On the occurrence of Gyrolite in County Antrim.

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ALTHOUGH the mineral gyrolite has long been known to occur in the British Isles, namely in the basalt lavas of Skye, Mull, and the Treshnish Islands, &c., off the west coast of Scotland, and has more recently been described from the cliffs between Ardtornish Bay and the fault of Dearg Allt in Argyllshire on the mainland,[1] no instance of its occurrence in the lavas of the north of Ireland has hitherto been recorded.

The examination, however, of a large number of specimens collected both for me and by myself during the past year and a half has shown that the mineral, though occurring in small quantity relative to the other zeolites with which it is associated, is fairly widely distributed throughout the harder lavas in the neighbourhood of Belfast.

Up to the present time I have identified the mineral on specimens obtained from the following localities :—

Two quarries in the townland of Legoniel, which are situated one on the north and the other on the south side of the small eminence (locally called Cat Carn) on the high ground between Wolf Hill and Squires Hill; a quarry in the townland of Collinward, above the village of Whitewell on the slopes of Collinward; three quarries in the townland of Ballyhenry to the north-west of Carnmoney Hill; and two quarries on Carnmoney Hill, the one on the north-east slopes in the townland of Ballyduff, the other on the south-west slopes in that of Carnmoney.

These quarries are worked on short contracts for road-metal as it is wanted in the neighbourhood, and, unless a considerable amount of work is being done, specimens are not easy to obtain, even though they may be actually plentiful.

Quarries on Cat Carn, townland of Legoniel.

The first locality in which I noticed the mineral was the quarry on the northern slopes of this hill. In it but one flow is exposed at present, consisting of a fine-grained olivine-basalt containing magnetite in fair

[1] J. Currie, Mineralogical Magazine, 1905, vol. xiv, p. 93.

quantity. The olivines are small and often surround segregation-patches of minutely ophitic augite and felspar-laths, the latter giving the sections a mottled appearance. It shows considerable chloritization and oxidation, and also some serpentinization.

Cavities are numerous and reach at times six inches or more across. The gyrolite occurs in small hemispherical and spherical aggregates, rarely exceeding $\frac{1}{3}$–$\frac{1}{4}$ of an inch in diameter, which when broken open are found to consist of pearly leaflets. The latter are uniaxial and negative, and have strongish double refraction. Their specific gravity is 2·35–2·40.

In the usual type of occurrence the gyrolite nodules are scattered here and there, but sometimes they are grouped into a crust on the coating of faroelite that almost always lines the cavities, and are associated with brilliant, colourless, cube-like, and cubo-octahedral apophyllite crystals. In addition to the faroelite, gyrolite, and apophyllite, a secondary growth of thomsonite, similar in appearance to the so-called 'sphaerostilbite' from the Faroe Islands, and small, yellowish calcite crystals are by no means infrequently present, and more rarely analcite. Very rarely cavities are found in which the gyrolite is deposited on chabazite.

No very definite order of deposition can be observed, beyond the fact that in the common type of occurrence faroelite is the first mineral deposited. On the whole, the gyrolite is anterior to the secondary thomsonite, while as regards the apophyllite it occurs deposited both before and after the latter mineral.

Pure material was difficult to obtain, as in most cases minute crystals of one or other of the associated minerals cover the surfaces of the nodules. For examination as much pure mineral as possible was picked by hand, and this was supplemented by material that was obviously contaminated only with calcite, from which it was freed by treatment with cold citric acid solution. The aggregates were broken up for this purpose, but not powdered, then treated with the acid, washed, and air-dried.

As the external aspect of the nodules varied considerably, even when uncontaminated, several samples were prepared and the water-content of each determined by Penfield's method. No appreciable difference in the percentage of water was, however, observed. This was done in view of the recent work of F. Cornu on the 'micaceous zeolite' group[1] in

[1] F. Cornu, Min.-Petr. Mitt. (Tschermak), 1907, vol. xxv, pp. 513–521. F. Cornu and A. Himmelbauer, 'Untersuchungen am Apophyllit und den

which he showed that, in addition to the two known members of the group, gyrolite and zeophyllite, there exists a third, reyerite, [and probably a fourth] which is externally indistinguishable from those previously known, and which differs but slightly in physical characteristics, but which contains far less water.

The author is at present engaged upon a complete analysis of the minerals. The results [$SiO_2 = 51{\cdot}69$, $CaO = 30{\cdot}44$, $Al_2O_3 = 3{\cdot}64$ per cent.] obtained so far, in addition to the determination of the water, agree well with the analyses of the mineral from other sources. The determination of the percentage of water gave $H_2O = 13{\cdot}44$.[1]

The mode of occurrence of the mineral in the quarry on the south side of the hill is practically identical with that already mentioned, both as regards the habit of the mineral and its associates. The rock also is similar but rather more chloritized and oxidized, and the mottled appearance is more strongly marked.

Quarry on Collinward, in the townland of Collinward.

Here, as in many other Antrim basalt quarries, two distinct layers are visible. At the entrance to the quarry, which is situated on a steep hill-side, is a small exposure of decomposed, highly vesicular basalt, containing in its cavities chiefly analcite and more rarely chabazite, while the main exposure on the quarry face is composed of hard, coarse-grained olivine-basalt. This rock is extremely rich in olivine, which occurs in large porphyritic crystals in a ground-mass of felspar-laths and ophitic augite. Magnetite is fairly frequent, especially included in the olivines, which are often much oxidized.

