THURSDAY, MAY 17, 1877

SCIENCE AND WAR

RECENT wars have had particular interest for the man of science. If we go back some fifteen or twenty years and consider the different wars which have unfortunately occurred since that time, we shall find connected with each one of them certain features which undoubtedly mark progress in the art of killing and wounding. Some argue—and on very good grounds, no doubt—that the more sharp and terrible warfare is made the more speedily must it come to an end, and hence look with favour upon the means taken every day to render weapons more destructive and the soldier more cunning in his dangerous trade. We do not propose to discuss this argument, nor to enter at all into any comparison between the wars of our forefathers and those of to-day, but at a crisis like the present we need hardly apologise for bringing before our readers some points illustrating the marked influence of science upon modern warfare.

Starting from the close of the Crimean war, the first in which the electric telegraph was employed, we find ample examples of the assistance furnished to the soldier by scientific research. One instance taken from the war of 1858 is especially interesting. The Austrians held Venice at the time, it may be remembered, and to protect the harbour, torpedoes were laid down. The torpedoes were fired by electricity, and contained gun-cotton, this being the first instance on record of the employment of electric torpedoes and of the newly-invented nitro-compounds. Nor was this all. The torpedo-system devised at Venice by the Austrian engineers had yet another point of scientific interest. A camera obscura was built overlooking the harbour, and upon the white table of this instrument were reflected the waters of Venice. As the torpedoes were sunk one by one a sentinel in the camera noted the place of their disappearance with a pencil, giving each torpedo a consecutive number. A row-boat in the harbour described a circle around the sunken torpedo indicating the zone of its destructive power, and the sentinel again, with his pencil, made a corresponding ring upon the camera table. In the end, therefore, while the harbour itself was apparently free from all obstruction, a very effective means of torpedo defence was established, the key of which was only to be found in the camera obscura. The sentinel here had wires in connection with every torpedo, and was in a position to fire any one as soon as he observed—by means of the camera—the presence of a hostile vessel within the limits of any of the circles marked upon his white table.

In the American war of 1860, the electric torpedo, invented but two years before, played a most conspicuous *rôle*, and formed indeed with the use of big guns and monitor ironclads, one of the most important features of the struggle, at any rate from a scientific point of view. The war of 1866, when the Austrians suffered such a terrible defeat at the hands of the Prussians, will long be remembered as a combat between the old muzzle-loading rifle and the breech-loader, in which the latter was victorious. The Franco-German struggle of 1870 again, though marked by the employment of no special arm, if we except the mitrailleuse, was assisted by important applications of science; to wit, the reproduction, by means of photo-lithography of the French ordnance maps and plans, which were distributed in thousands throughout the German army, and the establishment in France of *la poste aérienne* to communicate with the besieged garrison of Paris. The regularity with which the mails left Paris *par ballon monté*, must still be fresh in the memories of our readers, the publication of correspondence from the French capital being maintained in our journals during the whole period of the investment. From September 23 to January 28, when Paris was practically cut off from the rest of the republic, no less than sixty-four balloons left the city with passengers, mails, and pigeons, and of these only three were lost, while five were captured. The return-post by "homing pigeons" was hardly so regular, but nevertheless half the number of despatches given in by correspondents at Tours and elsewhere, or in other words 100,000 messages, were by the unflagging energy of the postal authorities carried into the beleaguered capital. The despatches, most of them as brief as telegrams, were distinctly printed in broad sheets and photographed by the aid of a micro-camera; impressions upon thin transparent films were then taken and rolled in a quill attached to the tail of the winged messenger which was to bear them into Paris. Arrived at their destination, the tiny photographic films were enlarged again by the camera, and the despatches being once more legible, were distributed to the various addresses.

The present Russo-Turkish war cannot well be less interesting than those that have so recently preceded it, and we may especially point out two directions in which fresh examples of scientific warfare will probably manifest themselves—in connection, namely, with the cavalry pioneer and the Whitehead torpedo. Both of these will probably be seen in warfare for the first time, and before many days are past we may hear of their doings in action.

The cavalry pioneer must not be confounded with the Prussian Uhlan who played so conspicuous a part in the last war. The ubiquitous Uhlan, terrible as he was, did not work the injury which some of the Cossacks will have it in their power to inflict if accoutred as pioneers. These are selected from the smartest and most daring troopers, lightly armed and well mounted. In a belt round their waists they carry a few pounds of gun-cotton or dynamite, and with this highly destructive explosive they may work incalculable harm. A small charge of gun-cotton placed simply upon a rail and fired with a fuze suffices to blow several feet of the iron to a distance of many yards, thus rendering the railway unserviceable on the instant. A trooper may dismount, place a charge at the base of a telegraph pole, fire it, and be in his saddle again within sixty seconds. Wires may thus be cut and communication stopped in the heart of an enemy's country by fearless riders, who have but to draw rein for an instant to effect the mischief, while lines of railway in the neighbourhood are entirely at their mercy. Even light bridges and well-built stockades may be thrown down by the violent detonation of compressed gun-cotton, and forest roads considerably obstructed by trees thrown across, which are never so rapidly felled as when a small charge of this explosive is fired at their roots.

The influence of the Whitehead torpedo, of which we have heard so much of late, will likewise be felt for the first time during the present war. An implement so ingenious in its character that, as Lord Charles Beresford the other day happily remarked, it can do almost anything but talk, is in the possession of both belligerents, and will doubtless be heard of ere long on the Danube and in the Black Sea. These torpedoes are manufactured at Fiume on the Mediterranean, and, like Krupp guns, are to be purchased by any one who chooses to pay for them.

The British Government manufactures its own Whitehead torpedoes in this country, having paid several thousands of pounds for the privilege. The machinery inside this torpedo is still a secret, which is strictly maintained by our Government, but the principle of the invention is well known. It is a long cigar-shaped machine measuring a dozen feet and upwards. In the head is a charge of some violent explosive, such as gun-cotton, or dynamite, which explodes as soon as the torpedo strikes an obstacle. The motive power is compressed air, which is forced into the machine by powerful air-pumps, immediately before the torpedo is discharged into the sea, no less than 600 lbs. on the square inch being the pressure exerted. The Whitehead is shot from a tube, and moves through the water as straight as a dart, the compressed air working upon a screw in the tail of the machine. The delicate machinery permits the torpedo to swim at any depth below the surface that may be desirable, and it flies straight in the direction it is aimed, at a speed of something like twenty miles an hour. If it fails to strike the foe, then the intelligent apparatus at once rises to the surface, becoming innocuous as it does so, and may in this condition be captured without difficulty.

A torpedo of this sort striking the sides of an ironclad would almost infallibly send her to the bottom, and although it has been proved that a network or crinoline around the ship is capable of retarding the progress of a "fish" of this nature, and exploding the same harmlessly in its toils, it is obviously a very difficult matter thus to protect one's craft. Against heavy torpedoes, indeed, there seems no way of defence at all (the Whitehead generally carries a charge of 70 lb. or 80 lb., but moored torpedoes may contain a 500 lb. charge), and therefore Turkish vessels will have to give Russian ports a wide berth. All must remember how the magnificent fleet of the French was kept at bay by the torpedoes of the Germans in the North Sea in 1870, and the Black Sea ports are no doubt similarly protected. So demoralising is the dread of the torpedo with sailors apparently, that they will dare anything rather than venture into waters which conceal these cruel foes.

H. Baden Pritchard

THE OWENS COLLEGE UNIVERSITY QUESTION

IN his address on Tuesday last week, at the London University, the Chancellor noticed in dignified and sensible words the proposed application of Owens College to the Government for a Charter of Incorporation as a university, either by itself, or as the centre of a family of northern colleges. Nothing could well have been more unfortunate or ill-judged than the furious onslaught of Mr. Lowe, the member for the University, in the *Fortnightly Review*. The complaint of the Manchester people is that the London system, however suitable in itself, hampers the educational activity and usefulness of institutions capable of an independent existence, and it was scarcely decent for the member for that university to step forward in her interests as a mere partisan of the *status quo*. In fact there is no antagonism. Manchester has never denied that it is a good thing that there should be a university in London to examine all comers. She has said that she thinks it a bad thing for institutions with a sufficient permanent teaching staff, a large enough number of students and a solid establishment in the district to which they belong, to have to shape their work according to the ideas of any central university that must suit all comers. Mr. Lowe is the one member of Parliament who should have held his tongue on the matter till he was forced to speak, because a hasty utterance on his part could not but seem to compromise his University. Lord Granville took pains to remove the injurious impression of an unworthy jealousy in London which Mr. Lowe's article could scarcely fail to create. He tells us that London feels "absolutely no objections of a merely jealous character," and that London would have a "very friendly feeling to any university which, after due deliberation and with a sound regard to the real advantages of education, may hereafter be established." In that wise and sensible attitude it is open to the University to consider either of the two schemes suggested for the northern university. The first of them, which is that favoured by the college authorities, is that Manchester should be created a university much as Glasgow is. According to the views of the supporters of that scheme we should be prepared to multiply our universities as the Scotch have done, by chartering one in any large town where its students and its endowments, its history and its reputation offer equally solid guarantees of permanence. The other is that Manchester should be the capital—*primus inter pares*—of a new northern university on the original affiliation basis from which London has departed. The weakness of the affiliation principle is that it is scarcely in nature that it should not gradually relax, so that colleges should be affiliated on easier and easier conditions till it becomes useless to keep up the farce. But both schemes, the latter of which, indeed, is Dr. Carpenter's, are practicable—both worthy of careful consideration and discussion—and it is pleasant to see that the University of London, through her Chancellor, disavows any settled policy of obstruction.

Lord Granville reminded his hearers of what most people have forgotten—the history of the incorporation of the University. It was a subject of excited debate in this country and in Parliament, for ten years from its first inception. The project was started in 1825. Funds were then raised by subscriptions in 100*l.* shares, and the institution was in activity in 1828. In 1830 an application was made to the Crown for a charter, and the charter as prayed for had gone through nearly all the necessary preliminary stages, when its progress was stayed by the opposition of Oxford and Cambridge. In 1833 the application was renewed, and it was supported by an address to the throne from the City of London. It was opposed

by Oxford and Cambridge, by the Royal College of Surgeons, by the teachers of medicine and surgery in the London hospitals, and by others. The matter was referred to the Privy Council, and argued before it in 1834. There was no question then of anything so futile as what has been once or twice suggested for Owens College, the title of university, without the privilege of degrees. The Privy Council found the subject surrounded by difficulties, and adjourned its consideration. Shortly after, Lord Melbourne's Ministry, which was friendly, retired from office, and Sir Robert Peel's, which took the view of the old universities, succeeded. An address to the Crown, however, was carried against the Ministry by 246 to 136, on the motion of Mr. W. Tooke, praying that a charter might be granted to the University of London, with no restriction but that they were not to confer degrees in divinity. The Privy Council was asked to report on the subject, but the report was delayed, and before they presented it Lord Melbourne returned to power. In August, 1835, the Chancellor of the Exchequer, Mr. Spring Rice, communicated to the Council of the existing University College that Government proposed to incorporate by charter as a university in London, a body of gentlemen eminent in learning and science, with the power of examining and granting degrees in arts, medicine, and laws to students of *certain colleges in London, therein named*, and of others existing throughout the country to be afterwards recognised, as well as of the schools of professional education. This university was to be supported by an annual grant. There were to be no religious tests. The existing body, which called itself the University of London, received a charter as a college and was named as one of the colleges entitled to submit students for examination. The two charters to the new university and the new college were issued on November 28, 1835. They have been several times modified. The list of affiliated colleges was always large, and as the Senate of the University had no control over the affiliated colleges it grew unwieldy, institutions of the feeblest character receiving affiliation. In 1863 a charter was granted empowering the Senate to admit persons not educated in affiliated colleges to examination, and this decision creates the University of London of to-day as distinguished from the institution of the same name founded in 1835. About half the students now come from affiliated Colleges and half from anywhere or nowhere. The examinations must be fixed in view of this fact. Examiners must take into account as a most vital matter the books on the subjects of their examination which are readily accessible to students, and they cannot shape their examinations in view of the practice in teaching of any one or more of the affiliated colleges. We hope that the proposed university of the north may have a shorter novitiate, and that she may be conducted in as elevated a spirit and with as resolute a desire to promote the interests of literature and science as the University of London has been. It would have been a painful spectacle if the youngest of our Universities, forgetful of her own early struggles, had spent her energies in an opposition which Oxford and Cambridge have thought unnecessary or unworthy of them. The speech of her Chancellor leads us to hope that the claims of the proposed new university will be considered calmly and on their merits.

NICHOLSON'S "LIFE-HISTORY OF THE EARTH"

The Ancient Life-History of the Earth; a Comprehensive Outline of the Principles and Leading Facts of Palæontological Science. By H. Alleyne Nicholson, M.D., D.Sc., M.A., Ph.D. (Gött.), F.R.S.E., F.L.S., Professor of Natural History in the University of St. Andrews. (Edinburgh and London: William Blackwood and Sons, 1877.)

THERE is no feature in which the ordinary geological manuals in common use in this country are more deficient than in the sketches which they give of the leading characteristics of the animal and vegetable life of the successive periods which they describe. The truth of this remark will be made strikingly apparent by a comparison of the works in question with some of the best German treatises on geology, such as those of von Hauer and Credner, and still more if we examine them side by side with that most excellent of text-books, Prof. Dana's "Manual of Geology."

Some writers on geology in this country would indeed appear to hold the opinion that, since the succession of geological formations was first determined in our own islands, an appeal to the facts of British stratigraphical geology must in every case be final in deciding all difficulties which may arise concerning the definition and limits of the different systems of stratified rocks in every part of the globe. Hence the controversies which have taken place in this country concerning the boundaries between the Cambrian and Silurian, the Devonian and Carboniferous, and the Permian and Trias have acquired an altogether factitious importance, and undue weight has been attached to the interpretation of some obscure section, the significance of a local unconformity, or the appearance—often a fallacious one—of a gradual transition between two sets of beds, while far more suggestive facts connected with the relations of the fossil contents of the two series of rocks are too often altogether lost sight of.

But it cannot be too strongly impressed upon the minds of English geologists that the district in which a system of strata is first detected may not necessarily be the one in which it is best adapted to serve as the type of that series; that as a matter of fact the best illustration of the features and relations of the Cambrian and Silurian is to be found, not in Wales, but in Bohemia; and of the Devonian, not in Devonshire, but in the Eifel. English students, too, need to be reminded that the classification of the stratified rocks is based not upon the occurrence of certain physical breaks, in the continuity of a series of beds, which are often, indeed, of very local character and small importance, but upon the great principle that each formation is characterised by a well-marked and distinctive fauna or flora. Concerning the fact, position, and significance of many of the physical breaks in the succession of formations, the ablest field-geologists, such as Sedgwick and Murchison, Jukes and Godwin-Austen, have frequently arrived at very opposite conclusions; and the importance which has been attached to these discussions on points of details has doubtless led many to entertain a notion of the instability of the foundations of the geological systems of classification which is very far from

having any real foundation in fact. For it must not be forgotten that, however certain questions now pending concerning the nomenclature of the Welsh strata may eventually be decided—and these questions of nomenclature and priority are, after all, of very secondary importance—the grand fact first clearly determined by the discoveries of the illustrious Barrande in Bohemia, that there can be distinguished in the series of older Palæozoic strata three great divisions, each characterised by a well-defined fauna, is quite independent of these controverted points, and its value cannot be affected in any way by their decision either one way or the other.

