur troughs, out of which the mud boiled up in enormous bubbles, which at length burst; and sulphur springs and new but smaller columns of smoke showed themselves in other places. The noise was terrible; the sound made by the discharge of a rifle was like the snapping of a bonbon in the midst of the hilarity of a banqueting hall. Some of the party ventured to descend a little way into the crater, a few even to step tentatively upon its hot and burning floor. They brought back with them pieces of pumice and lava[1]—a kind of black glass—or a piece of sulphur as a memento of the visit. By the time they reached the steamer again darkness had come on, and the spectacle was then one of extraordinary beauty and grandeur. The great column of smoke was still tolerably visible, but the lower part had become a mass of glowing red, from which tongues of yellow flame continued to dart incessantly. At intervals a shower of fine sparks broke out from the cloud, and red-hot stones clove fiery furrows in the air, and fell back at an acute angle to the earth, where they were shattered into a thousand pieces.

That the activity of the mountain was continued during the months of June and July is certain from the report of the Comptroller of Katimbang (on the easternmost promontory of Sumatra), who observed several violent detonations. Also from other places in Sumatra, and particularly from Mexapi (100° 28′ E. long., 0° 20′ S. lat.), came tidings of volcanic movements; and similar reports arrived from Java.

Then came the outbreak of August 26, surprising, inconceivable, in its terrible effects. Although full and detailed reports are not yet to hand, as indeed from the nature of the circumstances they cannot well be expected to be, for communications are in great measure interrupted, destroyed, and rendered impossible, or those who should have made the reports have either fallen victims to the catastrophe, or have fled—who knows where?—yet sufficient intelligence has reached us to justify an estimate of the number of the victims who have perished at tens of thousands; and as for the amount and extent of the material damage done, it is so great that an approximate calculation even cannot be attempted.

The plain simple facts to which all this is due were the eruption of August 26, and particularly the ocean wave which succeeded it on the following day.[2] This destructive wave appears to have started from Krakatoa, or its neighbourhood, as a centre, to have dashed with terrific force upon the contiguous coasts of Java and Sumatra, to have proceeded down the Sunda Straits eastwards with a height that reached from 40 to 100 feet in the narrow throat of the pass opposite Anjer, and 17 feet at Batavia, and even to have extended to the western and eastern shores of America, where it was observed on the 27th and 29th respectively. Not to repeat what has been already stated in this journal (vol. xxviii. p. 443), it will be sufficient to add that a few days after the occurrence we learnt in Europe from official telegrams that Tjiringin, Anjer, and the quarries of Merak, as well as the cone of Krakatoa, had disappeared from sight. But further intelligence from Java, of August 28, states that Krakatoa has not entirely disappeared.

Although information respecting the extent of damage and destruction caused on the south coast of Sumatra is still very meagre, it appears that the two bays of Lampong and Semangka have been rendered totally unfit for navigation owing to the immense masses of floating pumice with which they are covered. In Lampong Bay, notwithstanding that it was protected by certain islands, the momentum was so great that at Telok Betong a Government steamer was carried three miles inland. Telok Betong itself, the chief town of the Royal Lampong District, is, with the exception of the resident's house, the fort, and the prison, completely destroyed.

[1] This deserves particular notice. Herr Metzger ascended several of the volcanoes of Java, and often stayed days and weeks together upon them and in their immediate vicinity without ever once finding what was, strictly speaking, lava.

[2] It is now stated that waves, but of no extraordinary height, were observed at 6 p.m. on August 26.

Fortunately the district as a whole was not very populous. According to the *Royal Almanac* for 1883 there was on an area of nearly 10,100 English square miles a population of 70 Europeans (excluding the military force), 128,939 natives, 255 Chinese, and 154 Arabian and other foreign races. No exact estimate of the loss amongst these has yet reached Europe; all we know is that it has been very great, and the destruction to property not less so. Except the three parallel chains of volcanic origin which stretch from north-west to south-east in the three promontories already mentioned, the country is flat and monotonous, and covered with thick woods. In these are the scattered villages and fields of the native population.

On the opposite coast of Java it is the Residency of Bantam which has borne the full brunt of the wave. We learn that at Tjiringin and Anjer it reached a height of nearly 100 feet. Accordingly all along the coast from Java's First Point to Anjer everything must have perished. And although no accurate or detailed returns of the number of lives lost in this district have yet come in, it may perhaps help us to form some conception of what it will probably amount to if we state that Bantam, on an area of about 3200 square miles, had a population of 350 Europeans, 565,438 natives, 1479 Chinese, and 21 Arabs and others. Between Java's First Point and the country to the south of Tjiringin a range of low hills, by alternately advancing and receding from the coast, formed several small bays and coves, the shores of which were more or less thickly studded with native villages and flourishing tracts of cultivated soil. But these were less frequent in the western part on account of the tigers. On the eastern margin of Pepper Bay, south of Tjiringin, the country was more flat and level, and, preserving this character, extended farther inland. But from Tjiringin to Anjer the mountains approached close to the sea. Along their base ran the chief highway to Anjer, thickly set with prosperous villages, while several others hung on the slopes. Here the full force of the great wave was expended; being broken against the rocky walls, it seems to have swept round them on the north and south and to have completely covered the lower-lying districts about Anjer and Tjiringin. South of Anjer was a bay and small valley running eastwards into the land and bordered by ranges of hills called Kramat Watu, which form the connecting link between the mountain systems to the north and south of this point. The sea is now said to wash the foot of these hills, the invasion having come from the west. It has been already stated that Tjiringin, Anjer, and Merak have disappeared; and all the ground which the inundations have not swept away is now covered with ashes. Tjiringin had six European households, while in Anjer and Merak together there were twenty-two.

Further reports, necessarily imperfect, have come in of the ruin caused by the inundations along the whole extent of the north coast of Java right away to Batavia, and even still farther. Bridges have been swept away, dams broken down, villages swamped, and the cultivated land washed bare by the floods, causing, as everywhere else where they appeared, great losses of life and still greater losses in property. In Tanara alone 700 corpses have been already found. Notwithstanding the facts that the ocean wave, when once it had emerged into the Indian Ocean southwards and into the Java Sea northwards, had more room for expansion, that the Javan coast then formed a kind of angle running back into the land, and that several small islands to the north of Batavia acted as a sort of breakwater, the great wave still possessed such strength that it drove a man-of-war ashore on one of these islands and tore away its floating deck. At Tandjong Priok the sea was observed (unfortunately the time is not given) to rise to a height of more than seven feet above the normal level, and then immediately afterwards to sink ten feet below that point, thus giving a difference of seventeen feet, while the average difference between ebb and flow is not quite three feet. The water poured in through the narrow opening (410 feet wide) between the inner and outer harbours like a waterfall, and, having filled the basins, flowed out again in the same manner.

According to the accounts received up to the present time, everything to beyond Pandeglang (south of Serang) is covered with ashes, and everything that was in the fields has perished. Very considerable damage has also been done to the lightly constructed bamboo houses by the shower of ashes, so that more than half the population (the north-east portion of the district is by far the most populous) are without means of sustenance, and, what is of far graver consequence, without fodder for their cattle. Appalled by the eruption, and dreading the famine that would soon stare them in the face, they have, it is said, taken to flight, carrying off with them what they could, and leaving their territorial possessions in the lurch. It is probable, however, that this has only been in the first moments of terror, for the native is wont to cling tenaciously to his hereditary soil. It is to be hoped that the Government Commissioner will succeed in furnishing assistance, and that speedily and in no stinted measure, to these especially unfortunate people. For years they have been visited by epidemics, and have suffered great losses from murrains amongst their cattle. Indeed, during the last year alone, the population has fallen off 10 per cent. in numbers; and what makes the case so much the worse is that the Government itself has experienced from this disaster losses in public works and in its extensive coffee plantations which may safely be reckoned in millions.

What, however, was the immediate cause of this ocean wave, whether occasioned by the rising of sixteen new islands (active volcanoes?) between Krakatoa and Sebisi, or by the falling in of the cone of the former island (or whatever be the part of it which has disappeared), or whether both causes have co-operated together, must remain more or less matter for conjecture until we have more authoritative details, based on scientific examination of the scene of the disaster. J. T. BEALBY

Mr. Meldrum contributes to the Mauritius *Mercantile Record* fresh information on the tidal phenomenon of August 27 last, a condensed statement of which may be given here in connection with the above:—

At Cassis, during the whole day, the water was coming and going, but the movement was not taken much notice of till about 1.30 p.m. The tide on that day did not rise as usual. The water came with a swirl round the point of the sea wall, and in about a couple of minutes returned with the same speed. This took place several times. Similar phenomena occurred on the 28th, but to a much smaller extent.

At the St. Brandon Islands on August 27, Capt. Rault's vessel was anchored on the west-north-west side of Avocaire Island in 3¾ fathoms, a cable's length off shore, when at 3 p.m. the water began to rise 20 feet above the highest point attained by high water. It was then ebb tide. Quickly the water receded with a very rapid motion, leaving everything dry, showing out the shoal patches quite dry, to a very long distance from the island. Before fifteen minutes had elapsed the water rose again with the same velocity for the second time, coming up to the first mark. It was not a wave, nor a billow, nor a high sea; the water was smooth, except where there were heads of coral, and there a few wavelets only were produced. This motion of the water backwards and forwards lasted up to 7 o'clock p.m., the intervals between low water and high water being greater towards the evening; at first the intervals were about ten minutes, and towards six o'clock twenty minutes. The current was setting towards east-north-east of the compass, and the velocity was ten miles an hour. At sunset the sky in the western horizon had a peculiar smoky appearance, which extended nearly to the zenith in an east-south-east direction. On the 28th, at 4 a.m., the same tidal phenomenon took place and lasted up to 7 a.m., but it was less intense, the alternate motions of the sea having only been observed four times. When day dawned on the 28th there was a peculiar crimson colouration from east by north to south-east by east, and the sun after rising showed as if seen through the red shade of a sextant.

At the Seychelles, at 4 p.m. on August 27, the tide came rushing in at the rate of about four miles an hour, and rose two feet. In about half an hour it receded; it returned and receded.

This continued all night and all next day, but the action was quicker and the rise lower. The observations were taken in a channel about twenty-three feet wide, and walled in on both sides. The action continued all day and part of the next day (29th), but not so frequently. At 5 p.m. on the 28th the sun was clear and bright. At sunset there was a lurid glare all over the sky; at 6.30 it was much brighter, and at 6.45 it disappeared. On the 27th the sky was slightly hazy all day. On the morning of the 29th the sun at 7 a.m. was more like a full moon than anything else, and appeared about 70° above the horizon, instead of as usual about 30°. At sunset on the 28th the sun looked as it does through a fog on a frosty day in England.

At Rodrigues, about 1.30 p.m. on the 27th, the sea was all disturbed, resembling water boiling heavily in a pot, swinging the boats which were floating about in all directions. It was then low tide, and most of the boats were aground. This disturbance in the water made its appearance quite suddenly, lasted for about half an hour, and ceased as suddenly as it had commenced. At 2.30 p.m. a similar disturbance commenced again in the inner harbour, and the tide all of a sudden rose to a height of 5 feet 11 inches, with a current of about ten knots an hour to the westward, floating all the boats which were aground, and tearing them from their moorings. All this happened in a very few minutes, and then the tide turned with equal force to the eastward, leaving the boats which were close inshore suddenly dry on the beach, and dragging the Government boat (a large decked pinnace) from heavy moorings, and leaving her dry on the reef. At noon on the 29th the tide was about its usual height and appeared to be settled. The water was very muddy, and not nearly so salt as sea water usually is; it was little more than brackish. Since this singular occurrence took place the sky at north-west has had in the evenings, to as late as 7.15 p.m., a very threatening and strange appearance of a deep purplish red colour.

Tidal disturbances were also observed on the west coast of Réunion, and especially at St. Pierre, on the south-west coast. The maximum amplitude (in height) of this tide was about a metre and a half. The flow took scarcely five minutes to rise, after which the water remained about a minute at rest, and then receded with the same rapidity, to rise again a minute after.

At East London (South Africa) it was not low water on August 27 till 6.29 p.m. At 5.30 p.m. on that day the tide-gauge showed 2 feet 3 inches, and the tide was running in fast. The gauge showed 3 feet 3 inches at 5.38; 1 foot 8 inches at 5.45; 1 foot 3 inches at 5.49; and 2 feet 3 inches at 6.10. Thus, although it was a falling tide, the water suddenly rose 1 foot in 8 minutes, then fell 1 foot 7 inches in 7 minutes, and 5 inches in the next 4 minutes, and then rose 1 foot in 21 minutes. The wind was moderate from east-south-east, and the barometer was 30·40, with dull cloudy weather to south-east. It had been observed during the early part of the afternoon that the tide was oscillating very considerably, and ebbing very fast for neap tides.

On Sunday, August 26, while coming through the Straits of Banca, Capt Strachan, of the s.s. *Anerley*, thought he heard in the forenoon a noise like that of distant cannonading; about noon the noise was more distinct, and it soon attracted the attention of all on board; flashes of light were seen to the south-westward. In the evening an arch of light rose in a short time from the horizon to the zenith. Three aneroid barometers on board rose and fell to the extent of nearly an inch at short intervals. During a part of Monday, the 27th, there was total darkness. Showers of pumice-stone lasted till midnight. The *Anerley* ran back and anchored under the North Watcher Island. While afterwards passing Anjer Point, it was seen that the lighthouse had disappeared, and that great damage had been done.

