Mineralogy of Wales (MIN-WL)
Mineralogy of the Pennines (MIN-PEN)
Mineralogy of the Mendips (MIN-MEN)
Mineralogy of the Lake District (MIN-LAKE)
Mineralogy of South West England (MIN-SW-ENG)
Mineralogy of Scotland (MIN-SC)
Mineralogy of Peak District, Leicestershire, Cheshire & Shropshire (MIN-PD-L-C-S)

General Introduction to the Mineralogy GCR Blocks

Visit https://jncc.gov.uk/gcr-site-list, for more information on GCR blocks and sites.
For Igneous and Mineralogy GCR block descriptions and GCR site lists, visit https://jncc.gov.uk/gcr-blocks-igneous-and-mineralogy

This description provides a general introduction to the mineralogy GCR blocks.

Introduction

A glance at even the smallest scale geological map reveals the extremely varied geology of Scotland, England and Wales. Seen against this diverse geological background it is not surprising that Great Britain is also a region of a great diversity of types and ages of mineralization.

Most centres of mineralisation are clearly associated with particular geological environments and can be related to events in the geological evolution of Great Britain, and this has been the basis for the derivation of regional GCR Blocks. However, the main groups of mineral deposits or types of occurrence form the basis of the thematic mineralogical GCR Networks.

1. Minerals and mineral assemblages within igneous intrusions

Sites of igneous rocks which are of petrological importance are included within a number of GCR blocks. **See Carboniferous - Permian Igneous (C-P-IG), Caledonian igneous (CAL-IGN); Igneous Rocks of South-west England (IGN-SW-E); Ordovician Igneous Rocks (ORD-IGN); Old Red Sandstone Igneous (Silurian and Devonian Volcanic Rocks) (ORS-IGN); Tertiary Igneous (TER-IGN)**.

A handful of sites within Great Britain's igneous rocks, however, exhibit features which are principally of mineralogical interest. These include several pegmatites in the western Highlands; pegmatitic segregations within the Cairngorm Granite at Loch Avon which contain assemblages of such uncommon minerals as topaz and beryl; the pyroclastic deposit with euhedral augite crystals at Bail Hill, Dumfriesshire; and the volcanic neck with pyrope garnets at Elie Ness.

2. Stratiform deposits within the Dalradian rocks of the Grampian Highlands

The Dalradian Supergroup of the Grampian Highlands (see DAL) mainly comprises a thick succession of metasedimentary rocks. The range of mineralisation within the Dalradian is very diverse. Stratiform, synsedimentary, pre-metamorphic mineralisation occurs within the Middle Dalradian and may be subdivided into two main groups. The first of these are typically barium-rich with abundant baryte and/or barium silicates: the deposit worked at Foss Mine is a good example. The second group lack barium enrichment but contain abundant copper, zinc, lead and nickel: deposits in the Loch Fyne and Tyndrum areas provide examples. In both cases a genetic model is one in which hydrothermal mineralising solutions emanated onto, or immediately below, the contemporary sea-floor during sedimentation in a series of second-order basins.

3. Cambrian-Ordovician exhalative deposits of North Wales

The Cambrian and Ordovician sedimentary rocks of North Wales locally contain beds rich in manganese minerals. The Cambrian 'Manganese shales', which have in the past been worked as a source of manganese ore, contain a great variety of manganese minerals, including silicates, carbonates and oxides. It has been suggested that the manganese was probably of sub-marine exhalative origin. A similar origin has been advocated for the lenticular bodies of manganese ore within the Ordovician mudstones of the Lleyn area, North Wales.

A spectacular deposit believed to be the product of exhalation of hot mineralising fluids into the Ordovician sea, through the sort of vents known today as 'black smokers', is seen today at Parys Mountain on Anglesey. The mineralising fluids responsible for the accumulation of the thick sequence of sulphide minerals here are considered to have been derived from sea water circulating convectively through the underlying rocks which were being heated by volcanic activity. The term 'volcanogenic massive sulphide' (VMS) deposit has been applied to deposits of this type. Associated with the sulphide orebodies at Parys Mountain are large

areas of silica-rich mineralised rock thought to represent penecontemporaneous siliceous sinter deposits.

4. Magmatic segregations associated with Caledonian intrusive rocks

In Ordovician times, during early Caledonian deformation (see CAL-IGN), ultramafic and basic oceanic rocks associated with an island arc system were thrust over Dalradian and Moinian metasediments to produce the ophiolite complex seen today at Unst in the Shetland Isles. Serpentinites and associated ultrabasic rocks within this complex locally contain high concentrations of chromite in large, lenticular, pod-like bodies. Platinum group elements (PGE), present in small amounts in the chromite-bearing rocks, may have been introduced by hydrothermal processes. Shearing of parts of the serpentinite bodies has produced deposits of talc. Similar chromium-rich serpentinites are found locally within the Ballantrae ophiolite complex on the northern margin of the Southern Uplands.

