THURSDAY, JUNE 26, 1884

SCIENCE AND THE WOOLWICH AND SANDHURST EXAMINATIONS

It will be known to most readers of NATURE that after 1884 considerable changes will be made in the various subjects in the examinations for admission to Sandhurst, and it is generally understood that an extension of similar changes to the examination for Woolwich is in contemplation. When these changes were announced, those interested in the matter at once saw that one of their chief effects would be to greatly discourage science teaching in our schools, &c., in consequence of the extremely low marks allotted to it under the new scheme. Representations were made on the subject at the War Office by the President of the Royal Society, and subsequently it was stated in the House of Lords, in reply to a question put by Lord Salisbury, that the final position of the subjects is still under consideration. As there is every reason to suppose that the object of the War Office authorities is to secure as good an examination as possible, and as they can have no possible reason for wishing to discourage scientific candidates only because they are scientific, it would seem that the present is a favourable opportunity for bringing the subject into public notice. The following are perhaps the most important points in connection with it:—

1. How far the choice of subjects made by the candidates has hitherto been affected by the marks allotted to them, and hence in what degree the new regulations or any similar regulations will influence science studies in our public schools.

2. How far it is true that science subjects have been good (?) cram subjects, since from the discussion in the House of Lords it appears to be considered by the War Office authorities that they have been good cram subjects.

3. To what extent the subjects examined and their grouping is at present satisfactory, and in what respects they would be better for amendment.

4. Whether the standard of the examination is, as has been urged by some, too high.

In the consideration of 1 and 2 the statistics of past examinations will give much help; 3 and 4 are, no doubt, to a greater degree matters of opinion.

I. As the result of tabulating the proportions of the successful candidates who have selected each subject in the competitions for entrance into Woolwich and Sandhurst during the years 1880, 1881, 1882, 1883, very interesting information has been arrived at, which is given in a condensed form in the tables below.

Only the selections made by successful candidates have been considered, for on the whole they will show best which subjects have been most conducive to success. And as the marks allotted to the subjects are different in the two examinations, they afford a good criterion by which to judge in what way marks have during the last four years affected the selection of subjects. Compulsory subjects are not included. The percentages relating to Woolwich are calculated from data which include all the examinations in the years 1880, 1881, 1882, 1883. Those concerning Sandhurst are from data not quite so complete, but, as the larger tables from which these are taken exhibit considerable regularity, this is not of material importance.

		Mathematics	English	Latin	Greek	French	German	Experimental Science	Geography, Geology, &c.
SANDHURST	Marks allotted...	3000	3000	3000	2000	2000	2000	2000	2000
	Percentage of successful candidates taking the subject......	70	91	73	22	91	25	8	19
WOOLWICH	Marks allotted...	4000	2000	2000	2000	2000	2000	2000	2000
	Percentage of successful candidates taking the subject......	97	60	52	29	97	46	22	24

The influence of the maximum marks allotted to the subjects is perceptible at a glance. The increased marks given for mathematics in the Woolwich competition raises the proportion of those who take up that subject from 70 per cent at Sandhurst to 97 per cent. at Woolwich. Similarly English and Latin are selected by 60 per cent. and 52 per cent. at Woolwich, where the maximum is 2000, against 91 per cent. and 73 per cent. at Sandhurst, where the maximum is 3000. And Greek, German, and Experimental Science are taking 29 per cent., 46 per cent., and 22 per cent. at Woolwich, where there is the same mark as for English and Latin, against 22 per cent., 25 per cent., and 8 per cent. at Sandhurst, where English and Latin have the higher mark of 3000, and the others only 2000. The positions of French is peculiar, but we observe the relatively better marks given in the Woolwich competitions has its effect, though there is less room for much increase. The selection of French by so large a proportion of the successful candidates both at Sandhurst and Woolwich, is probably largely due to the circumstance that it is taught in nearly all divisions of our schools, and that it is often begun earlier than Greek, German, and science, so that when candidates select the subjects they will study for these competitions, they already very often have made some progress in French and much less in the other subjects. Statistics, however, seem to show that French is more liberally marked than some of the others.

In the remaining subject, General and Physical Geography and Geology, there is a similar though smaller increase in the number of candidates taking it at Woolwich examinations, where its mark value is higher than at Sandhurst. This is just what the opinions of teachers have foretold. They say to do poorly in a subject counting 3000 will pay so much better than to do well in one counting only 1500, that in future nearly all candidates will take up the four subjects which are to count 3000; some who are very weak in one of these will take one of those marked 2000; and the rest of the subjects, including the science, they do not see their way to using at all. Accordingly, science teachers, even in those schools where science is most valued, are already hearing proposals to drop the regular science work hitherto done by boys who are looking forward to joining the army, and to substitute for it extra Latin. In other words, the new regulations are already discouraging general education and encouraging an unfortunate system of specialisation.

II. The proportions of candidates who have chosen one of the branches of experimental science in these examinations show clearly that they are not generally regarded as paying subjects. At Sandhurst especially it is quite evident that there has been no considerable success in consequence of cramming in this subject. It has plainly not been worth while to cram it, nor to teach it for this examination, except in a few cases. At Woolwich under fairer conditions, it has been chosen by a greater number. Experience shows that in the Woolwich examinations candidates of real scientific ability who work well can do fairly, but only fairly, well, and accordingly such candidates are encouraged in those schools where science is taught to take up experimental science unless they are decidedly strong in some other subject. But the marks they get, even when successful, are not such as to encourage its adoption by any except those of a scientific ability quite above the average, and these do not want cramming. For example, a candidate standing second in order among the experimental science candidates lately obtained only 33 per cent. of the nominal maximum. And in one subject, chemistry, lads of such ability as would give them a fair chance of scholarships at our Universities had they time for sufficiently wide reading, will usually fail to get marks more than slightly exceeding 40 to 50 per cent. of the maximum, with the greatest diligence, even though their position on the list of experimental science candidates is a good one. These facts, and the absence of any rush on the subject seems quite inconsistent with the charge that experimental science has been a subject in which there has been much successful cramming—some there has no doubt been in this and in all subjects; candidates who have first-rate memories, and only moderate intelligence, will from time to time succeed by sheer industry in these and in all other competitions. Probably mathematics and experimental science suit these less than any other subject.

Geography, physical geography, and geology have been selected by rather more candidates both at the competitions for Sandhurst and Woolwich. From the nature of this subject it seems not impossible that there has been cramming in preparing for it. If so, the evil could surely be met, possibly by the changes proposed in Section III., combined with great care in setting the papers, and by the introduction of a *vivâ voce* examination.

III. As physiology is now extensively studied in the Universities, whence some of the Sandhurst candidates come, and is successfully taught in at least one great school—Eton—it is a question if the time has not come when it should be added to the science subjects examined.

And as practical physics is now taught in some schools, and examined at the scholarship competitions at Cambridge, it would be a gain if there could be a practical examination for candidates who take up physical subjects as there is for those who take up chemistry. This would act as a check on cramming, and would encourage students of a practical turn, and would encourage, as its absence discourages, this valuable branch of work in our public schools. One subject, chemistry, is encumbered by the addition of heat to it. Chemistry would be at least as difficult as the other divisions without this addition; with it, and its practical examination, it is in a most unfair position. It would probably be advantageous to add light to heat, and make them a new division. The scheme would then stand as follows:—

DIVISION *a.—Experimental Science*

1. Chemistry. With a practical examination.
2. Light and Heat. ,, ,, ,,
3. Electricity and Magnetism. ,, ,,

DIVISION *b*

1. Physiology. With some practical work.
2. Geography, Physical Geography, and Geology. With a *vivâ voce* examination on specimens.[1]

Candidates might be allowed to take one subject in Division *a* and one in Division *b*, which would be in accordance with the present plan at Woolwich, but would give greater choice of subjects. It would also be much fairer to one much-taught subject—chemistry.

IV. The very small proportion of the candidates for Sandhurst who select experimental science does suggest that in this case too high a standard is perhaps expected by the examiners, though it is probably a question of marks to a great extent. But with this exception, and if that very difficult subject, chemistry, were relieved of the addition of heat, on the whole it does not appear that the standard expected is much too high. It is true that there are other subjects marked more liberally; yet on the whole a high standard is more in the interests of science than a low one. The latter would encourage superficial teaching, and so lead to the discredit of the subject. Hitherto candidates of good scientific ability have been able to take advantage of their science at Woolwich if well taught, and if proper appliances for the work have been available. There does not seem therefore much ground for complaint on this score, though there has been a certain want of regularity in the marks awarded to similar boys in different subjects and at different examinations, which would probably be to a great extent removed if two papers instead of one were set on each subject, the papers being as far as possible of different characters. It has, however, been only just possible, even under the Woolwich system, for the scientific candidates to take up experimental science with the present standard of knowledge demanded, and a small difference in raising this standard or depressing the marks allotted to it would undoubtedly have very serious effects. The fairest method of allotting marks seems to be that adopted at Woolwich, where mathematics, which are essential, are marked above the rest, and the others are all upon an equal footing, free choice being allowed. To offer 3000 marks for four subjects, 2000 marks for two others, and 1500 for the rest, and to limit the candidates to four subjects, is equivalent to cutting out those for which 1500 are given, especially when it is a condition that of the four subjects selected three shall be taken from those for which 3000 marks are given, and only one at most from all the others. No doubt other plans which would be more satisfactory than that which has been employed at Woolwich could be suggested. But it is certain from past experience that a scheme of examination on the lines of the new regulations will seriously discourage the teaching of science in our public schools, and indeed will tend to narrow the instruction they give in all respects.

[1] Probably if the Geography were dropped and a higher standard of knowledge in the other two subjects were demanded, it would discourage superficiality, the Geography being retained in the preliminary examination, however, as a qualifying subject.

PROFESSOR TAIT'S "HEAT"

Heat. By P. G. Tait, M.A., Professor of Natural Philosophy in the University of Edinburgh. (London: Macmillan and Co., 1884.)

A TREATISE on heat by one so eminent, both as physicist and teacher of Physics, needs no apology, and yet no doubt the author is right in stating that his work is adapted to the lecture-room rather than to the study or the laboratory. Freshness and vigour of treatment are its characteristics, and the intelligent student who reads it conscientiously will rise from it not merely with a knowledge of heat but of a good many other things besides.

"If science," says our author (p. 368), "were all reduced to a matter of certainty, it could be embodied in one gigantic encyclopædia, and too many of its parts would then have . . . little more than the comparatively tranquil or, rather, languid interest which we feel in looking up in a good gazetteer such places as Bangkok, Ak-Hissar, or Tortuga." Not a few text-books of science are precisely of the nature of such a guide without its completeness, and while they carry the student successfully to the end of his journey, the way before him is made so utterly deficient in human interest that he reaches his goal with a sigh of relief, and looks back upon his journey with anything but satisfaction—as a task accomplished rather than as a holiday enjoyed. Now the presence of such a human interest is the great charm of the work before us. It may be a fancy on our part, but we cannot help likening our author to the well-known guide of Christiana and her family. Both have been equally successful in the slaughter of those giants whom the older generation of pilgrims had to find out for themselves and encounter alone. But here the likeness ends, for it is quite certain that those who place themselves under the scientific guidance of our author will not be treated like women or children, but they will be taught to fight like men. And surely to combat error is an essential part of the education of the true man of science, for, if not trained up as a good soldier of the truth to defend the king's highway, he will be only too apt to turn freebooter, and gain his livelihood by preying on the possessions of others.

The first chapter contains the fundamental principles. "Heat," says our author, "whatever it may be, is SOMETHING which can be transferred from one portion of matter to another; the consideration of temperatures is virtually that of the mere CONDITIONS which determine whether or not there shall be a transfer of heat, and in what direction the transfer is to take place."

Then follows a preliminary historical sketch of the subject, the result of which is that heat is now proved to be a form of energy. Again: "The mechanism upon which heat-energy depends is (probably at least) approximately known so far as regards heat in a gas and as regards radiant heat. Beyond these we have, as yet, little information on the subject."

The following is a digression by the way:—

"There can be no question about the fact that the *metre* is inconveniently long, and the *kilogramme* inconveniently massive, for the ordinary affairs of life. The average length of the arms of shop-girls, and the average quantity of tea or sugar wanted at a time by a small purchaser, have no conceivable necessary relation to the ten-millionth part of the quadrant of the earth's meridian passing through Paris, or the maximum density of water. But the standard *yard* and *pound* were, no doubt, originally devised to suit these very requirements as regards the average dimensions of the shop-girl or the paying powers of the ordinary customer. Yet this invaluable superiority of our *units* over those of the metrical system is, with an almost over-refinement of barbarism, thrown away at once when we come to multiples or submultiples."

It may be desirable to quote the author's own words regarding his classification of different kinds of heat:—

"In the first place, we have absolutely no proof that radiation from the sun is in any of the forms of energy which we call heat while it is passing through interplanetary space. That it is a form of energy, and that it depends upon some species of vibration of a medium, we have absolute proof. But it seems probable that we are no more entitled to call it heat than to call an electric current heat; for, though an electric current is a possible transformation of heat-energy, and can again be frittered down into heat, it is not usually looked upon as being itself heat. Just so the energy of vibrational radiation is a transformation of the heat of a hot body, and can again be frittered down into heat—but in the interval of its passage through space devoid of tangible matter, or even when passing (unabsorbed) through tangible matter, it is not necessarily *heat*."

That this is not a mere question of words may be seen from the following considerations. According to theory, all kinds of radiant heat, whether these have issued from a source of high or from one of low temperature, are in presence of an absolutely black surface at once and entirely converted into absorbed heat. On the other hand, absorbed heat is only entirely converted into radiant heat when the body from which it issues has been cooled down to the absolute zero of temperature, a condition which is practically unapproachable.

The following are the subjects which appear to us to be treated in the most original manner:—Thermo-electricity, combination and dissociation, conduction, convection, and radiation, discussion of isothermals and adiabatic lines. In the development of thermo-electricity and of conduction the author has taken a prominent part, and probably we must blame the late mild winter for our not hearing more about his latest research regarding the effect of pressure upon the point of the maximum density of water.

We cannot do justice to such a book in the course of a short notice like the present; we will therefore content ourselves with a few quotations and remarks. The following (p. 72) is an excellently clear definition of an isotropic body:—

"An isotropic body is one from which, if a small sphere were cut, it would be impossible to tell by any operation on it how it originally lay in the solid—it has, in fact, precisely the same properties in all directions."

In p. 91 an increase in clearness is produced by giving the coefficient of dilatation of mercury at various temperatures under three different heads, namely, mean coefficient of dilatation from 0°, coefficient referred to volume at 0°, true coefficient. The following statement will be found useful to meteorologists:—

"Vertical (convection) currents at definite places may be at once produced either by heating the requisite part of the lower portions of a fluid mass, or by cooling that of the upper portions. But the effects of cooling part of the lower portions, or heating some of the upper, are usually much less important. Hence the grander phases of *ocean circulation* (except in so far as they depend on winds, and therefore on *atmospheric circulation*) are much more dependent upon polar cold than upon tropical heat. On the other hand, those of atmospheric circulation depend more upon tropical heat than on polar cold. For the great temperature effects are produced mainly at the upper surface of the ocean, and at the lower surface of the atmosphere. Hence, if there were no great modifying causes, we should expect to find (on the whole) the lower water, as well as the lower air, coming from both sides towards the equator, and the upper currents of each flowing to the poles."

Chapter XXI. is entitled "Elements of Thermodynamics." The subject is nevertheless treated in a very complete manner, and is evidently regarded by our author as something in the shape of a *header*. We gather this from the very characteristic invitation to take the leap which is addressed to the student in Art. 381. We shall not, however, repeat the invitation, but rather leave the reader to find it out for himself and then—take the leap.

Let us conclude with one more quotation :—

"We have merely to think of the ideas which we try to express by such words as Time, Space, and Matter, to see that, however far discovery may be pushed, our little 'clearing' can never form more than an infinitesimal fraction of the 'boundless prairie.' No part of this, however, can strictly be called inaccessible to unaided human reason, if time and patience fail not. But far beyond in one sense, though in another sense ever intimately present with us, are the higher mysteries of the true Metaphysic, of which our senses and our reason, unaided, are alike unable to gain us any information."

While cordially indorsing these views, the writer of this notice would remark how admirably fitted is such a science as Physics for the discipline of the human mind. It possesses that boundlessness which is the *ultimate* characteristic of all true knowledge, and this is so obvious that few are bold enough to represent our "little Physical clearing" as bounded by an "impenetrable wall" or by the "abyss."

The scientific incendiary (to change the metaphor somewhat) prefers to confine himself to regions where there is a large collection of inflammable materials, until at length his attempts are brought to an end by the copious stream of cold water with which the physicist is able to deluge the scene of his exploits.

BALFOUR STEWART

OUR BOOK SHELF

Beiträge zur Kenntniss der Liasischen Brachiopodenjauna von Südtyrol und Venetien. Von Hyppolyt Haas, Dr. Phil., Privat-docent an der Universität Kiel. Mit 4 lithographirten tafeln. 4to. (Kiel: Lipsius und Tischer, 1884.)

THIS is one of the numerous works which have been published during the last half century on the fossil forms of Brachiopoda, that most ancient, abundant, and anomalous class of the Invertebrata. Dr. Davidson has devoted the greater part of a tolerably long life to the study of this exceedingly interesting group; and the volume of the Palæontographical Society's publications for the present year will complete and close his valuable labours on the fossil Brachiopoda of Great Britain. He has kindly furnished me with the following critical notice of Dr. Haas's work, the title of which is above given :—

"Dr. Haas describes in his memoir some 40 species of Liassic Brachiopoda, and of which number 12 are new. In four admirably drawn quarto plates he gives figures of 32 species. The Liassic Brachiopoda from South Tyrol and Venetia are very remarkable, and have in part been described and beautifully illustrated by Gemmellaro, Böckh, Uhlig, Meneghini, Canavari, Oppel, Zittel, and Schmid; *Waldheimia perforata*, Piette, and *Spiriferina rostrata*, Schl., being the only species out of the number that occur in the Liassic rocks of Great Britain. Dr. Haas's work adds much to our knowledge with respect to the Liassic Brachiopoda, and his descriptions have been carefully drawn up. In 1881 and 1882 Dr. H. Haas and Dr. Camille Petri published a very important work, entitled 'Die Brachiopoden der Juraformation von Elsass-Lothringen,' accompanied by 18 beautifully drawn quarto plates. In this work the authors describe some 92 species from the Lias and Inferior Oolite, and of which a large proportion occur likewise in our British rocks. It is to be hoped that Dr. Haas will continue his valuable researches among the Brachiopoda."

"Non meus hic sermo!"

J. GWYN JEFFREYS

Tricycles of the Year 1884. By H. H. Griffin. (London: L. Upcott Gill, 1884.)

WHATEVER improvement in health and strength may have resulted from the now prevalent exercise of cycling, there seems to be a mental improvement, for a knowledge of the science of mechanics is more widely spread, or at any rate there is a more general desire to understand this science in so far as its application to the bicycle and tricycle is concerned. For this reason such a book as Mr. Griffin's "Tricycles of the Year" is likely to be of value, for in it he describes in simple language most of the tricycles which can now be obtained, giving particulars of dimensions and weight, and other information which a cyclist may require.

It is a pity that many well-known machines are not so much as mentioned, among which are the "Rudge," the "Cheylesmore," and the direct-action machines. Is it that there has been no improvement in any of these since last year? If so, why should the "Oarsman" be omitted or some others be described at length?

The good qualities and advantages of each machine are set forth plainly enough, while the defects are left to be discovered by riders. The author has no doubt acted wisely here; it would be next to impossible in dealing with such a multitude of often similar machines to make comparisons which cyclists who hold opposite opinions would not consider unfair.