Capt. Perrot, of the French brig *Brani*, reports that on August 26 to 27, in 1° 39′ to 2° 59′ S. and 89° 56′ to 89° 50′ E. of P., constant peals of thunder were heard in the direction of Sumatra, but without any appearance of lightning in that direction. From midnight of the 27th to 11 a.m. of the 28th showers of "very white and very fine sand fell all over the vessel." More sand fell later on in the day and on the 29th. This sand obscured the atmosphere. On August 28, in 8° 20′ S., and 92° 04′ E., "a great quantity of dust, supposed to be coral dust," fell on board of the *County of Flint*, and a specimen of the dust has been kindly presented by Capt. Rowland, the master of that vessel. On September 9, in 4° 57′ S. and 79° 46′ E. of P., the French bark *Gipsy*, Capt. Martin, "encountered during the whole day a great bank of floating pumice-stone." On Sunday, August 26, in 0° 32′ S., and 105° 57′ E., Capt. Knight, of the brig *Airlie* heard, about 3 p.m., explosions, like the sound of heavy artillery, which continued at intervals till about 10 p.m., the last report making the ship tremble all over. Next morning the rigging and deck were covered with fine gray sand like dust.

Mr. Meldrum remarks that there is no doubt that the tidal disturbances observed at Mauritius and elsewhere in the Indian Ocean were due to earthquakes. The origin of the seismic waves was apparently in the Straits of Sunda, and at a very considerable depth below the surface. There were earth-waves, forced sea-waves, and aërial waves. The destruction in Java was caused, apparently, by an immense wave of translation. The extraordinary sunrises and sunsets observed at Mauritius, Rodrigues, and the Seychelles, were probably due to the sun's light passing obliquely through fine volcanic dust floating in the air. It is not improbable that the disturbances of the magnets on August 27 were due to electric currents produced by the action of subterranean forces.

THE LITERATURE OF THE FISHERIES EXHIBITION

FROM the moment of its inauguration, the present Exhibition has been the centre of a ceaseless activity, and we doubt if its streaming thousands of visitors have realised the amount of real work which has gone on in their presence. The results of this, embodied in an extensive literature, are now before the public, and add another testimony to the faultless management of the governing body. The enormity of the fishing interest and the need of reform in certain of its branches, are obvious; and now that the press is speculating upon the "outcome" of this great enterprise, all eyes are turned upon the executive. The extent to which the Exhibition is under State control is in itself a guarantee of success, and we hail with pleasure that same system of descriptive labelling of the exhibits, and the publication of authentic treatises upon or cognate to them, so long characteristic of the adjacent National Museum. By this system the public nets a tangible result—a knowledge of that which is at stake—becoming thus prepared to form a rational estimate of the final issue.

Of these treatises or "Handbooks"—also introductory to the more important "Conference Papers" to be spoken of hereafter—twelve have been already published, and it is to be regretted that they were not ready upon the opening day. Foremost among them is a powerful treatise on "The British Fish Trade," by His Excellency Spencer Walpole, whose authority in these matters no one will venture to doubt. Here at the outset, we encounter, in the deplored absence of reliable statistics, one of the most formidable difficulties of the whole question, and the labour under which the author has collected those upon which he so ably generalises, speaks for itself. It is shown that the East Coaster, Manxman, and Cornishman are—for obvious reasons—gradually monopolising the "take," and in the discussion upon and ultimate denunciation of the "brand" question, every thoughtful reader will agree. That a legal reform is pending no one will doubt, and such statements as those on p. 3 regarding the registration of boats, and on pp. 17 and 19 concerning the regulation of lights, suffice to show how the follies of this world can confound its administrative wisdom. This admirable work is a masterly analysis of the "catch and distribution," and should be read by all who would grasp the question in hand.

Dealing with the purely legal aspect, Mr. F. Pollock produces an authoritative work on "The Fishery Laws." The freshwater fisheries are seen to be, of necessity, more protected by law than those of the sea, territorial waters excepted; and it is important to note the extent to which conservators and other local authorities are empowered. The present aspect of the question is ably summed up in the author's "conclusion" to this a concise and well-arranged work.

The educational side of the matter has not been overlooked. In the production of a valuable little work on the zoology of food-fishes, Mr. G. B. Howes has successfully solved the very difficult problem of so diluting a large store of special knowledge, as to present it in a form well adapted to the assimilation of the class of readers for which it was avowedly written; and at the same time has contrived to invest it with an earnestness of tone and a dignity of conception which cannot fail to be productive of good to the most casual student. We cannot expect a composition of this kind to assume the accurate character of a text-book, and hence a few omissions, which more mature reflection would have remedied, constitute faults which should readily be overlooked Altogether the author may fairly be congratulated on having scored a genuine success. Mr. W. S. Kent has done good service by bringing into one volume a synopsis of the distinctive characters of *every species* of British fish. His work, welcome for this reason alone, also embodies observations upon fishes in captivity, made during his career as naturalist to various existing aquaria. Many of them are interesting, but those upon the feeding of fishes must not be taken as necessarily indicative of their natural habits. The strange, guarded mode of progression of the Boar-fish, John Dory, and others described, can also be seen in the Pike in his native run. Much of the controversial matter in this book, befitting a conference paper, would, so treated, have entailed a desirable curtailing of this, a popular work of reference.

Man's all-prevailing imagination is wisely checked in "Sea Monsters Unmasked," in which Mr. H. Lee collects the scattered literature of this subject, and puts in a strong plea for the "cuttle theory," of which he is a well-known champion. An able defence of Pontoppidan is maintained, and one novel record set forth in this work is the dissipation of superstition—the kraken of our childhood—by a bishop—a Norwegian however, and in the eighteenth century. The two last-named manuals are illustrated, and all concerned merit congratulation upon the production of such examples of xylographic art as cover pp. 18 and 21 of the latter work.

The four following volumes are devoted to the more practical side of the industry. Mr. E. W. Holdsworth gives an exceedingly clear and systematic account of "The Apparatus for Fishing," and by the use of well-chosen similes succeeds in making plain his descriptions of the most intricate apparatus. The advances dependent upon the introduction of the "ketch-rigged" boats must, as here set forth, impress the reader with the need and value of improved apparatus. From the manner in which the various topics are treated by so competent an author, the reader can form some definite notion of the real practical difficulties which our fishermen encounter. These and other like matters are also fully dealt with in the two following works, by Messrs. J. G. Bertram and W. M. Adams respectively. The former is a plea for "The Unappreciated Fisherfolk," and the latter deals with the "Fisheries and Fishermen of all Countries." Much fresh testimony to the antiquity of the industry and the remarkable community of its followers—wherever they are found—is brought forward in these two volumes. Their hard-worked lives are shown, as generally acknowledged, to bring in but a scanty remuneration, accompanied by ceaseless anxiety and danger: how far the former is not at times due to their inherited conservatism—especially as regards the bait question—remains uncertain. The moral attributes of their lives, often untainted by "civilisation," are fully attested, and any one who has witnessed the operations incident upon, say, a Scotch herring take, will know that reform in this respect is more needed among the "gutters" and others accessory to the work than among the fishermen proper. The evidence adduced here and elsewhere points to a need of immediate reform in the apprenticeship question, much that is bad in it being due to existing regulations. The sketch given of the decay of the Irish fisheries is to be deplored, but of their restoration a hope still lingers. It is certain that if our fisherfolk "know nothing whatever about fish, except the way to catch them," they know this at least thoroughly. Mr. Adams claims for Oppian the dignity of an ichthyologist, and gives Ælian perhaps more than his due on p. 16 of his book. An incident, bearing upon the foundation of "Holland's Maritime Ascendancy" (p. 37), will not fail to interest our readers at the present time, and we note that neither Mr. Adams' researches nor those of any one else, have yet satisfactorily cleared up the origin of trawling.

It is not reassuring to compare the state of affairs in India, as detailed in Dr. Day's Manual, according to which, matters in that land stand as much in need of reform as at home. The author attributes the existing deplorable condition of the Indian fishermen largely to misrule, but more especially to the weight of the salt-tax imposed by the British; indeed, this topic is the refrain of the whole book, and the author's own investigations go far to support the belief. As might be expected, there are some curious customs and forms of apparatus described, in use among men so interesting as these from an ethnological point of view. Some speculations on p. 37 as to the behaviour of ova in mud are at least suggestive as our knowledge stands, and it is sincerely to be regretted that we have no British representative of the air-breathing Ophiocephalidæ described on p. 31, for if so, we venture to say that reform in the matter of our freshwater-fisheries would be less slow. Dr. Day also furnishes a work on "Fish Culture," in which he gives a historical review of the different aspects of this subject, not altogether favourable to our own possessions. Bewailing the need of Governmental action, and deploring the lack of statistical evidence upon which to generalise, the writer has either collected or furnished a mass of information which will both enlighten the public and prove of service to the practical man. The style of this book is somewhat heavy, and might be improved by a little judicious thinning. Both Dr. Day's books are illustrated—in the case of the former somewhat unintelligibly. No one interested in fishing will regret the failure of an attempt (made, we believe, by the late F. Buckland) to acclimatise the Sheat-fish (Silurus).

Mr. C. E. Fryer, in his work on "Salmon Fisheries," throws some doubts upon the necessity of elaborate artificial breeding, in a weighty argument, having for its keystone the restoration of our waters by the removal of pollution. The intricacies of the vexed question in hand are admirably put before the reader, and the author shows that, in some cases, existing obstacles could be removed, or that at least considerate action could, if exercised at the right time, beneficially modify the present state of affairs. In a comparison of the "pass" and "dam" systems, the success of Cooper's pass, on the Ballisodare River, Ireland, is adduced as a strong argument for the salmon-ladder. The reported death, after spawning, of the kelts of British Columbia opens up a new field for inquiry; and those interested in animal intelligence, so much discussed in these pages, will find here some interesting additional testimony to the capacity of the salmon. The author's description of the dawn of life on pp. 13 and 14 might be advantageously improved.

The only remaining volume, one by Mr. J. P. Wheeldon, treats of "Angling Clubs and Preservation Societies"; and in tracing the growth of many of these it is shown that they have done good work, as, for example, the abolition of "snatching" and "night-lining." The opening remarks, however, are not favourable to the majority of those in London, whose members unfortunately constitute more than ninety per cent. of our Thames angling-community. In tracing the changes wrought in our local waters, the village poacher of old is compared with the modern steam launch as a destroyer, and one more protest against the latter is lodged by the writer, a champion in the cause. It is important to note that the best regulated waters are those in which the management is vested in the hands of resident local bodies.

Such are these "Handbooks," the main portion of a series which will doubtless form a complete, but none too hopeful, epitome of the subject-matter. We now turn to the "Conference Papers."

The meetings at which these were read and discussed were all thrown open to the public, and, what is of greater importance, there were to be found present influentials of all grades and nationalities from royalty down to the very fishermen and dealers whose immediate interests were under discussion. The chair was invariably occupied by some one of authority—in one case by a sole living "Minister of Fisheries."

Of the masterly inaugural address delivered by Prof. Huxley, and of the paper by H.R.H. the Duke of Edinburgh, which formed the subject of the first sitting, the public have already been fully informed, and no one who was present at either of those meetings could fail to observe that the surroundings augured at least an active future. Concerning the address, suffice it to say that the truth of the only statement upon which dissension has been raised—by a carping minority who have entirely misunderstood the real meaning implied—has been more fully verified at each subsequent sitting (we refer to the inexhaustibility of the herring-fisheries). The very fact that in the latter admirable paper an attempt has been made to estimate *for the first time* our national take of fish—615,000 tons per annum—to say nothing of other statistics, gathered with immense labour, is in itself sufficient to justify immediate action, striking as it does at the very root of the evil at present existing—at the same time forming a good starting point for future investigation.

Beyond the formal passing of a vote of thanks, these were both dismissed without discussion, that upon the latter being adjourned *sine die;* but the subject-matters of the twenty-six papers which follow on were all freely discussed, both the length of the paper itself and of each speaker's remarks being under control, such as favoured a thorough sifting and all-round investigation of the topic under consideration—the object being to get at facts rather than to frame schemes. The Exhibition itself shows the far-reaching interests of the fishing industry, but in the account which follows we have attempted to roughly classify the work done in conference.

The gravity of the important question of "supply" will be seriously increased should the ingenious argument advanced by Sir H. Thompson on pp. 14 and 15 of his "Fish as Food" be substantiated. This paper is of great value, embodying as it does the most recent analyses in the question, of which it must be admitted that very little is known, and dissipating certain cherished but fallacious notions, in matters dietetic. Deploring our national indifference to these, the author formulates them for all conditions ofmen, on the supposition that fish shall be eaten, giving some valuable hints for practical treatment. It is well known that the West Highlander would probably rather starve than eat the eel which abounds in his waters, and which, the experienced author of this paper shows, supplies the very requisites of which he most stands in need.

Of first importance among a series of papers dealing with our home sea-fisheries is that on "The Herring Fisheries of Scotland," by Mr. Duff, M.P. Certain aspects of this question have been before the public for some time past, but the conclusions drawn by the writer all point to the introduction of improved apparatus and harbour accommodation, and to the repeal of any restrictive legislation which may exist in this—a matter in which the current official report shows that we do not know sufficient of the habits of the fish themselves to even account for their movements, still less to legislate upon their capture. This paper will be of great value to the practical fisherman, and furnishes a good survey of all sides of the industry. No greater argument for improved tackle can be adduced than that of the change wrought in our herring-fisheries by the substitution of cotton for hemp netting. The closely allied "Mackerel and Pilchard Fisheries" form the subject of a thoroughly practical paper by Mr. T. Cornish, himself a worker. In the absence of statistics to prove otherwise, reform points in the same direction as for the herring-fisheries. Fuller information on the question and probable cause of the fluctuations in the "boat-side" price of mackerel (p. 10) would be acceptable. Although the habits of the pilchard baffle us, the author shows that where these fishes do occur they are most productive, and giving some interesting statistics concerning them, he advocates the establishment of a cheap market for their sale. In the discussion which follows, Prof. Brown Goode gives a short but interesting account of the American mackerel-fisheries. Two short papers on "Trawling" and "Line Fishing," respectively by Messrs. A. W. Ansell and C. M. Mundahl, embrace all the information upon our sea-fisheries other than that given above. Our readers are doubtless aware that a Commission is now inquiring into the disputes between the advocates of these two great systems, and much of the matter contained in these papers is naturally devoted to them. An amount of useful statistical information is collected, and certain subsidiary questions are discussed in their bearing upon the industry, notably those connected with transport. The old belief that the beam-trawl displaced and destroyed the ova of our deep-sea fishes has been but recently shattered by Sars, but Mr. Ansell adduces evidence to show that the question of shore-trawling demands investigation. There can be no reasonable doubt but that trawling will be the fishing of the future; it gives constant employment for the whole year, all objections raised against it are dissipated, and its advance must be sought in the application of steam power. It will be generally admitted that our existing home-difficulties are in no way due to defective apparatus.

