The Mining History and Mineralogy of the Leadhills Orefield, Scotland

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Introduction

The lead-mining villages of Wanlockhead and Leadhills in the Southern Uplands of Scotland are famous for the discovery of several new rare species over the last two centuries from the main ore bodies of lead, copper and zinc.

Origin of the deposit

Plate convergence that caused the Caledonian orogeny in the Silurian continued to form the Hercynian orogeny in the succeeding Devonian and Carboniferous Periods. Two periods of mineralisation have been recognised. These have been assigned to the Caledonian and Hercynian orogenies; the later associated with the lead-zinc mineralisation. Some vertical and lateral zoning has been observed with sphalerite increasing with depth but decreasing towards the eastern end of the deposit.

The mineralising solutions were acid in the early stages changing fairly rapidly to alkaline. The ore fluids have characteristics of basinal fluids which may have migrated along major structures such as the Leadhills fault from sedimentary basins in the Midland valley. The driving force may have been crustal thinning during this period of extension which generated an increased geothermal gradient and fracture permeability and thereby stimulated convection of upper crustal fluids through major structures. Metamprphosed Ordivician black shales are possible alternative source rocks.

The ore bodies are found in more than 70 mineral-rich veins, which generally trend NNW-SSE. The average width of the veins is 1m, although the largest is 4.3m thick. The local country rocks are Ordovician volcaniclastic greywackes, shales and cherts, and the veins themselves are in brecciated greywackes.

Mining history

The Leadhills-Wanlockhead area has a long history of mining activity. The earliest documentary evidence for mining is a Charter (ein Freibrief) of 1239 granted to the monks of Newbattle Abbey, near Edinburgh. Although this marks the earliest written evidence for mining at Leadhills-Wanlockhead, archaeological evidence such as stone and bronze tools found in old surface workings, hints at even earlier, possibly Roman, activity.

After 1239, lead-mining seems to have continued intermittently in the area. In the early 16th Century, John Leslie, Bishop of Ross, states that gold was discovered during the reign of James IV (1488 - 1513). Although lead probably continued to be extracted, it was now gold that attracted most attention. Between 1538 and 1542, enough gold was extracted to make crowns for King James V and his Queen. Indeed much of the gold coinage of James V and Mary, Queen of Scots was made from Leadhills gold.

In 1529, the lands around Leadhills were purchased by Thomas Foullis. In 1576, Foullis brought in the famous mining expert, Beavis Bulmer, to operate his lead mine.

Bulmer, however, soon turned his attention to gold. Employing 300 men, he extracted 30,000oz of gold valued at £100,000 (about 24 million GBP today). Most of this gold was alluvial gold, but he claimed to have discovered a gold-bearing quartz vein. He kept its location a secret, but he was killed in a mining accident and his secret died with him.

The fame of the rich ores of this area soon spread across Europe. English, Dutch and German miners were all employed in the mines at one time. At the end of the 16th Century, a German miner called Cornelius Hardskins, re-opened the Wanlockhead veins and production started there again. It is also about this time that the villages of Wanlockhead and Leadhills began to develop from the rough miner's camps that existed before.

The search for the gold continued during early part of the 17th Century. In an effort to locate the gold-bearing veins, George Bowes used a technique called "hushing". This involved using a sudden release of dammed-up water to strip-off soil. He failed to find the gold-veins but did uncover some new lead veins. By 1620, the gold-rush seems to have passed and no commercial gold extraction takes place after that date. The discovery of new lead veins by Bowes seems to have given new impetus to the lead-mining industry. Mining became better organised and hand-pumping and drainage levels were used to overcome ventilation and flooding problems. This also allowed the shafts to go deeper to follow the veins. By the end of the 17th Century, smelters had been constructed.

Despite the improvements in technology, mining at Leadhills-Wanlockhead was still fairly small scale. The difficult terrain and its remoteness meant that moving the ore was a long and difficult job. The advent of the Industrial Revolution in Britain during the late 18th Century brought great technological changes and the mines were at the forefront of pumping technology, as the mine operators strove to drain the water from the mines, which penetrated ever deeper into the hillsides. Steam power allowed miners to dig deeper and deeper shafts. Production also increased as the Napoleonic Wars led to a greater demand for lead for bullets. All the famous veins and mines of the district were now being worked. The Susanna, Belton Grain, Old and New Glencrieff veins are familiar names to collectors all over the World. At this period of peak production the orefield was at the cutting edge of science and technology.

