

as that they are insufficient to satisfy the requirements of psychology.

Both these papers are too materialistic, and take no notice of modern psychological research, which has demonstrated the paramount importance of *experience* in determining modes of reaction. This is especially remarkable in a publication issued in a series of "Psychological Monographs" by the "Psychological Review Company," of Princeton, N.J.

GEOLOGY AT THE BRITISH ASSOCIATION.

THE address of the President, Prof. Grenville A. J. Cole, was a brilliant and stimulating commencement to the proceedings of this section. Following it came an interesting address by Dr. George Hickling on the geology of Manchester and district, in which he pointed out the excellent position of Manchester, both geographically and geologically, situated at the junction of the red beds and the coal measures, with a great variety of opportunities for field-work in the neighbouring Pennine Chain. Prof. E. J. Garwood followed with a paper on the discovery of *Solenopora* and *Sphærocodium* in the Silurian rocks of Britain. Up to the delivery of his presidential address at Birmingham these organisms had not been found in Silurian rocks, but careful search has now proved that *Solenopora* occurs both in the Wenlock and Woolhope limestones. In areas on the borders of Herefordshire and Radnorshire had been found crystalline limestones, upwards of 80 ft. thick, containing remarkable developments of these and similar algal growths, amongst which were the remains of *Girvanella* and *Sphærocodium*, the latter genus being now recorded for the first time from rocks in Britain.

Prof. W. Boyd Dawkins contributed two papers. The first was on the classification of the Tertiary strata by means of the Eutherian mammals, based on their evolution. The most important break in the succession of life-forms occurs at the close of the Oligocene period, since when there is a marked continuity showing that the present face of the earth is merely the last in a long succession in the Tertiary period. His second paper dealt with the geological evidence in Britain as to the antiquity of man. He agreed with Prof. Boule in regarding the evidence of the rostracinate eoliths found in East Anglia as of doubtful value. The Ipswich skeleton was obtained from a shallow pit of decalcified boulder clay (not boulder clay *in situ*) into Glacial sands, and was, he believed, a case of interment which might be of any age from neolithic to modern times. In the case of the Piltown skull, he fully accepted Dr. Smith Woodward's opinion that the find belongs to the early Pleistocene period. The evidence indicated that man appeared in Britain and the Continent at the period when he might be expected to appear from the study of Tertiary mammalia—at the beginning of the Pleistocene age, when the existing Eutherian mammalian species were abundant. He may be looked for in the Pliocene, but in the older strata he can only be represented by an ancestry of intermediate forms.

On September 9 a joint discussion was held with Section E on the classification of land forms, which will be reported in the records of that Section. Afterwards Canon Bonney gave some notes on new sections in Charnwood Forest. Considerable quarrying had thrown light on sections previously described, which had caused him to modify his previous views. He was now convinced that the dominant Bardon breccia was really a very exceptional case of fluxion breccia. Prof. W. W. Watts followed with notes on the

granite surfaces of Mount Sorrel. It had been suggested that some of the ground and polished surfaces known in this area and in certain other Midland localities might be due to wind action in Pleistocene times. A recently discovered section at Mount Sorrel showed glacial striæ crossing wind grooves at a high angle, proving that the Triassic wind grooves had survived actual glaciation.

Dr. A. H. Cox and Mr. A. K. Wells contributed an account of investigations on the Ordovician sequence in Cader Idris. Re-examination of the area had shown that the older views of the igneous rocks of this area, as all of Arenig age, must be modified. Four distinct volcanic centres in the Ordovician series had now been discovered. Prof. W. G. Fearnside presented a preliminary account of investigations to prove the underground contours of the Barnsley seam of coal. The sites were plotted on a half-inch map, the depths to the coal were corrected for height above sea-level, and contour lines had been drawn among the spot-levels so obtained. From an analysis of the underground contours of the Barnsley bed, it is found that its strike lines generally range from N.E.-S.W. or N.W.-S.E., it being difficult to find either a N.-S. or E.-W. strike constant over more than a few miles of country. The greatest structural division of the coalfield basin is by the equivalent of a N.E.-S.W. anticline, of which the southern limb is along the line of the Don faults from Sheffield to Doncaster. North of this line there is some evidence of a syncline with its axis central near Frickley. The inclination of the Barnsley bed is steepest near the outcrop, the measures flattening out when the central line of the syncline is approached. The map indicates the interdependence of underground structure and topographical relief.

