THURSDAY, FEBRUARY 11, 1875

HANCOCK'S "BIRDS OF NORTHUMBERLAND AND DURHAM"

A Catalogue of the Birds of Northumberland and Durham. By John Hancock. (London: Williams and Norgate. Newcastle-on-Tyne: F. and W. Dodsworth, 1874.)

A STATE of expectancy in which British ornithologists have for some years been living has at length been ended by the appearance of Mr. John Hancock's "Catalogue of the Birds of Northumberland and Durham," which we lose no time in recommending to the notice of such of our readers as are interested in this branch of natural history. It will of course most recommend itself to dwellers in those two counties, but it contains besides much that concerns the lovers of birds everywhere in the British Islands, and its author has our warmest congratulations on the completion of his work in a form so inviting; while the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne, and the venerable Tyneside Naturalists' Field Club—at the joint expense of which it is produced—deserve our heartiest thanks for its publication.

Mr. John Hancock has long been known to some who, though comparatively few in number, are perhaps best able to form an opinion, as one of the closest and most careful observers of birds and bird-life in this country. The circle of his admirers would have been indefinitely wider but for the reticence which his natural modesty has for years made him keep. While others without a tithe of his knowledge have ostentatiously come forward as teachers so as to acquire a character as "celebrated ornithologists" out of all proportion to their ability, he has been content to look on, seldom obtruding on the public any of the results of his experience, and then perhaps only at the earnest solicitation of some particular friend. Yet this ornithological oracle of the North of England has never been hard to consult, and the number of those who, through information privately derived from him, have in a manner reaped the fruit of his continual observation—not always, we fear, with due acknowledgment on their part—is not inconsiderable. It is, therefore, with great pleasure that we find he has at last summoned courage to speak for himself. As a consequence of his diffidence, a good deal of what he has to tell us has oozed out through other channels, but there is more than sufficient novelty in the 200 and odd pages of this "Catalogue" amply to repay their study, and even when facts ascertained by him have been announced before, it is most satisfactory to have the record of them here stamped by his personal authority. It will be news, we take it, to most people to learn that Mr. Hancock was the first who recognised Bewick's Swan as a distinct species;* and we cannot but wonder that forty-five years and more have been allowed to elapse before this fact was made publicly known. Yet Mr. Hancock shows not the least trace of annoyance at the way in which his claims have been overlooked—his conduct in this respect being in exemplary contrast to the selfish and utterly unphilosophical squabbling as to "priority" which so often disgraces the votaries of all sciences. To him it is enough that a discovery was made; if important, so much the better; but, so long as knowledge has been extended, it matters nothing by whose means the end was attained. If we have not here a practical illustration of true scientific spirit, it will be difficult to meet with it anywhere.

We are therefore somewhat at a loss how to treat the work of a man so indifferent to what is called by the vulgar "fame." To pick out and here recount the various discoveries which, whether before announced or not, are due to Mr. Hancock, would be to set at nought the example given by his preaching and practice. The discrimination of the Iceland and Greenland Falcons, a question that has agitated ornithologists both here and on the Continent in no common degree, was first settled by Mr. Hancock in 1854. Yet to him the chief value of the discovery seems to be that it enables him to lay down the general law:—

"Not only do all the noble or true falcons acquire their adult plumage in the first moult, but many of the ignoble species do so likewise, as the Honey Buzzard, the Goshawk, the Sparrow-hawk, and the Harriers. This fact cannot be too strongly pressed on the attention of ornithologists, for it leads to a correct understanding of the variations of the plumage of the *Falconidæ*." (P. 10.)

This is no mere *dictum*, but the result of long-continued observation; and well indeed would it be were writers, who have very recently attempted to deal with this subject, to learn as Mr. Hancock has done, in Dame Nature's simple school, instead of perpetuating error and confusion by grandly setting forth their unsound and arbitrary views on the "first year's," "second year's," and "third year's" plumage of birds of prey.

The work before us is most strictly what its title professes, a "Catalogue," and does not pretend to give a complete history of the birds found in the two counties; in other words, to be a "Fauna" of the class. But it is a catalogue conceived in no narrow spirit, for the author, as the extract just given shows, is on occasion not averse to add remarks having a very general bearing. To few of these will our space allow us to call attention, but we must especially notice the valuable "Introduction," wherein, after briefly touching upon former lists of the birds of the district, and comparing, not without some justifiable pride, its ornithological wealth (265 species) with that of Norfolk (280 or 290 species)—the richest county in this respect of the whole United Kingdom—Mr. Hancock gives an admirable account of the physical features of Northumberland and Durham. Concise as it is, we cannot here reproduce it: we must leave it to our readers, and only extract a few passages:—

"Our extensive seaboard lies in the direct line of the annual migrations to and from the northern latitudes, and is well fitted to the requirements of many species of seafowl. The coast in many parts is bold and rocky, but is agreeably varied with beautiful sandy beaches of vast extent, backed with wild hummocky 'links,' and not unfrequently with belts of bog and pools of sedgy water. There is also no want of muddy flats or estuaries, though these features are fast disappearing under the necessities of commerce.

"The northern and western portions of the counties are

* This he did in *January* 1829. Pallas had described it as a variety in 1811, and it was not till *November* 1829 that Yarrell announced himself satisfied that it was anything else.

wild and hilly. The Cheviot range attains an elevation of 2,658 feet, and this, along with that of Simonside, gives quite a sub-alpine character to this portion of the country. In these uplands, the Eagle and Peregrine Falcon formerly had their abode. . . . The western part of Durham is also wild, moory, and mountainous, but of less elevation. These wild regions are characterised by vast tracts of grass land, in some places fine, in others coarse, boggy, and hummocky; and by extensive moors of heath, gorse, and bracken, with swamps, mosses, tarns, and lochs. . . . Numerous lively streams in pebbly beds, and whimpering rills, diversified with little lippering cascades, abound; some almost concealed under the scrubby foliage of their banks, others fully revealed and sparkling over their stony channels. . . .

"The cultivated regions are in some places well wooded, and the fields are mostly divided by thorn hedgerows, giving at once beauty to the landscape and shelter to the more delicate tribes of the *Passeres*. But such, particularly the warblers, find their haunts in our numerous wooded dells, or 'denes,' which abound in both counties, and by the shrubby banks of our burns or streamlets. Here the hawthorn, the blackthorn, the wild rose, and bramble, and undergrowths of all kinds, afford to these delicate songsters the shelter and seclusion they require. These 'denes,' of which Castle Eden Dene is a fine example, are frequently well timbered, deep, and have a stream running through them. The principal rivers, the Tyne, the Coquet, and the Wear, not to mention the bordering streams, the Tweed and the Tees, run through deep wide valleys, with, in many parts, well-wooded banks, affording likewise favourite homes for many feathered tribes. Besides such localities, there is no want of extensive woods dispersed throughout the counties, and well-wooded park grounds." (*Introduction*, pp. vii. viii.)

Some two or three localities, on account of their ornithological features, obtain special mention by Mr. Hancock. First of these is the well-known cluster of the Farne Islands, where in a limited area no less than fifteen species of sea-fowls breed. We would willingly recall the recollections of our first visit, nearly a quarter of a century since, to that sea-girt paradise, by transcribing Mr. Hancock's description of its charms, but the exigencies of space are not to be overruled, and we can only pay a tribute to the memory of the late Archdeacon Thorpe, who for so many years, ere Bird-Preservation Acts of Parliament were dreamt of, from proud Bamborough's tower threw the ægis of protection over his feathered tenants on the distant Farnes. No such thoughtful guardian had Jarrow Slake or Dobham Shelf. The encroachments of the engineer have almost destroyed the former as a *statio gratissima mergis*, and probably not a single Teesmouth gunner has even a memory of the latter, though two hundred years since it entertained "an infynite number of sea-fowle which laye theyr Egges heere and there scatteringlie in such sorte, that in Tyme of breedinge one can hardly sett his Foote so warylye that he spoyle not many of theyr nests." Past also are the glories of another spot, though they continued much later. Hear Mr. Hancock:—

"But no locality in the North of England had such interest for the naturalist as Prestwick Car. The botanist, the entomologist, the conchologist, and the ornithologist, were all equally interested in this one of nature's most famous nurseries. Here the naturalists of the district had resorted for several generations to collect the objects of their respective studies. . . . It is an area depressed, as if by subsidence, of about 1,100 acres, and is of a rounded or subquadrangular form, about two miles in diameter; and the surrounding land is little elevated. The greater or central portion is (or rather was, for it is now all changed) composed of peat, more or less covered with a growth of ling and heather, and of boggy, hummocky, coarse grass land; this central portion was surrounded by a belt of good pasture land varied with gorse or 'whin.' Towards the north and west boundaries there was a chain of pools, the largest and most important of which was called the Black Pool; towards the south extended another chain of pools, among which was the Moor-spot Pool. The Black Pool could not be less than a mile in length, and was of considerable width. There were three islands in it, two towards the east, and one towards the west end. The drainage was through this sheet of water, from which there was a cut, or open ditch, to the River Pont; but the fall was so slight that the drainage was very incomplete, and the water flowed backwards and forwards in accordance with the state of the river. These pools were on a peaty bottom, in which the remains of numerous trees, chiefly Scotch fir and birch, stood erect, and firmly rooted. They were not visible above the surface of the water, though in droughty seasons numbers of them were frequently exposed near the margins of the pools. The trees were of no great size, and in most instances the wood was in such a good state of preservation, and contained so much resin, that it was used by the neighbouring villagers for firewood." (Pp. xii. xiii.)

This priceless nursery of plants and animals and delicious recreation-ground of naturalists was drained in 1857, and with its disappearance vanished many of its frequenters. "The birds that congregated there have been dispersed, and several that had on account of their breeding in that place ranked as residents, have now become mere visitants." Its destruction, therefore, has not failed materially to affect the ornithology of the district. Hence Mr. Hancock is led to remark on the wholesale extermination of some species, and in one point at least, that of the birds of prey, what he says merits every attention:—

"This policy of the game-preserver is of questionable utility in promoting the increase of game; nor does it appear that much has been achieved in this respect, for, after some inquiry, I cannot ascertain that either partridges or grouse are more numerous than they were some years ago when birds of prey were yet to be seen on the wing." They are not, he continues, "an unmitigated evil; they are a necessary part of the great scheme of nature, and may be essential to the perfectly healthy development of the birds they feed upon. It is undoubtedly advantageous that the feebly organised and sickly individuals should be weeded out, and this is done by birds of prey. We have of late years heard much about stamping out epidemics among mankind. It is a function of the Peregrine and its congeners to assist in stamping out epidemics among game-birds." (Pp. xviii. xix.)

Mr. Hancock has some hard and well-deserved strictures on the Wild Birds Preservation Act of 1872, which he rightly says shows the ignorance of those who drew up its schedule; but he does not seem fully to comprehend some of the practical difficulties attending any such measure. He complains that some species "stand in it under two, three, or even four different names," overlooking the fact that in different parts of the country certain species are known only by one particular and often very local name, so that if that name was omitted it would in such cases be impossible to obtain a conviction under the provisions of the Act. He also laments that some species, "the greatest favourites of the public," are excluded from its protection; but we may ask, is there any good ground for supposing that they require it?

There are a few other points in which we should be disposed, had we room, to discuss some of Mr. Hancock's opinions—but at all times with the greatest respect, for such is justly due to his authority. His assertion, for instance, as to the amount of variability in Cuckoos' eggs (p. 25) will hardly change the mind of those who have seen long series of specimens from Germany or other countries, or recollect the evidence of foreign ornithologists adduced some years ago in these pages (NATURE, vol. i. p. 266). Nor is it by any means certain that *all* birds "do not discriminate nicely the colours or other characters of their eggs." None of the examples he quotes to that effect are of kinds which act as foster-parents to the Cuckoo, and their case therefore can hardly be said to apply to "the theory of Dr. Baldamus." Again, too, we must remark that Mr. Hancock must have been exceptionally unfortunate in performing the experiments of Herr Meves to explain the "bleating" or humming of the Snipe. The late Mr. Wolley put on record his acquiescence in their satisfactory nature (Proc. Zool. Soc. 1858, p. 201), and a more competent witness could not be easily found, especially when we consider that his evidence was given after he was acquainted with the extraordinary and entirely different noise made by the smaller species of Snipe which has not stiff *rectrices*. We must therefore demur to Mr. Hancock's statement that "the neighing or bleating of the Snipe results from the action of the wings, and that any sound produced by the tail-feathers is inaudible."

It remains for us to notice the plates, fourteen in number, by which this work is embellished. All of them are characteristic, and most of them excellent; a fact especially to be noticed, since they are chiefly designed from birds stuffed and mounted by Mr. Hancock. Yet most of us who are old enough to remember his beautiful contributions to the Great Exhibition of 1851, to say nothing of specimens of his skill which we may have since seen elsewhere, have therein no cause for surprise. In the art of taxidermy—for art it is with him in a high sense—Mr. Hancock has no equal now, and possibly never had but one, the late Mr Waterton; and the difference between specimens mounted as these are and the handiwork of ordinary bird-stuffers is apparent to anyone who has an eye for a bird. Whether Mr. Hancock's genius in this respect is innate, or whether it has been developed in him from a study of his fellow-townsman Bewick's labours, matters not much; both artists may be rated equally high as delineators of birds, while the younger one, as the pages of this publication prove, stands as a naturalist immeasurably above the elder.

OUR BOOK SHELF

Notes of Demonstrations on Physiological Chemistry. By S. W. Moore, F.C.S., &c. (London: Smith, Elder, and Co., 1874.)

THE Preface to the "Notes of Demonstrations on Physiological Chemistry" states "the want felt by the average medical student, viz., hints as to which are the most important points in practical work which he can be expected to acquire," and "the impossibility for a class of men with only three hours a week at its disposal for practical work to go through lengthy and uninteresting processes," induced the author to compile the "Notes," "so arranging them as to show the student methods that more nearly concern his immediate and future requirements." In other words, the book is not intended to treat thoroughly of any part of physiological chemistry, but only to remind the student of the principal points on which he is likely to be questioned, and to refer him for further information to the College Demonstration. To place a book of this kind in the hands of the medical student cannot be productive of good, as it enables him to acquire a pretence of knowledge that is, in his case especially, worse than the want of it. No one will deny it to be the duty of the teacher to confine the attention of students to those matters he regards as essential, and to pass over lightly those of less importance. But what will be the result if every teacher writes a book pointing out his mode of treating the subject? The effect will be to educate one-sided men, and to stifle all craving for further information. The only way to avoid this catastrophe is to recommend the use of a really good book, so that the student may acquaint himself with any part of the subject, or confine his attention solely to those points treated by the lecturer. The present work may be very useful to the author's pupils, but we cannot commend it as a satisfactory introduction to the subject of physiological chemistry.

The Microscope and its Revelations. By W. B. Carpenter, M.D., F.R.S. Fifth Edition. (London: J. and A. Churchill, 1874)

THE recent excellent investigations of Mr. Wenham, Col. Woodward, and others, on the optical principles of microscope construction and manipulation, together with the results obtained by the employment of immersion objectives, have added so much to our knowledge of the principles of minute investigation and the interpretation of the results obtained, that any standard work on "The Microscope" must necessarily require fresh editing. In the fifth edition, just published, of his well-known work on the subject, Dr. Carpenter shows how well he has kept pace with modern investigations. In it we find the most recent views on the nature of the markings on Diatoms fully entered into, the opinions of Col. Woodward, Mr. Stoddard, and Mr. Rylands, being clearly stated and criticised. The much discussed new principles and methods proposed by Dr. Royston-Piggott are in no wise omitted, the general tenour of the comments on their value being rather in their favour than otherwise. This last-mentioned subject the author has placed in the hands of Mr. H. J. Slack, the secretary to the Microscopical Society. In looking at the book as a whole, the question which we cannot help asking is, what is the limit to the points which should be touched upon in it? Why should certain tissues be described, and not others? Why should the organisation of some minute animals be entered into, while others are not referred to? We cannot answer this question ourselves, and think it will become more difficult to do so as every fresh fact in histology and minute zoology is added to the considerable mass already at our disposal.

Ueber Algebraische Raumcurven. Von Eduard Weyr.—*Ueber die Steiner'schen Polygone auf einer curve dritter Ordnung C^3 und damit zusammenhängende Sätze aus der Geometrie der Lage.* Von Prof. Karl Küpper.—*Die Lemniscate in Razionaler Behandlung.* Von Dr. Emil Weyr. (Prag, 1873.)

THE first memoir (27 pp.) treats of curves in space, and then discusses special space-curves, viz., those of the fifth order, concluding with the consideration of curves of the sixth order and second and third class. Reference is made to Prof. Cayley's papers on the subject in the *Comptes Rendus*, tome liv. (1862).

