point is of paramount importance, especially since temperature observations are not merely the most important popularly, but they form besides the very groundwork of meteorology.

It is a remarkable circumstance that no country in Western Europe could be named, with perhaps the single exception of Ireland, of the meteorology of which so little is known as of England. The meteorological institutes and societies of Scotland, Norway, Denmark, Italy, Austria, Holland, Belgium, &c., have published discussions of atmospheric pressure, temperature, rain, and other of the meteorological elements based on the observations of many years, but we look in vain through the pages of the Journal of the English Society for the discussion of a single one of these elements for England. For any information which is to be had on these matters we must have recourse to the Journal of the Scottish Meteorological Society, in which the barometric and thermometric observations for England have been partly discussed. It is scarcely necessary to say that this essential part of the work of a meteorological society can only be properly performed by its paid officials. Viewed in this connection, it may be worth the consideration of the Council of the Society whether the tendency of the arrangement entered into with the Meteorological Office to supply that office with copies of observations, thus constantly throwing on their officials an enormous amount of mere copying, be not to preclude the Society from properly discharging this part of its work and taking a position among kindred societies which it ought to occupy.

We dissent from the position assumed by Dr. Mann when he states that "the practical outcome of the recent Conference of Meteorologists at Leipsig, of the Meteorological Congress at Vienna, and of the Maritime Conference in London, is an unmistakable and most satisfactory movement on the part of the leading authorities of meteorological science towards concerted and uniform action in the prosecution of their favourite pursuit." We have already stated (vol. x. p. 56) that the Vienna Congress did good work in the treatment of certain details which lie on the outskirts of meteorology, but it would be a mistake to suppose that at these international assemblies of meteorologists any concerted action was taken which would lead to uniformity of observation of atmospheric temperature, pressure, humidity, or rainfall—anything, in short, that would place the observation of these phenomena on an international basis for the subservience of international objects ; in truth, the Congress can scarcely be said to have got the length even of attempting any concerted action towards uniformity of observation of these elements which are the very life-blood of the science.

*DR. BECCARI'S DISCOVERIES IN HERPETOLOGY**

NOT long ago we called the attention of our readers to the herpetological discoveries of a German naturalist and traveller in New Guinea and the adjoining islands. We are now indebted to the Marchese G. Doria, of Genoa, for an account of the investigations of an Italian explorer, Dr. O. Beccari, in the same countries, although not quite in the same localities. The memoir before us treats of a collection of Reptiles and Batrachians made by Dr. Beccari in Amboyna, the Aru Islands, and the Ké Islands, in 1872 and 1873, which contained altogether 670 examples referable to fifty-three species. As regards Amboyna, not much novelty could be expected, this island having been thoroughly explored years ago by the Dutch naturalists. But the two other groups of Papuan islands to which Dr. Beccari devoted his attention were almost *terræ incognitæ* as regards herpetology; Mr. Wallace, their previous explorer, having devoted himself mainly to birds and insects. Here, therefore, Dr. Beccari's collections prove to have contained much interesting material, of which our author gives us an excellent account, illustrated by some carefully executed plates.

The species actually new to science in Dr. Beccari's collection are not numerous, but it is of interest to find that the general character of the reptilian fauna of the Aru and Ké Islands is, like that of their birds, essentially Papuan. In the latter group, however, there is rather a stronger infusion of Indo-Malayan forms. In the Ké Islands the Australian Death-adder, *Acanthophis antarcticus*, which spreads over the whole of the Papuan region, is very abundant. In Aru the Saurians are more numerous in species than the Ophidians, but in the Ké Islands the contrary is the case. No Batrachian was met with by Dr. Beccari in the latter group of islands, whereas three were found in Wokan, the northernmost of the Aru group, one of which was the widely-spread *Pelodryas cæruleus* of Australia.

This memoir forms part of the sixth volume of the "Annals" of that young and flourishing institution, the Museo Civico of Genoa, of which its author is the originator and director ; and, like most of the papers published in the five preceding volumes, contains much matter that is interesting to the naturalist.

