Metalliferous mineralisation, Grampian Highlands

From Earthwise

Jump to navigation Jump to search

Stephenson, D, and Gould, D. 1995. British regional geology: the Grampian Highlands. Fourth edition. Reprint 2007. Keyworth, Nottingham: British Geological Survey.

☐

Contents

- 1 Metalliferous mineralisation - introduction
- 2 Mineral production
- 3 Dalradian stratabound mineralisation
- 4 Vein deposits
- 5 Other types of mineralisation
- 6 Full list of references

Metalliferous mineralisation - introduction

Many occurrences of precious and base metals and of baryte have been discovered in the Grampian Highlands over the last quarter of a century as geochemical and other modern exploration techniques have been applied to the region; these add to the old records of metalliferous mineralisation (Wilson and Flett, 1921). Publications arising from the BGS Mineral Reconnaissance and Geochemical Survey programmes, plus the reports of exploration companies now on open file (Colman, 1990), form a metalliferous database comparable with that of any other region of similar size in the world. Geochemical atlases covering the Grampians record well over 100 locations of significant mineralisation (e.g. Gallagher, 1990; 1991a; Gallagher and Young, 1993) and provide multi-element data on drainage samples from 47 000 sites at a mean density of one sample/1.5 km^2. Also available are comprehensive gravity and aeromagnetic maps; airborne electromagnetic and radiometric surveys of some areas have been placed on open file by exploration companies.

Eight types of mineralisation are described on the basis of the 28 selected occurrences, numbered with references, in the table below and located on P915451. Of principal economic significance are Dalradian stratabound deposits and post-Caledonian vein deposits, probably of late Silurian to Carboniferous age, cutting Dalradian rocks. Rocks of the Dalradian Supergroup are considered to have been the principal crustal reservoir of metals in the Grampians region (Simpson et al., 1989; Plant et al., 1991).

Principal metalliferous mineral occurrences in the Grampian Highlands, numbered from north to south as on P915451

No	Name	Type	Mineralogy	Reference
1	Stotfield	G	G1	Naylor et al., 1989
2	Littlemill	C	Cp PGM Pn Po	Fletcher and Rice, 1989
3	Balfreish	F	Bt	Gallagher, 1984
4	Arthrath	C	Cp PGM Pn Po	Rice, 1975; Gallagher, 1991a

5	Kelman Hill	C	PGM Po	Gunn et al., 1990
6	Rhynie	E	(As Au Sb)	Rice and Trewin, 1988
7	Lecht	B	Mx	Smith, 1985; Nicholson and Anderton, 1989; Smith et al., 1991
8	Gairnshiel	D	Bm Ct Fl Mb Sp Wo	Webb et al., 1992
9	Abergairn	H	Fl Gl Sp	Dunham, 1952; Gallagher, 1991a
10	Coire Loch Kander	A	Bt Gl Sp	Gallagher et al., 1989; Fortey et al., 1991; Fortey et al., 1993
13	Duntanlich Ben Eagach Foss	A	Bt Cn Sp Gl	Coats et al., 1981; Fortey and Beddoe-Stephens, 1982; Moles, 1982; Willan and Coleman, 1983
14	Glen Lyon	A	Gl Sp	Coats et al., 1984
15	Calliachar Burn	H	Ap Cp Gl Go Sp	Mason et al., 1991
16	Loch Lyon	A	Bt Cn Gl Sp	Coats et al., 1984
17	Tomnadashan	D	Ap Bm Cp Mb St	Pattrick, 1984
18	Corriecharmaig	C	Ch	Harrison, 1985; Hawson and Hall, 1987
19	Corrie Buie	H	Bm Cp Gl Go Sp	Pattrick, 1984
20	Auchtertyre	A	Cp Gl Mb Sp	Fortey and Smith, 1986; Smith et al., 1988; Scott et al., 1988
21	Tyndrum	H	Bt Cp Gl Sp Tt Ur	Pattrick et al., 1988; Pattrick et al., 1991
22	Cononish	H	Cp Gl Go Sp Te	Parker et al., 1989; Earls et al., 1992
23	Lagalochan	D	Ap Cp Gl Go Sp St Te	Harris et al., 1988
24	Coille-braghad	A	Po Cp	Wilson and Flett, 1921
25	McPhun's Cairn	A	Cp Gl Sp	Smith et al., 1977; Willan and Hall, 1980
26	Kilmartin	H	Cp	Wilson and Flett, 1921
27	Meall Mor	A	Cp Gl Sp St	Smith et al., 1978; Mohammed, 1987
28	Mulreesh	H	Cp Gl Sp	Wilson and Flett, 1921; Barnett, 1959
				Mineralogy: Brackets indicate chemical elements, not minerals
				Key to types of metaliferous mineral occurences
				Types of metalliferous mineral occurrence
				H Vein
				G Hosted by Permo-Triassic sedimentary rock
				F Hosted by Middle Devonian sedimentary rock
				E Epithermal
				D Associated with granite and diorite
				C Associated with basic and ultramafic rocks

