

*Notes on the occurrence of fluorite in Aberdeenshire
and Banffshire.*

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FLUORITE is by no means a common mineral in Scotland, and Scottish specimens, with the exception of those from Craigmuschat quarry, Gourrock, Renfrewshire, are very rarely to be seen in collections. In the following notes an account is given of some of the more remarkable occurrences visited by the writer in the summer of 1934. Others recorded by M. F. Heddle¹ were also visited and are mentioned, although they no longer yield specimens.

Abergairn lead mine, Glen Gairn, Ballater, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 91 NE).

This small but interesting mine (Corrybeg mine of Heddle) is situated about one mile north-west of Ballater. The occurrence of galena here was known prior to 1794, but according to the old 'Statistical account of Scotland', 1794, vol. 12, p. 227, no attempt had been made to find the vein. It is referred to by William MacGillivray in his 'Natural history of Deeside and Braemar', 1855, p. 199, as an abandoned mine from the dump of which he collected cubes of yellow fluorite. The mine was apparently opened between 1820 and 1830, but attained a depth of only six fathoms, two shafts being sunk, a number of pits made on the vein, and a shallow level driven in from the hillside.

The main vein, a fault fissure, has a direction about north-north-west, and has been traced for about 120 yards. It is, according to Heddle, intersected by another vein, both of them containing fluorite. The enclosing rock is hornblende-schist and fine-grained siliceous schist very near the granite.

The specimens described in the following notes were obtained by the writer in digging through the old dump and by breaking up large masses of vein-stuff which had been built into a wall. Typical

¹ M. F. Heddle, *The mineralogy of Scotland*, 1901, vol. 1, p. 40.

specimens of the vein-filling show the following sequence of minerals from wall to wall: quartz with a very pale greenish steatite-like mineral and greenish-grey siliceous schist containing small crystals of pyrite; white lamellar calcite (schieferspar); bluish-grey-green to purplish blue fluorite containing small crystals of galena and yellow blende; a very thin band of deep violet fluorite; ivory-coloured crystalline granular orthoclase; and calcite into which project from the granular material slender prismatic crystals of orthoclase.

The following are the characters of the minerals observed:

Fluorite forms one of the principal vein constituents and when massive the prevailing colours are bluish-grey-green to greyish blue. When crystallized there is a complete and remarkable sequence of forms from the simple cube and simple octahedron to an almost globular habit showing six crystal forms (with a possible total of 122 facets).

The following six types of crystals may be distinguished:

1. Deep honey-yellow cubes up to 4 cm. along the edge, often with the corners clear and smooth, central portion of the faces being cloudy and showing raised cubic corrosion figures. These crystals are often encrusted with small yellowish stained crystals of orthoclase of adularia habit, and are associated with small bipyramidal crystals of quartz.

2. Small pale yellow cubes up to 4 mm. along the edge with well-developed faces of m (311).

3. Associated with the large, deep honey-yellow cubes are small, up to $1\frac{1}{2}$ mm., beautifully symmetrical and nearly colourless crystals, combinations of a (100), d (110), f (310), o (111), m (311), V (15.6.2). These crystals graduate between elongated cubes with small faces of all the forms given above, to nearly globular crystals in which the same forms are all more or less largely developed. Fig. 1 represents one of the crystals measured. The mean of four measurements of the angle (15.6.2) : (100) is $22^\circ 59'$, calculated $22^\circ 51\frac{1}{2}'$. Some of the elongated cubes have curious raised edges suppressing (110) and (310), with an opening at each corner (this peculiarity was noticed by Heddle).

4. Small pale violet or colourless cubes up to 5 mm. with well-developed faces of d (110); with small octahedral crystals of galena (100), (111), yellow blende, calcite, and quartz.

5. Small very pale violet to almost colourless corroded crystals

(100) with largely developed (111) and (110), with deep violet-blue surface patches parallel to the cube or octahedron faces. Associated with these are small white crystals of orthoclase of adularia habit.

6. Very rarely small (4 mm.) greyish-blue simple octahedra; with small prismatic crystals of quartz in cavities in massive fluorite of the same colour.

Heddle in his 'Mineralogy of Scotland' (pls. XI and XII) has figured eight crystals from this locality, showing the combinations *af*, *af*₀, *ado*, *adm*, *admo*, *an*, *adno*, *ap*; and he also mentions the combination *ao*.¹ His crystallographic descriptions and drawings are, however, often very unreliable.

