

same time the number of persons remaining in the crowd will represent the quantity of heat in, and so the temperature of, the interior. Then it will be obvious that as the crowd disperses the number of persons at any one time between the lines may continue about the same (although the individuals will be changed), whilst those in the central crowd become fewer and fewer. This illustrates how the temperature of the crust may continue nearly uniform in spite of the continued loss of heat from, and cooling of, the interior.

I believe that I have long ago proved that the mere cooling of a solid earth would not give the amount of contraction needed to account for the observed inequalities of the surface, and I surmise that a diminution of the earth's volume has been caused by the escape of steam and gases from volcanic vents during past ages. This view has, however, attracted more attention in America than at home.

O. FISHER

Harlow, Cambridge, December 13

Magnetic Storm, May 14, 1878

I AM inclined to think that Mr. Mance's observations (vol. xix. p. 148) upon the earth currents observed at Kurrachee must be incorrectly reported. To agree with the observations in China, Stonyhurst, Greenwich, and Haverfordwest, they should have commenced at 4 A.M. on May 15, and terminated at 5 P.M. on the same day (Kurrachee time).

It is a pity that electricians do not record these currents in absolute units. To say that the current was equal to fourteen Daniell cells means nothing unless the resistances present are also given. If an earth current is observed upon a cable it is easy to reproduce this current upon the same galvanometer with a known resistance and a known electromotive force, and then to express its value in webers or milliwebers. Thus if at Kurrachee 50° were noted on a galvanometer, and one Daniell cell reproduced this deflection through a total resistance of 125 ohms, then the current would be equal to $\frac{1}{125}$, or '008 weber or 8 milliwebers, a magnitude which every electrician would understand. Moreover, if the length, resistance, and general direction of the cable or wire were given, as well as the direction of the current itself, the difference of potential of the earth at the two ends would be known. This if the cable were 246 miles long, and lay due east and west, and its resistance were 5 ω per mile, then in the above case

$$\frac{E}{1230} = '008$$

$$E = 9'84 \text{ volts,}$$

which is the difference of potential of the two ends.

If simultaneous observations were made in this way at numerous stations on the earth's surface, we should be able to plot out the distribution of potential on the globe, and arrive at some better knowledge of the cause of earth-currents than we have at present.

W. H. FREECE

December 20

The Derivation of Life from the North

ATTENTION has been called by the President of the Royal Society to the labours of Mr. Dyer, as pointing in the case of plants to the conclusion that their various forms have been developed and dispersed from the north. I presume it is recognised that similar conclusions have been arrived at by Mr. A. R. Wallace in the case of animals. Mr. Wallace points to the palaearctic region as the great centre of their development or creation. On reading "The Geographical Distribution of Animals" when it first appeared, I was so much struck with the evidence adduced, that I was tempted to write and ask him if his work might not be said to occupy the following position in the history of unravelling what was formerly the mystery of geographical distribution. Mr. Darwin and others, including Mr. Wallace himself, had found a causal nexus in the case of islands, had shown that the faunas of islands had been derived from that of the nearest mainland, and in a character and degree varying concomitantly with the degree of their present disconnection therewith. They had thus completed the necessity for "centres of creation." Did not "The Geographical Distribution of Animals" afford the requisite evidence for carrying this commencement to its logical conclusion: for showing that in their turn the great continents themselves, or, more precisely, those

which are outlying to the central mass (which is in the north, around the Pole), have a similar dependence, and have borrowed their own faunas from that northern mass, in a character and degree proportional to the dates and degree of their connection or separation from it, the islands might then be said to be the satellites, and the great zoological regions the planets of this system, all having borrowed their life directly or indirectly from a single "centre of creation."

To render this still clearer to my own mind I had a map of the world designed on a polar projection, the northern hemisphere being projected to somewhat beyond the southern tropic. By this means the manner in which the land surface of the globe is built around the pole is clearly seen, and the extremities of America, Africa, and Australia, extending into the great oceans of the world, are embraced, or nearly so. When the sub-divisional regions (zoologically) of each of these great projections, and of the whole, are marked in colours, a succession of zoological strata, to speak rather inaccurately, appears. By carrying an ideal section from the supposed centre of creation in the north through either of these three great extremities, and from thence to the nearer, and afterwards the more remote, dependencies of those extremities (remote not in point of actual distance, as in degree of connection), we pass in each case through zoological strata of different types, until we arrive at those where no land-mammals are to be found at all. And this succession in space, as evidenced by geography, corresponds in a rough way with the succession in time, as revealed by geology. 1. As we recede in distance we meet with increased dissimilarity. 2. This dissimilarity partakes of a recession in type. 3. Some of these geographical districts seem to have their counterparts in geological periods. The Ethiopian region, as Mr. Wallace shows, presents us with the exiled miocene fauna of Europe in the most striking manner. Eocene forms may be seen in its dependency of Madagascar, or in the West Indies. Highly isolated Australia with its marsupials, &c., appears as if it were still in the secondary age. Oceanic islands, such as New Zealand, with a more beautiful climate, and more extensive surface than Great Britain, give us no land mammals at all. In others the reptiles "possess the land."

Mr. Wallace's plan is an excellent illustration of the comparative method, and shows how a careful classification leads to the solution of historical questions connected with the causes of that classification. Those causes are in this case comprised in the inference that a succession of waves of life has been propagated from the north, not all of which have had an equal extension, nor all encountered similar modifying circumstances.

If these inferences are not correct, perhaps Mr. Wallace would kindly set me right.

J. W. BARRY

1, Duncombe Place, York

Glaciation of the Italian Lakes

HAVING spent some time lately on the border-land between Switzerland and Italy, it has occurred to me that a note on some glacial features of that region may prove of interest to the readers of NATURE.

The Lake of Lugano is a rock-basin. I believe it to have been scooped out by the glaciers which have formerly descended from the Alps. Of this there is abundant proof. The crystalline rocks in their lower reaches possess the easily recognisable outlines of *roches moutonnées*, but the stratified mesozoic rocks have lost these characters. Above Lugano and Agno these features are very well marked, and in these localities striation is tolerably frequent, the direction of the striae being southerly. Along both sides of the southern extension of Mount St. Salvatore to Moreate, striae can be seen in a few places near the lake-level, and the same is the case on both the Piombello and Generoso shores. At the southern extremities of the lake are abundant moraine-mounds. Erratics are also present, most being gneissose or granitic, but a few have fallen upon the moving ice from nearer localities, as they are of dolomite. The moraine masses are cut through by the northerly flowing streams, but, after passing the parting between the waters flowing towards Lake Lugano and those running into Lake Como, there is the appearance of great destruction of the moraines. Unfortunately I had a mere cursory glance down the Val della Tresa, through which the drainage of the lake flows to Lago Maggiore. It has often been remarked that in this South Alpine lake district, the *debris* left by the glaciers is exceedingly small when contrasted with similar regions north of that moun-