On September 10 both morning and afternoon meetings of the Section were required to complete the programme. The morning session commenced by a description by Prof. J. W. Sollas of reconstructions of fossils by serial sections, illustrated by several remarkable models of restorations of a graptolite, a primitive fish, the skull of a reptile from the Karoo, and the skull of *Ichthyosaurus communis*, from Lyme Regis. The last-named was 520 mm. in length, and had been studied in 520 sections taken at equal intervals apart, and revealed in remarkable detail the internal structure of the head. Prof. R. C. Wallace, of Manitoba, described the brine springs of that area, which issue from the Middle and Upper Devonian limestones, and circulate in the Dakota limestone at the base of the Cretaceous, depositing salt at certain dolomitic horizons. The salt flats where the springs reached the surface were devoid of vegetation and studded with ice-carried boulders, granite, gneiss, etc., which have suffered intense chemical disintegration. Ferromagnesian minerals have been most intensely affected. The causes of this special disintegration, as compared with that of sea-water, were discussed. The boulders were partially submerged and films of liquid were maintained on the surface, in contact with atmospheric oxygen. Owing to partial adsorption by colloids an acid residual solution was produced, which is a powerful corrosive agent.

Dr. Albert Wilmore dealt with the Carboniferous limestone zones of N.E. Lancashire, describing the sequence found in the neighbourhood of Clitheroe and the Knoll district. Mr. H. Day referred to observations on a collection of fossils from Treak Cliff and Peakshill, Castleton, and discussed the value of the brachiopods and corals as zonal determinations, when compared with those of the Bristol area. He concluded that any system of zonal indices could be of local value only, and not of general application. Dr. Arthur Vaughan, who was recovering from a serious

illness, dealt with the shift of the western shore-line in England and Wales during the Avonian period. He concluded that a land mass stretching from Wales to Wicklow formed a barrier during the Avonian period between a "N.W. channel," reaching to the Isle of Man and the Lake district, and a "S.W. channel," which was an extended Bristol Channel. This barrier formed the land-crest between these two channels during the whole of Viséan time, and had a dominant trend from Anglesey to Dudley. The whole neck of land which contained the barrier and separated the "channels" shifted steadily southwards as Viséan time proceeded, owing to the advance of the sea on its northern side and its retreat on the south. The remarkable similarity of the Viséan sequence north and south of this barrier indicated free sea communication round its western margin, along which the sea remained persistently coastal during the period.

Dr. Albert Jowett contributed a preliminary note on the glaciation of the western slopes of the southern Pennines. No striated surfaces of solid rock had been found at high levels, and for detailed information of the ice-movement we had to depend on striations at Salford and Fallowfield, on the distribution of drift at high levels, and on the systems of drainage along the edge of the ice. These indicated a general movement from N.W.-S.E. The first barrier of hills met with on approaching the Pennines from the South Lancashire and Cheshire plain was almost everywhere overridden with ice, which left definite deposits of drift with foreign rocks up to 1360 ft., and scattered erratics up to 1400 ft. This drift had been traced across the main Pennine divide near Chapel-le-Grith (1100 ft.). Great lakes were held up by the ice-barrier some time after it commenced to retreat from the western slope of the Pennines. During early stages of the retreat the drainage from the lakes in and north of the Etherow valley escaped northwards, and ultimately discharged through the Walsden gap into the Calder. When the ice-barrier east of Manchester fell below 600 ft., this drainage followed the course of that south of the Etherow valley and escaped southwards.