The earlier part of the second memoir (28 pp.) treats of points, lines, and polygons, and swarms with results, upon the novelty or antiquity of which we cannot pronounce a judgment. We have then some proofs given of properties of the Tricusp, which is the envelope of the feet perpendicular lines of an inscribed triangle. Steiner's enunciations ("Crelle," vol. 53) have been demonstrated by Prof. Townsend ("Reprint from *Educational Times*," vol. iv. pp. 13-17), Prof. Cremona ("Crelle," vol. 64), and by other mathematicians.* An appendix of eleven pages, entitled "Ueber Raumcurven vierter Ordnung erster Art, und eine spezielle ebene curve vierter Ordnung C^4_1" closes the memoir.

The last memoir on our list (39 pp.) is a very interesting one, in which a great number of properties of the curve are established by means of its ordinary rectangular equation $(x^2+y^2)^2 - 2a^2(x^2 - y^2) = 0$. We should like to see this memoir in an English dress. On the authority of a German friend, we may say that it is written in elegant German. All three memoirs are extracted from the "Abhandlungen der k. böhm. Gesellsch. der Wissenschaften" (vi. folge, 6 Band). Whether the practice obtains on the Continent to any extent of thus reprinting separate memoirs we cannot say, but we learn from a distinguished physicist that such is the case with the Vienna "Transactions," of which any paper may be had separately through a bookseller at a price published in the table of contents. This is a laudable practice, and in these columns the desirableness of its introduction into this country has been more than once dwelt upon. Happily, we learn from the President's address (NATURE, vol. xi. p. 197) that the Royal Society have the matter under consideration. As the reasons *pro* and *con* have so recently been given, it would be out of place here to dwell longer on the matter. We hope, however, that it will be possible on some terms or other to get separate memoirs in the case of those societies whose publications embrace two or more specialities. A practice obtains in some societies of allowing readers of papers to have extra copies of their own papers, at reasonable prices, for distribution. Possibly, the best mode of proceeding at present for a specialist who wants a particular paper is for him to apply to the author on the chance of his having these extra copies.

Botanischer Jahresbericht: Systematisch geordenetes Repertorium der Botanischen Literatur aller Länder. Herausgegeben von Dr. Leopold Just. (Berlin: Gebrüder Bertraeger, 1873.)

WITH the rapid increase of botanical literature of every kind during the last few years every working botanist must have proved the inconvenience of having no work of reference at hand like this "Botanischer Jahresbuch," and particularly those who are engaged in any special inquiry involving much research and an extensive knowledge of the literature of his subject. As the preface to this excellent *résumé* of the botanical literature of 1873 truly says, "Almost every botanist has passed through the experience of having read through bulky treatises with the expenditure of much time, only to complain that it is so much time lost. On the other hand, it happens frequently enough that very important treatises appear in periodicals where they are not exactly looked for by botanists, and consequently frequently remain unknown and unused for years." This need no longer be the case, if the success which this undertaking thoroughly deserves is granted it, and warrants the continuance of it from year to year.

The work has been published in two half-volumes, and the first part or half-volume summarises the investigations which have been made, and the literature published on the various groups of the Cryptogamia, together with divisions on the morphology of cells, the morphology of tissues, the special morphology of conifers, the morphology of the Phanerogamia (monocotyledons and dicotyledons), and Physical and Chemical Physiology, continued in the second half-volume, which further contains divisions on fructification and reproduction, hybridation, origin of species. Lists and notices of systematic monographs and extra-European floras stand next in order, together with Palæobotany, treated according to the succession of formations, beginning with the Primary or Palæozoic formation. The other portions embrace pharmaceutical botany, technical botany, botany applied to forest management, diseases of plants, and geographical distribution.

The aim of the editors has been to give as complete a view as possible of the literature of the several subjects above mentioned, and with regard to most of the departments this has been successfully accomplished, but omissions occur in some of the divisions, particularly in those on the cellular cryptogams and the morphology of tissues. No notice, *e.g.*, is taken of the important work of Strasburger on *Azolla* and the Lycopodiaceæ, nor the work of Juranyi on the spores of *Salvinia natans*. Some of the omissions Dr. Just promises to rectify in the next year's volume.

In this deficient section, however, it may be observed that all newly constituted species amongst the Diatomaceæ and fungi are carefully noted, and of the latter brief descriptions are given. As an appendix to the fungi appears a section on the nutrition of the lower organisms.

The above-mentioned divisions of the work embrace all that has been published in the time specified (1873) in the German, French, and English languages. The literature of other countries is treated in special sections, each under the care of an editor chosen for the purpose; viz., Dutch, Italian, Russian, and Hungarian botanical literature. Dr. Just laments that it has not been possible to include the literature of Denmark, Norway, and Sweden in this first volume. This, however, will not be omitted in future volumes, a suitable editor having been chosen for the purpose.

* There is an article "Sur l'Hypocycloïde à trois Rebroussements" in the "Nouvelles Annales" (pp. 21-31), Janvier, 1875.

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.*]

Sub-Wealden Exploration

IN NATURE, vol. xi. p. 267, the Rev. J. F. Blake calls attention to the announcement that it is proposed by the Sub-Wealden Exploration Committee to abandon the present bore-hole and to begin again near the same spot. He asks why should not another spot be chosen; and suggests that it would be advisable to bore much more to the north-east, because there the Palæozoic rocks would be nearer the surface, and because at the present hole we have already learnt all that is necessary. May I be permitted to reply to these remarks?

In the first place, it should not be forgotten that to search for coal measures, or even for the Palæozoic rocks, is only one object of the exploration. In a purely scientific point of view, it is as important to determine the thickness and character of the Oolitic strata—so far removed from their surface outcrop—as it is to reach the older rocks. If it be true that the boring has been put down where the Oolitic series is well developed, then this object will be the better attained.

But there is even now no proof that the Palæozoic rocks must necessarily be very deep at Netherfield. We are not entitled to infer from the great development of any one member of the Oolitic series that the lower members will also be well developed at that spot. The Oolitic rocks in the Boulonnais come on in force as we recede from the Palæozoic area of Marquise. The Kimmeridge clay is well developed in the Pays de Bray; it is 1,000 feet thick near Rouen, and, on its outcrop to the south-west of that city, is underlain by Lower Oolites. One might therefore well have supposed that in the Pays de Bray there would be a considerable thickness of Oolitic strata over the Palæozoics; but a boring there proved the carboniferous limestone at 59 feet from the surface.

It is generally conceded that if the sole object of the exploration were to search for coal measures under the south-east of England, it might have been advisable to bore more to the north or north-east. There is no doubt that the Oolitic strata is thin in that direction, so that a boring between Maidstone and Folkestone would probably not meet with any, or with only a small thickness. But, on the other hand, the Lower Cretaceous strata might there be thick. Borings for water at Maidstone have been carried to 600 feet below sea-level, and only just pierced the Weald clay, getting water from the top beds of the Hastings sands. A boring at Ashford, carried to about the same depth, seems to have got into the Hastings sand series; but how much more Wealden strata may be below either of these bore-holes we cannot tell. Prof. Prestwich supposes that the Palæozoics may lie at a more moderate depth below the sea-level at Folkestone; and he proposes that the Channel Tunnel should be carried through these old rocks. We must all hope, and I for one believe, that the Tunnel can be successfully carried through the chalk; but if this should fail, it is probable that borings will be made to test the feasibility of Prof. Prestwich's scheme. Meanwhile, the Sub-Wealden Exploration can apply its funds in investigating other districts.

It should be remembered that the boring has been mainly supported by landowners and others connected with Sussex. Mr. Willett, the indefatigable secretary, has worked at the task that Sussex may have the honour of leading in an exploration which in future years, whatever may be the success of the present boring, will certainly be extended to other districts in the south-east of England. It is certain that no other spot in Sussex is so well suited for the work; and, all things considered, the best plan is to begin again on the same site.

The Committee has always kept the coal question in the background, preferring to urge forward the work on its scientific merits. Still, it is true that the chief cause of the wide interest taken in the boring is the hope that coal will be found, or at least that valuable information bearing on the point will be obtained. It may then be well again to call attention to the fact that Prof. Gosselet, whose researches on the Coal Measures of Northern France are so well known, believes that the boring is in the right position, and that it is very probable that a line of productive coal measures underlies the Weald. He has shown that the coal beds of Hardinghen, in the Boulonnais, are really true coal measures faulted down, and are not an abnormal development of the limestone series; a conclusion with which other geologists now agree.

I have entered into these long explanations from a fear lest Mr. Blake's well-meaning criticisms may convey the impression that money is now to be spent at Netherfield which could be better spent elsewhere. I think this is not the case, and I hope that those who have the means and the will may see the importance of aiding the work with their contributions. Mr. H. Willett (Arnold House, Brighton) has made himself personally responsible for the amount (600*l.*) needed to carry the new boring down to 1,000 feet, trusting that subscriptions will steadily come in for the future as they have done in the past.

Geological Survey Office, Jermyn Street, London, Feb. 7 — W. TOPLEY

Gaussian Constants

PROF. HUMPHREY LLOYD says, in his book "On Magnetism," published about two months ago, and reviewed (vol. xi. p. 221) in NATURE by Prof. Balfour Stewart, on page 115, in a paragraph on "Gauss's Theory":—"In addition to this, mainly through the exertions of General Sabine, magnetical observations have been vastly multiplied at other points of the earth's surface; and the time has consequently arrived when a re-calculation of the Gaussian constants, as they are called, may with advantage be undertaken. This laborious work is now in progress. General Sabine has completed the co-ordination of the observations, and Prof. Adams has generously offered to devote his valuable time to the re-calculation based upon them. The scientific world may therefore, before long, expect to see a series of charts exhibiting the actual condition of the earth's magnetism greatly more exact than any which have been yet produced."

It may therefore interest Prof. Lloyd and others to hear that about nine months ago was edited and published at Berlin, at the request of the Imperial Admiralty, "Die Grundlagen der Gaussischen Theorie und die Erscheinungen des Erdmagnetismus im Jahre 1829, mit Berücksichtigung der Sæcularvariationen aus allen vorliegenden Beobachtungen berechnet und dargestellt, von A. Erman und H. Petersen;" a re-calculation of the "Gaussian Constants," based on a co-ordination of the most reliable observations, containing a series of charts which exhibit the actual condition of the earth's magnetism.

O. REICHENBACH

Columnar Formation in Mud Banks

IN reference to the report in NATURE, vol. xi. p. 258, on Mr. Mallet's communication to the Royal Society, respecting the hexagonal crystallisation of basalt, I beg to offer to your readers a similar explanation of the columnar formation in some mud banks on the shores of some of the rivers in South Africa.

The modern channels are gradually becoming lower than formerly, owing to the rising of the land, and so the streams in estuaries and reaches have cut out deeper courses in the previously formed muddy bottoms, and these are now exposed on the sides of the rivers, but at the bottom of the valleys, to the action of the sun and the hot winds. These strata of mud are very thick, and they begin to dry on the surface, and split across into hexagonal-like discs all over the flat, and this splitting on the surface gradually deepens into the stratum, and a mass or congeries of columns is thus formed on the side lying nearest the river. The diameter of these columns may vary from 4 to 9 inches, but their length is very uncertain, and might be from 1 to 3 feet. These again become detached by gravity, rains and winds, and tumble into the stream, and are borne away by the currents to the sea, to become imbedded and fossilised in some sand-bank, and probably the study of some future palæontologist.

In the case of basalt the agency of crystallisation is stated to be by Mr. Mallet the abstraction of heat and contraction of fluidity into solidity; but in this case it may be attributed to loss of moisture by heat and dryness producing contraction of fluidity into solidity. A similar result would therefore appear to be produced by apparently two opposite causes, cooling in the one case and heating in the other, but both have tended to produce a closer aggregation of the molecules, and brought them within the range of their peculiar physical affinities.

Edinburgh — J. W. BLACK

Flowers and Bees

WITH reference to a letter which appeared in NATURE, vol. xi. p. 248, I may mention that on the 30th of August last nearly all the Snapdragon flowers I could find (including many unopened buds) had been bitten through by bees. I had been looking out for flowers in this state a short time before (I think not more than a week), when I could find only two, and those looked as if they might have been accidentally injured. The quickness and thoroughness with which the work had been done was very striking.

C. A. M.

Iron Pyrites

IN NATURE, vol. xi. p. 249, Mr. Carr mentions the fact that some iron pyrites in the Maidstone Museum "have crumbled into a coarse, finely divided mass;" and he inquires whether "such a thing has ever been observed before." It is a very common and well-known fact, and any work on chemistry will explain it. Perhaps we can best answer the question by quoting Dr. Miller on the subject (Chemistry, p. 588):—"Some varieties of iron pyrites, especially those found in the Tertiary strata, are speedily decomposed by exposure to air; oxygen is absorbed, and ferrous sulphate formed. This decomposition occurs with greater facility if the disulphide be mixed with other substances, as is the case in the aluminous schists; in which, by the further action of air, a basic ferric sulphate is formed, whilst the liberated sulphuric acid reacts upon the alumina, magnesia, or lime of the soil, and forms sulphates; those of aluminium and magnesia may be extracted by lixiviation. The ordinary crystallised pyrites from the older strata is not thus decomposed, but a variety of a whiter colour is disintegrated rapidly by exposure to the weather; this form of pyrites is known as *Marcasite*, or *white iron pyrites*."

R.

The Micrographic Dictionary—Pollen Grains

I READ your criticism of this book in last number of NATURE with a good deal of interest, and I fully agree with your reviewer in his statement that "workers in different fields will place a different estimate on the importance of their own department." Allow me to call your attention to the two singularly erroneous figures of the pollen grains of *Mimulus moschatus* (Pl. 32, Fig. 24) in this work. I have frequently examined the pollen of this plant, and have never seen it anything like the figures in the "Dictionary," or in any way differing from the grains of many other members of the Scrophulariaceæ. The pollen of *M. moschatus* is like a grain of wheat, and not like the wonderful convolute ball shown in the "Dictionary."

In his "Common Objects for the Microscope," Plate 3, Fig. 21, the Rev. J. G. Wood reproduces the *first* of these two extraordinary figures, and describes the pollen as "belted with wide and deep bands," &c., but by an oversight he omits to give the source from which the erroneous figure is copied.

In his "One Thousand Objects for the Microscope," Plate 2, Fig. 6, Mr. Cooke copies the *second* extraordinary figure of this pollen, and says, "these curious granules resemble a band or cord rolled or folded in a spherical mass," as if he had so seen them. The "Dictionary" plate certainly does look like this, but in the letter-press the folds are referred to as "slits or furrows." By an oversight Mr. Cooke also omits to give the source from which *his* erroneous figure is copied.

W. G. SMITH

The Phylloxera

IN the report to the Department of the Interior of the Canton of Geneva by the commission appointed to inquire into the best means of stopping the ravages of Phylloxera, which I have just received from Prof. Forel, of Morges, it is stated that the insect was most probably introduced from England in some vines which were taken to Geneva to certain graperies of Baron Rothschild in 1869. These graperies are in the middle of the infected district—they were found to be infected within twelve months of the arrival of the plants, and no vineyards but those in the neighbourhood of these graperies have been infected in all Switzerland. Prof. Forel, in his letter to me, says that while the surrounding vines have perished, those attacked in Baron Rothschild's houses have suffered very little indeed, and bear plenty of fruit. These vines, he says, are Black Hamburgh and Muscat d'Alexandrie or d'Alicante. He asks if in England anything is known which points out any kind of vine as suffering less than other kinds. Can any of your readers tell me anything about it?

Clifton, Jan. 23 G. H. WOLLASTON

Thermometer Scales

I SHALL feel greatly obliged if any reader of NATURE can inform me what scale the thermometer referred to in the following extracts was made to:—"7 Feb., 1775. This day the thermometer was down to 80, two hours after sunrise." "This thermometer has five inches divided into 75 degrees above temperate (*sic*); and $6\frac{3}{4}$ inches below temperate, divided into 100 degrees; the spirit at 80 was about an inch from the bottom. In the frost in 1739 the spirit sunk below all the marks in this thermometer." Also—"Dec. 30, 1739. Thermometer sunk below all the marks. . . . This thermo was marked down to 7 below Fahrenheit's freezing point of 32; so this was below 25 of Fahr." Some very hot days in July 1757 are marked (I presume by the same thermometer) at 40, 41, 46, and 47 degrees; another day, "very near 50" is spoken of as the hottest day the writer thinks he ever remembers in England, "except the famous hot Saturday on the 11th of June, 1748."

In 1783-4, 13 below 0 of *Linnæus* is mentioned as very severe cold. The scale of Linnæus is mentioned several times. I have failed to discover the scale of the first thermometer, and never heard of that of Linnæus. If any of your readers can enlighten me as to the relation of these scales to that of Fahrenheit or Réaumur, I shall feel greatly indebted.