* "Enumerazione dei Rettili raccolti dal Dott. O. Beccari in Amboina, alle Isole Aru ed alle Isole Kei durante gli anni 1872–73," per G. Doria. Estratto dagli Ann. del Mus. Civ. di St. Nat. di Genova. Vol. vi. 1874.

ARCTIC GEOLOGY

THE following notes on this subject will be of some interest at the present time.

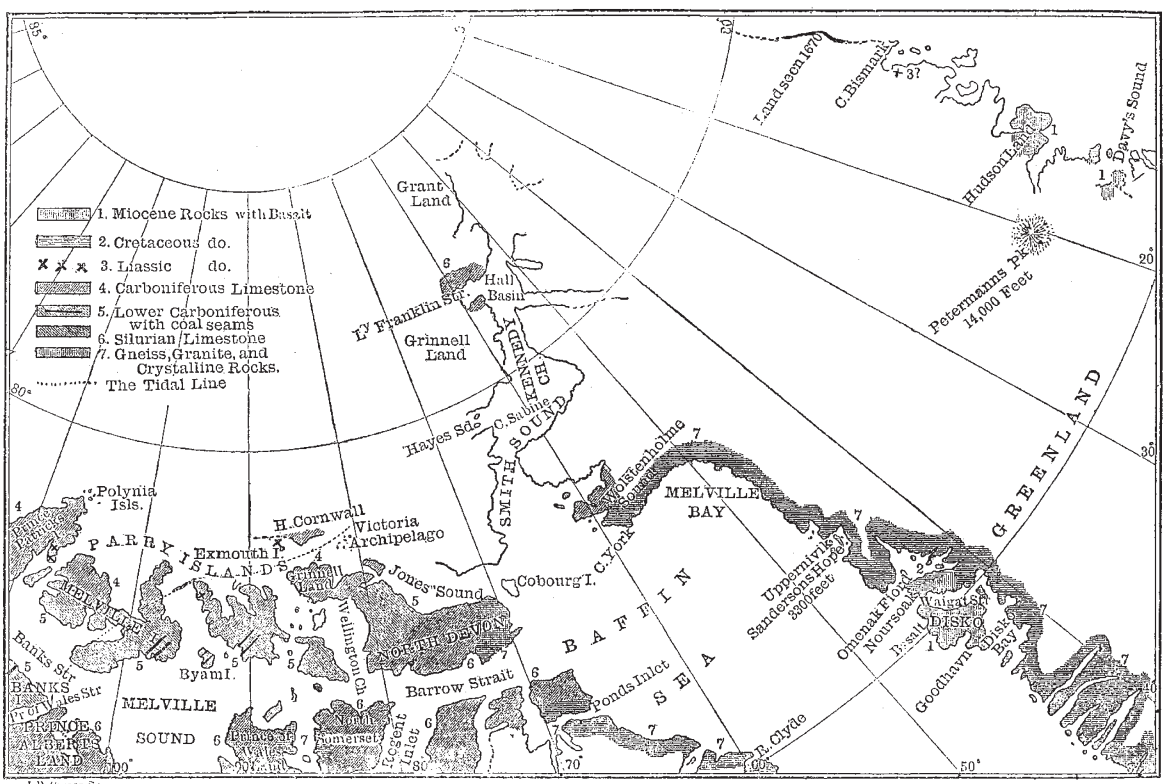
Greenland.—Glacial Phenomena.—An examination of the Chart of the North Polar Sea lately issued by the Government,* shows that Cape Bismarck, the most northern point reached by the German Expedition of 1870, on the east coast of Greenland, is in 77° N. lat., and about 2° south of land seen in 1690. On the west coast, the results of the American Expeditions, 1859—73, prove the continuation of Smith's Sound, through Kennedy Channel, Hall Basin, Robeson Channel, into Lincoln Sea, the broken and indented coasts of which in 84° N. lat. are only 40 degrees north-west of the land seen on the east coast in 1690, giving evidence of a series of islets forming the northern frontier ot Greenland ; the entire western coast is surrounded by a circlet of bare bleak islets 2,000 feet in height, separated from each other by fjords, through which passes the overflow of the great *mer de glace* which covers the country to an unknown depth, and covers up all sight of the rocks of the inland districts. Here and there this "inlands iis" of the Danes reaches the sea, and terminates in a steep cliff, *Sermik Soak* (ice-wall), of the Esquimaux, reaching 3,000 feet in height, where deep glens and fjords penetrate into the country. From the top of these ice-streams Dr. Rink found the surface rising by a series of steps, to the general level of the ice-field, which Dr. Kane describes as the "escaladed structure" of the Greenland Glacier. Once on the ice-field, and leaving the coast, the effect has been described as being similar to that of the land fading away when sailing out to sea—the ice rises gently and almost imperceptibly inland ; Prof. Nordenskjöld, who travelled thirty miles inland, found its surface there to be 2,000 feet above the sea. Thus the surface of Greenland beneath the ice must be considerably lower than the islands surrounding it, between which and the ice-wall is the narrow strip of ground on which, and on the islands, the Danish settlements are situated. In summer the snow which covers the great ice-desert melts, and rivers of icy-cold water flow over the surface and fall into the crevasses of unknown depth. These are exceedingly numerous, and apparently increase in number, on penetrating into the