The bluish-grey-green to greyish-blue fluorite from this locality exhibits brilliant phosphorescence on heating, showing first green, then sky-blue, and finally violet. The amber-yellow is non-phosphorescent. None are fluorescent under the ultra-violet rays.

Blende. This is one of the few localities in the British Isles that yield light yellow blende. It occurs as cleavage masses and rough crystals, in colour yellowish-brown, tawny to honey-yellow, embedded in greyish-blue fluorite, calcite, and ivory-coloured crystalline orthoclase, forming an attractive combination of colours. The crystals, which attain a diameter of 1½ cm., are combinations of *o*(111), *d*(110), *n*(211), many of them twinned on (111). The combination *d*(110), *m*(311) also occurs according to Heddle. This blende is phosphorescent when heated, but shows no fluorescence.

Galena as small cubes along with blende is sparingly distributed through the fluorite. Small dull grey cubes and octahedra with (100) often superficially altered to cerussite occur in cavities.

Cerussite, rarely as small white prismatic and tabular crystals, *b*(010), *m*(110), *p*(111), in cavities with galena and fluorite.

Pyromorphite and *erythrite* were observed as minute traces.

Pyrite, small embedded crystals, *e*(210), occur sparingly in the quartzose portion of the vein and in the adjoining schist.

¹ Letters as in Dana, System of Mineralogy, 6th edit., 1892.

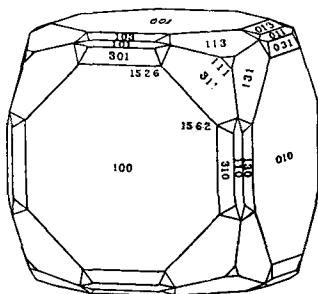


FIG. 1. Crystal of fluorite from Abergairn mine, Ballater, Aberdeenshire.

Chalcopyrite is occasionally present as small spots associated with galena and blende in the fluorite.

Manganite. Heddle records very minute crystals, $c(001)$, $k(230)$, as occurring here with fluorite.

Psilomelane occurred, according to Heddle, very rarely in quartz, with fluorite, galena, and blende.

Orthoclase. A rib of peculiar ivory-coloured crystalline granular orthoclase up to 2 cm. in thickness lying between fluorite and calcite appears to be persistent in the vein. This orthoclase has a specific gravity 2.56 and refractive index 1.523. Projecting from the granular material and embedded in the adjoining calcite, or more rarely free when the calcite has been dissolved, are long slender, somewhat diverging rhombic prisms, up to 1 cm. in length, $m(110)$ terminated by $c(001)$, and much elongated in the direction of the c -axis. These crystals are too rough for measurement, but they are undoubtedly orthoclase, although presenting such an unusual slender habit for that mineral.

Orthoclase is also present in the form of small (2 mm.) white to yellowish crystals of simple adularia habit, $m(110)$, $c(001)$, occupying cavities with small purple cubes (ao) of fluorite; while associated with the large yellow cubes of fluorite, either investing them as a crust or lining cavities, are small, deep yellowish-brown stained, short stout crystals, $c(001)$, $m(110)$, $x(\bar{1}01)$, with a tendency to polysynthetic development.

It seems probable that the dolomite recorded from here by Heddle, but of which the writer has seen no trace, was in reality orthoclase.

Creag an t-Seabhaig, north side of the Pass of Ballater, Ballater, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 91 NE.)

Robert Jameson recorded the occurrence of fluorite at this locality as long ago as 1804. It is also referred to by Greg and Lettsom¹ as 'Balater House', and by M. F. Heddle as 'near Monaltrie House and the Pass of Ballater'.

The specimens which form the subject of the present notes were obtained last summer by the writer by breaking up three very large blocks, each weighing several hundredweights, which had fallen, evidently some years ago, from a large vein high up on the cliff-like granite face of Creag an t-Seabhaig overlooking the road on the

¹ R. P. Greg and W. G. Lettsom, *Mineralogy of Great Britain and Ireland*, 1858, p. 24.

north side of the Pass of Ballater. The exact position of the vein could not be determined, but the granite scree forming the lower part of the escarpment is now being removed, and as a result material from higher up is constantly descending to the road level. The blocks in question consisted of crystalline, comby and often somewhat smoky quartz, fluorite, and included subangular fragments of altered granite, the constituents of which are quartz, pink orthoclase, and yellowish buff-coloured gilbertite. Included in the fluorite are rarely small spots of galena.