Norwich, Feb. 1 THOMAS SOUTHWELL

OUR ASTRONOMICAL COLUMN

THE NEXT RETURN OF HALLEY'S COMET.—In the year 1864 the late Count G. de Pontécoulant made an important communication to the Paris Academy of Sciences relating to the perturbations of this famous comet. He remarked at the outset: "I propose, in my new researches on the comet of Halley, to follow the course of that body from the epoch when it was observed for the first time in a manner sufficiently precise to allow of determining the orbit, until that of its next return to perihelion, which will take place in 1910, *i.e.* during an interval of nearly three hundred and eighty years, including five entire revolutions of the comet. I shall describe here, as succinctly as it is possible to do, the results of the immense calculations which it has been necessary to effect in order to attain this object." We shall confine ourselves in the present remarks to a few particulars relating to the appearance of the comet in 1910, reserving a further account of Pontécoulant's memoir for a future occasion. It is, however, impossible to avoid an expression of regret that the astronomer who has completed the enormous work indicated in the above extract, should have passed away without (so far as we know) putting upon record the successive steps of his calculations in sufficient detail to be of service to the future investigator, and it is to be hoped his papers may yet be made available for this purpose. Mere statements of final results, necessitating for their attainment such a prodigious amount of labour and such unusual skill, are hardly all that is required, though in this remark we imply no want of confidence in the accuracy of the work performed. It is almost certain that the perturbations of Halley's comet will be recomputed before the year of its next return, and it is as certain that the possession in detail of the various numerical results of Pontécoulant's work would be of very great service to anyone who may undertake its verification, not only by way of check as he proceeds, but as a guide to the effective management of the formidable mass of figures involved.

The perihelion passage in 1835 is fixed to Nov. 15·95 Paris mean time, at which moment the comet is found to have been moving in an ellipse with a period of 27895·81 days. The influence of the planet Jupiter upon the length of the present revolution is greater than in any of the four previous ones, and amounts to 679·37 days, by which the next perihelion passage is accelerated. Saturn retards the comet 2·79 days, while Uranus accelerates it 2·30 days, therefore nearly negativing the influence of Saturn. The attraction of other planets is neglected. The total effect of perturbation during the actual revolution is thus found to be 678·88 days, the period being shortened thereby; and hence the time of revolution corresponding to 1835, Nov. 16, is diminished to 27216·93 days, and the next perihelion passage is consequently fixed to 1910, May, 23·87 Paris time, the comet then completing the shortest revolution since 1531, the preceding revolution having been the longest, and their difference is upwards of two years. The periodic time corresponding to the comet's motion at perihelion in 1910 is 27,790 days. A notable change is produced by the action of the planet Jupiter in the perihelion distance, which is increased by upwards of a tenth of the earth's mean distance from the sun, and the comet's orbit is thus brought into very close proximity to that of the earth at the descending node. In 1835 the comet at this point passed 0·1511 from our track; in 1910, according to Pontécoulant, it will be distant only 0·0157. The excentricity of the orbit in 1910 is found to be 0·9617332; the semi-axis major, 17·95546; the longitude of perihelion, 305° 38′ 14″; the ascending node, 57° 10′ 33″; inclination, 17° 46′ 51″; the motion is retrograde. The longitudes are counted from the mean equinox at perihelion.

The track of the comet calculated from these elements is a very favourable one for observation. At the end of October 1909 the comet has the same theoretical intensity of light as when it was last glimpsed by Dr. Lamont with the Munich refractor, on the 17th of May, 1836. (It is often erroneously supposed that the last observations were made at the Cape of Good Hope.) Its position, according to the above data, is in the neighbourhood of 130 Tauri. Thence retrograding with a slow southerly motion in declination, it passes through the constellation Aries, in January 1910, and is situate in Pisces until it has approached our globe within the mean distance of the earth from the sun, or until about the beginning of the last week in May. Its apparent motion then rapidly accelerates. On June 12 the calculated position is close to the bright star Capella, and, five days later, on the confines of Lynx and Leo Minor. At this period the comet attains its least distance from the earth, which may be taken as 0·25. Descending pretty quickly towards the equator, we find it in the neighbourhood of 84 Leonis at the beginning of July, afterwards gradually losing itself in the evening twilight. With the date for perihelion passage assigned by Pontécoulant, the comet would be most conspicuous in the first half of the month of June, in the absence of the moon, which is full on the 22nd.

ENCKE'S COMET has been detected very close upon the calculated position at more than one of the private observatories in this country, but up to the interference of moonlight it was extremely faint. We shall continue the ephemeris next week.

ANTARES.—The measures of this star communicated last week by Mr. J. M. Wilson, of Rugby, are pretty conclusive as to a physical connection of the components. If the angle and distance used as a starting-point (1848) in our former notice be brought up to Mr. Wilson's epoch, 1873·42, by applying Leverrier's proper motions in the interval to the place of the large star, we have

Angle . . . 287°·8. Distance . . . 3″·53.

The observation gives the angle 268°·6 (differing 19°) less than any yet assigned by previous measures; but in 1845, Mitchel thought the small star was on the parallel preceding, and all subsequent observations except the one in question have placed the companion in the *n.p.* quadrant, Dawes in 1864 finding the angle nearly 276°.

LALANDE'S ÉTOILE SINGULIÈRE.—On the 4th of March, 1796 ("Histoire Céleste," p. 211), Lalande observed meridionally a star of 6·7 magnitude, the position of which for the beginning of the present year is in R.A. 8h. 13m. 3s., N.P.D. 68° 51′·5; on the 15th of the same month he again observed the star, and the resulting places for 1800 belong to Nos. 16292-3 of the reduced catalogue. On March 4 he attaches this remark to his observation—"Étoile singulière." The observation of the 15th is without note. We have examined this star telescopically on several occasions, without being able to detect any unusual appearance about it. The light is yellowish. Has any reader of NATURE had the curiosity to look at it? The remark is a strange one for the observer of so many thousands of stars to attach, unless there was really something singular in the star's aspect at the time.

NEWS FROM THE "CHALLENGER"*

THE *Challenger* left Port Nicholson on the 7th July, 1874, and proceeded under sail along the east coast of New Zealand. On the 8th we rounded and trawled in 1,100 fathoms, lat. 40° 13′ S., long. 177° 43′ E., with a bottom-temperature of 2° C., and a bottom of soft greenish ooze. Many animals were brought up by this trawl, resembling closely those which we had taken at a corresponding depth in other portions of the Southern Sea. On the 10th we again trawled and sounded in 700 fathoms about forty miles to the east of East Cape.

We then continued our course northwards towards the Kermadec Islands, and on the 14th we took our usual series of observations midway between Macaulay and Raoul Islands in the Kermadec group. At this station we trawled at a depth of 630 fathoms; and we were greatly struck with the general resemblance between the assemblage of animal forms brought up in the trawl and the results of a good haul in about the same depth off the coast of Portugal or North Africa. Among the more interesting objects were a very large and splendid specimen of a Hexactinellid sponge allied to *Poliopogon*, several other fine sponges referred to the same group, and three or four examples of two species of *Pentacrinus* new to science, resembling generally *P. asteria*, L., from the Antilles. We trawled on the following day in 600 fathoms, forty-five miles to the north of Raoul Island, with nearly equal success. On the evening of Sunday the 19th we arrived at Tongatabu and called on the principal missionary, Mr. Baker, from whom we received every possible attention during our short stay. After spending two days in visiting different parts of the island, we left Tongatabu on the 22nd of July, and after taking a few hauls of the dredge in shallow water we proceeded towards Kandavu in the Fijis. On the 24th we stopped off Matuku Island and landed a party of surveyors and naturalists; and while they were taking observations and exploring on shore we trawled in 300 fathoms, and received among other things a fine specimen of the pearly Nautilus, *Nautilus pompilius*, which we kept living in a tub for some time in order to observe its movements and attitudes.

On Saturday the 25th of July we arrived at Kandavu, on the 28th we went to Levuka, and we returned to Kandavu on the 3rd of August, where we remained until the 10th.

At Fiji the civilian staff were occupied in examining the reefs and generally in observing the natural history of the islands; and in this we received all friendly assistance from H.M. Consul, Mr. Layard, and from Mr. Thurston, Minister of King Cacobau. During our stay, a mixed party of naval and civilian officers went in the ship's barge to Mbaw and visited the king.

Between New Zealand and the Fiji group only two soundings were taken to a greater depth than 1,000 fathoms. Of these, one at a depth of 1,100 off Cape Turnagain, New Zealand, gave a bottom of grey ooze, and a bottom-temperature of 2° C.; and the second at 2,900 fathoms, lat. 25° 5′ S., long. 172° 56′ W., midway between the Kermadecs and the Friendly Islands, gave "red clay," and a temperature of 0°·5 C. Four serial temperature-soundings were taken; and the distribution of temperature was found to correspond in its main features with what we had previously met with in oceans communicating freely with the Antarctic Sea.

The dredgings, which, with the exception of one near the New Zealand coast, were all at depths varying from three to six hundred fathoms, yielded a great number of very interesting forms; but, as I have already remarked, they tended to confirm our impression that even at these comparatively moderate depths, at all depths, in fact, much greater than a hundred fathoms, while species differ in different localities, and different generic types are from time to time introduced, the general character of the fauna is everywhere very much the same.

On the 10th of August we left Kandavu and proceeded towards Api, one of the least known of the New Hebrides, where there is as yet no permanent missionary station. On the 12th we sounded and trawled in 1,350 fathoms, with a bottom of reddish ooze; we sounded again on the 15th in 1,450 fathoms with red clay; and on the 18th, after passing through the channel between Makuru and Two-Hill Islands, we stopped off Api in twenty-five fathoms, close to the edge of the reef and opposite a landing-place.

In order to receive, as far as we could, the good-will of

* "Report on the Cruise of H.M.S. *Challenger*, from July to November 1874," by Prof. Wyville Thomson, F.R.S., Director of the Civilian Scientific Staff. A paper, dated H.M.S. *Challenger*, Hong Kong, read before the Royal Society, Feb. 4.

the natives, Capt. Nares had given a passage to eleven Api men, who had been employed for a three-years' term in Fiji under the arrangement which exists there for the regulation of Polynesian labour. Two or three of us, with an armed party, took the returned labourers ashore; and as the natives, although they appeared somewhat mistrustful, and were all armed with clubs and spears and bows with sheaves of poisoned arrows, were sufficiently friendly, nearly all the officers landed and spent a few hours rambling about the shore. It was not thought prudent to go far into the forest, which was very dense and luxuriant, and came close down to the beach.

The natives were almost entirely naked, and certainly bore a very savage and forbidding aspect. One of them was manifestly greatly superior to the others, and appeared to exercise a considerable influence over them. He wore trousers and a shirt and a felt hat, and could speak English fairly. He recognised me at once as having seen me at the sugar plantation in Queensland, where he had been for the usual three-years' engagement, and showed me, with great pride, a note from his former employer, saying that the bearer was anxious to return to his service, and that he would willingly pay his passage money and all expenses in case of his being given a passage to Brisbane. I had been paying some attention to the South Sea labour question, and had formed a very strong opinion of the value to the inhabitants of these islands of the opportunity given them by this demand for labour, of testing their capacity to enter into and mix with the general current of working men, and thereby possibly avoid extermination; and I was greatly pleased to see the result in this instance.

From the island of Api we shaped our course to the north-westward towards Raine Island in a breach of the great barrier reef not far from the entrance of Torres Strait. On the 19th of August we sounded, lat. 16° 47′ S., long. 165° 20′ E., at a depth of 2,650 fathoms, with a bottom of "red clay," and a bottom-temperature of 1°·7 C. (35° F.) A serial temperature-sounding was taken to the depth of 1,500 fathoms, and it was found that the minimum temperature (1°·7 C.) was reached at a depth of 1,300 fathoms, and that consequently a stratum of water at that uniform temperature extended from that depth to the bottom.

Serial temperature-soundings were taken on the 21st, the 24th, the 25th, the 27th, and the 28th of August, in 2,325, 2,450, 2,440, 2,275, and 1,700 fathoms respectively; and in each case the minimum temperature of 1° 7 C., or a temperature so near it as to leave the difference within the limit of instrumental or personal error of observation, extended in a uniform layer, averaging 7,000 feet in thickness, from the depth of 1,300 fathoms to the bottom.

It will be seen by reference to the chart that on our course from Api to Raine Island we traversed for a distance of 1,400 miles a sea included within a broken barrier, consisting of the continent of Australia to the west; the Louisiade Archipelago, the Solomon Islands, and a small part of New Guinea to the north; the New Hebrides to the east; and New Caledonia and the line of shoals and reefs which connect that island with Australia to the south. The obvious explanation of this peculiar distribution of temperatures within this area, which we have called for convenience of reference the "Melanesian Sea," is that there is no free communication between this sea and the outer ocean to a greater depth than 1,300 fathoms, the encircling barrier being complete up to that point.

The "Melanesian Sea" is in the belt of the S.E. trade-winds, and the general course of a drift-current which traverses its long axis at an average rate of half a knot an hour is to the westward; evaporation is, as it is usually throughout the course of the trade-winds, greatly in excess of precipitation, so that a large amount of the surface-water is removed. This must, of course, be replaced, and it is so by an indraught of ocean-water over the lowest part of the barrier at the proper temperature for that depth. We had previously found a temperature of 1°·7 C. at a depth of 1,300 fathoms on the 16th, the 19th, and the 21st of June between Australia and New Zealand, on the 17th of July in lat. 25° 5′ S., long. 172° 56′ W., and earlier on the 10th of March in lat. 47° 25′ S. The bottom within the Melanesian Sea may be described generally as "red clay," with a small but varying proportion of the shells of Foraminifera, sometimes whole but more usually much broken up and decomposed. In one or two soundings the tube showed curiously interstratified deposits, differing markedly in colour and in composition. The trawl was sent down on the 25th of August to a depth of 2,440 fathoms. The animals procured were few in number—some spicules of Hyalonema, a dead example of *Fungia symmetrica*, two living specimens of a species of Umbellularia, which appears to differ in some respects from the Atlantic form, and a very fine and perfect Brisinga, also living. The existence of animal life is therefore not impossible in the still bottom-water of such an enclosed sea; but, as we have already seen in the Mediterranean, the conditions do not appear to be favourable to its development. On the 29th of August we trawled in 1,400 fathoms, about 75 miles to the east of Raine Island, with somewhat greater success. This might have been anticipated, as the depth was not much greater than that at which the free interchange of water was taking place, and diffusion and intermixture was no doubt much more rapid than at the bottom.

On the 31st of August we visited Raine Island, which we found to correspond in every respect to Jukes's description in the "Voyage of the *Fly*." We observed and collected the species of birds which were breeding there. In the afternoon we dredged off the island in 155 fathoms with small success, and proceeded towards Port Albany, Cape York, where we arrived on the 1st of September.

We left Somerset on the 8th, and proceeded across the Arafura Sea to the Arú Islands, reaching Dobbo on the island of Wamma on the 16th. We found no depth in the Arafura Sea greater than 50 fathoms, and the average depth was from 25 to 30 fathoms. The bottom was a greenish mud, due apparently in a great degree to the deposit from the great rivers of New Guinea and the rivers falling into the Gulf of Carpentaria. Animal life was not abundant. Many of the animals seemed dwarfed, and the fauna had somewhat the character of that of a harbour or estuary. The specific gravity of the surface-water was unusually low, falling on the 23rd off Dobbo Harbour to 1·02505; the temperature reduced to 15°·5 C., distilled water at 4° C. = 1.

After spending a few days shooting Paradise Birds and getting an idea of the natural history of the island of Wokaw, we left Dobbo on the 23rd and proceeded to Ké Doulan, the principal village in the Ké group. We then went on to the island of Banda, where we remained a couple of days, and thence to Amboina, which we reached on the 4th of October.

On the 20th of September, after leaving the Ké islands, we sounded and trawled in 129 fathoms. The trawl brought up a wonderful assemblage of things, including, with a large number of Mollusca, Crustacea, and Echinoderms of more ordinary forms, several fine examples of undescribed Hexactinellid sponges, and several very perfect specimens of two new species of Pentacrinus. Temperature-soundings were taken on the 28th of September and on the 3rd of October at depths of 2,800 and 1,420 fathoms respectively, and on both occasions the minimum temperature (3° C.) was reached at a depth of 900 fathoms, indicating that the lowest part of a barrier inclosing the Banda Sea, bounded by Taliabo, Buru, and Ceram on the north, the Arú islands on the east, Timor and the Serwatty islands on the south, and Celebes and the shoals of the Flores Sea on the west, is 900 fathoms beneath the surface.