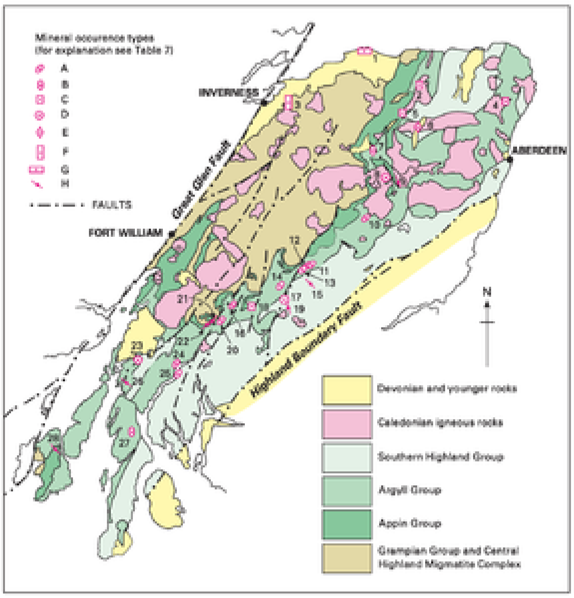
				B Manganese
				A Dalradian stratabound

Mineral production

Mining for lead, with silver as a valuable by-product, and to a lesser extent for copper, nickel and manganese, was quite widespread in the Grampian Highlands in the past, extending into the present century only at Tyndrum (21 on P915451) where about 10 000 tonnes of lead ore were produced from veins in the periods 1741 to 1862 and 1916 to 1925. Some 200 t of zinc ore was extracted from dumps in this final period. Wilson and Flett (1921) record an output of 1400 t lead and 0.5 t silver in the period 1862 to 1880 from Islay, principally from veins at Mulreesh (28). Smaller mines at Abergairn (9) and Corrie Buie (19) exploited lead veins and the Kilmartin veins (26) yielded copper, as did a diorite-granite intrusion containing disseminated sulphides at Tomnadashan (17). Some 400 t of ore containing nickeliferous pyrrhotite were raised from the Coillebraghad deposit (24) which, like the old copper mine of Abhainn Strathain at Meall Mor (27) and the lead-copper trial at McPhun’s Cairn (25), is classified as Dalradian stratabound in type. Iron was extracted in the eighteenth century, and manganese in the nineteenth, from breccias in the Dalradian at the Lecht (7).

Bedded baryte and zinc-lead sulphide deposits in Dalradian rocks of the Aberfeldy district, found in the 1970s (Coats et al., 1984) are among the most important mineral discoveries to be made in Britain this century. Foss Mine (13), the largest baryte producer in Britain, and the Ben Eagach Quarry (12; P064564) have yielded more than 0.5 Mt of direct shipping-grade ore (defined by a minimum specific gravity of 4.2 gcm^{-3}) since 1984 for use in drilling fluid in North Sea hydrocarbons operations. Underground production of 0.2 Mt/annum over 30 years is planned for the adjacent Duntanlich deposit (11) (Butcher et al., 1991). A small amount of baryte was quarried at Balfriesh (3) around 1980. Economic evaluations have also taken place of gold-bearing structures at Cononish (22), presently regarded as Britain’s premier gold-silver deposit, and at Calliachar Burn (15) where a little gold was extracted in 1991.

Dalradian stratabound mineralisation



Principal metalliferous mineral occurrences in the Grampian Highlands. P915451.


Stratabound baryte deposit, Ben Eagach Quarry, Aberfeldy, Perthshire. P064564.

Eas Anie Vein, Cononish gold prospect, Tyndrum, Perthshire; a complex breccia vein (right) cut by shears (centre). P244649.

Metasedimentary rocks of the Easdale and Crinan subgroups in the Argyll Group contain stratabound deposits of baryte, barium silicates, base metal sulphides and chromian minerals at locations over some 200 km of the regional strike (P915448). Mineralisation is recognisable in at least six horizons despite Caledonian deformation and amphibolite-grade metamorphism (Smith et al., 1984).