Capt. Temple, in writing on "Seal Fisheries," adopts the wise course of holding himself responsible only for those of which he has had actual experience, leaving a hiatus, filled in during discussion by Mr. Martin and others. Devoting but little attention to the legal aspect of the industry, which we venture to say stands, with us, sorely in need of reform, the author seems more hopeful than the world at large of the chances of the chase. The body of the paper sets forth the *modus operandi* of the unenviable life of the sealer, whose lot entails great hardship, often rendered none the less buoyant for an excess of oil, nor the less happy under a "truck system." More might have been said with regard to this industry.

Turning now to other countries, we have most prominent a highly important paper on "The Fishery Industries of the United States," by Prof. Brown Goode. Some idea of its contents will be formed when we say that it fully bears out the impression made by the magnificent exhibits of that country, to study which delegates have even been sent over from other lands. The paper is a mine of useful information, and the refreshing speeches which have fallen from its author during the Conference meetings have shown how much remains untapped. The accounts given of refrigerator-cars, special oyster-trains, of the utilisation of waste, and the well-known potting system on the economic side; of floating hatcheries, of the artificial propagation of fish (twenty-seven species), and other practical topics; and on the administrative side, of the amount of liberty allowed in matters where a more jealous State might interfere, surely point to a common moral. The history of the Menhaden fishery cannot fail to strike all readers as an example of what can be done by persevering in a "new departure," and it is important to note that the system of management and insurance of the boats composing the American fishing fleets is such as to give every impetus to the work by arousing the best interests of the men, at the same time insuring those of the capitalist. The statements advanced in both this and a paper on the Canadian fisheries, by Mr. L. Z. Joneas, are based upon deductions from a most perfect system of registration. The status of the latter country—jealous of its reputation—in fishing matters is everywhere recognised, but even it has to record the failure of attempts to artificially cure the cod—the staple fish of its trade—and the writer deplores, for good reasons, the want of export traders in this the leading enterprise of its fishing population. The herring and mackerel fisheries are also dealt with, and it is reassuring to us to read that for the regulation of its lobster fisheries, of ten years' standing, Government measures are still being taken. The written account of the seal fishery conveys a good notion of its importance and a far better one of its technique than do certain sanguinary models exhibited in the Newfoundland section. The method of working a steam service on a wage system (in connection with their Great Lake fisheries) is worthy of attention.

Coming nearer home, Prof. Hubrecht, on behalf of the Dutch Government, tenders some very valuable observations upon the "Oyster Culture and Fisheries in the Netherlands." Upon the present state of *our* oyster-beds no comment is needed, any more than upon the fruitless efforts on the part of private individuals to establish new fisheries in our own waters. The experimental evidence—the result of observations still going on—brought forward by the author is of the highest importance; statistics favourable to artificial culture are given, the period of sexual maturation has been determined, and these and other similar facts ascertained all point to the conclusion drawn, viz. that "a close time *may* be of service, but that the great thing appears to be to leave a fair portion of the oysters on or around a natural bed wholly undisturbed for a series of consecutive years." This fact, discovered by chance in the Netherlands, embodies the sense of a statement made by Prof. Huxley in the matter in his opening address. It is noteworthy that the purely scientific biological and physico-chemical aspects of this question have received their full share of attention.

The main question bearing upon Mr. C. Harding's paper on "Mollusks" is that of bait. As the matter stands, action would be premature, until it can be shown that other forms of bait than those now in use are of no avail. It is well known that, on the one hand, fishermen are often compelled to stay on shore for want of bait, and on the other, it must be remembered that they are as conservative in this matter as in any which concerns them; but the fact that under *like circumstances* the Lofoden Islanders carry on a brisk catch by aid of the "gill-net," must not be overlooked.

(*To be continued.*)

THE PARIS OBSERVATORY EQUATORIAL[1]

THE accompanying illustration represents the remarkable apparatus recently set up in the Observatory of Paris, to which we have before called attention, the ingenious construction of which is due to M. Lœwy, sub-director of that establishment. Begun under the administration of M. Delaunay, interrupted during the war, thanks to a new act of munificence on the part of M. Bischoffsheim, it has now been finished.

To answer the requirements of modern astronomy equatorials are necessarily gigantic. Like the guns of modern warfare, each new apparatus is constructed on a larger scale than that of its predecessors, though it is not for purposes of destruction that they are aimed at the celestial bodies.

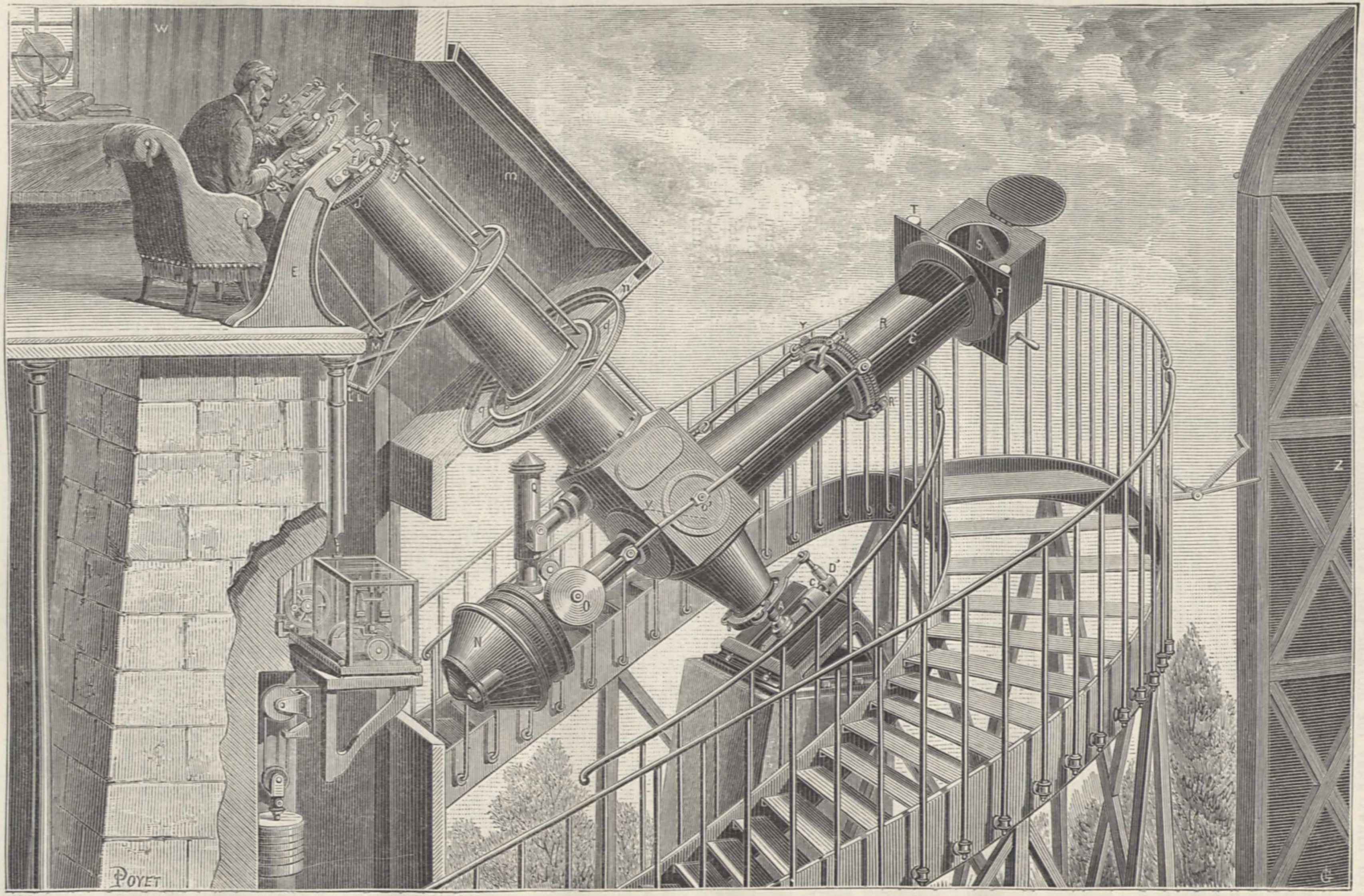
The advantages of the new equatorial are (1) that it measures great angular distances; (2) that it enables observations to be made with comparative ease and rapidity. Seated on a fixed chair apart from the support of the instrument, the astronomer is as if placed before his writing-table. The instrument obeys him, not he the instrument.

The new telescope is bent at right angles, one part directed in a line with the axis of the earth, and capable of turning round itself; the other perpendicular to it, and therefore moving in the plane of the equator. At the extremity of the latter is a mirror, and at the elbow of the telescope, in the interior, another mirror, both forming with the axis an angle of 45°. These mirrors are intended to reflect to each other, and finally to the observer seated with his eye at the eyepiece, the image of the star which is the object of observation.

The loss of light from successive reflections is hardly perceptible. The deformation which the images might suffer from the use of mirrors of insufficient thickness has been guarded against. In its optical qualities, too, the new equatorial is not surpassed by any telescope in the Observatory. Two advantages have thus been secured—the power of measuring great angular distances, and that of exploring the entire heavens, the observer regulating the apparatus himself, and not needing to shift his position.

Another benefit resulting from these happy arrangements must also be mentioned—the abolition of the Observatory with a heavy, ungainly, and expensive dome, and the substitution of one of much smaller compass and of much simpler construction. It consists of a movable part covering the object-glass end, and of a fixed part appropriated to the observer. When proceeding to make observations the

[1] From *La Nature*.



The New Bent Equatorial at the Paris Observatory.

observer draws away the movable part, which readily rolls on a railway. The extremity of the telescope bearing the mirror of the objective is thus left uncovered, while the astronomer, ensconced in his fixed part as in his own room, and sheltered from all inclemencies of weather, studies the infinitely great in conditions as comfortable as those of the naturalist who examines under his microscope the infinitely little.

Seeing it is but just that those who bear the burden should also enjoy the honour, we again state that the optical part of this instrument has been executed by the Brothers Henry, and the mechanical part by MM. Eichens and Gauthier.

THE INSTITUTION OF MECHANICAL ENGINEERS

THE Institution of Mechanical Engineers have held their autumn meeting this year in Birmingham—a town which for many years was the headquarters of the Society. The returning to their former seat was specially opportune, because the first paper on the list related to one of the greatest of Birmingham worthies, viz. James Watt. The title of the paper was "On the Inventions of James Watt, and his Models preserved at South Kensing- and Handsworth." The author is Mr. Edward A. Cowper, who, from his long connection with engineering both personally and through his father and uncle, is perhaps as well fitted as any man in England to trace out the course of Watt's inventions. This he has endeavoured to do, using as his main guide the numerous models preserved partly at the South Kensington Museum, partly at the Patent Office Museum, and partly at James Watt's house at Handsworth in Birmingham. Some of the models at South Kensington were in danger of falling altogether to pieces from dry rot and decay, but owing to the exertions of Mr. Sandham, the curator of this department, they have, as far as possible, been repaired; whilst, in addition, a complete set of photographs has been taken, which, even if the models themselves should cease to exist, would preserve their appearance and construction to future ages.

The sequence of James Watt's inventions with regard to the steam engine is stated at the end of Mr. Cowper's paper as follows:—

Firstly, in 1769 he made an invention (the separate condenser) which was practically an improvement on the Newcomen engine, the effect of which was to work pumping engines more economically and quickly.

Secondly, in 1781 he produced rotative power for driving factories, obtaining it in a manner by having a heavy balance weight to act one way whilst the steam acted the other way; however, the obtaining rotative motion by steam was an enormous advantage, far greater in its effect, in the author's opinion, than the improvement in the pumping engine.

Thirdly, the crowning invention of 1782 made the steam engine the one useful motive power, by making it double-acting and fit to drive cotton mills, flour mills, and all other machinery requiring regular rotative motion.

These various stages are illustrated by the models above mentioned. It is indeed doubtful whether there exists at present any model embodying the first idea of the separate condenser; but there is a most interesting model at South Kensington showing the condensation of steam in a separate surface condenser, composed of a large number of vertical tubes and provided with an air pump. This form of condenser, which in many cases, such as marine engines, has superseded all others, is thus proved to have been invented by James Watt, and not only invented, but brought to a high degree of perfection. The arrangements in this model, according to Mr. Cowper (than whom there can be no better authority), are in points equal to the best modern examples of surface condensation.

The only model actually exhibited was an engine of the character of Watt's patent of 1771. It is single acting, and has an open-topped cylinder, air pump, and condenser. There is a heavy bob on the connecting rod, which is used to help the piston up, while the vacuum formed below it causes it to descend on the return stroke, thus obtaining rotative motion. This engine, however, has a crank, and it is known that for many years Watt was afraid to use the crank in his engines, as it was supposed to be barred by another patent: it is true that his patent of 1771 shows a crank composed of a pin in a disk, but this is carefully termed "the point of attachment of the connecting rod." In practice, however, he used other methods, chiefly the well known sun and planet motion. Of this there are several different forms, which are illustrated by models at South Kensington. There is also a device consisting of a long rack or ladder fixed to the end of the connecting rod and digging into the teeth of a spur wheel on the engine shaft; the rod being guided by means of rollers running in a guide plate, so as to keep it in gear throughout the revolution.

Turning now to the 1782 patent, we find what Watt describes as "the new improved engine, the piston of which is pressed forcibly both upwards and downwards by the power of steam," that is to say, the engine is no longer single-acting, but double-acting. Here the chain hitherto used between the piston-rod and beam is replaced by a parallel motion, and the engine takes very much the form which was still common for shop engines within recent years. A good model of such an engine exists in the South Kensington Museum.