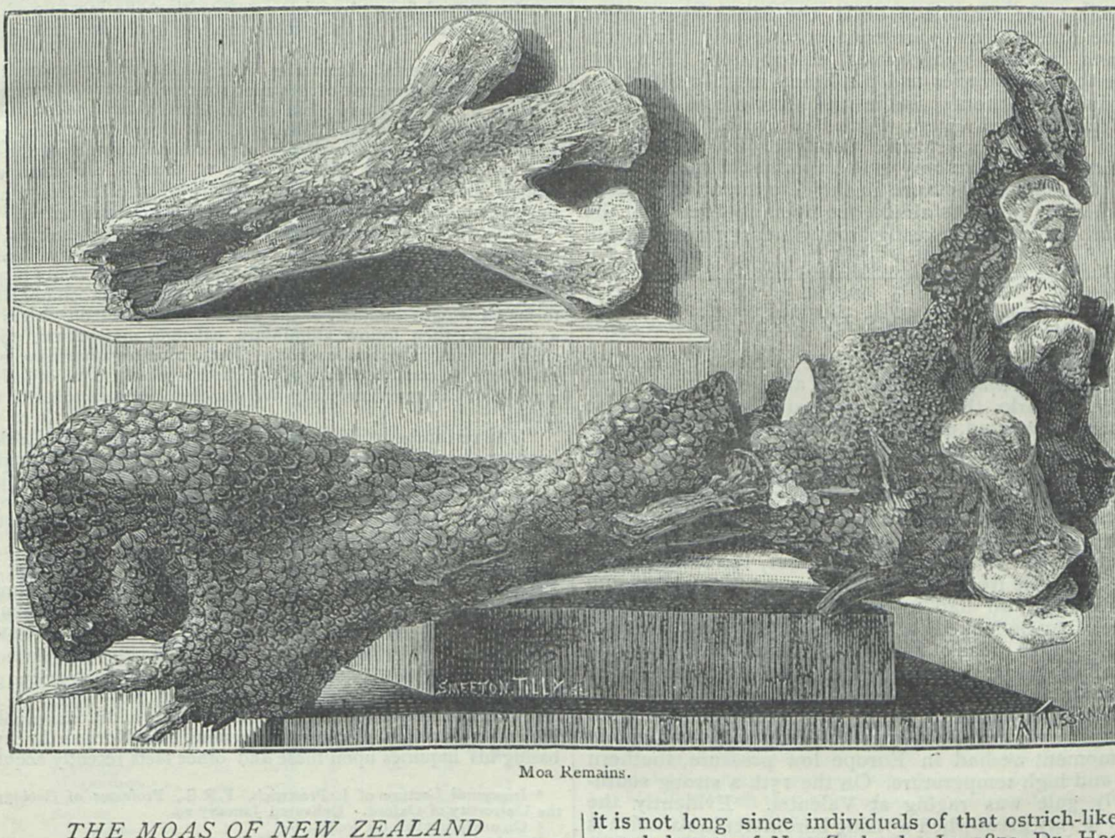
From Amboina we went to Ternate, and thence across the Molucca passage and into the Celebes Sea by the passage between Bejaren Island and the north-east point of Celebes. On the 13th we trawled and took serial temperatures near Great Tawallie Island. The trawl brought up several specimens of a very elegant stalked halichondroid sponge new to science, and the thermometer gave temperatures sinking normally to a bottom-temperature of 2°·04 C. On the following day we sounded in 1,200 fathoms, with again a normal bottom temperature of 1°·9 C. It seems, therefore, that the Molucca passage communicates freely with the outer ocean; it does so at all events to the depth of 1,200 fathoms, and most probably to the bottom, if it include greater depths.

In the Celebes Sea we had two deep soundings on the 20th, to 2,150 fathoms, and on the 22nd to 2600 fathoms. On both occasions serial temperature-soundings were taken, and on both the minimum temperature of 3°·7 C. (38°·7 F.) was reached at 700 fathoms. A passage of this depth into the Celebes Sea is therefore indicated very probably from the Molucca passage. This temperature corresponds almost exactly with that taken by Capt. Chimmo in the same area. We trawled on the 20th, and although the number of specimens procured was not large, they were sufficient to give evidence of the presence of the usual deep-sea fauna.

We reached Zamboanga on the 23rd, and on the 26th we passed into the Sulu Sea and trawled at a depth of 102 fathoms. On the 27th we sounded to 2,550 fathoms, and took a serial temperature-sounding. A minimum temperature of 10° C. was found at 400 fathoms, so that the Sulu Sea must be regarded as the fourth of this singular succession of basins cut off by barriers of varying height from communication with the ocean. This observation in the main confirmed those of Capt. Chimmo in the same locality. The minimum temperature reached was the same in both, but we appear to have found it at a somewhat higher level.

We arrived at Ilo Ilo on the 28th, and proceeded by the eastern passage to Manila, which we reached on the 4th of November.

The collections have been packed and catalogued in the usual way, and will be sent home from Hong Kong. We have had an opportunity during this cruise of making a very large number of observations of great interest. I believe I may say that the departments under my charge are going on in a very satisfactory way.



Moa Remains.

THE MOAS OF NEW ZEALAND

QUITE recently rumours have reached us from New Zealand to the effect that two living specimens of the colossal struthious birds, the Moas, have been captured in the province of Otago, which are to be taken to Christchurch. That the genus *Dinornis*, to which they belong, has been extinct for some time is the general impression, and it is based on evidence of no inconsiderable weight. Nevertheless, there are many reasons for the belief that it is not long since individuals of that ostrich-like group peopled parts of New Zealand. In 1870 Dr. Haast discovered kitchen-middens made up of fragments of Moas of different species, mixed up with bones of seals, dogs, and gulls, together with pieces of chalcedony, agate, &c., which evidently indicate that these gigantic birds were contemporaneous with the ancient human inhabitants of the islands. A human skeleton having been found with a Dinornis egg between its arms is also evidence in the same direction, as is the recent discovery of the neck of one of these birds with the muscles and integuments preserved.

Several portions of the external covering of the bird have also been discovered, along with bones, which show signs of recent interment. Beside feathers, the complete skeleton in the museum at York has the integument of the feet partly preserved, from which it is evident that the toes were covered with numerous small hexagonal scales. We are now able to supplement our knowledge with a description of the covering of the tarsus from a specimen sent by Dr. Haast to Prof. Alphonse Milne-Edwards, which is to be seen in the Museum of Natural History at Paris. This specimen is figured, one-fourth the natural size, in the accompanying drawing, for which we have to thank the proprietors of our enterprising French namesake *La Nature*. It was obtained at Knobly Range, Otago, and belongs to the species *Dinornis ingens*. From it we learn that the tarsus, as well as the toes, was nearly entirely covered with small horny imbricate scales, and not with broad transverse scutes, as it might quite possibly have been. It is also evident that the hind toe, or hallux, which is not present in either the Ostrich, Rea, Emu, Cassowary, nor in some species of Moas, was articulated to the metatarsal segment of the limb a little above the level of the other toes. Those species of *Dinornis* which possess the hind toe, Prof. Owen includes in the genus *Palapteryx*.

Amongst the struthious birds, the Moas agree most with the Apteryx, in the presence (occasionally) of a fourth toe; and in their geographical distribution. They resemble the Cassowaries and the Emus most in the structure of their feathers; and in the structure of the skull differ from all to an extent which has made Prof. Huxley arrange them as a separate family of the Ratitæ. A knowledge of the anatomy of their perishable parts would be an invaluable assistance in the determination of their true affinities, but it is almost too much to hope that the material for such an investigation will ever present itself.

THE RECENT STORMS IN THE ATLANTIC

THIS subject has attracted the notice of the *New York Herald*, which, in an article on the 23rd January, remarks that "the successive gales appear to have been connected with the high barometer or polar air-waves which have recently swept across the northern part of the United States." Our contemporary says, moreover, that the last "great barometer fluctuation was followed by a storm centre which the weather reports recorded on the 19th inst. as then moving eastward over the Gulf of St. Lawrence. . . . In fact, the lesson apparently deducible from the recent steamer detentions and ship disasters we had to record is, that the severest cyclones may be looked for as the sequel phenomena of the great winter areas of high barometer and intense cold; or, in other words, the rising glass should be studied by the seaman as carefully as the falling glass."

Certainly, there is some truth in this assertion; but our contemporary ignores the startling fact that at the very same moment we had in Europe low pressure, southern gales, and high temperature. On the 15th a strong south-westerly gale was raging at Valentia. Evidently the danger is very great when a rising barometer in America is coupled with a falling barometer in Europe, or *vice versa*.

Unhappily, the Transatlantic Telegraph is not in use now for sending meteorological summaries between Europe and America. It is deeply to be regretted that the practice was discontinued, and we hope the recent disastrous gales will induce the nations on both sides of the great ocean to neglect no longer that useful channel of mutual information.

W. DE FONVIELLE

THE PAST AND FUTURE WORK OF GEOLOGY*

ON the 29th ult. Prof. Prestwich, who, as our readers know, has succeeded the late Prof. Phillips in the chair of Geology at Oxford, gave his inaugural lecture in the Museum of the University. He commenced by paying a high and well-merited tribute to the value of the work, the wide attainments and character of his predecessor, Prof. Phillips, and giving a brief sketch of the aspect of geological science at the time the chair was established. Prof. Prestwich then proceeded to notice some of the larger features, whether on questions of theory or on questions of fact, by which the progress of geology has been marked, and which, while they may serve to show how much has been done, will yet indicate how much still remains to be accomplished.

"The geologist commences," Prof. Prestwich said, "where the astronomer ends. We have to adapt the large and broad generalisations of cosmical phenomena to the minuter details of terrestrial structure and constitution, which it is our business to study. The common origin of the solar system has been long inferred from the spheroidal figure of the earth and the relations of the planets to one another, and explained by evolution from an original nebulous mass; and geologists have had to consider how far such a hypothesis is in accordance with geological facts. The questions connected with the earliest stages of the earth's history are on the very boundary line of our science, but they have too important a bearing on its subsequent stages not to command our serious attention; and though obscure and theoretical, they serve to guide us to firmer ground. This nebular hypothesis has recently received from physicists corroboration of a most novel and striking character, equally interesting to geologists and astronomers.

"The wonderful discoveries with respect to the solar atmosphere, made by means of the spectroscope, have now presented us with an entirely new class of evidence, which, taken in conjunction with the argument derived from figure and plan, gives irresistible weight to the theory of a common origin of the sun and its planets; and while serving to connect our earth with distant worlds, indicates as a corollary what of necessity must have been its early condition and probable constitution.

"The whole number of known elements composing the crust and atmosphere of the earth, the lecturer went on to say, amount only to sixty-four, and their relative distribution is vastly disproportionate. It has been estimated that oxygen in combination forms by weight one-half of the earth's crust; silicon enters for a quarter; then follow aluminium, calcium, magnesium, potassium, sodium, iron, and carbon. These nine together have been estimated to constitute $\frac{977}{1000}$ of the earth's crust. The other $\frac{23}{1000}$ consist of the remaining fifty-five non-metallic and metallic elements.

"The researches of Kirchhoff, Angström, Thalèn, and Lockyer have now made known, that of these sixty-four terrestrial elements there are twenty present in those parts of the solar atmosphere called the "chromosphere" and "reversing layer," as the stratum which surrounds the photosphere is called from certain optical properties. They consist of †—

Aluminium.	Chromium.	Lead (?)	Sodium.
Barium.	Cobalt.	Magnesium.	Strontium.
Cadmium.	Copper (?)	Manganese.	Titanium.
Calcium.	Hydrogen.	Nickel.	Uranium.
Cerium.	Iron.	Potassium.	Zinc.

"Nor, with possibly two exceptions, does the spectroscope give any indication of unknown elements.

"While these phenomena afford such strong additional proofs of the common origin of our solar system, Mr. Norman Lockyer, basing his inquiries upon these and other facts recently acquired

* Inaugural Lecture of J. Prestwich, F.R.S., Professor of Geology in the University of Oxford. Delivered January 29.

† On analysing this list we find:—

1 Permanent Gas	Hydrogen.		
2 Metals of the Alkalies	Sodium.	Potassium.	
All the Metals of the Alkaline Earths	Calcium.	Strontium.	Barium.
3 Metals of the Zinc class	Magnesium.	Zinc.	Cadmium.
All the Metals of the Iron Class...	Manganese.	Cobalt.	Chromium
	Iron.	Nickel.	Uranium.
2 Metals of the Tin class	Tin.	Titanium.	
1 Metal of the Lead class (probably)			

The metals of the Tungsten, Antimony, Silver, and Gold classes are entirely unrepresented, while, if we except the metallic nature of hydrogen, there is not a single metalloid on the list, although they have been diligently searched for.

on the constitution of the sun, has been led to form some views of singular interest bearing on the probable structure of the crust and nucleus of the earth. With his permission I am enabled to lay before you some of the points in the inquiry he is now pursuing.

"Observation and theory have both led him to the unexpected conclusion that in the case of an atmosphere of enormous height and consisting of gases and of metallic elements in a gaseous state, gravity overcomes diffusion, and the various vapours extend to different heights, and so practically arrange themselves in layers; and that in the sun, where owing to the fierce solar temperature the elements exist in such a state of vapour and of complete dissociation, the known elements are observed to thin out in the main in the following order * :—

Coronal Atmosphere . . .	Cooler Hydrogen
Chromosphere	Incandescent Hydrogen. Magnesium. Calcium.
Reversing layer	Sodium. Chromium. Manganese. Iron. Nickel, &c.

"Mr. Lockyer suggests, and has communicated some evidence to the Royal Society in support of his suggestion, that the metalloids or non-metallic elements as a group lie outside the metallic atmosphere. He also explains why under these conditions their record among the Fraunhofer lines should be a feeble one. Hence he considers that we have no argument against the presence of some quantity of the metalloids in the sun taken as a whole, although that quantity may be small.

"Mr. Lockyer then takes the observed facts together with the hypothesis of the external position of the metalloids, and is considering these two questions :—

1. Assuming the earth to have once been in the same condition as the sun now is, what would be the chemical constitution of its crust?

2. Assuming the solar nebula to have once existed as a nebulous star at a temperature of complete dissociation, what would be the chemical constitution of the planets thrown off as the nebulosity contracted?

"It will be seen that there is a most intimate connection between these two inquiries; the localisation of the various elements and the reduction of temperature acting in the same way in both cases.

"Thus to deal with the first question; as the external gaseous vapours (those of the metalloids) cooled they condensed and fell on the underlying layer, where they entered into combination, forming one set of binary compounds, and then others as the temperature was reduced, until finally all the metals and earths were precipitated. †

"If now we turn to the earth's crust we find it very generally assumed that the fundamental igneous rocks which underlie the sedimentary strata, and which formed originally the outer layers, may be divided into two great masses holding generally and on the whole a definite relation one to the other—an upper one consisting of granite and other Plutonic rocks, rich in silica, moderate in alumina, and poor in lime, iron, and magnesia; and of a lower mass of basaltic and volcanic rocks of greater specific gravity, with silica in smaller proportions, alumina in equal, and iron, lime, and magnesia in much larger proportions, with also a great variety of other elements as occasional constituents; while the denser metals are in larger proportion in the more central portion of the nucleus. The suggestion of Mr. Lockyer is that this order follows necessarily from the original localisation of the earths and metals before referred to, by which the oxygen, silicon, and other metalloids formed, as they now do in the sun, an outer atmosphere, succeeded by an inner one consisting in greater part of the alkaline earths and alkalies, then by a lower one of iron and its associated group of metals, and finally by an inner nucleus containing the other and denser metals.

"As we have before observed, above nine-tenths of the earth's crust consists of those elements which, on the assumption of the external position of the metalloids, would constitute the outer layers of the nebular mass. Thus, oxygen and silicon alone constitute on the average $\frac{75}{100}$ of the mass of acid Plutonic rocks of which the upper part of the first assumed shell of the earth consists; while beneath it are the basic rocks, into the composition of which calcium, magnesium, and iron, combined with oxygen, enter in the proportion of, say, $\frac{35}{100}$, the silica being less by $\frac{25}{100}$; still deeper lie the denser and harder metals, which reach the surface only through the veins transversing the outer layers.

"We next come to the second question dealing with the chemical constitution of the planets. It is imagined that the same consideration would hold good, and that the exterior planets may approach in their constitution that of the sun's outer atmosphere, and that the planets may become more metallic as their orbits lie nearer the central portion of the nebula. Mr. Lockyer considers that the low density and gigantic and highly absorbing atmospheres of the outer planets accord with their being more metalloidal; and that, on the other hand, the high density and comparatively small and feebly absorbing atmospheres of the inner planets, points to a more intimate relation with the inner layers of the original nebulous mass. For the same reason we should expect to find the metalloids scarcer in the sun than in the earth.

"In the Jovian system, and in our own moon, we have a still further support of the hypothesis in the fact that the density of the satellites is less than that of their primary.