It will be manifest from what we have said above that we regard the present work of Prof. Nicholson as dealing with a subject in connection with which the want of a competent text-book in this country has long been a serious evil; and of the general accuracy and reliability of the information supplied by this convenient little volume we can also speak in terms of high commendation.

Prof. Nicholson has wisely availed himself to the fullest extent of woodcut illustrations in aid of his descriptions of the fossil forms; and the 270 engravings, many of them containing illustrations of a number of different species, will be a great boon to the geological student. Some of these woodcuts now appear for the first time, but others have already done duty in the author's previous writings. We cannot unfortunately award anything like equal praise to all these illustrations, for while some of them are of exquisite truthfulness, detail, and finish, certain others are so coarsely executed and so wanting in character, that it is a marvel to us how so accomplished a naturalist as the author could have ever permitted them to disfigure his pages. There is one omission in connection with the illustrations, which will greatly detract, we fear, from the value which they would otherwise have for the student, namely, the absence of indications of the number of times which the scale of the drawings is magnified or reduced from that of the original objects. Every one engaged in teaching is aware what erroneous notions concerning fossil forms are often propagated by want of attention to this detail.

In his discussion of the characters distinguishing the flora and fauna of each of the great geological periods, Prof. Nicholson is usually very clear in his descriptions and happy in his choice of typical forms. The greatest danger which besets the writer of such a work as the present is that of overwhelming the student with masses of detail, unrelieved by those broader generalisations which may serve to aid his memory in grouping the facts about convenient centres. Had Prof. Nicholson in the present work prefaced each of his descriptions of the great geological periods with a succinct statement of its leading palæontological characteristics, and also furnished similar summaries for the greater epochs, we cannot but think that the work would have been far better adapted to the wants of the student, and at the same time its suitability for general readers would have been in no wise impaired.

The references to authorities at the end of the chapters will be found useful by all classes of readers, and the general remarks on the "Principles of Palæontology" with which the work opens will sufficiently prepare those who may be totally unacquainted even with the fundamental facts of geological science for a profitable perusal of the succeeding chapters. The work before us constitutes a popular exposition and summary of the facts of palæontology, suitably arranged for beginners; but as a text-book for the more advanced student of the science, it still leaves much to be desired. We search it in vain, for example, for information on many important questions, such as the classification of the multifarious forms grouped under the name of *Ammonites*, and we sometimes find obsolete names employed for certain genera and species. There are certain obvious errors and omissions which will doubtless be corrected and supplied in a subsequent edition of the work—such, for example, as the table of Cambrian strata on p. 79, and the absence of all notice of the remarkable Devonian fossil, *Calceola sandalina*.

As a compact and popularly written introduction to a very important department of science, Prof. Nicholson's new work may be safely recommended; and it is well worthy to take its place among that series of useful manuals for which we are already indebted to its industrious author.

OUR BOOK SHELF

Geological Survey of Canada. Report of Progress for 1874-75. Alfred R. C. Selwyn, F.R.S., F.G.S., Director. (Published by Authority of Parliament, 1876.)

ALTHOUGH Mr. Selwyn, like his predecessor, Sir William Logan, has the highest possible ideal of the importance of pure geological mapping, the necessity for the rapid exploration of a vast unsurveyed new land simultaneously with the development of rich coalfields, compels him to employ two very different systems of working. With a staff of only ten geologists, two-thirds of whose time is engrossed by topographical preliminaries, the usefulness of the survey as a whole must depend to a great extent on the judicious determination of the degree of importance attached to the details of its various parts. Accordingly, Mr. Selwyn has confined the detailed mapping to the settled eastern sea-board, carrying on at the same time reconnaissances in the central and western regions, where complete maps will not be demanded for some time to come.

During the past year Mr. Selwyn has been able, in addition to his administrative duties, to overtake some field-work, chiefly among the palæozoic rocks of New Brunswick and the coalfields of Cumberland and Sydney. The Report contains two geological maps of portions of the Cape Breton Coalfield, by Messrs. Robb and Fletcher, exhibiting all the completeness of the British coalfield maps.

Mr. R. W. Ells furnishes a map and report on the hematite ores of Carleton County, New Brunswick. The ore appears to occur in veins along the strike of highly-inclined Silurian rocks.

Mr. Henry G. Vennor has been surveying in the Laurentian region of Frontenac and Lanark Counties, and embodies the results of his labours in a map and report. It appears that apatite mining in this district has recently ceased to be a profitable industry. Mr. Vennor sees the cause of failure in the injudicious and costly manner in which the mining was carried on. Iron ore (magnetite) occurs at Eagle Lake in a bedded form, associated with hornblendic and dioritic rocks.

Mr. Robert Bell and Mr. Joseph Spencer describe the country between the head-waters of the Assineboine River and Lakes Manitoba and Winnepegosis. During a rapid survey of this little-known tract, they recorded the occurrence of Laurentian schists and rocks of Huronian,

Devonion, and Cretaceous age. They also made many valuable observations on the superficial deposits, as well as on the physical geography of the region. An interesting point in their report is the frequency of old beaver-dams in places where there is now little or no water—an evidence of the former greater humidity of the climate.

In British Columbia Mr. James Richardson continued his explorations. He traversed metamorphic crystalline rocks (auriferous) extending over seven degrees of latitude and six of longitude. The complicated structure of the Nanaimo coalfield was further investigated, but the work is not yet complete.

Mr. J. Lionel Smith reports on the salt manufacture and trade of Ontario, and makes some interesting and useful comparisons between the various processes for the treatment of the brine in Canada and elsewhere.

Mr. J. Harrington closes the volume with notes on Canadian rocks and minerals.

R. L. JACK

The Schools of Forestry in Europe. A Plea for the Creation of a School of Forestry in Connection with the Arboretum at Edinburgh. By John Crombie Brown, LL.D., &c. (Edinburgh: Oliver and Boyd.)

THIS pamphlet is written in the form of a letter or address to the Lord Provost of Edinburgh and the promoters of the Arboretum at Inverleith, and is in short a strong argument in favour of the formation of a school of Forestry to be connected with the Arboretum. Dr. Brown shows that in France, Spain, Italy, Austria, Poland, Russia, Finland, Sweden, and in fact in almost every country except Great Britain, its Colonial dependencies and the United States of America, such schools exist under Government authority, and it is in these very countries that such schools would be of immense utility. The proposed curriculum of three years' study sketched out by Dr. Brown as likely to prove advantageous is, in the main, good, but we think that the French and German languages should be taken before the end of the third year. The notices of the arrangements and systems of studies in the various Continental forest schools are not without interest. Dr. Brown concludes his "plea" with a comparison of the English and Continental forests; the extent of the latter, together with the threatened lack of fuel by the extinction of forests as against our supplies of this necessary article from coal mines, being, no doubt, among the principal causes of the decrease of forest training in this country. The lack of special literature on the subject in the English language also compares badly with that of the Continent.

Unser Sonnenkörper nach seiner physikalischen, sprachlichen und mythologischen Seite hin betrachtet. By Dr. Schmidt. (Trübner, 1877.)

DR. SCHMIDT has more learning than method. In fact, he belongs to that school of paradoxers who are less common in Germany than in this country. He proposes to show that the sun is a cold inhabited body, heat being developed by the friction of its rays against the earth and other celestial bodies. Upon this physical theory he superimposes his mythological one. Words which have a slight resemblance in sound and meaning are gathered together from all parts of the world and assumed to be connected in spite of their belonging to different families of speech. Out of this hodgepodge are extracted such conclusions as that the sun-god was believed to illumine the dead in Hades or that the snake represented the return of Apollo to the light of day. But the philology of the writer may be easily appreciated when we find him speaking of "the Armeno-Caucasian family, to which belong not only Semites and Aryans, but also some Turanian tribes," and intimating that the roots of the Chinese language are allied to those of the "Armeno-Caucasian." As might have been expected, Dr. Schmidt is not always right in the words he quotes from the numerous languages, ancient and modern, which he has laid under contribution.

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 ensure the appearance even of communications containing interesting and novel facts.]

Passage of Plants Across the Atlantic—Haplomitrium Hookeri, Lyell

PROF. UNGER arrived at the conclusion that in Tertiary times there was a passage of plants from America to Europe. A plant found by myself last year in the Island of Dominica, West Indies, led me to think it probable that there had been an extension of at least one plant in the opposite direction. The plant to which I refer is one of the Hepaticæ, *Haplomitrium hookeri* of Lyell. It differs so much from other Hepaticæ that I was able approximately to identify it on the spot where I found it in considerable abundance. Should it prove to be specifically distinct, my remarks may still, to some extent, hold good. It was growing in a dark, moist, shady spot on the north side of a mountain at an elevation of about 4000 feet. *H. hookeri* is generally distributed over the North of Europe, but I cannot find that it has ever before been found out of Europe. Dr. Oliver kindly informs me that there are only European specimens in the herbarium at Kew. I have failed in obtaining information of its occurrence either in North or South America, or in the intermediate islands. Nees ab Esenbeck, in his "Synopsis Hepaticorum," whilst recording a large number of Hepaticæ from the West Indies, mentions *H. hookeri* only from Europe. Now it is by no means an inconspicuous plant, and it seems altogether unlikely to have been overlooked by such careful observers as Swartz and others who have studied the Hepaticæ of the West Indies. Hence I draw the following inferences, to which may be attached a greater or a less amount of probability. 1. That the biological centre for *H. hookeri* is Northern Europe. 2. That it has thence crossed the Atlantic in a rather narrow zone. 3. That it did not reach the Continent of America. This, of course, is subject to correction. It may have been found there. From the great extent of territory and variety of climate on the mainland, I think if it had ever reached America it would still be found there. 4. That it may have reached the West Indies and have died out from Cuba, Jamaica, and other islands, through the prevalence of dry seasons, before the lower Cryptogamic plants were studied by competent botanists. 5. That it has remained in Dominica because of the altogether peculiar moisture of the climate in that island. 6. That it has not hitherto been found in Dominica because, from some reason unknown to myself, botanists seem to have neglected this *true* pearl of the Antilles, matchless in the beauty of its natural scenery, and in the wealth of its Cryptogamic flora.

H. hookeri is noticed as peculiar in not recovering its freshness when moistened after having been dried. This I found to be the case. On being carefully moistened about eight months after it was collected and dried, it remained flaccid, whilst the rest of the mosses and Hepaticæ from Dominica, when similarly treated, looked as fresh as when they were gathered. But *H. hookeri* exhibited another peculiarity even more remarkable, for it alone of all the Muscineæ that I brought home, grew and produced fruit after so long a period of desiccation. The fruiting parts of a specimen which I sent to the herbarium at Kew were entirely developed in a moist case on the table at which I am now writing. It seems as if the plant, incapable of the imbibition or intussusception of moisture sufficient to restore the freshness of its foliage, nevertheless retained, in a very unusual degree, its capacity for such development as might secure the continuance of its species. Such a speciality no doubt favours the suggestion that *H. hookeri* may have crossed from the East, but I confess myself inclined to be suspicious when coincidences run too much on "all fours." I found many mosses in Madeira and several lichens in Jamaica, which I have been quite unable to distinguish from British species. These may be common cases of widely distributed forms. *H. hookeri* does not appear to be of this class.

HENRY H. HIGGINS

Rainhill, May 2

Patenas in Ceylon

I REGRET that through an accident I was able only yesterday to read Mr. Heelis's reply to my letter on the subject of patenas in Ceylon. I have not a copy of my own letter by me and therefore cannot speak with certainty, but I believe that I only suggested that the cropping out of the thick band of quartzite amongst the gneiss was sufficient to explain the existence of many of the larger patenas in the Kandyan Province. The immense majority of the smaller and more isolated patenas I am fully aware cannnot be explained on my supposition, nor can they at present be explained on *any* reasonable supposition. I do not think, however, that even the most superficial observer can have any doubt as to the large patena mentioned in my letter between Pussellawa and Rambodde, covering several thousands of acres, being entirely due to the quartzite band that lies above it. In regard to the Dimbula patenas it is no doubt true that gneiss is almost always found underlying the soil, but this does not prove that the patena soil is derived from the gneiss. The depth of the rock below the surface is against this view, especially when taken in connection with the fact that I was never able to trace in the case of patenas as I did in scores of cases of jungle land, in railway and road cuttings throughout the Kandyan Province, the gradual changes from the hard rock upwards to the surface, which show that the soil has been produced by the disintegration of the gneiss *in situ*. The denuding forces at work among these mountains are so excessive (according to an estimate made by myself at Pussellawa the denudation was no less than ten inches in thirty years on land cleared for coffee) that strata probably of many thousands of feet in thickness have been carried away to the low country and the sea. It is not, it seems to me, at all an improbable supposition that in Dimbula and Ouvah a band of quartzite has during this denudation been disintegrated, and that its remnants are found now in isolated places resting on the gneiss. The limestone mentioned by Mr. Heelis as occurring in the Ouvah patena district proves, I think, a point in my favour, for the same kind of limestone is more plentiful in the neighbourhood of the quartzite band between Pussellawa and Rambodde than in any other district with which I am acquainted, there being no less than five entirely isolated spots near these villages where it occurs. This limestone is highly crystalline and of the same age as the gneiss, for I have found it at the upper fall at Rambodde passing almost imperceptibly both above and below into the gneiss. It is here about 450 feet above the upper surface of the quartzite band, where it crops out in the lower fall. Its stratified character may be readily seen at Pussellawa by the bands of mica-fragments that run through it in almost horizontal directions. I have never heard of this limestone covering any extensive area except at Matalé, where there must be some hundreds of acres of it. In other localities that I have visited it covers only an acre or more frequently only a fraction of an acre. The soil produced by its disintegration is, I believe, the richest in the island, as is shown by the fact that the limestone after being burnt is frequently used as a manure for coffee trees, and that the jungle growing below such rocks is generally of the richest description. I can scarcely therefore think that any considerable area of patena soil in Ouvah is formed by the disintegration of limestone, although it is quite consistent with what occurs at Rambodde that limestone should be extensively found in the neighbourhood of a large patena. As to the quality of the soil on the Ouvah patenas the test generally applied by planters is that of the power of the coffee tree to produce fruit. This is manifestly not a perfect test. Climate counts for a great deal, and the climate of Ouvah is recognised as the most favourable in Ceylon for the production of coffee, whilst that of Dimbula is acknowledged to be too humid for the perfect fruiting of the plant. I remember a pertinent remark made to me by a successful planter in regard to the relative values of soil and climate in the growing of coffee. "Give me the climate and I can make the soil." It is an exaggeration, but there is sufficient truth in it to illustrate well the point I am urging.

