Occultation of Star by the Moon (visible at Greenwich).

Feb.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.
			h. m.	h. m.	° °
26	7 Leonis	6½	5 16	6 7	112 291

March. h.
1 ... 23 ... Mars in conjunction with and 2° 37′ south of the Moon.
3 ... 19 ... Mercury in inferior conjunction with the Sun.

Meteor-Showers.

	R.A.	Decl.	
	°	°	
Near δ Virginis	192	2 N.	March 2 and 3.
From Sagittarius	280	17 S.	Very swift; streaks.

THE RELATIONS BETWEEN GEOLOGY AND THE BIOLOGICAL SCIENCES.[1]

IN the remarks which at our last anniversary I had the honour of offering from this chair, I congratulated the students of geology and mineralogy upon the new and intimate relations which, to their mutual advantage, are now growing up between those departments of science. It has, however, been suggested that, while geologists are thus being brought into closer alliance with mineralogists, the strong bonds of union which have so long united us with the biologists are becoming somewhat relaxed, and, indeed, stand in no small danger of actual dissolution.

Highly as I estimate the value of the *rapprochement* between the geological and mineralogical sciences, I for one should regard such a result as far too dearly purchased, if it necessarily involved any interruption of the close relations which have so long subsisted between geology and biology. But I cannot for one moment believe that such a grievous misfortune seriously threatens the cultivators of the two great departments of natural science.

Notwithstanding certain divergencies of opinion which have made themselves heard within an ancient University, and have awakened a faint echo in the halls of our National Museum, I cannot doubt that the teachers of geology and biology will easily discover a *modus vivendi* upon what is, after all, a subject of very secondary importance—the arrangement of natural-history collections.

No one can read recent declarations of the present Director of our National Museum without being impressed by his manifest desire to make the splendid collections under his care reflect, as completely as possible, the present condition of our knowledge of natural history. And if, on the other hand, we turn to the remarks made by the Keeper of the Zoological Department, at Swansea, in 1880, and to those of the Keeper of the Palæontological Department, at Manchester, last year, we shall find in those utterances ample guarantees that, in the arrangement of their collections, questions of practical convenience will not be lost sight of; we shall be satisfied that there is not the smallest danger of revolutionary ideas leading to the removal of "ancient landmarks," or of unattainable ideals being sought through the wholesale commingling of incongruous elements. The collections of our Universities are happily free from the conditions which must always hamper an institution where the interests of popular amusement have to be reconciled with those of scientific work; and it is for the teachers of natural science in those centres of thought to agree upon an arrangement which may best serve to illustrate their courses of instruction.

But while the discussion on museum-arrangement may be regarded as a purely academical one, which, after scintillating for a while in letters and pamphlets, died out in some not very formidable explosions at the recent meeting of the British Association, it may be wise on our part not to pass by quite unnoticed some indications of the attitude of the younger school of biologists towards palæontological science, this attitude having been very conspicuously manifested during the discussion in question.

If I rightly apprehend the views of some of my biological friends, as gathered not only from their published utterances, but also from private conversations, the position they are inclined to take up may be expressed somewhat as follows:—

"Palæontology has no right whatever to separate existence as a distinct branch of science. Fossils are simply portions of animals and plants, and ought to be dealt with as such; for all scientific purposes it is quite immaterial whether the organism which we are called upon to study expired only an hour since or died millions of years ago. Imperfect fragments can only be properly interpreted in the light afforded by the more complete structures found in recent organisms; and hence the naturalist who is engaged in studying a particular group of living organisms is the only person competent to deal with its fossil representatives. In our laboratories and our museums alike, therefore, fossil remains ought to be studied side by side with the living types which most nearly resemble them, and always by the same investigators. This being the case, it is neither necessary nor expedient that there should be a class of students whose chief concern is with extinct forms of life; and as for the geologists, they have really no farther concern with fossils than just to find them, attach a label indicating the period at which they must have lived, and hand them over to the biologist for study and incorporation in his collections. Any action beyond this can only be regarded, indeed, as an act of usurpation on the part of geologists, and must tend, not to the advancement, but to the injury of true science."

