

members were well rewarded. On the return to Cockburnspath the Peaseburn was crossed, a very picturesque example of a dene, about the formation of which the Director made some remarks (see page 122). The return to Edinburgh was made by the 6.23 train.

LONG EXCURSION.—ELIE AND ST. MONANS.

SATURDAY, JULY 31ST, 1897.

Director : PROF. JAMES GEIKIE, LL.D., F.R.S. L AND E., F.G.S.

(*Report by* THE DIRECTOR.)

It was at first intended that the party should proceed to St. Monans, and work back along the coast to Elie; but as the most interesting and important sections occur nearest to the last-named place, and the tide was flowing, it was considered advisable to visit the best sections first. The party assembled at Elie Harbour, in the centre of one of the remarkable volcanic necks for which this part of Fife is so noted. Here the Director gave a short outline of the various geological features to be studied. The region to be traversed lay wholly within the Carboniferous area, the strata representing the base of the Limestone series and the upper portion of the Calciferous Sandstone series. At Elie the prevalent dip is towards the west, while at St. Monans the inclination of the strata is easterly. At these two places the basement beds of the Limestone series are exposed, the stretch of coast-line between them showing the upper members of the underlying Calciferous Sandstones disposed in a series of more or less gentle, but sometimes sharp, anticlines and synclines. Between Elie and St. Monans no fewer than nine volcanic necks are exposed, and the main object of the Excursion was the examination of these and their relation to the rocks they traverse.

At Elie Harbour many interesting features were observed. The strata at the line of junction with the neck were much jumbled and shattered, often dipping in towards the neck at a high angle, and even in places standing on end. Here and there, also, the sandstones were baked and hardened so as to resemble quartzite and porcellanite. The neck was filled with agglomerate and tuff—the rock fragments consisting of sandstone, shale, limestone, basalt, diabase, etc. These fragmental materials showed a kind of rude bedding, having a distinctly centroclinal dip. Thin dykes and veins of basalt cut across the neck, and the adjacent sandstones and shales. Similar features characterised most of the necks subsequently visited, but were nowhere better displayed

than at Elie Harbour. The next neck examined was that of Shepherd Law, which measured not far short of twenty chains in diameter, or about twice the width of the neck at Elie Harbour. The junction of the agglomerate of Shepherd Law with the Carboniferous strata was particularly well seen. Here the latter were, as usual, jumbled and smashed and much hardened and baked in places. Searching the tuff, the party obtained a number of large broken crystals of hornblende and sanidine, scales of biotite and small garnets (pyrope). Sanidine and hornblende were also met with in the necks seen between Shepherd Law and Ardross Castle. At the latter place a thin limestone crops out. It is overlaid by shales, and underlaid by a few inches of blue clay, underneath which occurs a thin layer of coal resting upon a sandy underclay full of *Stigmara*. The shale above the limestone yielded many joints of crinoids and a number of other fossils, including *Productus*, *Lingula*, *Schizodus*, *Aviculopecten*, *Bellerophon*, *Nautilus*, etc. The large neck of Coalyard Hill was next crossed. Here the agglomerate presented much the same features as had already been studied—the party being particularly interested in the appearance of several dykes and veins of white trap, which cut across the junction of the neck with the surrounding shales and sandstones. Near Newark Castle two small necks were encountered. Neither of these exceeds forty yards across, yet each shows all the characteristic features of such structures. The strata at this place are thrown into a series of sharp anticlines and synclines, are much jumbled in places, and traversed by irregular intrusions of white trap. Two thin limestones crop out here, and the shales associated with them yielded a few fossils—chiefly *Lithostrotion*, *Aulophyllum*, *Poteriocrinus*, *Fenestella*, *Productus* (several species), *Orthis*, *Rhynchonella*, *Spirifera*, etc. These limestones dip east at a high angle below sandstones and shales, which are immediately truncated by the large neck at St. Monans. Traversing this neck the party found themselves upon the outcrops of the bottom limestones of the Scottish Carboniferous Limestone Series. The tide, however, had now come in too far to permit of a hunt for fossils, and the examination of the volcanic phenomena had occupied so much time, that it was necessary to make for the railway station on the return journey. A pleasant saunter of two and half miles brought the party back to Elie in time for the 4.10 p.m. train to Edinburgh.

This ended the official excursion, but a considerable number of the members who remained in Edinburgh were able to have the further advantage of Mr. Goodchild's leadership in an interesting ramble over Blackford Hill (see page 139), and a visit to the collection of Scottish Geology and Mineralogy in the Edinburgh Museum of Science and Art.