Finally in regard to abandoned clearings falling back not into "chena" and jungle but into patena land, I must confess I never met with an instance of it, and with Mr. Heelis' permission I would suggest that the Dimbula cricket ground is scarcely a case in point. It is probably the interest of the owner to keep it in grass and to prevent seeds accidentally carried to it from taking root. But supposing it were surrounded by forest and left to itself for twenty years, would it at the end of that period be still in grass, or would it have returned to "chena"? If it were genuine patena land, it would remain so, for plants accidentally imported into it would find no nourishment, but if it were impoverished jungle soil, I am inclined to the opinion that there would still be sufficient unextracted nourishment to enable at least the hardier species to grow in a stunted form until humus was deposited, when forest would succeed. Whilst differing from Mr. Heelis on the several points of his letter I cannot omit to thank him for the courtesy with which he has expressed his opinions.

R. ABBAY

Ouseburn, May 10

The Greenland Seal Fishery

ANOTHER year has passed and no steps have been taken to put some restriction upon the cruel and wasteful manner in which the seal fishery is prosecuted. Warning after warning has been given, and still nothing has been done. In 1868 Dr. Brown wrote (*Proc.* Zool. Soc., p. 440): "Supposing the sealing prosecuted with the same vigour as at present, I have little hesitation in stating my opinion that, before thirty years shall have passed away the seal-fishery, as a source of commercial revenue, will have come to a close." This season the Dundee vessels have been turning their attention to the Newfoundland seals, for, says a paragraph in the *Daily News*, "Capt. Adams has for some years been of opinion that that ground [the Greenland seal-fishery] is practically used up, and hence his visit to Newfoundland." The small success of the Greenland sealers this season fully corroborates Capt. Adams's opinion, and forms a practical comment upon Dr. Brown's prediction!

From the same source (*Daily News*) I learn that "advices of a very gratifying character have been received from Newfoundland. The *Panther* has taken 20,000 seals, the *Neptune* 30,000, the *Arctic* 24,000, the *Aurora* 15,000, and high expectations have been formed regarding the success of the whole fleet. These four vessels have secured 89,000 seals; Capt. Gray says 20 per cent. may be added to the number of seals actually taken for those mortally wounded and lost, and that as these are breeding seals each old one will leave a young one to die of starvation. (See letter in *Land and Water*, May 9, 1874.) The result will be that these four vessels destroyed 213,000 seals! Similarly "gratifying" advices have been received from the other vessels of the fleet.

If the Royal Society for Prevention of Cruelty to Animals and the anti-vivisection advocates really wish to do service in the cause of humanity, let them reprint Capt. Gray's letter and distribute it broadcast, nor let them cease their efforts till a proper close time is obtained for these persecuted animals. Apart from all questions of humanity, common prudence would dictate that so rich a source of revenue, which, if properly cared for, may last an indefinite period, should be secured from the rapacity of those who will otherwise soon bring about its extinction. Now is the time for considering the steps which should be taken to bring the matter before the Governments concerned; if left till later in the year hasty legislation will probably, as in the last attempt, end in failure.

Norwich THOMAS SOUTHWELL

A New Lecture Experiment for Proving the Compound Nature of White Light

THE old method of showing the compound nature of light by the composition of artificial colours on the lecture-table, is to arrange the various colours in the proper proportion on a disc and to revolve this disc rapidly; but a pure white cannot be produced by this method since there is necessarily a partial absorption of rays on every part of the disc.

My method is to arrange seven lanterns, in the first place, so as to project their several circles of light side by side on a white screen, then to colour each circle by introducing slides of glass stained to imitate the seven colours of the spectrum (the proper intensity of colour being found by trial); we thus get seven circles on the screen coloured from red to violet and arranged side by side. Then by turning the several lanterns so that the projected circles shall exactly overlap each other we get one circle of white light, proving that the seven colours together make white light.

The same effect can be produced with five colours only if properly selected; and even two, the ordinary cobalt blue and deep

orange, will nearly do. If these two last be made to partially overlap the effect is very striking. WM. TERRILL

Swansea, May 6

The Araucaria

IN your first number for March last you express your surprise that we should still be ignorant regarding some important phases of salmon life; but there is a question relating to facts much more within the sphere of our daily observation on which authorities differ as much. Does the common Araucaria (*A. imbricata*) require one year or two for the growth of a shoot on the main stem, estimating a shoot as the growth between two whorls of branches? Every gardener whom I have consulted on the subject in Scotland, from north to south, says positively that it requires two years, while the few of whom I have had any opportunity of inquiring in the south of England, decide equally positively in favour of one year. Prof. Balfour agrees with the former in as far as Scotland is concerned, while a gentleman residing on the border between the two countries, informs me that some of his have grown at the rate of a shoot in two years, others of a shoot annually, while a few show only a shoot for every year and a half since they were planted. It has been suggested to me that the difference, if it really exist, may be due to the more favourable climate of England; but araucarias may be seen growing as freely and as healthily in Ross-shire as in Kew Gardens. It would be satisfactory to have more general information on the subject from England and from the Continent of Europe, and still better to have it from the native countries of the tree.

There is another question equally important regarding it, namely, when the shoots are biennial, as they undoubtedly are in many cases, is there a timber ring in the stem for every year's growth, or one for every whorl of branches? On that point also the evidence is contradictory.

JAMES ELLIOT

The Hibernation of Swallows

IN connection with the Duke of Argyll's letter on this subject (NATURE, vol. xv. p. 527) there is an interesting communication in the *Ornithologisches Centralblatt* of May 1 from Herr J. Rohweder, under the head of "Ornithological Notes from Schleswig-Holstein." Herr Rohweder certifies to the competency and trustworthiness of the observer who communicated the facts to him. After the house-swallows (*Hirundo urbica*) in the autumn of 1870, from the beginning to the middle of September, had held their usual assemblies by hundreds on the sunny side of the roofs, stormy and rainy cold weather suddenly supervened. As suddenly did most of the swallows take their departure for the south. The few that remained behind flew about restlessly and anxiously, unable in the cold north wind to obtain sufficient insects to appease their hunger. Within a day after the others these also disappeared. Three days after, during which time no swallow was observed, Herr Rohweder's informant saw peeping out of the entrance of some nests under the projecting roof of the east side of his house, here a wing, there a tail or a few feathers. A ladder was obtained and the nests tapped, but no motion. On pulling at one of the overhanging wings a swallow was dragged out. It was alive, but seemed paralysed. After the swallow was held in the hand a while it fluttered about a short space and then fell to the earth. A second bird behaved in the same way, and a third showed few signs of life. A fourth appeared quite lifeless. In other nests six, and ten, and even fourteen swallows were found huddled together. Their condition was similar to those first found. The birds near the entrance of the nest appeared in a state of sound sleep, while those furthe in showed no signs of life. The former soon were able to fly, with difficulty, a larger or shorter round, only one flying to a considerable distance; the latter were thrown on a neighbouring heap of straw. On the following day, when the observer returned, no birds were found. The exact locality of these observations is not given. X.

Two Remarkable Meteors

WHILST walking on Sunday night with a friend, about 10'35 my attention was directed to a beautiful meteor, of a ruddy hue, not unlike Mars. It appeared a little to the south of Arcturus, and after passing along with a slow motion in an easterly direction, throwing out sparks meanwhile, disappeared near β Herculis. In size it seemed to be about four times as large as Jupiter, and continued visible for three or four seconds. About half a minute afterwards it was followed by another from the same quarter, which took almost exactly the same direction as the other. In colour and appearance it resembled the first, but was not quite so large. It remained visible about three seconds. The sky at the time was beautifully clear, and there was little or no wind.

Rottingdean, Brighton, May 14 W. H. S. J. HOPE

Yellow Crocuses

(Translation)

I have observed here that sparrows have shown a very considerable partiality for yellow crocuses during this spring. My neighbour and I vied with each other in our spring beds; he excelled in yellow crocuses and hyacinths, I in white and blue crocuses. One beautiful Sunday the whole of his crocuses were found bitten and torn by sparrows, and, what is noteworthy, also some yellow crocuses which had somehow wandered into my lot, while the blue and white remained almost untouched. Should this be regarded as an oversight, or was it a matter of taste?

So far the fact is incontestable, but it has not before been observed by me, though I am an old amateur. To be sure, for the last six years, I have always been, about the time of blooming, absent at the Reichstag, and perhaps, therefore, have forgotten early single observations. It may not be possible to obtain a positive explanation. The dryness of the spring, perhaps the colour-sense of the bird, or even a more or less delicate mixture of the plant-sap may account for it—quien sabe!

Hamburg, May 12 W. VON FREEDEN
Editor of the *Hansa*

Sound and Light

I SHOULD like to learn if the following phenomenon is well known and alluded to in scientific writings. While lying awake a few mornings ago, with my eyelids closed, I was startled by a railway whistle. At the same instant I perceived a blaze of light on a dark ground seemingly a few yards off. I made inquiry of my wife (who is of a much more nervous temperament than I) if she had ever observed such a coincidence, and was informed that in her case it is not a very unfrequent occurrence. I likewise reported the circumstance to some scientific friends, but they had neither read nor heard of noise being the occasioning cause of sensation of colour.

While the pen is in my hand I may mention, in reference to Mr. Renshaw's communication (p. 530), that sparrows are in the habit of demolishing the flowers of my yellow crocuses.

Bushy Hill, Cambuslang HENRY MUIRHEAD

Cloud Colours

A VEIN of thought is sometimes as a vein of the most fine gold, and observation is everything in meteorology as it is in geology, in which two difficult sciences we are much interested in this country, and of which your contributor is the unpretending student.

Now I first learned my lessons in weather science from the remarks of Admiral Fitzroy, the author of the Weather Book, which should be well known and read in this country. For years we have marked what an intimate correlation there is between the colour of the clouds and coming weather. Thus we have the cold dark blue and grey, and the reddish yellow masses of cloud as indicative of cold and snow, and we have the light bright grey with bright edges as accompanying or indicating hard frost. Then again we have the inky-coloured cloud, flying in shreds, as indicative of wind and rain, and also the mottled cloud of the same colour or thereabouts, as the sure indicative of rain. We have the sickly-looking green, the deep blue gloom, the muddy angry-looking red, and other such tints, as forecasts of storm, snow, rain, &c.; and frequently before a north-easter we have the grey bluish and whitish clouds setting from north-east, somewhat like the spread-out fingers of the hand. Our sunsets are often grand beyond my pen. The lavish wealth of crimson and gold is magnificent. It strikes us now to ask what relation chemistry and gases have with the cloud colours. I leave that

to older minds than mine, beyond the banks of Newfoundland.

But we see, from all that has been said, the *vast* importance of noting the *colours* of the clouds. We depend much in this country on the colour of the clouds for weather prediction. Ice, however, at this time of year, by refrigerating the atmosphere, often interferes with calculation. H. C.

Hailer Grace, Newfoundland

THE PROGRESS OF EVOLUTION[1]

THE new journal mentioned below is edited jointly by Dr. Otto Caspari, of Heidelberg, Prof. Dr. Gustav Jäger, of Stuttgart, and Dr. Ernst Krause (Carus Sterne), of Berlin; and on the list of its contributors are the names of Charles Darwin, Ernst Haeckel, Friedrich von Hellwald, and many others whose scientific creed is Darwinism.

The editors in their introductory statement say that a new day has dawned for natural science, since our great countryman applied the natural laws which govern the whole universe to the phenomena of the development of life, and showed the fallacy of assigning that central position in nature to man himself which had been attributed to him for ages, as Copernicus did in the case of our planet three centuries ago. Man, who seemed to stand above nature hitherto has, without being drawn down from his eminent position, been incorporated with nature as one of her integral parts. The new monistic philosophy caused a wonderful reaction, and an animated reciprocal intercourse arose between the subjective and objective sciences. All the sciences which treat of man, from anthropology, ethnology, and the psychology of peoples, to the history of culture and states, national economy, the philosophy of law, history, and religion, and the sciences of morals and dietetics, proved to be natural sciences quite as much as mineralogy, biology, the practical education of man, and the cultivation of plants and animals.

The result of this general intercourse of the different sciences, has been a continued and encouraging confirmation of the monistic principle contained in the theories of descent and development; the literature, however, which was generated by the reaction, is dispersed and can be collected only from the various scientific journals. Thus, a general desire for collection and concentration has sprung up amongst all those who look upon the theory of development as a considerable progress of the human mind.

The new *Kosmos* will bring together what has hitherto been unconnected; will point out the gaps still existing, and thus lead to their being speedily filled; will reduce contrasts and contradictions to their true nature, and will oppose pernicious dogmatism. *Kosmos* will, with regard to the special domains of natural science, bear a certain critical and polemical stamp, its editors being aware that even science is best developed and strengthened in the fight for its existence, and that in the end the "fittest" theory will survive. All articles in the new serial are written in popular language, and are intended for a large circle of readers.

The first number contains a series of very interesting articles, of which we may mention—Philosophy and its Union with Natural Science, by Otto Caspari; On Inheritance, by Dr. Gustav Jäger; On Modern Anthropology, by the same; On the Chronicles of the History of Development, by Ernst Haeckel; The History of Creation and Chorology two Centuries ago, by Carus Sterne; On the Significance and Objects of Ethnography, by Friedrich von Hellwald; and an excellent review of Darwin's work on Cross and Self-Fertilisation, by Dr. Hermann Müller.

[1] *Kosmos; Zeitschrift für einheitliche Weltanschauung auf Grund der Entwickelungslehre.* (1 Heft, April, 1877.)

ENGINEERING EDUCATION IN JAPAN

THE technical education of engineers is a subject which has engaged public attention for a long time past and is one of great national importance. It is somewhat singular that this country, foremost as it has always been in matters of engineering enterprise, should be so behindhand in the systematic education of its engineers, there being no establishment in England devoted to that object which is recognised by the profession. Under the system that has been in vogue up to a comparatively recent period a youth intended for an engineer is taken from school at the age of sixteen being thereby deprived of the most valuable years of his education, and placed in some engineering manufactory, where he remains, perhaps, till he is twenty. In those four years his so called "training" consists in going through the manual routine of the various workshops and "picking up" what knowledge he can by keeping his eyes open and living on good terms with the workmen. His last year is usually spent in the drawing-office, where, by a similar process of "picking up," he learns how to draw if not to design machinery or works of construction. At the end of that time his education is supposed to be complete, and he either remains as a draughtsman until something better is offered him, or he enters the office of another engineer for the purpose of improvement. All this time the far more important theoretical training is neglected altogether, no classes or examinations are held, no lectures or other instructions are given, and though some few energetic young men in some way make up this loss by private study they are a great exception, and the hours of manual work are usually so heavy (from 6 A.M. till 5 P.M.) as to render working in the evening both fatiguing and unprofitable.

The Continental system goes to the other extreme, teaching the theory and discarding the practice. This system is as bad as the other, for experience has shown that in engineering works a practical man without scientific training seldom makes such serious blunders as a scientific man without practical experience. It can only be by a judicious combination of the two systems, allowing science and practical experience to work hand in hand together in the education of an engineer that the best results can be looked for, and in these days of close competition, not only between man and man, but between country and country, it is of the utmost importance to a nation that its engineers should be instructed upon the best and soundest principles. The Indian Government recognised this when it established the Royal Indian Engineering College at Cooper's Hill for the systematic training of engineers for the Public Works Department of India; and it is remarkable that the profession of engineering should stand alone in England as having no recognised *Alma Mater* of its own. Many years ago an engineering college was established at Putney upon a good system, but it was badly managed, and after becoming a nuisance to the neighbourhood, was ultimately shut up; at the present time, with the exception of the technical classes at the Crystal Palace and at King's College, which, in a small way, are doing good work, there is no institution in this country devoted to the education of engineers.

