From gold to lead: the mineral riches of Leadhills-Wanlockhead mining district, Scotland

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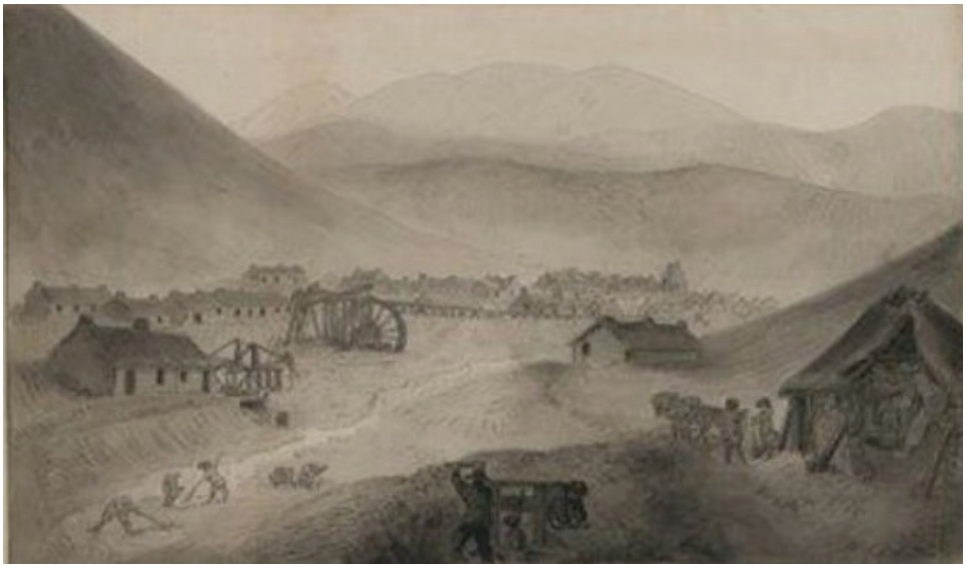
Leadhills and Wanlockhead, straddle the border of South Lanarkshire and Dumfries and Galloway on the north slope of the Lowther Hills. The rugged hills reveal piles of waste rock, adits and shafts, and deep gullies of 500-year-old hushes from the area's long mining history.

Leadhills–Wanlockhead is located in the Southern Uplands Terrane. It is bounded to the south by the Iapetus Suture, which formed during the collision of Laurentia and Avalonia. The northern boundary is the Southern Uplands Fault, which separates the terrane from the Midland Valley. Rocks of the Southern Uplands Terrane are predominantly Ordovician and Silurian greywacke and shale that have been intensely faulted into an imbricate thrust belt. It formed as an accretionary wedge as the Iapetus Ocean closed. The southernmost (mid-Silurian) part of the terrane formed in a foreland fold and thrust belt setting overriding Avalonia during the collision with Laurentia.

The oldest rocks around Leadhills–Wanlockhead are the chert, mudstone, and basalt of the Crawford Group. Black shale, chert, and meta-bentonite of the Moffat Shale Group overlie the Crawford Group. All of these rocks are interpreted to have been deposited on the ocean floor. Turbidite greywackes deposited as submarine fans comprise the Kirkcolm Formation, Portpatrick Formation, and Shinnel Formation.

Leadhills–Wanlockhead is the largest and most productive lead-zinc deposit in Scotland. About 70 veins occur in an 8 km^2 area. Ore veins are hosted by the intensely fractured and faulted Portpatrick Formation and are confined to an area between the Leadhills Fault to the northwest and the Fardingmullach Fault to the southeast. Typical vein width is about 1 m, although the largest has a width of 4.3 m. The ore deposits were emplaced during the Carboniferous at a depth of about 600 to 1,200 m by saline fluids (19 to 30 equivalent weight percent NaCl + CaCl2) at temperatures calculated to be 143 to 281°C. A pre-mineralisation reverse fault with impermeable rocks in the hanging wall created a barrier for ore fluids and forms the northwest boundary of the mineral deposits. Ore fluids are thought to be derived from sedimentary basins in the Midland Valley. Crustal

An old walking beam.



Leadhills area ca. 1775

thinning and extension increased the geothermal gradient, causing migration of these fluids along major faults. An alternative source of the fluids suggested by some researchers could be metamorphosed Ordovician black shales.

Typical veins include the ore minerals galena, sphalerite, and chalcopyrite with the gangue minerals ankerite, calcite, dolomite, quartz, barite, and pyrite. The upper parts of the veins are oxidised, which has created numerous interesting oxidation minerals. In addition, interesting minerals can be found in slag heaps. Overall, 108 different minerals have been identified at Leadhills–Wanlockhead and it is the type locality of ten minerals: caledonite, chenite, lanarkite, leadhillite, macphersonite, mattheddleite, plattnerite, plumbonacrite, scotlandite, and susanite. The area also hosts alluvial gold deposits.

The earliest confirmed mining activity around Leadhills–Wanlockhead was in 1239, when the monks of Newbattle Abbey were granted a charter for lead mining. It is possible, however, that mining occurred much earlier. A study of lead concentrations in a nearby bog shows elevated lead levels that suggest possible Late Bronze Age and Iron Age mining around

Entry to the Lochnell Mine.

365 BC to AD 70. In addition, lead beads excavated at Carghidown, an Iron Age hillfort, date to 360 BC to 60 AD. Analysis showed these beads have a similar isotope chemistry to Leadhills galena. A possible stone hammer discovered at Wanlockhead in 1929 further supports an ancient history of mining in the area, although some researchers believe it is not a hammer, but a loom weight. In the late nineteenth century, stone and bronze picks were reportedly discovered at both Leadhills and Wanlockhead. Unfortunately, these artefacts have been lost and while ancient mining in the area is a possibility, there is no unequivocal evidence to prove it.

Mining became a major activity in the area in the sixteenth century. While lead mining was occurring, much of the focus was on the alluvial gold that had been discovered. Leadhills–Wanlockhead became an important source of gold for coinage during the reigns of James V and Mary, Queen of Scots. The gold was also used to make crowns and regalia for the Scottish monarchs. In 1620, George Bowes was using hushing in an attempt to find the source of the gold, but instead found rich lead veins. This ended the interest in gold and increased the extraction of lead.

Much of the early lead mining exploited ore by hushing in addition to hand extraction from shallow shafts and adits. As mining progressed, shafts became deeper, stopes were opened underground, and dewatering became an issue. Rope and bucket dewatering and drainage levels were initially used, but by the early eighteenth century water-driven beam engines and waterwheel-driven pumps were common at the mines. Using water power posed many problems as streams froze in winter, waterwheels were overwhelmed by spring runoff, and summer drought stalled them. The first steam engines to power pumps were installed in the late 1700s and remained the main source of power until the mid-nineteenth century, when the low price of lead and high cost of operating steam engines impelled a switch back to water power.

Production reached a peak during the Napoleonic Wars when the Leadhills–Wanlockhead mines accounted for 90% of the total lead and zinc production in Scotland before suffering a serious decline. Mining continued throughout the nineteenth century and experienced a short-lived revival with significant production in the early twentieth century. The last mine closed in 1934, the district having produced an estimated 270,000 tonnes lead ore, 13,800 tonnes sphalerite, and 23 tonnes silver.

The mines are silent and abandoned now, but the moors around Leadhills–Wanlockhead hold a long history for visitors to discover. Deep gullies from hushing, adits and shafts, and an old beam engine are ghosts of this former industry. The Museum of Lead Mining in Wanlockhead houses exhibits about the geology and mining history of the district as well as offering the only underground mine tour in Scotland and preserving miners' cottages.