"I had hoped," Prof. Prestwich continued, "to have brought before you some of the results of the examination of the spectra of portions of the outer igneous rock crust of the earth, which Mr. Lockyer kindly undertook to compare with the solar spectrum, but, owing to the state of the weather, the investigation is not yet complete. It may, however, be stated that, as in the spectrum of the sun, so in the spectra of the granite, greenstone, and lava already tested, no trace of metalloids is present, although oxygen and silicon are so largely present in these rocks.

"We can, however, still only look on these views as hypothetical, but they commend themselves to us by their simplicity and grandeur, and their high suggestiveness for future inquiry and research. They show us also how the spectroscope may, as the microscope has done already, aid the investigations of the geologist—the one by endowing the eye with new powers of sight with respect to the infinitely minute, and the other with new powers of tangible analysis with respect to the infinitely distant.

"Quitting the early history of our globe, we leave the domain of the astronomer and enter upon one shared by the geologist, the mineralogist, the chemist, and the mathematician. Instead of the sixty-four simple elements, their mutual reactions have resulted in the formation of somewhere about 1,000 varieties of rocks and minerals alone, with which the geologist has in future to deal. He also has to deal with all the physical problems arising from the consolidation of the crust of the earth—from pressure due to gravitation and contraction—from the action of subterranean forces—from the effects of heat—and with all the varied phenomena resulting from these complex conditions."

Mr. Prestwich then referred to the early belief that the thickness of the crust of the earth does not now exceed thirty to sixty miles; and to the conclusion, supported by Sir W. Thomson, of the late Mr. Hopkins, who, reasoning on phenomena connected with precession or nutation, concluded that on the contrary it could not be less than 800 miles thick or more.

Remarking that it is difficult, however, to reconcile these views with the extent and character of modern volcanic action, Prof. Prestwich referred to the theories propounded by Mr. Mallet in his remarkable paper recently published in the Transactions of the Royal Society.

"In stratigraphical geology," the lecturer went on to say, "the great divisions originally marked out by our predecessors stand,

* Mr. Lockyer points out that this order is that of the old atomic or combining weights, and not that of the modern atomic weights, as the following table shows :—

	Old Atomic Weights.	New Atomic Weights.
Hydrogen	1	1
Magnesium	12	24
Calcium	20	40
Sodium	23	23
Chromium	26	52·5
Manganese	27	55
Iron	28	56
Nickel	29	58

Aluminium does not find a place in the above list, because its order in the layers has not yet been determined by observation, but the principle referred to would place it between magnesium and calcium.

† Firstly, those binary compounds capable of existing at a high temperature, such as the vapour of water, of hydrochloric acid, silica, carbonic acid, and others would be formed; secondly, the precipitation of these would give rise to numerous reactions, forming a variety of silicates, chlorides, sulphates, &c.; thirdly, with the condensation of water the constitution of minerals would be effected, double decompositions would ensue, and the consolidation of the outer shell commence.

but their number and the number of subdivisions have greatly increased. In 1822, when Phillips and Conybeare wrote their 'Geology of England and Wales,' twenty-three so-called formations were recognised, whereas now thirty-eight such are established, and these are divided into about 120 subdivisions, each characterised by some peculiarity of structure or of fauna. Palæontology as a separate science was not then known; structural and physical geology had chiefly occupied attention; but the study of organic remains has since advanced with such rapid and vigorous strides that the older branch was until lately in danger of being neglected and distanced.

"At that time the number of species of organic remains in Great Britain which had been described amounted only to 752, whereas now the number amounts to the large total of 13,276 species.

"Some idea of the extent and variety of the past life of our globe may be formed by comparing these figures with the numbers of plants and animals now living in Great Britain. Excluding those classes and families, such as the naked mollusca and others, which from their soft and gelatinous nature decay rapidly, and so escape fossilisation, and insects *—the preservation of which is exceptional—the number of living species amounts to 3,989, against 13,183 extinct species of the same classes.

"Thus, while the total number of those classes of vertebrate and invertebrate animals and plants represented in a fossil state, and now living in Great Britain, is only 3,989, there formerly lived in the same area as many as 13,276 species, so that the fossil exceed the recent by 9,287 species. It must be remembered also that plants are badly represented, for, owing to their restricted preservation, the fossil species only number 823 against 1,820 recent species. Birds are still worse represented, as only eighteen fossil species occur against 354 recent species.

"But the multiplicity of British fossils, however surprising as a whole, has to be viewed in another and different light. The large total represents, not as the recent species do, the life of one period, but the sum of those of all the geological periods. Geological periods, as we construct them, are necessarily arbitrary. The whole geological series consists of subdivisions, each one of which is marked by a certain number of characteristic species, but each having a large proportion of species common to the subdivisions above and below it. These various subdivisions are again massed into groups or stages, having certain features and certian species peculiar to them and common throughout, and which groups are separated from the groups above and below by greater breaks in the continuity of life and of stratification than mark the lesser divisions. As these on the whole severally exhibit a distinct fauna and flora, we may conveniently consider them as periods, each having its own distinctive life, and the number of which in Great Britain we have taken approximately at thirty-eight.

"The number of species common to one period and another varies very greatly, but taking the average of the sixteen divisions of the Jurassic and Cretaceous series, of which the lists were, with a portion of those of the older series, given a few years since by Prof. Ramsay, † we may assume that about thirty per cent. of the organic remains pass from one stage to another.

"Dividing the 13,276 fossil species among the thirty-eight stages, or omitting the lower stages and some others, and taking only thirty, we thus get an average of 442 species for each; and, allowing in addition for the number common to every two periods, we obtain a mean of 630 species as the population of each of the thirty periods, against the 3,989 species of the present period. On this view the relative numbers are therefore reversed.

"This gives a ratio for the fauna or flora of a past to that of the present period of only as 1 : 6·3. But it must be remembered that probably the actual as well as the relative numbers of the several classes *inter se* in each and all of these several formations, varied greatly at the different geological periods. Still we have no reason to suppose but that during the greater part of them life of one form or another was as prolific, or nearly so, in the British area then as at the present day, and we may thus form some conception of how little relatively, though so much really, we have yet discovered, and of how much yet remains to be done before we can re-establish the old lands and seas of each successive period, with their full and significant populations. This we cannot hope ever to succeed in accomplishing fully, for decay has been too quick and the rock entombment too much out of our reach ever to yield up all the varieties of past life; but although the limits of the horizon may never be reached, the field may be vastly extended; each segment of that semicircle may yet be prolonged we know not how far; and it is in this extension—in the filling up of the blanks existing in the life of each particular period—that lies one great work of the future."

(*To be continued.*)

* The number of British species of insects amounts to between 10,000 and 11,000.

† Anniversary Addresses for 1863 and 1864. *Quarterly Journal Geological Society*. The tables were computed by Mr. Etheridge.

NOTES

It is perhaps too much yet to expect any allusion to the interests of science in that very *staccato* composition, a Queen's Speech. The next best thing to this, however, occurred last Friday, when Lord Rayleigh, the seconder of the Address, very courageously pointed out the omission from the Speech of any allusion to an event "which had excited some public interest of a non-political character." His lordship referred to the recent Transit of Venus, in which the astronomers of this country had taken a part, but by no means, he thought, "too large a part." We confess that on this point we quite agree with Lord Rayleigh; indeed, we think he has stated the case, as against England in this matter, with remarkable mildness. But this is a mere detail compared with what followed. Lord Rayleigh said "he could not pass from astronomy without expressing a hope that other sciences of equal philosophical interest and greater material importance might receive more Government recognition than had hitherto been accorded them. It was something of an anomaly that England, whose great prosperity was largely due to scientific invention, should be slow to encourage those whose discoveries were laying the foundations of future progress. It was said, he knew, that these things might be safely left to individual enterprise, but there were fields of investigation in which individuals were powerless. We hope that this emphatic advocacy of the claims of science on Government, by one who has had the honour of being selected to second the Address on the Queen's Speech, augurs favourably for the amount of attention these claims are likely to secure during the forthcoming session.

The words of Mr. Disraeli on Monday night with regard to University Reform are also very cheering to those who wish to see some decided action taken towards the thorough reform of our Universities. Mr. Disraeli's words were very strong, so strong indeed as to amount to an assurance that Government really means to take into serious consideration this session the Report of the University Commission. "It is our opinion," the Prime Minister said, "that no Government can exist which for a moment maintains that the consideration of University Reform, and consequently legislation of some kind, will not form part of its duty." These words give out no uncertain sound. Mr. Disraeli said, moreover, that when the Report was presented at the end of last session, the Colleges were not assembled. It would be interesting to know whether the Colleges have yet met to consider the Report, and whether they are likely to act on this hint of the Premier and take some internal action—commence the work of reform from within, instead of waiting until they are driven to it by forces from without.

We are able to give this week the first instalment of an abstract of Prof. Prestwich's lecture in the chair of Geology at Oxford. We have printed it in small type, in order to be able to give as much as possible of an address which, our readers will see, is likely to mark an important stage in the history of geological science. The address will shortly be published in a separate form.

The Arctic Committee appointed by the Admiralty, having completed its work and sent in a final report, was dissolved last week. The Committee has got through much work in the way of ordering clothes and provisions, and making preparations of all kinds, in which it was ably assisted by Dr. Lyall and Mr. Lewis, two old Arctic officers of long experience. The further arrangements will be under the direct supervision of Capt. Nares, who will also assign the special duties to be undertaken by the different officers under his command. Commander Markham, who acquired much experience in ice navigation in 1873, will, it has now been arranged, accompany Capt. Nares in the first ship, and the younger executive officers are the very pick of the service. The medical staff, consisting of four officers, is also composed of men who are quite capable of taking charge of some branches of scientific investigation. One, at least, is a good botanist.

IN our last number, p. 268, is a letter in which the importance of attaching a competent geologist to the expedition is strongly urged. It is, of course, very desirable that, if scientific civilians are attached to the expedition, they should be men who can secure results which could not be equally well secured by any of the officers. As regards botany, the number of known flowering plants in Greenland is about 130, and it is unlikely that they can be largely added to. The point of botanical interest, within the unknown region, is the distribution of genera and species; and what is needed is diligent collection, with careful notes of the localities where the different species are found. This could be perfectly well done by the medical and other officers of the expedition. But to secure satisfactory geological results, a trained geologist, well acquainted with all the Arctic problems, is essential, and it is not likely that any of the officers would have the necessary qualifications. It is, therefore, very important that suggestions such as those of our correspondent last week, and of others who have urged the same views, should have their due weight.

AT the meeting of the Royal Geographical Society on Monday, Admiral Richards read to a large and distinguished audience, including H.R.H. the Prince of Wales, a paper on the proposed route to the Pole for the Arctic Expedition. It was intended at present, he said, that the two vessels should leave Portsmouth about the latter end of May, and, taking the usual route to Baffin's Bay, so endeavour to pass up Smith's Sound. In 81° or 82° north latitude they would probably separate, and while one would stay exploring the northern coast of Greenland, the other would push still further northwards. Everything, the Admiral was of opinion, had been done to ensure success. After a few remarks on the probable nature of the sea beyond 82° latitude, in the course of which he stated that from the violent current which swept southwards from Smith's Sound and through Hudson's Strait, along the coast of Labrador, he inferred that there was no great continent north of Smith's Sound, he concluded by pointing out the advantages that would result from the expedition.

WITH regard to the proposed German Arctic Expedition, the Committee of the Federal Council on Maritime Matters has proposed that the Council should submit the question of sending out a German Arctic Expedition to an Imperial Commission for consideration.

To those who are seeking for detailed information concerning the route of the Arctic Expedition, we would commend an article (with map) by Dr. R. Brown, in the *Geographical Magazine* for February, on Disco Bay, giving a very full idea, derived from personal experience, of the physical and social condition of the West Greenland coast between 69° and 71° N. lat. The *Magazine* states that Dr. Brown is "the greatest living authority on all scientific questions connected with Greenland." In the forthcoming volume of the "Transactions" of the Geological Society of Glasgow Dr. Brown will have a paper on the Noursoak Peninsula and Disco Island.

MANY influential French papers are circulating the intelligence that Lieutenant Bellot, although he came to London with the authorisation of the French Government, has not been admitted on the staff of the English Arctic Expedition. Strong remarks are made on the supposed selfishness of the British Admiralty.

LIEUT. CAMERON has sent home a map of Lake Tanganyika. from Ujiji to the south end, on a large scale; which represents geographical work of great importance. The work of Burton and Speke and Livingstone *on* the lake is confined to the portion north of Ujiji; for the voyage made by Dr. Livingstone along the west coast, south of Kasengé Island, was made at a time when he was too ill to make observations. Cameron's exploration is, therefore, a discovery in the true sense, and one of considerable interest, for that young officer has not only carefully delineated the outline of the lake with all the indentations of the coast and the mouths of rivers, but he has discovered the outlet, and thus solved a great geographical problem. He is himself very cautious in assuming anything without personal inspection, and even yet hesitates to allow that the stream which he found flowing out, and traced for some miles, is really an outlet. He holds it to be possible that it may flow into some swamp or backwater. But there really seems to be little room for doubt on the subject, although Lieut. Cameron is wisely resolved to make a further examination. The river Lukuga flows out of the lake, at the end of a large bay, a short distance south of the Kasengé Island, between which and the outlet is the mouth of the Rogumba, which flows into the lake. The Lukuga, according to the Chief and people who live on its banks, flows from Lake Tanganyika to the river Lualaba. On May 4th Cameron went down the Lukuga for a distance of four miles, and found it to be three to five fathoms deep, and five to six hundred yards wide, but much choked with grass. There was a distinct, but not a rapid current flowing out. We understand Cameron's map of Lake Tanganyika will shortly be published by the Geographical Society.

A VERY interesting paper in the *Geographical Magazine* is on Great Thibet, being an account of a journey made in 1872–73 from the headquarters of the Indian Great Trigonometrical Survey by a semi-Thibetan, a young man trained to the work, named Major Montgomerie. He crossed the Brahmaputra to the north of Shigatze, and journeyed along the river Sheang Chu, to the lake Tengri-Nor (the local name of which is Namcho), which he may be said to have discovered, as it has hitherto been placed on our maps merely on the authority of old Chinese surveys of unknown authorship. Its north point is just under 31° N. lat., and its south point about 30½°; it lies between 30° and 31° west. It is about 50 miles in length and between 16 and 25 miles in breadth. After suffering considerable hardships the young explorer and his small party returned to Lhassa.

To the keepership of the Zoological collections of the British Museum, vacated by the resignation of Dr. J. E. Gray, Dr. Albert Günther has been appointed. The appointment of Assistant Keeper, rendered vacant by Dr. Günther's promotion, has been filled by the appointment of Mr. F. Smith, of the Entomological Department.

PROFS. CHIERICI, Pigorini, and Strobel, have started a new periodical devoted to the prehistoric antiquities of Italy, under the title of the *Bullettino di Palentologia Italiana*, the first number of which has just appeared. It is intended to issue monthly numbers, each of sixteen pages, with at least six illustrative plates in the course of the year. The present number contains articles on flint flakes worked to a rhomboidal form like some of those discovered in Kent's Cavern, on the mode of hafting bronze celts, and notices of some recent discoveries in Italy. The annual subscription is seven francs.

WE would remind our readers that Prof. Clerk-Maxwell's lecture to the Chemical Society, "On the dynamical evidence of the molecular constitution of bodies," will be delivered on Thursday next, the 18th instant. The Faraday Lecture will be delivered by Dr. A. W. Hofmann on the 18th of March.

THE Cambridge Smith's Prizes have been adjudged as follows:—First prize, W. Burnside, B.A., Pembroke; second prize, G. Chrystal, B.A., St. Peter's. These two gentlemen were declared equal in the last Mathematical Tripos as Second Wrangler.

AT the 300th anniversary of the founding of the University of Leyden, held on the 8th inst., degrees were conferred on the following English men of science:—Prof. Cayley, Mr. Huggins, Mr. Prescott Joule, Dr. Odling, and also Prof. Newcomb, of Washington, U.S., created Doctors of Mathematics and Physics. Mr. Charles Darwin was created Doctor of Medicine.

IT is intended to issue, in October 1875, the first number of a periodical to be entitled *Mind; a Quarterly Review of Scientific Psychology and Philosophy*. Due prominence will be given in the Review to objective researches into the functions of the nervous system. All special lines of investigation affording insight into mind, in dependence on the main track of psychological inquiry, will receive attention in the Review; *e.g.*, Language, Primitive Culture, Mental Pathology, and Comparative Psychology. *Mind* will be published by Messrs. Williams and Norgate.

THE Board of Trinity College, Dublin, have elected Dr. J. Emerson Reynolds Professor of Chemistry in the University of Dublin. Dr. Reynolds is well known as an accomplished chemist, an excellent observer, and a skilful experimentalist. His researches on a new group of colloid bodies containing mercury, and on certain silicic acids, and his discovery of sulphuretted urea, have made his name well known. His election as one of the Professors of the Medical School of Dublin University is in every way for the interest of that school, and the announcement thereof will be received with the greatest favour by his colleagues.

