V.—*On Two Volcanic Necks in Applecross, Ross-shire.* By
J. HORNE, H.M. Geological Survey of Scotland. (*Communicated by permission of the Director-General of the Geological Survey.*)

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IN the course of my official work in Applecross I observed two "necks" in the south-western part of the peninsula which evidently represent the roots of two small volcanoes. Situated on the 1000 feet plateau, and within two miles of the western shore, they pierce the gently-inclined beds of Torridon sandstone. Were it not for the bright verdure that clothes the surface of one of these vents, they would almost escape recognition amid the rocky escarpments and peat-clad dip slopes of the surrounding rocks.

Following the Toscaig river to a point about three miles from Toscaig Bay, it there receives a small tributary on the west side, flowing out of Lochan nan Slochd. This lochan lies along a line of fracture that has been traced for a considerable distance in a NNE. and SSW. direction; the course of the fault being indicated on the surface by a more or less prominent hollow. These necks occur close to, and on opposite sides of, this line of fracture. The more important of the two is situated on the western slope of this hollow, and at a distance of about 300 yards from the south end of the loch.

Ascending this slope, the observer finds an oval-shaped mass of volcanic agglomerate measuring about 180 feet from east to west, and about 150 feet from north to south. The escarpments of Torridon sandstone, which there run nearly north and south, may be followed close to the edge of the agglomerate, when they are suddenly truncated by this amorphous mass. On approaching the edge of the vent the sandstones assumed a bleached appearance, but the contact alteration is certainly not very pronounced. They are indurated and break with a splintery fracture, thus differing from the normal characters of the sandstones and grits.

With the exception of a small patch of basalt at the south end of the neck, it is filled with agglomerate varying somewhat in character. It is of a brownish colour on some weathered surfaces, but in a fresh fracture the matrix has a dull green or grey tint. The blocks embedded in the agglomerate are mainly composed of Torridon sandstone and grit, which are occasionally

subangular, but more frequently oval-shaped. They are usually small, but some measure a foot across, and in one exceptional instance 4 feet by 2 feet. The alteration of the fragments of Torridon sandstone is not very prominent, but as a rule they have a bleached or paler tint than the normal grits of that formation: occasionally they have a glazed or vitreous appearance, and the quartz-grains are turbid or semi-opalescent. But in addition to these Torridon blocks there are abundant lapilli of a basic volcanic rock. A microscopic section of the agglomerate containing these basic lapilli is thus described by Mr Teall: "The lapilli vary considerably in size. They consist of porphyritic feldspars, extremely minute acicular microlites of feldspar, somewhat irregular transparent spaces, now occupied by a yellowish green substance, giving aggregate polarisation and interstitial matter which has been rendered opaque by the separation of ferric oxide. They are undoubtedly altered basaltic lapilli, and it is highly probable that the original base was of a glassy character. The matrix of the rock appears to consist of detached grains of the sandstone and the finer lapilli."

At the south end of the vent, and within the margin of the mass there is a small exposure—a few yards in extent—of highly decomposed basalt, so weathered that it is difficult to get a fresh specimen. It appears to pierce the agglomerate.

The second neck occurs on the east side of the fault already referred to, and about 500 yards from Lochan nan Slochd. Its relations are much obscured by a covering of peat, but along the northern margin of the vent there is a good exposure of coarse agglomerate resembling that just described; the Torridon blocks being of a larger size. Its eastern limit is defined by a small feature formed by the agglomerate, which is covered with peat or turf. At the south end, decomposing basalt is exposed in small scars, but its relations to the agglomerate are not visible.

There is no indication of the age of these two volcanic orifices. Basalt dykes occur in the immediate neighbourhood, and thin sills of the same material traverse the Torridon sandstone near Toscaig and Camasterach. From the nature of the matrix of part of the agglomerate, and the character of the basalt piercing the mass, it is not improbable that they may belong to some phase of the volcanic history of the West Highlands during the Tertiary Period. In the course of his inspection of my field work, Sir A. Geikie paid a special visit to the locality, and after examining the relations of these vents he was inclined to regard them as probably belonging to the Tertiary Period.

In his detailed description of the patch of Liassic strata at Applecross, Professor Judd calls attention to the fact that they are traversed by numerous basaltic sheets and dykes. He

further states that "though it is highly probable that this patch of strata was originally buried under an accumulation of lava sheets, which have since been entirely removed by denudation, yet it is manifest that the great faults which have clearly let down these strata many hundreds, and perhaps thousands, of feet below their original level into the heart of the mountains of Torridon sandstone, have had much to do with their preservation."¹

In 1874, the same author, in his brilliant paper on "The Ancient Volcanoes of the Highlands," has described a large neck of agglomerate in the peninsula of Ardnamurchan, forming the headland of Srone More or Maclean's Nose. The agglomerate breccia "contains numerous angular fragments of both the felspathic and basaltic lavas of earlier Tertiary periods, with some of the underlying gneiss, such being the rocks on which the mass of Bain Shiant is built up; mingled with these are numerous fragments of felspathic scoriæ and ashes, with many fractured and worn crystals of glassy felspar included in the mass."²

In his great monograph on "The History of Volcanic Action during the Tertiary Period in the British Isles" (Trans. Roy. Soc., Vol. xxxv., p. 107), Sir A. Geikie has described an enormous vent filled with agglomerate, about two miles in width, on the north side of the main valley of Strath, in Skye. He states that it has been so seriously invaded by the eruptive rocks of the group of the Red Hills, that its original dimensions and its relations to the surrounding rocks, especially to the bedded basalts, are much obscured. But it has been drilled through the Cambrian limestone, and, as the result of protracted denudation, it now towers steeply five or six hundred feet above that formation on the floor of the valley. He refers to the agglomerate as a coarse, tumultuous assemblage of blocks and bombs embedded in the usual dull, dirty-green matrix. Among the stones are amygdaloidal basalts, various quartz-porphyrries, and large masses of altered Cambrian limestone and quartzite, and pieces of yellow sandstone and shale (Jurassic). The rock is wholly without structure or stratification of any kind.

From these descriptions it is evident that necks filled with volcanic agglomerate are a prominent feature of the Tertiary volcanic rocks of the Western Isles. Indeed, it is highly probable that others may be met with along the sea-board of the mainland between Applecross and Ardnamurchan.

¹ See Q. J. G. Soc., Vol. xxxiv., p. 672.

² *Ibid.* Vol. xxx., p. 263.