THE GEOLOGY OF THE GRAMPIANS.[1]

THERE are few parts of the British Isles which can rival the southern Highlands of Scotland for beauty and variety of scenery. Over much of this district the genius of Scott has thrown the glamour of romance, and year after year crowds of tourists visit the scenes which he has rendered famous. The flat vales which lie to the south of the mountains (the plain of Strathmore) afford an excellent contrast to the bolder hill country behind them. Even the most stolid traveller who enters this region may be expected to feel some curiosity regarding the origin of the scenery and the history of the rocks which meet his eyes. Not a little has been written on this subject, but much of it is contained in scientific memoirs and periodicals which are beyond the grasp of the untrained geologist. The country, especially the Highland portion of it, is of great complexity, and its structure has given rise to discussions, many of which are far from settled at the present time. The task which the author of this work has essayed is one of considerable difficulty. He aims at giving an account of the geology and physiographical development of this intricate region which shall be intelligible to the unscientific and at the same time thoroughly abreast of the most recent researches. He has achieved a large measure of success even in the most difficult part, while some of his chapters, such as those on glaciation and scenery, are excellent. The result is a book which is at once interesting to the layman and useful to the professed geologist.

The great boundary fault which runs across Scotland from Stonehaven to the Firth of Clyde separates the Highlands from the valley of Strathmore, two districts which are as different in their geology as in their scenery and economic development. To the north lie metamorphic schists and gneisses of unknown age; to the south are fossiliferous Old Red Sandstone and Carboniferous rocks. One volume is assigned to each of these subdivisions. Much of the southern Highlands has been mapped by the Geological Survey, which has published maps (and in some cases memoirs also. Mr. Macnair is well known for his investigations on the metamorphic rocks of Perthshire, and is familiar with a large part of the area he undertakes to describe. His researches have led him to conclusions not essentially different from those of the Survey officers, whose opinions and observations he frequently quotes. He accepts the current theories that as we proceed northwards from the Highland border we pass over a succession of slates, grits, gneisses, mica schists, and limestones, which are not only apparently but actually in ascending order. They vary in lithological character and in degree of metamorphism, but are essentially an unbroken and continuous succession, the quartzite of Schiehallion and Ben-y-gloe being the highest, while the grits and slates of Leny and Aberfoyle are the lowest rocks of the district. Two series of igneous rocks are found among the sedimentary schists, one older and another later than the period of folding and metamorphism. The former comprises the hornblendic schists, which are especially common around Loch Tay, and the acid gneisses of Ben Vuroch; among the latter may be placed the granitic bosses of Garabal Hill, Glen Lednock, &c. Mr. Macnair describes what, in his opinion, is the structure of the country, and gives sections showing a series of complex fans and synclinoria the axes of which have a north-east trend. Although these hypotheses are accepted by probably the majority of the geologists who are working in this district at the present time, they cannot by any means be regarded as established on any firm basis of proof. The apparent upward succession is quite possibly misleading. Many strong reasons may be advanced against it, and the structure is not more clear than the sequence. Apart from this, Mr. Macnair's account of the geology of the Grampians is clear and judicious, and may be recommended to those who wish to get a general idea of the subject without too much detail.

The second volume begins with a description of the Old Red Sandstone (Upper and Lower) of Strathmore. This vast sedimentary formation has always had a strong attraction for Scottish geologists. The author has given much time to its study; he discusses it with enthusiasm, and attempts to prove that, contrary to the usual opinion, the deposits are of marine origin, and at one time completely buried the Highland mountains. The arguments he brings forward are not new to geologists, and, we must confess, are, in our opinion, far from convincing; the old theories of Godwin Austen, Ramsay, and Sir A. Geikie are not yet disposed of and out of date. These chapters contain, however, many observations which are little known and well worth placing on record. The Carboniferous rocks occupy only a very small area, and are not otherwise important.

Photo. by W. L. Howie.

FIG. 1.—The Killin Hills, from the Dochart. From "Geology and Scenery of the Grampians."