While England is so far behindhand in this important question, a great work has been done by the Japanese Government in the establishment of an Imperial College of Engineering at Tokei, an institution which gives to its students a highly scientific training, combined with actual practical experience in engineering workshops which give employment at the present time to over three hundred workmen, but which are being largely increased and are turning out all classes of engineering work.

The system adopted is as follows:—The course of training extends over six years. The first two years are spent entirely at college; during the next two years, six months of each year are spent at college and six months in the practice of that particular branch which the student may select; the last two years are spent entirely in practical work. The system of instruction in the college is partly professorial and partly tutorial, consisting in the delivery of lectures and in assistance being given to the students in their work.

Candidates for admission must be Japanese subjects under the age of twenty, and must pass a preliminary examination, the best fifty being chosen as cadets, of which there are two classes. A student may elect to enter either as a Government cadet—in which case all his expenses are defrayed by Government, under whom he binds himself to serve for seven years at the expiration of his six years' training—or he may enter as a private cadet, paying his own expenses, in which case the obligation to serve subsequently under Government is dispensed with. In all other respects he is on the same footing as the Government cadet.

The whole system of training may be divided into three courses:—(1) General and Scientific, (2) Technical, and (3) Practical. The general and scientific course, which is taught during the first two years, includes (1) English language and composition, (2) geography, (3) elementary mathematics, (4) elementary mechanics, (5) elementary physics, (6) chemistry, and (7) mechanical drawing.

The Technical course consists of the following branches of engineering:—(1) Civil engineering, (2) mechanical engineering, (3) telegraphy, (4) architecture, (5) chemistry and metallurgy, and (6) mining. This course is taught during the third and fourth years of the curriculum. The practical course, in which the students are engaged during the last two years in the practice of the special branch each may have selected, consists of working in the laboratories of the college, and in the engineering works connected with it established at Akabane, where they serve a regular engineering apprenticeship. While this course is going on lectures on special subjects are given, and the students are required to prepare reports upon the work in which they have been engaged.

In the Technical course are included the higher mathematics and natural philosophy, engineering, civil and mechanical, geology, mineralogy, surveying, naval architecture, strength of materials, practice in the chemical, physical, metallurgical, and engineering laboratories, and in the drawing office and workshops.

The main building, which is a very handsome structure, consists of a central portion containing the large examination hall and library, drawing offices and class rooms, and on each side of this extends a wing containing other class rooms and lecture halls. This is the College proper, and surrounding it are separate buildings set apart for the dormitories, Professors' houses, museum and laboratories of which there are four devoted respectively to chemistry, physics, metallurgy, and engineering. The buildings have been very admirably arranged by the Principal of the College, Mr. Henry Dyer, C.E., and the architectural details have been carried out with great skill by Mr. C. A. de Boinville.

The staff of the College consists of a Principal and nine English Professors, assisted by Japanese teachers, and the Institution is under the jurisdiction of the Minister of Public Works.

A calendar of the College is published annually, which contains information relative to the admission of students, courses of study, and examination papers, as well as catalogues of the splendid collection of instruments in the laboratories, and of the books in the library, which seems to be exceptionally rich in almost every branch of general and scientific literature. C. W. C.

SUSPECTED RELATIONS BETWEEN THE SUN AND EARTH[1]

III.

IN the first of these articles I tried to show that the magnetism of the earth is affected by the state of the sun's surface. I shall now try to show that the meteorology of the earth is likewise affected by the same cause.

Mr. Baxendell, of Manchester, was, I think, the first to point out that the meteorological convection currents of the earth appear to vary according to the state of the sun's surface. More recently Mr. Meldrum, of the Mauritius Observatory, has brought this connection very forcibly before us by showing, from the results of his observations, that there are more cyclones in the Indian Ocean during years of maximum than during years of minimum sun-spots. This will be seen from the following table:—

TABLE II.

Comparison of the Yearly Number of Cyclones occurring in the Indian Ocean with the Yearly Number of Spots on the Sun.

Character as regards Sun-spots.	Years.	Total number of Cyclones.	No. of Cyclones in max. and min. Periods.	Character as regards Sun spots.	Years.	Total number of Cyclones.	No. of Cyclones in max. and min. Periods.
Max.	1847	5	23		1862	10	
	1848	8			1863	9	
	1849	10			1864	5	
	1850	8			1865	7	21
	1851	7		Min.	1866	8	
	1852	8			1867	6	
	1853	8			1868	7	
	1854	4			1869	9	
Min.	1855	5	13		1870	11	31
	1856	4		Max.	1871	11	
	1857	4			1872	13	
	1858	9			1873	12	
	1859	15					
Max.	1860	13	39				
	1861	11					

Prof. Poey has confirmed this conclusion of Mr. Meldrum by showing that there is a similar periodicity as regards the cyclones which make their appearance off the coast of Central America.

In the next place Dr. Arthur Schuster has found that the years of minimum sun-spots coincide very nearly with the good wine years in Germany. This will appear from the following table.

TABLE III.

Exhibiting the near Coincidence between the Years known as good Wine Years in Germany and the Years of minimum Sun-spots.

Dates of Minimum Sun-spots.	Years known in Germany as good Wine Years.
1784·8	1784
1798·5	(?)
1810·5	1811
1823·2	1822
1833·8	1834
1844·0	1846
1856·2	1857
	1858
1867·2	1868

Again, it has quite recently been remarked by Dr. Hunter, Director-General of Statistics to the Government of India, that the famines in Southern India have a period of recurrence which is nearly eleven years, being thus of the same duration as that of sun-spot frequency.

[1] Continued from p. 28.

Here we have evidence from various quarters of a connection of some sort between the state of the sun's surface and the meteorology of the earth, and it becomes a question of great interest what is the nature of this connection.

In the first of these articles a diagram was exhibited showing the close relation that exists between the state of the sun's surface and the range of oscillation of the magnet freely suspended at the Kew Observatory. If instead of taking the daily magnetic ranges we take the daily temperature ranges, that is to say, the differences between the maximum and minimum thermometers, we find an apparent reference to the state of the sun in these also, inasmuch as these ranges appear to be greater at times

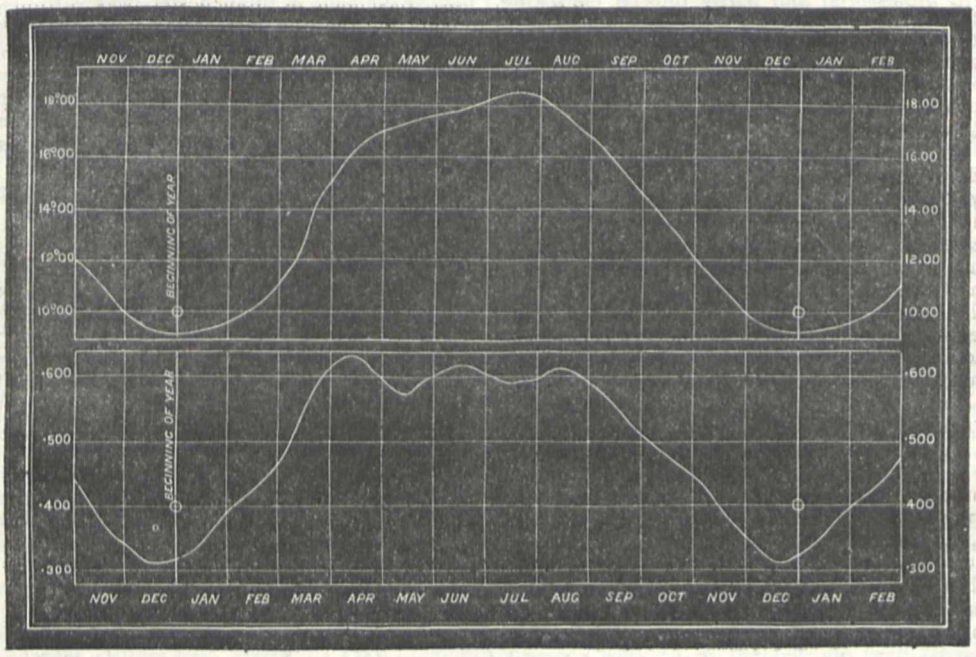

DIAGRAM K.—The Upper Curve denotes Temperature Range, the Lower Curve Declination Range.

of maximum than at times of minimum sun-spot frequency. Nevertheless the correspondence is not nearly so well marked as in the case of the magnetic declination, and there is no doubt much local irregularity. But here the following question of much interest and importance crops up. Do these fluctuations of the daily temperature range at the Kew Observatory coincide in point of time with the corresponding solar fluctuations? or do the former lag behind the latter, as is the case with the magnet? The practical bearing of this question is easily seen, for if temperature oscillations and other meteorological fluctuations are simultaneous with the corresponding solar changes, we can hardly expect that a study of the sun's surface will ever enable us to forecast meteorological occurrences; but if on the other hand the solar changes precede the meteorological ones, we may hope, when the nature of the connection between them is fully understood, to make use of solar observations in order to predict the greater meteorological occurrences. Now it appears to the writer that there are certain well-marked fluctuations of temperature range at the Kew Observatory which coincide very closely with corresponding magnetic fluctuations, and which therefore lag behind the solar fluctuations nearly six months (see Article I.); but this interesting and important question can only be determined by further investigations.

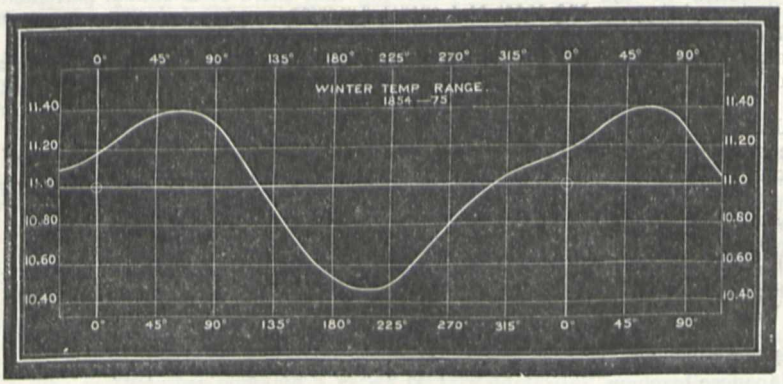

DIAGRAM L.

I may here remark that meteorologists are beginning to suspect a somewhat intimate connection between the magnetism and the meteorology of the earth. Mr. Baxendell was, I think, the first to point out that there is a diurnal inequality in the direction and velocity of the wind apparently connected with the daily changes of magnetic declination. On this subject the writer has recently received a letter from Mr. J. A. Broun, the well-known meteorologist and magnetician, who says, "My present opinion is that meteorological phenomena are due to solar actions; that the heating action is not the only one; but that the action which produces variations in the earth's magnetic force affects the conditions of the atmospheric gases, introducing forces which we cannot in the present state of our knowledge appreciate, though the facts appear to me to prove their existence."

It will be seen, by Diagram K, that there is a very

marked likeness between the annual variation of the temperature range and the annual variation of the declination range at the Kew Observatory.

There yet remains a question which is nearly allied to the present inquiry. If the sun affects the earth in a variety of ways, and if the planets affect the sun, why should not the moon affect the earth? Now it is known to affect terrestrial magnetism, producing a well-marked variation of a tidal nature, that is to say with two maxima and minima in each lunar day, and there are also indications of a variation with only one maximum and minimum.

Again, Mr. Park Harrison was the first to point out that terrestrial temperature is influenced by the relative position of the sun and moon.

The writer of this article has found in the daily temperature range at the Kew Observatory an unmistakable reference to the phase of the moon.

In summer when the full moon is low in the heavens, we have a less decided reference, which seems to imply a maximum of daily temperature range about new moon and also about full moon. But in winter, when the full moon is high, we have a very decided reference showing a maximum of daily temperature range about new moon, and a minimum about full moon.

Again, in the magnetic ranges at Kew the same features occur, namely, in summer a maximum range at new and at full moon, and in winter a maximum at new and a minimum at full moon.

The winter lunar variations of the temperature and declination ranges at Kew are exhibited in the Diagrams L and M, from which it will be seen that there is a very decided likeness between the two.

These last diagrams are especially interesting because they exhibit an influence which appears to be similar *in form* to that which the planets may be supposed to produce upon the surface of the sun. This, however, is a question which can only be decided by further investigation.

If we now bring together the results of these three papers we may compare the three problems, solar research, terrestrial magnetism, and meteorology, to three corners of a triangle that are bound together. Of their three relations we are, it may be said, perfectly certain of the connection between solar research and terrestrial magnetism. The connection between solar research and meteorology is perhaps not so well defined, but our evidence is here supplemented by independent traces of a connection between magnetism and meteorology. Thus the three things hang together, and scientific prudence points to the desirability of their being studied together as a whole, a consideration which will not, I trust, be overlooked in the contemplated reorganisation of British meteorology.

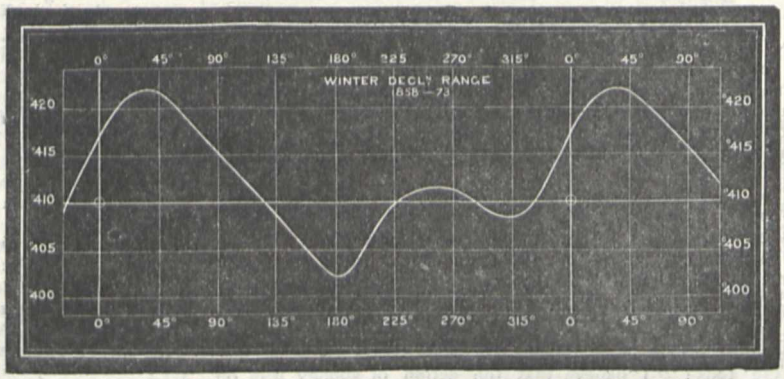

DIAGRAM M.

I would desire now to conclude by asking, in all honesty, Have we not here a plea for the establishment of some institution that will keep a daily watch upon that luminary which is thus seen to affect us in such a variety of ways?