Such, so far as I have been able to gather them, are the extreme opinions which some biologists now entertain. It may, perhaps, seem presumptuous on my part to venture to offer a plea for palæontology, but there are considerations which may induce us to regard such a plea as coming better from one whose place in the ranks of the geological army lies nearer the centre than in the biological wing; from one who regards palæontology as the borderland of the geological and biological sciences—a borderland where the cultivators of both ought ever to meet, not for rivalry and aggression, but for the necessities of intellectual commerce and the advantages of mutual help.

The view of palæontology which I have ascribed, I believe not unjustly, to some biologists is one which has just such an amount of truth in it as to render it plausible, but at the same time, as I cannot but believe, is one of those half-truths which are proverbially more dangerous than downright errors. Palæontology is not, as has often been confidently asserted, simply a branch of biology; it is equally a part of geological science, and there are the strongest grounds, both of reason and expediency, for retaining it in that position. All geological science is based on the principle that the past can only be interpreted by the study of the present; Darwin was the intellectual child of Lyell, and the "Origin of Species" was the logical outcome of the "Principles of Geology." No palæontologist, worthy of the name, has ever dreamed of studying fossils except in the light afforded by the investigation of their recent analogues. Indeed, if we were to carry out the aggressive ideas of some biologists to their legitimate consequences, there would be left to us no science of geology at all; for why, it may be asked, should the study of physical processes in the past be carried on separately from the investigation of the same processes as exhibited at the present time? But then, by a strange Nemesis, I fear the same all-devouring physics, after swallowing up geology, would make very short work indeed with biology itself. And there is still in the background another claimant for universal empire in the realms of thought, for are there not some who dream of all sciences ultimately becoming the victims of that new portent of ambition—"geography"?

In considering the present position and future claims of palæontology, I may be permitted at the outset to offer a protest against a class of objections which has sometimes been very unfairly urged against the votaries of that branch of science. It has often been assumed that the students of fossils are contented with a lower standard of excellence than that which is aspired to by the cultivators of other branches of natural history. Now, setting aside for a moment the very important consideration that, owing to the imperfection of the remains which they are called upon to study, palæontologists are confronted by difficulties which do not beset the investigators of recent forms, I maintain that the charge is an altogether unjust one. Palæontologists are no more responsible for the unwise use made of fossils by incompetent persons than are zoologists for the vagaries of shell- and butterfly-hunters, or botanists for the absurdities of fern- and diatom-collectors.

Doubtless there has been much work done in connection with

[1] Address to the Geological Society by the President, Prof. John W. Judd, F.R.S., at the Anniversary Meeting, on February 17.

fossils, as well as with other natural history objects, of which we can only speak with shame and regret as having been undertaken unadvisedly and performed ignorantly,—work which, prompted by an unwise ambition, has been conceived in error and brought forth in presumption.

It would ill become anyone from this chair to speak lightly of the great, the inestimable services rendered to our science by the collectors of fossils. How many interesting and novel forms have been brought to light by their patient efforts! How often has the structure of obscure types been rendered clear through their constant and persevering endeavours to obtain more perfect specimens! Yet sometimes the very zeal of collectors has led them astray. Despairing of finding systematic zoologists and botanists who could devote the necessary time and attention to the study of objects which they have obtained with so much trouble and pains, they have unwisely undertaken, without the necessary training and knowledge, the naming and description of forms of life which required for their proper interpretation all the skill and experience of the most able comparative anatomist or vegetable morphologist.

I feel sure that, if those who have thus erred, through acting with "a zeal which is not according to knowledge," could realize the injury done to science by such proceedings, they would pause before burdening scientific literature with premature names, imperfect diagnoses, and ill-digested materials. Fossils are, it is true, "the medals of creation," and for the purposes of the historian of past geological times, it may seem that any name, however bad, which can be employed for purposes of reference must be better than none at all. But fossils, it must be remembered, are much more than mere "medals." They are the precious relics of the faunas and floras of bygone times; landmarks—the only ones we can ever hope to discover—which may serve to guide us in tracing the wonderful story of the evolution of the existing forms of life. Reverently—as the mineralogist treats meteorites, those pocket-planets and errant members of the outer universe—should the biologist regard fossils, the fragments of an earlier life, the collateral, if not the direct, ancestors of living types.