The action of parts that are peculiar to any machine is carefully described, figures being inserted where necessary to make the text more comprehensible. The general appearance which many tricycles present is shown by a series of woodcuts.

Bicycles are not discussed, as they form the subject of a corresponding work. C. V. B.

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.*]

Chalk and the "Origin and Distribution of Deep-Sea Deposits"

I LOOKED forward with great interest to the conclusion of Messrs. Murray and Renard's "Origin and Distribution of Deep-Sea Deposits," hoping that some useful comparisons would have been made between the present sea-beds and the Chalk, the Gault, and the Greensands, which appear to be among the deepest water deposits now accessible as dry land. Instead of this we are merely told that chalk "must be regarded as having been laid down rather along the border of a continent than in a true oceanic area" (NATURE, p. 134). All geologists are aware, since the publication of Dr. Gwyn Jeffreys' address to the British Association, and the appearance of Mr. Wallace's "Island Life," that some naturalists regard the Chalk as a shallow-water formation, but the former opinion, pronounced as it was by one of the most competent judges, was based exclusively on the present habits of the very few genera of Mollusca that have survived from the Chalk period, and seems quite in contradiction to the far more important groups, the Sponges, Echinodermata, and the minute organisms of which the formation is so largely composed, while no opinion has yet found its way into the hands of geologists regarding the depth of water indicated by the Crustacea and the fishes of the Chalk. Mr. Wallace's collation of the Chalk, as a formation, with the decomposed coral mud of Ooahu, is so fantastic as to have failed to carry conviction to the mind of any competent geologist. The points of resemblance between some Globigerina ooze and the Chalk are so numerous and peculiar, that surely the assertion that the latter is a littoral formation, while the former is oceanic, requires strong support. The relative analyses of chips from the Chalk and of Globigerina ooze, quoted by Mr. Wallace, are not by any means final or conclusive. We all know that the silica has been removed and segregated into flints from the White Chalk at Shoreham, and that the iron and other metals are also segregated into crystallised masses, so that a comparison of the Chalk, minus these, is misleading. In like manner the Grey Chalk at Folkestone has lost all its oxide of iron by segregation and crystallisation, and many of the layers are cherty, and unduly rich in silica obtained probably at the expense of other layers in which it is now relatively scarce. During the ages that Chalk has been elevated and has acted as a sponge for the collection of rain water, who can say what other of its constituents may not have been dissolved away or metamorphosed? Siliceous sponge skeletons have been replaced by calcite, calcite shells have been replaced by silica, whilst aragonite shells have been entirely dissolved away. In like manner, can it possibly be contended that the absence of volcanic matter in the Chalk is an important distinction between it and Atlantic ooze? It is an accidental lithological distinction, but nothing more, and merely shows that volcanic dust was not being ejected in the same masses as at present. The Cretaceous and Eocene eruptions, so far as I am aware, are all fissure eruptions of vast magnitude, and the contemporary rocks in their vicinity seem to show that they were not accompanied by the showers of ash that mark eruptions from craters at the present day. Messrs. Renard and Murray have had exceptional opportunities of studying this question, and have no doubt convincing proofs of their statement regarding the littoral character of the Chalk deposit; but I really think that, considering the national character of the undertaking which made the collection of proof possible, it should no longer be withheld. Geologists at present, supposing my feelings are generally shared, are asked to believe that an enormous formation, which shows little, if any, trace of the proximity of land, and abounds with the remains of deep-sea life, was laid down upon a coastline; but beyond the extravagant assertion that it is decomposed coral-mud no reasons whatever for this belief are brought forward, nor are any areas pointed out in which an equivalent to the Chalk is in course of deposition. I cannot conceive why our official geologists have ignored this, one of the most important questions in the whole range of the science. It is little to our national credit that, having spent vast sums in the collection of evidence, we are still in the dark as to its geological significance.

J. STARKIE GARDNER

A Rhyolitic Rock from Lake Tanganyika

THE interesting note by Dr. H. J. Johnston-Lavis on a volcanic rock from the shores of Lake Nyassa (NATURE, p. 62) calls to my mind a couple of specimens in my collection which, with not a few others of interest, have perforce remained for some time undescribed. They were given to me by N. F. Robarts, Esq., F.G.S., who received them from Capt. Hore of the London Missionary Society, by whom they were collected at Cameron's Bay on the south-west of Lake Tanganyika, a little north of the Lofu River. As they are evidently fragments of the same kind of rock, I have only had a slide prepared from one of them. The rock is externally of a pale yellowish- to reddish-gray colour; compact, but exhibiting faint traces of a fluidal structure, with occasional spots resembling small crystals of decomposed felspar. A fresh broken surface, however, shows the real colour to be a purplish brown, streaked and mottled with a pale reddish tint. Microscopic examination shows that the rock is a rhyolite, somewhat darkened with numerous specks of disseminated ferrite, with many clearer bands, indicative of a fluidal structure. In this matrix are scattered crystals of decomposed felspar, not exceeding ·1 inch in diameter, and a few plates of a ferruginous mica, also exhibiting signs of decomposition, with two or three granules of quartz. With crossed Nicols a minute devitrification structure is exhibited by the slide as a whole, and this is coarser and stronger in the clearer bands. Here crystalline quartz is developed, which assumes with the felspars on occasion a spherulitic or sometimes approximately micrographitic structure. The larger felspar crystals are rather decomposed, but orthoclase and a plagioclastic felspar can be recognised. Many distinct granules of iron peroxide (? hæmatite) are scattered about. Examination with high powers causes me to doubt whether the devitrification is complete in all parts of the slide, and whether the phenomena are not rather due to the development of a large number of minute crystallites of not very regular form in an isotropic base. In this, however, there is nothing exceptional.

From the structure I should consider it more probable that the specimen had been taken from a flow than from a dyke. I should suspect the devitrification structure to be the result of secondary change, and the rock not a very modern one. In some respects it reminds me of the pre-Cambrian rhyolites (devitrified) of Britain, but I should think it had not quite so high a percentage of silica, *i.e.* that this did not exceed 70, and perhaps was rather less. Among the rhyolitic rocks which I described from Socotra (*Phil. Trans.* 1883, p. 273), collected by Prof. I. B. Balfour, were some of a rather dark purple colour, not unlike to this specimen from Lake Tanganyika.

T. G. BONNEY

Aseismatic Tables for Mitigating Earthquake Shocks

IN Mr. Topley's paper on the Colchester earthquake, which appeared in NATURE, vol. xxx. p. 60, he mentions the aseismatic joint designed by my father, Mr. David Stevenson, for mitigating the effects of shocks on lighthouses in countries subject to earthquakes, and from information which Mr. Topley has received and cites it would appear that the appliance had been tried in Japan, found wanting, and abandoned. The facts of the case, however, are as follows, and are supplied to me by Mr. Simpkins, who was engaged in fitting up the apparatus sent out from here, and has only recently returned from Japan. Of the seven lighthouse apparatus designed by Messrs. D. and T. Stevenson and furnished with the aseismatic joint and sent out to Japan, there are three at present in action, and have been so for ten years, viz. Mikomoto, Siwomisaki, and Yesaki. At Iwosima and Satanomisaki, in the south end of the island, the tables are screwed up so as not to act, as it is reported that no earthquakes are felt at these stations. At Tsuragisaki and Kashmosaki, which are revolving lights, the steadying screws sent out with the apparatus (to prevent the table oscillating while winding up the machine, which is the main inconvenience felt, and which was foreseen) were for some reason not put in at these stations, and the tables were firmly strutted with timber to prevent any motion. These two are the only lighthouses at which any damage has been done; while those stations at which the tables are in operation have never suffered at all, although they have been repeatedly subjected to shocks.

With regard to the effect of wind, to which Mr. Topley alludes, I may say that none of the *towers* are placed on tables, it is only the *apparatus* inside the lantern which is so treated, although my father proposed it for the towers themselves, and I have no doubt that, from the experiments I saw made here, they would have been equally effective. Two towers fitted with the tables were made and sent out to Japan, but were unfortunately lost at sea and not replaced.

CHARLES A. STEVENSON

45, Melville Street, Edinburgh, June 16

The "Cotton-Spinner"

ON seeing my article on this rare British Holothurian, Mrs. Fisher—who, as Miss Arabella B. Buckley, is well known to a large circle of readers—kindly sent me an account of her experience of the offensive use of the Cuvierian organs. She tells me that in the Bay of Rapallo at Santa Margherita, near Porto Fino, she dredged a large black Holothurian, and that "the tangled mass of white threads you mention is *so* sticky and in such quantity that, after having taken one of these animals out with my hand, I had considerable difficulty in freeing my fingers from the threads; indeed, my hand was not comfortable till I had washed it in hot water." On the other hand, an inquiry made of a gentleman living at Penzance, and interested in Echinoderms, resulted in the answer that he had never heard of the "Cotton-Spinner." F. JEFFREY BELL

The Red Glow

IN your issue of April 10 (p. 549) is the statement by an observer in Australia that the "*red glow* was margined by an *immense black bow* stretching across from north-west to south-east."

I wish to say that the above language almost exactly describes the appearance to which I alluded *on the same page* as "the *earth shadow* cutting off the upper rim of the first glow." The "black bow" of the Australian was evidently the shadow of the horizon projected on the haze stratum. In both the above cases the lower surface of the haze was evidently well defined, so that as the horizon intercepted the direct rays of the sun, a well-marked shadow moved westward and downward. Above this black rim or bow appeared the *secondary* glow, produced by the reflection of the sun's rays from that portion of the haze surface which was directly illuminated. Very often the second glow was more conspicuous and impressive than the first, because it shone against the dark sky of night.

In the *Proceedings* of some association I have just read an astonishing estimate of the height of the haze as 141 miles, based on the fact that it received the sun's rays one hour after sunset, the fact being strangely overlooked that the late reflection was a *secondary* one.

One evening the shadow or "black bow" was beautifully indented or serrated, doubtless by the shadows of remote cumuli such as are commonly seen in platoons on our evening horizons. The "black bow" was seen only during the first few days of the glows in September. S. E. BISHOP

Hawaiian Government Survey, Honolulu, May 20

P.S.—I hoped long ere this to have sent you data from the Caroline Islands received per *Morning Star*, now much overdue. We fear she has suffered disaster.

Light Phenomenon

THIS evening towards sunset, at 7.55 p.m., there was a column of light extending from the upper part of the setting sun to about 20°, the column being truncated and perpendicular to the horizon. After remaining thus for about two minutes, the sides of the pillar lost somewhat of their perpendicularity, and, with the whole volume of the sun, put on prismatic colouring, the ray (a single one, and still truncated) at times appearing to be a wave of flame. I observed this, with four or five other persons, from the cliffs, and should like to know if the peculiarity of this sunset was observed by others. It continued until 8.20 p.m., when the sun was below the horizon, and the wave of flame ceased. I can hardly better describe this ray than as being very like a northern light, only extremely circumscribed in size, and intensely brilliant. R. D. GIBNEY

Falmouth, June 21

Atmospheric Dust

IN connection with the recent experiments of Dr. Lodge and Mr. John Aitken (described in late numbers of NATURE) on the filtration of dusty atmospheres, I have ventured to call your attention to the following, as of possible interest. I have had frequent occasion to note the intensity of the so-called "rain-band," an absorption-band of terrestrial origin, due probably to the dust and water-vapour present in the atmosphere, and of just less refrangibility than the less refrangible of the D lines, and have at present two continuous records of observations taken, in the main, five times a day, running back a year and a half or so. I have also a very thorough list of the auroral displays which have occurred for the same period in this vicinity. Granting that the aurora is an electric discharge in high regions of the atmosphere, or, more accurately, where its density is inappreciable compared with that at the earth's surface, and knowing that according to these recent experiments an electric discharge is capable of precipitating the dust-particles in the atmosphere, it should follow that at times of auroral display, or immediately following, the intensity of this rain-band should be at a minimum. Searching the records to ascertain if any such correspondence could be noticed, it is quite astonishing to find how distinct and well marked this variation in the intensity of the rain-band at times of auroral occurrence is. The atmosphere is full of fine dust-particles, and our very general, though not yet decisively proven, belief is that the aurora is somewhat of a glow-like discharge from electrified air strata, in whose vicinity the density of the dielectric is inconsiderable. The direct inference is that at such times the fine dust and vapour particles are deposited, made to settle, or, uniting together, form an agglomeration, and become perhaps cloud-nuclei. Perhaps other evidence on this matter can be elicited. The records at hand show very plainly just such an agreement as was anticipated.

ALEXANDER MCADIE

26, Garden Street, Cambridge, Mass., U.S.A., June 5

Some Botanical Queries

THERE is a plant here with a very large bulb, *Scilla maritima* (?), whose flower I have not seen. I grew two of them in pots last year, but they failed. This plant is set by the peasants near the fig-trees with the idea that these latter will produce better fruit. Is this a mere superstition? or can the Scilla be connected in any way with caprification?

Is *Lilium bulbiferum* known to be polygamous? The greater part of the specimens I have found in the mountains near here are staminate, but in some there is a very minute though perfectly formed pistil. Müller, my only book of reference, says nothing on this point.

Is *Trifolium repens* among the list of cleistogamous plants? I am watching a specimen which seems to produce abundant fruit, but no ordinary flowers. LIGUS

Nice, France, June 20

Primæval Man and Working-Men Students

UNDER the above heading you published a letter from me in NATURE, August 2, 1883, p. 320, giving the names of four thoughtful artisans, who, after studying the Pitt-Rivers collection of antiquities, and reading my notes in NATURE, had made finds of Palæolithic implements in Essex. Ten months have passed since that letter was published, and a fifth student, Mr. W. Swain, has now joined the original party of four. On Sunday, June 15, these admirable workers called upon me with their recent discoveries. They consisted of fifteen Palæolithic implements found in the drift gravels of Leyton, Wanstead, and Plaistow, with the usual complement of flakes. Some of the implements were of the older abraded class, others were as keen as knives, and from my "Palæolithic Floor," traces of which, as I have pointed out, may be seen in Essex. Three nondescript tools were also lighted on, and four hammer-stones of quartzite with abraded ends, one from Nazing; five Neolithic instruments from Jordan's Wood, and a large collection of flakes.

The excursions for these tools and flakes have necessarily all been made on Sundays. The finders of the stones are not mere collectors, but men who have mastered the meaning of their subject. W. G. S.

FORESTRY

THE approaching International Forestry Exhibition at Edinburgh, which is to open on July 1 next, and which promises to be a very successful affair so far as the variety of the exhibits and the general arrangements of the Exhibition are concerned, will, it is hoped, prove something more than a mere show during the months it is open to the public. Though the objects exhibited will, in all probability, be a source of considerable attraction and instruction, inasmuch as the arrangement and scope of the several classes seem to have been carefully considered, it is much to be hoped that the Exhibition will be the means of leaving a lasting improvement on the condition of forestry in this country. One thing it certainly must do, and that is it will draw attention to the great importance of practical forestry in utilising and developing the resources of forest produce, and in directing attention to these products the eyes of many will be opened as to their value, whether to the consumer or to the producer. There is, however, a higher aim in the prosecution of scientific forestry than even these points just referred to, namely, the preservation of indigenous arboreal vegetation and the securing of a sufficient rainfall.

The superiority of our Indian Empire and many of the British colonies, as well as France and other countries of continental Europe, over Great Britain itself must, from the nature of things, be prominently seen in the forthcoming Exhibition, whether in the character of the exhibits themselves, or in the exemplification of forest workings. This, then, should bring some good results towards putting our own country on a more satisfactory footing regarding the teaching of the principles of forestry, so that we may not in the future stand in the unenviable position of being about the only country of any importance which has not its School of Forestry or some institution or college where the Government recognises the importance of the subject by a grant from the Imperial Exchequer. The position of England in this respect as compared with other countries was admirably shown by Col. Pearson in his paper on "The Teaching of Forestry," read before the Society of Arts on March 1, 1882. He then pointed out that, "besides the establishments for teaching forest management in Germany and France, schools of sylviculture now exist in all the principal countries of Europe except in Great Britain. Austria, Italy, Russia, Switzerland, and even Roumania, most of them, after sending pupils for a few years to the French and German schools, have set up schools of their own, and thus rendered themselves independent of foreign educational aid." After referring to the fact that America was at that time about founding a similar school, Col. Pearson says:—

"It is to be regretted that as yet no steps have been taken to do the same in Great Britain, for with us, as elsewhere, a forest school would become not only an establishment for teaching sylvicuture, but also a centre of study and practical observation from whence a knowledge of sylviculture as a science would be spread abroad for the benefit of society in general.

"It is certain that, unless the forests of a country are properly and economically managed, the time may come when, as was the case in India, it will find itself without the means of procuring the needful supply of timber, except at an extravagant price; while at the same time the general interests of the community require that a fairly abundant and cheap supply should be constantly available. This is especially the case where, as in the great continental areas, deficiency in the means of transport, or the distance from the timber-producing tracts, adds materially to its cost. In such cases experience has shown that the only practicable way out of the difficulty is for the State to intervene; and although in England we have special facilities for supplying our wants from abroad, owing to our extended commerce with all countries, the extreme limits of a reasonably cheap supply seem to have been reached; and at all events State action seems so far desirable as to help private proprietors to make the best use of their timber-producing lands."

Following on this, namely, in August last, Sir John Lubbock asked from his place in the House of Commons whether Her Majesty's Government, during the autumn then ensuing, would consider the question of forest education in this country, and whether the national forests might not be utilised for this purpose, taking occasion to point out that our woods and plantations amounted in round numbers to 2,500,000 acres, and, moreover, that in Scotland and Wales it was calculated that there were 5,000,000 or 6,000,000 acres at present almost valueless, which, if judiciously planted, would give large results, thereby showing that the subject was one of vast importance. Sir John Lubbock further said:—"We were the only important nation in Europe without a forest school, and yet if we included our colonies, our forests were the largest and most valuable in the world. It appeared to be a very strong argument in favour of the establishment of a forest school in this country that at present the young men who were going out to manage our Indian forests had to be sent for instruction to the great French Forest School at Nancy. No doubt that this was a most excellent institution, and we were indebted to the French Government for the courtesy with which they had received our English students; but the system of education given there naturally contained some branches—as, for instance, the study of French law—that were not adapted to English students, while there were many other considerations, such as climate, which rendered a Continental school less suitable for English requirements. He might add that no young Englishman as a matter of fact, went there excepting those intended for the Indian service. For our colonies, again, the establishment of a good forest school here would be of very great importance. A judicious management of their woods would add considerably to their income." As an illustration of the need of some system of forest teaching in this country, Sir John Lubbock referred to the recent appointment of a Forest Commissioner by the Government of the Cape of Good Hope at a high salary, a French gentleman having been selected in consequence of the failure to find a properly qualified Englishman.

India was perhaps the first country belonging to the British Empire to organise a complete system of forest conservancy, and this was not effected before it was absolutely needed, for many of the valuable timber trees of India were threatened with annihilation in consequence of the reckless manner in which they were felled to supply the wants of the people. The appointment of Dr. Brandis as Inspector-General of Forests, in 1863, was the commencement of a better state of things, "and in 1867 his scheme for training foresters for India in the schools of France and Germany was, after much discussion, adopted finally by both the Home and Indian Governments." The outcome of this is well known, and India now has a large and well-trained staff of educated forest officers, who not only furnish valuable and interesting periodical reports on the forests of their respective districts, but standard works on the subject of India's arboreal vegetation are not amongst the least important result of their labours. As a proof of this we need only mention the titles of Beddome's "Flora Sylvatica of Madras," published in 1873; Brandis's "Forest Flora of North-West and Central India," published in 1874; Kurz's "Forest Flora of British Burma," published in 1877, and last, though not by any means least, Gamble's "Manual of Indian Timbers," published in 1881.

