

## THE STONES OF OUR DISTRICT.

BY W. M. ALEXANDER.

To those who use the open country primarily as a place of recreation, three branches of science make a special appeal, those, namely, that deal with the plants, animals, and rocks. But while the desirability of knowing something about these is plain, practical considerations must in every case determine how far it is possible to push such knowledge. The ideal would seem to be the possession of such a quantity of information as can be conveniently carried about ; more is a burden, if not to the carrier, then perhaps to his companions ; and we must assume that the mountaineer and walker have set out with the intention of travelling light. In what follows we are discussing geology, from the standpoint of the ordinary person. That person as a rule does not concern himself much with rocks and stones. He knows that modern scientific books are filled with a very formidable terminology and vocabulary, of which he can make little ; and if he does take up a book on geology he lays it down disheartened, and leaves the entire department to the specialist.

Now, it should be possible for the ordinary person to get some knowledge of field geology without excessive effort, rather more in fact than he seems generally to consider within his reach. The mere fact that many books on the subject are unreadable should not blind him to the fact that there is much that can be got not from books but from personal observation ; that personal observation, carried on as opportunity offers over a period of years, is cumulative in its results. Above all, it is not necessary for the thing to be made a task, or even a definite hobby ; let it remain an amusement and nothing more. Here we will attempt to set down something of the casual observational information which is within the reach of the average member of the Cairngorm Club ; that is to say, of a person who makes

frequent tramps about the neighbourhood of Aberdeen on Saturday afternoons and Sundays, and excursions here or there to the hills in summer.

There is one consideration, a very general one, which may be thought to justify such people in taking a casual interest in the rocks below their feet. That is, that the north-east of Scotland, and the region with which the Cairngorm Club is most identified in particular, is located definitely upon one of the world's great mountain chains of the past. That is the chain of the Caledonian Mountains, or as the geological text-books call them, the "Caledonides." Their remains run diagonally across Scotland from north-east to Argyleshire; they reappear in Ireland on one side, and in Scandinavia on the other; and they were once probably of Alpine, and possibly of Himalayan, stature. This fact stands at the back of all field geology in our district, whether it be amateur or professional; and the amateur may find comfort in the additional fact that the structure of the Caledonian Mountains—what they call the "tectonics"—contains many problems which the professionals are still far from solving.

Suppose now that we want to know what rocks these mountains are built up of, and to learn in a rough way to distinguish the different rock types. We have not far to go; for nature has been good enough to lay out collections of representative samples for us in unlimited quantity; these samples are unlabelled, but they are very accessible. We have simply to visit one of the pebbly stretches by the River Dee to be able to handle, one after another, specimens of all the chief rock types on Deeside. Here we can make a start. The pebbles, it will be seen, vary in tint from nearly white to nearly black; and they also vary in schistosity, or capacity for splitting instead of breaking when struck. They can be grouped into some half dozen classes. In the first place there are easily recognizable granites, generally of the reddish granite of the Hill of Fare, Lochnagar sort. There are others of a brighter brick red, close in grain; these are probably quartz-porphyrines. Then there are gneisses, with light and dark bands, extremely variable in

appearance. Flat stones, suitable for skipping on the water, are generally mica-schists. An important group are the quartzites, of two main types; one is an almost white stone formed of quartz grains, the other is greyish and is formed of grains of quartz and of black mica. The remainder are for the most part dark or black stones, and the majority of them are classed as hornblende schists. These pebbles all represent native rock which is to be found in place on Deeside. The great variability within such a class, say, as the hornblende schists, helps us to realize that with a stone we can never get a specific name, as we can for a plant or an animal; the utmost we can get is a class name, while stones of any one class may differ much in general appearance from each other, and may shade imperceptibly into another class.

Suppose that, leaving the pebbles, we climb to such an eminence as the Blue Hill. We see at a glance that the rocks that underlie the north-east of Scotland are for the most part concealed under a covering of gravel, soil, and vegetation; exposures are few, except on the ridges, and are never extensive. In only one direction can we look for a good continuous section of bare rock, and that is along the coast. The coast from Aberdeen to Cove is very easily reached, and provides some features of interest. For instance, the rocks near the harbour mouth and round Girdleness, and again south of Cove harbour, give an excellent show of granite in contact with gneiss, the granite winding about in veins and strings through the darker rock in a striking manner. Along the same stretch of coast are to be seen some examples of intrusive rocks; about half way to Cove, beside a big inlet, there is a sill, or horizontal intrusion, of quartz-porphry, conspicuous with its bright, pink colour; while less conspicuous, there are at other points at least two dykes, or vertical intrusions, of greenstone. This section of coast would appear to give us a true idea of the character of the rock bottom which underlies the whole of lower Deeside; that bottom may be taken to consist of gneiss shot through with granite, and with occasional intrusions of quartz-porphry; the existing quarry holes in the area prove this.