Deposits of baryte accompanied by sulphidic quartz-celsian rocks and barium-enriched mica-schists extend at intervals over 7 km of the strike-length of the Ben Eagach Schist (Easdale Subgroup) near Aberfeldy (11–13). The Duntanlich deposit is sited towards the base of the formation on the strike extension of the deposit being quarried (in 1993) at Ben Eagach, forming a mineralised zone tens of metres thick running for some 2 km. Foss Mine on the other hand, lies in a baryte bed close to the stratigraphical top of the Ben Eagach Schist, at a similar level to the subeconomic mineralised zone adjacent to the Duntanlich deposit (Gallagher, 1991b). Although of no economic significance, unusual barium minerals–barian muscovite containing up to 8% BaO and the barium feldspar celsian—are the major components of the mineralised zones. Another barium feldspar, hyalophane, and the hydrated barium silicate, cymrite, are also present. Overall the Aberfeldy section of the Ben Eagach Schist probably represents the highest concentration of barium known worldwide. The bedded baryte of the Aberfeldy deposits is composed of anhedral grains 0.1–2.0 mm across with accessory carbonate, magnetite, sulphides (mainly pyrite) and rare fuchsite (the chromian mica). Thin veins of coarse-grained crystalline baryte are ascribable to postmetamorphic remobilisation.

Company drilling at Duntanlich (11) defined a high-grade baryte bed 5– 13 m thick (maximum 28 m), extending over 0.8 km of strike and to at least 550 m below surface. The bed is enclosed by quartz-celsian rocks in which sphalerite and galena can attain econonomic grades. These rocks exhibit fragmental textures interpreted as a consequence of growth fault activity during basin-floor ore formation. The upper mineralised zone at Duntanlich, which runs for 0.6 km, contains faulted units of baryte and quartz-celsian rock. It has an outcrop width of 100 m made up largely of barium-enriched graphitic muscovite-schist, calcareous-schist and muscovite-schist. The Ben Eagach quarry (12) has operated since 1990 with an annual production of 10 000 t of baryte from a folded bed averaging 2.5 m in thickness over a strike-length of 250 m. The associated quartz-celsian rocks can be rich in sphalerite and galena, which have been locally remobilised, and exhibit spots of fuchsite. At this locality are present a 4.3 m-thick bed of manganoan calcite containing fine-grained sphalerite and galena of ore grade, sulphidic dolomitic quartz-rock, barium-enriched muscovite-schist and sphalerite-galena veins in cherty quartz-celsian rock. Foss Mine (13) has produced about 50 000 t of baryte annually since 1984 from a bed averaging 4 m in thickness in the underground and openpit workings where extraction has been successfully adapted to the pronounced folding. It forms part of mineralised zone 1.8 km in strike-length and 60 to 100 m thick which has been tested by drilling through 250 m of vertical interval.

Deposits closely similar to Foss in composition and lithostratigraphical position are preserved 45 km to the WSW at Loch Lyon (16) and 45 km north-east at Coire Loch Kander (10) along the regional strike of the Ben Eagach Schist and its lateral equivalent in the north-east, the Glas Maol Schist. On Beinn Heasgarnich and in Allt Chall south of Loch Lyon, a thin (1–2 mm) layer of calcareous schist containing variable amounts of baryte, barium silicates (barian muscovite, celsian and hyalophane), sphalerite and galena is conspicuously exposed a few metres beneath the base of the Ben Lawers Schist. The horizon extends for 3 km on the upper limb of the recumbent Ben Lui fold and on the lower limb it is traceable for at least 1 km. At Allt an Loch near Coire Loch Kander, bedded baryte-quartz rock, 4.5 m thick in a drill intersection, can be followed for 0.7 km in thin graphitic schist lying directly beneath amphibolite of the Ben Lawers Schist (Forty et al., 1993). In the corrie itself sphalerite, galena and iron sulphides are common in a 15 m-thick band of barian quartzite which displays a mineralogy unique to Britain, including armenite [$BaCa_2Al_3(Al_3Si_9O_{30})2H_2O$], hyalophane, baryte, salitic pyroxene and tremolite-actinolite, attributable at least in part to the contact metamorphic effects of a Silurian diorite stock. This intrusion also postdates a thin baryte-galena vein which is therefore among the oldest recorded in Europe.