So far I am from thinking that the study of fossils ought in all cases to be undertaken by those who are actually engaged in working out their recent representatives, that I believe such a practical abolition of palæontology as a distinct branch of science would tend, not to the advantage, but to the injury, of both biology and geology. And I will venture to set forth my grounds for this conclusion.

It may be remarked at the outset that at a time when all the tendencies of biological science appear to be towards an extreme specialization, it is strange to find that there are advocates for the suppression of what is now so well-developed a department of biological science as palæontology. When the work to be done has become so vast that some biologists feel themselves compelled to restrict their studies and labours to the morphological, or even to the histological department, others to the embryological, the physiological, the taxonomic, or the chorological branches of zoology or botany respectively, why should not some concentrate their efforts upon the elucidation of the ancient forms of life? When the study of a single group, often a very limited group, of animals or plants is sufficient to exhaust the energies of a particular naturalist, it is surely not unreasonable that forms which have become extinct and have left only very imperfect evidence of their structure and affinities, and these requiring peculiar methods for their study, should attract the attention of special investigators.

The study of fossils, we may remark, if it be undertaken by any biologists, must fall to systematic zoologists and botanists, and these have become somewhat rare and out of fashion in modern times; so few in numbers, indeed, do they seem as to be scarcely able to cope with the ever-increasing array of living forms; and it would be a hopeless task if upon them were also cast the overwhelming mass of fossil ones.

Imagine the embarrassment and dismay of a student of living sponges, whose favourite (possibly his only) method of research has consisted in studying with the microscope innumerable thin slices cut from tissues and embryos, if a cartload of chalk-flinks were thrown down at his door, and he were required to interpret the fragments of sponge-skeletons which they contained in every conceivable variety of disguise through peculiar processes of mineralization!

There are, indeed, a variety of special reasons why ordinary systematic zoologists and botanists become, by the very habits acquired in their daily pursuits, singularly ill fitted for dealing with fossil forms.

In studying recent forms the zoologist or botanist is bound to take into consideration, in fixing the systematic position of an organism, not only its skeleton, but all its soft parts, and even the structure and mode of development of its embryo; he may also be called upon to note physiological peculiarities, before he is in a position to arrive at a decision as to its place in the zoological or botanical series. But for the student of fossil forms none of these aids are available, he is compelled to do his best without them. Investigators of the recent Mollusca are, of course, "malacologists," but he who studies the extinct forms of the group must perforce labour under the stigma of being "a mere conchologist." In examining recent vertebrates it is allowable to make every possible use of the aid afforded by a study of the ligamental skeleton, in unravelling their affinities; but he who works on fossil vertebrates is and must remain a pure osteologist. Botanists have been led to the conclusion that for the classification of plants the reproductive organs always afford the safest guides; but palæontologists, alas! are frequently called upon to do their best in deciphering fragmentary remains of the vegetative organs.

It is not, as some biologists would almost seem to imagine, that palæontologists are led by any perversity of mind to reject the light which is afforded to them, or that they are not deeply sensible of the great value and importance of many recent researches in respect to living forms; but simply that they realize—often very sadly realize—the impossibility of availing themselves of the help afforded by such researches, in connection with the very imperfect material with which they are called upon to deal.

If we were to suppose that a surveying ship brought home from a newly-discovered island a heterogeneous mixture of isolated bones and teeth, of shells, bits of stick and fallen leaves, zoologists and botanists might be perfectly justified in refusing to waste their time upon such unsatisfactory materials. But if, subsequently, news arrived that after the departure of the ship the whole island had sunk beneath the ocean, then the circumstances would have completely changed, and no pains and care would be felt to be too great if expended in dealing with such a unique collection, however imperfect it might be. Or, to take a case which has actually occurred, the curators of the Ashmolean Museum were fully justified in ordering the destruction of the moth-eaten dodo skin, so long as they had no reason for doubting that other and better specimens were procurable; but now no labour and pains is considered too great in studying the most imperfect fragment of the bird.