As might be expected in a region of such varied topography, the glacial and alluvial deposits are of considerable importance. The chapters devoted to them and to their effect on the scenery of this part of Scotland are the most readable in the book, and should prove interesting to anyone who cares for geology

[1] "The Geology and Scenery of the Grampians and the Valley of Strathmore." By Peter Macnair. 2 Vols. Vol. i., pp. xiv+195; vol. ii., pp. xii+199. (Glasgow: James MacLehose and Sons, 1908.) Price, 2 vols., 21s. net.

or physiography. They are also free from the controversial matter which is rather obtrusive in the chapters on Highland schists and Old Red Sandstone. We must congratulate the author also on the excellence of the illustrations, most of which are from photographs. Many of them are very beautiful and appropriate, and should be of great help to those who are not specially versed in geological literature. An exception may be made in the case of some of the photomicrographs of rock sections, which are not up to the general high standard of the book. A really good geological map of the area described is also a desideratum which should be supplied if the book reaches a second edition, as we hope it will.

J. S. F.

Photo. by W. L. Howie

FIG. 2.—View from the summit of Ben Lawers looking north-east along th great axial line of folding. From "The Geology and Scenery of the Grampians."

THE LICK OBSERVATORY-CROCKER ECLIPSE EXPEDITION, JANUARY, 1908.

BY the courtesy of Prof. Campbell in furnishing advance proofs of Lick Observatory Bulletins Nos. 131 and 132, and from preliminary reports published by himself[1] and Dr. Albrecht,[2] we are able to form an idea of the perfect organisation of, and the results obtained by, the expedition from Lick Observatory which went to Flint Island to observe the total eclipse of the sun of January 3.

The whole of the expenses of the Lick expedition was defrayed by Mr. W. H. Crocker, this making the ninth occasion on which his generosity has rendered such an expedition feasible. The party was conveyed from Tahiti to Flint Island by the U.S. gunboat *Annapolis*, and arrived at the latter place, which is in latitude 11° S., and is 450 miles N.W. of Tahiti, on December 9, thus leaving twenty-four clear days for the erection and adjustment of the instruments. In addition to the Lick party, consisting of Prof. Campbell, Messrs. Perrine, Aitken and Albrecht, and Mrs. Campbell, the expedition included Prof. Lewis, of Berkeley, and Prof. Boss, and was accompanied by an expedition dispatched by the Smithsonian Institution; the latter consisted of Prof. Abbot and his assistant, Mr. A. F. Moore, who were charged with the task of making bolometric observations of the coronal radiations. Readers of NATURE will remember that this island was also selected by Mr. F. K. McClean as the *locale* of the expedition which he fitted up and carried through at his own expense, and Prof. Campbell remarks that they (the McClean party) were found to be "helpful and congenial companions."

The programme of the Lick observers comprised the determination of the contact times, the photography of the corona, on large and small scales, and of the coronal and chromospheric spectra, and a photographic search for any possible intra-mercurial planet. As Mr. McClean has already reported, the weather on the morning of the eclipse was extremely sensational, rain falling in torrents between five minutes before and two or three seconds after the commencement of totality, but happily the clouds dispersed, and the remainder of the eclipse was observed in a comparatively clear sky. That results were obtained which are likely to provide valuable additions to our knowledge of solar physics may be inferred from the following brief *résumé* of the preliminary reports of the observers.

The observations of the contacts showed that mid-eclipse took place some 27 seconds earlier, whilst totality lasted some 9 seconds less, than the predicted times.

In the intra-mercurial planet research two quadruple sets of cameras were employed, each set so arranged as to include an area 9° broad and 28° long in the direction of the sun's equator. Three hundred star images, going down to the ninth magnitude, were recorded, and all have been identified with known stars by Prof. Perrine. It now seems certain that no planet brighter than the seventh magnitude exists nearer the sun than Mercury, and, as it would need a large number of seventh-magnitude planets to account for the outstanding anomalies in the motion of Mercury, Dr. Albrecht considers that the observational side of this research should now be considered as closed. The *raison d'être* of the Mercury anomalies must be sought elsewhere; possibly, as suggested by Prof. Seeliger, the material responsible for the Zodiacal Light may be sufficient to account for them.

With the Floyd camera, having a Clark lens of 5 inches aperture and 67 inches focal length, fed by a 12-inch cœlostat, eight exposures, varying from "instantaneous" to 16 seconds, produced excellent

[1] Publications of the Astronomical Society of the Pacific, No. 119, April, 1908.

[2] The Journal of the Royal Astronomical Society of Canada, vol. ii., No. 3, p. 115.