Trained as Indian forest officers now are before commencing their duties, and with the books we have mentioned as their guides, it is not difficult to understand that our Indian Empire possesses a well-organised Forest Department, and many of the colonies are following, if not on exactly similar lines, the example set for the preservation of their forests. With all these indications around us that foreign countries and our own dependencies are fully alive to the importance of a proper management of their forests, it is not a little remarkable that we in this country are no farther advanced in the matter of establishing forest teaching here than we were two years since, when the subject was so strongly represented by Col. Pearson, or when nearly a year since Sir John Lubbock revived it, and placed the matter prominently before the present Government. It is therefore sincerely to be hoped that the forthcoming Exhibition at Edinburgh will be the means of putting a new spoke in the wheel, and that before the close of the Exhibition, or soon after, something tangible may have resulted in making forestry one of the branches of education either in distinctly constituted forest schools, or in our present agricultural colleges.

It is satisfactory to know that the arrangements of the Exhibition are in a forward state, and that, if the promises which have been received by the executive are fulfilled, the Exhibition will exceed the anticipations of the promoters. JOHN R. JACKSON

RAINFALL OF NEW SOUTH WALES[1]

UNDER the energetic direction of Mr. Russell the investigation of the rainfall of New South Wales is being prosecuted with much success, and the interest of the colonists may now fairly be regarded as awakened to the importance of the inquiry. This is evidenced by the recent rapid increase of stations, the number of rain stations for the five years ending 1882 being 96, 153, 191, 256, and 308, having thus trebled during this brief interval. A comparison of the maps of stations for 1878 and 1882 shows that the increase has been pretty evenly distributed over the whole colony; and of particular importance is it to note the spread of the rain-gauge over the extensive regions which lie to the north and north-west of the Murray River.

Mr. Russell draws pointed attention, in the following extract, to the practical value to the colonists of well kept rain registers:—

"As a proof of the necessity for the use of the rain-gauge all over the colony, not only for purposes of science, but also as a necessary instrument on every run, I may mention that on Goolhi station six gauges are kept on various parts of the run, and the records range from 19·81 inches to 27·75 inches. It would obviously lead to a false estimate of the grass the run would produce if only one gauge had been used, and that one where only 19·81 inches were recorded. I hope that the facts which the yearly records bring to light will have the effect of awakening those interested to the immense importance of collecting these statistics carefully and at once, so that every year will add to the knowledge which will be of such value in forming estimates of the seasons which are to come, and of the possibility of conserving water."

Lately much speculation was indulged in, and various schemes were proposed of increasing by artificial means the rainfall of New South Wales, particularly in seasons of drought when day after day the sky becomes covered with dark, dense-looking clouds which regularly pass away without a drop of rain. In these cases, science can as yet hold out no hopes to the agriculturist. The successful instances of rain-production by artificial means have occurred when the atmosphere in the district where the experiment was made was at or near the point of saturation, a state of things which does not exist in the arid plains of the interior of Australia under the meteorological conditions when clouds daily darken the skies and as regularly mock the expectation of the farmer.

It must then be to a judicious and skilful cropping of the rainfall that the Australian farmer must look for the supply of his wants in the dry season and still more in seasons of exceptional drought. Now, as contributions towards the solution of this problem, the annual rainfall reports of Mr. Russell are simply invaluable. These reports give the rainfall and total days of rain for each month and for the year, to which is added the mean annual rainfall and rainy days calculated from previous years' observations at each place available for the purpose. The annual rainfall for each year is represented on a large map of the colony, 22 by 26 inches, where the fall for each station is entered in its place as a black spot, the diameter of which is proportioned to the quantity of rain. By this device, the eye takes in readily and at a glance the distribution of the rainfall for the year. The comparative results of the five years for the different districts of the colony are most instructive.

Owing to its position on the globe and its physical configuration, New South Wales presents extremely different climates according to the varying amounts of the rainfall. Thus at Antony, on the coast near the borders of Queensland, the mean annual rainfall amounts to 65·15 inches; whereas at Mount Poole, in the extreme north-west, it is only 8·38 inches. For the nine years beginning with 1874, an approximation to the annual rainfall of the colony for each year has been calculated by Mr. Russell, the results for the separate years being 33·46, 29·38, 27·66, 20·48, 25·05, 30·75, 19·93, 20·73, and 20·11 inches, each of the last three years showing a marked deficiency. Now the interesting point is this, and it is a peculiarity which every other country possesses, but particularly those which exhibit climates so diversified as New South Wales, viz. that the rainfall of any month, or of any year, is very far from being equably distributed. The amounts of the excesses above, or the defects from, the average, tend really to partition the country into several well-defined rain districts for the time, these being determined apparently by river basins, watersheds, and other features of its physical configuration taken in connection with their relations to the thunderstorms and the rain-bringing winds. It is quite in the future, as an outcome of Mr. Russell's work, that the settlers in different parts of the colony will receive specific directions as to the cropping of their rainfall so as to provide even against the recurring calamitous droughts of the Australian climates.

An interesting feature of the reports are the diagrams, showing, by curves, the heights for each day of the Darling, Murrumbidgee, and Murray Rivers. A heavy flood occurred at Bourke, on the Darling River, on February 4, 1882, and reached its maximum, 26 feet 2 inches, by the end of the month, and the river did not fall to its summer level until April 5. This flood was occasioned by heavy tropical rains, from February 1 to 7, that fell over the northern part of the Darling watershed, which took two months to drain off, as is proved by the fact that little or no rain fell during the latter half of February and all March. In a few years these systematic observations of the heights of the principal rivers of Australia will furnish invaluable data for the determination of not a few important problems of meteorology and physical geography, which the marked insular character of this continent is so well suited to elucidate.

[1] "Results of Rain and River Observations made in New South Wales during 1878-82." By H. C. Russell, B.A., Government Astronomer for New South Wales.

CALCUTTA BOTANIC GARDEN

SIR JOSEPH HOOKER has kindly placed at our disposal the following letter on the Calcutta Botanic Garden:—

"Our beautiful garden is now looking very nice. Let me tell you what I am looking out upon. On the right is a fine *Terminalia Catappa*, a mass of dark green foliage from base to summit, its branches with a quantity of *Soranthus longiflorus* on them. Further off, towering in the distance, is a clean-stemmed, stately-looking *Dipterocarpus alatus*, its branches the roost of vultures and *cheels*. Almost as tall, to one side of the Dipterocarp, is a beautiful *Terminalia Arunja*, with mahoganies and the golden-flowered *Peltophorum* in front. *Dillenia pentagyna* in front, and *Morinda tinctoria* covered with masses of *Vanda Roxburghii*. There is a fine *Adina cordifolia*, one of the monarchs of the garden; its straight, strong stem, disdaining to bend in the sudden squalls and rain-storms, bears evidence of having been topped before, and I am always expecting to see it go. At its feet cluster our bed of Cycads, the latter shaded by young Oreodoxas and Caryotas, and with the margin of the bed fringed by the long feathered leaves, plume-like, of *Phœnix rupicola*. Here and there gleams of silver catch the eye, as the sun, striking on the ornamental stretches of water, glances through the foliage. To the left another member of that beautiful section of the *Rubiaceæ*—the *Naucleæ*—occupies a prominent place, its stem the home of the handsome blossoms of *Vanda teres*. The pretty marble pillar and urn to the memory of Col. Kyd is seen through the branches. From it roads lead to the principal landing-stage bordered by Oreodoxas, mahoganies, and our only attempt at ribbon gardening, long lines of Acalyphas, &c. Another road, straight for nearly, if not quite, half a mile to one of the exits, has an avenue of *Polyalthia longifolia*, sacred to the Hindoos, and groups of Betle palms; then of Oreodoxas, and lastly of *Inga Saman*. We have great difficulty with the Oreodoxas on account of a beetle that lays its eggs in the terminal buds. Still another road leads to the Orchid House bordered by clumps of graceful bamboos. In the house we generally manage to have a pretty show, and its neighbourhood in the proper season is gay with the blossoms of *Amherstia Gustavia*, *Thunbergia Napoleona*, &c. *Magnolia grandiflora* is flowering with us just now. What a glorious flower it is! Yesterday and the day before there came down on us one of the sudden miniature cyclones that we are so liable to have at the approach of the change of the monsoon. It blew, rained, and hailed tremendously. The trees tossed their arms and wailed, poor things, with such effect that their branches everywhere broke and strewed the ground. However only one small mahogany fell. It was quite cold, and the rain froze, as it was falling, into lumps as big as marbles."

THE EXTINCT LAKES OF THE GREAT BASIN

THE Great Basin of North America presents the most singular contrasts of scenery to the regions that surround it. East of it rise the dark pine-covered heights of the Rocky Mountain system, with the high, bare, grassy prairies beyond them. To the west tower the more serrated scarps of the Sierra Nevada, with the steep Pacific slope on the other side. The traveller who enters the Basin, and passes beyond the marginal tracts where, with the aid of water from the neighbouring mountains, human industry has made the desert to blossom as the rose, soon finds himself in an arid climate and an almost lifeless desert. The rains that fall on the encircling mountains feed some streams that pour their waters into the Basin, but out of it no stream emerges. All the water is evaporated; and it would seem that at present even more is evaporated than is received, and that consequently the various lakes are diminishing. The Great Salt Lake is conspicuously less than it was a few years ago. Even within the short time that this remarkable region has been known, distinct oscillations in the level of the lake have been recorded. There are evidently cycles of greater and less precipitation, and consequently of higher and lower levels in the lakes of the Basin, though we are not yet in possession of sufficient data to estimate the extent and recurrence of these fluctuations.

It is now well known that oscillations of the most gigantic kind have taken place during past time in the level and condition of the waters of the Great Basin. The terraces of the Great Salt Lake afford striking evidence that this vast sheet of water was once somewhere about 1000 feet higher in level, and had then an outflow by a northern pass into the lava deserts through which the cañons of the Snake River and its tributaries wind their way towards the Pacific. Mr. Clarence King, Mr. Gilbert, and their associates in the Survey of the 40th Parallel, threw a flood of light upon the early history of the lake and the climatic changes of which its deposits have preserved a record. They showed that the present Great Salt Lake is only one of several shrunken sheets of water, the former areas of which can still be accurately traced by the terraces they have left along their ancient margins. To one of the largest of these vanished lakes the name of the French explorer Lahontan has been given. The geologists of the 40th Parallel Survey were able to portray its outlines on a map, and to offer material for a comparison between it and the former still larger reservoir of which the present Great Salt Lake is only a relic. The United States Geological Survey has since begun the more detailed investigation of the region, so that ere long we shall be in possession of data for a better solution of some of the many problems which the phenomena of the Great Basin present. In the meantime Mr. J. C. Russell, who has been intrusted with this work, has written an interesting and suggestive preliminary report of his labours.

The average rainfall of the area of the Great Basin is probably not more than 12 or 15 inches. In the more desert tracts it may not exceed 4 inches, though in the valleys on the borders of the Basin it may rise to 20 or 30 inches. The rain falls chiefly in autumn and winter, consequently many of the streams only flow during the rainy season, and for most of the year present dry channels. Even of the perennial water-courses, the larger part of their discharge is crowded into a brief space towards the end of the rainy season. Most of the streams diminish in volume as they descend into the valleys, and many of them disappear altogether as they wander across the blazing thirsty desert. Loaded with sediment, and more or less bitter with saline and alkaline solutions, they do little to redeem the lifelessness of these wastes.

Over the lower parts of the surface of the Basin are scattered numerous sheets of water. Where these have an outflow to lower levels they are fresh, as in the examples of Bear Lake, Utah Lake, and Tahoe Lake. But the great majority have no outflow. Some of them are merely temporary sheets of shallow water, appearing after a stormy night, and vanishing again beneath the next noonday sun, or gathering during the rainy season, and disappearing in summer. Yet in some cases these transient lakes cover an area of 100 square miles or more. When they dry up, they leave behind them hard smooth plains of grayish mud, that crack up under the burning sun, and then look like a broken mosaic of marble. Of the permanent lakes the largest is the Great Salt Lake. It is also by much the most saline. Though all of them are more or less charged with alkaline and saline solutions, the percentage of these impurities is in some cases not so great as to prevent the water from being drunk by animals, or even on an emergency by man himself. Nothing in the physics of the Basin is more remarkable than the great diversity in the amount and nature of the mineral substances in solution in the lakes.

The vanished sheet of water, or "fossil lake," as the American surveyors call it, known as Lake Lahontan, lay chiefly in the north-west part of Nevada, but extended also into California. In outline it was exceptionally irregular, being composed of a number of almost detached strips and basins connected by narrow straits, and sometimes separated only by narrow ridges. It inclosed a rugged mountainous island 126 miles long from north to south, and 50 miles broad, which contained two lakes, neither of them apparently overflowing into the main lake. The Central Pacific Railroad passes for 165 miles through the dried-up bed of Lake Lahontan. From the windows of the car one can look out upon the ancient clay floor of the lake and mark the marginal terraces winding with almost artificial precision along the bases of the hills. The larger basins, which were formerly united into one continuous sheet of water, still hold lakes, all of which are more or less saline and alkaline, but they are far from being such concentrated brines as might be expected were they due to the progressive evaporation of the large original lake.

In tracing back the history of this interesting topography, we are first brought face to face with the fact that the area of the Great Basin has within recent geological times been subject to powerful and long-continued subterranean movements. In numerous cases, rocks have been fractured and displaced to an extent of 4000 or 5000 feet. So recent are some of the fractures that they actually cut through the alluvial cones that stream out from the base of the mountains, and in numerous instances displace the terraces of the old lake to the extent of 50 or 60, or sometimes even 100 feet. There seems no reason to dispute the conclusion to which Mr. Russell and his colleagues have come, that the movements are actually still in progress, and that the constant occurrence of hot springs along the lines of recent fracture may be taken as evidence of the conversion of the subterranean movement into heat.

What may have been the topography of the region before the first depression and isolation of the Great Basin is still unknown. Doubtless the ground had undergone extensive denudation as well as great subterranean disturbance. Considerable irregularities of surface would also necessarily be produced by the intermittent discharge of volcanic rocks. When this uneven floor sank below the level of the surrounding tracts so as to become a basin of inland drainage, a magnificent series of lakes was established. Of these the largest, to which the name of Lake Bonneville has been given, and of which the Great Salt Lake is the diminished representative, covered an area of not less than 19,750 square miles. Lake Lahontan was of hardly inferior dimensions, these two hydrographic basins occupying the whole breadth of the Great Basin in the latitude of the 41st parallel. No fewer than fifteen other smaller basins have been discovered, which, though now either dry or partially covered with saline or alkaline waters, were well-filled lakes at a former period.

It is some years since Mr. Gilbert, from a study of the deposits left by Lake Bonneville, announced his conclusion that they bear testimony to a remarkable oscillation of climate between humidity and aridity. Similar deductions have now been drawn from the deposits of Lake Lahontan. Previous to the appearance of this body of water the climate is believed to have been at least as dry as it is at present, when alluvial cones were pushed outwards from the base of mountains into the area of the future lake. Then came a moist period, when the hollow of Lahontan was filled up with water to a depth of 500 feet above its present desiccated floor in the Carson Desert. At or about this height the water must have stood a long time, for it has deposited, along its rocky margin and round its islets, a thick mass of calcareous tufa. That the water, if not fresh, was at least not so saline as to be inimical to life, is shown by the abundant occurrence in it of fresh-water gasteropods. An epoch of aridity ensuing, the lake fell to so low a level as to become intensely bitter and alkaline, depositing thickly along its margin crystals, six or eight inches long, of gaylussite (a hydrated carbonate of soda and lime). The soda of these crystals having been subsequently removed, the deposit is one of tufa, mainly composed of calcareous pseudomorphs after gaylussite. Next followed a period of increased precipitation, when the lake rose to within 200 feet of its highest level, and when the thickest and most abundant of the tufa deposits of the region was laid down to a depth of sometimes 20 or even 50 feet. This third incrustation of tufa was formed mainly along the rocky shores and islands; but curious mushroom-like protuberances of it likewise gathered upon stones lying on the floor of the lake. The water then rose to the highest level it ever reached, since which time the climate has again become arid. From the fact that the isolated lakes of the Lahontan Basin are not the saturated alkaline and saline solutions which they would certainly have been had they resulted from the evaporation of such a sheet of water as that in which the three tufa terraces were elaborated, it is inferred that the whole of the original lake was evaporated to dryness, and that its alkalies and salts, having been precipitated at the bottom, were covered over with a layer of mud so as to be partially protected from rapid solution. The existing lakes may thus be supposed to be the result of a subsequent diminution of the extreme aridity, but the time within which they have been in existence has not been long enough to enable them to become as bitter and saline as the original lake.

Such are some of the views which renewed exploration of this weird region has suggested to the able surveyors who have undertaken its investigation. Mr. Russell's report, lucid and interesting as it is, must be regarded as merely a prelude to the fuller results which he and his colleagues are gathering for the good of science, and to the credit of the admirably organised and administered Geological Survey of the United States.

NOTES

PROF. FLOWER, F.R.S., will preside at a meeting which it is proposed to hold on Tuesday next, July 1, in the lecture-room of the Natural History Museum, when Mr. R. Bowdler Sharpe will read a paper on the expediency or otherwise of adopting trinomial nomenclature in zoology. Many British naturalists have been anxious to meet the distinguished American naturalist, Dr. Elliott Coues, who is now on a visit to this country, and to exchange views with him on the subject of nomenclature. Invitations have been sent to a large number of the leading British zoologists, and an interesting discussion is expected.

THE Prince of Wales, President of the City and Guilds of London Institute, opened the Central Institution, Exhibition Road, yesterday afternoon at four o'clock. The Education Section of the International Health Exhibition, in the south wing of the Central Institution, was opened at the same time.

THE following additional donations to the Equipment Fund of the Central Institution of the City and Guilds of London Institute have been voted in response to the appeal of the Prince of Wales:—The Goldsmiths' Company, 4000*l*. (subject to confirmation); the Salters' Company, 525*l*.; the Cordwainers, 250*l*. The Plaisterers have increased their annual subscription from 50 guineas to 100*l*.

IT is stated that the English Foreign Office is endeavouring to obtain the co-operation of the German Government in the International Educational Conference to be held at the South Kensington Health Exhibition about the middle of August. The Committee attaches special importance to the attendance of representative German pedagogues (this word being used in the higher and German sense) at this conference to read or communicate papers especially on the subjects of technical and secondary education and the organisation of universities; and it is particularly anxious to know, as early as possible, the names of any Germans of note who may be disposed to attend, and the subjects likely to be selected for papers.

A LARGE and influential deputation, including the Earl of Rosebery, the Earl of Fife, Mr. Stephen Williamson, M.P., Hon. R. P. Bruce, M.P., Prof. Cossar Ewart, Prof. Macintosh (St. Andrew's), a number of Scotch M.P.'s, and other gentlemen, waited last Monday on the Home Secretary with the view of impressing on the Government the importance of granting further funds to the Scottish Fishery Board to further scientific investigation into the habits of herring and other food fishes. The principal lines of proposed inquiry are: (1) The examination of the spawning beds around the Scottish coast with the view of increasing the fishing, more especially on the west coast; (2) the further collection of material for determining the nature of the food of the useful fishes met with on the Scottish coast; (3) the further investigation of the percentage of immature herring and other food fishes destroyed under present methods of fishing; (4) the investigation of the influence of sea-birds, parasites, &c., on the supply of food fishes; (5) the study of the development, rate of growth, and general life history of the herring and other economic fishes, and the further study of the spawning process, and the nature of the eggs of fish; (6) the determination of the best means of restocking deserted fishing grounds, by artificial cultivation or otherwise, of herring, cod, flat fish, &c.; (7) the determination of the practicability of increasing the supply by artificial means of lobsters, mussels, oysters, and other shell fish; (8) the inquiry as to the influence of fungi and other minute organisms in destroying the life of useful fishes, and the conditions which predispose to the attacks of these organisms. The Board estimates that a sum of at the very least 1000*l*. will be required during 1884–85 in order to carry on such inquiries properly. It would also immensely facilitate matters if the sailing cruiser belonging to the Board were superseded by a steam-vessel of somewhat larger size, and H.M.S. *Jackal* replaced by a seaworthy boat adapted for the work of a fishery cruiser. It is also of importance that the Admiralty should encourage and take part in scientific researches, not only on our own coasts but all over the world. Comparatively little has been done by Great Britain for the furtherance of our knowledge of the nature and habits of fish on her coast, important as these are as articles of food and commerce. The Board confidently anticipates that with the assistance now asked the investigations would yield most excellent results, as the Board is already an institution with a large staff of intelligent officers capable of making observations, collecting materials, &c., as several distinguished naturalists and the scientific members have promised to assist it gratuitously, and, moreover, that the exertions already made have yielded results of the highest promise. The deputation was most favourably received.