BALFOUR STEWART

THE SOUTH AFRICAN MUSEUM

OUR notice of the condition of the South African Museum, and the various sums allotted to research by the Government of the Colony, has called forth some criticisms on the part of the Cape-town *Standard and Mail* of April 7. "What NATURE and other scientific organs in Europe mean by 'research,'" it states, "is not what the responsible advisers of the Cape mean by their favouring grants. It would not be saying too much, nor putting it too strongly, to assert that there is no scientific research carried on in connection with any botanical gardens in South Africa. In regard to our museums there is some genuine work being done; at all events in the South African and Albany museums original observations are being recorded. As to our libraries which absorb 2,000*l.* per annum of the public money, the less said, perhaps, the better. The South African Library, as far as standard works in such branches of science as anatomy, chemistry, mineralogy, natural philosophy, &c., are concerned, is simply deficient, and unaccountably so, considering the demands of these departments and the standing of some of the directors. The only sums voted for purely original scientific work are those for 'Geological Researches,' for the publication of Dr. Bleek's Bushman Researches, and for the Meteorological Commission. With the exception of the first of these, which amounts to 1,500*l.*, research in the sense NATURE must mean, is fostered by only some four or five hundred pounds." The writer then goes on to describe the consequences of Dr. Bleek's death; the linguistic and ethnological researches he was carrying on have been stopped, and instead of appointing a qualified scholar to fill his place, the Government allowed his office and salary "to be absorbed into the general and ignoble management of the South African Library, which is only a representative of Mudie, being conducted in the charitable idea of providing, at three pounds sterling per annum, the current literature of the day to subscribers who for the same reading would have to pay in a circulating library about four times the amount. . . . 'Novels are the solace of my life,' was the plea (of Mr. Goodliffe) from the chair in favour of continuing a national institution subsidised by the Government of the Colony, and therefore supported from the revenue of the country, as a receptacle for the custodianship of the popular writings of the period. The scientific work of South Africa has been done by amateurs holding no professed natural history appointments." The Gill College Herbarium now receives a subsidy of 100*l.* a year, but "Prof. Macowan worked at the botany of the Colony for thirteen years before he received any grant to enable him to prosecute the study, or to cover the expenses of preserving a large herbarium." The Colonial Herbarium in Capetown "has a collection of types of the very highest value to Cape botany—those arranged and classified by Dr. Harvey. It has the collections of Dr. Pappe, the late Colonial botanist, consisting of thousands of species, which were bought by a former Government for some 200*l.* Other collections more or less valuable are also in the Herbarium." But

"the greater part of these interesting and valuable plants has been destroyed by rain leaking through the roof of the library buildings into the room where they are kept, and by the ravages of moths, &c. In a short time the herbarium will be simply nothing but a mass of uninteresting fragments. We understand that some time back the Parliament voted a small sum to be expended in putting the herbarium into order. How far anything could possibly have been done by those in charge may be learned from the fact that Dr. Rehman, the Austrian botanist, found whole fasiculi destroyed."

SPONGY IRON FILTERS

IN a paper presented by Prof. Frankland, F.R.S., and read before the Royal Society, Mr. Gustav Bischof describes numerous experiments made with spongy iron filters and with charcoal filters. He states that chemical analysis is incapable of discriminating between living or dead, fresh or putrescent organic matters. The microscope reveals their nature more fully; but it is nevertheless frequ ntly a matter of great difficulty to decide as to the existence or non-existence of *Bacteria* of putrefaction, or their germs, in water.

We must refer our readers to the paper for a full account of the experiments and the conditions under which they were performed. Mr. Bischof states that they show that *Bacteria* present in drinking water are *not* killed in passing through charcoal and are killed in passing through spongy iron.

He adds: "I believe that the action of spongy iron on organic matters largely consists in a reduction of ferric hydrate by organic impurities in water. We know that even such organic matters as straw or branches are capable of reducing ferric to ferrous hydrate. We know that even such indestructible organic matter as linen and cotton fibres are gradually destroyed by rust stains. This action is slow when experimenting upon ordinary ferric hydrate, but it may, *in statu nascendi*, be very energetic, the more so if we consider the nature of the organic matter in water. Ferric hydrate is always formed in the upper part of a layer of spongy iron, when water is passed through that material. The ferrous hydrate resulting from the reduction by organic matter may be re-oxidised by oxygen dissolved in the water, and thus the two reactions repeat themselves. This would explain why the action of spongy iron continues so long.

"It is, however, quite certain that there is also a reducing action taking place when ordinary water is passed through spongy iron. This is clearly indicated by the reduction of nitrates.

"Our knowledge of those low organisms, which are believed to be the cause of certain epidemics, is as yet too limited to allow of direct experiments upon them. It is not improbable that, like the *Bacteria* of putrefaction, they are rendered harmless when water containing them passes through spongy iron; but until we possess the means of isolating these organisms, this question can only be definitively settled by practical experience."

CENTROIDS AND THEIR APPLICATION TO SOME MECHANICAL PROBLEMS[1]

THE principal object of the following paper is to suggest the use of a more general form than is commonly employed in the statement of some of the more important theorems of elementary mechanics. Such a generalisation, if in itself satisfactory, has two-fold advantages; it both facilitates the direct solution of problems otherwise apparently complex, and it enables a common method to be employed in an infinite variety of cases, each of which otherwise has to be treated in its own special way. The methods to be described are purely geometric, and admit in all cases of graphic solutions. In the study of mechanism and in all applications of mechanics to engineering work this is a matter of considerable importance, for graphic methods have such enormous advantages in these cases that they must supplant all others when they give equally good results.

By the centroid of any body A relatively to another B is meant *the locus of the instantaneous centres of A in its motion relatively to B*.[2] The expression includes two things, which must be distinguished from each other;—(i.) the locus as part of the moving body A, (ii.) the locus as part of the body B relatively to which A's motion is observed, and which may for convenience be regarded as fixed. These loci may be entirely different as to form, but in all their properties they are absolutely similar and reciprocal. It would therefore be wrong to give them different names, they can be distinguished, when necessary, as the centroid *of a body*, and the centroid *for the motion of a body* respectively. The centroid of A is therefore the locus *upon* A of its inst. centres relatively to B; the centroid for the motion of A is the locus *upon* B of the same centres.

The following are the most important characteristics of these curves. As the bodies to which they belong move the centroids roll upon each other, and every point in each becomes in turn the inst. centre. Their rolling, therefore, represents continuously the whole motion of the bodies (considered as changes of position merely), quite irrespective of their form; in other words it defines the path of motion of all points in the bodies. The two centroids have always one point in common—their point of contact—this point being the instantaneous centre. This point may be included in both bodies, and has no motion relatively to either. Any motion which it has must therefore be common to both, so that it may be entirely neglected in investigating their relative motions. In problems affecting the motion of either body relatively to a third this is often of much use.

For the sake of definiteness it has been presupposed in the foregoing paragraphs that the motions referred to were conplane, or, more generally, took place about some fixed point. When the motion is conplane this point is at infinity, and the centroids are plane curves, sections of the cylindric ruled surfaces formed by the successive positions of the instantaneous axes. When the distance of the point is finite, the centroids are, of course, spheric curves, the instantaneous axes forming cones of which the point mentioned is the vertex. These theorems were given by Poinsot in his "Théorie Nouvelle de la Rotation des Corps." It may be interesting just to mention also the case of general motion in space, where (as Belanger seems first to have pointed out), the solids of instantaneous axes, or *axoids*, as Reuleaux calls them—are general ruled surfaces twisting on each other. Each generator of the surface is a "screw," and on each in turn a twist occurs. The surfaces are in general non-developable.

For the sake of brevity, only conplane motions will be considered in this paper. This class of motions includes nine-tenths of those occurring in mechanism. Two or three special cases of frequent occurrence may first be mentioned. If the relative motion of two bodies be a simple rotation, the centroids are a pair of coincident points, one of which must still be considered to roll on the other. The instantaneous centre here becomes a permanent centre. It is convenient, however, to treat the point not only as a permanent centre, but as a special (limiting) case of the centroid. If all points in a body move in parallel straight lines, the centroid for the motion of the body is a point at infinity, and the centroid of the body is also a point at infinity coincident with the former. If the path of the body were infinitely long, the two points would roll round each other. If, on the other hand, a body move parallel to itself, every point in the centroid for its motion (and therefore all points in its own centroid) must be at infinity. The two centroids must again be coincident, so that the motion is represented by the line at infinity rolling on itself.[1]

Proceeding now to notice the bearing of the theory of centroids upon some of the theorems of elementary mechanics, these may be taken in order of simplicity, commencing with those which involve only the notion of change of position. If, then, the line joining any moving point with the point of contact of its centroids be called its instantaneous radius, we can state the general theorem thus: *The direction of motion of every point in a body is normal to its instantaneous radius.* While this obviously includes the simpler special cases already examined, its form allows of direct application to the most general cases, and especially to all cases in mechanism. Two corollaries out of many which are deducible from it may be mentioned as of some special interest: (i.) The inst. radii of a point moving in a straight line are parallel; and (ii.) the inst. radii of a point moving in a circle must pass through one point. In either case the centroids may be quite general curves, as is easily seen. These corollaries have important practical applications in me-

[1] Abstract of a paper read before Section A of the British Association at Glasgow, by Prof. Alex. B. W. Kennedy, C.E., of University College, London.

[2] The word *centroid* was suggested to the author by his colleague, Prof. W. K. Clifford.

[1] Some physical conception of this case can easily be obtained by rolling one hyperbola upon another. The change in the appearance of the rolling as the point of contact recedes along either branch is very striking.

chanism, especially in "parallel motions," both real and approximate.

The familiar theorem that *the relative velocities of points in any body vary as their instantaneous radii* needs merely to be mentioned. It is to be regretted that it is not more generally used, for while it does not increase the difficulty of comprehending simple cases, it is of enormous advantage in simplifying such (apparently) complex ones as not unfrequently occur in mechanism.

The expression for static equilibrium is also tolerably familiar:—*the sum of the moments of all the forces acting upon a body about its inst. centre must* = 0. For practical purposes, however, it is generally more convenient to state the proposition:—*the resultant of all the forces acting upon a body must pass through the point of contact of its centroids.* The application of this proposition to all the simpler cases is self-evident, and at the same time it reduces complex cases to their smallest possible dimensions, rendering most very easy, and in many cases greatly aiding the comprehension of the alterations in conditions of equilibrium corresponding to consecutive alterations in the positions of mechanisms as their links move. It may just be noted that as the two forces of a couple have for their resultant a force (infinitely small) acting along the line at infinity, the proposition gives at once that where the inst. centre of a body is at infinity it is in equilibrio under any number of couples of any magnitude. In the case of a body moving parallel to itself, therefore (see *ante*) all couples may be neglected so far as its static equilibrium is concerned, whatever their magnitude or sense.

The following are, in conclusion, a few of the kinetic propositions the solution of which is greatly aided by the use of centroids:—

(I.) If a force[1] constant in direction and position act upon a body, then (i.) if it cut the centroid for the motion of the body in one or more points motion will take place until the first of these becomes the point of contact, and will then cease; (ii.) if it pass entirely without this centroid, there will be continuous motion. As corollaries to (i) may be mentioned (*a*), if the centroid for the motion of a body be a curve of the 2nd, 3rd . . . *n*th order, the body has a maximum of 2, 3 . . . *n* positions of equilibrium under some one or more forces constant in direction and position. Also (*b*), if a body have not more than a single position of equilibrium under any such force, the centroid for its motion must be a straight line.

(II.) If the position of a force relatively to the body upon which it acts remain constant, then (i.) if it cut the centroid of the body in one or more points, motion will take place until one of these becomes the point of contact, (ii.) if it lie entirely without the centroid of the body, there will be continuous motion. This gives corollaries as to positions of equilibrium similar to those just stated.

(III.) If a force constant in direction act always at the same point of a body, motion will continue until the instantaneous radius of the point becomes parallel to the direction of the force. There is here no case of continual motion; the theorems as to number, &c., of positions of equilibrium are similar to those given above.

English writers have used these curves very little. Among modern continental writers who have employed them may be mentioned Dwelshauvers-Dery (Liége) who uses them in his "Cinématique" for questions relating to relative velocities; Schell (Carlsruhe) in his "Theorie der Bewegung u. d. Kräfte; Reuleaux ("Theoretische Kinematik," and elsewhere), who gave them the name (*Polbahnen*), by which they are known in Germany, and who has used them ably and extensively for kinematic problems; and lastly Pröll, who has made use of them in his recent "Versuch einer graphischen Dynamik." The writer has not, however, found them anywhere unreservedly adopted, and has, therefore, made this attempt to show how easily centroidal methods adapt themselves to the general treatment of mechanical problems, especially those connected with mechanism, and at the same time how well suited they appear to be for educational purposes.

[1] Or here, and in the following propositions, the resultant of any number of forces.

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF 1882, MAY 17.—Hallaschka, in his "Elementa Eclipsium," describes this eclipse as broadly total, whereas, it will be, in reality, total, though the zone of totality will not be a broad one. An error in the moon's semi-diameter led to the statement in Hallaschka's work. The following elements of this eclipse, calculated upon the same system that has been applied in the examination of other solar eclipses in this column, will probably be near the truth:—

Conjunction in R.A., May 16, at 19h. 41m. 11·7s. G.M.T.

R.A.	53	56	35·4
Moon's hourly motion in R.A. ...		36	14·5
Sun's ,, ,, ...		2	28·7
Moon's declination	19	38	46·4 N.
Sun's ,, ...	19	19	38·8 N.
Moon's hourly motion in decl. ...		4	56·0 N.
Sun's ,, ,, ,, ...		0	33·8 N.
Moon's horizontal parallax		58	15·1
Sun's ,, ,, ...			8·8
Moon's true semi-diameter		15	52·4
Sun's ,, ,, ...		15	48·8

The central and total eclipse begins at 17h. 53·8m. in longitude 3° 11′ W., and latitude 10° 40′ N.; it occurs with the sun on the meridian in 63° 44′ E., and 38° 35′ N., and ends at 21h. 18·8m. in 138° 51′ E., and 25° 25′ N. The following are points upon the central line in that portion of its track where observations are most likely to be made:—

Long.	Lat.	Sun's Zenith dist.	Long.	Lat.	Sun's Zenith dist.
29° 49′ E.	25° 36′ N.	49°·9	51° 27′ E.	35° 30′ N.	23°·7
34 5	27 48	44·1	54 58	36 38	21·2
36 3	28 47	41·5	68 48	39 31	21·2
41 33	31 27	34·4	77 23 E.	40 2 N.	26·7
48 20 E.	34 21 N.	26·7			

The central line therefore commences in the west of Africa, and traversing that continent in the direction of Upper Egypt, it passes over the Nile below Thebes, thence over the extremity of the peninsula of Sinai, near Ras Muhammed, and almost directly over Hillah, the site of the ruins of Babylon, to Teheran. The position of this capital according to Gen. Stebitzky (*Astron. Nach.*, No. 2,113) is in longitude 3h. 25m. 41·7s. E. of Greenwich, and latitude 35° 41′ 7″, this point referring to the station of the Indo-European telegraph; so that the central line of shadow according to our elements passes sixteen miles to the south of it. Calculating directly for this longitude we have the following results:—

	h.	m.	s.	
Totality begins May 16 at	22	36	29	local M.T.
,, ends ,,	22	38	13	local M.T.
Duration		1	44	

The sun at an altitude of 67°. So that the greatest duration of totality in this eclipse about 12° east of Teheran is about 1m. 46s.

The central line subsequently traverses China, passing off at or close to Shanghai, at which place a total eclipse of short duration may be observed.

The next total solar eclipse on July 29, 1878, which crosses the United States is pretty fully noticed in the various Ephemerides, though in due time the American astronomers will no doubt provide a chart showing on a larger scale the breadth and position of the zone of totality over their country. Then follows the total eclipse of January 11, 1880, in which the track of the central line lies almost wholly upon the Pacific, the total phase being visible for a brief duration only near the coast of California, above San Francisco. The total eclipse of May, 1882, of which the elements are here given is the next in order of date.