Some variations of this engine, probably made subsequently, are also illustrated by models, such as the Bull engine, in which the piston-rod passes out through the bottom of the cylinder, and takes hold of a beam placed lower down.

Still more interesting are Watt's proposals to make use of the expansion of steam for the saving of fuel; a diagram in one of his specifications shows that he fully understood this action, and he gives several methods by which the load upon the piston may be varied so that when the pressure is least it shall have least work to do. One of these is to mount a weight high up above the beam, which would be lifted when starting from either end of the stroke, and fall after passing the centre; this has been used even in recent times with good results. Several miscellaneous inventions of high interest are also described; one of these is the well-known invention of the steam indicator in probably its earliest and rudest form. Another is a counter for telling the revolutions of an engine, of which an actual specimen in good preservation remains in the Patent Office Museum.

There is also an arangement for obtaining rotary motion in opposite directions out of the same engine by means of two connecting rods starting from a cross-head at one end of the beam, but working opposite ways. Another model shows two hammers worked by a single engine, the one lifted from the belly like an ordinary forge hammer, and the other by depressing the tail like a tilt hammer. A yet more curious device is a semi-rotary engine, of which an unfinished model remains in the Watt Room at Heathfield Hall. Here there is a piston fixed in a radial line to the shaft, within a large disk or cylinder. Inside this cylinder, at one part, is a fixed support, against which the steam presses each way as it acts against the piston, in either one direction or the other. The reciprocating shaft was made to act by a spur wheel on two racks attached to the pump rods. Watt also invented a very simple form of rotary engine, which, as Mr. Cowper states, has probably been reinvented at least fifty times since 1782, the year of his patent.

This leads us to notice the Watt Room, or attic workshop of James Watt, which still remains at Heathfield Hall precisely as he left it—his lathe and bench standing at the window, his tools lying about, and his old leather apron hung on the vice. There are numerous shelves with drugs and parcels on them, chiefly relating to his invention of copying-ink, and nests of small drawers full of tools; but the principal objects which strike the attention are two large machines for copying sculpture, whether in marble, alabaster, or wood. One of them copies to the exact size of the original, but the other is a reducing machine, taking a copy on a very reduced scale. The construction of both machines is described in the paper, and bears testimony to the inventive and mechanical genius of James Watt. The principle in each case consists in using a bar or slide, having at one end a blunt point to feel over the surface of the model, and at the other end a quick-running drill to cut away the surface of the material operated on. This drill is worked by a light cord attached to an ordinary foot lathe, whilst the bar, by means of a skilful arrangement of trussed frames, is made movable in any direction as the feeler passes over the model. The model and work can also be rotated, so as to be set at an angle for handcutting, &c. The drills and cutters, of which a large number are preserved, are excellent in their design and workmanship. These machines were apparently the amusement of Watt's late years, and are frequently referred to in his correspondence. They were never protected in any way, and partly perhaps for that reason have never been followed up and brought to perfection.

The second paper read was a report by the Research Committee on Friction. The Institution experiments on friction, which have been long delayed, have at length been carried so far as to admit of the publication of an interim report, prepared by Mr. Beauchamp Tower, which proves to be of great interest. They are, properly speaking, experiments on *lubrication*, being conducted on a 6-inch steel shaft or journal, which could be run at any given velocity, and on which rested a brass bearing carrying a loaded frame. By altering the load on this frame the pressure per square inch on the brass could be altered; and the temperature could also be altered by means of gas jets under the journal. As a standard of comparison experiments were first tried with the underside of the journal running in a bath of oil, so as to give the maximum of lubrication. The results of these experiments were to show that the friction of bearings under such circumstances follows the laws of liquid rather than (as usually assumed) of solid friction. These laws are very different. Solid friction varies directly as the pressure per unit of area, is independent of velocity at low speeds (Morin), but decreases with increasing velocity at high speeds (Galton, &c.). Liquid friction, on the other hand, is independent of the pressure per unit of surface, is directly dependent on the extent of surface, and increases as the square of the velocity. In fact it is not friction at all, but the shearing of one part of a more or less viscous fluid across another, as the above law plainly indicate. Now the Institution experiments show that, in the case of oil-bath lubrication, there is really a film of liquid oil surrounding the journal and keeping it away from the brass; and that what is called journal friction is really the shearing of one part of this film over the other. In such cases the friction may be exceedingly small: in some of these experiments it actually was as low as 1/1000th, and 1/500th is easily attained. This is much below what is generally supposed to obtain. The limit of pressure appeared to be about 600 lbs. per square inch. Beyond this the oil is squeezed out, and the metal "seizes." This is of course with high speed and constant pressure; with low speeds and intermittent pressure (as was pointed out in the discussion) very much higher pressures are admissible.

So far the experiments were satisfactory; but when the oil-bath was replaced by ordinary modes of lubrication, great difficulties were experienced. When the oil was introduced from above through grooves in the brass, it was found that, however these were cut, and at whatever part of the brass then opened, the bearing seized at a comparatively low pressure. The fact that such methods do as a matter of fact answer with ordinary railway vehicles is accounted for, it is supposed, by the end play of such bearings, and probably also by the general vibration. When, however, a pad fed with oil by capillary attraction from a bath below, was placed below the journal, so as to press lightly against it, satisfactory results were obtained, although the lubrication was so slight as only to appear to the touch as a slight greasiness. The laws here, however, approximated to those of solid friction, and probably the oil merely acts to fill up the little inequalities of the metal, and so practically render it smoother.

A curious subsidiary result should be noticed. When the oil-bath experiments were in progress, advantage was taken of the brass being removed to drill a hole in it for the subsequent tests with ordinary lubrication. On resuming the running, however, the oil was found in the hole, and on a pressure-gauge being attached, the finger rose to above 200 lbs. per square inch, which was the limit of its indications. This pressure was above the *average* pressure on the brass, and shows clearly that the surfaces are separated by a continuous film of oil, having at each point an actual hydrostatic pressure due to the external pressure which obtains at that point.

On the whole, these experiments, while to a great extent confirming the well-known researches of Prof. Thurston in America, throw a good deal more light on the curious phenomena and laws of journal friction. Their results (including some on temperature, which was found to have a marked influence in diminishing friction) are contained in a series of tables, which our space forbids us to publish, but which can no doubt be obtained, by any one interested, from the offices of the Institution, at 16, Victoria Chambers, Westminster.

NORDENSKJÖLD'S GREENLAND EXPEDITION[1]

II.

IN my report of the expedition of 1870 I drew attention to a clayey mud which is found in circular cavities, from one to three feet in depth, on the surface of the inland ice, not only near the shore, but even as far inland as we reached on that occasion. My companion on that occasion, Prof. Berggren, discovered that this substance formed the substratum of a peculiar[2] ice-flora, consisting of a quantity of different microscopical plants (algæ), of which some are even distributed beyond the clay on the ice itself, and which, in spite of their insignificance, play beyond doubt a very important part in nature's economy, from the fact that their dark colour far more readily absorbs the sun's heat than the bluish-white ice, and thereby they contribute to the destruction of the ice-sheet, and prevent its extension. Undoubtedly we have, in no small degree, to thank these organisms for the melting away of the layer of ice which once covered the Scandinavian peninsula. I examined the appearance of this substance in its relation to geology, and demonstrated:—

1. That it cannot have been washed down from the mountain ridges at the sides of the glaciers, as it was found evenly distributed at a far higher elevation than

[1] Continued from p. 13.

[2] Lately described by Prof. V. Wittrock. "Om Snöns och Isens Flora, Särskildt i Arktiska Trakterna." Ur "A. E. Nordenskjöld, Studier och Forskningar föranledda af mina resor i höga Norden." (Stockholm, 1883.) See NATURE, vol. xxviii. p. 304.

that of the ridges on the border of the glaciers, as well as in equal quantity on the top of the ice-knolls as on their sides or in the hollows between them.

2. That neither had it been distributed over the surface of the ice by running water, nor been pressed up from the hypothetical bottom "ground" moraine.

3. That the clay must therefore be a sediment from the air, the chief constituent of which is probably terrestrial dust spread by the wind over the surface of the ice.

4. That cosmic elements exist in this substance, as it contained molecules of metallic iron which could be drawn out by the magnet, and which under the blowpipe gave a reaction of cobalt and nickel.

Under these circumstances the remarkable dust which I have named "kryokonite," *i.e.* ice dust, obtained a great scientific interest, particularly as the cosmic element, viz. the matter deposited from space, was very considerable. Even later students who have visited the inland ice have observed this dust, but in places surrounded by mountains from which it might with more probability have been washed down. They have, therefore, and without having examined Prof. Berggren's and my own researches of 1870, paid little attention to the same, while the samples brought home by Dr. N. O. Holst from South Greenland in 1880 were not very extensive.

But now Dr. Berlin brings home from a great variety of places ice algæ, which, I feel convinced, will contribute fresh materials to our knowledge of the flora of the ice and snow. For my own part I have re-examined my first researches of the kryokonite, and they are fully corroborated. Everywhere where the snow from last winter has melted away, a fine dust, gray in colour, and, when wet, black or dark brown, is distributed over the inland ice in a layer which I should estimate at from 0·1 to 1 mm. in thickness if it was evenly distributed over the entire surface of the ice. It appears in the same quantity in the vicinity of the ice border surrounded by mountains as a hundred kilometres inland, but in the former locality it is mixed with a very fine sand, gray in colour, which may be separated from the kryokonite. Further inland this disappears, however, completely. Gravel or real sand I have never, in spite of searching for them, discovered in the kryokonite. The kryokonite always contains very fine granular atoms, which are attracted by the magnet, and which, as may be demonstrated by grating in an agate mortar and by analysis under the blowpipe, consist of a gray, metallic element, viz. nickel iron In general the dust is spread equally over the entire surface of the ice; thus it was found everywhere where the snow from the previous year had melted away, while, to judge by appearances, there seemed to be little difference between the quantity found near the coast and in the interior. The dust does not, however, form a continuous layer of clay, but has, by the melting of the ice, collected in cavities filled with water, which are found all over the surface. These are round, sometimes semicircular, one to three feet in depth, with a diameter of from a couple of millimetres to one metre or more. At the bottom a layer of kryokonite one to four millimetres in thickness is deposited, which has often, by organisms and by the wind, been formed into little balls, and everywhere where the original surface of the ice has not been changed by water-currents the cavities are found so close to each other that it would be very difficult to find a spot on the ice as large as the crown of a hat free from them. In the night, at a few degrees below freezing point, new ice forms on these hollows, but they do not freeze to the bottom even under the severest frost, and the sheet which covers them is never strong enough to support a man, more particularly if the hole is, as was the case during half our journey, covered with a few inches of newly-fallen snow.

The kryokonite cavities were perhaps more dangerous to our expedition than anything else we were exposed to. We passed, of course, a number of crevasses without bottom as far as the eye could penetrate, and wide enough to swallow up a man, but they were "open," *i.e.* free from a cover of snow, and could with proper caution be avoided, and the danger of these could further be minimised by the sending of the two-men sledges in front, and if one of the men fell into the crevasse he was supported by the runners and the alpenstock, which always enabled him to get up on the ice again. But this was far from being the case with the kryokonite hollows. These lie, with a diameter just large enough to hold the foot, as close to one another as the stumps of the trees in a felled forest, and it was therefore impossible not to stumble into them at every moment, which was the more annoying as it happened just when the foot was stretched for a step forward, and the traveller was precipitated to the ground, with his foot fastened in a hole three feet in depth. The worst part of our journey was four days outward and three days of the return, and it is not too much to say that each one of us during these seven days fell a hundred times into these cavities, viz. for all of us 7000 times. I am only surprised that no bones were broken, an accident which would not only have brought my exploration to an abrupt close, but might have had the most disastrous consequences, as it would have been utterly impossible to have carried a man in that state back to the coast. One advantage the kryokonite cavities had, however, viz. of offering us the purest drinking-water imaginable, of which we fully availed ourselves without the least bad consequences, in spite of our perspiring state.

On July 16 we covered thirteen, on the 17th eighteen and a half, and on the 18th seventeen and a half kilometres. The country, or more correctly the ice, now gradually rose from 965 to 1213 metres. The distances enumerated show that the ice became more smooth; but the road was still impeded by the kryokonite cavities, whereas the rivers, which even here were rich in water, became shallower, but stronger, thus easier of crossing. Our road was, besides, often cut off by immense snow-covered crevasses, which, however, did not cause much trouble.

On the night of the 18th, when arrived at camp No. 14, the Lapp Anders came to me and asked if he might be permitted to "have a run," viz. to make a reconnaissance on "skidor,"[1] to see if there was no "land" to the east. This granted, he started off without awaiting supper. He came back after six hours' absence, and reported that he had reached 27 kilometres further east, that the ice became smoother, but was still rising, but there was no sign of "land." If his statement was true, he had, after a laborious day's journey, in six hours covered about sixty kilometres! At first I considered his estimate exaggerated, but it proved to be perfectly correct. It took us thus *two whole* days to reach as far as he had got, as shown by the track in the snow. I particularly mention this occurrence in order to show that the Lapps really did cover the estimated distance of their journey eastward, of which more below.

During these days we passed several lakes, some of which had the appearance of not flowing away in the winter, as we found here large ice blocks several feet in diameter, screwed up on the shore, which circumstance I could only explain by assuming that a large quantity of water still remained here when the pools about became covered with new ice. The lakes are mostly circular, and their shores formed a snow "bog" which was almost impassable with the heavy sledges.