Layered gabbroic intrusions in North-East Scotland, which may be the roots of a volcanic arc emplaced over a northerly-directed subduction zone during the early part of the Caledonian Orogeny, locally contain concentrations of primary magmatic and remobilised iron-copper-nickel mineralisation.

Small concentrations of mainly iron and nickel minerals within a dioritic intrusion at Talnotry, Galloway also belong within this group.

5. Porphyry-style mineralisation associated with Caledonian intrusive rocks

'Porphyry-style' deposits occur in association with a number of Britain's Caledonian intrusions (**see also Caledonian igneous (CAL-IGN)**). In these deposits metallic mineralisation, usually dominated by either copper or molybdenum, typically occurs disseminated, as grains or in veinlets, through a very large volume of igneous rock of acid or intermediate composition. Concentric zones characterised by distinctive styles of alteration are a feature of porphyry

6. Metalliferous veins associated with Caledonian intrusions

Caledonian tectonism and associated igneous activity (**see Caledonian igneous (CAL-IGN)**) was responsible for the emplacement of a variety of types of mineralisation. Most widespread of the deposits of Caledonian age are the numerous vein deposits found in several parts of Scotland, the Lake District and Wales. All vein deposits associated with Caledonian intrusions are considered together as one GCR network.

7. Gold veins of North Wales

Although occupying a comparatively small area, the gold-bearing veins of the so-called 'Dolgellau Gold Belt' may be considered to comprise a distinctive suite of deposits, and thus to constitute a separate GCR network. The gold mineralisation probably developed as a result of dewatering of Precambrian and Cambrian rocks during uplift in late Silurian times. Gold was preferentially deposited in the resultant quartz veins where methane and nitrogen were introduced into the mineralising fluids where they came into contact with the Cambrian Clogau Shales.

8. Lead-zinc-fluorite-baryte veins of the Pennines, North Wales and the Mendip Hills

Five discrete orefields characterised by deposits dominated by these minerals occur within limestones and associated sedimentary rocks of Carboniferous age. The largest and most important economically are the three Pennine orefields; the Northern Pennine Orefield of the Alston Block, the Northern Pennine Orefield of the Askrigg Block and the Peak District, or Derbyshire, Orefield. The North Wales and Mendip orefields are smaller and of less economic significance. Whereas each of these orefields exhibits distinctive structural and mineralogical features, all share a number of characteristics which link them together within the class of ore deposits known as 'Mississippi Valley-type'.

9. Tin-copper-arsenic veins associated with the Cornubian granitic batholith

The counties of Cornwall and Devon include one of the most intensely mineralised areas of Great Britain. Best known for its long history of tin and copper production the region has also produced a number of other metals and mineral products including ores of arsenic, iron, tungsten, cobalt, nickel, uranium and manganese. Large quantities of china clay are still produced from intensely kaolinised granite.

Cornwall and Devon, also known as 'Cornubia', form part of the northern portion of the Variscan, or Hercynian, orogenic belt. The Devonian and Carboniferous rocks of the region have been metamorphosed and intruded by numerous high-level granites which unite at depth to form the Cornubian granitic batholith (**see Igneous Rocks of South-west England (IGN-SW-E)**). Associated with the granites are numerous quartz-feldspar porphyry dykes known locally as elvans. A feature of some of the granites is the extensive metasomatism which has produced widespread tourmalinisation and greisenisation and intense kaolinisation locally. Important pegmatites are associated with some granites.

Whereas a number of mineral deposits within the region can be shown to predate the granites, e.g. the numerous small manganese deposits which may have a volcano-sedimentary origin, the great majority of the region's mineralisation is clearly genetically related to the underlying batholith. The majority of the mineralisation occurs in the form of fissure veins or lodes, the mineralogy of which is often complex. A distinct vertical and lateral variation, or zoning, in mineral content is apparent throughout the region. In general tin and tungsten mineralisation occur within or close to the granites, with the greatest concentration of copper in a zone beyond the tin-rich zone. Lead and zinc, and some antimony and iron, deposits are important in veins in the outer aureole rocks most distant from the granites. Non-metalliferous, or gangue, minerals also exhibit evidence of zoning which may also be related to temperatures of mineralising fluids. Emplacement of the main veins began during or shortly after the final stages of granite emplacement.

10. Hematites of west and south Cumbria

The Lower Carboniferous limestones of west and south Cumbria host a large number of deposits composed almost exclusively of hematite. These are typically large, irregular or flat-lying replacements of limestone, usually closely associated with, or adjacent to, faults. A unique group of deposits, known as 'sops', is restricted to south Cumbria. In these deposits hematite fills large, roughly conical dissolution hollows in the limestone. The centre of each 'sop' is typically filled with sand or broken sandstone from the overlying Permo-Triassic beds. Small fissure veins of similar composition, genetically associated with these deposits, occur within the Lower Palaeozoic rocks of the adjacent Lake District inlier.