The stratabound baryte and related deposits in the Ben Eagach Schist are of synsedimentary-exhalative origin. The sulphur isotope value of Aberfeldy baryte (^{34}S + 33%) is close to that of late Neoproterozoic seawater and most of the associated sulphides are also isotopically heavy (about + 24%), indicating sulphur of hydrothermal origin. Metalliferous brines are believed to have been exhaled into small rifted basins floored by carbonaceous mud.

Sulphide concentrations unaccompanied by barium minerals also occur in the Ben Eagach Schist, notably near Dericambus in Glen Lyon (14) where sphalerite-galena-pyrrhotite-pyrite assemblages can be traced along 300 m of strike and across strike for 200 m in quartzites of the Ben Eagach Schist transitional with the underlying Carn Mairg Quartzite. Remobilisation of the sulphides into late metamorphic quartz segregations is unusually common.

In the upper part of the Ben Lawers Schist, which overlies the Ben Eagach Schist, a thick zone of weakly cupriferous pyrite enrichment running south-westwards from Glenshee to Tyndrum (Smith et al., 1984) is regarded as volcanogenic in origin (Scott et al., 1991). The Ardrishaig Phyllite, probably a lateral equivalent of the Ben Lawers Schist, hosts nickeliferous sulphide at Coillebraghad (24), originally described as a metasomatic replacement deposit (Wilson and Flett, 1921), and Cu-Pb-Zn sulphides at McPhun's Cairn (25). Lying above the Ben Lawers Schist in the Tyndrum district, the Ben Challum Quartzite hosts two developments of low-grade base metal sulphides near Auchtertyre (20). The lower one extends for 8 km and is about 80 m thick; the upper one is 10 to 20 m thick on Ben Challum and incorporates 1 m-thick units containing 3% Zn which are considered to be siliceous exhalites. To the south-west, on Creag Bhocan, chalcopyrite and pyrite occur at the same level in the Ben Challum Quartzite which is overlain by a carbonate-fuchsite horizon at the base of the Ben Lui Schist Formation in the Crinan Subgroup. At Meall Mor (27), the Erins Quartzite, which lies in the same sub-group, carries a thick pyritic zone containing chalcopyrite and other sulphides. Within this zone, copper mineralisation was worked in the past at Abhainn Srathain from the margins of metabasaltic bodies, suggesting that the mineralisation was partly volcanogenic in orgin.

Vein deposits

Wilson and Flett (1921) document more than 50 mines and trials on metalliferous veins within the Grampian Highlands. With few exceptions, the deposits occur in the south-west of the region and in Dalradian rocks. Past metal production was principally from veins of the Tyndrum district (the Hard, Clay, Eas Anie, Crom Allt and Meall Odhar veins) and is estimated to total 6000 t of lead, 1 t of silver, 100 t of zinc and 100 t of copper. Modern exploration has located gold-bearing structures, notably at Cononish (22) near Tyndrum and at Calliachar Burn (15) near Aberfeldy, and some small baryte and base metal veins (Gallagher, 1991b).

The celebrated Tyndrum veins occupy fractures running subparallel to and on the north-west side of the Tyndrum Fault, which trends around 040°, (Pattrick, 1985, fig. 1). Host rocks are mainly psammites of the Appin Group transitional with psammites of the underlying Grampian Group. Younger rocks of the Argyll Group lying south-east of the fault rarely contain metalliferous veins (Smith et al., 1984).

The Cononish gold-silver vein is 0.2 to 6 m thick and has been proved over 0.7 km of strike-length and up to 0.5 km below surface within a fault structure traceable for 2.5 km. Ore reserves of 0.75 Mt grading 10 g/t Au and 43 g/t Ag have been defined. Quartz veins containing visible gold were first located at the near-surface intersection of the fault structure with the Ben Eagach Schist, lying above the much older metasedimentary rocks at a slide junction (Gallagher, 1991b, fig. 16.18). The fault trends 050°, terminating north-eastwards against a barren quartz vein, the Mother Reef. Pyrite is the dominant sulphide of the Cononish structure, occurring with fine-grained galena in an early phase of white quartz and in a later phase of mottled quartz formed as a result of brecciation. Gold occurs in the pyrite and galena, usually as particles less than 20 m in size. Chalcopyrite, sphalerite and minor amounts of haematite, covellite, tellurides and native silver are also present. Gold values are lower in a phase of grey pyritic quartz and absent from cross-cutting white quartz.