On July 19 we covered seventeen and a half, on the 20th sixteen and a half, on the 21st, seven, and on the 22nd seven and a half kilometres (15th to 18th camp). The ice rose between them from 1213 to 1492

[1] [The Swedish "skidor" and Norwegian "Ski," are long strips of pinewood slightly bent at the top, polished and as elastic as if they were of the finest steel, with a strap for the feet in the centre, on which the Lapps and Scandinavians run on the snow with remarkable agility at a tremendous pace.—ED.]

metres. The distances enumerated fully show the nature of the ice. It was at first excellent, particularly in the morning, when the new snow was covered with a layer of hard ice; but on the latter days we had great difficulty in proceeding, as a sleet fell with a south-east wind in the night between the 20th and the 21st. The new snow, as well as that lying from the previous year, became a perfect snow bog in which the sledges constantly stuck so that it required at times four men to get them out. We all got wet, and had great difficulty in finding a spot on the ice dry enough to pitch the tent. On the 22nd we had to pitch it in the wet snow, where the feet immediately became saturated on putting them outside the indiarubber mattresses. A little later on in the year, when the surface of the snow is again covered with ice, or earlier, before the thaw sets in, the surface would no doubt be excellent to journey on.

When we, therefore, on July 21, were compelled to pitch the tent in wet snow, as no dry spot could be discovered, and it was impossible to drag the sledges further, I sent the Lapp Lars Tuorda forward on "skidor" to find a dry road. He came back and stated that the ice everywhere was covered with water and snow. For the first time in his life he was at a loss what to suggest. It being utterly impossible to get the sledges further, I had no choice. I decided to turn back.

I wished, however, to let the Lapps go forward some distance to the east to see the country as far as possible. At first I considered it advisable to let their journey only last twenty-four hours, but as both Anders and Lars insisted that they were most eager to find the "Promised Land," and said they could do nothing towards discovering it in that short period, I granted them leave to run eastwards for four days and nights, and then return.

On leaving I gave them the following written orders:—

"Instructions for Lars and Anders's 'skid' run on the inland ice of Greenland, viz.:—

"Lars and Anders have orders to proceed on skidor eastwards, but are allowed to alter the course, if they may deem it advisable, to north or south.

"At the end of every third mile the barometer shall be read and the direction run noted.

"The absence is to be four days, but we will wait for six days. After that, viz. on the morning of July 28, we return. If not returned, we leave behind in a sledge provisions, brandy, mattresses, &c.

"Lars is warned not to be too bold. Should land be reached, you are to collect as much as you may gather of blossoms and grass, if possible several kinds (specimens) of each.

"Given on the inland ice in Greenland, July 21, 1883,
"A. E. NORDENSKJÖLD"

They were allowed to select what provisions, &c., they desired, and were furnished with two compasses, aneroid barometers, and a watch.

At 2.30 a.m. on July 22 they started. The days we waited for them were generally spent in the tent, as water surrounded us everywhere. The sky was covered with a thin veil of clouds, through which the sun shone warmly, at times even scorchingly. From time to time this veil of clouds, or haze, descended to the surface of the ice and hid the view over the expanse, but it was, remarkably enough, not wet but *dry*, yes, so dry that our wet clothes absolutely dried in it. We have therefore, I consider, witnessed a phenomenon on the inland ice of Greenland which is related to the "sun-smoke" phenomenon of Scandinavia, viz. what Arago has described under the name "brouillard sec."

On the 24th, after an absence of fifty-seven hours, the Lapps returned. It was the want of drinking-water and fuel which compelled them to return. The surface had been excellent for their journey, and they had covered a distance out and back of 230 kilometres, an estimate which I consider perfectly reliable. During the march forward the barometer was read every third hour. It gave the point of return a height of 2000 metres.[1]

As to the run, Lars rendered the following report: When they had reached thirty miles from the camp no more water could be found. Further on the ice became perfectly smooth. The thermometer registered $-5°$ C. It was very easy to proceed on the "skidor." At the point of return the snow was level and packed by the wind. There was no trace of land. They only saw before them a smooth ice covered by fine and hard snow. The composition of the surface was this—first four feet of loose snow, then granular ice, and at last an open space large enough to hold an outstretched hand. It was surrounded by angular bits of ice (crystals). The inland ice was formed in terraces—thus, first a hill, then a level, again another hill, and so on. The Lapps had slept for four hours, from twelve midnight on July 23, in a hollow dug in the snow while a terrific storm blew. They had till then been awake for fifty-three hours. On the first day there was no wind, but next day it came from the south, and lasted thus until twenty-four miles on the return journey, when it changed to west. On the return journey, when forty miles from our camp, two ravens were seen. They came from the north and returned in the same direction. The Lapps had for a moment lost the track of the "skidor" in the snow. The ravens flew at first, they found, parallel with the track, and then turned to the north.

On July 25 we began the return journey. It was high time, as the weather now became very bad, and it was with great difficulty we proceeded in the hazy air between the number of crevasses. The cold, after the sun sunk below the horizon at night, also became very great; and on the morning of July 27 the glass fell to $-11°$ C.

As to the return journey I may be very brief. The rivers now impeded us but little, as they were to a great extent dried up. The ice-knolls had decreased considerably in size too, and lay more apart, but the glacial crevasses had greatly expanded, and were more dangerous, being covered with snow. Even the cavities and the glacial wells, of which many undoubtedly leave a veritable testimony of their existence behind them in the shape of corresponding hollows in the rock beneath, had expanded and increased in number. On a few occasions, on the return journey, we saw flocks of birds, most probably water-fowl, which were returning from the north.

On July 31 we again sighted land, which was reached on the afternoon of August 4, and proceeded to "Sophia Harbour," where Esquimaux were, as arranged, waiting for us. For convenience sake I now divided our party into two, one of which sailed in the lifeboat of the *Sophia* to Egedesminde, where the steamer was to take us on board, and the other, in which was myself, marched to that place across the low but broad promontory which separates Tessiusarsoak and South-East Bay, and then in two Esquimaux "Kone" boats to Ikamiut and Egedesminde.

On August 16 the *Sophia* arrived from the north, embarked us, and made for Ivigtut, where we arrived on the 19th.

Of the expedition carried out under Dr. Nathorst during my absence he will himself make a report,[2] and I have no doubt that the results of the same will prove very important. Particularly will the very rich collections of fossil plants, which he has made with the greatest regard to the geological condition of the strata, be of great value to science, as they will furnish us with many new materials and detailed illustrations of the flora of the Far North during the epoch when forests of fig-trees, cycadi, ginko, magnolia, and tulip-trees covered these regions. Dr. Forsstrand and Herr

[1] I have as yet been unable to verify the barometer calculations, and the figures stated here may suffer some modification.
[2] NATURE, vol. xxviii. p. 541.

Kolthoff's collections and studies of the fauna of Greenland will also contribute to extend our knowledge of the naturalistic conditions of the Arctic regions, while the careful researches made by Herr Hamberg of the saltness, composition, and temperature of the sea will, I am sure, greatly benefit hydrography. His researches have been effected in Davis Strait and Baffin's Bay too, the hydrographical conditions of which are but little known.

With regard to the results of my exploration of the inland ice, I may be permitted to say a few words. That we found no ice-free land in the interior, or, that it does not exist between 68° and 69° lat. in Greenland, is due directly to the orographical conditions which exist in this part of the country, as referred to in my programme of the expedition.[1] The land has here the form of a round loaf of bread, with sides which gradually and symmetrically slope down to the sea, *i.e.* exactly the shape which I then pointed out was a necessary condition if the entire country should be covered with a continuous sheet of ice.

But, thanks to the Lapps, my expedition is the first which has penetrated into the very heart of the enormous Greenland continent, and which has thus solved a problem of the greatest geographical and scientific importance. It is the first exploration of the hitherto unknown interior of Greenland, the only continent in the world into which man had not penetrated.

A new means of locomotion, the "skidor," seems also to have been acquired for the Arctic explorer of the future, which may greatly assist him in his work, and enable him to reach places hitherto deemed impossible of approach, but of the use of which the Lapp seems to possess, so to speak, the monopoly.

A. E. NORDENSKJÖLD

We are enabled to supplement Baron Nordenskjöld's report by the following account, furnished to us by another member of the expedition, of the visit paid to the remarkable Igaliko ruins:—

On August 24 the *Sophia* steamed to Igaliko, at the bottom of the fjord of the same name. The object of this visit was to examine the ancient Norse ruins which are found here. Those who thus believe that the "Österbygd" of Greenland was situated in this part assert that the ruins of Igaliko are nothing more nor less than those of Erik Röde's own mansion "Brattelid." However that may be, the Norseman who selected this spot for his residence acted very wisely. The ruins are situated at the very bottom of the fjord, where the absence or presence of the ocean ice on the coast affects the climate but little. The vegetation in this spot is, in consequence, quite luxuriant. Thus a vaginal plant, *Lathyrus maritimus*, grows here in such abundance that it reminds one of a field of peas, while *Ranunculus acris* attains a height of two feet, and *Campanula rotundifolia*, the bluebell, along with various grasses, flourish in great profusion. In the pools Menyanthes and Potamogeton thrive, while copses of birch-trees and willows offer excellent fuel. There are also plenty of wild berries. The ruins, the walls of which were formed of enormous blocks of sandstone, lie just below a table-shaped ridge of sandstone by the side of a crystal brook, copiously encircled by *Alchemilla vulgaris* and watercress. The spot is, in fact, one which would fully justify the name given to the country. At the time of our visit about a dozen cows were fed here, whose excellent milk we tasted, while in the beds around the huts of the natives swedes and potatoes grew luxuriantly, the former having attained the size of large apples. It certainly was strange to view this spot, and we naturally asked each other, what has become of the old Norsemen who once peopled it? It is impossible to believe that they were extirpated or conquered by the Esquimaux. It seems far more probable that both races have commingled, an assumption further corroborated by the strange circumstance that Esquimaux are found in this tract who have never been in contact with the Danes, but who nevertheless possess features of pure Norse character.

[1] NATURE, vol. xxviii. p. 37.

THE VIENNA INTERNATIONAL ELECTRIC EXHIBITION

(FROM OUR VIENNA CORRESPONDENT.)

THE Scientific Commission having for its purpose the taking of electrical measurements and conducting scientific researches at the Exhibition commenced its work on September 17. By the assembled Austrian and foreign delegates Prof. Stefan (Vienna) was elected president, while as vice-presidents were elected Prof. Galilei Ferraris (Turin), Col. J. Florensoff (St. Petersburg), Prof. Hauffe (Vienna), Prof. Kittler (Darmstadt), Major A. Obermayer (Vienna), Sir William Siemens (London), Prof. Mascart (Paris), Emil Effendi Lacoine (Constantinople), Prof. E. Gerard (Liége). The Commission is subdivided into the following eight sections according to the matters to be dealt with:—1. Scientific instruments. 2. Motors and general mechanics. 3. Dynamo-electric machines, electric lighting, and transmission of power. 4. Electro-chemistry. 5. Telegraphy, telephony, electric bells and clocks. 6. Signalling for railways and military purposes. 7. Electro-therapeutics. 8. Application of electricity relating to arts, industry, and technology. At the third section the measurements are carried out according to the plans devised for electric measurements by the president of the section, Prof. Kittler, and for photometric measurements by Prof. Voit (Munich). A control calibration of the instruments used in this section showed their accuracy and precision, as well as the correctness of the hypothesis that the variations of the earth's magnetism during the daily periods of measuring could not exert any important influence on the results of the measurements. When the first trials were made, some disturbances of the delicate instruments arose, the cause being that the iron building of the Rotunda was charged with electricity by the return currents of the dynamo-electric machines. But this difficulty was soon overcome by modifying the arrangements of the conducting wires, and the Commission is now hard at work trying the various electric lamps and machines. The results of these trials when finished will be published by the Commission. The series of lectures delivered at the theatre of the Exhibition is still continued, and we had occasion to hear, among others, Mr. Preece (who spoke in English), on the recent progress of telegraphy in England, and the Austrian professors Mach, Zenger, Pfaundler, Waltenhofen. The attendance on the part of the public is as large as it was at the Universal Exhibition in the year 1873, the average number of visitors being 15,000 daily.

While in the Bernstein lamps described in our last letter a relatively thick carbon is used, in the Cruto lamps brought to the Exhibition a few days ago a very fine but hollow carbon loop is employed; it is prepared by a process similar to that already devised by Mr. Sawyer in the year 1878 for flashing carbon filaments. A thin platinum wire (1/20 mm. to 1/60 mm. in diameter) is heated, by an electric current passing through it, in a vessel containing the vapour of a hydrocarbon. The hydrocarbon being decomposed in a short time, the platinum wire is covered by a homogeneous layer of deposited pure carbon. The platinum is then removed by volatilising it. The remaining hollow carbon filaments thus obtained are very fine and elastic, and show a metallic polish. The Cruto lamps, as well as a series of Lodiguine incandescent lamps, are fed by Gravier's distributers of electricity, the installation of which has been completed during the past week. The process of preparing the illuminating portions of the new incandescent lamps with high resistance exhibited by Siemens and Halske, and lighting beautifully Witzmann's restaurant and the exhibits of this firm, is still kept secret. The stall of the Société Anonyme d'Électricité is lighted by several Gerard incandescent lamps of high candle-power (300 candles). These lamps have large ovoid glass bulbs pierced at their broad part by a narrow glass tube containing the two terminals of the conducting wires. The five straight and comparatively thick carbon rods forming the illuminating part of the lamp are cemented together at their ends by means of a carbonaceous paste in such a manner that, by the two pairs of longer rods being connected by a short intermediate carbon rod, two long-sided, acute-angled triangles crossing one another are formed, which, if brought to incandescence, make the appearance of a single flame, giving an agreeable and bright light. This chain of carbon rods is fastened to the supporting terminals by two short cylindrical pieces of carbon. An interesting historical collection of incandescent lamps is exhibited in the Prussian Section, showing the lamps made by Florensoff, Buliguine, and Khotinsky in the years 1872 and 1873. The latter had already used exhausted glass bulbs, but the carbon rod used having a diameter of 1·5 mm. to a length of 1½ cm. could not give a good result.

Most of the incandescent lamps exhibited have transparent bulbs, and very disagreeable after images of the glowing carbon filaments are caused if they are looked at only for a moment or two.

