the Dachstein glaciers. He found that the so-called Karlseisfeld has since 1856 lost about 50-60 metres in thickness, the middle portion about 40-50 metres. The decrease in the thickness of the ice is most noticeable in the high and steep descent from the middle to the lower portion of this glacier. Here a piece of the glacier-bed—a rock of about 30 metres in height and 60 broad—has been laid quite bare. Up to 1856 the glaciers were steadily increasing, but since then the decrease has been equally incessant.

IN the ordinary air thermometer the pressure of the air in the thermometric bulb is generally measured by means of a mercury manometer. M. Schneebeli, of Zurich (*Archives des Sciences*), employs, instead of the latter, a metallic manometer, of the Hottinger-Goldschmidt system. The bulb of the thermometer terminates in a capillary tube, to which the manometer is connected by means of another capillary tube of lead. The space between the latter and the elastic membrane of the manometer is filled with glycerine. M. Schneebeli believes the arrangement capable of being really serviceable to industry, because of the simplicity of its construction and of the manipulations required. A mere reading of the position of the manometric pointer gives the temperature.

OUR ASTRONOMICAL COLUMN

COMET 1882, *b*.—In consequence of cloudy mornings, it is stated that this comet was not seen at Melbourne until 5 a.m. on September 10; it was visible with the telescope till within one minute of sunrise, and its intrinsic brightness was estimated equal to that of the planet Jupiter. The tail was well defined and bright, but extending only over 3° or 4° at most. At 5h. 24m. 51s. a.m. its right ascension was 9h. 45m. 46·61s., with 0° 53′ 36″ south declination.

At Adelaide the comet was remarked from the observatory on the morning of September 9, but Mr. Todd reports that a police-constable had seen it a few mornings previously.

Prof. Riccò observed it at 11 a.m. on September 22, with the Palermo refractor of 0·25 m. aperture; there was a trace of a tail towards the south-west. At the same hour on September 23 Prof. Millosevich saw it at Rome, and describes it as "un fiocchetto di lana disegualmente illuminato."

It appears by no means improbable that with our larger telescopes the comet may be visible till the end of the year, or later. About the time of new moon, or at midnight on January 8, its place will be in R.A. 6h. 53m., with 23° south declination, distant from the earth 2·21, and from the sun 2·57, so that it will be upon the meridian at 11h. 40m. p.m., with an altitude of more than 15° at Greenwich.

With regard to the distinguishing letter which has been attached to the comet in this column, Mr. T. W. Backhouse writes from Sunderland:—"Surely it is a mistake to call the present comet 'Comet *b* 1882.' Is not Well's comet *a;* the comet seen in the eclipse, *b;* the great comet, *c;* Barnard's comet, *d;* and Schmidt's, *e?*" On this point we should reply that the main or indeed only reason for attaching letters to comets as they are discovered is to afford a ready means of distinguishing them *while they are under observation:* when the orbits are catalogued the comets appear as I., II., III., &c., of a particular year. The comet of May 18 was only seen for a minute during the totality of the eclipse, having been looked for unsuccessfully morning and evening subsequently, at least by M. Trepied. It is not likely to be mentioned except in connection with the eclipse, and there is, consequently, no apparent utility in assigning a letter to it. We may take the opportunity to remark that M. Trepied, who did not regard this object as a comet while he had it in view, has informed us in conversation within the last fortnight that he is now quite convinced of its cometary nature.

THE NOVEMBER METEORS.—The first comet of 1866, in the track of which the periodical meteors of November are found to move, has probably just passed the aphelion point of its orbit, which is distant from the sun 19·673, the earth's mean distance being taken as unity. It may be interesting to note the character of the shower under this condition, should it be repeated when the earth arrives at the descending node of the comet's orbit on the evening of November 13.

On the morning of October 23, when the great comet was so favourably viewed in the vicinity of London, a number of bright meteors diverged from a point not far from the radiant of the November shower.

GEOGRAPHICAL NOTES

ACCORDING to the Russian newspaper *Sibir*, the meteorological expedition to the mouth of the Lena has started on board large boats provided with all necessaries for building a house, and for successful wintering. The station will be erected on the Tumanskaya branch of the Lena, if the water is deep enough in this branch to allow the passage of the boats. It is hoped that, with the exception of the three summer months, the reports of the station will reach Yakutsk regularly. They will be sent, first, by M. Jurgens to Bulun; thence they will be forwarded to Nerkhoyansk, where they will be taken up by the post, which will run twice a month instead of once every four months as before. In the summer, the *tundra* being covered with water, messages can be sent only *viâ* the Lena; they will be taken by the merchants who leave Bulun for Yakutsk, as soon as the ice is melted, and reach Yakutsk in the end of July; another message can be sent with the returning fishermen, who reach Yakutsk in September.