THERE will be an examination at Downing College, on Tuesday, April 6, and three following days, for a Scholarship in Natural Science. Information can be obtained of the tutor of the College, Mr. John Perkins.

THE Government has received a despatch from Batavia, dated Feb. 3, announcing an eruption of the volcano Kloet, in the island of Java, whereby great destruction has been caused at Blitar.

WE have received an instalment of the thirty-ninth supplement to Petermann's *Mittheilungen*, which is to be occupied with a full geographical and statistical account of the Argentine Republic, Chili, Paraguay, and Uruguay. The part to hand contains details concerning the physical features, political divisions, and population of the first-named, and a large finely executed map of all the four. Dr. Petermann himself compiles the strictly geographical account from the latest official statistics, while a geographico-statistical appendix is to be given by Dr. Burmeister, director of the Museum of Buenos Ayres.

THE January part of Petermann's *Mittheilungen* contains a very interesting sketch, by E. Behm, of the origin and progress of the German African Society, which has already set to work in earnest on the West Coast, and promises to do much for the exploration of Africa in this direction. Dr. Petermann writes on the means by which the Society's explorers are to carry on their work, and strongly advocates the use of elephants. A map of the coast from 2° N. to 10° S. accompanies the papers, showing the routes of previous explorers, and those of Bastian, Güssfeldt, and Lenz, in 1873-74. The moving spirit of the Society is the accomplished Dr. Bastian, who himself has travelled in nearly every region of the globe.

THE January number of the *Bulletin* of the French Geographical Society contains the first instalment of a series of extracts from Abbé David's account of his travels in Mongolia in 1866. Abbé David is one of the most indefatigable of living travellers, and has probably done more than any other explorer to make known the natural history of China; for it is for botanical and zoological, rather than for geographical purposes, he travels. The narrative of this his first journey, and also of his second in 1868–70, up the Yang-tse-Kiang, and as far as the borders of Thibet, have been published in the *Nouvelles Archives* of the Paris Museum. From these narratives the present extracts, presenting mainly the geographical results, are taken. Abbé David was compelled to return to Europe last April to recruit his shattered health, and contemplates publishing a separate narrative of a third journey, from Pekin down through the centre of China, during which he explored the important chain of the Tsing-ling Mountains.

AT the last *soirée* of the Paris Observatory M. Dupuy de Lome explained his ferry-boat intended to carry railway trains between England and France. M. de Lesseps also delivered a lecture on the tunnel which it is proposed to bore from Calais to Dover. A commission of nineteen members has been elected by the Versailles Assembly to report upon the boring of a preliminary gallery. All the members are unanimous to grant the required authorisation. The president of the commissioners is M. Martel, one of the members for Pas de Calais. Four other members for that department are amongst the commission.

ON the 1st of February M. Leverrier announced to the Academy of Sciences the discovery, by M. Stéphan, the director of the Marseilles Observatory, of Encke's comet. On the 8th he announced the detection, by M. Stéphan, of Winnecke's comet, which is a more notable object, and can be observed with a finder. It is necessary to employ powerful instruments to see Encke's with certainty. Both comets were seen at Marseilles for the first time, that of Encke in 1818, and Winnecke in 1819.

IN the number of the 30th January of the *International Bulletin of the Paris Observatory*, M. Leverrier publishes the first list of the corrected observations for the small planets in 1873. Almost all the numbers are incorrect by a few tenths of a second, many of one second, some of twenty seconds, and one of two degrees.

THE Statistical Society have published this year for the first time an almanac for 1875. It is very neatly got up, and will no doubt prove useful to the members of the Society; and the very carefully and originally arranged calendar ought to make it interesting to outsiders. The almanac contains, besides, a list of the principal statistical documents issued by the several State departments, and a series of tables of equivalents of imperial and metric weights and measures. During the year 1875 the Council hope to make arrangements for compiling *Tables of Constants* relating to population, pauperism, crime, education, exports and imports, &c., with a view to their publication with the almanac for 1876.

THE following is the title of the essay to which the Howard Medal will be awarded by the Statistical Society in November 1875; the essays to be sent in on or before June 30, 1875:—"The State of the Dwellings of the Poor in the Rural Districts of England, with special regard to the Improvements that have taken place since the middle of the 18th century; and their Influence on the Health and Morals of the Inmates."

THE South Park Commissioners of Chicago have recently determined upon the establishment of botanical gardens in the park, and have set apart for the purpose a tract of sixty acres, to which additions will be made from time to time as occasion may require. A botanical museum and herbarium will be included in the scheme. A circular has been issued by the board of managers, soliciting contributions from kindred institutions. The works are to be commenced as soon as the weather will permit.

IT may be remembered that the United States steamer *Tuscarora*, after having completed the line of soundings made for the purpose of selecting a suitable route for a Transpacific cable, under Commander Belknap, again started on the same duty, under the charge of Capt. Erben, leaving San Francisco on the 1st of November direct for the Sandwich Islands. The *Hawaiian Gazette* of Dec. 2 announces her arrival at Honolulu, and remarks that, in all, sixty-two casts of the sounding-line were made, the first near the Farallones, the water gradually deepening from that point to 2,500 fathoms. In lat. 33° 10′ and long. 132° the depth began rapidly to diminish, showing 1,417, 435, 413, and, finally, 385 fathoms in lat. 32° 58′. Numerous observations were made, which showed that there was a submarine peak rising about 2,200 fathoms from the ocean bed. Beyond this, for a circuit of five miles around this peak, deep water was found in every direction, and a few miles from the peak 2,500 fathoms were reached. From this the depth gradually increased, until in lat. 24° long. 152° the depth was 3,115 fathoms. This was only about 400 miles from Honolulu. The soundings brought up from the peak showed a mixture of lava and coral, which is supposed to be indicative of a submarine volcano. The temperature at the bottom was found to vary but little from 35° to 36° F. The results of the survey, according to the *Gazette*, are satisfactory, showing, if anything, a better line between Honolulu and San Francisco than that from San Diego.

THE science of medicine and surgery according to European notions is making some progress in Japan. We learn that in the hospital at Hakodadi there are twenty young men regularly entered as students of medicine, daily lectures are given, and "bedside and other clinical demonstrations," the curriculum being similar to that of most medical schools. An illustrated medical journal in the Japanese language is also published every two months.

FROM the Superintendent's Report (1874) it appears that the Royal Botanic Gardens, Calcutta, are recovering very slowly from the devastating effects of the cyclones of 1864 and 1867. The growth of the shrubs and trees planted to replace those uprooted has not been very luxuriant, and a long time must elapse before the welcome and useful shade of noble trees such as once filled the garden will be enjoyed there again.

THE additions to the Zoological Society's Gardens during the past week include four Summer Ducks (*Aix sponsa*) from N. America, presented by Lord Braybrook, F.Z.S.; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Pole Shawe; a Zebu (*Bos indicus*) born in the Menagerie; a White-fronted Capuchin Monkey (*Cebus albifrons*) from S. America, deposited; two Indian Tree Ducks (*Dendrocygna arcuata*) from India, received in exchange; fourteen Basse (*Labrax lupus*), three Grey Mullet (*Mugil capito*), and a Cottus, (*Cottus bubalis*) from British Seas, purchased.

SCIENTIFIC SERIALS

Der Zoologische Garten.—In the December number the first article is one on monstrosities in wild birds, by Herr Pfarrer Jäckel, who describes several instances of additional and deficient limbs, and figures the leg of a Golden Eagle with two well-developed extra toes attached to the back of the tarsus.—The editor, Dr. Noll, treats of the salmon-fishery on the Rhine at St. Goar. In 1873 the number of fish captured was 1,162, weighing in all 16,612 lbs.—An account by Dr. Taiber of the chase of the South American Ostrich (*Rea americana*) with the *bolas* is reproduced from the "La Plata Monatsschrift."—Dr. R. Meyer describes two breeding nests of the squirrel (*Sciurus vulgaris*), in which the entrance was covered by a lid or flap, formed of fine grass; he confirms the statement that these animals have other nests to which they remove their young in case of danger.—Dr. A. Praetorius writes on the domestic animals of the ancient Greeks.—Victor Ritter von Tschusi-Schmidhofen states, on the authority of L. v. Hueber, that the Lesser Kestrel (*Tinnunculus cenchris*) is spreading northward in Carinthia, and replacing the common species (*T. alandarius*), and also gives an instance of the breeding of the Waxwing (*Bombicylla garrula*) in Austria, a nest having been found in May 1872, in the Castle park at Kremsier by Pfarrer Kaspar. Unfortunately, it was destroyed, and the birds disappeared.

Journal of the Asiatic Society of Bengal, Part II. No. 2, 1874.—Record of the Khairpur meteorite of Sept. 23, 1873, by H. B. Medlicott. This is simply a record of the appearance and fall of a meteorite, from the observations of several persons, and the weights of the specimens collected, the largest of which weighed 10 lb. 12 oz. 126 gr. The stone is described as being of the usual steel-grey colour and crypto-crystalline texture.—Contributions towards a knowledge of the Burmese Flora, Part I., by S. Kurz: an abridged enumeration of Burmese plants, phanerogamic and cryptogamic, as far as they have come to the writer's knowledge, containing the polypetalous dicotyledons, Ranunculaceæ to the end of the Geraniaceæ. Epitomised generic descriptions are given, as well as a conspectus of the species of each genus.—On the Asiatic species of Molossi, by G. E. Dobson. Two new species are described, viz., *Nyctinomus tragatus* and *N. Johorensis*.—Index to Part II. vol. xlii., 1873.

Astronomische Nachrichten, No. 2,018.—This number contains a long article detailing observations of the spectra of Winnecke's and Coggia's comets, and of changes in the head of that of Coggia. As to the spectrum of Winnecke's comet, the author states that on the 7th and 10th of May last the spectrum consisted of three bright bands, the middle one the brightest, and sharply limited towards the red end of the spectrum. The brightest portion of this band appeared a little more refrangible than the b_4 line, while the beginning of the band coincided with it. The bright central portion of the comet, 1½′ diameter, appeared to have in it certain bright points like stars of 12 to 14 magnitude, and the central portion gave a faint continuous spectrum. On the 6th of May, Coggia's comet gave a spectrum of three bands: the central one near *b* line was brightest, and the one nearest the blue the faintest; the nucleus and contiguous portions gave a continuous spectrum, in addition to the former one, extending from wave-length 590 to 440. On the 18th the middle line was seen sharply limited towards the red and shading towards the blue; the wave-length of the sharp limit was estimated at 515; the other bands were not so sharply defined on the red side as the central one, and the relative brightness of each is given as yellow, 2; green, 4; and blue, 1. The bands were strongest where crossed by the continuous spectrum of the nucleus. No other bands were visible; the positions of the commencement of the bands from a mean of observations are, 1st band, 562·5; 2nd band, 515·1; and 3rd band, 471·6. A change in the comparative brightness of the bands appears to have been noticed at times, and the author observes that one might expect absorption bands in the continuous spectrum corresponding to the bright bands, and that the changes of brightness of the lines should be viewed as an important matter in reference to this expectation. Traces of absorption bands appear to have been noticed, but their position not fixed. The following table of comparison of spectra of comets and hydrocarbons is given:—

		Comet. Coggia.	Comet. Henry.	Comet II. 1868.
First band of Spectrum.	Beginning	562·5	562·6	563·1
	Brightest part ...	553·8	559	—
	End	541	541	538
Second ditto.	Beginning	515·1	517·1	517·2
	Brightest part ...	511·8	516	—
	End	500	500	492
Third ditto.	Beginning	471.6	472·7	471·4
	Brightest part ...	468·9	466	—
	End	465	464	458

	Benzine.	Blue part of gas flame.	Blue part of petroleum flame.
Beginning of 1st band...	563·2	562·9	—
End	—	537	—
Beginning of 2nd band..	516·4	516·1	515·5 bright line.
		512·5 broad bright line.	512·1 faint band.
End of 2nd band	—	501	—
Beginning of 3rd band...	474·2	473·8	473 very delicate line.
Brightest part	471·2	—	472·5 faint bands.
End	—	464	466·0
		436·8 middle of a band.	437·1 middle of broad faint band.
		430·9 broad line.	430·8 bright line.

From this table it appears that the beginning of the bands of each comet correspond, but that the brightest parts of these vary in position. For comparison with other comets the brightest parts of the bands are given :—

	Comet I., 1871.	Tuttle's Comet.	Encke's Comet.	Coggia's Comet.
1st band	557	557	555	554
2nd band	511	513	512	512
3rd band	—	472	473	469

The remainder of the paper on the change of form consists of daily notes referring to drawings and giving measurements of the comet. The nucleus appears to have changed its shape from round to oval and other forms.—In No. 2,019 Dr. Luther gives an ephemeris for Planet (104) Clymene, which has not been seen since 1868.—Dr. Holetschek and Dr. Luther give position observations of comets and minor planets made last year.—G. W. Hill sends a note on a long period of irregularity of Hestia, arising from the action of the earth, and its application to ascertain the value of the solar parallax.—J. Palisa writes to say that he has discovered Clymene; he also saw Dione and Althæa again.—Winnecke mentions the discovery, by Borrelly, of a comet, position December 10th.: Decl., + 39° 49′·5; R.A., 16h. 4m. 65s.

SOCIETIES AND ACADEMIES

London

Royal Society, Jan. 28.—"On the Theory of Ventilation: an attempt to establish a positive basis for the calculation of the amount of fresh air required for an inhabited air-space," by Surgeon-Major F. de. Chaumont, M.D., Assistant Professor of Hygiene, Army Medical School. Communicated by Prof. Parkes, M.D., F.R.S.

In a paper in the *Edinburgh Medical Journal* for May 1867, the author adduced some results to show that the evidence of the senses might be employed (if used with proper care and precautions) as the ground-work of a scale, and gave a short table of the amounts of respiratory impurity (estimated at CO_2) which corresponded to certain conditions noted as affecting the sense of smell.

It is generally admitted that it is organic matter that is the poison in air rendered impure by the products of respiration. It is also admitted that it is the same substance that gives the disagreeable sensation described as "closeness" in an ill-ventilated air-space. Although the nature of the organic matter may vary to a certain extent, it will be allowed that a condition of good ventilation may be established if we dilute the air sufficiently with fresh air, so that the amount of organic matter shall not vary *sensibly* from that of the external air. Observations, however, as far as they have gone, seem to show that the amount of organic impurity bears a fairly regular proportion to the amount of carbonic acid evolved by the inhabitant in an air-space; and as the latter can be easily and certainly determined, we may take it as a *measure* of the condition of the air-space. If we adopt as our *standard* the point at which there is no sensible difference between the air of an inhabited space and the external air, and agree that this shall be determined by the effects on the sense of *smell*, our next step is to *ascertain* from experiment what is the average amount of CO_2 in such an air-space, from which we can then calculate the amount of air required to keep it in that condition. All the author's results have been obtained in barracks and hospitals.

The plan followed in all was to take the observations chiefly at night, when the rooms or wards were occupied, and when fires and lights (except the lamp or candle used for the observation) were out. On first entering the room from the outer air the sensation was noted and recorded just as it occurred to the observer, such terms as "fresh," "fair," "not close," "close," "very close," "extremely close," &c. being employed. The air was then collected (generally in two jars or bottles, for controlling experiments), and set aside with lime-water for subsequent analysis, and the temperatures of the wet and dry bulb thermometers noted. About the same time samples of the external air were also taken, and the thermometers read. In this way any unintentional bias in the record of sensations was avoided, and this source of fallacy fairly well eliminated.

Although the records of sensation are various in terms, the author has thought that they might be advantageously reduced to *five* orders or classes, each of which he characterises by one or more appropriate terms in common use.

He then proceeds to give an analysis of the results of his observations on the case of each order, from which he draws the following conclusions :—

In order No. 1, "Fresh," &c., a condition of atmosphere not *sensibly* different from the external air, the conditions which are those of *good* ventilation are the following :—

Temperature about 63° Fahrenheit.

Vapour shall not exceed 4·7 grains per cubic foot.

Carbonic acid shall not exceed the amount in the outer air by more than 0·2000 per 1000 volumes.

No. 2.—"Rather close," &c. A condition of atmosphere in which the organic matter begins to be appreciated by the senses, and the ventilation ceases to be *good*:—

Vapour in the air exceeds 4·7 grains per cubic foot.

CO_2 in excess over outer air, ratio reaching 0·4000 per 1000 volumes.

No. 3.—"Close," &c. The point at which the organic matter begins to be decidedly disagreeable to the senses, and the ventilation begins to be decidedly *bad*:—

Vapour reaches 4·9 grains per cubic foot.

Carbonic acid in excess over outer air to the amount of 0·6000 per 1000 volumes.