The fluorite in mass shows a zonal concentric structure following octahedral outlines, the centre of each structure often showing a distinct deep blue-green-grey octahedron which on fracture of the mass is sometimes partly isolated. This is succeeded by bands of white, dark slate-violet, and deep bluish-grey-green. More rarely, the fluorite is finely banded in heliotrope-grey, green, vinaceous-purple, and white, all the bands having minute spots of deep purple; the contrasts of these colours, in both cases, being very beautiful. In one very quartzose block the fluorite is opaque white to very slightly greenish, with the same zonal structure, and forming a sort of breccia with light drab-coloured rounded fragments of crystalline quartz.

Cavities in these masses are lined with crystals of fluorite, small colourless prismatic crystals of quartz, and occasionally contain small tabular twinned crystals of cerussite. The fluorite crystals present the following characters:

1. Violet-grey to, in part, opaque heliotrope-grey cubes up to 2 cm. along the edge.
2. Dull violet-black cubes, some with small faces of (15.6.2), up to 1 cm. along the edge.
3. Very pale violet cubes with small, deep violet triangular markings at each corner.
4. Small pale green cubes grouped in parallel positions.
5. Small two-coloured violet and green cubes up to 2 mm. along the edge, more or less grouped in parallel position, with a tendency to assume polysynthetic octahedral aggregates. Some of these crystals show an extremely beautiful colour figure. The outer violet cube has a smaller green octahedral plan set diagonally within and traversed by a cloudy white axial cross (fig. 2).

The multi-coloured and white fluorite from this locality exhibits remarkably brilliant and persistent phosphorescence on heating:

first green and then a beautiful violet. Its fluorescence is extremely feeble.

In the wood about 1600 yards a little east of north of Creag an t-Seabhaig a trial has been made on a small galena-fluorite-bearing vein traversing the granite, and is probably the actual locality referred to by R. Jameson in 1804. It is shown as 'Old Lead Mine' on the six-inch Ordnance map, Aberdeenshire sheet 91 NE.

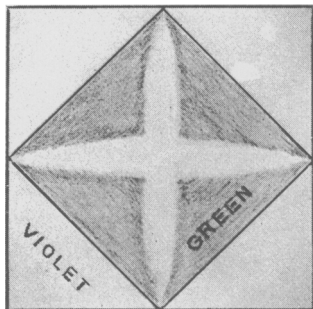


FIG. 2. Fluorite from Ballater, showing zonal structure and white axial cross.

Tomnakiest upper granite quarry, Cambus O'May, Ballater, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 81 SW.)

Fluorite occurs here rarely as a thin, finely crystalline, deep greyish-lavender crust, and as minute, pale yellowish cubes, with yellow gilbertite on joint-faces of pinkish granite.

Neil's granite quarry, Rinabaich, Ballater, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 91 NW.)

Here the vertical joint-faces of the fine-grained pinkish granite are sometimes thickly encrusted with small (2 mm.) dark purple-drab cubes of fluorite.

The following localities for fluorite are given by M. F. Heddle in his 'Mineralogy of Scotland', 1901, vol. 1, p. 42:

Coilacriech, Ballater, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 91 NW.)

Fluorite is stated by Heddle to occur as violet crystals in a bed of yellow metamorphic limestone above this place. He also, on the authority of Michie, gives the north bank of the river Dee near Coilacriech as a locality for fluorite. The writer failed to find fluorite at either of these localities.

Crathie limestone quarry, Creag a Chlamhain, Crathie, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 90.)

Fluorite occurred here rarely as violet crystalline patches in white crystalline calcite in metamorphic limestone, associated with garnet,

wollastonite, &c. There is a specimen of this description, collected by Heddle, in the Royal Scottish Museum, Edinburgh. The quarry has been abandoned for many years, and the writer failed (1934) to find any fluorite.

Muir limestone quarry, Aboyne, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 93 NE.)

Fluorite is recorded from here by Heddle as deep purple octahedra associated with diopside, graphite, sphene, and pyrrhotine in a quartzose belt in metamorphic limestone.