THERE has been considerable alarm recently with reference to the parasites in that useful and plentiful fish, mackerel; so much so that Prof. Huxley has thought it advisable to write a letter to Mr. J. L. Sayer of Lower Thames Street, showing that any such alarm is unnecessary:—"It is perfectly true," he writes, "that mackerel, like all other fish, are more or less infested by parasites, one of which, a small thread-worm, is often so abundant as to be conspicuous when the fish is opened. But it is not true that there is any reason to believe that this thread-worm would be injurious to a man, even if he swallowed it uncooked and alive, and to speak of it as a possible cause of cholera is sheer nonsense. I have no doubt that the 'excessive use of mackerel and mild ale,' whether separately or in combination, would be followed by unpleasant results, not only at this season of the year but at any other. But I undertake to say that the consequences would be the same whether the fish contained thread-worms or not. It is very much to be regretted that the food-supply of the people should be diminished, and that the fishing population should be robbed of the fruit of their labours by the authoritative propagation of statements which are devoid of foundation; and if you think the publication of this letter will be of any use to the public and to the fishing interest, it is at your service."

A *conversazione* will be held at the International Health Exhibition by the Council of the Society of Arts, in conjunction with the Executive Council of the Exhibition, on Wednesday, July 9. The whole of the buildings will be open, and the gardens will be illuminated.

THE Council of the Society of Arts have awarded the Society's Silver Medals to the following readers of papers during the Session 1883–84:—The Most Hon. the Marquis of Lorne, K.T., for his paper on "Canada and its Products"; Rev. J. A. Rivington, for his paper on a "New Process of Permanent Mural Painting, invented by Joseph Keim"; C. V. Boys, for his paper on "Bicycles and Tricycles"; Prof. Fleeming Jenkin, F.R.S., for his paper on "Telpherage"; I. Probert, for his paper on "Primary Batteries for Electric Lighting"; H. H. Johnston, for his paper on "The Portuguese Colonies of West Africa"; Prof. Silvanus P. Thompson, for his paper on "Recent Progress in Dynamo-Electric Machinery"; Edward C. Stanford, F.C.S., for his paper on "Economic Applications of Seaweed"; W. Seton-Karr, for his paper on "The New Bengal Rent Bill"; C. Purdon Clarke, C.I.E., for his paper on "Street Architecture in India." Thanks were voted to the following Members of Council for the papers read by them:—W. H. Preece, F.R.S., vice-president of the Society, for his paper on "The Progress of Electric Lighting"; B. W. Richardson, M.D., F.R.S., vice-president of the Society, for his paper on "Vital Steps in Sanitary Progress"; Col. Webber, R.E., C.B., Member of Council, for his paper on "Telegraph Tariffs"; B. Francis Cobb, vice-president of the Society, for his paper on "Borneo"; J. M. Maclean, Member of Council, for his paper on "State Monopoly of Railways in India"; W. G. Pedder, Member of Council, for his paper on "The Existing Law of Landlord and Tenant in India."

THE Italian Government proposes to found a central magnetic observatory at Rome, to be placed under the direction of the Meteorological Office. The Government asks for a vote of 176,000 francs, in addition to an annual sum of 5550 francs for general expenses, and 11,500 francs for *personnel*.

THE *Times* Berlin correspondent, telegraphing on Thursday last, states that the reddish-brown atmosphere and the peculiar appearance of the sun and sky which were noticed last year, especially in November, reappeared on the previous evening almost as vividly as ever.

THE results of the analyses made at the Municipal Laboratory of Paris are so satisfactory that tradesmen of that city are holding indignation meetings on behalf of the liberty of watering their liquors and mixing the different kinds of wine. It is needless to state that the public and the administration are equally hostile to any alterations being made in the existing law. But greater precision will now be introduced into the verdict of the experts, and when they declare any liquor to be bad they will state whether it is by adulteration, or alteration of its primitive elements, or mixing with inferior sorts. The development of the institution is so important that forty persons are now engaged in this kind of work. Similar institutions have been created in provincial cities, and a central administration established in Paris. The late M. Wurtz was the head of this useful Bureau; his place is now filled by M. Berthelot.

THE Russian Admiralty has under consideration a plan for an expedition to the North Pole, with a view to benefit by the experience gained by the *Jeannette* disaster. The expedition is proposed to start from the Jeannette, Bennet, and Henriette Islands, where large depots will be established. The journey will be continued thence to Franz-Josef Land by steamer, and further northwards by sledges and on foot. The expedition would be divided into three parties, the first of which would act as a kind of vanguard, the two following not moving forward until suitable camping places had been found and depots established. This system would make the progress safe and systematic. It is estimated that the expedition would require three years to reach the Pole and to return to Northern Siberia. The expenses of the same will probably be covered by a national subscription, the Government, and the Russian Geographical Society.

THE Prussian Government having requested the Swedish to effect measurements of the tide, &c., on the Swedish coasts in the Baltic, similar to those which for some time have been carried out on the Pomeranian coast, Capt. Malmberg and Prof. Rosen have been commissioned to visit the German stations during the summer, and select the most suitable places on the Swedish coast for realising this proposal.

THE Norwegian Storthing has voted the entire sum proposed for scientific and literary purposes—about 5000*l*. Among these we note 150*l*. to the *Technical Journal*, 350*l*. to Dr. Norman's "Flora," 60*l*. to Dr. Sophus Tromholt for prosecuting his auroral researches, 50*l*. each to the *Acta Mathematica* and the "Fauna litoralis Norvegiæ."

AT Weimar, München, Elberfeld, and some other German towns have been erected what are called "pyramids of instruction." They show on their various faces the elevation of the place above the level of the sea, the population, the difference of local time from that of Vienna, Paris, London, New York, &c. There are also a clock, barometer, thermometer, vane, and a variety of statistical information.

MR. H. W. EATON of Louisville, Kentucky, writes to *Science* that the *Commercial* of that city for May 17 and 18 gave accounts of a tailed child recently born there. As such cases are of scientific interest, and are very rare, a party of four, including a prominent doctor and Mr. Eaton, concluded to investigate the case. "We found a female negro-child, eight weeks old, normally formed in all respects, except that slightly to the left of the median line, and about 1 inch above the lower end of the spinal column, is a fleshy pedunculated protuberance about 2½ inches long. At the base it measures 1¼ inch in circumference. A quarter of an inch from the base it is somewhat larger, and from that it tapers gradually to a small blunt point. It closely resembles a pig's tail in shape, but shows no sign of bone or cartilage. There seems to be a slight mole-like protuberance at the point of attachment. The appendage has grown in length about a quarter of an inch since the birth of the child. The mother, Lucy Clark, is a quadroon, seventeen years old, and the father a negro of twenty,—both normally formed. In Darwin's 'Descent of Man,' vol. i. p. 28, he speaks of a similar case, and refers to an article in *Revue des Cours Scientifiques*, 1867–68, p. 625. A more complete article is that by Dr. Max Bartels, in *Archiv für Anthropologie* for 1880. He describes twenty-one cases of persons born with tails, most of them being fleshy protuberances like the one just described."

ON May 27, at about 8.45 p.m., immediately after sunset, a magnificent meteor or fireball was seen at Skonevik, on the west coast of Norway. It went in a perfectly horizontal line to north-north-west, leaving a bright tail behind appearing like steam. This trail was distinctly observable for quite five minutes, when it gradually spread in the shape of a light cloud, which was soon hidden in the approaching darkness. About two minutes after the ball had passed out of sight a loud report was heard in the same direction; it was very much like ordinary thunder heard from a distance, with the exception of its lasting twice as long. The sky was perfectly clear, and several persons witnessed the phenomenon. The meteor was also observed in the Kvinherred parish.

ANOTHER "blue grotto," or, rather, series of three large grottoes, 87 metres in length, has been discovered on the Dalmatian island of Buoi, lying to the south-west of Lissa. The cave is described by its discoverer, Baron Ramsonnet, Austrian Secretary of Legation, as surpassing the famous Capri Grotto.

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus* ♀♀) from India, presented respectively by Mr. Howard Lane and Madam Kettner; two White-fronted Capuchins (*Cebus albifrons* ♂♀) from South America, presented by Mr. Messum; a Coypu (*Myopotamus coypus*) from South America, presented by Mrs. Constance Keely; a Harpy Eagle (*Thrasaetus harpyia*) from South America, a Red-billed Tree Duck (*Dendrocygna autumnalis*) from America, presented by Capt. H. King; a White-tailed Buzzard (*Buteo albicaudatus*) from America, presented by Mr. Lewis; a Wedge-tailed Eagle (*Aquila audax*) from Queensland, presented by Mr. Henry Ling Roth; two Choughs (*Pyrrhocorax graculus*), British, presented by Mr. J. Compton Lees; a Gray-breasted Parrakeet (*Bolborhynchus monachus*) from Monte Video, presented by Mrs. Moore; two Cape Crowned Cranes (*Balearica chrysopelargus*) from South Africa, presented by Mr. J. R. Chapman; a White Stork (*Ciconia alba*), European, presented by Mr. Hubert D. Astley; a Partridge (*Perdix cinerea*), British, presented by Mr. George Rubie; a Blue and Yellow Macaw (*Ara ararauna*) from South America, deposited; a Brush-tailed Kangaroo (*Petrogale penicillata*) from New South Wales, four White Storks (*Ciconia alba*), three European Pond Tortoises (*Emys europæa*), European, a Common Boa (*Boa constrictor*) from South America, purchased; a Black-necked Swan (*Cygnus nigricollis*) from Antarctic America, received in exchange.

OUR ASTRONOMICAL COLUMN

THE OXFORD UNIVERSITY OBSERVATORY.—The Savilian Professor of Astronomy has issued his Annual Report to the Board of Visitors of the University Observatory, which was read on the 5th of the present month, and forms a supplement to No. 493 of the *Oxford University Gazette*. The attendance of students at the lectures has been greater than at any previous time, and the Professor mentions "the phenomenon" of the regular appearance of two ladies at his lectures on the planetary and lunar theories, at the same time reminding the Board what even the approximate mastery of such theory implies.

On the astronomical work of the staff of the institution during the year, Prof. Pritchard's Report is a most favourable one. He refers to three memoirs on important astronomical questions which have issued therefrom, and which have been printed in the *Memoirs* of the Royal Astronomical Society. These include an extensive memoir by himself on the "Photometric Determination of the Relative Brightness of the Brighter Stars North of the Equator," in which his work at Cairo is brought to bear, and a memoir by the first assistant, Mr. W. E. Plummer, on the probable motion of the solar system in space, the data for which depend upon Mr. Stone's recent catalogue of southern stars; it is a memoir very similar in character to the well-known one by the late Mr. Galloway. Further, Prof. Pritchard has communicated to the Royal Astronomical Society a paper which was read at the last meeting, demonstrating, as he thinks, the existence of small displacements among the Pleiades. Upwards of a thousand measures of the relative brightness of stars were made, leaving about the same number to be made in the next year. This measurement of all the naked-eye stars from the Pole to the Equator will furnish a *Uranometria Nova Oxoniensis*, and Prof. Pritchard hopes that its publication may be undertaken by the University Press. The measures of the Pleiades having been completed, he now intends to devote himself to lunar work—the determination of selenographical longitude and latitude of a large number of points on the moon's surface by means of a valuable series of lunar photographs at the Observatory. Reference is made, in addition to the Pleiades work, to the existence of measures of some 250 stars in another cluster made at the Observatory a few years since, and to be shortly reduced and published; the particular cluster is not indicated in the Report, but presumably may be M. 39 in Cygnus, described by Messier when he observed it in 1764 as "a star-cluster of 1° diameter."

VARIABLE STARS.—In a communication to the Liverpool Astronomical Society Mr. Baxendell notifies that his determinations of the times of eight maxima between 1861 October 16 and 1881 November 21 are not satisfied by a constant period, but that, dividing them into two groups, he obtains the following results:—

Group 1. Mean period 206·37 days. Ep. 1864 Jan. 17·47.
Group 2. Mean period 212·52 days. Ep. 1880 Sept. 24·21.

Such a difference is well worthy of further investigation. The magnitude at maximum has varied between 7·8 and 9·3.

There does not appear to be any earlier observation of this star than that by Bessel on January 6, 1833, when it was estimated a ninth magnitude. It was not observed either by Lalande or D'Agelet. Prof. Schönfeld's elements in his second catalogue, which assume a uniform period of 208·8 days, would give a maximum on October 6, 1881; according to Mr. Baxendell, it took place on November 21.

Communications from Mr. Knott and Herr Wilsing, of the Observatory, Potsdam, on Ceraski's short-period variable, U Cephei, have appeared in the *Astronomische Nachrichten*. Mr. Knott, from 20 minima observed by him between 1880 October 23 and 1884 March 20 finds for elements—

Ep. 1882 April 19·92641 G.M.T. + 2·4928722 d. E.

Herr Wilsing has collected 61 minima by different observers between 1880 July 3 and 1884 April 9, and finds (similarly expressed)—

Ep. 1881 Nov. 21·34640 G.M.T. + 2·4928646 d. E.

To the suspected circumpolar variables recently named in this column may be added Bradley 392, which figures in our catalogues with various estimates of magnitude from 4·5 (Argelander's Zones) to 7 and 8 (Taylor and Lalande); generally, however, it has been called a sixth magnitude. Doubtless in many, perhaps in most, cases, such discordances arise from errors of estimation, through clouds, &c., or from misprints, but in others, as in the case of Schwerd's magnitudes of U Cephei (6·7, 8, 10 respectively), they are known to have been caused by a real fluctuation in the star's brightness, and hence it seems worth while to examine similar instances of disagreement in the catalogues.

Missing Nebulæ.—In Rümker's Catalogue are two objects observed as nebulæ which were missed by D'Arrest and Auwers. In No. 1542 of the *Astronomische Nachrichten* Mr. G. Rümker has given the particulars of the observations from his father's manuscripts. The first nebula was observed on May 27, 1841, and its apparent place was R.A. 13h. 52m. 38·20s., Decl. + 45° 36′ 13″·8. The Hamburg mean time of the observations was 9h. 31m. 43s. In the *Durchmusterung* we find a star thus—

8·8 ... 13h. 53m. 10·0s. + 45° 31′·7 ... R.

Consequently Argelander identifies this star 8·8 m. with Rümker's nebula. Two questions arise in such a case, and not for the first time: Was a comet projected on the place of Argelander's object at the time of Rümker's observation? or (more improbably), Was the star at that time surrounded by nebulosity which has since become invisible? Bessel, we know, observed a nebulosity on November 8, 1832, in a position where only a star 9·3 m. was subsequently seen by Argelander and D'Arrest. We refer to Rümker's first nebula more especially because its place was not very far from that which might have been occupied by the third comet of 1858, recently shown to be periodical by M. Schulhof. If that comet were at perihelion about 1841 April 21·8, its right ascension might have agreed with that of Rümker's nebula, but the declination would be given by calculation about 6° further north. Whether with the consequent period of revolution, which, assuming three periods, 1841–58, would be near M. Schulhof's lower limit, the action of the planet Jupiter during the first revolution could have caused such difference from the orbit for 1858 as to reconcile the discordance in the observed and computed declination, we cannot say, though it hardly appears likely. Still it may be worth while to mention the above approximate coincidence, as M. Schulhof has searched unsuccessfully for an indication of a former appearance of the comet in question.

GEOLOGICAL NOTES

Triclinic Pyroxene.—Mr. J. J. Harris Teall points out to us that since the paper was written on this subject by Mr. Whitman Cross, to which reference was made in Nature (*ante*, p. 155), this author has found that, after reconsidering the matter in the light of the researches of Fouqué and Michel Lévy on the optical properties of monoclinic pyroxene, a great majority of the instances cited by him as indicating a triclinic pyroxene are explainable as augite, and that the few cases which still seem anomalous are not in themselves sufficient to justify a reference to the triclinic system. The mistake was made in specimens not cut rigidly parallel to the axis, for it appears that the ellipsoid of elasticity is so situated as to produce very great variations in optical behaviour in sections which are but little inclined to each other. [*Amer. Journ. Science*, No. 151, xxvi. p. 76].

The Brussels Museum and its Work.—The second volume of the *Bulletin of the Musée Royal d'Histoire Naturelle de Belgique* has just been completed by the issue of a fourth fasciculus. In this part geology and palæontology continue to assert their supremacy. M. Dollo supplies a paper on a gigantic fossil bird (*Gastornis Edwardsii*, Lemoine) from the lower part of the Landenian stage at Mesin, near Mons. Having completed the summary description of the Iguanodons, but not being yet in a position to publish his expected large monograph on that important group, he has in the meantime turned to the Crocodilians of Bernissart, of which he furnishes here a preliminary notice. They consist of four individuals capable of division into two well-marked groups—two large specimens indicating an animal about two metres in length, to which he gives the name of *Goniopholis simus*, and two small forms which he regards as belonging to a new genus, named by him *Bernissartia*. M. Ernest Van den Broeck, following up the memoir published in a previous number of the *Bulletin* by his colleague, M. A. Rutot, offers a note on a new mode of classification and of graphic notation for geological deposits, based upon the study of marine sedimentation. The veteran palæontologist, Dr. L. G. De Koninck, contributes an essay on the *Spirifer mosquensis* and its affinities with other species of the same genus.

Geological Survey of Belgium.—Appended to the last number of the *Bulletin of the Musée Royal* is a Report by M. Dupont, Director of the Museum, on the state of the detailed geological map of Belgium, which is being prepared under his supervision. The preliminary examination, which was estimated to require six years, having been completed, the continuous survey of the formations has been prosecuted, each important group being intrusted to an officer specially qualified for its investigation. Nineteen sheets are in the course of preparation for publication. Of these the greater number belong to the remarkable Devonian territory which forms so interesting and important a part of Belgian geology. We see from the map that these sheets are mainly the work of M. Dupont himself. He spent 100 days in the field last year almost entirely among the Devonian rocks. M. Mourlon devoted his time to tracing the area of the Famennian beds. The third section, under the charge of M. Van den Broeck, has made progress among the oligocene Tertiary deposits of Central and Northern Belgium. The fourth section, supervised by M. Rutot, spent half of the season in mapping the Eocene deposits of Limbourg, and the remainder in prosecuting the investigation of Hainault, Brabant, Flanders, and the study of the Upper Cretaceous rocks and base of the Eocene series, the Eocene part of three sheets being finished. Dr. Purves, in charge of the fifth section, has devoted his energy to the mapping of the Jurassic rocks of Luxembourg, and the study of the Cretaceous series of Hainault and Limbourg. The total number of days spent in field-work by the whole staff has been 512.