No. 4.—"Very close," &c. The point at which the organic matter begins to be offensive and oppressive to the senses, and the ventilation *very bad*:—

Vapour reaches 5·00 grains per cubic foot.

Carbonic acid in excess over outer air reaches 0·8000 per 1000 volumes.

No. 5.—"Extremely close," &c. The maximum point of differentiation by the senses :—

Vapour 5·100 grains per cubic foot.

Carbonic acid, in excess over the amount in the outer air beyond, 0·8500 per 1000 volumes.

It will at once be seen that the figures in No. 5 differ but little from those in No. 4, and that the probable *limit of differentiation* by the senses is reached in No. 4. The number of recorded observations in No. 5 is also very few comparatively; and the author thinks it would therefore be better to group the two together thus :—

Nos. 4 and 5 combined, being the probable limit of possible differentiation by the senses.

1. *Temperature.*—In the outer air 51°·43, in the inhabited air-spaces 65°·12, or a mean difference of 13°·69.

2. *Vapour and Humidity.*—The vapour in the outer air was 3·729, inside 5·108, or a mean difference of 1·379 grain, corresponding to a lowering of relative humidity of 8·92 per cent.

3. *Carbonic Acid.*—In the outer air 0·3928, in the inhabited air-spaces 1·2461, or a mean difference due to respiratory impurity of 0·8533, the range for probable error of result being between 0·8717 and 0·8349.

We may therefore say that when the vapour * reaches 5·100 grains per cubic foot, and the CO_2 in excess 0·8000 volume per 1,000, the maximum point of differentiation by the senses is reached.

The author then shows that there is a regular progression as we pass from one order to another.

He then proceeds to give a large number of tabular statements, calculations, and ratios, his practical conclusion being that the experimental data already quoted fairly justify the adoption of the following

Conditions as the Standard of good Ventilation.

Temperature (dry bulb) 63° to 65° Fahrenheit.
" (wet bulb) 58° to 61° "

* It is to be understood that the amounts of vapour stated in these cases are in reference to a mean temperature of about 63° F.

Vapour ought not to exceed 4°·7 grains per cubic foot at a temperature of 63° F., or 5·0 grains at a temperature of 65° F.

Humidity (per cent.) ought not to exceed 73 to 75.

Carbonic Acid. Respiratory impurity ought not to exceed 0·0002 per foot, or 0·2000 per 1000 volumes.

Taking the mean external air ratio at 0·4000 per 1000, this would give a mean internal air ratio of 0·6000 per 1000 volumes.

Feb. 4.—Remarks on Professor Wyville Thomson's Preliminary Notes on the nature of the Sea-bottom procured by the soundings of H.M.S. *Challenger*, by William B. Carpenter, F.R.S.

The author began by referring to two of the questions started and partly discussed in Professor Wyville Thomson's communication.

The first of these questions is, whether the *Globigerinæ*, by the accumulation of whose shells the *Globigerina* ooze is being formed on the deep-sea bottom, live and multiply on that bottom, or pass their whole lives in the superjacent water (especially in its upper stratum), only subsiding to the bottom when dead.

Prof. Wyville Thomson has been led to adopt the latter opinion, by the results of Mr. Murray's explorations of the surface and sub-surface waters with the tow-net; while the close relation which they further indicate between the surface-fauna of any particular locality and the materials of the organic deposit at the bottom appears to Prof. Wyville Thomson to warrant the conclusion that the latter is altogether derived from the former.

The author, without calling in question the correctness of these observations, submitted, *first*, that they bear a different interpretation; and, *second*, that this interpretation is required by other facts, of which no account seems to have been taken by Prof. Wyville Thomson and his coadjutor. That the *Globigerinæ live on the bottom only*, is a position clearly no longer tenable; but that they live and multiply *in the upper waters only*, and only sink to the bottom after death, seems to the author a position no more tenable than the preceding; and he adduces the evidence which appears to him at present to justify the conclusion that whilst the *Globigerinæ* are pelagic in an earlier stage of their lives, frequenting the upper stratum of the ocean, they sink to the bottom *whilst still living*, in consequence of the increasing thickness of their calcareous shells, and not only continue to *live* on the sea-bed, but probably *multiply* there,—perhaps there exclusively.

That there is no *à priori* improbability in their doing so, is proved by the abundant evidence in the author's possession of the existence of foraminiferal life at abyssal depths obtained during the *Porcupine* expeditions of 1869 and 1870.

Of the existence of living *Globigerinæ* in great numbers in the stratum of water immediately above the bottom, at from 500 to 750 fathoms' depth, the author is able to speak with great positiveness. It several times happened, during the third cruise of the *Porcupine* in 1869, that the water brought up by the water bottle from immediately above the *Globigerina* ooze was quite turbid; and this turbidity was found (by filtration) to depend, not upon the suspension of amorphous particles diffused through the water, but upon the presence of multitudes of young *Globigerinæ*, which were retained upon the filter, the water passing through it quite clear. The contrast in size and condition between the floating shells and those lying on the bottom immediately beneath them was most complete.

The author then alluded to the observations of Dr. Wallich, with which his own are in entire accordance, and which leave no reasonable ground for doubt that the contrast is a consequence of their continued *life*. For it is clearly shown, by making thin transparent sections of the thick-shelled *Globigerinæ*, that the change of external aspect is due to the remarkable *exogenous deposit* which is formed, after the full growth of the *Globigerina* has been attained, upon the outside of the proper chamber-wall. This deposit is not only many times thicker than the original chamber-wall, but it often contains flask-shaped cavities opening from the exterior, and containing sarcode prolonged into it from the sarcodic investment of the shell. From these important observations, it seems to the author an almost inevitable inference that the subsidence of the *Globigerinæ* to the bottom is the consequence, not of their death, but of the increasing thickness and weight of their shells, produced by living action.

That the *Globigerinæ* which have subsided to the bottom continue to live there is further indicated by the condition of the sarcodic contents of their shells. In any sample of *Globigerina* ooze that the author has seen brought up by the dredge or the sounding apparatus, part of the shells (presumably those of the surface-layer) were filled with a sarcode-body corresponding in condition with that of foraminifera known to live on the sea-bed, and retaining the characteristic form of the organism after the removal of the shell by dilute acid. In the same sample will be found shells distinguishable from the preceding by their dingy look and greyish colour, by the want of consistence and viscidity in their sarcode contents, and by the absence of any external sarcodic investment; these are presumably dead. Other shells, again, are entirely empty; and even when the surface stratum is formed of perfect *Globigerinæ*, the character of the deposit soon changes as it is traced downwards. (See "Depths of the Sea," p. 410). These facts seem to the author to mark very strongly the distinction between the *living* surface-layer and the *dead* sub-surface layer; and to show that there is nothing in the condition of the deep sea that is likely to prevent or even to retard the decomposition of the dead sarcode bodies of *Globigerinæ*. There is a significant indication of the undecomposed condition of the sarcode bodies of the *Globigerinæ* of the surface-layer, in the fact that they serve as food to various higher animals which live on the same bottom.

It seems to the author clear, from the foregoing facts, that the *onus probandi* rests on those who maintain that the *Globigerinæ* do *not* live on the bottom; and such proof is altogether wanting. The most cogent evidence in favour of that proposition would be furnished by the capture, floating in the upper waters, of the large thick-shelled specimens which are at present only known as having been brought up from the sea-bed. And the capture of such specimens would only prove that even in this condition the *Globigerinæ* can float; it would not show that they cannot also live on the bottom.

That the *Globigerinæ* not only *live*, but *propagate*, on the sea-bottom, is indicated by the presence (as already stated) of enormous multitudes of very young specimens in the water immediately overlying it. And thus all we at present know of the life-history of this most important type seems to lead to the conclusion, that whilst in the earlier stages of their existence they are inhabitants of the upper waters, they sink to the bottom on reaching adult age, in consequence of the increasing thickness of their shells, that they propagate there (whether by gemmation or sexual generation is not known), and that the young, rising to the surface, repeat the same history.

The author then proceeded to show that the relation between the surface-fauna and the bottom-deposit is by no means as constant as Prof. Wyville Thomson and Mr. Murray affirm it to be.

It may be taken as proved that there is no want of foraminiferal life in the Mediterranean. To confirm this the author referred to the results obtained by various observers. That Foraminifera, especially *Globigerinæ*, abound in its surface-water at Messina, is testified by Hæckel in the passage cited by Prof. Wyville Thomson; and when it is considered how large an influx of Atlantic water is constantly entering through the Strait of Gibraltar, and is being diffused throughout the Mediterranean basin, and how favourable is its temperature-condition, it can scarcely be doubted that if the doctrine now upheld by Prof. Wyville Thomson were correct, the deposit of *Globigerina* shells over the whole bottom-area ought to be as abundant as it is in the Atlantic under corresponding latitudes. Yet the author found the deeper bottoms, from 300 fathoms downwards, entirely destitute of Globigerinæ as of higher forms of animal life; and this was also the experience of Oscar Schmidt.

The author can see no other way of accounting for the absence of *Globigerina* ooze from the bottom of the Mediterranean, save on its shallow borders, than by attributing it to the unfavourable nature of the influences affecting the *bottom-life* of this basin; that is to say, the gradual settling down of the fine sedimentary deposit which forms the layer of inorganic mud everywhere spread over its deeper bottom; and the deficiency of oxygen and excess of carbonic acid which the author has shown to prevail in its abyssal waters, giving them the character of a stagnant pool; these influences acting either singly or in combination.

Another fact to which Prof. Wyville Thomson formerly attached considerable importance as indicative of the bottom-life of the *Globigerinæ*, is unnoticed in his recent communication, viz., the singular limitation of the *Globigerina* ooze to the "warm area" of the sea-bed between the North of Scotland and the Faroe Islands. Details of the observation will be found in the author's *Lightning* and *Porcupine* Reports on the exploration of this region. On the "cold area" the author never found a single *Globigerina*; the bottom consisting of sand and gravel, and the Foraminifera brought up from it being almost exclusively those which form arenaceous tests. The "warm area," on the other hand, is covered with *Globigerina* ooze to an unknown depth; its surface stratum being composed of perfect shells filled with sarcode, whilst its deeper layers are amorphous. Near the junction of the two areas, but still within the thermal limit of the "warm," sand and *Globigerina* ooze are mingled; this being peculiarly noticeable on the "*Holtenia* ground," which yielded a large proportion of our most noteworthy captures in this locality. Now, if the bottom-deposit is dependent on the life of the surface-stratum, why should there be this complete absence of *Globigerina* ooze over the "cold area," the condition of the surface-stratum being everywhere the same? The author can see no other way of accounting for it than by attributing it to the drift of the cold underflow carrying away the *Globigerinæ* that are subsiding through it, towards the deep basin of the Atlantic, into which he believes that underflow to discharge itself. Prof. Wyville Thomson, however, denies any sensible movement to this underflow, continuing to speak of it as "banked up" by the Gulf Stream,* which here (according to him) has a depth of 700 fathoms; and this very striking example of want of conformity between the surface-fauna and the bottom-deposit consequently remains to be accounted for on his hypothesis.

The other of Prof. Wyville Thomson's principal conclusions relates to the origin of the "red clay," which he found covering large areas in the Atlantic, and met with also between Kerguelen's Land and Melbourne. Into this red clay he describes the *Globigerina* ooze as graduating through the "grey ooze;" and he affirms this transition to be essentially dependent on the depth of the bottom. And from the data which he gives he considers it an indubitable inference "that the red clay is essentially the insoluble residue, the *ash*, as it were, of the calcareous organisms which form the *Globigerina* ooze after the calcareous matter has been by some means removed." This inference he considers to have been confirmed by the analysis of several samples of *Globigerina* ooze, "always with the result that a small proportion of a red sediment remains, which possesses all the characters of the red clay." Prof. Wyville Thomson further suggests that the removal of the calcareous matter may be due to the presence of an excess of carbonic acid in the bottom waters, and to the derivation of this water in great part from circumpolar freshwater ice, so that, being comparatively free from carbonate of lime, its solvent power for that substance is greater than that of the superjacent waters of the ocean. He might have added probability to his hypothesis, if he had cited the observations of Mr. Sorby as to the increase of solvent power for carbonate of lime possessed by water under greatly augmented pressure.†

The author, however, after a careful examination of the data given by Prof. Wyville Thomson, thinks it is clear that no constant relation exists betweeen depth and the nature of the bottom.

The author agrees with Prof. Wyville Thomson in thinking that the remarkable uniformity of the "red clay" deposit, coupled with its peculiar composition, indicates that it is not derived from the land; and the author's suggestion is based on its near relation in composition, notwithstanding its great difference in appearance, to *Glauconite*—the mineral of which the greensands that occur in various geological formations are for the most part composed, and which is a silicate of peroxide of iron and alumina.

It is well known that Prof. Ehrenberg, in 1853,‡ drew attention to the fact that the grains of these green sands are for the most part, if not entirely, *internal casts* of Foraminifera; the sarcodic bodies of the animals having been replaced by glauconite, and the calcareous shells subsequently got rid of, either by abrasion, or by some solvent which does not attack their contents. It was soon afterwards shown by Prof. Bailey (U.S.), that in certain localities a like replacement is going on at the present time, the chambers of recent Foraminifera being occasionally found to be occupied by mineral deposit, which, when the shell has been dissolved away by dilute acid, presents a perfect internal cast of its cavities. The author then referred in this connection to the researches of Messrs. Parker and Rupert Jones on Mr. Beete Jukes's Australian dredgings, and to his own on a portion of the foraminiferal sand dredged by Capt. Spratt in the Ægean (kindly placed in his hands by Mr. J. Gwyn Jeffreys).

* See his "Depths of the Sea," p. 400.
† Proceedings of the Royal Society, 1862-63, p. 538.
‡ "Ueber den Grüusand und seine Erlauterung des organischen Lebens," in Abhandl. der Königl. Acad. der Wissensch. zu Berlin, 1855, p. 85.

The author said that alike in Mr. Jukes's and in Capt. Spratt's dredgings, some of these casts are in *green* silicates, and some in *ochreous*, corresponding precisely to the two kinds of fossil casts described by Prof. Ehrenberg.

The author, in the residue left after the decalcification of Capt. Spratt's dredgings, noticed a number of small particles of *red clay*, some of them presenting no definite shape, whilst others approximated sufficiently closely in form and size to the green and ochreous "internal casts" to induce him to surmise that these also had been originally deposited in the chambers of Foraminifera, their material being probably very nearly the same, although its state of aggregation is different. And if this was their real origin, he would be disposed to extend the same view to the red clay of the *Challenger* soundings.

In conclusion, the author submitted that if the red clay is (as he is disposed to believe) a derivation of the *Globigerina* ooze, its production is more probably due to a *post-mortem* deposit in the chambers of the Foraminifera than to the appropriation of its material by the living animals in the formation of their shells. That deposit may have had the character, in the first instance, of either the green or the ochreous silicate of alumina and iron, which constitutes the material of the internal casts; and may have been subsequently changed in its character by a metamorphic action analogous to that which changes felspar into clay. The presence of an excess of carbonic acid would have an important share in such a metamorphosis, and the same agency (especially when operating under great pressure) would be fully competent to effect the removal of the calcareous shells. This seems to the author the most probable mode of accounting for their disappearance from a deep-sea deposit, where no mechanical cause can be invoked. But in shallower waters, where the same excess of carbonic acid does not exist, and the aid of pressure is wanting, but where a movement of water over the bottom is produced by tides and currents, he is disposed rather to attribute the disappearance of the shells to mechanical abrasion. This is the explanation the author would be disposed to give of the disappearance of the shells from the green sand brought up by the *Challenger* in the course of the Agulhas Current; but whether it was mechanical abrasion or chemical solution that removed the foraminiferal shells whose internal casts formed the Greensand deposit of the Cretaceous epoch, must remain for the present an open question.

Linnean Society, Feb. 4.—Dr. G. J. Allman, F.R.S., president, in the chair.—Capt. Gilbert Mair and Dr. Llewellyn Powell were elected Fellows.—The following papers were read:—On *Arisæna speciosum*, by Mr. J. Gammie. The remarkable appendage to the spadix of this plant had been supposed to be connected with a contrivance to favour cross-fertilisation, but the author had been unable to find that it is visited by insects.—On the Algæ of Simon's Bay.—On the Fungi collected during the *Challenger* Expedition, by the Rev. M. J. Berkeley.—On the plants and insects of Kerguelen's Land, by Mr. H. N. Moseley. The author enumerated the insects met with during the visit of the party, including only one winged gnat, all the rest being apterous. A great quantity of one species were seen crawling over the *Pringlea*, but not on the infloresence.—On the origin and prevailing systems of phyllotaxis, by the Rev. G. Henslow. In this elaborate paper the object of the author appeared to be to trace all existing systems of phyllotaxis to modifications of the decussate as the simplest.—A discussion followed, in which Mr. Hiern, Prof. Dyer, Mr. A. W. Bennett, and Dr. Masters took part.