* Chart to accompany Paper and Correspondence relating to the equipment and fitting out of the Arctic Expedition of 1875.

inland district, where not one trace of life, one patch of earth, or one single stone occurs to enliven the monotony of a silent and to the eye motionless ocean, extending for 1,200 miles from north to south, with a breadth of 400 miles. When the additional matter of eight months' snow is poured upon it the glacier overflows, finding a way through the fjords, the overflow corresponding to the effluent glaciers, some of which, like the Humboldt Glacier in Smith's Sound, are sixty miles in width. Where no fjords are available, the ice pours over the cliffs, hanging until gravity overcomes its cohesiveness.

Dr. Rink believes that the outpour of the Greenland precipitation of snow and rain in the form of glacier ice amounts to only two inches, while he estimates the fall at twelve inches; so that, as the evaporation must be exceedingly small, a large portion of the remaining ten inches must be carried off by sub-glacial rivers: Dr. Rink instances a lake which rises whenever the glacier river disappears. The effect of these streams on the *moraine profonde*, or *couche de boue*, as Agassiz called it, the result of the trituration of the rocks over which the ice passed, must be considerable, and accounts for the muddy water found opposite the entrance of all ice fjords, and the eventual choking up of the channels through which the bergs, broken off from the face of the "Iis-blink" (ice-glance) of the Danes, plough their way on their journey seawards, the direction of which is entirely governed by that of the currents, and not invariably, as often imagined, from the north to the south.

Ground-ice has been shown by Dr. Henry Landor to form in Canadian streams, when the thermometer is at zero, being most abundant where there is no surface-ice; as it gradually thickens, it becomes honey-combed in the direction of the current, the water flowing through



Geological Sketch-Map of Arctic Archipelago and Greenland. Compiled by C. E. De Rance, F.G.S. The Topography from the Admiralty N. Polar Chart.

the tubes. In course of time it floats, bearing up the stones to which it is anchored, often of large size, descends the stream, and becomes frozen up in the surface-ice. The movement of these ice-floated boulders often produces grooves on the faces of cliffs, as well-marked, according to Sir W. Logan, as those of glacial times.