Midstrath limestone quarry, Aboyne, Aberdeenshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Aberdeenshire sheet 94 NW.)

Fluorite is also recorded from here by Heddle under conditions exactly similar to those at Muir. Both Muir and Midstrath quarries have been abandoned for many years; the former is much overgrown and the latter full of water, and the writer failed (1934) to find any of the recorded minerals.

James Sowerby, in his 'British Mineralogy', 1804, vol. 1, p. 59, and plate 26, figures and describes a specimen of fluorite from Aberdeenshire. This shows small dark purple octahedra, some with greenish interiors, on calcite and baryte (cawk), the latter mineral being probably a wrong identification. This specimen may possibly have been from either Muir or Midstrath quarries.

Na tri Chaochain, river Avon between Tomintoul and Inchrory, Banffshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 44; six-inch Banffshire sheet 43.)

Attention was probably first called to this remarkable occurrence of fluorite by the local keepers, who have been responsible all over the Highlands for pointing out many of the more inaccessible localities of striking minerals. Professor James Nicol seems to have been the first to record the occurrence in William MacGillivray's 'Natural history of Deeside and Braemar', 1855, for this contains a list of minerals occurring in the Braemar district drawn up by Nicol, and amongst them it is stated that fluorite occurs 'in the granite of Glen Aun (Avon) above Pomantoul [Tomintoul] and at Alt-tri-chaochan'. Heddle also visited the place, and it was briefly referred to by Lionel W. Hinxman in 'The explanation of sheet 75, Mem. Geol. Survey of Scotland', 1896, p. 14, and in more detail by Heddle in his posthumous 'Mineralogy of Scotland', 1901, vol. 1, pp. 41-42.

The following observations are based on repeated visits to the locality by the writer in the summer of 1934, much kindly and intelligent help having been rendered by the keepers, Mr. Angus MacDonald and Mr. Alexander Stevenson.

The locality is situated on the property of the Duke of Richmond



FIG. 3. Na tri Chaochain, Banffshire. View showing two of the three burns with the river Avon in foreground. That on the right is the one from which the specimens described were obtained.

and Gordon, $5\frac{1}{2}$ miles south of Tomintoul on the Inchrory road, and about 400 yards from the west bank of the river Avon. Here three small parallel rocky burns (Na tri Chaochain, or Allt tri Caochan of Heddle), often nearly dry during the summer months, have cut narrow gorges in the hill-side before joining the Avon (fig. 3). The hill is composed of light grey mica-schist with thin bands and lenticles of light to dark grey highly metamorphosed limestone. About 400 yards from their junction with the Avon all three burns are traversed by a fault having a north-west and south-east direction, but it is only in the middle one that the mineral contents of this fault are well exposed, and it is here seen to contain an abundance of fluorite.

The filling across the fault from west to east consists, as far as can be seen, of a breccia made up of angular fragments of more or less silicified mica-schist, sometimes containing small garnets, and enveloped in comby and radially aggregated quartz, violet and green fluorite, pink and white calcite, with no metallic minerals save a trace of pyrite. Only a very few yards of the fault are exposed along its strike, and its width, which is very considerable, is largely

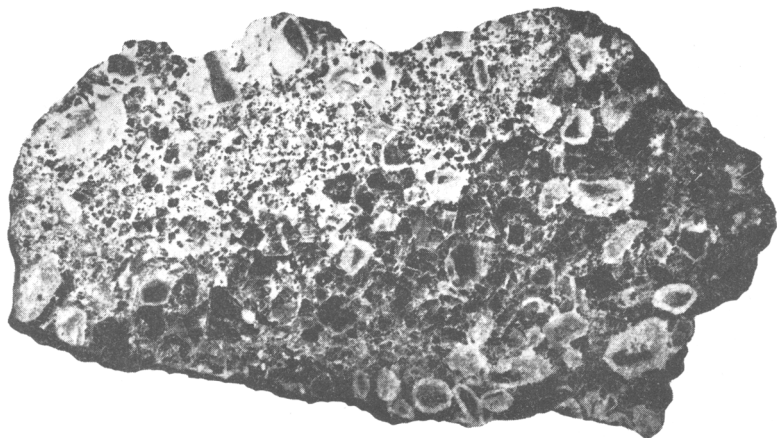


FIG. 4. Fluorite, quartz, mica-schist breccia from Na tri Chaochain, Tomintoul, Banffshire.