The Cononish gold vein is best developed where the fault intersects psammitic rocks, which display alteration up to 15 m from the vein contact. An outer chloritised zone is succeeded by a sericitised zone and, within 2 m of the vein, intensely altered and reddened psammite, which has been haematitised, silicified and pyritised, can carry economic gold values. The presence of red psammite clasts within the early phase of white quartz signifies alteration and brecciation of wallrock prior to vein formation. The gold-bearing structure is cut by a late Carboniferous basic dyke and by the Eas Anie Vein (P244649). This vein is characterised by coarse-grained galena, calcite and baryte with only minor pyrite; it is not gold-bearing, nor are the Hard and other veins mined for lead in the past.

At Tyndrum Mine *(21)* the Hard Vein dips steeply south-east to terminate against the Tyndrum Fault, occupied by the later Clay Vein. Levels 145 to 365 m in length were driven through 230 m of vertical interval along veins up to 6 m thick containing coarse-grained galena and sphalerite, together with chalcopyrite and a little pyrite. Massive quartz is the main gangue mineral, accompanied by local concentrations of calcite and baryte. Ore textures are typical of growth into 'open space', namely vuggy breccias and banded veins. Silver-and cadmium-rich tetrahedrites occur in the massive galena. Minor amounts of uraninite have been recorded from a cross-course vein.

Lead was mined on Islay from at least 12 veins of diverse trend (035°–135°) cutting both the Islay and the older Ballygrant limestones of the Dalradian Appin Group (Gallagher and Young, 1993). The principal veins at Mulreesh (28) were up to 1 m thick and 250 m in strike-length, containing chalcopyrite, pyrite and sphalerite as well as galena, set in a gangue of calcite, dolomite and quartz. A vein at nearby Kilsleven was first worked for copper, and native silver is reported from Gartness. Modern drilling at Mulreesh identified narrow sub-vertical fault breccias containing up to 3.1% Zn, 0.1% Pb and 15 g/t Ag, suggesting that the mineralisation is zinc-dominant and silver-enriched. One vein is cut by a NW-trending basalt dyke, presumably of Palaeogene age.

East of Loch Tay, at Corrie Buie (19), an outlier of the Loch Tay Limestone on the inverted limb of the Tay Nappe is cut by narrow quartz-sulphide veins trending 160°. Silver-rich galena, minor sphalerite, chalcopyrite and iron sulphides, and rare native bismuth and gold occur in a gangue of quartz and lesser carbonate. Adits uncovered in recent gold exploration follow veins for at least 200 m. Precious metals are also reported from chalcopyrite-rich ore mined from a quartz-calcite vein trending north-west in a metabasaltic body in Argyll Group rocks at Kilmartin (26).

Gold-bearing structures at Calliachar Burn south-west of Aberfeldy (15) trend 150° in garnetiferous mica-schist, psammitic schist and hornblende-schist of the Southern Highland Group. Although thin (0.1–0.5 m), the structures can contain up to 350 g/t Au, including visible gold in quartz veinlets and in goethite. Mineralisation was accompanied by movement on the structures, resulting in deformation of the sulphides. Hornblende-schist wallrocks are bleached over a few centimetres with formation of ferroan dolomite. In the hypogene sulphide assemblage, electrum (50–65 wt% Au) forms clusters of inclusions on fractures in pyrite and larger grains at pyrite–galena boundaries. Sphalerite is replaced in part by chalcopyrite. At surface, pyrite is oxidised to goethite, limonite and jarosite, and galena to anglesite and pyromorphite. Chalcopyrite breaks down to covellite and native copper, and arsenopyrite to scorodite. The nearby Urlar Burn veins (Wilson and Flett, 1921) are also NW-trending, at right angles to the regional Caledonide grain. Galena from the veins contains the tellurides altaite, hessite and coloradoite.

Other types of mineralisation

Vein and Dalradian stratabound deposits apart, at least six other types of mineralisation are recognisable in the Grampian Highlands (C to H on P915456). Iron and manganese were formerly worked at the Lecht (7) from goethite and cryptomelane deposits in post-Dalradian explosive-intrusion breccias. Associated minerals are todorokite, cacoxenite and lithiophorite which contains up to 145 ppm Th. Drilling in the 1980s indicated a resource of 0.25 Mt grading 7% MnO and high levels of barium and of zinc (2.5% Zn over 11 m) in the breccias. Stratiform manganese-rich garnet intersected in Argyll Group pelitic metasedimentary rocks adjacent to the worked breccia deposits represents a potential source of manganese.