THE COMETS OF 1402.—It is singular, considering the attention which the Chinese paid to the observation of comets, their annals containing reference to several hundreds of these bodies, should not have recorded the appearance of the two evidently great comets of 1402. In particular is this the case with the first comet, which, according to the descriptions in the European

chronicles collected by Pingré, was first seen early in February, and increasing daily in brilliancy, would appear, if we may rely upon the historians, to have presented a wonderful aspect shortly before Easter. On Palm Sunday, and two following days, we are told "its increase was prodigious;" "le dimanche, sa queue fut longue de vingt-cinq brasses; le lundi, de cinquante et même de cent; de plus de deux cents le mardi." It then ceased to be visible at night, but during the eight following days it was seen near the sun, which it preceded; its tail had then shortened to "une ou deux brasses," but its brilliancy was such that the light of the sun did not prevent its being seen at noon-day. It continued visible till the middle of April.

Some years since the late Mr. John Williams, Assistant-Secretary of the Royal Astronomical Society, and author of the valuable work upon Chinese cometary astronomy, at the request of the writer, made a strict search for mention of a comet or comets in 1402 in several Chinese authorities in his possession, but without any success; nor is there any reference to a comet in this year in M. Biot's translations. Failing thus to obtain any data for calculation beyond the vague indications of the comet's positions given in the "Cometographie," the writer endeavoured to utilise them to form some idea of the orbit, and found that with perihelion passage assumed on March 21, in longitude 208°, ascending node 117°, inclination 55°, least distance 0·38, and direct motion, the principal circumstances of the comet's appearance, so far at least as regards track across the heavens, might be represented; but its extraordinary brightness is not easily accounted for. The comet is mentioned in Kaempfer's History of Japan, which renders it the more curious that the Chinese annals should have no account of it. Struyck thought it was a return of the comet of 1661, but in his day that body was thought to be identical with Apian's comet of 1532, an idea which was negatived by Mechain's subsequent calculations and by the non-discovery of the comet about the year 1790, notwithstanding Maskelyne's efforts to insure observations if it returned at that time.

METEOROLOGICAL NOTES

Variations in the Relation of the Barometric Gradient to the Force of the Wind.—In a very suggestive paper recently communicated to the Meteorological Society of London, Mr. Clement Ley shows that the mean velocity of the wind corresponding to each barometric gradient is much higher in summer than in winter, and that this is the case at all stations examined, with all winds, with all lengths of radius of isobaric curvature, and with all values of actual barometric pressure. The diurnal and seasonal variation in the relation of the gradient to the force of the wind is unquestionably one of the fundamental questions of meteorological research, and we hope Mr. Ley will soon again return to its discussion, with ampler data for a more satisfactory handling of the subject than he has yet had before him. That the mean diurnal oscillations of the barometer cannot be neglected in the inquiry is very evident. Thus, while in June at 8 A.M. the barometer at Kew is 0·015 inch above the daily average, on the coast at Falmouth it is only 0·001 inch; but while at 3 P.M. it is 0·015 inch below the average at Kew, it is still 0·001 inch above the average at Falmouth. Crossing to the Continent and contrasting Helder on the coast with Namur inland, it is seen that in June at 8 A.M. the barometer at Helder is 0·004 inch under the average, while at Namur it is 0·008 inch above it, but at 3 P.M. it is at Helder 0·007 inch above, whereas at Namur it is 0·011 inch below the average. An interesting part of the paper is that descriptive of the mean diurnal variations in the velocity of the wind, in which, among other interesting features, it is pointed out that at the coast stations, the mean horary curve in summer approximates in type to the winter curve at the inland stations, the diurnal maximum being about 2 P.M. In connection with this it is interesting to note that while at Valentia and Falmouth the anemometric maximum occurs in summer about 2 P.M., the barometric minimum does not occur till from three to four hours later. The point might be even still more strikingly put by a reference to the observations made at Pola, near the head of the Adriatic Sea, where during June, July, and August, 1876, the anemometric maximum occurred from 10 A.M. to noon, and the barometric maximum from 11 A.M. to 1 P.M. The two maxima are thus all but contemporaneous, a result directly opposed to the view generally entertained that in such cases the barometric maxima are contemporaneous with the anemometric minima. London presents very considerable facilities for the working out of this question in its two well-equipped observatories at Greenwich and Kew, and in the number of meteorological stations situated within a radius of fifty miles, in connection with the Meteorological Office, Mr. Glaisher, and the London Meteorological Society. Observations made at these stations at 9 A.M., 3, and 9 P.M., would render possible the drawing of the isobarics over the south-east of England, with an approach to correctness sufficient to give the barometric gradients for Greenwich and Kew as may meet the requirements of the problem. Isobarics drawn from the Daily Telegraphic Reports alone, while sufficient in a first tentative inquiry, are, owing to the great distances between the stations, necessarily very hypothetical, and therefore much too rough for any satisfactory investigation of this important subject.

Climate of Pekin.—A memoir on this subject, read by H. Fritsche before the Imperial Academy of Sciences of St. Petersburg on August 17, 1876, has just been published in the *Repertorium für Meteorologie*. The memoir is an able and exhaustive discussion of the elaborate meteorological observations made at Pekin from the beginning of 1841, and published by the Russian Government under the superintendence successively of Kuppfer, Kaemtz, and Wild. H. Fritsche has thus been able to give in a very complete form the hourly and general monthly averages for temperature, pressure, and humidity, and very satisfactory, though necessarily less complete, averages of wind, cloud, rain, snow, hail, and thunderstorms. The mean temperature and pressure of each day of the year has been worked out in detail, and several of the more important extremes are also tabulated. This well-discussed material has a peculiar meteorological value, arising from the position of Pekin with reference to the continent of Asia, since it results from that position that Pekin may be regarded as situated during the winter months in an extensive anti-cyclone, the prevailing winds being from the continent seawards, and from at least April to July, in an extensive cyclone when the prevailing winds blow from the sea in upon the continent. Hence its dry winter climate, the mean monthly rainfall amounting only to 0·14 inch, and its wet summer climate, the average rainfall in July being nearly 20·00 inches. Hence also snow falls only on eleven days during the year. Thunderstorms occur on twenty-seven days, from the end of April to the beginning of October, reaching the maximum in June, July, and August, when a thunderstorm occurs on an average about every fifth day. The same season marks the period of hail, which is, however, of rare occurrence, being only once in two years. Of special interest are the hourly averages in their relation to the winds and weather of this part of Asia. Thus, while the climate of Pekin loses much of its continental character during the summer months, the hourly barometric curves lose their strictly continental character, the morning minimum, for instance, falling close to, or even slightly below, the mean of the day, thus tending to be assimilated to the curves of the sea-side climates about the latitude of Pekin.

Why the Barometer does not always Indicate Real Vertical Pressure.—Mr. Robert Tennent writes from Edin-

burgh to point out why the barometer does not always indicate real vertical pressure. He points out that as the upper currents of the atmosphere when in motion are more mobile than the lower, and less retarded by friction than the lowest, there are frequent movements or "liftings" from the lower to the upper layers, and this affects the barometric column, "the normal upward diminution of pressure which takes place when the atmosphere is at rest being greatly altered when its upper portion is in rapid motion." Mr. Tennent says "the practical conclusion from this is obvious. On weather charts the constant rise and fall of the barometer which is there reported, is to a large extent simply due to the passage of air over a resisting surface; over a surface devoid of friction these mechanical effects would be entirely removed, its rise and fall would be greatly reduced, and might be considered as being solely dependent on the effects of heat and vapour. The gradients and isobars which are dependent upon it would also be similarly affected. The barometer does not indicate the real weight of the atmosphere, it only exhibits the amount of its elasticity from which its real weight can only be deduced when the dynamical element of motion does not enter into one of its currents." . . . "As a general rule, in the British Isles equatorial winds are accompanied by these rapid upper movements, while Polar winds move with a greater uniformity in the velocity of their various layers, and sometimes even those on the surface move more rapidly when copiously supplied from a vertical source. There is hence a remarkable difference in their *mode of inflow*. Equatorial winds as they increase in force are hence accompanied by 'lifting' and a fall of the barometer. Polar winds are not attended by 'lifting,' and if their supply is copious and partly from a vertical source, their increase in force is accompanied by a rise of the barometer. The range of the thermometer is equally great both above and below its mean. But with the barometer the extent of its range above the mean is not more than one-half of that which takes place when it is below it. When it is below the mean, equatorial winds generally prevail which are accompanied by 'lifting' and extensive range. Above the mean, Polar winds prevail which are not attended by 'lifting' or such extensive fluctuations. Hence, as a general rule, equatorial winds exhibit fictitious or dynamical pressure, while Polar winds possess more nearly real or statical pressure, being unaccompanied by the mechanical oscillations due to the passage of air over a resisting surface."

THUNDERSTORMS AT ANTIBES ON MARCH 26, 1877.—Col. Gazan has given a brief account, in the *Bulletin International* for April 18, of three thunderstorms which occurred at Antibes, in the south-east of France, on March 26, possessing certain characteristics well deserving of attention. About 7 A.M. a flash of lightning occurred followed by a clap of thunder, and at 7.10 A.M. a fall of hail without rain, lasting ten minutes. The hailstones were for the most part regularly round, quite opaque, and not bigger than common peas, the largest not much exceeding half an inch in diameter. Clear patches of blue sky in the east and south-west formed a striking contrast to a nimbus cloud in the west, which was connected with the upper clouds. The clouds were absolutely motionless, the air so calm that not a leaf was stirring, and the fall of hail exactly perpendicular. At 11.10 A.M. the sky was entirely overcast, and under the same conditions as before a fresh fall of hail took place, mingled with heavy rain, the hailstones being more equal in size and generally smaller. About 2.30 P.M. a pretty smart shower of rain fell, which, immediately after a flash of lightning followed by thunder, increased in violence, and was accompanied with hail. The largest of the hailstones did not much exceed the largest of those of the two falls preceding. During the whole time there was not a breath of wind until just before the end of the last thunderstorm, when a light westerly breeze sprang up. Col. Gazan infers from the quiescent state of the air, as shown by the absence of motion in the clouds, the perfect calm at the earth's surface, and the regular distribution of the hailstones over the ground, that the three thunderstorms were formed immediately over the place and that the phenomena were unattended with any gyratory movement whatever—conclusions which, if correct, have important bearings on the theory of thunderstorms, and therefore are well deserving of the most careful examination on the part of observers of the phenomena of atmospheric electricity.

METEOROLOGY IN ITALY.—The *Rivista Scientifico Industriale* publishes a "project for the constitution of an Italian Meteorological Society" from the pen of Prof. D. Ragona, director of the Modena Observatory, in which the writer points out the importance of meteorology, and adds that this science owes much to Italy, as it was in that country that the most valuable meteorological instruments, viz., the barometer, thermometer, and rain-gauge, were invented. More than 100 meteorological stations are already in existence, some of which are renowned for exactness of the determinations and delicacy of the researches they have made. They have also the advantage of great variety in their elevations, more than sixty of them being situated between 200 and 2,500 metres above sea level. Several influential persons have already consented to become members of the new society, and amongst them are the Minister for Agriculture, Industry, and Commerce, and Prof. G. V. Schiaparelli, of Milan. We wish the project every success.

METEOROLOGY IN FRANCE.—The prefects of three different departments have published a circular notifying to the mayors of the several communes under their authority the required conditions for receiving daily the weather-warnings issued by the observatory. It is the first time that official action has been taken for the propagation of the system inaugurated by M. Leverrier. The progress made under his direction is very remarkable, and meteorology is becoming very popular in every part of France. The system is to continue on the voluntary principle.

SUNDAY WEATHER WARNINGS.—The weather telegrams sent every Sunday by the British Meteorological Board have been discontinued, as it is only during winter that the taking of observations has been authorised. The head of the Meteorological Office has written to M. Leverrier notifying the fact, and expressing a hope that the Sunday service will be resumed next September. This decision has given rise to some sarcastic paragraphs in the French leading journals, which doubt whether storms will be found strict Sabbatarians even in summer.

GEOLOGICAL NOTES

GEOLOGICAL MAP OF BELGIUM.—Considerable discussion has lately taken place in Belgium regarding a detailed geological map of that kingdom which it has been proposed to construct. The Academy of Sciences, the Geological Society of Belgium, and the Association of Engineers have all formed committees of inquiry as to the best methods of preparing the map. It may interest geological readers to know the scheme which after prolonged discussion has been agreed upon by the Geological Society of Belgium. The organisation of the staff is proposed to include a geological committee charged with the actual survey, and consisting wholly of geologists; a cartographical committee composed of cartographers and geodesists, to take charge of the engraving and publication of the map in chromolithography; a director, as president of both committees, to be appointed by the King, on the recommendation of the geological committee. Each committee is to be independent of the other, and to have the utmost liberty within its own proper sphere of action. The Government, on the recommendation of the Royal Academy of Belgium, names the first five members of the geo-

logical committee, and the additions to this number are made by the Government on the recommendation of the committee itself. The geological committee may nominate for appointment by the Government as associate members, the assistants which it will require for the execution of the work, and it will regulate their remuneration subject to ministerial approbation. This committee will settle the legend of the map, as well as all details which can be regulated in advance; it will determine by whom and under what conditions the geological work is to be carried on, and it will decide upon the memoirs or other works connected with the geology of the country, which are to be published as accompaniments of the map. Each published sheet of the map will bear the name of its author. The geological committee will communicate through the director with the cartographical committee before the final printing off of the sheets of the map. The cartographical committee will comprise five members, including the director-president, all appointed by the Government. The Director will convoke the committees as often as he considers necessary and at least once in three months. It will be his duty to superintend the execution of the work determined by the committees, and to give an account of its progress at every quarterly meeting. He will also present annually to Government a report upon the whole work connected with the map and upon the employment of the funds placed at his disposal. These regulations embody the views of the majority of the Geological Society of Belgium, but from the keen and prolonged debate on the subject (well reported in the *Bulletin*), it is clear that some members of the Society shrewdly foresee the difficulties which are sure to arise if these regulations are finally adopted by the Government. The whole scheme is too cumbrous. Unless the president happens to be a man of singular powers, it will be a matter of herculean labour to get a harmonious and complete result out of the independent work of two committees, who need not be summoned above once a quarter, and who are not compelled to have any direct communication with each other until just before the final issue of each sheet of the map. The actual survey will be made, in part at least, by paid assistants. Their work will be subjected to the criticism of the geological committee, the majority of which may change from time to time, thus affording no guarantee of uniformity of system. The maps, after coming out of the ordeal of this committee, will pass under that of the cartographers, who, it seems, are to have full power to bring out the maps in any style or shape they choose, and who may possibly be quite unacquainted with geological requirements. We can anticipate the astonishment with which some fine day one of the assistants may peruse a published copy of his own "feuille." Perhaps his name engraved at the bottom of the sheet may be the only indication he will recognise of his association in a work with which his connection ceased when he handed his field-maps over to the geological committee. It is to be hoped that the Government will reduce this somewhat complicated machinery. A responsible director, with, if need be, a small council of geologists, palæontologists, and map-makers with whom he might from time to time consult, would be sufficient to organise a staff of field-surveyors and to carry out in fullest detail and in complete harmony a geological survey of the country.