Geology of Finmark.—Mr. Karl Pettersen continues his contributions to our knowledge of the geology of the Norwegian coast. In a recent memoir (*Archiv for Math. og Naturvidenskab.*, Bd. viii. p. 322) he describes that picturesque tract lying between the mouth of the Kvenangen Fjord and the Refsbotten, which includes the lonely Jökelfjord and Bergsfjord with the islands of Stjernö, Seiland, Sörö, and Kvalö. The greater portion of this area is occupied by various crystalline rocks—gneiss, mica-schist, gabbro, diorite, &c.—referred by the author to the Laurentian series. Above these lie certain certain mica-schists with included beds of limestone, which, under the name of the Tromsö mica-schist group, are assigned to the Cambrian system.

American Jurassic Dinosaurs.—In the *American Journal of Science* (April 1884) Prof. Marsh continues the valuable series of papers which he has contributed to our knowledge of the structure and affinities of the Jurassic Dinosaurs. In part viii. he discusses the carnivorous order Theropoda, two nearly perfect skeletons belonging to which have enabled him to throw some new and most important light on the order. An almost perfect skeleton, above seventeen feet long, has been named by him *Ceratosaurus*, and presents some novel features in dinosaurian organisation. It has a large horn on the skull, a new, strange, and unexpected type of vertebra, a pelvis with all the bones co-ossified as in existing birds, and a set of osseous dermal plates extending from the base of the skull along the neck over the vertebræ.

GEOLOGICAL SURVEY OF NEW ZEALAND.—Dr. Hector's Report for 1882 has just been received. It contains some additions to our knowledge of the geological structure of the country, but these do not involve any marked alterations in the system of classification already adopted for the formations, but rather tend to establish its general applicability. The Report is specially characterised by the attention paid to the development of the mineral resources of the colony. Mr. S. H. Cox, in compliance with specific instructions, made a careful examination of the gold-fields of the Cape Colville Peninsula and of other mineral tracts, while Mr. A. McKay reported on some antimony and other lodes. The geology, petrography, and palæontology of the islands have likewise received attention. The schists of the Reefton district are regarded as a metamorphic series of Silurian age, as they can be traced into fossiliferous Silurian strata. The granite-porphyries by which they are traversed were intruded into them subsequent to the Devonian rocks. The metamorphic series is covered in some places by the Devonian beds, from which fossils have been obtained at a number of new localities. The auriferous rocks of Reefton are referred to the Matai or Carboniferous formation, and are believed to lie unconformably on the younger Devonian rocks. The Cretaceous and Cretaceo-Tertiary series form a continuous sequence in which coal has long been known to occur. Seams of coal, four to ten feet thick on an average, characterise certain horizons, one seam at the head of the Murray Creek reaching even to thirty or forty feet. The coarse sandstones and grits among which the coals lie are represented as being conformably overlaid by Miocene gravels.

THE AUSTRIAN GEOLOGICAL INSTITUTE.—This admirable organisation, under the energetic management of its Director, F. Ritter von Hauer, shows no sign of any diminution in its activity or of any lessening of the wide scope of its labours. Among the recent numbers of its *Verhandlungen* some interesting papers have appeared, of which may be mentioned: A. Bittner, on the Limestone Alps of Salzburg; E. Tietze, on the occurrence of turquois in Persia; V. Hilber, on the geology of the region between Krzyzanowice and Tarnobrzeg; D. Stur, on some fossil plants from South Wales; A. Böhm, on geo-isothermal lines under mountains. The last two numbers of the *Jahrbuch* are full of important memoirs. Among these reference may be made to Bittner's Report on the survey of the Triassic region of Recoaro; Paul's "Recent Additions to our Knowledge of the Carpathian Sandstone"; Dr. Tietze's essay on the geology of Montenegro, and the continuation of his contributions to the geology of Gallicia.

ON NORTHERN NORWAY UNDER THE GLACIAL AGE

The Stream of Inland Ice.—From the broad sound between the Kval Island and the province of Finmarken, from which the Troms Island juts forth, the Kval Sound—about 20 km. in length—leads to the open ocean. Outside the Kval Sound several little islands rise from the sea, while beyond the coast is girded by holms and rocks termed the "Skjærgaard." A little south of the Troms Island the Balsfjord, about 60 km. in length, cuts into the land, closed at the bottom by small ridges leading up to the valley in which the Maals River flows, and to the borderland between Norway and Sweden, chiefly through the long Divi Valley. The borderland embraces large mountainous tracts, where peaks rise to an elevation of 1569 m., crossed by dales and high valleys.

In the district described, the local conditions during the Glacial age seem to have been remarkably suited to the formation of large masses of ice. These would have their natural outlet towards the Maals River, through the Divi Valley, and the main stream has no doubt therefrom flown down the Maals Valley, but an arm may have curved more to the north along the northern slope of the Mauken ridge, and by ice-streams from this and from the gigantic high plateaux around the Maar peaks down to the bottom of the Balsfjord. From here the joint stream would have moved further forward to the sounds along both sides of the Troms Island, and thence, through the Kval Sound, over the islands in the Skjærgaard. The channel described has a length of 215 km.

As is generally known, the inland ice of Scandinavia is assumed to have shot far beyond the edges of the peninsula. Thus from Southern Norway the inland ice is believed to have moved forward along the fjords, and filled the entire North Sea as far as England, while further north it has been curved in a more northerly direction, by the ice-streams issuing from Scotland, towards the Orkneys and the Shetlands. It might be supposed that similar conditions existed during the Glacial period in the north of Norway; but from what is known at present there is nothing indicating that the Glacial age has appeared in a more severe form in the southern than in the northern part of Norway; it seems, in fact, from the geographical situation of the land, that the reverse must have been the case. There are besides, as I will presently show, indications which seem to demonstrate that the ice-masses of the Glacial age, at all events in certain parts of Northern Norway, have attained an extent which equals those of Southern Norway, as, for instance, those along the Sognefjord, 1700 m. to 1800 m. in depth. On the high plateau behind the Divi Valley, close to the frontier, the cone of the Great Jerta, built of amphibolitic slate, rises to a height of 1569 m. Nowhere have granite strata been found intercepting this slate. On the top of this peak a large travelled granite block was found, which in most probability has been transported thither from the extensive granite field which stretches forward on both sides of the frontier. The ice which has moved down the Divi Valley must therefore have been very nearly 1600 m. in depth.

There seems every reason to suppose that the channel from the bottom of the Balsfjord to the Skjærgaard has, during the Glacial age, boasted a comparatively uniform depth; and, supposing the sea to have been about 188 m. higher than at present, this channel would nowhere have been deeper than 470 m. An ice-stream moving forward by this channel, and which probably had a thickness of 1600 m., must have moved forward along its bottom, and most probably with a quick motion. If the ice-streams from the south-west of Norway have, as assumed, moved forward, and filled not only the fjords to the bottom, but the entire North Sea to England, we may conclude that this should also have been the case in the channel in question during the Glacial period. If this has been so, marked traces of such an ice-stream would, no doubt, have been visible from the very bottom of the Balsfjord right out to the Skjærgaard; but the researches made here point in a different direction. I will elucidate this by following the channel referred to *from* the ocean coastwards.

About 11 km. from the mouth of the Kval Sound, in the open ocean, lies the little Ris Island, surrounded on south, west, and north by a great number of tiny islands, reaching a height of 100 m. It is formed of a ridge running north to south, in the west sinking abruptly into the sea, but which in the east sinks into a low-lying plain, from which several isolated knolls spring forth. Several of these knolls are connected with the main island by sand dunes, and have most probably at no distant time formed separate holms. Most of the numerous holms surrounding the Ris Island are small, and only rise a few feet above the water. The mineral of which this group of islands is formed is a hard kind of gneiss, greatly interspersed with granite more or less pure; the mineral is, in fact, with its petrographical variations and forms, rather to be considered a kind of granite-gneiss, a name which is given to it in these parts. The strike of the granite strata is, roughly speaking, north to south, with a sudden dip to the east. By its structural condition this mineral should be greatly affected by smoothing and polishing agencies, and also retain the traces of such. Should, therefore, the inland ice at a certain period have moved forward along the Kval Sound, the group of islands around the Ris Island would undoubtedly bear the most patent indications of this action. The polishing phenomena are often met with at lower levels, which either lie within the littoral belt, at high tide under the sea, or rise only a few feet above high tide, but with the sea continually washing over them. At higher elevations these phenomena are rarely discovered. Here severe destructive forces have been at work on the previously polished surfaces, and the numerous sea-birds breeding on these islands have further contributed to the corrosion.

Several circumstances seem, however, to indicate that the polishing in question cannot be referred to the scourings of the ice in the Glacial period, but is of a far later date. The rapid destruction seems in fact to demonstrate that the smoothing must be referred to agencies of shorter duration. The smooth, ings which are shown—certainly not very marked—seem to point in this direction, while the smoothing along the lower levels of the holms referred to above are generally met with more in the parts most exposed to the fury of the sea than inland. The smoothing appears but rarely in spots on the lee side of the ocean, even where they might be assumed to have been very exposed to the glaciers. I have therefore come to the conclusion that the smoothing phenomena observed here must be ascribed to the erosion of the sea, which, under its action in the littoral belt, carries with it finer as well as coarser materials of scouring. Striæ have nowhere been observed on the Ris Island or the surrounding islands.

If ice-streams from the southern part of the Scandinavian peninsula have carried blocks from the mountain plateaux of Sweden and Norway across the Central European plain to England, to the Orkneys, and the Shetlands, an ice-stream moving along the Balsfjord and further along the channel described above through the Kval Sound should naturally have progressed in the same manner, and strewn blocks along its whole course. This is, however, not the case. On the Ris Island, thus, and surrounding islands, not a single boulder or travelled block whose place of birth could have been on the upland behind has been found. The mountains along the Balsfjord and towards the Troms Island is mostly built of slaty minerals, such as glimmer-slate (interspersed with crystalline chalk), quartz, sandstone-like slate, &c. Such minerals might have been greatly subjected to being ground away during a longer transport, and that travelled blocks of this kind are not found might be ascribed to this circumstance; but among the travelled blocks strewn over the Central European high plateau there are found also many of slate, which are supposed to have been transported thither from Scandinavia, and if these have been able to resist the destructive agencies during such a long transport, they would decidedly have done so here where the distance is so short.

Among the softer minerals forming the mountains from the Balsfjord there frequently occur strata of harder nature, as, for instance, of gneiss, massive amphibolites, and eclogites, while Saussurite appears in the bottom of the fjord. There are minerals whose composition would enable them to resist the severest destructive agencies even during the longest journey. The total absence of foreign travelled blocks on Ris Island and adjacent holms is therefore hardly to be reconciled with the supposition that continuous streams of ice from the inland moved thither. Neither is moraine drift met with about the archipelago in question.

Just north of the Ris Island, the Sandviks Island, 407 m. in height, rises above the sea. Along the whole eastern side extensive accumulations of sand containing marine shells are met with to a height of 63 m. In the higher-lying layer the sand is, however, poor in such remains, although fragments may be found at an elevation of 56 m. Here it seems as if the coast districts must have been earlier denuded of the local glaciers of the post-Glacial period than the upland behind. Along the Troms Island and the adjacent district the shell-bearing layer of sand is never found above 13 m., while in the clay deposits along the rivers fossil shells are never found at a higher elevation than 38 m. The Troms Island has, however, at a time when the sea in relation to the rock was 40 m. higher than at present, been greatly covered by local glaciers, while the coast district beyond must have been almost free from such. The conditions for the development of a more copious fauna of mollusks have thus existed along the outer coast *earlier* than in the fjords behind. It appears therefore that during the transition from the Glacial to the post-Glacial period the milder climate has spread from the sea *coastwards*, although, as it seems, very slowly.

We now turn to the district behind the channel referred to, particularly to the little Troms Island, where there has been special opportunity of examining these indications. The island is 11 km. long and 157 m. in height, and, lying just in the flow of the ice-stream, was situated so that the travelling glaciers should have left lasting traces on it. By a cursory glance the glacialist is led to believe that the markings must be referred to the streams of inland ice, particularly as the island is all along the southern part, at higher as well as at lower elevations, covered with a layer of drift from the "ground" moraine several feet in thickness, while old boulder drift-wolds may be seen in several places. Besides this, foreign travelled blocks are strewn in great numbers along the sides of the island, while striæ appear in many places along the littoral belt and adjacent levels. A closer examination will, however, put these indications in a different light. Thus, with regard to the boulder drift, it will be found that most of the stones and blocks embedded in the same belong to the island itself, and none can with certainty be asserted to have belonged to mountains beyond the island. These drifts must therefore be ascribed to local glaciers, which at one time partly covered the island. With regard to the striæ, which appear in some places at lower levels, I am of the opinion that they were made in what is at present the littoral belt. Foreign travelled blocks, *i.e.* those consisting of various species of granite, are, as stated, only found here at low levels, viz. from the present seashore to an elevation of 38 m. These blocks have, however, I believe, been transported thither by floating glaciers. The elevation, even, in which they are found, indicate that the transport of these foreign blocks can only have begun at a period when the more continuous layers of inland ice were broken up.

The district along the Balsfjord is, on the other hand, to a great extent built of the same kind of crystalline slate rocks which form the Troms Island, and it is therefore impossible to deny with certainty that there are boulders in the drift which have been carried from the land behind. But there is another circumstance which I believe will make this point plainer still. Between the minerals of the district around the Balfsjord there is, as stated above, also a stratum of Saussurite gabbro, which at the bottom of the fjord is of enormous thickness. The Saussurite gabbro is a remarkably tough rock, especially qualified to resist the destructive agencies under a long transport. Should therefore a continuous stream of ice at one time have moved forward along this fjord and its bottom, there seems every reason to assume that fragments of Saussurite gabbro would have been carried with it and now be found along its track, which should particularly be the case with the Troms Island, more advantageously situated for receiving the same than any other spot. But in spite of the most careful search the scientist has not succeeded, either between the loose, solitary blocks or in the Glacial drift here, in discovering a single fragment of Saussurite gabbro. There is, therefore, every reason to assume that the ice-streams which moved down the Balsfjord cannot have reached the Troms Island.

If this conclusion be correct, traces of the Balsfjord ice-stream will not be found along the channels outside, *i.e.* north of Tromsö, viz. neither in the Kval Sound nor in the others in which the ice moved to the sea. There has not been any opportunity of proving this, but from impressions during my frequent journeys along these inlets, I can with confidence assert that no travelled blocks will be found here either whose birthplace was on the upland behind.

A few years ago I examined the greater part of the mouth of the Balsfjord, and I have neither there observed travelled blocks which were transported from the bottom of the fjord. I have therefore come to the conclusion that the continuous ice-stream of the Glacial period cannot have reached beyond the basin of the fjord.

From the premises thus set forth we may draw the deduction that the inland ice in North Norway during the Glacial age did not move forward along the above-described line, viz. through the sounds to the ocean, while we may presume that neither did they travel through the Balsfjord.

By the foregoing line of argument the conditions of Northern Norway must have differed greatly from those which we assume prevailed in Southern Scandinavia under the Glacial period. These two deductions, so much at variance, lead to the following conclusions: (1) That either the Glacial period must have appeared in a far severer form in the southern than in the northern part of the peninsula, or (2) that the conclusions here arrived at are based on an erroneous construction of the evidence presented to us.

With regard to the first of the points, I have already pointed out that every sign seems to indicate that somewhat similar conditions prevailed throughout the Scandinavian peninsula during this period. If thus the inland ice in Northern Norway was not powerful enough to move to the ocean along the sounds, there is but little probability of the conditions having differed in this respect in the southern part. And if, on the contrary, this has been the case in the southern half of the peninsula, there is every reason to suppose that it was so also in Northern Norway, and that ice has moved coastwards, scouring the surface wherever the depth permitted. It seems, therefore, necessary to assume that the second suggestion is correct, and that erroneous conclusions have been arrived at. There seems, for instance, reason to suggest that these deductions, even if logically correct for the district delineated, may not apply to the entire northern half of Norway in general before they have been more extensively corroborated. As to this suggestion, I may reply that the district described above comprises a great area. It includes thus channels of continuous fjords and sounds close upon 120 km. in length, and a coast line 90 km. long, and what is most important, that the channel in question is one which, by the orographical structure, has offered one of the most suited channels for the flow of the ice. If the inland ice has not been powerful enough to move forward by this channel, there is, I believe, little probability of finding a single similar channel in Northern Norway in the district between Salten and the North Cape by which the inland ice has moved to the coast.

If, on the other hand, the southern part of the Scandinavian peninsula is examined, where the inland ice is supposed not only to have filled the fjords but also the entire North Sea and the Baltic, such a circumstance presupposes, in my opinion, conditions so gigantic that they may even from the first be doubted. In fact, the area of the snowfall from which these enormous masses of ice must have been originated is not proportionate to the supposed results. Anything corresponding with such a result is not to be found even within the Arctic zone, which at present suffers most from glaciation. The Polar basin itself is, I believe, nowhere filled with ice masses, which reach the bottom. It is, in my opinion, filled with sea ice in constant drift.

My deduction is, therefore, that the theory of the ice-streams from the Scandinavian peninsula having advanced and covered the North Sea, the Baltic, and reached the Central European plain, England, the Orkneys, and the Shetlands, cannot with the facts at our disposal be accepted as a scientific doctrine.

Travelled Granite Blocks in the Neighbourhood of Tromsö.—Of the loose blocks and boulders which are found in such large numbers about this town, partly embedded in the sand, and partly in old moraine drift, or strewn over the ground, the greatest number had their origin in the solid mountains in the vicinity. These may, as we may have reason to assume, be found at the most different elevations, as the agencies which produced them have been in continuous action down to our time. Real travelled blocks, transported to their present place from a distance, appear also in quantities in this district, but the latter seem to be confined to certain levels. Of these foreign kinds of travelled blocks, most are of granite, and I draw particular attention to these, not only on account of their frequent occurrence, but also from their great dimensions, a great many being thus from a half to one cubic metre, and more. These blocks are mostly rounded, without, however, showing any greater polishing. Striæ are never found on them.

They appear in greatest number up to a height of 25 to 30 m., and more seldom between 30 and 38 m. Up to the former height they are everywhere to be found, while in higher elevations they are difficult of discovery. The line of demarcation upwards is pretty distinctly defined, but the blocks are not always to be found to the above height. There are lines along which the granite blocks are heaped up to this height, and beyond they suddenly disappear. The change is so startling that attention is at once arrested. It should, however, be stated that the line mentioned at 38 m. very nearly answers to the level of the shore line graven in the solid rock, which, greatly pronounced in this place, may be traced for miles.

During the summer of 1882 I carefully examined these conditions, paying the most minute attention to the two sides of Troms Island, 11·3 km. in length, whence I extended my researches along the sounds on both sides of this island, viz. southwards to the tracts about the mouth of the Balsfjord, about 11 km. in length. But while the travelled blocks will be confined upwards to certain levels, no such demarcation will be found downwards. They are to be found down to the lowest level of the littoral belt. Particularly there will within this belt often be found heaps of large blocks ranged in rows along the central tide line, *i.e.* the line marking half tide. On the Ren Island, too, some eighteen miles north of Tromsö, I found once a great number of granite travelled blocks strewn along the lower levels in a line from south to north. With the exception of certain parts of Kvals and Ringvats Islands, the mountains along this district will nowhere be found to consist of granite, neither will there be found strata of granite nature to which these travelled rocks might be ascribed. I must, of course, admit that a series of continuous researches are certainly required before it is possible with certainty to fix the place of birth of these blocks. With the materials at present at our disposal, however, we may arrive at some safe conclusions.

The granite field nearest from the sea inland is found far up in the Divi Valley. Of other granite strata inland there cannot here be a question.

This granite field is 124 km. from the Troms Island. Nearer than the above-described district is, however, the coast with extensive strata of gneiss-granite, which appears particularly prominent over the Kval Island situated just west of the Troms Island. From either of these the travelled blocks must have their origin.