THE *Germania*, which conveyed the German North Polar Expedition to Kingawa in Cumberland Sound, has returned to Hamburg. When the *Germania* left Kingawa on September 6, the observatory was completed, so that observations had already begun. Besides the two larger expeditions sent out by the German Government, Dr. Koch has also been sent to Labrador in order to establish meteorological observatories among the missionary settlements of the Moravian brotherhood. Dr. Koch arrived at Hoffenthal Port on August 10, and was liberally supported by the missionaries. All the stations set down in the programme, viz.: Hoffenthal, Zoar, Nain, Ramah, Hebron, and Obak have now been established. A meteorological station has also been established on the Falkland Islands. It is to form an intermediary between the stations on the South American continent and that on South Georgia, and also to help in rendering more valuable the observations made on board of vessels passing through the neighbouring seas. Capt. Seemann, who was sent to the Falkland Islands by the Deutsche Seewarte, reports that work has begun.

A DESPATCH, dated September 19, has been received in Stockholm from the Swedish Meteorological Expedition at Smith's Observatory, Spitzbergen. It states that observations are being regularly made, and that all was well with the members.

THE November part of Hartleben's "Deutsche Rundschau für Geographie und Statistik" contains articles on land formations in the Sunda district, by Jos. v. Lehnert; on the position of women in the life of peoples, by Dr. M. Geistbeck; on the North Sea according to the investigations of the Norwegian Expedition during the years 1876 to 1878, by Dr. J. Chavanne; on the ethnography of Central Asia, by Prof. Ujfalvy; on the transit of Venus and the solar parallax, by Dr. J. Holetschek; on the hydrography of Africa and the Welle problem, by J. Chavanne. There is a good ethnographical map of Central Asia.

A CATALOGUE of the fine commercial collections in the Oriental Museum in Vienna has been issued, as also a small volume of "Neue Volkwirthschaftliche Studien über Constantinopel und das anliegende Gebiet." In the latter, especially, the ornithologist will find several things to instruct him.

THE Municipal Council of Paris has granted unanimously a gold medal of 120*l.* to M. Savorgnan de Brazza, for his discoveries in Tropical Africa.

LIEUT. BOVE, together with the Italians of the Antarctic Expedition scientific staff, arrived at Genoa all well.

THE well-known Bremen naturalist, Dr. Otto Finsch, to whose travels in Polynesia we recently referred, has just returned to Berlin. During the last six months the traveller was in New Guinea, and instituted anthropological comparisons between the Papuans and the Eastern Melanesians. He is accompanied by a native of New Britain, aged fifteen. His

sketches of New Zealand, New Britain, New Guinea, and the Caroline Archipelago are exceedingly well drawn and valuable. He brings about 1co cases of ethnographical specimens intended for the new Ethnological Museum at Berlin.

THE AIMS AND METHOD OF GEOLOGICAL INQUIRY[1]

IN entering upon the duties of this Chair I can hardly do better, perhaps, than try to set before you what are the primary aims and general bearings of that branch of natural science which we are about to study, and to indicate the nature of the problems with which it deals. In doing so I will endeavour at the same time to point out the method of research and the mode of reasoning which we must pursue if we are to be successful investigators. Geology (in which comprehensive term I include mineralogy and palæontology), is concerned in the first place with observations of minerals, rocks, and fossil organic remains, and in the second place with the inferences which may be drawn from those observations. Its object is thus not only to note the nature and position of the various materials which constitute the solid crust of our globe, but by processes of inductive and deductive reasoning to ascertain how minerals and rocks have been formed and caused to assume the different appearances which they now present. In few words, then, our science might be defined as an inquiry into the history or development of the earth's crust, and of the several floras and faunas which have clothed and peopled its surface. It thus treats of the genesis of oceanic and continental areas—of mutations of climate—of the appearance and disappearance of successive tribes of plants and animals. More than this, in revealing the past it throws strong light upon the present, and has, perhaps, more than any of the cognate sciences, tended to revolutionise our conceptions of nature, and to lead zoologists and botanists iato fruitful fields of inquiry which their own proper studies, no matter how assiduously prosecuted, could never have enabled them to reach.

