whilst pledging themselves to the as yet unproved empiric method of Natural Selection, retard the "rapid and right progress" of zoology, unmindful of the Baconian warning that "knowledge, whilst it lies in aphorisms and observations, remains in a growing state; but when once fashioned into methods, though it may be farther polished, illustrated, and fitted for use, it no longer increases in bulk and substance."

The study of the palæontological and biological sciences has revolutionized modern knowledge. The attention to system and detail, which *savans* of a past generation so carefully bestowed upon animals and plants, is now producing its good fruits, and the confused mass of facts and observations which have been collected is now giving place to wide and comprehensive generalizations. The mind of modern scientific men has been "slowly and insensibly withdrawn from imaginary pictures of catastrophes and chaotic confusion, such as had haunted the imagination of the early cosmogonists. Numerous proofs have been discovered of the tranquil deposition of sedimentary matter, and the slow and successive development of organic life." He who has studied the subject with care, quits it with the consciousness that he has learnt the important lesson that, however specialized and modified man's structure, he still retains within him the remnants of the old primæval *idée*, the old patterns, exemplars, and archetypes of being, in whose perfect image he was originally designed; however remote in point of time he may be from the earliest incarnation of life on this globe, he still bears traces in his early career of a close analogy to the lowest organized monad; and, above all, he, from the simple elements of the originally created spinal chord in the lower vertebrata, has developed a complex organ of thought far surpassing that possessed by any other animal form.

I am, Sir, your obedient servant,

CHARLES CARTER BLAKE.

GLACIERS IN WALES.

By PROFESSOR A. C. RAMSAY, F.R.S., F.G.S.

In the year 1851 I read a paper before the Geological Society "On the Superficial Accumulations and Surface-markings in North Wales," in which I attempted to show that there had been two glacier epochs in that country, one before, and the other after the deposition of the boulder drift, which was ploughed out of some of the larger valleys by the secondhand smaller set of glaciers; and in a later work on the old glaciers of North Wales, I went further, showing that cold sufficient to form glaciers lasted during the whole time of submergence and emergence, both when the higher mountain-tops stood out of the sea as a cluster of small islands, and afterwards when the whole land rose out of the water.

The first of these memoirs touched on several subjects not immediately connected with the glaciation of Wales, though bearing in a larger sense on the same Geological period, and on the same set of questions. This the Council of the Geological Society decided not to print in their Journal, on the ground that it was too speculative—an opinion with which, in a great measure, I now coincide. One

question was, however, raised in this unprinted matter which I do not yet remember to have seen in any published paper, and I now mention it because of late the attention of many persons have been more and more drawn to the discussion of the subject.

The opinion I then held was that cold great enough to have produced the first and larger set of glaciers in our own neighbouring counties might have arisen from an elevation of land equal to, or greater than, the amount of depression that it underwent during the middle portion of the glacial period. I then stated "that I hold it as a sound doctrine in Geology that any amount of depression that any part of the earth's crust may have undergone, may have been equalled there or elsewhere by an opposite movement, giving an equivalent amount of deviation. Bearing this in mind, it seems within the limit of fair speculation to suppose a possible upheaval, equal to, or exceeding the above-mentioned known amount of depression (2,300 feet*)—an elevation probably sufficient to have produced a degree of cold, taken in connection with other conditions, equal to the production of glaciers on the first and greater scale. This land (Wales) would then consist of a lofty central cluster of mountains, with numerous valleys, down which the larger glaciers flowed, debouching upon an elevated plateau of land, part of which now forms Anglesea and the sea-boards of Carnaervonshire. A further extension of this flat, dotted by other clusters of mountains, now forming the high grounds of Britain and Ireland, would spread as far as the 100 fathom line indicated by Sir Henry De La Beche in his 'Theoretical Researches,' including the German Ocean, the the Irish Sea, and a wide tract of the Atlantic stretching northward along the coast of Norway."

In 1846 the late Professor E. Forbes published his celebrated memoir "On the Distribution of the Fauna and Flora of the British Islands," in which, in consequence of a partial ideality in the littoral fauna of the North of Europe and of North America, he inferred a former direct union of these continents across the area now occupied by the North Atlantic. Generalizing on this idea, I conceived it probable that this northern continent might have stretched so far south "that the mean annual Isothermal line, and the January Isothermal line, that in Central Asia and in North America run nearly east and west in latitudes about 55 degs. and 38 degs., would be continued in the same direction across the continent instead of curving northwards, as they now do, under the influence of the Gulf Stream. The mean annual Isothermal line of 32 degs. Fahr. would then pass across the south of Scotland, and the January line near the south of Spain. Across the Altai Mountains, in Central Asia, at points between these lines in latitudes 49 degs. to 51 degs. north, the snow-line is 7,034 feet above the sea, and in those mountains (from 9,000 to 10,000 feet high) at the Colonne de Katoune, there

* Mentioned in a previous part of the Memoir, and printed in the Society's Journal.

are glaciers in latitude 50 degs. north. The Snowdon group is at least three degrees further north than this, and, if instead of being part of an island, that district, at a higher elevation, were part of a broad continent spreading east and west, we should have in its peaks and valleys all the conditions needful for the formation of large glaciers; and the same may be said of other mountain regions of the British Islands."

I now send you these speculations for what they are worth, although in the long run I think it will appear that the wide-spreading, long-continued, and most intense cold of the glacial period was due to some unexplained cause far more general than any mere changes in physical geography.

BRITISH ASSOCIATION MEETING.

ON A NEW POINT IN THE STRUCTURE OF SIGILLARIA, WITH SOME REMARKS ON THE BIVALVES OF THE COAL.

By J. W. SALTER, Esq., F.G.S.

AMONG the very fine collections of fossil-plants in the Manchester Museum, are some specimens of *Sigillaria* well worthy attention, and which show, as I believe, a new point of structure, bearing on their aquatic habits.

They belong to that section of the genus which is distinguished by the leaf-scars, being arranged close together in the vertical rows, not at a distance apart, as in most of the species. So close, indeed, that they press on one another, and compel each other to take an hexagonal form.

At certain points along the trunk, new lines of scars are interpolated, so as to make the number of ridges greater (and at the same time the individual ridges narrower) in the younger portions of the tree. In *Favularia* these intercalations very much at particular spots, forming a sort of varix, or node, not very obscurely marked. At these points, too, in *certain* species, the stem is swelled, the spaces between the ridges deepened—the ridges themselves narrower and more prominent, and altogether angular in form. Brongniart's artist has badly represented such a varicose swelling in his figure of *Sigillaria hexagona*.

The species in which I have observed this characteristic are:—the *Favularia tessellata*, from Tonge, Bolton; *F. nodosa*, from Oldham, and a species from Glamorganshire; *F. hexagona*, from Manchester coal-field.

In a perfectly preserved stem of *F. tessellata*, from the roof of the "four-foot" coal, the intervals between the ridges are occupied by rows of circular scars, not hexagonal, nor purse-shaped, as the leaf-scars between them are, but round. Nor with the characteristic flattened surface and double imprint from which the vascular bundles of the leaf arise, but deeply indented, and with a minute protuberance in the centre, which structure is characteristic of the rootlets of the underground portion of the stem (*Stigmaria*).

The look of these small interpolated scars is so different from those of the leaf-rows (they are clearly not interpolated ridges, for they die out at each