As indicated, what the amateur field geologist may aim

at is a broad general classification of rocks. He uses, shall we say, no other instrument than a pocket magnifying glass. So he must perforce ignore all refinements of classification. These are carried out very thoroughly by modern petrologists by means of microscopes specially fitted for mineralogical work and requiring a special technique. The amateur will accordingly realise his own limitations; his classification can be systematic and quite scientific, but it must be a broad one. We are concerning ourselves only with the north-east of Scotland, and in what follows we will attempt to set out the main rock groups represented there and mention some of the places where they can be seen.

In short synopsis they are as follows:—

Plutonic Rocks—granite, diorite, gabbro.

Volcanic Rocks—andesite, basalt.

Metamorphic Rocks—gneiss, micaschist, quartzite, crystalline limestone, hornblende schist and serpentine.

Sedimentary Rocks—old red sandstone.

Intrusive Rocks—quartz-porphry, greenstone.

#### PLUTONIC GROUP.

*Granite.*—The standard composition of granite is quartz, felspar, and mica. There is much variation in the quantity of mica, black or white, which is present: and the sub-classification of the granite family depends on the chemical nature of the felspar. The granites of our area have been shown to fall into two series, an older and a younger; the former being those which are closely bound up with the country rock, such as we saw at Girdleness, the latter being the large independent masses like such as form Lochnagar, the Cairngorms, and so on. There is no need to mention localities where granite may be seen. Its manner of weathering and decay will be what will sometimes catch our eye as we go along. Sometimes we see it disintegrating in place into “rotten rock.” On the knobs on the higher hills the jointing, whether vertical or horizontal, is always conspicuous. The most interesting form, however, assumed

by our granites when weathering in the mass is to be seen on the summit plateaus of the Cairngorms, where there are frequently considerable areas of loose blocks of stone lying promiscuously upon each other; there is a good instance on Ben Macdhui, near the top of the Tailors' Burn. The German geological books call this phenomenon rather graphically, a "sea of rocks" (felsenmeer).

*Diorite.*—The standard type of diorite consists of crystals of black hornblende and pale felspar. The result is a spotty rock weathering dull and greenish. Diorite is supposed to have arisen in association with adjoining masses of granite, but it is nothing like so abundant as granite. A notable occurrence of it is to be seen in Glen Derry, and can be found by going up the Glas Allt on the east side of the glen. The patch of diorite there may be a mile in diameter, and is entirely surrounded by the Cairngorm granite. It is a conspicuous stone. A similarly big-grained diorite can be got in Strathdon; but most occurrences of this rock are much less noticeable than the Glen Derry sort.

*Gabbro.*—This family comprises a series of rocks of somewhat varied appearance. All are dark, or black-green or black-blue; weathering with a rough surface or with a brown skin that peels off. There is little gabbro on Deeside; probably more in Strathdon; more important occurrences are at Belhelvie, Portsoy, etc. Under certain geologic conditions gabbro may be altered into other sorts of rock, notably epidiorite, hornblende schist and serpentine; this will be discussed under metamorphic rocks.

#### VOLCANIC GROUP.

The volcanic rocks of our region are confined to the old red sandstone area of Kincardineshire and consist of two kinds, andesite and basalt. These represent the lavas of the old red sandstone age.

*Andesite.*—A brown or chocolate-coloured stone, not very hard, dotted frequently with little oblong felspars. Many of the field walls from Dunnottar southwards are built of it.

*Basalt*.—A hard, black rock, weathering dirty brown-green; the typical volcanic lava. The best exhibit of it within our reach is at the Crawton, four miles south of Stonehaven. Several big flows of it are to be seen there in the pudding-stone, and at one place facing the sea there is a rude columnar structure with a suggestion of a giant's causeway.

#### METAMORPHIC GROUP.

The metamorphic rocks are so called because they are metamorphosed or altered forms of other rocks, the alteration having come about by pressure or heat or chemical action, processes which presumably operated on a great scale during the folding of the "Caledonian Mountains." Our area provides a good range of these rocks. Though the main types are distinct, the different classes grade into one another, and many specimens turn up which are on the boundary line between one class and the next. There are some half dozen chief classes in our district.

*Gneiss*.—Main constituents: quartz, felspar, and mica. Well known, especially in boulders, where its characteristic banding appearance is often noticeable. The banding is more or less parallel but winds about in every direction. Gneiss may have arisen from the alteration of plutonic or sedimentary rock, but its origin in any given case may be quite obscure. It can be taken to be an ancient rock.

*Mica schist*.—The definite character of mica schist consists of its marked tendency to split and its abundance of mica. Specimens vary according to locality. It may approximate to gneiss on one hand or to slate on the other; but it is always splittable.