Ground-ice laden with sea-weed, stones, and gravel, often rises in the shallow portions of the Baltic, where sheets of boulder-laden ice are driven by storms, and packed on the coast to a height of 50 feet. In Davis Straits the sea-water has a specific gravity, according to Scoresby, of 1·0263, and freezes at 28½° F., when the salt, 5¾ oz. to the gallon, is precipitated, and the "bay-ice" of the whalers is formed, which eventually becomes a floe, and afterwards pack-ice. The ice, in summer, melts on the sides of the channel before that in the centre, which constitutes the middle ice of the whalers; but between the open water and the land a narrow fringe of ice still hangs to the cliff, the "iis-fod" of the Greenland Danes. This, receiving large quantities of land-slips and other débris from the cliffs, afterwards breaks up and floats seawards, grazing the rocks at low tide, and on melting, deposits the fragments at the bottom of the sea; thus forming a close analogy to those conditions which prevailed when the English boulder-clay was deposited, beneath which the rocks are smoothed and scored, in positions that render it improbable that it was done by glacier ice; the latter prevailed, however, in Britain both before and after the period of submergence. The occasional patches and nests of sand and gravel found in boulder-clay may well have been derived from portions of the gravel-laden ice-foot which became entangled in the pack-ice. Masses of débris-laden ice-foot derived from one district are often driven by winds and high tides on to the coasts of other districts, which well explains the lines of more or less rounded tumultuous gravels found in many parts of Britain.

Kane's and Hayes' expeditions found distinct terraces

at various levels from 32 to 110 feet above the high-tide mark of Smith's Sound, and everywhere along the known coast of Greenland. The hollows are described as being filled up with glacier-clay, containing in places Echinodermata, Crustacea, and Mollusca of local Arctic species, with the exception of two, *Glycimeris siliqua* and *Panopæa norvegica*, and extending up to 500 feet above the sea. In the banks overlooking the glaciers, and in nodules of this clay, occur the well-known impressions of the Angmaksaett (*Mallotus arcticus*, O. Fabr.), a fish still living in Davis Straits; of which nodules several examples are preserved in the British Museum, split longitudinally. The great density of the nodules is noticeable, and the analogy to the iron-stone nodules of the coal measures containing plants very striking.

Recent depression of West Coast of Greenland.—Arctander, between 1777-9, noticed that land in a firth called Igalliko (60° 43′) was submerged at spring tides, though buildings with walls five feet in thickness still remained on it; half a century later, the tract was entirely submerged, the ruins being alone visible.

Julianshaab was founded at the mouth of the firth in 1776, near a rock called the "Castle" by the Danes, by which they erected a storehouse, submerged when Dr. Pingel, of Copenhagen, described it in 1835; and he found a village deserted near the glacier which now separates Fredrikshaab from Fiskernaes, on an island now overflowed. The Moravian village of Lichtenfeld, founded in 1758, had to be moved forty years later, and the poles to which the omiaks (women's boats) were tied still remain uncovered at every low tide. Houses of the time of Egede, the Apostle of Greenland, 1721-36, have now the sea flowing into them at high tide.

Attempt to advance from the coast on the inland ice.—In 1728 a Danish expedition was sent to endeavour to re-discover the lost (East) Greenland, but failed. In 1751 a Danish merchant, Dalager, advanced inland from about 62° 31′, and in two days reached some mountain peaks projecting above the ice, eight miles within the ice-field, but was then obliged to retreat, and returned to Fredrikshaab. In July 1870 Prof. Nordenskjöld and Dr. Berggren advanced from the head of Auleitsivikfjord over the inland ice thirty miles, to a point 2,200 feet above the level of the sea, in lat. 68° 22′ N., passing magnificent rivers, which, flowing between walls of blue ice, eventually disappeared in vertical chasms in the ice, probably 2,000 feet in depth. On the surface of the ice they found a sandy trachytic mineral, scattered like a grey sand, which has been named Kryokonite, and on it, and sometimes on the ice, brown polycellular algæ, the dark masses of which, absorbing the sun's rays, cause the ice to melt, forming the deep holes which traverse the surface.

In Melville Bay, N.W. Greenland, Sutherland describes the glaciers reaching the coast and forming a continuous wall seventy to eighty miles in length, and 1,200 to 1,500 feet in height, of which about one-eighth is above; the Esquimaux required 300 fathoms of line to reach the bottom of the face of the ice, in halibut fishing. In lat. 68°, near Clanshaven, and where valleys come down to the coast, the thickness of the ice is sometimes as much as 2,400 feet. The largest icebergs are launched from Melville Bay. Further north, beyond Cape York, the glaciers are smaller, through greater cold, producing smaller evaporation, while further south the air is charged with watery vapour from the Atlantic.*

M. Delesse describes shelly deposits on sand beds in the Arctic seas east of Southampton Island and in Fox's Channel, and as far north as 77° near Smith's Sound, at depths of more than 200 metres in some instances, the cold being less intense at this level. In Hudson Straits, Baffin's Bay, and the various straits intersecting Arctic lands, muddy sediment prevails, due to the waste of the palæozoic schists of the North American continent and the precipitation of sediment being favoured by the impeding effect of the land-locked and ice-locked seas on the agitation of the waters, and to the immense quantities of mud brought into the sea by the glaciers which extend over the Arctic regions.