Dealing, as geology does, with the operations of Nature in the past, it is obvious that before we proceed to interpret the record of the rocks we ought to have a clear knowledge of the mode in which Nature works at present. Without this preliminary knowledge, it is just as hopeless to attempt to decipher that record as it would be to endeavour to understand a page of Greek without having first mastered the grammar and rudiments of that language. We must turn our attention then, at the very outset, to a study of those great forces by the action of which the crust of our globe is being continually modified. It is essential that we learn to appreciate the work done by the atmosphere, by frost and snow and ice, by rain and underground water, by rivers and lakes, by the sea, by plants and animals, and by the subterranean forces, before we can hope to recognise the different parts which those various agents of change have performed in the past. All geologists are agreed upon this, and are ready to acknowledge it as the chief article of their faith. Nevertheless, this obligatory article has received different interpretations. Some, for example, have held that the present condition of things must be taken as the exact type of all the phases through which the earth's surface has passed, during the different stages of which we have any recognisable records preserved to us in the stratified rocks of the globe. They admit that countless modifications of land and sea have taken place—that the climate of particular areas has varied again and again—that the subterranean and volcanic forces have manifested themselves with unvarying intensity, now in one place, now in another—but they hold that all these changes have been accomplished upon the same scale and at the same rate as at present, and that, as a consequence, the development of floras and faunas, so far as that is dependent upon physical conditions, has proceeded no more rapidly in former times than in our own day. They do not, indeed, deny that in the very earliest stages of the earth's history the agents of geological change must have acted with greater intensity than now, but of such a period, they tell us, we have no certain evidence treasured up in the sedimentary rocks, or at least such evidence, if it should exist, has not yet been detected. Only allow time, they say, and the constant drop will wear away the hardest stone. The gradual elevation of land, which is now going on in certain parts of the globe at so slow a rate that some have been inclined to doubt whether there is any movement at all, would nevertheless suffice in time to lift tracts now within tide-wash into stupendous table-lands and mountains. Nor is it necessary, we are assured, to suppose that the apparent evidence of convulsive rending and displacement of strata, which is often so conspicuous in the heart of great mountain-chains and ranges, is really any proof of paroxysmal action. All the rupturing and confusion which we may note among the Alps and not a few mountain-regions, may quite well have been brought about, we are informed, in the most gentle and gradual manner.

Other theorists, again, are of opinion that, while the agents of change have necessarily been through all time the same in kind, they have yet varied again and again in degree, and that the present moderate condition of things cannot therefore be taken as an exact type and pattern of all preceding phases in the world's history. They cannot allow that the elevation of mountain-chains and the larger fractures and displacements of strata are the result of the repetition of such small movements of the crust as are taking place now. Admitting that considerable areas of the earth's surface are rising at the rate of a yard or more in a century, they yet cannot agree that this is a criterion by which to estimate the time required for the elevation of all protuberant parts of the earth's crust. They remind us that in our own day we have had experience of paroxysmal changes of level, nor can they doubt that similar sudden catastrophes must have happened oftentimes in the lapse of ages. They point to the appearance of ruin and confusion which may be traced along a line of mountain-elevation, and maintain that the broken and shattered strata are proofs of a more or less sudden yielding to enormous strain or tension. They do not deny that upheaval may have been going on over a given area at an extremely slow rate during long periods of time, but they argue that a point would at last be reached when the tension to which the strata were subjected could no longer be resisted. A sudden fracturing would at last take place—the strata would be violently dislocated, thrust forward, crumpled, and heaped, as it were, in confused and steeply-inclined masses along the main line of dislocation. Again, it is objected to uniformitarian views that these do not explain and cannot account for certain remarkable mutations of climate which are known to have occurred. It is not denied that the earth has been receiving for untold ages the same annual amount of heat from the sun, but it is maintained that, owing to certain astronomical changes, and the modifications induced thereby, that heat must have been very differently distributed over the globe at various epochs in the past. It is held, in short, that the climate both of the northern and the southern hemispheres has thus been frequently modified, and that in consequence of this the action of the geological agents has been influenced again and again—the decay and reconstruction of rocks the oscillations of the land—and the development of floras and faunas having been alternately accelerated and retarded according as extreme or moderate conditions prevailed.

Thus each school has its own method of interpreting the fundamental axiom of our science—that the Present is the key to the Past. And as the primary aim of geology is to interpret the stony record with a view to the reconstruction of our earth's history, it is obviously important that we should be able to satisfy ourselves as to which of these rival conceptions is most consonant with truth. In other words, we must do our utmost to ascertain which gives the most reasonable interpretation of geological phenomena. Each view must in its turn be tested by an appeal to facts, and a rigorous application of logical analysis. Probably we shall find that while there is much to be said on both sides, we can agree entirely neither with the one school nor the other. Before we are in a position, however, to discuss such questions, we must first have ranged over a very wide field of inquiry, and obtained a thorough grasp of the principles of our science.

Meanwhile, our chief concern in beginning our studies must necessarily be to detect resemblances between the present and the past. For every observation we make we must endeavour to discover a correlative phenomenon in the present order of things. And so long as we confine our attention to the facts before our eyes and to the more obvious interpretations of these which are suggested by forces now in action, we shall not fail to be impressed with the uniformity of nature.

We examine, let us suppose, a section of strata exposed upon the sea-shore or along the banks of a river. Our knowledge of the different kinds of sediment in course of transportation and

[1] The Inaugural Lecture at the opening of the Class of Geology and Mineralogy in the University of Edinburgh, October 27, 1882, by James Geikie, LL.D., F.R.S. L. and E., Regius Professor of Geology and Mineralogy in the University.