*Quartzite*.—This stone consists of quartz grains which represent an altered quartz sandstone. The Deeside quartzites are mostly fine grained and sugary in texture. The most striking type is a conspicuous white quartzite which stretches in belts across the hills south-west of Braemar, forming Ben Lutharn and other hills; pebbles of this can be picked up anywhere on the river. Another type of quartzite is found along the Dee valley west of



A MOUNTAIN OF QUARTZITE—WEST SIDE OF BEN IUTHARN MOR.



CONTORTED LIMESTONE IN GLENEY.

Braemar ; it has a more definite tendency to split, and so can be called a quartz schist. Similar stones containing mica may be called quartz-mica schist.

*Limestone.*—The limestones of north-eastern Scotland are all crystalline limestones, that is, they are ancient sedimentary limestones which have been completely recrystallised and have lost their sedimentary character. On Deeside this sort of limestone occurs intermittently from Banchory westward ; its presence is frequently indicated by the old lime-kilns in which it was formerly burnt for use.

*Hornblende schist.*—This stone consists mostly of black hornblende. The outside is more or less dirty black ; fresh surfaces rather blue-black. It is fairly common as rock, but is probably still more common as boulders and in field-dykes. It can be very hard. The popular name for it is "blue heathen." Hornblende schist represents, in origin, an altered gabbro or greenstone. In any stretch of country where supposedly there may have been in ancient times a tract of fresh gabbro, forces of metamorphism are generally found to have turned the whole into a "complex" of varied rocks, all referable to the same origin. There is an example of such a complex in upper Deeside, in a stretch of country extending from Glenmuick across Morven into Strathdon. The south side of lower Glenmuick is hornblende schist. Morven is epidiorite, which is an intermediate form of the same rock. The Coyles are serpentine, which is regarded as a chemical alteration of gabbro. Serpentine is easy to recognize : it is black or dark with splashes of colour, and it can be cut with a knife.

#### SEDIMENTARY GROUP.

Of the great series of sedimentary rocks, so abundantly represented elsewhere in Britain, we have only to consider one member : the *old red sandstone*. This formation is best known to us as a rough conglomerate or pudding-stone ; it can be well seen in the mass in the sea cliffs south of Stonehaven. In this pudding-stone will be seen boulders of granite, quartzite, and other rocks of the Grampian range.



The old red sandstone also appears on the north side of our area, in scattered patches over the country which drains into the Moray Firth. On Deeside it does not occur; and on Donside only about Kildrummy. Curiously enough, it underlies part of the town of Aberdeen, but is not visible. There is a rather odd outcrop of it on the shore at Balmedie, where, about half a mile beyond the Black Dog Rock, a considerable stretch of the conglomerate is laid bare at low tide.

#### INTRUSIVE GROUP.

This consists of a rather distinctive group of rocks which can be called dyke-rocks. They form "dykes"; that is to say they fill rents in the old rock surface. The width of these dykes may be anything, but it generally runs about from ten to fifty feet; in length they may run for miles across country, always in a fairly straight line. The rock of these dykes is uniform, hard and compact, and is very frequently worked for road metal. It is of two main sorts, quartz-porphry and greenstone.

*Quartz-porphry.*—This is a well-known stone in our area, much used on the roads. It is pink to brick red in tint; it has the same composition as granite, but is much finer in the grain; and it is called quartz-porphry because the quartz crystals in it often stand out prominently in relation to the ground mass. A good example of a quartz-porphry dyke crosses the Dee at Potarch, slanting across the river bed; many examples may be noticed on the higher hills, where the absence of soil makes it possible to detect their boundaries and to follow them for long distances.

*Greenstone.*—This is the handy field term for a dyke-rock that is scarcer in our district than the foregoing and very different from it in appearance. It is blue-black when broken, and on weathered surfaces disintegrates with a brown-green crust. This stone, called "dolerite" by the geologists, and "whinstone" by roadmen, makes an excellent roadstone. But with us the occurrences of it seem to be neither so frequent nor so extensive as they are in other parts of the country.

Such, then, are the main classes of rocks which members of the Cairngorm Club are likely to meet with in the course of their tramps. The foregoing list has no expert authority ; it is set down by an amateur for amateurs, from the idea that some smattering of geology, sufficient to add materially to the interest of hill excursions, is within the reach of the ordinary person. It is not for a moment suggested that the thing should be made a task ; it should be treated rather as an amusement. The whole problem, in handling stones in the field, is one of classification. Confronting a plant, you can ask, " what is the name of that ? " ; confronting a stone, your question is, " what class does that go into ? " The answer is frequently by no means easy ; but it should be possible for any amateur by using a scheme of broad classes, as suggested, to attain without much trouble a standard of correct diagnosis of say 75 per cent. Further than this he scarcely requires to go ; unless he is to make a definite hobby of the rocks, in which case he can push classification to any lengths he likes.