Ice-Work in Labrador.—Mr. H. Y. Hind, who has already published much valuable information regarding the glacial phenomena of British North America, has recently visited part of the north-eastern coast of Labrador, and has prepared some notes of the chief geological results of the journey. His contributions to our knowledge of the glaciation of that part of the world are of special interest, and will no doubt be welcomed by those geologists who still maintain the potency of icebergs and floating-ice over glaciers and ice-cap. He describes the "pan-ice" of the Labrador coast—that is, the frozen sea-water of the bays and shallow seas along the coast, and shows that though in winter it has no lateral motion but merely rises and falls with the tides, in spring and summer it breaks up into pieces or "pans" from a few square yards to many acres in extent. These "pans" pressed by the south-east Arctic current against the coast, and accommodating themselves to all its sinuosities, are pushed over the low islands and promontories with irresistible force, grinding and polishing the hard rocks, rasping the sides of steeper cliffs, and driving before them every boulder and pebble which may be lying on the surface, as well as any blocks which they may be able to detach from the solid rocks. The same kind of action takes place in the shallow seas, the bottom of which, down to a depth of twelve or fifteen feet, is smoothed and planed by the drifting ice. While the prevalent drift is from the north-west out of Davis Strait, a change of wind sometimes brings the endless chain of loose ice back again. The rocks are again abraded and the loose blocks are driven to and fro until they acquire the true boulder-form. In the sheltered depressions of the sea-floor accumulations of *débris* must be taking place like some varieties of boulder-clay. Mr. Hind remarks that this form of ice-work goes on over hundreds of miles of coast. He assumes that it has been the means of smoothing and polishing the rocks of Labrador up to a height of many hundred feet above the sea during the gradual elevation of the land. At the same time he states that though he believes the deep fjords to have been excavated by glaciers, he has found after the most careful search only one example of glacial striæ. An obvious objection will occur to many readers; it may be that the smoothing and polishing of the hills of Labrador has not been done by pan-ice but by solid sheets of land-ice which moved over the country, no doubt grooving and striating it from end to end. All that pan-ice has effected may have been merely the rubbing down of the exposed parts of this general glaciated surface, and the consequent removal of the striæ. The sea-bottom off the Labrador coast freezes in sixty and seventy feet of water, forming what is called "anchor-ice." Seals taken in seal-nets from depths of ten or fifteen fathoms are often found frozen solid when brought to the surface, where, however, they thaw in a few hours. The Labrador climate, as is well known, owes much of its severity to the constant supply of ice drifted past it from the north. Mr. Hind examined thousands of icebergs near at hand last summer, and in only one or two instances did he detect upon them any foreign material. He concludes that true icebergs have little opportunity of transporting rock and *débris*, though he admits that where they ground they may be deepening the water by their incessant rolling and grinding, as the swell of the sea sways them to and fro. He speaks of a loose fringe of such stranded bergs on banks at a distance of ten or fifteen miles from the outermost islands, extending for hundreds of miles along the coast of north-eastern Labrador. These banks intercept the icebergs and prevent them approaching nearer to the land, so that it is only the broken fragments of the smaller "foundered" bergs which enter the fjords and channels.

Human Remains in a Raised Beach.—During the recent long excursion of the geology class of the University of Edinburgh, an interesting find was made in the raised beach to the west of Pittenweem, on the coast of Fife. The storms of last winter have cut away some new slices of the coast, and laid bare fresh sections of the low raised beach which fringes the more sheltered parts of that coast-line. Portions of the skull, arm, and shoulder-bones of a full-grown skeleton were observed protruding from an upper argillaceous layer of the undisturbed gravel of this raised beach. In examining them, one of the phalanges of a child was likewise obtained. Some additional bones were picked up on the beach, but the greater part of the skeleton had no doubt been removed by the waves. From the

position of the bones seen *in situ*, it was inferred by the students that the body had originally been cast ashore by the sea with one arm extended beyond the head, and that in this posture it had been covered up with mud and gravel. The stratum, containing the remains, lay about 4½ feet above the present high water-mark, and was covered with earthy sand.

NOTES

WE regret to see what we must characterise as an unwarranted attack made upon Sir Wyville Thomson in the current number of the *Annals and Magazine of Natural History*, as to the disposal of the specimens obtained by the *Challenger* Expedition. Dr. Martin Duncan appears to have taken for granted that an extract of a private letter which some indiscreet friend of Mr. Alexander Agassiz published in *Silliman's Journal*, and which then found its way into the English journals, is "official." He would have done well to have ascertained whether this was really the case before allowing himself to comment on Sir Wyville Thomson's proceedings in such severe terms. So far as we are aware, out of the many naturalists actually engaged to work out the results of the *Challenger* Expedition, only *three* are not Englishmen, two being Americans, and one German. These three gentlemen are of the very highest repute in their respective branches, and Sir Wyville Thomson has, in our opinion, done well for science to secure their services.

A LARGE and influential deputation of members of both Houses of Parliament, headed by the Duke of Richmond and Gordon, President of the Scottish Meteorological Society, waited on the Chancellor of the Exchequer on Tuesday to advocate that society's claims to State assistance. Sir Stafford Northcote said that the Treasury was prepared to grant 1,000*l.* for services rendered to Government during the past twenty years, and as regards the future he promised to consider the matter.

MR. J. RUSSELL REEVES, F.R.S., after whom that magificent bird Reeves' pheasant was named, died on the 1st instant at Wimbledon, aged 73. As a young man in the H.E.I.C.'s service in China, Mr. Reeves contributed not a little to our knowledge of the flora and fauna of that country, several new plants and animals having been sent home or described by him. His love for natural history continued to the time of his death, and for some time he kept up a good aviary at his house at Wimbledon.

THE Rhind lectures, delivered in Edinburgh by Dr. Arthur Mitchell, on the condition and antiquity of the cave-man of Western Europe, in other words the early, or earliest European of whom we have any knowledge, were brought to a close on Friday last. Dr. Mitchell showed that the cave-man's weapons of the chase and war were made of bone or horn, and highly finished, while his implements of stone were extremely rude, and calculated chiefly to serve as tools in the making of his bone implements, thus placing him in the bone rather than in the stone age of civilisation. From an elaborate examination of the objects which the cave-man has left, displaying an art-faculty, and from the study of the crania of the cave-people themselves, he showed that they must have possessed a high capacity for culture in all directions, and must have been as complete in their whole manhood as living Europeans. From an exhaustive examination of the cave-fauna, and of the actual fauna of Western Europe, Dr. Mitchell gave reasons, which certainly call for grave consideration on the part of archæologists, for believing that the antiquity of the cave-man of Western Europe is to be measured by a few thousands, and not by tens or hundreds of thousands of years.

THE Anthropological Institute will hold a Conference at 4, St. Martin's Place, Trafalgar Square, on May 22, on the Present State of the Question of the Antiquity of Man, when the following papers will be read:—Prof. Boyd Dawkins, F.R.S.—"On the Evidence Afforded by the Caves of Great Britain;" Prof. McKenny Hughes—"On the Evidence Afforded by the Gravels and Brick Earth;" Mr. R. H. Tiddeman.—"On the Hyæna Bed in the Victoria Cave." Communications have also been solicited from foreign anthropologists.

THE Paris Acclimatisation Society distributed its medals last Saturday at the Vaudeville. One of them was awarded to Mr. Alfred Mosenthal, Consul of the late Transvaal Republic, for his admirable work on the acclimatisation of the ostrich. Successful experiments on his system have been made on a large scale in Algiers.

MR. ETHERIDGE writes to the *Times* with reference to his examination of the red and green shales found below the depth of 1,073 feet in the boring at Meux's Brewery, and of which Prof. Judd spoke in a recent article in NATURE on Deep Well-borings in London. He states that the evidence now shows them to be of palæozoic age, and of the continental type of Devonian rocks containing the molluscan fauna of that period.

AT the April session of the German Geological Society Herr Speyer exhibited a number of fine palæontological specimens belonging to the Permian formation, obtained at a depth of 242 metres from borings in the vicinity of Memel. The twenty-five species found embraced eleven molluscs, five entomostracæ, two bryozoa, &c. Although nearly all of them are represented in the Lower Permian of Thuringia, Hesse, and Wetterau, but one-third of the number are found in the corresponding English formations. The above-mentioned borings yielded in the midst of the Permian formation occasional specimens of dolomite, with crinoidal stems and imperfect remains of brachypods, belonging properly to the Devonian.

THE monument to Liebig to which we have previously referred, was unveiled at Darmstadt, his birthplace, on the 12th inst., the seventy-fourth anniversary of his birth.

THE Annual Meeting of the Cumberland Literary and Scientific Association was held at Keswick on the first three days of the present month. This association, as we have previously intimated, is formed of a large number of local Cumberland societies, and both its first and its recent meetings have been highly successful. The idea of thus associating the various local societies of a county is admirable, and we would strongly recommend its universal adoption. The president at the last meeting was the Bishop of Carlisle, who gave a really interesting and fairly liberal address on the "Analogies and Contrasts between Human and Divine Science," the greater part of which consisted of an account of some recent advances in physical science. Several other papers were read, nearly all of them scientific, and more or less on subjects connected with the district. The new president is Mr. Isaac Fletcher, M.P., F.R.S., and the next meeting will be held at Cockermouth in May, 1878.

COMMANDER PERRIER read a paper at the last meeting of the Geographical Society of Paris, on the determination of the longitude of Algiers by telegraphy. The exact longitude is 2′ 50″·21 east from Paris, the probable error being only 0″·01. The time required for the transmission of the electricity from Paris to Marseilles was found to be only $\frac{2}{100}$ of a second; the distance between these two cities being 863 kilometres, it shows that the velocity of the electricity was not less than 46,000 kilometres per second. Similar experiments tried on the submarine cable between Algiers and Marseilles proved that the time required to travel was $\frac{25}{100}$ of a second; for a distance of 926 kilometres this shows a velocity of only 4,000 kilometres. But the battery used for signalling in the aërial line was composed of 100 elements,

and only ten elements were used in the sub-Mediterranean cable. The triangulation of Algeria is an accomplished fact, and the calculations will be finished two or three months hence. When the operations shall have been completed it will be possible to know the exact length of an arc of meridian passing through the Paris Observatory, and extending from Shetland to Laghouat. The amplitude will be exactly 30°. An arc of parallel will be measured, also extending from Nemours on the Marocco frontier to Bona, in the vicinity of Tunis. The mean latitude will be 36° and amplitude 10°.

THE following courses of instruction for science teachers will probably be organised this summer at South Kensington :—1. Chemistry (Elementary), from July 4 to July 26, by Mr. W. Valentin, F.C.S. ; 2. Sound, from June 19 to July 11 ; 3. Light, from July 12 to August 3, both by Prof. Guthrie, F.R.S. ; 4. Steam, from July 4 to July 26, by Prof. Goodeve, M.A., and Prof. Shelley ; 5. Biology, from June 13 to July 5, by Prof. Huxley, Sec. R.S. Details may be obtained by application to the Science and Art Department.

THE award of the Public Schools' Prize Medals of the Geographical Society for the present year has been as follows :—Physical Geography—Gold medal, Walter New, Dulwich College ; Bronze medal, Arthur Smyth Flower, Winchester College. Political Geography—Gold medal, William John Newton, Liverpool College ; Bronze medal, John Wilkie, Liverpool College.

ARTIFICIAL flowers called *barometers* are being now exhibited in a number of Parisian opticians' shops. They are coloured with a material composed of chloride of cobalt. When exposed to sun and dry air the leaves become deep blue ; when the air is saturated with moisture they become pinky. All the intermediate shades are easily observed.

A REPORT from Dr. v. Bary on his recent excursion into the Tuareg region of the Western Sahara was read at the last meeting of the Berlin Geographical Society. His researches yield but few grounds in support of the theory that the Sahara was formerly the bed of a sea. He is inclined more to the belief that North Africa has long been free from a covering of water, as no traces of Tertiary formations were found, and the sand-downs cannot be regarded as proofs of the former existence of a sea. The traveller found the valley of Mihero not only remarkable for the number of crocodiles existing in its pools, but also on account of the rich growth of trees in striking contrast to the surrounding deserts. A mass of luxuriant climbing plants prevents the passage of beasts of burden.

FINNISH papers report that vast masses of smoke are issuing from a mountain adjoining the river Tana, and that the snow in the vicinity has been melted away. The region has hitherto been free from evidences of volcanic activity. The theory has often been advanced that the gradual elevation of the shores of the Gulf of Bothnia is due to volcanic forces, and it is possible that these are finally seeking a vent.

THE royal tigress in the Berlin Zoological Gardens, lately brought forth a litter of two, which she utterly refused to take care of. They were accordingly placed amidst the family of a Newfoundland dog, who welcomed the new-comers warmly and bestows upon them all necessary maternal attentions.

AN extensive movement of subsidence has taken place at Marano Marchesato, in the territory of Cosenza (Calabria). Vast chasms have opened, a great number of houses have been destroyed, and many others threaten ruin. The movement extends to the north, passing the hills of S. Fili e Bucita as well as to the river that divides Marano from Rende, the waters of which are partly escaping through large fissures in its bed. At the observatory of Cosenza there have been noticed for some time a barometrical depression of 10 mm., an extraordinarily low state of temperature with variable winds, fresh snow on the mountains, and a very abundant rainfall. The magnetic instruments, too, show an extraordinary agitation.

THE town of Iquique, in Peru, was visited by a destructive earthquake on May 10. The damage done is not so great as was at first anticipated, and it is stated that no lives have been lost. Early on the following day, between 2 and 3 A.M., a shock of earthquake is reported to have occurred at Comrie and the surrounding district of Perthshire ; the shock, as usual, came apparently from south-west, proceeding to north-east, and was accompanied with a noise resembling that of distant thunder or the discharge of cannon. On May 2 several shocks of an earthquake were experienced in the neighbourhood of Löfta, in Sweden, causing some degree of damage.

IN the April session of the Berlin Anthropological Society, Baron v. Schleinitz, commander of the late German exploring expedition, gave an extended account of his anthropological studies among the inhabitants of New Guinea and the islands of the Melanesian Archipelago, which possess an interesting character on account of the isolated character of the region. The natives belong almost exclusively to the pure Papuan race. Three sharply-distinguished types were noticed. Thefirst, prevalent in the northern part of New Guinea, is characterised by a thin, ill-shaped, hairy body, smooth face, thick lips, woolly hair, prognathous features, thin calves, &c. A second, occupying the islands of New Hanover and New Ireland, is slightly modified. The colour is a light brown, scarcely darker than that of South Europeans ; the body is better proportioned and more fully rounded ; clothing is not worn by the men and rarely by the women. A comparatively strict observance of morality, the rights of property, and family relations was, however, observed. A third race, found on the western coast of New Guinea, evidently possesses a slight mixture of Malaysian blood. They are russet brown and dolichocephalous, with intelligent and handsome features, and well proportioned form. Many of the tribes inhabit villages built on piles and well secured against attack. Polygamy is prevalent in certain regions, and a legalised system of marriage appears to be general.