An interesting and practical regulator for single incandescent lamps has been exhibited by the International Electric Company. By turning a handle the intensity of incandescence can be raised or lowered. This regulating apparatus consists of a hollow perforated brass bulb mounted below the lamp, containing a number of carbon disks, which, when the handle is right over in one direction, are highly compressed, a metallic circuit being established at the same time. By turning the handle, the metallic circuit is broken, and the current passes through the carbon disks, while the pressure on them being gradually relaxed causes a steady increase of resistance to the current, thus diminishing its intensity, and in the final position the circuit is broken, and the carbon filament of the lamp ceases to glow.

Vienna, October 16

NOTES

We have received the following announcement from the Royal Society:—On the last day of the present month the Fellows of the Royal Society will hold their anniversary meeting, and elect Council and officers for the ensuing year. The following list has been nominated:—President: Prof. Thomas Henry Huxley, LL.D.; Treasurer: John Evans, D.C.L., LL.D.; Secretaries: Prof. George Gabriel Stokes, M.A., D.C.L., LL.D., Prof. Michael Foster, M.A., M.D.; Foreign Secretary: Prof. Alexander William Williamson, LL.D.; other Members of the Council: Capt. W. de Wiveleslie Abney, R.E., Prof. W. Grylls Adams, M.A., F.C.P.S., the Duke of Argyll, K.T., D.C.L., John Gilbert Baker, F.L.S., Thomas Lauder Brunton, M.D., Sc.D., William Henry M. Christie, Astronomer-Royal, William De la Rue, M.A., D.C.L., Sir Frederick J. O. Evans, K.C.B., Prof. George Carey Foster, B.A., Francis Galton, M.A., F.G.S., James Whitbread Lee Glaisher, M.A., Sir William Withey Gull, Bart., M.D., Hugo Müller, Ph.D., Prof. Joseph Prestwich, M.A., F.G.S., Prof. Osborne Reynolds, M.A., Osbert Salvin, M.A., F.L.S. It will be a subject of congratulation to the scientific world at large to learn from the above announcement that Prof. Huxley has consented to allow himself to be nominated for President.

A NOTICE of some importance has just been issued by St. John's College, Cambridge. Inasmuch as it indicates an advance on the old examination in mathematics and classics only, which has hitherto obtained at this college, we are glad to welcome the change. It will tend to place science candidates still more on an equality with those who pursue the older studies, and it will directly encourage them to undertake "independent" work (the word is better than "original" where Bachelors of Arts are concerned) at the stage when they have most leisure and most plasticity. The notice is as follows:—"Candidates for Fellowships at the next annual election are invited to submit to the electors dissertations or other writings as evidence of their independent work, in accordance with the following directions:—(*a*) The matter and form of the writings to be left to the discretion of the candidates; (*b*) the writings may be prepared especially with a view to the election, or may consist wholly or partly of work already published; (*c*) the candidates to state clearly what parts of their writings they claim to be original; (*d*) the candidates to inform the Master not later than June 1 of the subjects of the writings they propose to submit; (*e*) the writings to be sent to the Master not later than September 1. The electors wish it to be understood that at the next election their decision will be influenced by consideration of the following points:—(1) The performance of the candidates in the University and other public examinations. (2) The quality and promise of the writings submitted by the candidates. Candidates may be examined by papers or *vivâ voce* on questions arising out of their writings, and on other matters also if the electors desire it. (3) The proficiency in some special subject of candidates who do not submit any writings. Such candidates may at their own request be examined in their special subject, provided they give full and precise information in regard to it by letter addressed to the Master not later than June 1. (4) The candidates' power of expression as shown in the composition of an extempore English essay. Candidates will be offered a certain number of subjects to choose from; and in judging of the essays account will be taken of method and style. (5) Such other evidence as may be forthcoming to attest the candidates' qualifications. The next annual election will take place on Monday, November 3, 1884. Candidates will be required to present themselves for examination on Tuesday, October 21, at 9 a.m."

THE success which attended the course of lectures delivered this year has induced the Council of the Institution of Civil Engineers to make arrangements for a similar series next session. Electricity was then dealt with. Another most important subject will now be treated, namely, "Heat in its Mechanical Applications." The lectures will be delivered on Thursday evenings at 8 p.m., in the months from November to April, as under:—1883: November 15, "The General Theory of Thermodynamics," by Prof. Osborne Reynolds, F.R.S.; December 6, "The Generation of Steam, and the Thermodynamic Problems Involved," by Mr. W. Anderson, M.Inst.C.E.; 1884: January 17, "The Steam-Engine," by Mr. E. A. Cowper, M.Inst.C.E.; February 21, "Gas- and Caloric-Engines," by Prof. Fleeming Jenkin, F.R.SS.L. and E., M.Inst.C.E.; March 20, "Compressed-Air and other Refrigerating Machinery," by Mr. A. C. Kirk, M.Inst.C.E.; April 3, "Heat-Action of Explosives," by Capt. Andrew Noble, F.R.S., M.Inst.C.E.

THE 130th Session of the Society of Arts will commence on the 21st inst., with an opening address from Sir William Siemens, the chairman of the Society's Council. Previous to Christmas there will be four ordinary meetings, in addition to the opening meeting, and for these the following arrangements have been made:—November 28, A. J. R. Trendell, "The International Fisheries Exhibition of 1883;" December 5, Thomas T. P. Bruce Warren, "The Manufacture of Mineral Waters;" December 12, Thomas Fletcher, F.C.S., "Coal Gas as a Labour-saving Agent in Mechanical Trades;" December 19, W. H. Preece, F.R.S., "The Progress of Electric Lighting." There will be six courses of lectures delivered during the session, under the bequest of Dr. Cantor. These will be: (1) "The Scientific Basis of Cookery," by W. Mattieu Williams, F.C.S.; (2) "Recent Improvements in Photo-mechanical Printing Methods," by Thomas Bolas, F.C.S.; (3) "London Houses," by Robert W. Edis, F.S.A.; (4) "The Alloys used for Coinage," by Prof. W. Chandler Roberts, F.R.S., Chemist of the Royal Mint; (5) "Some New Optical Instruments and Arrangements," by J. Norman Lockyer, F.R.S., F.R.A.S.; and (6) "Fermentation and Distillation," by Prof. W. Noel Hartley, F.C.S. The usual short course of Juvenile Lectures will be delivered during the Christmas holidays. The subject will be "Crystals and Crystallisation," and the lecturer Mr. J. M. Thomson, of King's College, London.

The death is announced of Prof. Peter T. Riess, whose treatise on frictional electricity—"Die Lehre von Reibungselektricität"—has long been a standard work. Riess was a careful and accurate observer of phenomena. His researches on ring-figures produced by discharges, on the electric air thermometer, and on the phenomena of the return stroke, are well known. His memoirs on electricity were published in a collected form some years ago.

The sum of 100*l*. has been placed at the disposal of the Council of the Statistical Society by Mr. H. D. Pochin for an essay in memory of the late Mr. Wm. Newmarch, F.R.S., "On the Extent to which Recent Legislation is in accordance with, or Deviates from, the True Principles of Economic Science; and showing the Permanent Effects which may be expected to arise from such Legislation." The Council accordingly invite public competition for the prize above mentioned. Essays must be sent in on or before May 1, 1884.

Dr. Sophus Tromholt has just left for Iceland, where he intends to establish his auroral station during the coming winter.

In connection with the vote given by the delegates to the congress at Rome for establishing a meridian common to all civilised nations, it may be stated that the first French meridian was not originally that of Paris and special to the French geographers, but Ferro, according to an ordinance of Louis XIII., published in 1632 in compliance with a report drawn up by Cardinal de Richelieu, then superintendent of commerce and navigation. It was transferred to Paris only fifty years afterwards by Dominique Cassini, who obtained the authorisation of Louis XIV. and the French Academy of Sciences, because it was too difficult to ascertain the exact distance of the Ferro meridian.

The date of admission of foundation members to the International Society of Electricians has been postponed to Nov. 15, when a general meeting to constitute the Society will be held, which at present numbers 900 members, belonging to twenty nationalities. Requests for admission should be addressed to M. Georges Berger, 99, rue de Grenelle, Paris.

M. Raphael Perujta writing to *La Nature* under date Manilla, September 14, states that the detonations of the Java eruption of August 27 were distinctly heard throughout the Philippine Islands; so distinctly were the sounds heard that gunboats were sent out under the impression that a fight was going on at Java, or that a ship in distress was firing for help.

Of the expeditions despatched in May last from Denmark to Greenland, the one to North Greenland, under Lieut. Hammers, has just returned, after having succeeded in accomplishing its object, viz. to map out and examine the coast from Ritenbank to Kongatsiok in the Egedesminde district, *viâ* Jacobshavn and Kristiansbank, between 70° and 68° 20′ N. lat. During the journey the finest weather prevailed, which was a necessary condition, as this part of the coast is greatly obstructed by islands and holmes, while there are but few heights along it. By Lieut. Hammers and his companions' labours the exploration of the coast of North Greenland has been completed, Lieuts. Steenstrup and Hammers having—between 1878 and 1880—explored the district between Pröven (Upernivik) and Godhavn, and Lieut. Jensen, in 1879, the coast between Holstensborg and Egedesminde. These expeditions have succeeded in collecting all the materials necessary for a map of the whole coast between Pröven and Holstenborg. Lieut. Hammers has, besides geographical researches, also made collections in natural history, and brought home valuable botanical and mineralogical collections. From the second expedition, under Lieut. Holm, despatched this summer to the district of Julianshaab in order to carry out a two-and-a-half years' exploration of the south coast of Greenland, a short report has been received, stating that it had arrived at Huilek, a small settlement on the east coast, in lat. 61°. Lieut. Holm had established a depot of provisions here, to be brought north next summer to his place of wintering. He intended to return to Nanortalik, on the west coast, between Julianshaab and Cape Farewell, this autumn, where the expedition will carry out meteorological and auroral observations during the winter, which would be a continuation on a small scale of those effected at Godthaab for a year under the international scheme. These observations will be carried on in the buildings erected there by Capt. Hoffmeyer in 1882, and with the instruments of the previous expedition. On returning to the west coast in the autumn, Lieut. Holm's expedition will effect detailed explorations of the coast, fjords, and the ice and sea. He has arranged with several Esquimaux to meet and assist him on his journey northwards next year, when he hopes to reach the sixty-seventh degree of latitude.

Mr. Carl Bock's new book is now nearly ready for publication. Its title will be "Temples and Elephants," a narrative of a journey of exploration through Upper Siam and Lao. Messrs. Sampson Low and Co. are the publishers.

During the last few years the Swedish Government have, as an experiment, retained an entomologist to assist farmers in the destruction of insects, &c., dangerous to the crops. The services of this functionary have, however, been in such request that the appointment is to be made a permanent one.

On October 26 at about 7 p.m. a splendid meteor was seen in the district of Hernösand, Sweden. A traveller on the road to Ragunda states that he suddenly saw the night lit up as in broad daylight, which was caused by a large meteor appearing with a blinding white lustre in the zenith and travelling very rapidly down to the horizon. When half way, as it appeared to the observer, between zenith and the earth it suddenly burst, throwing a quantity of sparks in every direction.

A Universal Exhibition on a tolerably large scale will be opened at Nice on December 1 next, and will continue open the whole of the winter. The Algerian *Akhbar* suggests that in 1885 a Pan-Mediterranean exhibition should be opened in Algiers, and in 1887 a Pan-African one.

We have to announce three new numbers of the "Encyclopædia of Natural Sciences" from the publishing house of Eduard Trewendt, Breslau—No. 35 of Part 1, and Nos. 17 and 18 of Part 2, making up altogether a substantial addition to what had been previously accomplished in the progress of this comprehensive work. No. 35, Part 1, gives a continuation of "Schenk's Manual of Botany," more particularly a paper by Göbel, well and copiously illustrated, on the "Comparative

History of the Development of Vegetable Organs." No. 17 of the second part of the total work concludes the first volume of the "Alphabetical Manual of Chemistry," edited by Ladenburg, and begins the second volume with a series of valuable articles; one by Biedermann, on the "Atmosphere," taking up by itself as much as two and a half printed sheets. No. 18 brings the "Alphabetical Manual of Mineralogy, Geology, and Palæontology" as far as the letter "I," and supplies treatises by Kenngott, Lasaulx, and Rolle. Lasaulx's work on "Glaciers" should, especially, be of interest.

"UNIVERSAL GEOGRAPHIES" are appearing on all hands. There is M. Reclus' magnum opus and Stanford's Compendium; a new edition of Balbi is appearing in Vienna, and we believe of Malte Brun in Paris. Now the first parts of an Italian "Universal Geography" have been sent us, "La Terra," by Signor G. Marinelli, and published by Dr. F. Vallardi of Milan. It begins at the beginning, with the earth as a member of the solar system, and enters into considerable astronomical detail, and into the composition of the sun and the results of recent solar research. It is abundantly illustrated, and seems to us to deserve a large circulation, which we hope it will have in Italy. We have also the first part of a new German work of this class, "Unser Wissen von der Erde, Allgemeine Erdkunde," edited by Drs. Hann, Baron von Hochstetter, and A. Pokorny. These names are a guarantee that this work will be up to a high scientific standard, and it is evident that scientific geography will occupy a large space. The illustrations are good. The publisher is Freytag of Leipzig.