Zoological Society, Feb. 2.—Dr. A. Günther, F.R.S., vice-president, in the chair.—Mr. Sclater exhibited and made remarks on a fine skin and skull of a female Huemul (*Cervus chilensis*), and a pair of horns of an adult male of the same animal, forwarded by Mr. Edwyn C. Reed, of the National Museum, Santiago, Chili.—Dr. E. Hamilton exhibited and made remarks on some deformed sterna of the common fowl.—Prof. A. H. Garrod read a paper on the kangaroo called *Halmaturus luctuosus* by D'Albertis, and on its affinities, in which such points in the anatomy of the type-specimen were described as served to explain its systematic position. It was shown from the form of the premolar and molar teeth, from the nature of the fur, and from other minor details, that this species must be placed in the same genus as the *Dorcopsis brunii* (Müller), named more correctly *D. muelleri* (Schlegel). The species, therefore, should stand as *Dorcopsis luctuosa*, being the only other known species of the genus. It was also shown that *Dorcopsis*, together with *Dendro-*

lagus, form a well-marked independent group of the Macropoid Marsupialia.—Mr. Sclater read notices of some rare parrots now living in the Society's Gardens, and called special attention to examples of Goffin's Cockatoo (*Cacatua goffini*), and Bouquet's Parrot (*Chrysotis bouqueti*), as being amongst the rarest specimens.—A communication was read from Mr. Edward Bartlett, curator of the Museum and Public Library, Maidstone, containing a list of the mammals and birds collected by Mr. Waters in Madagascar, amongst which was a fine adult specimen of the Madagascar River-hog (*Potamochœrus edwardsi*).—A communication was read from Mr. E. P. Ramsay, containing remarks on the original skin of *Ptilonorhynchus rawnsleyi*, which he regarded as a hybrid between the Satin Bower-bird (*Ptilonorhynchus holo-cericeus*) and the Regent-bird (*Sericulus chrysocephalus*).—Mr. R. Bowdler Sharpe read a paper entitled "Contributions to the Ornithology of Madagascar," being the fourth communication on the same subject made to the Society. This paper contained descriptions of a new Accipitrine form proposed to be called *Eutriorchis astur*, a new species of *Atelornis*, proposed to be called *A. crossleyi*, and a new form of Nectariniidæ, to which the name *Neodrepanis coruscans* was assigned.—Dr. Günther, F.R.S., read a paper on some mammals recently collected by Mr. Crossley in Madagascar, amongst which were a new Lemur, proposed to be called *Chirogaleus trichotis*, and a new form of rodent, belonging to the Muridæ, for which the name *Brachytarsomys albicauda* was suggested.

Geological Society, Jan. 7.—Mr. John Evans, F.R.S., president, in the chair.—The following communications were read:—On the structure and age of Arthur's Seat, Edinburgh, by Mr. John W. Judd. The author said that Arthur's Seat, so long the battle-ground of rival theorists, furnished in the hands of Charles Maclaren a beautiful illustration of the identity between the agencies at work during past geological periods and those in operation at the present day. One portion, however, of Maclaren's masterly exposition of the structure of Arthur's Seat, that which requires a *second* period of eruption upon the same site, but subsequent to the deposition, the upheaval and the denudation of the whole of the Carboniferous rocks, is beset with the gravest difficulties. The Tertiary and Secondary epochs have in turn been proposed and abandoned as the period of this supposed second period of eruption; and it has more recently been placed, on very questionable grounds, in the Permian. The antecedent improbabilities of this hypothesis of a second period of eruption are so great, that it was abandoned by its author himself before his death. A careful study of the whole question by the aid of the light thrown upon it in comparing the structure of Arthur's Seat with that of many other volcanoes, new and old, shows the hypothesis to be alike untenable and unnecessary. The supposed proofs of a second period of eruption, drawn from the position of the central lava column, the nature and relations of the fragmentary materials in the upper and lower parts of the hill respectively, and the position of certain rocks in the Lion's Haunch, all break down on re-examination. While, on the other hand, an examination of Arthur's Seat, in connection with the contemporaneous volcanic rocks of Forfar, Fife, and the Lothians, shows that in the former we have the relics of a volcano which was at first submarine but gradually rose above the Carboniferous sea, and was the product of *a single* and almost continuous series of eruptions.—"The Glaciation of the Southern Part of the Lake-district, and the Glacial Origin of the Lake-basins of Cumberland and Westmoreland" (second paper), by Mr. J. Clifton Ward. The directions of ice-scratches in the various dales having been pointed out, the course of the several main glaciers was described, and it was shown how they must have become confluent in all the lower ground, forming a more or less continuous ice-sheet, which overlapped most of the minor ridges parting valley from valley, and was frequently forced diagonally across them. The positions of certain ice-grooves having an abnormal direction were described; in several cases these cross lofty ridges at right angles to their direction, and generally at passes or depressions along a water-shedding line. Most of those noticed had a generally east and west direction, and occurred at varying heights, from 1,250 to 2,400 feet. The author, while acknowledging the difficulty attendant upon *any* explanation, was inclined, though somewhat doubtfully, to regard these abnormal markings as due to floating ice, during the great period of interglacial submergence. The moraines were all believed to belong to the last set of glaciers. The subject of the "Glacial origin of Lake-basins" was then entered upon, and the following lakes discussed by means of diagrams drawn to scale, showing lake-depths, mountain outlines, and the thickness of the ice:—Wastwater, Grasmere, Easdale, Windermere, Coniston, and Esthwaite, together with several mountain tarns. In the case of Wastwater, the bottom was shown to run below the level of the sea for a distance of a mile and a quarter, and the deepest point to be just opposite the spot at which the only side valley joins the main one. While the greatest depth of the lake is 251 feet, the thickness of the old glacier-ice must have been fully 1,500; and, all points considered, Prof. Ramsay's theory of glacial erosion seemed to the author certainly to be upheld. In like manner, the same theory was thought to account for the origin of the other lakes mentioned, such ones as Windermere and Coniston being but long narrow grooves formed at the bottom of pre-existing valleys. Mountain tarns were held to be due sometimes wholly to glacial erosion, sometimes to this combined with a moraine dam, and occasionally to the ponding back of water by moraines alone, or moraine-like mounds formed at the foot of snow-slopes.

Chemical Society, Feb. 4.—Prof. Odling, F.R.S., in the chair.—A communication from Mr. G. Whewell, entitled "Test for Carbolic Acid," and a note on the action of anhydrous ether on titanic tetrachloride, by Mr. P. P. Benson, were read. Two crystalline compounds are obtained in this reaction: the one, boiling at 105° to 120° C., and melting at 42° to 48° C., has the composition $TiCl_4 (C_4H_{10}) O$; the other, titanium ethyl trichlorhydrine, $TiCl_3 (C_2H_5O)$, melts at 76° to 78° C., and boils at 186° to 188° C.—The last paper was by Mr. W. H. Perkins, F.R.S., on dibromacetic and glyoxylic acids.

Institution of Civil Engineers, Feb. 2.—Mr. Thos. E. Harrison, president, in the chair.—The paper read was "On the origin of the Chesil Bank, and on the relation of the existing beaches to past geological changes, independent of the present coast action," by Prof. Joseph Prestwich, F.R.S., &c.—This remarkable bank of pebbles, extending from Portland to Abbotsbury, a distance of nearly eleven miles, was described with great accuracy by Sir John Coode, M. Inst. C.E., in 1853 (*vide* "Minutes of Proceedings Inst. C.E.," vol. xii. p. 520). It was then 43 feet high and 600 feet wide at the south end, decreasing to 23 feet high and 510 feet wide at the north end. The pebbles diminished in size from Portland to Abbotsbury. Sir John Coode also stated that the shingle consisted chiefly of pepples of chalk-flint, with a small proportion of others of red sandstone, porphyry, and jasper, none of which could have been derived from local rocks. In order to determine their origin, he examined the coast from Portland to Start Point, and traced the flints to the chalk cliffs between Axmouth and Lyme, and the red sandstone, porphyry, and jasper pebbles to the new red sandstone of Budleigh Salterton and other places in Devonshire; whence he concluded that the only source from which the shingle of the Chesil Bank could have been derived was between Lyme Regis and Budleigh, and that it was propelled eastward along the coast to the Chesil Bank by the action of wind-waves, due to the prevalent and heaviest seas. The objection to this view urged at the time by the Astronomer Royal was, that the largest shingle occurred at the Portland end of the beach, or the most distant part from which it had travelled. More recently an old "raised beach," standing from twenty-one to forty-seven feet above the present beach, had been discovered on the Bill of Portland, and Prof. Prestwich showed that this beach contained all the materials found in the Chesil Bank, including also numerous chert pebbles from the Upper Greensand of the cliff between Bridport and Sidmouth. This raised beach was not due to any existing agency, but to causes in operation at a geological period so remote as the end of the glacial period, and before the land had assumed its present position and shape. Remnants of this beach could be found in or on the present cliffs, at intervals from Brighton to the coast of Cornwall, being more numerous in Devon and Cornwall, as the rocks were harder, than among the softer strata of Dorset and Hants, where, with few exceptions, the old line of cliff had been worn back and deeper bays formed. The travel of the shingle of this old beach was generally like that of the present beach, from west to east. The author considered that the action of the "Race" off Portland, and of the tidal waves during storms, combined to drive the shingle of the old beach at the Bill, and of that portion of it which must be spread on the sea-bed westward of Portland, on to the south end of the Chesil Bank, whence the shingle was driven northward to Abbotsbury and Burton, by the action of the wind-waves, having their maximum force from the S.S.W., a direction which he showed to be the mean of the prevalent winds. Here these wind-waves became parallel with the coast, and the westward movement ceased about Bridport, beyond which point the shingle travelled in the opposite direction, viz., from west to east, or from the coast of Devon to that of Dorset; the quartzite pebbles from the conglomerate beds of Budleigh Salterton, which travelled from that part of the coast eastward to and beyond Sidmouth, gradually diminishing in numbers as they approached Lyme, very few, if any, reaching Bridport. This conclusion was in accordance with the facts—(1) That the pebbles of the Devonshire and Dorset strata, which formed the shingle of the "raised beach," constituted also the bulk of the Chesil Bank; (2) That there were also, in that bank, pebbles of the rocks and flint of Portland itself; (3) That the largest pebbles occurred at the Portland end of the bank, the pebbles decreasing gradually in size to Abbotsbury. The large dimensions of the bank he attributed to the great accumulative and small lateral action of the waves. Prof. Prestwich next discussed the questions connected with the shingle of the south coast generally, and showed that the greater part of it was derived indirectly from beds of quaternary gravel and débris, from the wreck of the "raised beach," and partly from the strata of the chalk and other cliffs, and not altogether or directly from the present cliffs. He noticed, also, the westward movement of the shingle from Lulworth towards Weymouth, owing to the interference of the Isle of Portland with the force of the S.S.W. wind-waves, and considered that none of the Devon and West Dorset shingle beach now passed the Bill of Portland, and that other such breaks might exist to the eastward whenever similar conditions were repeated. He explained the origin of the Fleet, like that of the Weymouth backwater, and of the Lodmore Marshes, by the growth of the Chesil Bank on the one hand, and of the Ringstead and Weymouth Beach on the other, gradually damming in portions of the old coast line. Those beaches themselves travelled on a line along which the opposing forces of the wind-waves and tidal currents and the inertia of the mass to be moved were balanced. These views were stated to be in conformity with the theoretical opinion expressed on abstract grounds by the Astronomer Royal, and with the experience of practical persons residing on the spot. The paper was illustrated by sections and diagrams, showing the position and range of the "raised beach" along the coasts of Dorset and Devonshire.

Royal Microscopical Society, February 3.—Anniversary Meeting.—Mr. Charles Brooke, president, in the chair.—The Annual Report of the Council was submitted, and showed that the library, cabinet, and instruments were in a satisfactory condition; that seventeen new fellows, one honorary fellow, and one corresponding fellow had been elected during the year, and that ten had been removed by death.—The President read the annual address.—The result of the ballot for officers and Council for the ensuing year was as follows:—President, Mr. C. H. Sorby. Vice-Presidents: Dr. Robert Braithwaite, Mr. Chas. Brooke, Dr. J. Millar, and Dr. W. B. Carpenter. Treasurer, Mr. John W. Stephenson. Hon. Secs., Messrs. H. J. Slack and Charles Stewart. Council: Messrs. Frank Crisp, J. E. Inkpen, S. J. M'Intire, Henry Lee, W. T. Loy, Dr. Lawson, Dr. J. Matthews, Messrs. George Shadbolt, Chas. Tyler, F. H. Ward, F. H. Wenham, and Chas. F. White. Assist. Sec., Walter W. Reeves.

PARIS

Academy of Sciences, Feb. 1.—M. M. Frémy in the chair.—The following papers were read:—On the physico-chemical forces and their intervention in the production of natural phenomena, by M. Becquerel.—A note by M. Yvon Villarceau, relating to the discussion of the observations of the transit of Venus.—M. Leverrier then presented to the Academy a new part of the "*Atlas écliptique de l'Observatoire de Paris.*" This atlas represents a circular zone of 5 degrees breadth (2½° each side of the ecliptic), and on each map contains a space of 20 min. of R.A. Seventy-two maps will thus complete it, but it will doubtless contain several more for the vicinity of the equinoxes; all stars visible in a telescope of 24 centimetres aperture (about 9½ in.), down to the 13th magnitude inclusive, will be carefully mapped in it. Four plates of the new part just published are by MM. Paul and Prosper Henry, and contain 7,655 stars.—M. Leverrier then made some remarks on the results of the observations of the transit of Venus.—The Academy elected as candidates for the chair of Natural History of Inorganic Bodies, at the Collège de France, rendered vacant by the death of M. Elie de Beaumont, in the first place, M. Ch. St. Claire-Deville, and in the second, M. Fouqué.—The remaining papers read were the following:—On an "anallatic" telescope and its application to a levelling compass and a "tacheomèter," by M. C. M. Goulier.—On the general theory of percussions and the manner to apply it in the calculation of the effect of shots, and the different parts of the gun-carriages, by M. H. Putz.—A note on magnetism, by M. J. M. Gaugain. Another one on the same subject, by M. A. Trève.—On the magnetic anomaly of peroxide of iron prepared from meteoric iron, by M. L. Smith.—On the artificial reproduction of monazite and xenotime, by M. F. Radominski; these minerals are the very rare phosphates of cerium, lanthanum, and didymium.—On the pulverisation of manures and the best means to increase the fertility of soils, by M. Menier.—A note by M. H. Tarry, on the possibility of predicting for some days in advance the arrival in Europe of cyclones, which cross the Atlantic; these remarks were based on the fact that M. Tarry received telegrams on Jan. 11th from Boston and St. Pierre Miquelon, stating that a great cyclone had its centre in Newfoundland on Jan. 10th, and was taking its course eastward—that it was calculated to arrive in Europe by way of Ireland in four or five days. The cyclone actually reached Ireland on Jan. 15th, and progressed in an easterly direction for several days after.—MM. J. B. Schnetzler, Rohart, and Le Breton made some communications on Phylloxera.—On "viridic" acid, by M. C. O. Cech.—On a case of recovery from aneurism of the right external carotid artery through digital pressure, by M. J. A. Marques.—On the analysis and classification of cements, by M. Ducournau.—A note by M. Bonnet, on aërial locomotion.—A memoir by M. Maillard, on the treatment of cholera.—M. Gruey communicated the provisional elements of Comet VI., 1874, Borrelly.—M. Stephan transmitted an account of new observations of the comets of Encke and Winnecke.—M. Genocchi made some observations regarding M. Darboux' paper on the existence of the integral in equations with partial derivatives, containing any number of functions and independent variables.—M. Darboux made a communication on the same subject.—On hydrogenated iron, by M. L. Cailletet; account of experiments made by the author, showing that iron will absorb on the average 240 times its own volume of hydrogen, but after heating will not again absorb hydrogen, as Graham showed to be the case with palladium; the experiments gave results in accordance with those obtained by St. Claire-Deville, Troost, and Hautefeuille, in their researches on the passage of hydrogen through homogeneous bodies, and the compounds of hydrogen with alkaline metals.—On the molecular equilibrium of a solution of chrome alum, by M. Lecoq de Boisbaudran.—On perbromide of bromo-acetylene, by M. E. Bourgoin.—On the improvements in the quality of beetroot, by M. Ch. Viollette.—On a special butyric fermentation, by M. P. Schützenberger.—On the dilating action exercised by the glosso-pharyngian nerve on the vessels of the mucous membrane at the base of the tongue, by M. A. Vulpian.—On a new historical document relating to Salomon de Caus, by M. G. Depping.—A note by M. Neyreneuf, on the combustion of explosive mixtures.—A note by M. J. Kordon, on the composition and distribution of printing type.

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