The hematite deposits of west and south Cumbria are distinguished by consisting almost entirely of hematite. Other metallic minerals are generally rare, though small quantities of manganese oxides were found locally and very small amounts of galena and copper sulphides have been recorded. A restricted range of gangue minerals includes dolomite, baryte, quartz, calcite and fluorite.

The consensus view is that the iron was derived, by convective leaching, from Permo-Triassic sediments within the Irish Sea Basin. Mineralising fluids were driven up-dip through Permo-Triassic, and possibly Carboniferous, sandstones to gain access via faults, and in the south Cumbria area dissolution hollows, in the Carboniferous limestones. Estimates of the age of emplacement of these orebodies varies from Permian to post-Triassic.

Similar replacement deposits, consisting of abundant goethite as well as hematite, occur within Carboniferous limestones in South Wales and the Forest of Dean.

11. Regional metamorphic assemblages.

Rocks of the Scottish Highlands contain numerous minerals developed during regional metamorphism. Whereas these are in general, principally of petrological interest and have are encompassed by other GCR Blocks, locally spectacular examples of these minerals occur.

12. Contact metamorphic assemblages associated with intrusions of various ages.

Contact metamorphic rocks associated with igneous intrusions of various ages are included within a number of other GCR Blocks. A handful of contact metamorphic rocks, designated as GCR sites principally for their mineralogical interest. These sites include the highly aluminous, corundum-bearing, xenoliths in the Tertiary sills of Mull, the metamorphosed Dalradian limestones of Deeside and the skarn assemblages of the Kilchrist area of Skye and the St Just area, Cornwall.

13. Amygdale-minerals in lavas.

The Old Red Sandstone lavas of central Scotland are celebrated for the occurrence within them of siliceous amygdales, commonly in the form of beautiful agates. Known as ‘Scotch Pebbles’ They have long been collected as semi-precious stones from weathered outcrops and river and beach shingles.

The lavas of the British Tertiary igneous province (**see Tertiary Igneous (TER-IGN)**) are well-known for the presence of a variety of zeolites and related minerals within vesicles and veins. Spectacular specimens of a number of these are prominent in many museum collections. Other important occurrences of these minerals include those of the Carboniferous volcanic rocks of the Midland Valley of Scotland.

14. Diagenetic minerals of various ages

The sedimentary rocks of Great Britain locally contain important occurrences of minerals, or suites of minerals, of diagenetic origin. In the GCR, the mineralogical interests of these rocks is typically encompassed within the stratigraphy GCR blocks.

15. Supergene assemblages

When subjected to oxidising processes above the permanent water table, many of the primary, or hypogene, minerals of most mineral deposits are unstable and undergo a process of secondary, or supergene, alteration. Sulphide and carbonate minerals are particularly susceptible to this form of alteration. In an ideal case the upper zones of orebodies tend to be leached of most metallic elements, commonly leaving any iron present as a near surface crust or ‘gossan’. Other metals transported downwards in solution are commonly precipitated above the water table as carbonates, sulphates, phosphates, arsenates etc. Below the water table reaction of copper-bearing solutions with pre-existing copper sulphides may result in the formation of new sulphides in a zone of secondary enrichment. Particularly rich deposits of copper ores have been worked from such zones in many mines in South-West England. In certain deposits, notably some of those in South-West England, the oxidised zone is known to have extended to as much as 365 m below the surface.

GCR site selection

For the purposes of site selection the mineralogy of Great Britain has been arranged into the following GCR Blocks:

- Mineralogy of Scotland
- Mineralogy of the Lake District
- Mineralogy of the Pennines
- Mineralogy of the Peak District, Leicestershire, Cheshire and Shropshire
- Mineralogy of Wales

• Mineralogy of the Mendips

• Mineralogy of South-West England

However, the 15 GCR mineralogy networks (described above) are based upon mineralogical or genetic affinities and age as well as geographical distribution.

The importance of some sites stems from the mineralogical composition of the rocks themselves. In other cases the importance lies in individual minerals, or suites of minerals, which form parts of mineral deposits emplaced within these host rocks. As might be expected the great majority of these sites occur within the varied and generally more structurally complex pre-Mesozoic sedimentary rocks of Britain, though a number of localities within these Mesozoic and Tertiary rocks also contain minerals and mineral assemblages of considerable interest and importance.

The selected sites are therefore not confined to those which represent important features within more or less well defined mineral provinces or orefields but includes a wide range of sites drawn from across the whole field of mineralogy. Included are localities at which the mineral assemblages give important insights into mineralising or metallogenic processes as well as sites at which igneous, metamorphic or diagenetic processes have given rise to distinctive or unusual occurrences of individual minerals or assemblages.

A number of sites are included primarily because they comprise the ‘type locality’ for one or more mineral species.