MR. G. K. GILBERT has recently, according to *Science*, given some rather disturbing suggestions to the people of Salt Lake City (*Salt Lake Weekly Tribune*, September 20) concerning the probability of destructive earthquakes there. He describes the slow and still continuing growth of the ranges in the Great Basin by repeated dislocation along great fractures, the earth's crust on one side being elevated and tilted into mountain attitude by an upthrust that produces compression and distortion in the rocky mass, until the strain can no longer be borne, and something must give way. Suddenly and violently there is a slipping of one wall of the fissure on the other, far enough to relieve the strain, and this is felt as an earthquake; then follows a long period of quiet, during which the strain is gradually reimposed. Such a shock occurred in Owen's Valley, along the eastern base of the Sierra Nevada, in 1872, when a fault-scarp five to twenty feet high and forty miles long was produced. A scarp thirty or forty feet high is known along the western foot of the Wahsatch Range, south of Salt Lake, and other scarps of similar origin have been found at the bases of many of the Basin ranges. The date of their formation is not known; but it must be comparatively recent, because they are still so little worn away. Wherever they are fresh, and consequently of modern uplift, there is probable safety from earthquakes for ages to come, because a long time is needed for the accumulation of another strain sufficient to cause a slipping of one wall of the fissure on the other. Conversely, when they are old and worn down, the breaking strain may even now be almost reached, and an earthquake may be expected at any time. This is the case at Salt Lake; for, continuous as are the fault-scarps along the base of the Wahsatch, they are absent near this city. From the Warm Springs to Emigration Cañon they have not been found, and the rational explanation of their absence is that a very long time has elapsed since their last renewal. In this period the earth-strain has been slowly increasing. Some day it will overcome the friction, lift the mountains a few feet, and re-enact on a fearful scale the catastrophe of Owen's Valley.

THE Aristotelian Society is exerting itself, we hear, to widen its sphere of action, so that it may be to philosophy what the scientific societies are to science. Very encouraging support has already been obtained from those interested in philosophy and the relations between philosophy and science.

WE have received the first number of *The Science Monthly* (Bogue), neatly got up and well printed.

THE additions to the Zoological Society's Gardens during the past week include a Sykes's Monkey (*Cercopithecus albigularis*) from East Africa, presented by Mr. Thomas L. M. Rose; a Black-eared Marmoset (*Hapale penicillata*) from South-East Brazil, presented by Mr. S. Sandbach Parker; a Globose Curassow (*Crax globicera* ♀) from Central America, presented by Miss Beale; a Red-throated Diver (*Colymbus septentrionalis*), British, presented by Mr. T. E. Gunn; a Dwarf Chameleon (*Chamæleon pumilus*) from South Africa, presented by Capt. J. C. Robinson; a Common Heron (*Ardea cinerea*), European, a Common Cormorant (*Phalacrocorax carbo*), a Gannet (*Sula bassana*), British, deposited; a Common Otter (*Lutra vulgaris*), British, two Crested Screamers (*Chauna chavaria*) from Buenos Ayres, purchased.

OUR ASTRONOMICAL COLUMN

PONS' COMET.—We continue our ephemeris of this comet from the provisionally-corrected orbit of MM. Schulhof and Bossert:—

At Greenwich Midnight

1883.	R.A. h. m. s.	Decl. ° ′	Log. distance from Earth.	Log. distance from Sun.
Nov. 21	17 57 16	+48 49·1	0·1079	0·1445
23	18 4 12	48 23·6		
25	18 11 30	47 56·8	0·0839	0·1276
27	18 19 11	47 28·4		
29	18 27 18	46 57·9	0·0583	0·1102
Dec. 1	18 35 51	46 25·0		
3	18 44 51	45 49·0	0·0311	0·0923
5	18 54 20	45 9·4		
7	19 4 19	44 25·5	0·0023	0·0738
9	19 14 48	43 36·5		
11	19 25 47	42 41·5	9·9721	0·0549
13	19 37 17	41 39·5		
15	19 49 17	40 29·3	9·9409	0·0356
17	20 1 47	39 9·8		
19	20 14 45	37 39·8	9·9093	0·0161
21	20 28 9	35 57·8		
23	20 41 54	34 2·8	9·8784	9·9965
25	20 55 57	31 53·6		
27	21 10 13	29 29·3	9·8500	9·9772
29	21 24 37	26 49·5		
31	21 39 4	+23 54·9	9·8263	9·9585

On the evening of November 4 the comet as viewed in one of the larger-sized comet-seekers of Martins of Berlin, was conspicuous enough, with traces of a tail. On October 29 Mr. Talmage, observing with Mr. Barclay's 10-inch refractor at Leyton, considered it made about the same impression upon the eye as the annular nebula in Lyra.

TEMPEL'S COMET, 1873 II.—According to the calculations of M. L. Schulhof, of Paris, this comet will arrive at perihelion on the 20th of the present month. Its position on the evening of the previous day will be approximately in R.A. 18h. 33m., N.P.D. 114° 0′, distant from the earth 1·93, and from the sun 1·34, so that the theoretical intensity of light expressed in the usual way will be 0·15, under which condition it will be of the last degree of faintness, judging from the experience of 1878. Still as the comet sets more than 2h. 20m. after the sun, it would be well worth while to search for it where there is a clear sky near the horizon, especially in the South of Europe.

A NEW STAR CATALOGUE.—Prof. van de Sande Bakhuyzen states that the catalogue of positions of stars contained in the first sixty-six volumes of the *Astronomische Nachrichten*, commenced by the late Prof. Hoek and continued by Dr. Kam, formerly of the Observatory at Leyden, has been completed and is ready for the press. It contains the places of nearly 5000 stars reduced to 1855·0, with their annual precessions, and the secular variations, the epoch of observation, &c. It is not mentioned in what way the publication of the catalague is to be effected.

THE OBAN PENNATULIDA[1]

THIS report is a very thorough piece of work. It consists of a detailed and finished description of specimens dredged during an excursion of the Birmingham Natural History Society in July, 1881. The specimens all belonged to the three species *Funiculina quadrangularis*, *Pennatula phosphorea*, and *Virgularia mirabilis*. The language in which they are described is very distinct and lucid, though perhaps some criticism may be allowed as to the scale of measurement used and as to a certain point in the nomenclature. Measurements are given in the decimal divisions of an inch, instead of the metrical system, which is so much more satisfactory. The axial portion of a Pennatulid is described as consisting of two parts—the stalk and the rachis, the latter being the polyp-bearing portion; and the word "stem" is used for the calcareous rod running through the axis of both rachis and stalk. "Stem" would naturally mean both the stalk and rachis together as opposed to the polyp-leaves. "Core" might be suggested as a better term for the axial skeleton. The example of Kölliker has been followed in the use of the terms "polyps" and "zooids" for the two kinds of individuals. In describing the "stomach," its inner lining membrane is called ectoderm, but no reference is made to he fact that the evidence for its being ectodermic is embryological.

The description and figures given of *Funiculina* are the first published in English which deal with the internal structure; and they are in some respects more complete and perfect than those of Kölliker in his monograph on the Pennatulida. The examination of the largest of the specimens, which was thirty-nine inches long, has finally disproved the validity of the distinction maintained by Verrill and Gray to exist between the Scotch *Funiculina*, and that of the Mediterranean and Scandinavia. The supposed species, *F. Forbesii*, is simply the younger form, the largest of the Oban specimens being in all respects a typical *F. quadrangularis*.

A very interesting part of the work is that which refers to the reproductive organs of *Pennatula phosphorea*; the male and female elements are here fully described and figured for the first time. The fact of the sexes being distinct was ascertained by Lacaze Duthiers, but neither he nor Kölliker give figures or satisfactory descriptions of the sexual organs. The male elements are shown here to be produced in spherical capsules, which at first sight resemble ova.

In the account of *Virgularia* the process of the origin of new polyps is described. The stomachs arise as invaginations of the surface of the rachis into the cavity of large canals lined by endoderm.

An ingenious discussion of the reason why specimens of *Virgularia* when dredged are almost always truncated at the upper end leads to the conclusion that the loss is due to the attacks of fish.

The descriptions are followed by a complete critical list of the literature, and an account of the geographical distribution both in the sea and in museums. The figures are very clear, and at the same time artistic. It is much to be regretted that the condition of the specimens did not allow the histology to be completely made out. No doubt the Birmingham Society will pay greater attention to the preservation of material for this purpose on future occasions. J. T. CUNNINGHAM

[1] Report by Prof A. Milnes Marshall, M.D., D.Sc., and William P. Marshall. Birmingham, 1882.

NOTES FROM THE OTAGO UNIVERSITY MUSEUM

III.—*On some Embryos of "Callorhynchus antarcticus"*

SOME weeks since I obtained from a fisherman a number of eggs of *Callorhynchus antarcticus* from Wickliffe Bay, Otago Peninsula. As I believe this is the first time any observations have been made on the development of the *Holocephali*, the following report of remarks made at a meeting of the Otago Institute on May 7 may be of some interest to morphologists:—

"The eggs were found buried in the sand a little below low-water mark, a position which would seem to cast some doubt on the generally accepted theory which accounts for the peculiar form of the egg-shell by supposing it to have acquired a protective resemblance to kelp. The cavity for the embryo has an elongated pyriform shape, the broad end being anterior, and the narrower or posterior end produced into a long canal. On what may be described as the 'hairy' in contradistinction to the smooth side of the egg-shell, there is on each side of the middle line at the anterior end a longitudinal slit in the wall of the cavity, which serves to allow of currents to and from the latter for respiratory purposes. The anterior ends of these slits are united by a weak place in the wall of the egg-shell; very slight pressure from within causes rupture along this line and produces a valve, the lateral boundaries of which are formed by the respiratory slits, its anterior boundary by the line of rupture. This valve readily opens outwards by pressure on its inner face, and serves for the exit of the fœtus; pressure upon its outer face only forces it against the opposite wall of the cavity.

"The advanced embryo lies in the cavity in such a position that its head lies at about the level of the base or hinge of the valve, and therefore some distance from the anterior end of the cavity, its tail lies in the narrow posterior prolongation of the cavity, which fits it accurately; its right side lies almost invariably against the smooth, its left against the hairy side of the egg-shell.

"Unfortunately the embryos in all the four dozen eggs examined were in a tolerably advanced stage of development, so that there will be little chance of getting younger stages until next autumn. The youngest obtained are about four inches long; they have large yolk-sacs (1·75 inch in length), and very long external gills projecting from the opercular aperture; the snout has acquired the characteristic form, but the tail shows as yet no trace of heterocercality, nor the skin of the silvery character it has in the adult, being in the fresh state translucent and highly vascular. The yolk-sac is remarkable; it is longitudinally elongated, and produced into numerous blunt paired projections, which are tolerably constant in position; one pair of these always lies to the anterior end of the dorsal surface of the yolk-sac, and between them the snout of the embryo is invariably situated. The umbilical or somatic stalk is practically obsolete, the fœtus being sessile upon the yolk-sac.

"As in Elasmobranchs the yolk-sac is gradually drawn into the cœlome, and so consists in advanced stages of an internal and an external portion, the former continually increasing at the expense of the latter. As the external portion diminishes in size, it loses its blood-vessels, and its projections gradually disappear. In the latest stage obtained, the external portion is not more than 0·5 inch long, the internal portion being fully 1·25 inch in length, and causing a great distension of the abdominal walls. In this stage also, the external gills are absorbed, and the adult characters of the integument attained."

The foregoing description appeared in the *New Zealand Journal of Science* for this month. T. JEFFERY PARKER

Dunedin, N.Z., July 13

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The delegates of the Common University Fund have agreed to appoint a Reader in Anthropology, so as to utilise the presence of Dr. Tylor for University instruction. In a Convocation to be held on November 15, a decree will be submitted to the House, fixing the Reader's stipend at 200*l.* a year, on condition that he lecture at least once a week in each of the three terms, and receive students for informal instruction and assistance.

A Scholarship in Natural Science is offered this term by Wadham College. Candidates may offer either Animal Morphology, Botanical Morphology, or Physiology. They will also be examined in Elementary Chemistry and Physics. Weight will also be given to a knowledge of French or German. Candidates must send in their names to the Warden on or before November 15.

CAMBRIDGE.—Dr. H. Sidgwick has been elected Knightbridge Professor of Moral Philosophy. Prof. Bonney, F.R.S., has been approved for the degree of Sc.D. Dr. Routh has been elected Hon. Fellow of Peterhouse; and Professors Dewar and M. J. M. Hill have been elected Ordinary Fellows. Messrs. A. G. Greenhill and R. R. Webb will be the Examiners in the Mathematical Tripos of 1874. The honorary degree of M.A. has been conferred on Prof. Macalister, F.R.S. Messrs. J. A. Fleming and S. L. Hart, both distinguished Natural Science graduates, have been elected Fellows of St. John's.

Dr. Gaskell, F.R.S., is to be approved as a Teacher of Physiology, Dr. F. Darwin as a Teacher of Biology, and Mr. G. B.

Atkinson as a Teacher of Physics, for the purposes of medical education.

The honorary degree of M.A. is proposed to be conferred on Mr. A. Graham, First Assistant at the Observatory, in recognition of his astronomical services.

Mr. M. C. Potter of Peterhouse has been appointed Assistant Curator of the Herbarium.

Mr. W. H. Caldwell, Fellow of Caius College, has been appointed the first Balfour student.

At St. John's College, in December, there will be open for competition among students who have not commenced residence in the University—The Foundation Scholarships then vacant, two of which may, after residence is commenced, be increased in value to 100*l.* a year on condition of regular residence, satisfactory progress, and good conduct; four Minor Scholarships, two being of the value of 75*l.* a year and two of 50*l.* a year; three Exhibitions of 50*l.* a year for two years; one Exhibition of 40*l.* a year for four years; one Exhibition of 32*l.* a year for four years; together with two Exhibitions of 30*l.* a year for four years; one Exhibition of 33*l.* 6*s.* 8*d.* a year for three years. The number of Exhibitions may be increased if candidates of sufficient merit present themselves. The Foundation Scholarships and Minor Scholarships are open to candidates under nineteen years of age. The Minor Scholarships are tenable for two years, or until the Minor Scholar is elected to a Foundation Scholarship. The Exhibitions are open to all candidates irrespective of age, and are not vacated by the election of the Exhibitioner to a Foundation Scholarship. The number of Foundation Scholarships is sixty. Candidates may present themselves for examination in any of the following subjects, namely, Classics, Mathematics, Natural Science, Hebrew, and Sanskrit. A candidate may be elected on the ground of proficiency in any one of these taken singly. The Examination in Natural Science will include papers and practical work in Physics, Chemistry, General Biology, Botany, Zoology and Comparative Anatomy, Human Anatomy, Physiology, and Geology. Every candidate must show a competent knowledge of two at least of the following subjects, namely: (1) Elementary Physics, (2) Elementary Chemistry, (3) Elementary Biology [the range of the examination in Elementary Biology may be taken as defined by the contents of Huxley and Martin's "Course of Practical Instruction in Elementary Biology" (Macmillan)]. A candidate may be elected on the ground of special proficiency in any one of the foregoing sciences. Each candidate's name should be sent not later than November 27, 1883, to the tutor under whom it is proposed to place him.