masked by the bed of the burn being filled with loose rock. This consists of slab-like masses of mica-schist, many of them showing on their weathered surfaces numerous crystals of altered andalusite averaging 1 cm. in length, light grey slaty limestone, and large masses of the breccia, also occasional water-worn boulders of transported pinkish granite (the nearest granite being distant about three miles to the south). Similar rock material is present in both the other burns, though fluorite is far less abundant. The fluorite occurs as follows :

1. Large masses consisting of a breccia of small angular fragments of silicified mica-schist surrounded by aureoles of minute, radially arranged white quartz crystals, set in a groundmass of dark violet fluorite. In the interior of some of the masses the mica-schist nuclei are hardly, if at all, apparent, and the quartz forms white radial aggregates (fig. 4). This particular occurrence of fluorite is unlike any other known in the British Isles.

2. Dark violet-grey to blackish-violet-grey octahedra, up to $4\frac{1}{2}$ cm. along the edge. These crystals have somewhat the character of cleavage octahedra from the fact that they do not occur in open cavities, but are included in very easily cleavable crystalline fluorite, and are only exposed when such violet masses are carefully broken, leaving sharp octahedral casts. Their faces are, however, rough and dull in contradistinction to the cleavage octahedra. In some

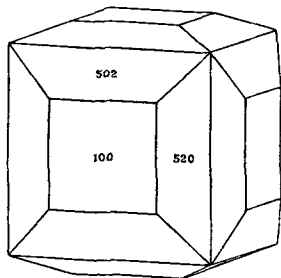


FIG. 5. Crystal of fluorite from Na tri Chaochain, Tomintoul, Banffshire.

cases their easy separation is due to the fact that they are enveloped in a very thin layer of calcite, while some of the larger crystals have their faces traversed by numerous narrow bands of white calcite which occupy the octahedral cleavage planes. These crystals were all obtained from the west side of the fault just below the small waterfall high up the burn.

3. Very rarely as small (up to 2 mm.) slightly pinkish four-faced cubes a (100), k (520) (fig. 5), resting on minute grey drusy quartz crystals, on a quartz and mica-schist breccia. A single specimen of this description was obtained from among the loose material in the bed of the middle burn.

4. Sage-green to celandine-green veins with pink coarsely cleavable calcite; also as large masses, celandine-green and dark to pale violet.

5. Green octahedra, and green octahedra with a thin outer layer of dark violet, up to 2 cm. along the edge, enclosed in a brecciated groundmass of comb-like and radially arranged quartz surrounding mica-schist fragments. This breccia contains many cavities lined with minute quartz crystals covered with pearly white scaly sericite. One cavity in such a mass contains a single minute dark violet poly-synthetic four-faced cube of fluorite. These specimens were obtained from loose blocks in the lower part of the burn.

Hedde mentions the occurrence of pale green fluorite in rude cubic crystals, about ten inches along the side, embedded in calcite. If this observation is correct the particular exposure is now obliterated as no trace of such a thing was observed by the writer.

The dark violet-grey fluorite from this locality exhibits a bright blue-violet phosphorescence on heating; the green, first a green and then violet. It shows no fluorescence.

The only other mineral observed was prochlorite (recorded by Heddle), which occurs rarely as rosettes, up to 5 mm., formed of six-sided platy crystals, internally greyish-green and externally rusty-brown, associated with quartz and calcite.

Maisley limestone quarry, Keith, Banffshire. (One-inch Ordnance Survey of Scotland, popular edition, sheet 29; six-inch Banffshire sheet 20 NW.)

Fluorite was known from here prior to 1858, and the locality is mentioned by Heddle ('Mineralogy of Scotland', 1901, vol. 1, pp. 42, 14; pl. XI, fig. 2) on the authority of Cunningham. It is stated to have occurred as purple octahedral crystals, $o(111)$, $a(110)$, $n(211)$, associated with stibnite in grey limestone. In the description under fluorite there is a misprint of 'stilbite' for stibnite. This quarry has been long abandoned and is now much grown over, and the writer failed (1934) to find a trace of either of these minerals. Two specimens of massive foliated stibnite from here are preserved in the Royal Scottish Museum, Edinburgh.
