GEOLOGICAL STOCKTAKING IN SCOTLAND

The Geology of Scotland

Edited by Gordon Y. Craig. Pp. xv + 556. (Edinburgh and London: Oliver and Boyd, Ltd., 1965.) 105*s*.

IN his preface to *The Geology of Scotland*, the editor gives a short selective history covering the past 150 years, during which this book may be said to have evolved. After mentioning Hutton he refers to Ami Boué's *Essai Géologique sur l'Ecosse* of 1820 and to Nicol's *Guide to the Geology of Scotland* of 1844, an illustrated work with an up-to-date geological map, a revised version of Macculloch's 1836 map. Nicol's publishers then were Oliver and Boyd, who are the publishers now, 120 years later, of the present imposing volume.

However, just a century after Macculloch's death in 1835, a new geology of Scotland, in all but title, was issued in five parts of *British Regional Geology*. These books from the Geological Survey cover all Scotland and present a well-balanced account of the geology accompanied by some candid remarks on the divergent opinions it aroused. Then, at the International Geological Congress in 1948, came an essay entitled "The Structural History of Scotland", by E. B. Bailey (*Intern. Geol. Congress, Report of the XVIII Session*, 230–255; 1950). This summarized progress and views held up to the end of the Second World War. The present volume continues from there, utilizing the results of research carried out during the past two decades involving the routine use of current bedding technique and the geometry of folds, foliation, concepts in metamorphism and deductions drawn from analyses of radioactive isotopes in rock-forming minerals. Some of these exercises require the acceptance and comprehension of more theory than did any of the publications before this epoch.

Prof. Neville George has written an introductory chapter which covers the long period of some 2,600 m.y. between the early Lewisian and the present time. He uses as check points eight tectonic episodes dated by radioactive work. They are as follows: (1) deformation and metamorphism of Lewisian rocks before the Scourie pegmatites *c*. 2,600–2,250 m.y. ago; (2) deformation and metamorphism of Lewisian rocks after the Scourie basic dykes beginning *c*. 1,600 m.y. ago; (3) early metamorphism of the Moines *c*. 740 m.y. ago; (4) Caledonian folding of the Dalradians followed by metamorphism *c*. 440 m.y. ago; (5) later metamorphism of the Moines *c*. 390 m.y. ago; (6) 'main' Caledonian movements including the Moine thrust; (7) 'main' Hercynian movements *c*. 270 m.y. ago; (8) later alpine movements 25–10 m.y. ago.

Some discussion of the column of strata between the check points is given. Scotland is also divided by convenient faults into five geographical blocks, the Southern Uplands, the Midland Valley, the Caledonian Fold-belt with its orderly metamorphic zones split in two by the Great Glen fault, and the Foreland, west of the Moine thrust. Here the Lewisian, traversed by shatter bands of mylonite, is well exposed and here the unmetamorphosed Torridonian west of the thrust can be compared with the Moines east of the thrust, reputed to be their metamorphosed equivalent, carried here from the east by thrusts. The Caledonian Fold-belt is occupied by the Moines and the Dalradian. Although they occur together the latter, probably unconformably, overlies the former. Complex structures affect both groups, but are more difficult to unravel in the monotonous marker-starved Moines than in the Dalradians with their diversified stratigraphy. The folds and over-folds affected by faults are the result of four phases of folding. The whole Fold-belt is pierced by many granitic intrusions and migmatization affects some areas. South of the Highland Boundary fault the Dalradians are covered by the Old Red Sandstone which, further south, rests unconformably on thick packets of shales and greywackes of Ordovician and Silurian ages. These Lower Palaeozoics have been arched up by compression and wrinkled into small asymmetrical folds or faulted folds. In much of the Midland Valley, Carboniferous and Permian lie in open folds. They are much faulted and fill basement-controlled basins. Round the coasts there is a fringe of Mesozoic formations including relics of Cretaceous which with their cover of Tertiary volcanics are also folded and faulted. They show that restlessness continued until late in, if not all through, Alpine time. Towards the end Prof. George allows himself the luxury of 'imaginative reconstruction' in picturing the development of the scenery since a late Tertiary uplift. By then much of the erupted lava and the dykes cutting it had been eroded and a wave-cut surface formed. It was probably warped as it rose. Its crest may have been in the north-west, anywhere beyond the present watershed; possibly so far west as the Outer Hebrides. As rivers gathered and flowed downslope they produced a group of roughly parallel valleys discharging eastwards. As time went on and tributaries formed they found north-east–south-west fault planes easy to follow and their valleys were eroded more rapidly than those of the primary rivers. In consequence piracy occurred and some of the primary rivers were beheaded to form a network of streams derived from the intersection of the primary and secondary rivers. When the Ice Age came the ice opened and deepened these north-east–south-west fault zones of which the Great Glen is the type and the Minch possibly another example.

The Geology of Scotland is well illustrated, the diagrams clear and instructive. One figure (6.13) may strike a controversial note, as some readers may prefer a section sketched by Sir James Hall in 1812 (Bailey, E. B., *op. cit.*, p. 230) to that by Dr. Walton in 1963 to illustrate Southern Upland structures. The hallowed ground of the Tertiary Volcanic districts, formerly the precinct of J. E. Richey, is described and augmented with an excellent account of recent surveys in Skye and Rum. The volume is, in every way, a worthy member of a long sequence of distinguished works on Scotland. Fashions will doubtless change in the future as they have done in the past and a time will come when another version will be written, say in A.D. 2015 or even A.D. 2065, when more enigmas will have been discussed and left to the future awaiting a final answer.

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THE PHYSICS OF CRYSTALS

Crystal Physics

By G. S. Zhdanov. Translated and edited by Dr. A. F. Brown. Pp. ix + 500. (Edinburgh and London: Oliver and Boyd, Ltd., 1965.) 80*s*. net.

CRYSTAL physics has become a branch of science of interest to workers in many disciplines, and as materials, crystals now assume a special importance in technology since they may possess special mechanical, electrical, magnetic or optical properties. The investigation of crystalline media relates the various physical properties of crystalline solids to chemical composition and atomic structure, in addition to covering methods of crystal production and investigating their behaviour and properties over a wide range of physical conditions. *Crystal Physics*, translated from the Russian by Dr. A. F. Brown, of the University of Edinburgh, attempts to give a unified account of this vast subject which will be of interest to all pure and applied scientists with specialist interests in this field.

A knowledge of crystal physics must be based on an understanding of the atomic and electron structure of matter together with the forces of interatomic and intermolecular interaction, and the author has used this as the underlying theme of his book. In the introductory chapters the results of quantum mechanics, which are of particular application in solid-state physics, are estab-