SCIENTIFIC SERIALS

THE *Journal of Physiology*, vol. iv. Nos. 2 and 3, August, 1883, contains: W. H. Gaskell, on the innervation of the heart, with special reference to the heart of the tortoise (plates 2 to 5). —J. Th. Cash, description of a double cardiograph for the frog's heart.—Wesley T. Mills, an examination of some controverted points of the physiology of the voice, especially the registers of the singing voice and the falsetto.—F. Warner, a method and apparatus for obtaining graphic records of various kinds of movements of the hand and its parts, and of enumerating such movements and their combinations (plate 6).—H. H. Donaldson and L. T. Stevens, the influence of digitaline on the work of the heart and on the flow through the blood-vessels.—G. F. Yeo and Th. Cash, on the relation between the active phases of contraction and the latent period of skeletal muscle.—S. Ringer, a third contribution regarding the influence of the inorganic constituents of the blood on the ventricular contraction.—L. C. Wooldridge, further observations on the coagulation of the blood.—Also Supplement Part to vol. iv. Physiological papers of 1882.

THE *Journal of the Royal Microscopical Society*, October, 1883, contains: On *Asplanchna ebbesbornii*, nov. sp., by E. T. Hudson, LL.D. (plates 9 and 10), with the usual bimonthly summary of current researches relating to zoology and botany (principally Invertebrata and Cryptogamia), microscopy, &c.

THE *American Naturalist* for October, 1883, contains: Man's place in nature, by W. N. Lockington.—The Naturalist Brazilian Expedition (No. 2, continued), the Lower Jacuhy and São Jeronymo, by H. H. Smith.—On the shells of the Colorado desert and the region further east, by R. E. Stearns (woodcuts). —Review of Report C_4 second geological survey of Pennsylvania, by Dr. P. Frazer.—Means of plant dispersion, by E. J. Hill.—Is the group Arthropoda a valid one? by J. S. Kingsley. —On the Serpentine of Staten Island, New York, and on a classification of the natural sciences, by T. Sterry Hunt.

Proceedings of the Linnean Society of New South Wales, vol. vii. part 4, 1883, contains:—E. P. Ramsay, on new species of Solea; contributions to Australian Oology, part 2; notes on birds from Solomon Islands.—E. Meyrick, Australian Micro-lepidoptera, Oecophoridæ.—Prof. Stephens, geology of the Western coalfields, parts 1 and 2.—Dr. J. C. Cox, edible Australian oysters.—C. W. de Vis, new birds of Queensland; description of a new Belideus from Northern Queensland; on two new Queensland fishes.—Rev. C. Kalchbrenner, *Fungi aliquot Australiæ Orientalis*, and on new species of Agaricus.—Rev. J. E. Tenison-Woods, botanical notes on Queensland; on a species of Brachyphyllum from mesozoic coal beds, Ipswich, Queensland.—Wm. Macleay, new fishes of New Guinea, No. 3. —Wm. A. Haswell, on *Phoronis australis*, n.sp.; an instance of symbiosis (an Actinia lodging in the pits of a species of Cellepora); segmental organs of Aphroditea.—On some new species of Australian tubicolous annelids (plate).—E. Haviland, plants indigenous to Sydney.—Rev. Dr. Woolls, Eucalypts first known in Europe.—J. J. Fletcher, comparative anatomy of the female urogenital system in kangaroos, part 1.—Dr. H. B. Guppy, habits of the Birgus of the Solomon Islands.

Vol. viii. part 1, June 19, 1883, contains:—William Macleay, a new form of mullet from New Guinea.—J. J. Fletcher, anatomy of the urogenital system of the kangaroos, part 2.— C. W. de Vis, extinct marsupial remains.—C. P. Ramsay, contributions to the zoology of New Guinea (plate, *Hapalotes papuanus*).—Some new Australian fishes.—H. R. Whittell, habits of *Pelopæus lætus*, and *Larrada australis*; on the voracity of a species of Heterostema.—Rev. J. E. Tenison-Woods, on the coal flora of Australia (eleven plates, heliotypes); gives a history of the subject and descriptive list of fossils (pp. 36-167).— Rev. B. Scortechini, contributions to the flora of Queensland.— Rev. C. Kalchbrenner, two new fungi.—Jas. Norton, fructification of the Bunya (*Araucaria bidwellii*) in Queensland.

Vol. viii. part 2, July 17, 1883, contains:—E. Haviland, plants indigenous to Sydney, Nos. 3 and 4.—C. W. de Vis, tooth-marked bones of extinct marsupials; on *Brachalletes palmeri*, an extinct marsupial; on a lower jaw of *Palorchestes azael*; on some new genera and species of Australian fishes.—H. K. Bennett, habits of *Leipoa ocellata*; on water from Eucalypti roots.—Wm. Macleay, fishes from the Burdekin and Mary Rivers; New Guinea fishes, No. 4.—J. J. Fletcher, on a viviparous lizard (*Hinulia elegans*).—John Brazier, synonymy of Australian and Polynesian land and marine mollusca; localities of some species of recent Polynesian mollusca.—Rev. J. E. Tenison-Woods, mesozoic fossils from Central Australia (two plates).—Rev. B. Scortechini, second half century of plants new to South Queensland.

Revue Internationale des Sciences Biologiques for July, 1883, contains:—Elie Reclus, studies on indigenous people: the Khonds.—Prof. Huxley, living organisms and the way to study them (translated).—Proceedings of the Academy of Sciences, Paris.

August.—Leon Metchnikov, essay on the Christian communion: the God of Nyssa and the God of Nazareth.—Prof. Huxley, living organisms and the way to study them (translated).—Proceedings of the Academy of Sciences, Amsterdam, and of the Academy of Sciences, Paris.

September.—Prof. Huxley, living organisms and the way to study them (translated).—Prof. Williamson, the primitive ancestors of living plants and their relation to the doctrine of evolution.—Proceedings of the Academy of Sciences, Paris.

Atti of the Royal Academy dei Lincei, June 17.—Remarks on Schiff's memoir on changes of volume during fusion, by Sig. Camizzaro.—On De Stefani's upper crest of the Apennines, by S. Capellini and Taramelli.—On the temperature corresponding with the glacial period, by S. Pietro Blaserna. —On the measurement of altitudes by means of the barometer, by S. Paolo Busin.—On the isobarometric types of Italy, by the same author.—On the first phenomena in the development of the embryo of the Böops (*Salpa maxima*), by S. Francesco Todaro.—On the caloric developed in liquids by the discharge of electric condensers, by S. Emilio Villari.—Report on the antiquities recently discovered in Val della Torre, Adria, Forli, Orvieto, and other parts of Italy, by S. Fiorelli.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, October 29.—M. Blanchard, president, in the chair.—Allusion was made by the President to the loss sustained by the Academy in the person of M. Louis Breguet, the mechanician, who died suddenly on the night of October 26.—Observations on the geometrical deformations produced by pressure on a rectangular parallelopipedon with prolongation in a single direction (two illustrations), by M. Tresca.—Fossil and savage man; anthropological studies, by M. de Quatrefages. In presenting this important work to the Academy, the author remarked that since the discoveries of Boucher de Perthes and the jawbone of Moulin-Quignon some twenty years ago, not only has the existence of Quaternary man been universally recognised, but a certain number of distinct Quaternary races has already been determined. The existence of Tertiary man also, without being yet fully demonstrated, has been rendered highly probable, especially by the researches of M. Capellini. A detailed account is given of all the known Quaternary races of Western Europe, based mainly on the fossil remains collected by M. de Baye in the artificial caves explored by him in the department of La Marne.—Note on the freezing point of alcoholic solutions, by M. F. M. Raoult. In accordance with the general law established by the author, the soluble bases are shown to belong to two distinct groups, one presenting a molecular lowering of the freezing point comprised between 33° and 48°, with a mean of 39°; the other lying between 16° and 20°, with a mean of 19°.—Report on the results of the treatment of the vines attacked by phylloxera in the Maritime Alps, by M. Laugier. The report speaks favourably of the experiments made during the years 1881-83 with sulphuret of carbon and sulphocarbonate of potassium.—On certain equations connected with surfaces of constant curvature, by M. G. Darboux.—Determination of the equivalent of nickel by means of its sulphate, by M. H. Daubigny.—On a process for detecting by chemical analysis the traces of blood in clothes that have been washed, by M. C. Husson.—A comparative study of the excitability of the surface and deeper parts of the brain, by M. Couty.—On the spermatogenesis of podophthalmous crustaceans, and especially of the decapods, by M. G. Herrmann.—Note on the anatomy and physiology of the Sacculine and the allied genera Peltogaster and Lernæodiscus, by M. Yves Delage.

BERLIN

Physical Society, October 19.—Dr. Frölich made a report on measurements of solar heat executed by him in continuation of observations he had made at an earlier date, according to the method he was still pursuing, on the temperature of celestial space. Observations on the temperature of the earth's surface had led him to the conviction that solar heat, the principal source of the temperature of the earth, must pass through very rapid oscillations, which were in all probability connected with the quick movements on the solar surface that had been brought to light by the new methods of investigation. To establish these variations beyond all doubt required long-continued observations of the sun's heat by means of trustworthy instruments remaining invariable for years. Thermoelectric piles provided with due protective apparatus could alone be deemed instruments of this description. Mr. Langley's bolometer was not adequate for any length of time, the electric resistance of thin metal plates being liable to very rapid variations. The thermoelectric pile he had made use of was inclosed in a wide, double-walled pipe, opening in front in the shape of a funnel, in which circulated a constant stream of water of atmospheric temperature. The exposed front end of the thermopile was closed by a plate of rock salt, and the whole was set up in such a manner that it could turn in a frame, which itself might be turned in all directions and closed by means of a Venetian shutter. The whole apparatus was capable of revolving in all directions. The thermopile and the galvanometer of Siemens and Halske's recent construction were perfectly trustworthy instruments, as Dr. Frölich had repeatedly convinced himself. There now remained the task of finding a standard for the solar heat. For this purpose preparatory experiments were instituted with luminous heat generators—a glowing platina sheet and an electrical glow-lamp of older construction. These experiments, however, came to nothing. At last recourse was had to dark heat, such as was produced from a hollow screen filled with steam, one side of which is blackened with smoke, and the other whitened with chalk. With these apparatus measurements of solar heat were taken on perfectly clear days under a bright sun at very different points of the sun's altitude, and were represented by curves, the abscissæ of which showed the thickness of the transmitted atmosphere; the ordinates, the observed warmth of the sun. Under favourable conditions the curve formed a straight line, which, when extended to zero of the abscissa, furnished the measurement of the solar heat without atmospheric absorption. The measurements were at first attempted to be taken at the Berlin Observatory, but were found to present so many irregularities and oscillations in consequence of the situation of the Observatory in the midst of the city and the constantly vaporous and dusty state of the atmosphere surrounding it that they had to be discontinued there. Better and more regular results were obtained from observations made at a house in the western suburbs. The best and most conclusive measurements, however, in which the errors of observation were reduced to 1 per cent., were obtained from a tower in the West End near Berlin, where, throughout six days of the past summer, curves were registered approximating very closely to a straight line. One single measurement executed on the Faulhorn at a height of 9000 feet yielded a perfectly straight curve. The six measurements distributed over the months of June, July, August, September, and October, showed considerably different results in the different months. Dr. Fröhlich caused Dr. Lohse, who had been taking daily photographs of the sun at the Potsdam Observatory, to supply him with data regarding the presence of sunspots in the last months. From these data Dr. Fröhlich found that the lower degrees of solar heat corresponded with numerous formations of spots, while the higher gradations of heat were attended with fewer sunspots. In this coincidence Dr. Frölich was disposed to see a sequence of cause and effect. It would be necessary, however, to accumulate a large number of observations, and in particular to take them at elevated stations before any definitive judgment could be passed respecting the influence of sunspots on solar heat.

CONTENTS

PAGE
Zoology of the North Atlantic Expedition 25
A Bushel of Corn. By Prof. John Wrightson . . . 26
Our Book Shelf:—
Anderson's "Catalogue and Handbook of the Archæological Collections in the Indian Museum" . . . 27
Letters to the Editor:—
The Green Sun.—**C. Michie Smith; Dr. Warren De La Rue, F.R.S.; S. S. T.; Nathl. Bernard Beardmore** 28
The Division of the Circle.—**Antoine d'Abbadie** . . 28
Christian Conrad Sprengel.—**Dr. H. A. Hagen** . . 29
"Challenger" Zoological Reports.—**F. Buchanan White** 29
Barytes from Chirbury.—**H. A. Miers** (*With Diagram*) 29
"Anatomy for Artists."—**An Art Student** 30
Meteor.—**J. M. Hayward** 30
The Java Eruption and Earthquake Waves. By J. T. Bealby 30
The Literature of the Fisheries Exhibition 33
The Paris Observatory Equatorial (*With Illustration*) 36
The Institution of Mechanical Engineers 38
Nordenskjöld's Greenland Expedition, II. By Baron A. E. Nordenskjöld 39
The Vienna International Electric Exhibition . . . 42
Notes 43
Our Astronomical Column:—
Pons' Comet 45
Tempel's Comet, 1873 II. 45
A New Star Catalogue 45
The Oban Pennatulida. By J. T. Cunningham . . 46
Notes from the Otago University Museum. By Prof. T. Jeffery Parker 46
University and Educational Intelligence 46
Scientific Serials 47
Societies and Academies 48