And here I may perhaps be permitted to say a word in defence of what has been treated as an absurd practice on the part of palæontologists—that of giving names to small fragments of organisms. It must be admitted that when subsequent investigation proves that distinct generic and specific names have been given to the root, the stem, the outer and the inner bark, the pith, the foliage, and the fruit of the same plant, the absurdity does seem striking. But it is impossible to defer giving a name to a fossil until all doubts about its structure and affinities have been completely settled by the finding of exceptionally perfect specimens. Nevertheless, it ought certainly to be insisted on that names should be given to very fragmentary fossils only by a competent naturalist, and that he must accept the responsibility of his act. A single tooth of a mammal may afford good grounds for the establishment of a genus and species, while it might be utter folly to treat the tooth of a shark in the same manner.

The remains of many extinct forms are in such a peculiarly mineralized condition as to require special skill and training for their proper interpretation. Skeletal elements which were originally siliceous are now represented by pseudomorphs in calcite, and *vice versâ*. Characteristic structures in bones, shells, or wood may be wholly obliterated, and mineral structures of a strangely deceptive kind may be developed in their place. The curious story of *Eozoon canadense* and its supposed allies is surely a sufficient justification for the existence of palæontologists—that is, of specialists trained equally in the interpretation of biological and petrological structures. Dr. Sorby has shown that whole families of Mollusca may disappear from a fauna because of the unstable condition of the calcic carbonate which composes their shells, and his conclusions have been confirmed by Mr. Kendall.

Prof. Sollas has similarly shown that the absence of the por-

cellanous types of the Foraminifera from the Palæozoic rocks may be due, not to their non-existence when those rocks were formed, but to the fact of their shells being composed of the unstable aragonite.

Such facts as these must convince any unprejudiced person of the absolute necessity, to the naturalist who attempts to study extinct forms, of an acquaintance with the nature of the mineral changes which organic remains undergo. In his interesting memoir upon those curious and enigmatical fossils, the Receptaculitidæ, Dr. Hinde has admirably shown the advantages of this combination of biological and petrographical study.

In this connection I cannot avoid alluding to a very prevalent and, as I cannot help thinking, very erroneous notion, that an intermingled zoological and palæontological collection, however inconvenient, would certainly be very instructive. To this view I offer the strongest protest, for I believe that the mistakes which would arise from the examination of such a collection would far outweigh any instruction to be derived from it.

I fail to see what useful lesson would be taught by swamping a collection of the lizards, snakes, tortoises, and crocodiles living at the present day with the vast slabs containing the relics of Reptilia which have existed in periods ranging from the Permian to the Pliocene. Nor is it apparent to me why the precious remains of *Archæopteryx* should be hidden away among a wilderness of bird-skins.

Any arrangement which could lead to the idea that even the richest collection of fossils is in any way commensurable with the assemblages of specimens that in our museums represent the existing fauna is very greatly to be deprecated. So numerous are the gaps among fossil faunas, owing to the fact that only animals with hard parts, and, as a rule, only those that lived in the sea, had any chance of preservation, that the finest palæontological collections are, and must always remain, extremely fragmentary. We have, in the past, fallen into so many and such grievous errors, by ignoring the imperfection of the geological record, that we may well hesitate before doing anything that would confirm this mischievous delusion.

On the other hand, it may be pointed out that our acquaintance with extinct forms of life has increased to such an extent in recent years that a biologist may well be pardoned for not realizing the vastness and importance of the problems involved in the study of fossils. It can only be a very inadequate idea of the value of palæontological evidence which leads fossils to be regarded (like the fauna and flora of a newly-discovered territory) as simply supplying a few missing links required to fill up gaps in a natural-history classification, or as the appropriate ballast for a Noah's Ark on a scale of national grandeur. Small as may be the whole bulk of a palæontological collection in the eye of the student of recent forms, its great and transcendent value depends on the fact that the objects composing it belong to the faunas and floras of periods widely separated from the present and from one another. The discovery of a new type of reptiles in the Trias is a very different matter from the detection of an equally remarkable form living in New Zealand. The latter may, it is true, be a singular survival of some old type; but the former is an actual landmark in the course of reptilian development; and by the study of the fossil we are actually brought much nearer to the solution of the problems connected with the history of that development than is possible by the study of any recent form.

