

V.—*On a BED of FINE-GRAINED INDURATED SANDSTONE, enclosing Rolled Pebbles of Quartzite, interstratified with the Trap of the Campsie Fells.* By JOHN YOUNG, F.G.S.,
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It is now many years since, in my rambles amongst the trap rocks of the Campsie Fells, I became acquainted with the peculiar masses of rock which form the subject of the present communication. In my paper "On the Geology of the Campsie District," I purposely omitted all reference to them, hoping to be able at some time to discover whether or not the rock belonged to the hill, and if so, to find its outcrop. Other duties, however, for a long time prevented me from continuing the investigation, though the subject frequently occurred to my memory; and since the discovery of beds of coal and other strata, with plants and fish-remains of Carboniferous age, intercalated with the traps of the Kilpatrick Hills, recorded in the *Transactions of the Society*,* the importance of finding evidence of interbedded strata at other points in the trap of the Lennox range of hills became the more apparent.

The tract of hill-side on which I first discovered the rock in question, lies to the north-west of the village of Lennoxton, below a lofty precipice of trap known as the "Black Craig." Underneath this precipice a long slope of the hill is covered with debris and large masses of rock that have fallen from the cliffs above. These strew the hill-side as far down as the road leading from Campsie to Fintry. If the hill be ascended from this point, a little to the east of the present march-dyke, until we come to the old "Crow Road"—an old and now disused car-road that formerly crossed the face of the hill to Fintry at a higher level than the present road—several masses of the rock enclosing pebbles of quartzite will be found.

From this point upwards on the hill-side, the boulders may be traced in increasing numbers, until we arrive at the bottom of the hollow in the eastern side of the "Black Craig," where they are lost, or become covered with the trap debris. This point is

* See Vol. II. p. 149; Vol. IV. p. 77, and p. 123.

about 900 feet above sea level, and about 650 above the level of the Campsie valley. At higher levels than 900 feet, I have always failed to trace the rock; and from this circumstance I concluded that the masses did not fall from higher portions of the hill, but were probably derived from the outcrop of some intercalated bed now concealed from view.

Being in the district this last autumn, I made a short excursion along the hill-side to the east of the "Black Craig," for the purpose of ascertaining if any trace of the indurated sandstone could be found in that direction. Keeping on the 900 feet level, where I formerly lost all trace of the rock, I was fortunate in again finding it at several points. Nowhere can I say that I saw the bed exactly *in situ*, but from the numerous blocks of the rock which I met with along this level, either lying loose upon the hill-side, or partially imbedded in the soil, I felt convinced that I was on the line of its outcrop. After tracing it for some distance to the eastward, in the direction of Sloughmucklock, I again lost sight of it, owing to the smooth and verdure-covered slope of the hill concealing the underlying beds. The base of the hill for some distance below the indurated sandstone is composed of bedded trap. In Campsie Glen, about half a mile to the westward, these traps are seen to rest upon members of the Ballagan limestone series, while to the eastward of the "Black Craig" the trap is flanked by the lower Carboniferous limestone strata of the Campsie valley.

From an examination of some of the largest blocks of the indurated sandstone that lie upon the hill-side, the bed seems to average from $2\frac{1}{2}$ to 3 feet in thickness. It is in contact above and below with beds of a fine grained dolerite, which in transparent sections prepared for the microscope shew numerous small dark-green crystals of a mineral, probably either of augite or hornblende, and minute grains of iron in a base of felspar.

The colour of the sandstone is a blackish-grey, varying in some blocks to a brownish-grey. The contained pebbles, which are all quartzite, are of a light-grey or white colour. The rock as it lies on the hill-side under its coating of lichens, is not to be distinguished from the trap of the hill by any peculiarity in its colour, and might readily be passed by, but for the quartz pebbles that are occasionally to be seen protruding from the matrix. The stratum differs, however, from an ordinary conglomerate in this respect, that the pebbles, varying in size from

2 to upwards of 6 inches in diameter, occur only at intervals in the enclosing matrix, which is fine-grained and highly siliceous, there being no grit nor smaller stones filling up the spaces between, as in ordinary conglomerates.

The pebbles, which form the characteristic feature of the bed, are all well rounded and water-worn. In most cases they come quite readily, and with a smooth surface, out of the enclosing matrix. It is evident that the bed must have been deposited in water, as a stratum of fine-grained sand over the surface of the underlying trap; but how the rounded pebbles came to be transported into it at intervals from their parent district, is a point not very easy of explanation. They appear to have been dropped into the sand only here and there, and not to have been drifted by currents of water into their present position. My reasons for coming to this conclusion are that the matrix, as formerly stated, is a very fine grained deposit, and any current that had the power to carry forward pebbles of the size indicated, could not have failed to transport from the same region coarse sand, gravel, and smaller stones; but these we have seen are wanting. The bed therefore differs from the type of an ordinary conglomerate, in which we find stones of various sizes, down to gravel and sand, entering into its composition. As already stated, the stones in the bed are seen to be well rolled; this, I think, it is evident, could only have been done before they were carried to their present position. By what agent they were carried, I will not presume to indicate, beyond stating that water plants when torn up by storms from the stations on which they grew, sometimes enclose water-worn stones amongst their roots, and that these are often drifted away to other tracts where fine sediments are being laid down. This agency has been credited with the carrying of isolated stones met with in other of the geological formations, and it is certain the phenomenon of plants carrying stones over the flat sandy reaches within our own estuary of the Clyde is quite a common occurrence.

If plants carried the stones in this instance, no trace of their remains are now to be found in the bed, nor have I found any fossil evidence to shew whether the stratum is of fresh water or marine origin. I have also broken up several of the quartzite pebbles, and they likewise contain no trace of fossils.

It has been already stated, that the bed under notice lies in the midst of the traps of the hill at an elevation of 900 feet

above-sea level. As the hill at this point rises to the height of 1,500 feet, it follows that at least 600 feet of bedded traps lie over it.

These igneous rocks were no doubt the agents which so highly indurated the stratum from its normal condition of a sandstone, and which would also further vitrify the enclosed pebbles, so that now they cannot be distinguished in hardness and structure from the most vitreous Highland quartzites of Silurian age.

The stratum of sandstone is probably of lower Carboniferous age, like those beds that lie on nearly a similar horizon in the trap of the Kilpatrick Hills to the west. It has evidently been deposited in a basin of the trap, and is probably a lenticular stratum of no great horizontal extent; but from what region the pebbles of quartzite and the arenaceous deposit forming the matrix were derived, it is now impossible to say. From the composition of the materials forming the bed, and the apparent absence of pebbles of trap in the deposit, it is evident the surrounding trap was not then exposed to denudation. We are also entirely ignorant of what may have then been the physical features of the district; indeed all we know is that the Ballagan strata and the traps which form the base of these hills were laid down ere the bed in question was deposited; and that like those already noted in the Kilpatrick Hills, it marks one of those periods of repose between the great outbursts of igneous rock-matter, of which the Campsie Fells are principally built up.

NOTE.—A suite of specimens of the pebbles, matrix, and contiguous trap, were exhibited to afford members an opportunity of studying the peculiarities of the bed. These I purpose placing in the Hunterian Museum, where they may afterwards be consulted along with those obtained from the trap of the Kilpatrick Hills at Bowling.—J. Y.