If, now, the Divi Valley is accepted as their place of origin, the transport has been effected from the inland coastwards. If, on the other hand, the Kval Island is designated as their place of production, the transport must have taken place in opposite directions, viz. *from the coast landwards.*

If we now examine the petrographical composition of the travelled blocks, a great many will be found to be formed of varieties which belong to the gneiss-granite of the coast. But there may, on the other hand, be found many blocks among them which seem petrographically to be less related to the gneiss-granite, but to resemble typical inland granite far more.

At first sight, therefore, one would conclude that the travelled blocks might have been brought by both named roads. In this respect I must, however, point out that the gneiss-granite of the coast may petrographically vary considerably, and that it may be interspersed by or run into granite of purer character. In spite even of the greatly varying petrographical forms under which the travelled granite blocks may appear in the neighbourhood of Tromsö, I do not therein see any reason for denying that the travelled blocks may in general have their origin from the gneiss-granite. There are, however, several circumstances which tend to refute the theory of the blocks having been moved thither from the granite fields in the Divi Valley. If the blocks were thus carried down to to the Troms Island and adjacent sounds, it must have been effected in either of the following ways:—

1. Either from the upper part of the Maals River across the mountain ridges down to the bottom of the Balsfjord, and thence outwards to the Troms Island.

2. Or along the bed of the Maals River to the bottom of Malangen, and thence further through the sounds which here run in an easterly direction towards the Troms Island, between the mainland and the southern side of the Kval Island.

And here I must point out that the granite stratum in the Divi Valley appears with its western edge at a height of about 188 m. above the sea. The Divi River runs, however, into the Maals River at an elevation of about 78 m. above the sea, while the bottom of the Balsfjord is separated from the Maals Valley and thus also from the Divi Valley by a higher mountain ridge in which the deepest insections, tending towards the Balsfjord, lie at an elevation of about 160 m., *i.e.* about 78 m. *higher* than the conflux between the Divi and the Maals Rivers. If, therefore, the blocks from the Divi Valley travelled down to the bottom of the Balsfjord, they must have done so over passes which lay 78 m. higher than the conflux between the two rivers! Although it might be most natural to assume that the ice-streams of the Divi Valley followed the bed of the Maals River, the suggestion that an arm from the same might have moved over the higher ridges down to the bottom of the Balsfjord is certainly one which cannot be ignored. But, if this was the case, the granite blocks which had been carried from the Divi Valley in this way ought to be found at the bottom of the Balsfjord at a higher elevation than 30 m. above the sea. Whether travelled granite blocks will be found at the bottom of this fjord is a question which cannot be answered, as but little attention has yet been paid to the same. I am, however, of the opinion, from my own investigations, that they are totally absent in this place.

If granite blocks were, on the other hand, carried down into the Balsfjord by this road, they must, judging by the height to which they are found near Tromsö, have been carried from this place further by drift ice. The beginning of the transport belongs thus to a period when the real Glacial age was closed, and the continuous ice-layer broken up. In this case it might be assumed that the travelled blocks should be found in largest numbers along the sides of the Balsfjord, and decreasing in numbers from the bottom of the fjord outwards to

Tromsö. On this point, too, we are without conclusive proofs, but the examinations have, as already stated, been extended inwards to the mouth of the Balsfjord and its environs, and the results of these disprove such an assumption. Granite blocks are thus to be found about the mouth of the Balsfjord, but in far lesser numbers than over the Troms Island. It is just on the southern part of this island that travelled blocks are found in largest numbers in the whole district; while the circumstance that neither blocks nor fragments of Saussurite gabbro, which, as pointed out, are found in enormous quantities in the neighbourhood of the Bal fjord, can be discovered among the travelled blocks on the Troms Island, further corroborates my belief that no transport of blocks from the Balsfjord outwards to the sea has taken place. In fact, I am fully convinced that the block-transport has taken place *from the coast inwards.*

There is thus every reason to believe that the travelled granite blocks have not been carried out to the Troms Island through the Balsfjord. In fact, there seems more probability that the transport was effected through the Maals River. But, if this was so, travelled granite blocks would have been found on the slopes of the Malang, and here too in decreasing numbers *from the inland towards the outer islands,* which appears, however, not to be the case. I have therefore come to the conclusion that the birthplace of the travelled granite blocks in the vicinity of Tromsö must be referred to the gneiss-granite stratum of the coast, and thus again chiefly to that part of the same which appears at the Kval and Ringvats Islands west of Tromsö. This assumption is supported too by the circumstance that a great number of the travelled blocks, judging by the petrographic composition of the mountains in question, undoubtedly belong to the gneiss-granite of the coast, and that there is nothing to disprove the theory that even the blocks which petrographically seem to differ in composition also belong to the same stratum in composition.

The highest elevation in which the travelled blocks are found in the neighbourhood of Tromsö indicates that the transport of the same has taken place *after* the close of the Glacial period, *i.e.* in an age when the continuous layer of the Ice age had broken up into more or less separated glaciers. Under these circumstances the transport of the blocks from the Kval Island inwards to the Troms Island *must have been effected by floating ice.* The highest line of elevation in which the blocks along the sounds are deposited *indicates, therefore, the height of the sea at the commencement of the block-transport.* And as the blocks are often found in greatest number somewhat below this line, I have come to the conclusion *that block-transport has progressed more rapidly as this period advanced.* I may, however, add that the whole epoch of the block-transport has probably been a short one.

The local conditions of Kval Island seem also to have greatly favoured even the most extensive block-transport at an early age. The continuous layer of ice of the Glacial period has thus, as demonstrated above, been broken up thus early, that the ice remained only in local glaciers of great extent. So early must the block-transport have taken place also in an easterly direction, both through open channels of the Balsfjord and the Kval Sound, and unimpeded by the ice-streams moving down from the mainland. When, however, this, as appears from the blocks in the neighbourhood of Tromsö cannot have been the case, at all events to a limited extent alone, there is herein an obvious proof that special conditions which favoured the current carrying the blocks to the shore did not exist before the epoch which corresponds with the highest level in which the blocks are found.

If the blocks were, as I believe is demonstrated beyond doubt, transported to their places by floating ice, the flow of the currents must have greatly influenced the direction of the block-transport. At a period, therefore, which is determined by the transport commencing eastwards, special conditions must have existed which have caused a stronger flow of the current from the outer coast inwards. There are, in fact, several circumstances which seem to point in this direction. There is in particular that of the Gulf Stream. It is thus evident that the Gulf Stream, which during the Glacial age was diverted from the coast of North Norway, has, in a comparatively recent era, curved towards the coast to a considerable extent.

As is generally known, a complete Arctic Sea fauna existed along the coast of Norway in the early part of the Quaternary age; but by degrees this has been more and more mixed with southern species, an encroachment which continued without interruption to the present time, and is, I believe, still in full operation. Some perfectly pure species of the Arctic fauna may still be met with in some of the deepest fjords of Norway, but even these remains are most probably in retrogression. This constant retrogression of the original Arctic Sea fauna on the coast, and the encroachment of a more southern, must naturally be dependent on currents of warm water coming from the south, and as long as the Arctic fauna alone supervened, these warm currents must have been entirely absent from the coast line referred to in this paper. From the moment access was made for the same, the southern fauna began to manifest itself. In the block-transport here described, which began at a period when the surface of the sea lay, in relation to the fundamental rock, about 30 m. higher than at present, I believe we may find a more exact determination of the time when this curve in the current took place.

There is, besides this circumstance, another of equally great importance which points in the same direction. It is a fact, thus, that fragments of pumice-stone are constantly washed ashore on the coasts of North Norway, and even on those of the Polar lands as far as the Gulf Stream reaches, but pumice-stone is not found at any elevation in Northern Norway, *but only at the lowest by the shore.* In fact, the highest line along which pumice-stone is found here *coincides nearly exactly with that of the travelled granite blocks in the neighbourhood of Tromsö.* In no case does it exceed the same. KARL PETTERSEN

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A NEW FORM OF SPRING FOR ELECTRIC AND OTHER MEASURING INSTRUMENTS[1]

In steam- and gas-engine indicators the pressure of the fluid on a piston produces a slight shortening of a spiral spring which is magnified by a lever, and so the pressure of the steam or gas is recorded. In what are usually known as spring balances there is also occasionally a magnification of the elongation of a spiral spring effected by the use of a rack and pinion. Such magnifying arrangements, however, not only introduce inaccuracy by the bad fitting of hinges or of teeth, an inaccuracy which

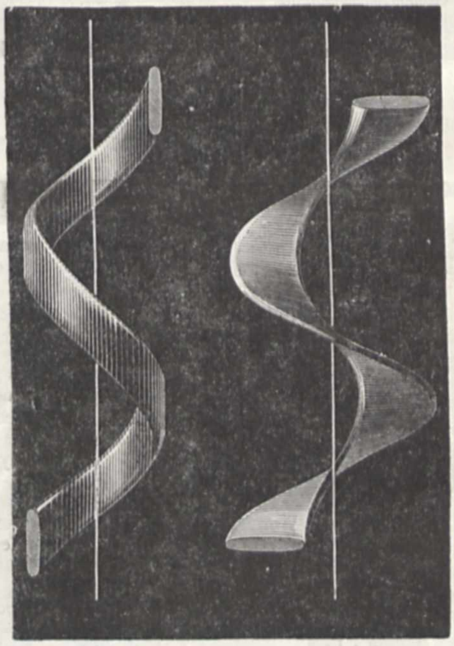

FIG. 1. FIG. 2.

is aggravated by wear, but they increase the cost of measuring-instruments and their liability to get out of order.

And, as an example of the difficulty of using the wheel and pinion for the magnification of an angular motion produced by a small force, the authors mentioned the fact that although they used this plan for a year or more in their electric measuring-

[1] Abstract of a paper read before the Royal Society by Profs. W. E. Ayrton, F.R.S., and John Perry, M.E.

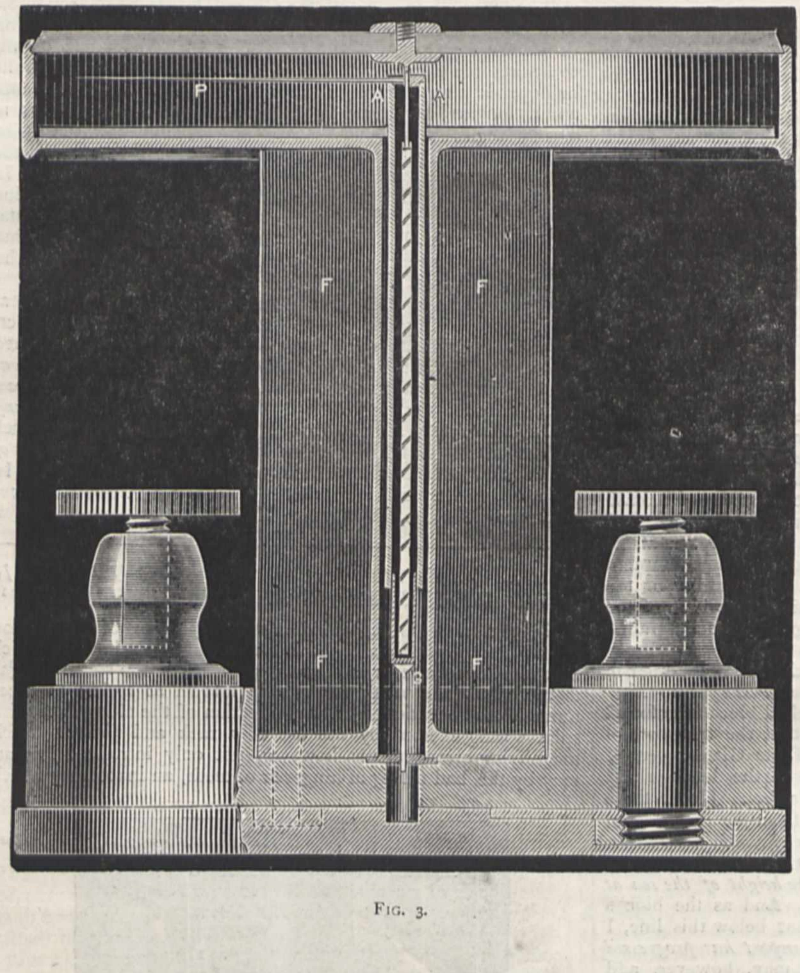

FIG. 3.

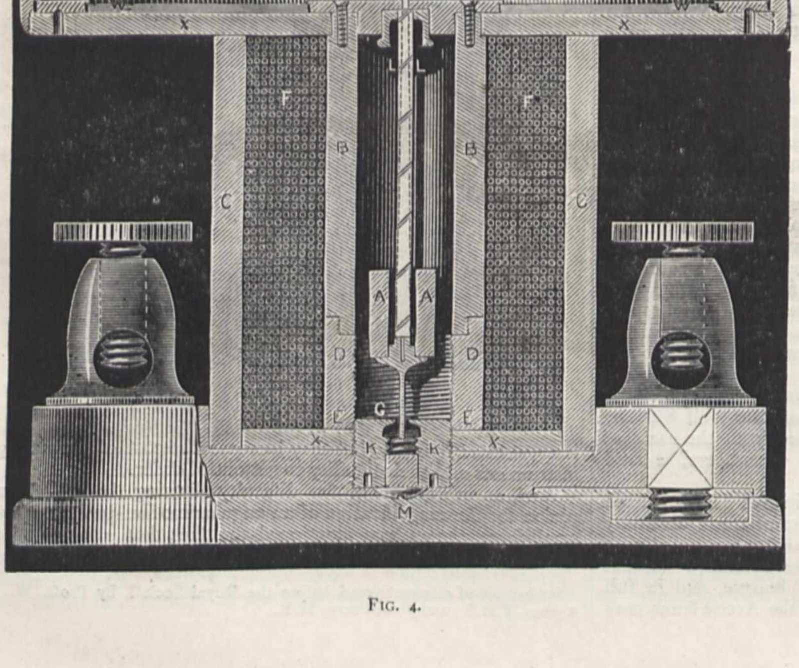

FIG. 4.

instruments, and although the wheels and pinions were made by a good watchmaker, still the friction involved in such a plan has induced them to abandon it in favour of the new arrangement which is the subject of their present communication.

The telescopic method employed by Weber, and the spot of light method due to Sir W. Thomson, for magnifying the effect of an angular motion are, of course, unequalled for stationary measuring-instruments, but for instruments which must be carried about and used quickly without the necessity of adjustment, these most ingenious reflecting methods are quite unsuitable.

With an ordinary cylindric spring, having a small angle between the osculating plane and a plane perpendicular to the axis, as is the case with all spiral springs such as are in practical use, it is well known that but very little rotation is produced between its ends by the application of an axial force. Consequently with such springs it is only possible to obtain magnification by the employment of a system of levers, or of a rack and pinion. It occurred to the authors, therefore, to consider whether it would not be possible to make a spiral spring of such a nature that for a comparatively small axial motion of its ends there should be considerable rotation of one end relatively to the other, and by the employment of which all levers, racks, and pinions could be dispensed with, so that no error could be introduced by wear and tear, or by want of fitting of joints, and further so that the temperature correction should be merely one affecting the rigidity of the material used as a spring, and not a correction such as had to be applied in consequence of the contractions and expansions of the various parts of an ordinary magnifying apparatus.

The theory of the strength and stiffness of the ordinary cylindric spiral spring of small angle was given for the first time in 1848 by Prof. James Thomson, andt he authors follow his method in investigating the laws governing the behaviour of spiral springs generally. They find that if the centres of all cross-sections of the wire, or strip, forming the spring lie on a right circular cylinder of radius r; if the spiral have everywhere an inclination α to the plane perpendicular to the axis of the cylinder, and if a force F act at one end of the spring along the axis, the other end of the spring being fixed; if B is the flexural rigidity of the wire in the osculating plane, and if A is the torsional rigidity about the spiral line at any place; if the angular motion, in a horizontal plane, of the free end of the spring relatively to the fixed end be called ϕ, and if the axial increase of length be called d, and the whole length of the spring along the spiral l, then—

$$\phi = l F r \sin \alpha \cos \alpha \left(\frac{1}{A} - \frac{1}{B}\right) \quad . \quad . \quad (1),$$

and

$$d = l F r^2 \left(\frac{\cos^2 \alpha}{A} + \frac{\sin^2 \alpha}{B}\right) \quad . \quad . \quad (2).$$

Assuming for the general investigation that the cross-section of the wire is elliptic, it is found that the rotation of the free end of a spring like Fig. 1 or Fig. 2 is greater the greater the inequality in the principal diameters of the elliptic section.

In Fig. 1 it is found that there is an uncoiling on the application of an axial pull. Fig. 2 shows a spring made of the same material, but the wire has been passed through rolls so as to flatten it in the opposite way, and now a rotation tending to coil it up is found to be produced by the application of an axial pull.

The twisting torque to which the spring is subjected is $F r \cos \alpha$, and the bending torque to $F r \sin \alpha$. But the twist must be multiplied by $\sin \alpha$, and the bend by $\cos \alpha$ when we project these motions on a horizontal plane. So far then as the total rotation in a horizontal plane of the free end of the spring relatively to the fixed end is concerned, it may be regarded as being produced by equal twisting and bending torques, each of them equal to $F r \sin \alpha \cos \alpha$; and the total rotation of the free end of the spring relatively to the fixed end, which is the special feature of the springs considered, is proportional to the difference between the two angular rotations produced in the wire by these equal bending and twisting torques. The twist alone would cause an increase in the number of coils, that is, a rotation in the direction of coiling which is the positive direction, while the bending, or rather the unbending, alone would cause a negative rotation, or one tending to uncoil the spring. When both occur together in the actual spiral spring subjected to an axial force, the total rotation is positive or negative, according as the angular twist or the angular bend is the greater. Hence the flexura and torsional rigidities of the wire alone determine whether the rotation is positive or negative.

It is well known, for example, that, when a wire of circular section is subjected to equal twisting and bending torques, the twist is greater than the bending for almost all substances, that is, substances in which the ratio of the modulus of rigidity to Young's modulus is between one-third and one-half. Hence we may expect that in a spring made of round wire, and with the spires making an angle of 45° with a plane perpendicular to the axis, the total rotation will be positive for an axial force applied so as to lengthen the spring. And experiment shows that this is the case.

If the wire be flattened and bent so that the flat side of the strip touches the cylinder on which the wire is coiled, as shown in Fig. 1, then the arrangement is such that the bending is greater than the twist. Hence an axial force applied so as to lengthen this spring causes a negative rotation, whereas if the strip be coiled as in Fig. 2, so that the edge of the strip lies against the cylinder on which it is coiled, an axial force similarly applied will now cause a positive rotation. It is almost certain that for any strip of material the positive value of ϕ obtained with the latter form of spring is likely to be greater than the corresponding negative value with the former kind, but the difficulty of manufacturing the second form of spring compelled the authors to confine their attention to the former type.

Having constructed some very delicate springs of the first kind, one of the first difficulties which the authors met with arose from the liability of such springs to acquire a permanent set, so that it became necessary to determine the dimensions of the spring which would give the largest amount of rotation with the minimum amount of stress in the material. Having made their calculation of the greatest amount of stress, the general conclusions arrived at are, that in order, with a given axial force, to obtain a large amount of turning of the free end of the spring, combined with small maximum total stress in the material, and not too much axial motion of the free end of the spring, the strip of elliptic section should be as long and as thin as possible, should be wound in a spiral such that the osculating plane makes an angle of 40° to 45° with a plane perpendicular to the axis of the spiral, and so that the smaller diameter of the elliptic section is at right angles to the axis of the spiral.