The basic and ultrabasic rocks of the region contain nickel-copper sulphides, elevated values of the platinum-group elements and ilmenite, but only at Corriecharmaig (18) has there been any exploitation, in this instance of chromite in altered serpentinite which contains considerable quantities of magnesite. The serpentinite at Corrycharmaig lies at the base of the Ben Lui Schist (Crinan Subgroup), in a similar position to the chromian mineral horizon near Auchtertyre (20). Complex platinum-bearing grains intergrown with nickel arsenide are reported from another serpentinite at Kelman Hill (5). Syn- to late-tectonic basic and ultramafic bodies in Aberdeenshire have been systematically explored and Ni-Cu mineralisation located in the contact zone of the Huntly–Knock mass at Littlemill (2) and in xenolithic norite of the Arthrath–Dudwick intrusion (4). Massive pyrrhotite, accompanied by pentlandite and chalcopyrite, is up to 20 m thick in the Littlemill ore zone and can contain up to 3% Ni, 6.5% Cu together with traces of platinum, palladium and gold. Sulphides are also concentrated in olivine-bearing cumulates and in graphitic, pyroxenic pegmatites within the Huntly–Knock mass.

Metalliferous minerals are known from many of the Caledonian granitic bodies in the Grampian Highlands but none of the occurrences are of economic significance. Some copper was extracted last century from a diorite mass at Tomnadashan on the east side of Loch Tay (17). Sulphides are concentrated at the edges of lenses of granodiorite and granite within the mass; calcite, quartz, siderite and baryte are associated minerals. A rich mineralogy has recently been described from an outcrop of zinnwaldite-bearing granite within the Coilacreich pluton at Gairnshiel, west of Ballater (8). Wolframite, cassiterite and scheelite are found in quartz veins and their silicified wallrocks. A second assemblage infilling cavities in the veins and dissolution zones in the granite comprises either molybdenite or sphalerite with pyrite, chalcopyrite and cassiterite, together with rare stannite and argentiferous cosalite.

The porphyry and breccia complex at Lagalochan near Kilmelford (23) also displays a wide range of mineralisation. An early hypogene stage of Cu-Au-(Mo) mineralisation is associated with breccias and granodiorite–diorite intrusives. Electrum (55–94 wt% Au) forms irregular inclusions up to 100 µm in size in pyrite and chalcopyrite. Subsequently, a Pb-Zn-Ag-Au-As-Sb suite developed as veins and disseminations in shear zones cutting porphyry breccia. Locally high silver values are related to inclusions of argentiferous tetrahedrite, lead-antimony sulphosalts and native silver in sphalerite and in galena which is itself non-argentian. A third phase of mineralisation is represented by Pb-Zn-Ag carbonate veins. Intense sericite-quartz-pyrite and carbonate alteration is associated with the mineralisation.

Small but distinctive amounts of Au, As and Sb occur in altered lavas and plant-bearing siliceous sinter at the faulted western margin of the Rhynie outlier of Lower Devonian rocks (6). Andesitic lavas and tuffs are intensely altered to K-feldspar, silica, mica, chlorite and pyrite. The alteration and metalliferous enrichment are ascribed to epithermal hot spring activity related to a nearby volcanic vent which developed in the final stages of Caledonian magmatism. The Rhynie deposit is the only example of epithermal gold concentration known in Britain.

Disseminated baryte has been worked from Middle Old Red Sandstone sedimentary rocks resting on a late Caledonian felsite body at Balfreish (3). The baryte is irregularly developed in the matrix of a breccio-conglomerate, most probably as a diagenetic constituent, and also forms small lenses and veins. The boundary of the Orcadian Basin in the north of the Grampian Highlands is an important mineralisation control. Younger arenaceous sediments in the Permo-Triassic sequence of the Elgin area commonly contain minor amounts of galena, haematite, fluorite and baryte. The Stotfield Cherty Rock, interpreted as a calcrete horizon, was worked in the past for galena at (1).

Full list of references

‘http://earthwise.bgs.ac.uk/index.php?title=Metalliferous_mineralisation,_Grampian_Highlands&oldid=34532’
Category:

- Grampian Highlands

Navigation menu

Personal tools

- Not logged in
- Talk
- Contributions
- Log in
- Request account

Namespaces

- Page
- Discussion

☐

Variants

Views

- Read
- Edit
- View history
- PDF Export

☐

More

Search

Search Go

Navigation

- Main page
- Recent changes
- Random page
- Help about MediaWiki

Tools

- What links here
- Related changes
- Special pages
- Permanent link
- Page information
- Cite this page
- Browse properties

- This page was last modified on 31 January 2018, at 15:42.

- Privacy policy
- About Earthwise
- Disclaimers