WE have received from Prof. Henrici the sum of 1*l.* 10*s.* towards the Gauss Monument Fund.

THE additions to the Zoological Society's Gardens during the past week include a Hoolock Gibbon (*Hylobates hoolock*) from Assam, presented by Mr. John Scrymgeour ; two Mauge's Dasyures (*Dasyurus maugæi*) from Australia, presented by Capt. J. C. Harris ; an Antarctic Skua (*Stercorarius antarcticus*) from the Antarctic Seas, a Ceylon Hawk Eagle (*Spizaëtus ceylonensis*) from Ceylon, presented by Capt. W. Vincent Legge ; two White eared Conures (*Conurus leucotis*) from South America, presented by the Lady Greville ; three Touracous (*Corythaix persa*) from West Africa, presented by Mr. J. G. Tayler and Capt. R. H. Crewe ; a Saddle-billed Stork (*Xenorhynchus senegalensis*), a Black Sternothere (*Sternothærus niger*) from West Africa, five Kappler's Armadillos (*Tatusia kappleri*) from South America, purchased ; a Wild Boar (*Sus scrofa*), born in the Gardens.

UNIVERSITY INTELLIGENCE

OXFORD.—The Master and Fellows of Balliol College give notice that they are willing to receive as members of the College without further examination, selected candidates for the Indian Civil Service, not exceeding in number ten, and to assist in their education. Any candidate who wishes to avail himself of this proposal is requested to communicate with the Master of Balliol.

CAMBRIDGE.—The Adams Prize awarded biennially for the best essay on some subjects of Pure Mathematics, Astronomy,

or other branch of Natural Philosophy, the competition being open to all persons who have at any time been admitted to a degree in the University of Cambridge, has been adjudged to Edward John Routh, M.A., F.R.S., St. Peter's College. The subject of the essay is "The Criterion of Dynamical Stability." The value of the prize is about 250*l*.

A Warden of Cavendish College in the place of the Rev. T. J. Lawrence, resigned, will be elected on Tuesday, June 5. The College is intended for students somewhat younger than ordinary undergraduates, and the teaching and discipline correspond with those of the higher forms in a public school. The salary is 500*l*., or a capitation fee of 5*l*. when the number of students exceeds 100. Candidates are requested to communicate with the Rev. Prebendary Brereton, Little Massingham, Rougham, Norfolk.

GLASGOW.—The Town Council has given a subscription of 5,000*l*. to the funds of the University of that city.

BRISTOL.—It will be seen from our advertising columns that a Principal is wanted for University College. For so young an institution the salary offered is very fair, and we hope that a thoroughly good man will be obtained for the post, one who, if not a man of science himself, at least regards it as of equal importance with literature.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 12.—"On certain Molecular Changes which occur in Iron and Steel during the separate acts of Heating and Cooling," by Prof. Norris, M.D., Queen's College, Birmingham.

An exhaustive study of the various conditions has led to the elucidation of the nature of hardening, softening, tempering, annealing, &c., and has further shown that numerical values may be assigned to these states.

The research has further established the existence in steel and in iron containing *free* carbon of a contraction or shortening which is excited by heat, and which proceeds simultaneously with the dynamical expansion, and masks its true amount. This is divisible into *high* and *low* temperature contraction.

The presence of a cooling expansion or crystallisation, which comes in during the dynamical contraction, and masks its true amount.

These effects, due to crystallisation and decrystallisation, are the causes of the so-called kicks, or temporary contractions and expansions which occur during the heating and cooling of the steel.

That the low-temperature contraction and cooling expansion are due to decrystallisation and crystallisation which occur during the acts of heating and cooling, while the kicks themselves are simply the thermal effects associated with these changes, and are proportionate to their extent.

That protracted annealing, that is, *extremely slow cooling*, brings about molecular separation of the carbon and iron; and steel in such a state contracts greatly when high temperatures are reached, producing the *contraction returns* seen at the end of the heating, and which are due to the condensation produced by the recombination of the carbon and iron. Steels in this state are less susceptible to cooling expansion (crystallisation), and therefore to low temperature contraction on subsequent heating.

April 26.—"Researches on Emeralds and Beryls.—Part II. On some of the Processes Employed in the Analysis of Emeralds and Beryls," by Greville Williams, F.R.S.

"On the Nature and Origin of the Beds of Chert in the Upper Carboniferous Limestones of Ireland," by Prof. Edward Hull, M.A., F.R.S., Director of the Geological Survey of Ireland. With "Chemical Notes," by E. T. Hardman, F.C.S., of the Geological Survey of Ireland.

From a review of the whole circumstances, it appeared that the origin of the chert-beds was to be attributed to the replacement of the original limestone or calcareous "ooze," due to organic agency by silica, and that the rock is truly a pseudomorph, a view held by several observers.

The manner in which this replacement had been brought about was then touched upon. It was shown that there was reason for believing that at the close of the period during which the carboniferous limestone was formed over the area of Central Ireland, the sea-bed was elevated so as to be covered by the waters of a shallow sea exposed to the sun's rays, and of a warmer temperature than when at a greater depth. The waters appear to have been charged with a more than usual supply of silica in solution, derived (as Mr. Hardman suggests) from the surrounding lands, formed, for the most part, of highly siliceous materials. As silica is less soluble than carbonate of lime, chemical replacement would naturally take place, the carbonate of lime being dissolved out and its place taken by the silica. The warm condition of the sea-water, its exposure to sunlight, the porous character of the coralline, crinoidal and other forms, and the soft and "oozy" condition of the foraminiferal mud would give easy access to the sea-waters, and the process of silicification would take place analogous to that described by Dr. Martin Duncan, F.R.S., as having occurred in the West Indies.

Linnean Society, April 19.—G. Bentham, F.R.S., vice-president, in the chair.—M. Cassimir De Candolle read an important paper on the geographical distribution of the Meliaceæ. His general conclusions with regard to the Melia family may thus be summarised: (*a*) The number and the mutual affinities of the various genera of Meliaceæ decrease from the Asiatic region towards Africa and America on one side and towards East Polynesia on the other; (*b*) Between the Meliaceæ of America and Africa there exists analogy, whilst Polynesian species belong to Indian type; (*c*) New Caledonia contains within itself a remarkable number of distinct species, the type of which, however, is Indian; (*d*) in Australia three Indian genera are found, along with three genera exclusively belonging to Australia; (*e*) No species of Meliaceæ have hitherto been collected in the most eastern islands of Polynesia; if subsequent observations reveal such it will be interesting to know whether they pertain to Indian or American type.—Another contribution on the geographical distribution of the Indian fresh-water fishes (Part II. The Siluridæ), read by Dr. Francis Day, curiously enough in some ways points to a similar conclusion to that derived from the plants above-mentioned. Dr. Day showed that of the twenty-six genera of Siluroidæ represented in the Indian Empire, ten are found in the Malay Archipelago, two more reach Cochin China or China, whilst *Clarias* only is common to India and Africa, and moreover it likewise is found in the Malay Archipelago. He infers that the said freshwater fish of India are more closely related to a Malayan than to an African fish fauna.—Mr. R. Irwin Lynch, of Kew Gardens, brought before the notice of the Society some observations on the disarticulation of the branches of *Castilloa elastica*, the caoutchouc tree of Central America. He has noticed that the lateral branches are detached from the ascending stem of the plant in a regular manner from below upwards in the same way as leaves, and this happens always at the point of insertion. In certain Euphorbiaceous genera which have leaf-like branches, these fall as does a leaf, and they bear in their axils a bud from which alone the permanent branches are produced. They are themselves subtended by a leaf reduced to a scale.—Capt. Chimmo followed by two communications, one concerning the mode of obtaining and the structure of the so-called *Euplectella* of the Philippines, the other a description of a supposed new Rhizopod.

Anthropological Institute, May 8.—John Evans, F.R.S., president, in the chair.—Special thanks were voted for the present to the Library of a complete set of the volumes relating to the voyage of the *Novara*, published and presented by the Austrian Government.—On an exhibition, by Mr. R. Biddulph Martin, of objects from a large refuse heap in the neighbourhood of Smyrna, Mr. Hyde Clarke, Col. Lane Fox, and the president offered remarks.—Mr. A. L. Lewis communicated a description of the remains of a stone circle at Colderham, Kent, illustrating his remarks by a well-prepared plan.—Dr. John Rae read a paper on the skulls of the Esquimaux, attributing the fact that two distinct types of skull exist among these peoples to an admixture of blood. An interesting discussion followed, in which Dr. Beddoe, Col. Lane Fox, and others took part.—Dr. Beddoe, F.R.S., communicated a paper on the Aborigines of Queensland, whom he described, on the authority of Mr. Christison, who had had many years' knowledge of them, and employed them very largely in sheep-farming, to be, in many respects, not so black as they have been painted.

Royal Microscopical Society, May 2.—H. C. Sorby, F.R.S., president, in the chair. A number of donations to the society were announced, including a sum of 500*l*. presented by Mr. C. Lambert, from a bequest of 25,000*l*. left by that gentleman's late father, to be appropriated to benevolent and scientific purposes.

—The first of a series of lectures founded in honour of the late Prof. J. Quekett was delivered by Sir John Lubbock, Bart., M.P., "On Some Points in the Anatomy of Ants." Commencing by reference to the occasion, and appropriately giving a short history of the life and labours of Prof. J. Quekett, the lecturer proceeded to describe in a minute and interesting manner the general structure and microscopic anatomy of these insects, pointing out the differences found to exist between individuals of different species, and also between the various classes of the same species. Attention was specially drawn to the structure of the antennæ, and to certain organs presumed to be those of hearing, also to the structure of the mouth, with its extensive muscles and mouth-sac. At the conclusion of the lecture, the "Quekett Medal" of the society, struck for the occasion, was presented to Sir John Lubbock by the president, amidst great applause from the fellows.

Victoria (Philosophical) Institute, May 7.—Dr. C. Brooke, F.R.S., in the chair.—A paper on the indestructibility of matter by Prof. Challis, F.R.S., was read.

ROME

R. Accademia dei Lincei, March 4.—The Roman Tuscia and the Tolfa, by M. Ponzi.—On graphical statics, by M. Battaligni.—On some cavern-myriapods of France and of Spain, by M. Fonzago.—Studies on some anouran amphibians of Piedmont, by M. Lessona.—On a new function of the liver and the effect of ligature of the vena porta, by M. Tommaso-Crudeli.—On the Meibomian glands, by the same.—On the chemical constitution of the cyanamides, by MM. Fileti and Schiff.—On the tenacity of copper, steel, brass, and aluminium, at various temperatures, by M. Pisati and others.—On the dilatation, capillarity, and viscosity of fused sulphur, by M. Pisati.—On organisation of the meteorological services of forecast for agriculture; on publication of meteorological observations; and on history of the atmosphere, April to September, 1876, by M. Tarry.—On the small proof plane, by M. Volpicelli.—Ephemerides and graphic representation of the height of the water surface of the Tiber, measured daily in 1876, by M. Belocchi.—On titanite and apatite of the plain of Spedallacio, near Sarsalba, and on mancinite, by M. Uzielli.—Indian corn and pellagra, by M. Selmi.

PARIS

Academy of Sciences, May 7.—M. Peligot in the chair.—The following papers were read:—Two general laws of geometric curves, by M. Chasles.—Studies of Mr. Sylvester on the algebraic theory of forms, by M. Hermite.—Note *à propos* of M. Favé's communications on the theory of heat, by M. Resal. He opposes M. Favé's views.—On determination of the difference of longitude between Paris and Berlin, by M. Mouchez. The first series of astronomical observations are on the eve of completion.—Researches on the law of Avogadro and Ampère, by M. Wurtz. Oxalate of potassium loses its water when heated in dry air under a certain pressure, but does not lose it, if heated under the same pressure, in chloral vapour or in a mixture of air and water vapour. We may infer that hydrated chloral vapour does not act like dry air, but like a mixture of anhydrous chloral and water vapour.—Chemical researches on the green matter of leaves, by M. Fremy (third paper). He thinks it proved that the colouring matter of leaves is a mixture of phylloxanthine and phyllocyanate of potash. During life chlorophyll acts by decomposing CO_2. When the leaves die and fall the colouring matter is destroyed and gives up to the ground the salt of potash it contained.—Change of colour of chlorophyll; its passage to blue and to red or orange, by M. Trecul.—On meteorological predictions sent from the United States, by M. Faye. Some think the success of these owing to the *rôle* of the Gulf Stream, which they suppose to be the grand route taken by storms in traversing the ocean. M. Faye shows this to be a mistake; the path of storms depending on currents in the higher regions of the atmosphere.—On the identity of anthrax in all the species of domestic animals, by M. Bouley. Contagion is its most essential character.—M. Bernard made some remarks in presenting his *Leçons sur le diabete et la glycogénése animale*.—Reports on the geodetic and topographic works executed in Algeria, by M. Roudaire. This relates to his measurement of the meridian of Biskra, and survey of the region of the Chotts.—Practical reduced form of the development of Taylor, by M. Rouyaux.—Integration of linear differential equations of any co-efficients, with or without second member, by M. André.—Solar spots observed at Madrid in April, 1877, by M. Ventosa. Another confirmation of what M. Janssen observed.—On M. Janssen's communication on the sudden formation of a very important sun-spot, by M. Gazan. He thinks the spot was not formed suddenly; all spots are preceded by violent agitation of the luminous matter. He passes some other strictures.—Researches on accidental double refraction, by M. Maré. The double refraction produced by hardening is identical with that produced by a regular heating of the contour of the plate.—On the interior resistance of thermo-electric elements, by M. Rolland. The experiments were made with Clamond's pile. The curve of resistances oscillates continually; its course, at first rather irregular, becomes nearly normal only after about twenty minutes; it is then fixed at a height which it retains during about ten minutes. When the pile cools the curve again oscillates irregularly.—On acid acetates, by M. Lescœur.—On some derivatives of acetylacetic ether, by M. Demarçay.—On nitrosalicylic acid, by M. Phipson.—Action of toxical and antiseptic vapours on the fermentation of fruits, by MM. Lechartier and Bellamy. The action of vapour of phenic acid, cyanide of potassium, and camphor destroys or diminishes considerably the vitality of fruit cells.—On the same subject, by M. Gayon. He tried chloroform, ether, and sulphide of carbon with similar results. Sulphide of carbon and camphor (in the two series of experiments) acted less powerfully than the other substances; they allowed a little fermentation.—On two new niobates, by Mr. Lawrence Smith. These, found in North Carolina, he names *Hatchettolite* and *Rogersite*.—Researches on the mode of formation of Cyclopia, by M. Dureste.—Note on the peristaltic movement of the intestine, by M. Guerin. The matters in the intestine are not moved along by an action *a tergo*, resulting from simple circular contraction of the muscular membrane, but by a double propulsive and suctional action, realised through contraction of the circular and longitudinal planes of the intestine.—On a whale, properly so called, caught in the Bay of Tarentum, by M. Capellini.—On the mines of New South Wales, by M. Simon.

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