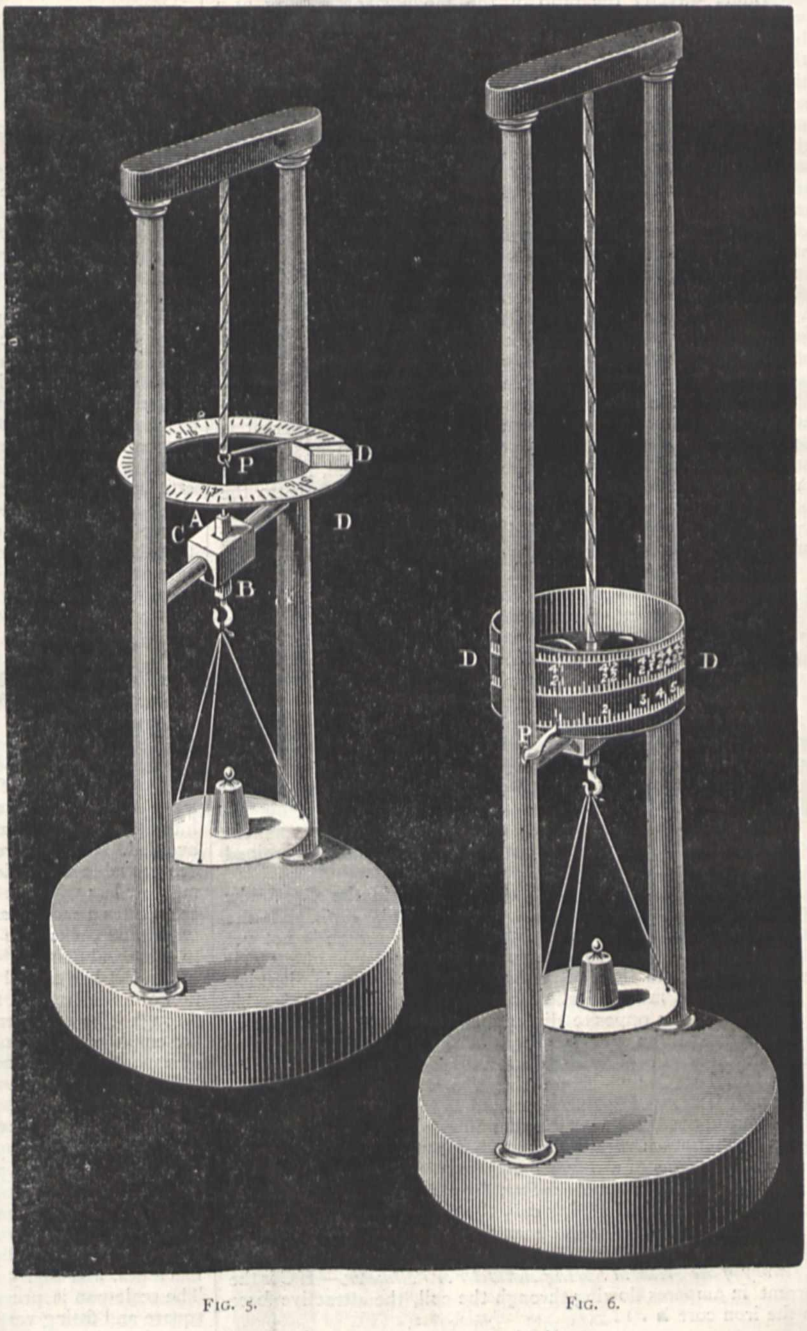

Fig. 5. Fig. 6.

In the springs employed by the authors in measuring-instruments the edges of the strip nearly touch one another in consecutive coils, so that the strip forms almost a continuous cylindric surface, the angle of the spiral being 45°, the cross-section of the strip being rectangular, and they find the following laws:—

$$\phi \propto \frac{l F}{t^3}\left(\frac{1}{4 N} - \frac{1}{E}\right)$$

$$d \propto \frac{lFr}{b^3}\left(\frac{1}{4N} + \frac{1}{E}\right)$$

$$f \propto \frac{F}{b^2}$$

where f is the greatest stress in the material, b the thickness of the strip, N the modulus of rigidity, and E Young's modulus for the material.

The authors now show how their springs may be used to determine directly the ratio of the modulus of rigidity of a material to its Young's modulus, and they conclude their paper by describing some practical applications of their springs which they have already made in measuring-instruments. Thus by the employment of springs such as those described, they have succeeded in making *ammeters* and *voltmeters*, or instruments for measuring respectively electric currents and differences of potential, in which the pointer moves over in some cases as much as 270° of the scale instead of only 50°, which is all that can be obtained with ordinary galvanometers. One form of the instrument is shown in Fig. 3, where A A is a thin, hollow tube of charcoal iron attached at its lower end to a brass piece G guided at the bottom in the way shown. To G is attached the lower end of a spring made in the way described, of silver or hard phosphor-bronze, the upper end of which is attached rigidly by a thin rod to the glass top of the instrument, which itself is fastened rigidly to the framework of the instrument. The rod attached to the glass, and to which the upper end of the spring is attached, also serves as a guide to the top of the iron tube. In the space F F a solenoid wire or strip is wound, its ends being attached to the terminals shown. Hence, when a current is passed through the wire, the iron tube is sucked into the solenoid, and its lower end G, to which the spring is attached, receives a large rotatory motion, which is communicated directly to the pointer attached to the top of the iron tube. Parallax in taking readings of the pointer is avoided by the horizontal scale being on looking-glass in the well-known way.

By making the iron tube A A very thin, so that it is magnetically saturated for a comparatively weak current, by fixing it so that it projects into the solenoid a fixed distance which has been carefully determined by experiment, and by constructing the spring in conformity with the conditions worked out in this paper, so as to obtain a large rotation with minimum stress, and with not too much axial motion of the free end of the spring, they have succeeded in obtaining deflections up to 270° directly proportional to the current, and without any permanent set being given to the spring.

To prevent a spring taking a permanent set for a large deflection, it is of great importance that the spring after being delivered by the maker should receive a large degree of permanent set in the direction in which we wish it to be afterwards strained in ordinary working.

In spite of the fact that Prof. J. Thomson in the *Cambridge and Dublin Math. Journ.*, November 1848, explained the importance of initial strains in materials, the reason is not yet sufficiently well understood why when a round bar has been well twisted beyond the limit of permanent set in a certain direction it has twice as much elastic strength to resist torsion in this direction as in the opposite direction. Now in the very act of manufacturing these springs, that is in the bending of the strip, the material acquires strains which are just opposite in character to the initial strains which we wish it to possess, for, as already explained, if the spring be constructed as in Fig. 1, an extension of the spring produces a rotation tending to uncoil it. Hence a spring must not be regarded as ready for use until it receives a good set by means of a weight hung from its end.

This instrument is *direct reading*, the adjustment for sensibility being made by a small sliding coil, the correct position of which is initially determined experimentally by the makers, and in which position the coil is permanently fixed.

Theory of the Solenoid Spring Ammeter or Voltmeter.—If C is the current in amperes flowing through the coil, the attractive force on the iron core is

$$\frac{KC^2}{1 + SC},$$

where S is a constant, which is the greater as the current is smaller for which the iron tube A A, Fig. 3, becomes saturated with magnetism. The position of this iron core in the solenoid is so selected that K remains practically constant throughout the small range of downward motion of the core.

Since the rotation ϕ has been produced by an axial force, we know from the theory of the spring already given, that this axial force is $p\phi$, where p is some constant. Hence

$$p\phi = \frac{KC^2}{1 + SC},$$

and since SC is great in comparison with unity for such currents as we wish to measure, we have

$$\frac{p\phi}{K} = \frac{C}{S} - \frac{1}{S^2},$$

or

$$C = \frac{Sp}{K}\phi + \frac{1}{S},$$

that is, equal divisions of the scale correspond with equal additions to the strength of the current except close to the zero, and the authors do not usually graduate these instruments within 5° of the zero.

Shielded Measuring-Instruments.—When it is desired to use the instrument close to a dynamo machine or electromotor in action, they have adopted a different and somewhat special form of construction, which is shown in Fig. 4, by means of which the instrument is to a great extent shielded from even powerful external magnetic fields. In this instrument the electromagnet consists of a hollow core, part of which, B B, is of charcoal iron, and part, D E, of brass, or other non-magnetic metal. The outside tube, C C, and the plates, X X, top and bottom, are also of charcoal iron. The space F F is filled with insulated wire or strip in electric connection with the terminal, so that when a current is sent through the instrument an intense magnetic field is formed between D and E, which are the poles of the electromagnet. To the iron tube A A, also made of charcoal iron, the spiral spring, in this case made of extremely thin hard steel, is attached, the other end being attached to the piece F, which is fixed relatively to the bobbin. The spindle G G, which is fixed to the moving iron core A A, moves freely in bearings H H, so that the only movements of which A is capable are one of rotation and one parallel to the axis of the bobbin. As the iron core A projects into the strong magnetic field between D and E, it is strongly attracted towards E when the current flows, and, as before, causes a large rotation of the pointer P over the scale. As a means of varying the power of the instrument an adjustable iron piece K is provided, which can be screwed nearer to or farther from the core A, and by the use of which the sensibility of the instrument can be adjusted so as to make the instrument "direct reading," that is to say, each division of the scale can be made to correspond with 1 ampere of current, or 1 volt difference of potential, and the employment of a constant such as 1·34 amperes, or volts, per degree, which has hitherto been necessary with our measuring-instruments, is now avoided. This power of adjustment produced by the use of the movable iron piece K, combined with the ease with which more or less wire can be wound on to the instrument, which also constitutes a second adjustment of sensibility, is of considerable importance, since the employment of a constant has not only led to error and delay in measurements made in electric-light factories, but has caused the breakage of the pointer or the destruction of an instrument from a far too powerful current being sent through it by an observer (often a man with little experience in the employment of instruments) having confounded the constant of some other instrument with that of the one he was using.

In the first of these magnifying spring ammeters and voltmeters made by the authors, the instrument did not show the *direction* of the current, but they have since added on the base of the instrument a small compass needle (not seen in the accompanying illustrations), which points out at which of the terminals the positive current enters, while the main pointer of the instrument shows as before the magnitude of the thing to be measured.

Weighing-Machines.—Another class of instruments in which they have practically employed this spring are weighing-machines, and Fig. 5 shows one of the arrangements adopted. The scale-pan is prevented from turning by the part A B being square and fitting very loosely a square hole in C. This arrangement introduces practically no friction, and prevents the moment of inertia of the scale-pan and load interfering, by means of a rotatory motion, with the rapidity with which the pointer comes to rest when a load is put into the pan. The position of the pointer P, which revolves when a weight is placed in the scale-pan, is read off upon the spiral scale D, which in the specimen shown was graduated in pounds. In another of these weighing-machines, shown in Fig. 6, the arrangement is the same with the exception that a cylindric scale D is fixed to the end of the spring and turns with it; the pointer P fixed on the frame of the instrument points to an indication of the weight on a spiral line drawn on the cylinder D. This second arrangement allows of the employment of springs whose ends have a relative motion of five or six revolutions.

The authors also brought before the Royal Society a model showing a combination of bifilar and spiral spring suspension, in which great rotation and small axial lengthening or shortening are produced by an axial force.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Mr. A. E. Shipley, of Christ's College, will give a repetition of the Elementary Biology course in the Morphological Laboratory during the Long Vacation, beginning July 7.

The workshops of Mechanism will be open during the Long Vacation.

The Observatory Syndicate report 2305 observations of R.A. and N.P.D. in 1883-84, including 1579 observations of zone-stars made on 100 nights. The observations of standard stars are reduced to about the end of 1883. The zone-stars are completely reduced to end of 1881, the mean R.A. and N.P.D. to end of 1877.

It appears that the new expenditure entered into for professors, readers, University lecturers and demonstrators, and for apparatus and buildings, already exceeds the annual receipts from the colleges under the recent Act. Thus there is little chance at present of the appointment of the numerous readers contemplated by the University Commissioners.

The placing of a new story over the Mineralogical Museum for a laboratory of Elementary Biology has been sanctioned. The recommendations regarding a lecture-room and additions to the Physiological Laboratory are in abeyance.

The Botanic Garden Syndicate reports that during the past year the houses have been improved in many details. The Bromeliaceæ are now represented by fifty species. A new fern pit for filmy ferns is well stocked. The collection of Irises has been greatly improved, largely by Prof. Michael Foster's generous contribution, making it probably the finest in any botanic garden. The liberality of Mr. Barr has contributed a very fine collection of daffodils, and one of Funkias, not surpassed anywhere. Numerous plants of scientific interest have flowered in the Gardens and been figured. Col. T. Clarke has contributed a set of important Croci; Messrs. Low of Clapton a fine set of orchids.

The local lectures in provincial centres continue to gain large audiences, many courses of lectures on physical science and biology being given. Great difficulty, however, is felt in establishing sufficiently continuous courses of lectures in successive years, so as to give complete schemes of study.

The Cavendish and the Chemical Laboratories will be open during July and August.

Prof. Macalister will hold a class in Osteology during the Long Vacation. The Demonstrator will take a class in Practical Histology.

SCIENTIFIC SERIALS

THE *Journal of Botany* for May contains several articles of interest to cryptogamists:—Mr. W. B. Grove describes a number of fungi, some of them but little known or new; and the paper is illustrated by two plates.—Mr. S. Le M. Moore has paid special attention to the small class of endophytic algæ, and gives some interesting particulars regarding the structure and reproduction especially of *Chlorochytrium Lemnæ* and *Scotinosphæra paradoxa*.—Dr. Hance describes, under the name *Ptilopteris*, a new genus of polypodiaceous ferns; and Mr. J. G. Baker several new species of ferns in the collection of M. Humblot from Madagascar.—Among the minor notes evidence is given that *Centaurea Jacea*, L., must be regarded as a true British species.

In the number for June the only original article of importance is an exhaustive monograph by Mr. F. Townsend, of the variable species *Euphrasia officinalis*. He classifies the various forms under eight groups, only three of which are found in the British Islands.—A large portion of this number is occupied by the completion of the annual list (continued from the previous number) of new flowering plants published in periodicals in Britain during 1883. The length of this list affords evidence that the study of descriptive and systematic botany is not altogether neglected in this country.

Rendiconti del R. Istituto Lombardo, May 15.—Biographical notice of Giovanni Polli, with a list of his scientific productions, by Prof. Gaetano Strambio.—Influence of Virgil on the style of Dante, Petrarch, Metastasio, and Parini, by E. Giulio Carcano.—On the present condition of agricultural interests in Europe and North America, by Prof. Gaetano Cantoni.—On surfaces of the third order, by Prof. E. Bertini.—Experimental studies on the cure and prevention of tuberculosis, by Prof. G. Sormani.

Journal de Physique, April.—E. Blavier, study of earth-currents. In France these currents generally flow from north-west to south-west, and inversely; but often their direction changes and they go from north to south, north-east to south-west, east to west, or inversely. It is still impossible to give a general law.—E. Mascart, on the reciprocal action of two electrified spheres, shows that if the distance between centres is triple the diameter the law of Coulomb is correct to 2 per cent.—M. Brilloin, duration of swing of a magnetic system with its index.—M. Izarn, electro-dynamic and electro-magnetic experiments. An astatic float based upon that of Ampère is used to demonstrate the law of repulsion of consecutive elements of the current. The apparatus does not disprove Maxwell's view, however.—M. Buguet, action of two consecutive portions of one current.

May.—E. Mercadier, on the laws of transverse vibrations of elastic rods. From experiments on rods of steel and iron held at two points it appears that the number of vibrations is proportional to the thickness in the direction of the displacement, inversely proportional to the square of the length, and independent of the breadth.—P. Garbe, on Joule's law. Experiments made with an incandescent lamp placed in a calorimeter.—M. Marey, analysis of movements of photography. Gives a diagram of movements of a man running.—E. Mathieu, figures of liquid drops at the moment when they are about to detach themselves from a capillary tube fastened to the bottom of a vase.—M. Neyreneuf, on the transmission of sound.

Bulletin de l'Académie R. de Belgique, April 5.—Investigations on the spectra of the comets and on the luminous spectra of the hydrocarbonic gases, by Nicolas von Konkoly.—On the presence of the Biscay whale (Nordcaper) on the coasts of Norway in ancient and modern times, by G. A. Guldberg.—On the influence of temperature on the bands of the spectrum, by Ch. Fievez.—On the sand-heaps and sandstone boulders scattered over the Upper Devonian hills in the Sambre and Meuse districts, by Michel Mourlon.—On the influence of the atmospheric conditions on the appearance of certain colours in the scintillation of the stars; application of these observations to the prediction of changes of weather, by Ch. Montigny.—Spermatogenesis in *Ascaris megalocephala*, by Edouard Van Beneden.—On the advanced state of vegetation in Belgium in the month of March, 1884, by G. Dewalque.—Remarks on the cause of metamorphism in the rocks of the Recogne district, Luxemburg, by Jules Gosselet.—On the existence of a fourth species (*Balænoptera borealis*) of the genus Balænoptera in the North European waters, by G. A. Guldberg.

Journal of the Russian Chemical and Physical Society, vol. xvi. fasc. 3.—On the formation of amides of ammoniacal salts, by N. Menschutkin. The speed of amidation of the investigated acids increases with the increase of temperature, and the influence of temperature could be represented by similar curves for the different acids. The velocity of amidation depends also on the molecular weight, that of formic acid going on at a greater speed than those of acids which have higher molecular weights. Even with the aromatic acids the speed of amidation depends on the isomeric form of the acid. The results as to the dependency on isomerism and molecular weight are identical with those arrived at with regard to the compound ethers.—On the hydrates of the chloride of cobalt, and on the cause of the changes of colour of its dissolution, by A. Potilitzin.—On the action of the haloid salts of aluminium on the saturated hydrocarbons, by G. Gustavson. Organic bodies undergo great modifications when they enter into reactions with these salts, even when they enter into unstable temporary combinations; they acquire the capacity of entering into several new reactions, and undergo deep modifications even without being heated. The experiments might throw a new light on the part played by mineral salts in organisms, the component parts of which may be thus submitted to changes that are favourable for life.—On a new salt of rhodium, by Th. Wilm.—Note on M. Kanonnikoff's memoir on the refracting power of organic substances, by F.

Flavitzky.—On the preparation of animal colours from albuminoids, by W. Mihailoff.—Notes on the pseudosulphocyanogen, and on the dissolution of fibrine, by A. Lidoff.—On the thermal phenomena due to magnetism, by P. Bakhmetieff.—On the reproduction of curves traced by a point of the axis of a revolving body suspended at a point of its axis, by D. Bobyleff. The author publishes a photolithographed plate showing the different curves described by a conical pendulum revolving around its axis of symmetry, and balancing at the same time about its point of suspension. The apparatus having been improved, the curves are very symmetrical, and, notwithstanding the influence of the decrease of the oscillations, the curves are most like those deduced from the integration of the differential equations.—A preliminary note on the electrical properties of quartz, by G. Woulff.—On the conditions of sensibility of the method of Mance, a mathematical inquiry by D. Zolstareff.—On the changes produced in the intensity of an induction current by the introduction of a branch containing a bobbin, by J. Borgmann.—Notes on elementary optics, by P. Ziloff and M. Wolkoff.—Note on friction, by M. Kraiewitsch.

SOCIETIES AND ACADEMIES

London

Royal Society, June 19.—"On the Structure and Development of the Skull in the Mammalia. Part II. Edentata." By W. K. Parker, F.R.S.

My former paper on the structure and development of the mammalian skull was published in the *Philosophical Transactions* in 1874; it was on that of the Pig.

Since then, whilst gathering fresh and fresh mammalian materials, the greater part of my actual work has been on the skull of the other classes.

I have come to the conclusion that the Edentata are nearer of kin to the Monotremata than to the Marsupialia, and that if they did, as indeed they must have done, pass through a Metatherian, or Marsupial stage, they did not utilise it, but ran through it in an *abbreviated pre-natal* stage.