In Davis Straits, from Cape Farewell to Smith's Sound, the channel, varying in depth from two to 200 fathoms, is stated by Dr. Sutherland to swarm with Echinoderms and brittle Starfish. In Melville Bay, Ascidians, Cirripedes, and seaweed attached to the rocks, do not appear to be often grazed by the bergs, though at times they reap immense crops of Laminaria, with broken shells of *Mya* and *Saxicava*, entangled in their leafy masses, torn from a depth of 100 fathoms. When the bottom is very hard the berg is brought to a stand, and even when consisting of soft mud or clay the same effect is produced by a berg, moraine or talus being pushed up by the movement of the berg. In Davis Straits the bergs are so covered with earthy matter as to resemble rocks, boulders weighing 100 tons often lying on their surface or frozen into their mass. Submarine banks thrown up in this way constantly increase in size by the clustering of small bergs on them, and form the haunt of shoals of cod and halibut, and myriads of sharks. As the ice melts, brown slime, liberated from the ice, is rolled into pellets by the ripple of the water, and is deposited in beds near the coast, resembling the berg-mehl of Sweden.

Prof. A. E. Nordenskjöld, who accompanied the Swedish Expedition to Greenland in May 1870, describes the water off that coast as being a decided greyish brown colour, especially in Davis Strait, off Fiskernaes, and at other times greyish-green. This was found to be due to brown and green slimes of organic origin, which spread over hundreds of thousands of square miles, and afford food for not only Crustacea and Annelides, but to swarms of birds and to the whale; this slime was examined by Dr. Öberg, and found to consist of various species of siliceous Diatomaceæ.*

South Greenland.—Prof. G. C. Laube,† the geologist attached to the second German North Polar Expedition, in his geological map of South Greenland, represents the east coast, as far as 61° N., as chiefly composed of granite and gneiss, which also extends from Cape Farewell to Julianshaab, near which, at the head of Tunnudleorbik, red sandstone and amphibolite occur, between which and the sea there is a large arm of hornblende granite with a belt of zircon granite intervening. Westward is a syenite granite, as far as Nunarsoit.

Dr. Karl Vrba,‡ who examined microscopically more than 200 rocks collected by Laube, of which the exact locality was known, found the following varieties:—Gneiss, granite, eurite, syenite, orthoclase porphyry, diorite, diabase, gabbro, and weichstein, including serpentine, &c.

South-West Greenland.—In lat. 61° N., Dr. Pingel, the geologist attached to the Danish Expedition of 1828, under Graah, to seek the lost Icelandic colonies, discovered the red sandstone of Igalliko and of the fjord of Tunnudleorbik. No fossils have been discovered, but it is believed to be of Devonian age; the rock is hard and composed of fused quartz particles. This is probably the same bed as that found by the German Expedition a little to the south.

The gneiss, mica schist, hornblende schist, syenite, &c., pierced by granite veins§ of Southern Greenland, continue throughout the whole of the west coast. From it the Greenlanders derive the steatite from which they make their lamps and other utensils. C. E. DE RANCE

(*To be continued.*)

* Quar. Journ. Geol. Soc., vol. ix.

* *Geological Magazine*, vol. ix, p. 298. *The Farmer*, Jan. 1, 1868, p 16.

† Sitzungsberichte der Kaiserlichen Akad. der Wissenschaften, 187 p. 17.

‡ Op. cit., 1874, p. 62.

§ From these narrow veins of granite, rich in felspar, Von Cotta records the presence of orthite and titanite.