The cavities, which are usually large and very irregular in form [the largest noted so far being three feet long by eight inches across at the widest part], are found at intervals in patches. They contain: gyrolite as irregular groups and tufts of small, very brilliant, thin, pearly leaflets; large tabular crystals of apophyllite; large hemispheres composed of radiating crystals up to one and a half inches in diameter, which from their optical properties and a partial analysis are mainly composed of thomsonite, but which often carry fine radiating needles of mesolite on their surfaces [these are almost isotropic and show only

Mineralien der Glimmerzeolithgruppe.' I. 'Untersuchungen am Gyrolith,' von F. Cornu. Sitzungsber. Akad. Wiss. Wien, Math.-naturw. Kl., 1907, vol. cxvi, Abt. i, pp. 1213–1241.

[1] F. Cornu, loc. cit., gyrolite from Böhmisch-Leipa, $H_2O = 13{\cdot}06$ %; gyrolite from Skye, $H_2O = 12{\cdot}80$ %; reyerite from Greenland, $H_2O = 6{\cdot}73$ %.

a faint bluish tinge between crossed nicols]; hemispherical aggregates and crusts of thomsonite formed of more or less interlacing crystals; large, colourless analcite crystals; compact and powdery saponite; and more rarely chabazite and calcite.

The gyrolite, which occurs on nearly every specimen but generally only in small quantity, is found in every possible position relative to the associated minerals, dating from the earliest to the latest period of deposition.

A determination of the percentage of water in the mineral gave $H_2O = 13{\cdot}06$.

Quarries in the townland of Ballyhenry.

Of the group of the three quarries in this townland, two are situated 300 yards apart, close by the road which runs north-west from Glengormy to Ballyclaire Junction, and the third a short distance south-west of the more southerly of the first two.

In the most northerly quarry, which is known as Nelson's quarry, two basalt flows are exposed. The upper one consists of hard, somewhat ophitic olivine-basalt, which is full of very small, chiefly granular and often considerably oxidized olivines, and contains also good magnetite crystals. Most of the augite also is granular, but some is ophitic. The lower flow is composed of soft, decomposed, highly vesicular basalt, the cavities of which contain small chabazite crystals and sometimes small analcites and faroelite nodules.

The gyrolite occurs in the upper flow in aggregates similar to those from Cat Carn. They are, however, more commonly packed together in crusts and their leafy structure is much more distinctly marked on their surfaces. They are associated with cube-like apophyllite crystals, secondary thomsonite (which is often very compact), and faroelite. The last is, as a rule, present only in very small quantity, generally as an almost microscopic crust next the cavity-walls.

A determination of the amount of water in the mineral gave $H_2O = 13{\cdot}30$ per cent.

In the quarry south-east of the last, two flows are again visible. The upper one consists of hard, fine-grained, ophitic olivine-basalt, the sections of which are very strongly mottled in appearance owing to the presence of numerous, very minutely ophitic patches surrounded by rather coarser material. It generally shows considerable chloritization and oxidation. The lower flow consists of much altered, highly vesicular basalt yielding

chiefly chabazite, but also in places, where the rock is deep red in colour, stilbite. This flow is exposed in a few places only on the floor of the quarry and opposite the main rock-face. Cavities are fairly numerous in parts of the upper flow, but they are mostly small and solidly plugged.

The gyrolite varies considerably in habit, ranging from compact, hemispherical aggregates like those from Cat Carn to loose aggregates of pearly leaflets like those from Collinward. It is associated with faroelite nodules (which are sometimes of remarkable size and generally well isolated from each other), cube-like apophyllite, fine hairs of almost isotropic mesolite, and small calcite crystals.

In the third quarry only the top flow is exposed, and this is similar in every way to the last. At present I have obtained but two examples of the mineral from this quarry. On these it occurs in loosely aggregated leaflets on faroelite, with thick-tabular and cube-like apophyllite crystals.

In general, these three occurrences differ from those on Cat Carn in the relative scarcity of apophyllite, which at that locality is, with the exception of faroelite, the commonest mineral.

Quarry on Carnmoney Hill, townland of Ballyduff.

In this quarry, which is the middle one of a group of three situated on the hill-side between 500 and 600 feet above sea-level and which has only recently been re-opened, there is only one flow visible. The rock is an olivine-basalt characterized by the presence of good porphyritic olivine crystals in a very fine-grained ground-mass of felspar-laths and granular augite.

Cavities are very scarce; of those found so far, only one contained gyrolite. In this instance the cavity was filled with radiating, leafy aggregates of the mineral in association with greenish saponite.

Quarry on Carnmoney Hill, townland of Carnmoney.

Two distinct layers are here visible; the upper one consisting of highly vesicular, decomposed basalt, yielding occasionally faroelite and small analcite crystals; the lower of hard olivine-basalt, similar in character to that in the townland of Ballyduff. This rock is rudely columnar over part of the exposure.

Cavities are not numerous, and are generally poor. Faroelite is the mineral most commonly found. In a few instances, however, aggregates

of gyrolite (similar to those from Cat Carn), in association with cube-like and cubo-octahedral apophyllite crystals, are deposited on the faroelite.

The author, who is at present engaged upon a systematic examination of the minerals from the various localities mentioned, desires to express his thanks to Dr. G. T. Prior and Mr. L. J. Spencer for their kind assistance, and to Mr. F. H. Butler, who undertook the examination of the rock-sections.