Of course the remarkable modification of their jaws, due to abortion, and in some cases complete suppression, of their teeth, is that which makes these forms so abnormal to the morphologist as well as to the zoologist.

As it happens, the most primitive form of Mammalia existing, the Prototheria (*Ornithorhynchus* and *Echidna*), are also abnormal on the same account, and thus the best standard existing by which to measure the height of the platform on which we find the Edentata is not itself normal, or straight, or perfect.

Now none of the Metatheria or Marsupials have suffered from this kind of degenerative specialisation; they therefore come in well as standards of measurement and comparison for the Insectivora next above them, but of little use here among the Edentata.

Prof. Flower, after working out the general anatomy of this group (*Proc. Zool. Soc.* 1882, pp. 358–367), has come to the conclusion that the Edentata of the Old World have little to do with those of the New.

That sounds like a hard saying to one not familiar with the structure of the group; it did to me, no long time ago, although what I had done at the group, long ago, went to prove the same thing; now, however, I am quite satisfied of the truth of my friend's deductions.

The Neotropical Edentata hold together much more than might have been expected; the Armadillos are the most isolated, but much as the Aard-Vark of the Cape looks like an archaic Armadillo without armour, he is not more than a very distant relative of the modern armed Armadillos.

Indeed, the curious coincidences that I have found between the structure of the Aard-Vark and that of a large Insectivore from a contiguous region, namely, the *Rhyncocyon* from Zanzibar, lead me to suspect that the Cape Anteater is an offshoot from the same stock, and is, indeed, the only Edentate that can be looked upon as probably arising originally from a Metatherian or Marsupial stock, like the Insectivora.

The other Palæotropical Edentata—the Pangolins—are perhaps still more isolated than the Aard-Vark, but they have not come so near extinction, and are found in more than one continent of the Old World.

If the term *Reptilian* might be applied to characters seen in any Placental Mammal, it might to what I find in this. This creature has most remarkable correspondences with the Reptilian group. Of course, the scaly covering is mimetic of the Lizard's scales, and is in reality made up of cemented hairs; that may pass; but not the structure of the sternum in some species, with its long "xiphisternal horns," as in the *Stellionidæ*, nor the cartilaginous abdominal ribs, as in the Chameleons and some other kinds. (See my memoir on the "Shoulder-girdle and Sternum," Ray. Soc., 1868, plate 22, fig. 13).

But the curious *ornithic* nasal bones, deeply cleft in front, the imperfect desmognathism of the palate, the feeble and segmented state of the anterior sphenoid, and the open pituitary space of the embryonic cartilaginous skull, all these things suggest that the Pangolins, whatever degenerative specialisation they may have undergone, never did rise to any height as Mammals.

Indeed, to me their *pre-natal* development—the Eutherian placentation—seems to be their best title to be ranked even amongst the low forms of the high Mammalia.

If a complete series of fossil types could be found, on one hand stretching backwards (or downwards) from the Glyptodons, and, on the other, from the Megatheroids, then, long before these two groups merged into a common Prototherian root-stock, we should find their differences one by one dying out.

Embryology would help us here very much if materials could be obtained. Even with the scanty treasures that I have been able to obtain, most remarkable things are shown.

Of the two Anteaters I have only been able to obtain the young (not the embryo) of the smallest and most aberrant type—*Cycloturus*—and of the Sloths only two embryos, and one of these considerably advanced, belonging to two genera, namely, *Cholœpus* and *Bradypus* (*Arctopithecus*, Gray).

But every step backward in the structure of the skull of the Sloth brings me nearer and nearer to what I see even in the young of the Little Anteater, and that it is possible for both of these types to have arisen from the same stock is no longer a doubtful thing.

But the skull of developing embryos of the Sloth (of either kind) forms a very valuable and easy-working key to what is difficult in the skulls of the extinct gigantic Megatheroids.

If this be the case, if Sloths, extinct or recent, have arisen during time from the same stock as the great terrestrial Ant-bear, and the little prehensile-tailed *Cycloturus*, then there is nothing in any other Order to shock the mind or to be a stumbling-block in the path of the most timid evolutionist.

That in the Armadillos the new husbandry, or growth, of hair—the correlate of milk glands—should thrive badly on the old stony ground of Reptilian horn-covered scales, breaking out where it can among the clefts, is not more wonderful than that this same new growth of hair in the Pangolin should mat itself together and imitate the scales of Reptiles and Fishes.

Physical Society, June 14.—Dr. Guthrie, president, in the chair.—New Member, Mr. Stanley Butler.—Mr. Hoffart read a paper on a new apparatus for colour synthesis, which he exhibited. The colours are obtained by sending through prisms the light from a series of platinum wires made incandescent by Grove or other cells. Three different rays can be compared or superposed at a time by the instrument shown. The rays are received into the eye through an adjustable eyepiece; and various ingenious devices are adopted in the construction of the apparatus. The intensities of the lights are regulated by rheostats in the circuits of the platinum electro-pyres. Lord Rayleigh, Mr. Stanley, and Prof. Perry commented on the apparatus, and Dr. Guthrie thought that it would be useful in studying colour-blindness.—Mr. Blaikley read a paper on the velocity of sound in small tubes—a continuation of experiments formerly brought before the Society by the author. Mr. Blaikley showed experimentally how his measurements were made. He found that pipes in which the upper proper tones were in harmonic order, or, better still, those in which they were far removed from the harmonic order, and therefore dissonant, were best for the purpose. He had obtained velocities from fine tubes varying from 11·4 to 88·2 mm. in diameter, the former giving 324·38, and the latter 330·13 m. per second as the velocity of sound. In free air Mr. Blaikley thought the velocity would come out 331 m. per second. The differences of velocity for the different pipes were very regular. Lord Rayleigh, Dr. Stone, and Dr. Guthrie made some observations on the paper, Dr. Stone remarking that the diameter of a pipe modified the pitch of the same rate, a fact noticed in musical instruments. In experiments on water-waves Dr. Guthrie had found that in rectangular troughs the rate of oscillation was less than in circular ones.—Mr. Howard read a paper by himself and Mr. Hayward, on the thermal relationship between water and certain salts, such as sulpho-ethylate. &c. Curves of results were given and interpreted.

Royal Meteorological Society, June 18.—Mr. R. H. Scott, F.R.S., president, in the chair.—Dr. Benjamin A. Gould, Director of the Cordova Observatory, Argentine Republic, was elected an Honorary Member.—The following papers were read:—The equinoctial gales—do they occur in the British Isles?, by Mr. R. H. Scott, F.R.S. The period investigated was the fourteen years 1870–84, and only those storms were selected which had attained force 9 of the Beaufort scale at more than two stations. The results show that the storms are all but exclusively confined to the winter half-year; and also how, for a certain interval, the stream of storm depressions sets over the British Isles, and then for a time takes another path, leaving this country at rest. In some years there are as many as four or five storms in a fortnight, and in others there are none, or only one. It is further shown that there is no strongly marked maximum at either equinox.—On the physical significance of concave and convex barographic or thermographic traces, by the Hon. R. Abercromby, F.R.Met.Soc. The author shows that a falling barogram is convex when the rate of the fall is increasing, concave when decreasing; and conversely, that a rising barogram is convex when the rate is decreasing, concave when increasing. As the rate of barometric change is proportional to the steepness of the gradients which are passing, and the wind also depends on the gradients, the author suggests the following rules for judging the coming force of a gale from the inspection of a barogram:—A convex barogram is always bad with a falling barometer, and good with a rising one; and a concave trace is sometimes a good sign with a falling barometer, and not always a bad indication with a rising one. The convexity or concavity of a thermogram is likewise shown to depend on the rate of thermal change. A method is given by which the distribution of diurnal isothermals over the globe can be deduced from the diurnal thermograms in different latitudes, and it is shown that the shape of diurnal isotherms on a Mercator chart for a limited number of degrees of latitude is similar to the shape of the curve of diurnal temperature range, if we turn time into longitude, and temperature into latitude, on a suitable scale.—Maritime losses and casualties for 1883 considered in connection with the weather, by Mr. C. Harding, F.R.Met.Soc. —The helm wind, by the Rev. J. Brunskill, F.R.Met.Soc. This is an account of a wind peculiar to the Crossfell Range; and its presence is indicated by a belt of clouds, denominated the "helm barr," which settles like a helmet over the top of the mountain.—Climate of the Delta of Egypt in 1798 to 1802 during the French and British campaigns, by Surgeon-Major W. T. Black, F.R.Met.Soc. The author has collected and discussed the meteorological observations made in Egypt during the French and British campaigns at the beginning of the present century.

Geological Society, May 28.—Prof. T. G. Bonney, D.Sc., F.R.S., president, in the chair.—John George Goodchild, Alexander Johnstone, and John Taylor were elected Fellows, and Prof. G. Meneghini, of Pisa, a Foreign Member of the Society. —The following communications were read:—The Archæan and Lower Palæozoic rocks of Anglesey, by Dr. C. Callaway, F.G.S., with an appendix on some rock-specimens, by Prof. T. G. Bonney, F.R.S. The object of the author was to furnish additional proof of the Archæan age of the altered rocks of the island. He held that the Pebidian mass on the north was fringed by Palæozoic conglomerates containing, amongst other materials, large rounded masses of limestone, derived from the calcareous series on the north coast, these conglomerates being probably a repetition by reflexed folding of those which lie at the base of the Palæozoic series. In like manner conglomerates which margined the western (Holyhead) schistose area contained angular pieces of altered slate undistinguishable from some of the Pebidian rocks of the north-west. These conglomerates dipped to the east, forming the western side of a syncline. Near Llanfihangel were sections which showed not only the Archæan age of the gneissic and slaty (Pebidian) groups, but also the higher antiquity of the former. These conclusions were derived from the occurrence of granitoid pebbles in the slaty series, and from the presence of masses of the slate, as well as gneissic fragments, in the basement Palæozoic conglomerates. The author was at present unable to accept the Cambrian age of the Lower Palæozoic rocks, and considered that the fossils he exhibited tended to confirm the views of the Survey on the correlation of those strata. The paper concluded with a sketch of the physical geography as it probably existed in Ordovician times. An appendix furnished by Prof. Bonney tended, by microscopic evidence, to confirm the proof furnished by the paper.—On the new railway-cutting at Guildford, by Lieut.-Col. H. H. Godwin-Austen, F.R.S., and W. Whitaker, F.G.S. In this paper the authors described a section exposed in a new railway-cutting just north of Guildford station. The beds exposed are chalk and Eocene strata at the base, with overlying Pleistocene or drift-beds. The Eocene beds appear at each end of the cutting, the London Clay resting upon Woolwich and Reading beds as described in 1850 by Prof. Prestwich; and the interest of the section is due in part to this exposure of the Woolwich and Reading beds, which are rarely seen in this neighbourhood, and in part to the thick mass of Pleistocene clays and gravels overlying the lower Tertiary deposits. The authors pointed out that the most interesting questions connected with these high-level gravels and sands of the ancient Wey are as follows:—1. What was their relation to the topography of the country in the past? 2. What relation do they bear to the outlines of the country at the present day? 3. What is their age? They showed that when the gravels and sands were deposited the main drainage of the country was the same as it now is, though the river was sixty feet above its present level. The sands with mammalian bones were probably an accumulation in a re-entering bend of the river, similar to one now existing a little further north. The river appears at first to have been more rapid, when the lower ironstone gravels were deposited; then slower, when the sands accumulated. Some change of levels ensued, and a considerable portion of the deposits was removed before the upper strata of loam and flints were formed. It is probable that the gorge of the Wey was no longer an outlet to the north whilst these beds were being deposited. In general the loam and flint beds are horizontal, whilst in some localities they are displaced in a manner remarkably like what is seen in the Glacial deposits of Alpine valleys. They contain land shells in places. The land surface indicated by the lower gravels and sands at Guildford is of older date than that described by Mr. R. A. C. Godwin-Austen in the country to the southward, and especially in the valley of the Tillingbourne. The deposits near Guildford belonging to the two epochs were noticed in some detail. Both are pre-Glacial, and have been formed when the climate was temperate. The overlying Glacial deposits formed of chalk-detritus, flints, and loam are attributed to the action of land ice, and the probable effects of a low temperature are described and illustrated by those observed on the plateaus around Chang Cheumo in Tibet.—On the fructification of *Zeilleria* (*Sphenopteris*) *delicatula*, Sternb., sp., with remarks on *Ursatopteris* (*Sphenopteris*) *tenella*, Brongn., sp., and *Hymenophyllites* (*Sphenopteris*) *quadridactylites*, Gutb., sp., by R. Kidston, F.G.S.—On the recent encroachment of the sea at Westward Ho!, North Devon, by Herbert Green Spearing. Communicated by Prof. Prestwich, F.R.S.—On further discoveries of footprints of Vertebrate animals in the Lower New Red of Penrith, by George Varty Smith, F.G.S.

PARIS

Academy of Sciences, June 16.—M. Rolland, president, in the chair.—Obituary notices of M. Bouisson, by M. Larrey; of M. Girardin, by M. Peligot; and of Mr. MacCormick, by M. Peligot.—Note accompanying the presentation of the second edition of his "Elementary Treatise of the Celestial Mechanism," by M. H. Resal.—Note on a communication from Dr. Tholozan regarding a meteorite reported to have fallen in February 1880, at Veramin, in the district of Zerind, sixty miles west of Teheran, Persia, by M. Daubrée. An analysis of the fragments submitted to the author revealed the presence of bronzite, peshamite, peridote, nickel, and granulated iron, thus showing the same constitution as that of the remarkable meteorites of Logroño (1842), Estherville (1879), Hainholtz (1856), and Newton County, Arkansas (1860).—Graphic methods applied to the art of engineering: historic aspect of the question and claim of priority of invention of certain appliances for transporting large and bulky masses, by M. L. Lalanne.—Identification of the recently-explored Wed Margelil and Lake Kelbiah, Tunis, with the ancient River Triton and Triton Gulf, by M. Rouire. Lake Kelbiah, which still communicates intermittently with the sea between Carthage and Hammamet (Hadrumetum), appears to be the largest in North Africa, with a circumference of nearly thirty miles at low water and a length of twelve miles. It is flooded throughout the year, and was evidently a marine inlet within comparatively recent times.—Description of a new apparatus for evaporating and distilling, specially suitable for the pneumatic treatment of saccharine juices (two illustrations), by M. P. Calliburcès.—Remarks on the Polar spots observed on the planet Venus at the Meudon Observatory, by M. E. L. Trouvelot.—On the irrational roots in equations of the second degree, by M. A. E. Pellet.—On the position to be assigned to the mean fibre in curved pieces in the theory of resistances, by M. H. Léauté.—Note on some colloidal compounds derived from hydrate of iron, by M. E. Grimaux.—Chemical researches on the nitric acid of the nitrates present in vegetable tissues, by MM. A. Arnaud and L. Padé.—Description of a new and effective process of soldering aluminium and using aluminium in the soldering of other metals, by M. Bourbouze.—Account of a simple process for purifying arseniferous zinc, by M. L. L'Hote.—Note on the nervous system of *Hyalinœcia tubicola*, Mull., *Eunice torquata*, Quatr., *Lumbriconereis impatiens*, Clap., and other members of the Eunice family, by M. G. Pruvot.—Researches on antiseptic substances and the consequences resulting from their use in surgical practice, by M. B. Ratimoff.—Remarks accompanying the presentation of M. Capellini's work on "The Upper Chalk and Priboma Group in the Northern Apennines," by M. Hébert.

BERLIN

Physiological Society, May 16.—Prof. Waldeyer read a communication from Mr. Hoggan of London, on an investigation upon the nerve-endings in the skin of the Polar bear. The results of this investigation have already been published in English. The preparations which had been sent over by Mr. Hoggan were exhibited in the demonstration-hall of the Institution.—Herr Schmey gave a short account of an investigation upon the alterations in the sense of touch which supervene in the skin after certain treatment. After having by several weeks' practice fixed a determinate constant for his "sensation-circles" (*i.e.* for the territories on his skin which corresponded to a unit of sensation), he made experiments upon himself to determine the influence of the fatigue of an extremity upon the sensibility of the skin, further, as to the effects of the application of a mustard sinapism, of a hyperæmia produced by nitrite of amyl, and again of pressure on the nerve supplying the particular portion of skin experimented upon. He found among other things that in the first stage of skin irritation by a sinapism the sensibility of the skin was increased, in the second stage it was diminished, and that pressure upon the ulnar nerve was followed by a lessened sensibility in the area of its distribution.—Prof. Kronecker described the experiments made by Dr. Markwald to determine accurately the effects of *Secale cornutum* and its various constituents,—the physiological effects of the following preparations in particular, which are known in commerce and have been introduced into practical medicine, were the subject of investigation; these were Extractum Secalis cornuti, Ergotin from various sources, Ergotinin, and Sclerotinic acid. All the physiological actions, those upon the uterus as well as those upon the regularity of the heart-beat, upon the blood-pressure, and the hæmostatic effects were investigated, in some cases individually, in others collectively, on dogs and rabbits. The Extractum Secalis cornuti first raised the blood-pressure, which afterwards sank to below the normal, and afterwards gradually rose again to the normal height or to a little above it. The presumption that a complex preparation caused the mixed action was verified in subsequent experiments. For the ergotin produced in different degrees, according to the purity and goodness of the preparation, a more or less marked increase of the blood-pressure, which was followed by a sinking to the normal level; whereas sclerotinic acid always produced a fall of the blood-pressure, followed by a rise to the normal pressure. The pulse showed slowings after the exhibition of ergotin, interrupted by successions of accelerated pulsations, giving rise to the impression that this drug elicited a periodic stimulation of the vagus. This phenomenon did not occur after section of the vagi, and was peculiar to this preparation. Satisfactory evidence of the existence of hæmostatic properties in ergotin could not be obtained, though these were present in an eminent degree in sclerotinic acid; the amount of blood that flowed out of a cut artery in a unit of time after the exhibition of ergotin actually increased to an insignificant extent, whereas it decreased very considerably after exhibition of sclerotinic acid. Upon the contraction of the uterus the preparations secale extract, ergotin, and sclerotinic acid have alike a decided effect, but ergotinin, which occurs in commerce in the form of a solution, was in this respect, as well as in the other respects previously investigated, sometimes inoperative and at other times uncertain. Rules for the therapeutical use of the preparations can easily be deduced from the physiological actions above described, but it is to be remarked that sclerotinic acid is very painful as a subcutaneous injection. This is not the case with a solution of ergotin. The results of the investigations were illustrated by Prof. Kronecker by means of numerous diagrams of curves.

VIENNA

Imperial Academy of Sciences, May 23.—L. Karpelles, on gall-mites (Phytoptus, Dug.).—L. Doederlein, contributions to a knowledge of the Japanese fishes.—R. Wegscheider, on isobutyl-naphthalene.—E. Spiegler, on an acetamine of the fat-series of high molecular constitution.

May 29.—Anniversary Meeting.—The meeting was opened in presence of the Crown Prince Rudolf by the Curator of the Academy, Archduke Rainer.—The Reports of the past year were read by the General Secretary, Prof. Siegel, and the Secretary of the Mathematical and Natural Science Class, Prof. Stefan.—Obituary Notes were read by the Secretaries on the members deceased—Prof. T. W. Gintl (Prague), Sir Edward Sabine, Jean Baptiste Dumas, Joachim Barrande, Julius Schmidt (Athens), Adolphe Wurtz.—The Reports were also read on the work done by the Prehistoric Commission and the Central Institute of Meteorology by Prof. Stefan. It was stated in this Report that the meteorological stations increased in number during 1883, ten stations being added during this year, and that a registering anemometer had been set up on the summit of the Obir Mountain (2147 m.), which works regularly.—Prof. Emil Weyr of Vienna University gave an address on the geometry of the ancient Egyptians, dealing with the contents of the papyrus, Rhind.

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