In pointing out how vast has been the progress of our knowledge in recent years concerning the ancient life of the globe, I may remind you of the estimates made by Prof. Huxley when speaking from this chair a little more than a quarter of a century ago. He then characterized "the positive change in passing from the recent to the ancient animal world" as "singularly small"; and he regarded the extinct orders of animals as not amounting "on the most liberal estimate" to more than one-tenth of the whole number known. The evidence which has been accumulated during the last twenty-five years, however, has modified this estimate in a remarkable manner, as no one would be more ready to admit than the author of it himself.

There is no little difficulty in making a calculation of the proportion of living to extinct orders, owing to the discrepancies in the opinions of zoologists and comparative anatomists as to what are the characters which ought to be considered as of ordinal rank. For my present purpose I very gladly avail myself of the useful "Synopsis of the Animal Kingdom" prepared by Mr. E. T. Newton, which is "founded on the classification proposed by Prof. Huxley, with such modifications as are rendered necessary by recent discoveries."

We may, I think, take the whole number of living orders of animals generally accepted by zoologists at about 108. But in any comparison of these with fossil forms, it is only fair to exclude from our consideration such as possess no hard parts and stand little or no chance of being preserved in a fossil state. Few would be bold enough to doubt that such soft-bodied forms must have existed in the past, or that they probably bore about the same proportion to the forms with hard skeletons as in the existing fauna; even the boldest sceptic on this subject would, I should think, be convinced by such singular accidents as that of the finding of the impression of *Rhizostomites*, one of the Discophoræ, preserved in the soft calcareous mud of the Solenhofen Slate.

Now among the 108 living orders of animals, at least 36 are totally destitute of any hard parts capable of being preserved in a fossil state, and we have thus left 72 living orders with which our comparison of the extinct orders must be made.

What is the number of orders which must be created to receive extinct forms, is a question that has given rise to wide diversities of opinion in recent years. While few naturalists would consider 18 as an excessive estimate, there are others who would probably double that number.

Taking the lower estimate and comparing the 18 extinct orders with the 72 living ones which contain animals with hard parts, we find the proportion of extinct orders to be 20 per cent. of the whole number known at the present time.

But in comparisons of this kind, it must be remembered that there is an unconscious tendency among the students of recent forms of life to *under-estimate* the differences between extinct and living forms. If we take such groups as the *Graptolitidæ*, the *Monticuliporidæ*, and the *Stromatoporidæ*, of the nature of the polyps of which we can know nothing, we can only place them in existing orders on the ground of some very general analogies in the skeleton. How little this may be worth, recent zoological researches, like those of Prof. Moseley on the *Milleporidæ* and the *Stylasteridæ* have amply shown.

The students of existing forms of life have arranged their pigeon-holes; and into those pigeon-holes our unfortunate fossils are too often *made* to go. If there were no other objection to the wholesale commingling of recent and fossil types in a museum, there would be the valid and insuperable one arising from the fact that there are very considerable and important groups of fossils which cannot, without violence, be made to find any place in our accepted classification of existing animals—and perhaps never will.

If, however, we consider the modifications which have been brought about in our views concerning the relations of extinct to living forms by the important discoveries that have been made since 1862, we shall be impressed by the conviction that no comparison of the numbers of living and extinct orders can give any adequate idea of the important influence of palæontological studies upon biological thought. The discovery of transitorial forms, like the *Archæopteryx*, the toothed birds of America, and the reptiles with avian affinities, together with the working out of the rich faunas of the Rocky Mountains, of Pikermi, Quercy, and the Siwaliks, of the Pampean formations of South America, the Karoo beds of South Africa, and the caves of Australia, have already done much towards revolutionizing the ideas held twenty-five years ago by biologists concerning the significance and value of fossil forms. While the recognition of the less specialized precursors of such types as the horse and the elephant have perhaps produced most effect in removing objections to evolutionary doctrines, the light thrown by the study of fossil forms on the manner in which individual structures have arisen, as has been so well shown by Prof. Alexander Agassiz, in the case of the Echinodermata, opens up to us a wide and perhaps far more hopeful field of inquiry. We are, however, only at the beginning of the great task of utilizing the grand palæontological collections of mammals, of reptiles, of fishes, and of the various groups of the invertebrates, for explaining the significance and tracing the origin of the structures found in living types.

