

have been shown to do, two contemporaneous but dissimilar climates, separated only by a few miles horizontally and by 300 fathoms vertically.

But further: the Temperature-soundings taken in the *Porcupine* Expeditions of 1869 and 1870 have conclusively shown that a temperature as low as $36^{\circ}5'$ prevails over the deeper parts of the North Atlantic sea-bed; this reduction being due to the pervasion of Arctic and Antarctic waters, which come to replace the superficial flow of Equatorial water (as in the Gulf Stream and other currents) towards the Polar areas. In conformity with this depression of temperature, many species of Mollusca, Crustacea, and Echinodermata, formerly supposed to be purely Arctic, have been found to range southwards in deep water as far as the Straits of Gibraltar; and we have shown it to be highly probable that an extension of the same mode of exploration would bring them up from the abysses of even intertropical seas, over which a similar climate prevails, and that an actual continuity may thus be found to exist between the Arctic and the Antarctic Fauna. This idea was well put forth some years since by our excellent friend Prof. Lovén, of Stockholm, in his discussion of the results of the deep-sea dredgings executed by the Swedish Spitzbergen Expedition of 1861, under Torell. "Considering," he says, "the power of endurance in these lower marine animals, and recollecting the facts, that properly Arctic species which live also on the coast of Europe, are generally found there at greater depths than in their proper home, and that certain Antarctic species very closely agree with Arctic species, the idea occurs that, while in our own seas and those of warm climates, the surface, the coast line, and the lesser depths are peopled with a rich and varied Fauna, there exists in the great Atlantic depression, perhaps in all the abysses of our globe, and continued from Pole to Pole, a Fauna of the same general character, thriving under severe conditions, and approaching the surface where none but such exist in the coldest seas."

But whilst the question of Deep-sea Temperature is one of the greatest Biological interest, its determination is of even greater importance to the Geologist, as affecting his interpretation of the phenomena on which his belief in a former general prevalence of a Glacial climate is founded. For if a Glacial temperature should be found now to prevail, and types of Animal life conformable thereto should prove to be diffused, over the deeper portion of the *existing* Sea-bed in all parts of the globe, it is obvious that the same may have been the case at *any* Geological epoch; for there must have been deep seas in all periods, and the Physical forces which maintain the oceanic circulation at the present time must have been always in operation, though modified in their local action by the distribution of land and water existing at any particular date. And as the elevation of the present deep-sea bed of even the Intertropical oceanic area would (if we have correctly interpreted the results of our own and others' observations) offer to the study of the Geologist of the future a deposit characterised by the presence of Polar types, so must the Geologist of the present hesitate in regarding the occurrence of Boreal types in any marine deposit as adequate evidence *per se* of the general extension of Glacial action into temperate or tropical regions. At any rate, it may be considered as having been now placed beyond reasonable doubt, that a Glacial Submarine climate may prevail over any area, without having any relation whatever to the Terrestrial climate of that area.

These views are offered by us with the more confidence, since they are in harmony with the deductions already drawn by Geologists of eminence from facts observed by them. Thus I find on my return from the Mediterranean a letter from Principal Dawson, of Montreal, from which I am sure he would permit me to make public the following extract:—

"... In reading your recent interesting publications on the Life of the Deep Sea, it occurred to me to mention to you that the fact which you have proved on the European coast, as to the existence and action of cold Arctic currents on the bottom of the ocean, was affirmed by me years ago for the American coast, on geological and geographical evidence, and was applied to the explanation of the Post-pliocene climate. On the American coast we have the cold currents in shallower water than you have now; though in the Post-pliocene you had them in shallow water also. It is true that the Glacial theories of Agassiz and others have prevented the proper amount of attention to these facts; but I have insisted on them again and again, and fully believe that the varying distribution of the cold and warm currents, depending on the elevation and depression of the

sea bottom, will account for most of the differences of climate indicated by fossils and boulders from the Laurentian to the Modern period. I have some new and unpublished facts on this subject, which I intend to bring out in connection with the work I am now doing with the help of your brother, in the Post-pliocene geology of Canada."

In conclusion, I venture to anticipate that the words with which I concluded my lecture at the Royal Institution, "On the Results obtained in the *Lightning* Expedition of 1868," will be found to have been fully justified by those of the "*Porcupine* Expeditions" of 1869 and 1870; and that whatever may be thought of the notion that "we are still living in the Cretaceous epoch," we have furnished adequate proof that the formation of Glacial beds was not limited to any special Geological period, but that they are now, and have been through all time, in course of deposition:—"The facts I have now brought before you, still more the speculations which I have ventured to connect with them, may seem to unsettle much that has been generally accredited in Geological Science, and thus to diminish rather than to augment our stock of positive knowledge; but this is the necessary result of the introduction of a new idea into any department of scientific inquiry. Like the flood which tests the security of every foundation that stands in the way of its onward rush, overthrowing the house built only on the sand, but leaving unharmed the edifice which rests secure on the solid rock, so does a new method of research, a new series of facts, or a new application of facts previously known, come to bear with impetuous force on a whole fabric of doctrine, and subject it to an undermining power which nothing can resist, save that which rests on the solid rock of Truth. And it is here that the Moral value of Scientific study, pursued in a spirit worthy of its elevated aims, pre-eminently shows itself. For, as was grandly said by Schiller in his admirable contrast between the Trader in Science and the true Philosopher, 'New discoveries in the field of his activity which depress the one, enrapture the other. Perhaps they fill a chasm which the growth of his ideas had rendered more wide and unseemly; or they place the last stone, the only one wanting, to the completion of the structure of his ideas. But even should they shiver it into ruins, should a new series of ideas, a new aspect of nature, a newly-discovered law in the physical world, overthrow the whole fabric of his knowledge, *he has always loved truth better than his system*, and gladly will he exchange her old and defective form for a new and fairer one.'"

WILLIAM B. CARPENTER

On a Method of Ascertaining the Rate of Ascent of Fluid in Plants

WHEN conducting a series of physiological experiments on the transpiration of fluid by leaves, it became a matter of importance to determine the rapidity of ascent of fluid. My colleague, Prof. Church, had suggested for another series of experiments the use of lithium citrate, a salt easily taken up by plants, and one which can be detected with the greatest readiness by means of the spectroscope. Preference was given to the citrate, because of its containing an organic acid, and on this account not likely to meet with any obstruction to its passage from the tissues. This method I have used with great success. In one experiment the fluid had risen nine inches in thirty minutes, in another five and a half inches in ten minutes. This method is greatly superior to the use of colouring matters, which seem to experience considerable resistance in their passage through the vessels. Full particulars of these and numerous other experiments in the same direction will shortly be published. W. R. M'NAB, M.D.

Royal Agricultural College, Cirencester, Oct. 20

The Aurora Borealis

HAVING read the two accounts of Aurora Borealis in this week's number of NATURE, I hope the following brief account of the very beautiful one that occurred here may not prove uninteresting. On Friday, the 14th Oct. at 8.15 p.m., I noticed a bright appearance towards the north-west, somewhat resembling the moon rising, and on going to the front of the house which faced the north, saw that the whole of the horizon from west to south-east was lit up with a bluish white light. Gradually long streaks of the same colour stretched themselves up almost to the zenith, and then a blood-coloured light formed the higher portions, while the lower kept the bluish white colour already noticed.