When peace returned, mining declined as cheaper foreign lead became available. Indeed, things became so bad that steam-power was thought too expensive and the mines returned to water power. In 1842, the mines of Wanlockhead were taken into the ownership of the local landlord, the Duke of Buccleugh. This kept the mines open and the miners in employment.

By the start of the 20th Century, the mines were returned to private ownership and steam power was re-introduced. An increase in the demand for lead made the future of the mines brighter. To help overcome the difficulties of transportation, a railway was built to the mines from Elvanfoot on the main Glasgow - London line. It was, however, a short-lived revival. By 1920 only two mines, now simply called the Wanlockhead Mine and the Leadhills Mine, remained. The final blow came during the economic depression of the 1930's. The last two mines were closed, taking the railway with them. A brief revival in the 1950's saw some new investigations and new hope. The mine at Wanlockhead was pumped out but no new extraction was done. During their long history at least 300,000 tonnes of lead, 10,000 tonnes of zinc and 25 tonnes of silver was extracted.

Visiting the area today, one can still see evidence of the old mines. Old shafts, buildings and dumps are still visible.

Minerals

The Wanlockhead - Leadhills locality is world famous. Few localities world-wide can boast such a diverse assemblage of secondary lead minerals. Around 60 species have been identified from this area, including eight new species. Though the National Museums of Scotland and the Natural History Museum both have outstanding collections of Wanlockhead - Leadhills minerals, specimens from this classic locality are found in museums across the World.

Interest in collecting minerals started in the middle of the 18th Century. The Reverend Dr John Walker, later Professor of Natural History at Edinburgh University, often visited the area between 1761 and 1764 and collected many specimens, some previously unknown in Britain including "*plumbum cyaneum*" or linarite.

Interested continued into the 19th Century as the increased production due to the Napoleonic Wars meant a good supply of specimens. Some mine managers, with a keen interest in science, kept these specimens and passed them on to mineralogists like James Sowerby, Henry Brooke and David Brewster who were beginning to apply the newly developed techniques of chemical analysis. Sowerby did a great deal of work on the material from Leadhills-Wanlockhead recognising and publishing descriptions of a lead carbonate as well as blue and green carbonates of copper. Brooke also did some important work and published his results in the *Edinburgh Philosophical Journal* in 1820 in which he called the new species of lead ore: sulphato-carbonate of lead, sulphato-tri-carbonate of lead and cupreous sulphato carbonate of lead.

In 1832, the French mineralogist Beudant, named these three minerals: lanarkite, leadhillite and caledonite.

In the 1860's, Professor Heddle of St Andrew's University was building up his collection of Scottish minerals; probably the finest collection of Scottish minerals ever. He published his descriptions of the minerals and their localities in 1901 in his famous *Mineralogy of Scotland*. Despite this, even Heddle noted that secondary minerals such as lanarkite were becoming rare. Collecting was by now often restricted to the dumps and spoil heaps. Heddle's Collection, along with that of his close friend Patrick Dudgeon, are now part of the Geological Collections of the National Museums Scotland.

The closure of the mines in the 1930's meant the end of new material from underground though the dumps and spoil heaps still attracted collectors from far and wide. Over 60 species have now been identified from the Leadhills-Wanlockhead ore-field. Some of these are listed below.

Species first described from Leadhills-Wanlockhead:

Caledonite	$Pb_5Cu_2(CO_3)(SO_4)_3(OH)_6$
Chenite	$Pb_4Cu^{+2}(SO_4)_2(OH)_6$
Lanarkite	$Pb_2(SO_4)O$
Leadhillite	$Pb_4(SO_4)(CO_3)_2(OH)_2$
Macphersonite	$Pb_4(SO_4)(CO_3)_2(OH)_2$
Mattheddleite	$Pb_{20}(SiO_4)_7(SO_4)_4Cl_4$
Scotlandite	$PbSO_3$
Susannite	$Pb_4(SO_4)(CO_3)_2(OH)_2$

Caledonite – Leadhills, Lanarkshire, Scotland (1991.31.61)

Among the many other species found here, notable specimens of the following have been recovered:

Anglesite
Aragonite
Aurichalcite
Barite
Calcite
Cerussite
Chalcopyrite
Chrysocolla
Galena
Hemimorphite
Hydrocerussite
Linarite
Pyrite
Pyromorphite
Quartz
Sphalerite
Vanadinite
Veszelyite
Witherite

Many of the old dumps and spoil heaps have now been removed but collecting is still possible and permitted.

Further reading and references

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