While maintaining that studies of this kind demand and justify the concentration of the labours of a special class of investigators, I feel sure that no one will misinterpret my meaning as to the qualifications required by the students of fossil forms. Far from suggesting that the palæontologist may be one destitute of a proper biological training, or that he may be satisfied with an equipment of knowledge which would be insufficient for a systematic zoologist or botanist, I would maintain that no one

has a right to take up the study and description of any fossil group until he has made a very careful and exhaustive study of its nearest living allies; but, in addition to this, he ought also to have made himself acquainted with the peculiar mineral changes which organic remains are liable to undergo. He will, moreover, be far more likely to interpret aright and to make the best use of the materials that come to his hand, if he have at least a general knowledge of what others working on similar materials belonging to other departments of the animal or vegetable world have been able to accomplish, and of the methods which they have followed. Such palæontologists, I insist, have as much right to recognition as any other class of biological specialists.

Still less should I wish it to be implied that I think systematic biologists can afford to be ignorant of the results of palæontological studies, in their own particular fields of labour. One of the most mischievous weeds that have accompanied the evolutionist in his incursions into various parts of the biological field is the preposterous "genealogical tree." We can scarcely turn over the leaves of a modern systematic work without finding it flourishing in full luxuriance. No sooner has the student of a particular group arranged his families, genera, and species, than he thinks it incumbent upon him to show their genetic relations. Very admirably has Prof. Alexander Agassiz pointed out the utter fatuity of such a proceeding. As Lyell used to say, in speaking of such proceedings, the imagination of the systematist, untrammelled by an acquaintance with the past history of the group, "revels with all the freedom characteristic of motion *in vacuo*." If for no other reason, zoologists and botanists ought to study fossil forms in order that, by encountering a few hard facts in the shape of fossils, they may be saved from these unprofitable flights of the imagination.

(*To be continued.*)

SCIENTIFIC SERIALS.

Rendiconti del Reale Istituto Lombardo, December 1887.—On the Tertiary formations near Cape La Mortola, in Liguria, North Italy, by Prof. T. Taramelli. The paper deals specially with the abrupt interruption which occurs in the prevailing Eocene and Secondary systems about this part of the Ligurian coast. This interruption is brought into connection with the great development in Liguria of the marine Pliocene formation, which in the Varo basin and near Ventimiglia stands at a present altitude of over 550 metres above the sea, but which does not occur at all further east in Istria and Friuli, where it is represented by thick alluvial deposits of vast extent.—On the neutralizers of tubercular virus, by Prof. Giuseppe Sormani. In continuation of his previous studies, the author here deals with twenty-one additional substances, or chemical reagents, making eighty altogether. According to their different action on Koch's Bacillus these are grouped in three categories: those that have no effect; those that only attenuate, and those that entirely destroy, the virus. As many as twenty-two, including camphorated chloral, the bromide of ethyl, and the nitrite of ethyl, are found to be effective.—Meteorological observations made at the Brera Observatory during the month of November 1887.

Rivista Scientifico-Industriale, January 15.—The crepuscular tints in connection with the hygrometric state of the atmosphere, by Prof. Costantino Rovelli. Constant observation shows that red and orange tints prevail in a dry, yellow and green in a moist, state of the atmosphere. This suggests a threefold division of the solar spectrum into (1) the region of warm rays transmitted by the lower atmospheric strata, and corresponding to a dry condition of the air; (2) the region of middle rays, yellow and green, more easily diffused and partly transmitted by the air in moist weather; (3) the region of cold rays diffused by an atmosphere abounding in aëriform vapour. The terrestrial dust suspended in the air, by condensing the aqueous vapour, as is now generally accepted, may also tend to produce those occasional after-glows of intense brightness, which have been so often observed after violent volcanic eruptions. The various character and intensity of the tints may all be thus explained by the theory of the eclectic transmission of the coloured rays by the corresponding states of the atmosphere, and partly also by the particles of dust held in suspense.—On the constitution of fogs and clouds, by Prof. F. Palagi. These phenomena are attributed to the presence of minute drops of water with diameter of 1/10 to 1/20 mm. at a temperature above zero. The recent observations made by the author on Mount Titano show that when the temperature falls below zero these globules are converted into minute hexagonal needles and flakes of the same form, the former about 1/20 mm. thick, and from two to ten times longer, the latter from 1/10 to 1/4 mm. in diameter. In their passage from the higher regions through the lower and less cold strata, but still below zero, these simple crystalline forms appear to be transformed by the process of condensation and agglomeration into the stars and flakes of ordinary snow. But when the temperature rises above zero they are again changed to the minute liquid drops of clouds, fog, and rain according to the varying degrees of altitude and temperature.