The afternoon meeting commenced with a discussion on radio-active problems in geology. Sir E. Rutherford opened the discussion by putting the problem from the point of view of the older geologists, with their comparatively low estimate of the age of the earth, though higher than physicists of those days were inclined to concede. The discovery of radium had greatly modified the position, and the age of the earth, based on evidence of radio-activity, was very much higher than the estimates accepted by geologists. The problem was how to reconcile geological facts with these new physical determinations. Sir Ernest Rutherford was inclined to believe that the larger estimates were nearer correct than the smaller.

Prof. J. Joly faced the problem from the viewpoint of the geologist on the assumption that geologists were agreed on the matter. He made several suggestions which might have the effect of reducing the large numbers derived from the study of radio-active materials.

Prof. Soddy hoped that geologists would not be in any immediate hurry to decide between the geological and radio-active estimates of the age of the earth. Owing to the element of uncertainty about the initial stages of the disintegration and the long periods involved, there was a great *terra incognita*, and the new theory of isotopes made it necessary to take into account many possibilities not thought of a couple of years ago. In addition there was always the possibility that thorium might be a branch of the uranium family, in which case some of the arguments that

had been used entirely fell to the ground. While he saw no successful method at present of altering the general order of the radio-active estimate, he did not regard it as more than tentative, and there might well be unknown factors of sufficient importance to bring the two methods into closer agreement in the future. Dr. J. H. Teall, Prof. Sollas, and Dr. J. W. Evans continued the discussion.

Prof. C. A. Edwards described the results of experiments producing twinning in metallic crystals. His remarks were illustrated by an interesting series of lantern slides. Dr. J. W. Evans followed with a description of the different methods by which the interference figures of a small mineral in a rock slice could be kept distinct from those of the adjoining minerals. He discussed various methods of using a diaphragm with the Becke combination of lenses, and condemned the common practice of placing the diaphragm for this purpose immediately below the Bertrand lens.

Dr. G. Hickling contributed a paper on the micro-structure of coal, illustrated by a series of beautiful lantern slides, showing remarkable success in dealing with very difficult material. He concluded that coal was essentially a "replacement" deposit consisting of an original peat-like mass of vegetable *débris*, in which the substance of the component tissues has been largely or wholly replaced by the liquid decomposition products of other vegetation. The concluding paper was by Mr. Thomas Crook, describing the economic mineral products of Damaraland, S.W. Africa, and emphasising their value. Several research committees were reappointed; and new committees were appointed to investigate rocks of Old Red Sandstone age at Rhynie, Aberdeenshire, and of Lower Carboniferous age at Gullane, Haddingtonshire. The sectional work concluded with a field excursion to Edale and Castleton. The surprise of the week was the magnificent weather, which made a successful meeting also a delightful memory.

W. L. C.

CORRESPONDING SOCIETIES AT THE BRITISH ASSOCIATION.

THE first meeting of the Conference of Delegates was held on September 8, and it was announced that the General Committee of the British Association had altered the titles of officers of the Conference from Chairman and Vice-Chairman to President and Vice-President, thereby giving them the same status as those of the Sections. Sir Thomas Holland delivered his opening address, entitled "The Classification of Scientific Societies," which was printed in NATURE of September 16.

The first subject for discussion was "Local Museums," suggested by the Selborne Society, and introduced by Dr. W. E. Hoyle. He laid it down that the first and fundamental function of a museum was to preserve. Museum officials are nowadays given so much advice about the desirability of making our exhibits æsthetically attractive, of compiling explanatory labels which shall at the same time instruct the specialist and interest the casual visitor, and of catering for school children, that they are, he said, in danger, perhaps, of forgetting that their paramount duty is to see that "neither moth nor rust doth corrupt" and that "thieves do not break through nor steal."

He gave a definition of a local museum, the first duty of which, he maintained, was to preserve the things of interest pertaining to the locality. Then he touched upon the important and delicate question of