Bulletin de l'Académie des Sciences de St. Pétersbourg, vol. xxxii. No. 1.—On the effects of the earthquake of February 23, 1887, at the Observatory of Pavlovsk, by Dr. Wild (in German). The effects of the catastrophe having been observed at the Observatories of England, France, Italy, Germany, and Austria, in trepidations of the magnetic instruments, it was interesting to see whether the earthquake was felt as far as St. Petersburg. The results indicate that it was not.—On the genus Hemiculter and a new species of Hemiculterella, by N. Warpachowski (in German).—Russian words used in the Sagai dialect, and their phonetic modifications, by N. Katunoff; and lists of Sagai names of rivers, villages, and tribes, by the same. This little dictionary is highly spoken of by M. Radlof.—Studies, by O. Backlund, about the Pulkowa catalogue of stars, "Positions moyennes de 3542 étoiles," published in 1886 (in German). A detailed comparison of the Pulkowa catalogue with the measurements by Herr Romberg at Pulkowa, as also with the catalogues of Becker, Respighi, and Boss.—Hydrological researches, by Dr. Carl Schmidt.—The temperature-maxima before midday in tropical seas, according to the observations of the corvette *Vityaz*, by M. Rykatcheff (in German). They show the existence of two separate maxima, one of which sets in half an hour before midday and the other half an hour later. More extensive observations are needed.—On the synthesis of albumen in chlorophyll-bearing plants, by Chrapowitzki (in German). The chlorophyll spots must be considered as places where synthesis of both carbohydrates and albumen is going on.—New additions to the Asiatic Museum, by C. Salemann. Summaries of two Persian and three Kagatai manuscripts brought in by M. Pantusoff from the Semiryetchensk province.

THE *Izvestia* of the Russian Geographical Society (1887, iv.), contains most valuable papers and maps. Dr. Junker contributes a report on his seven years' journeys in Equatorial Africa, and his paper is accompanied by a map, 53 miles to the inch, of the region extending for ten degrees on the north of the Equator, between the 22nd and 33rd degrees of longitude. Two papers, by M. Potanin, contain a summary of the information gathered from the natives as to Eastern Tibet (the regions of Amdo and Kam), and the region of Central Mongolia situated between the Nan-shan, the Khangai, Hami, and the Utai-shan. Both papers are accompanied by maps, on a scale of 100 miles to an inch, and the two maps complement one another, so as to give a very accurate idea of the upper Hoang-ho. Of the other papers, one by M. Krasnoff, on the manners of life of the Kirghizes in the Semiryetchensk province, will be welcome to ethnographers. The same number contains also a list of fifteen places in Laponia, the latitudes and longitudes of which have been measured in 1864 by Captain Ernefeld; and, in a separate appendix, tables, by Prof. Sharnhorst, for the calculation of heights from barometrical observations. It is self-evident, although it is too often lost of sight, that the calculation of heights upon observations of the barometer, when it is made by means of logarithms, means a much greater accuracy of results than anything that can be obtained from a few observations of atmospheric pressure during a journey, and that some plainer tables would give the results with an accuracy quite sufficient for the accuracy of the data themselves. M. Sharnhorst's tables are an improvement upon those formerly in use, and ought to be introduced into every manual for travellers, instead of the usual logarithmical tables.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 26.—"Report on Hygrometric Methods. First Part, including the Saturation Method and the Chemical Method, and Dew-point Instruments." By W. N.