

KEELDRUM

Background information

Mine Name: Keeldrum

Mine District: Donegal

Alternative Names:
Kildrum

Elements of interest:
Pb

Project Prefix: KLD-

County:
Donegal

Townland:
Keeldrum

Grid Reference:
E190346, N426239



The Keeldrum mine is located in northwest Co. Donegal. The site is situated on the N56 road, 8.5 km north of Gweedore. Lead was produced here in the early 19th century.

Production and Mining History

The Mining Company of Ireland (MCI) operated Keeldrum from 1825 to 1832, after leasing the land from Lord Leitrim. There appears to be no record of earlier production. An estimated 1,689 tons were produced in this period for a net loss of £5,449 (MCI Half-Yearly Accounts). By 1826 the mine was being operated via a level 150m long and almost 50m deep. Production ceased in 1832 owing to flooding, despite erection of a water wheel to power the pumps (Cole 1922). MCI reopened the mine in 1860 but after production of an estimated 130 tons for a loss of £9,626 the mine was deemed unviable and closed in 1862.

Geology and Mineralization

The mineralization was hosted by two lodes, Jacob's and Leitrim lodes, each striking northeast southwest and dipping towards the southeast (Pyne, 1975). The mineralization is fault-controlled and brecciated. The mineralization is hosted by the Dalradian Falcarragh Pelite Formation but lithologies in the mine area include pelites, quartzites and metamorphosed basic intrusions (amphibolites). Galena (PbS) occurs in quartz veins, in brecciated quartzite and most commonly in the amphibolites which also contain some pyrite (FeS₂) (OBrien 1951).

Site Description and Environmental Setting

Keeldrum is immediately west of the Gweedore – Gortahork road (N56) in Donegal. The road runs along a valley between boggy upland of the Muckish-Errigal uplands and Taobh an Leithid to the west. The land in the valley is mainly mixed grassland, used for cattle and sheep grazing. The Keeldrum site today is largely grassed over (Fig. 1). The northern part of the site is boggy, with rough grass cover, whereas to the south the land has been cleared to create a pasture field. Of the four shafts described by OBrien (1951), only two were located during a field visit for HMS-IRC. The engine shaft, west of the engine house (Fig. 1) is covered by a concrete cap. The shaft in the southern part of the site is a water-filled depression. The most substantial remaining mine buildings are the engine house and, beside it, a walled complex presumably used as workshops and/or for processing ore. The engine house ruins (photo, right) consist of two side walls and part of the bob wall. There is no trace of the engine house chimney. West of the engine house, across the road, is the roofless but otherwise intact magazine. A walled area incorporates the ruins of what may have been the mine manager's house and/or mine offices.



A large waste heap on the southern boundary of the pasture field (SP02) comprises a considerable proportion of mine waste and appears to have been created in the course of the field clearance. Smaller waste heaps are present in the northern part of the site around the ruins of the engine house and processing building. One of these, SP01a, consists of fine, metal-rich crushed waste that is interleaved with a layer of charcoal (photo, right). The charcoal appears to be burnt wood, presumably burned in a furnace used for smelting or powering a steam engine. Table 1 gives the estimated area and volume of the solid waste heaps shown on Fig. 1.



Table 1 Area and volume of spoil heaps at Keeldrum

Waste ID	Area (m ²)	Volume (m ³)
KLD-SP01a	525	262
KLD-SP01b	174	87
KLD-SP01c	29	14
KLD-SP02	499	998

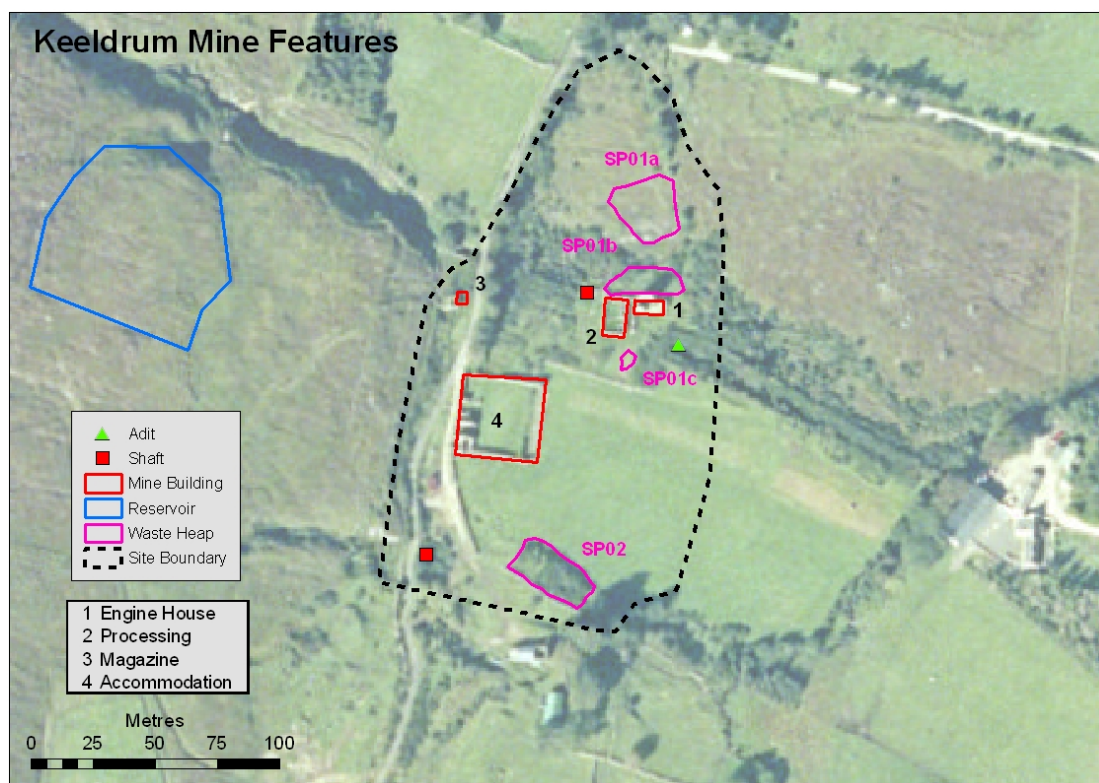


Fig. 1 Keeldrum Mine Features

Geochemical Assessment

1. Surface water

One surface water sample was taken at Keeldrum. A small mountain stream flows through the mine site and joins the Aspick River to the east. Because of difficulty of access to the stream, the sample was taken below the confluence of the stream and the river, after the two streams had joined together, but before it crossed under the road (Fig 2). The sample was analysed for both total and dissolved elements and 21 µg/l Pb was measured in the total metal sample. However, the analytical batch for total elements was affected by cross-contamination, particularly in the case of Pb, and results are therefore unreliable. Dissolved metal concentrations show no exceedances of any surface water standard.

2. Groundwater

Groundwater samples were not collected in the Keeldrum area. Leachate from a composite sample taken from the main spoil heap (SP01a) to the north of the engine house had a high concentration of the dissolved Pb (19860 µg/l) but low levels of both Zn (8 µg/l) and Cu (6 µg/l).

3. Stream sediments

No stream sediment samples were collected in the vicinity of the Keeldrum mine for the HMS-IRC project.

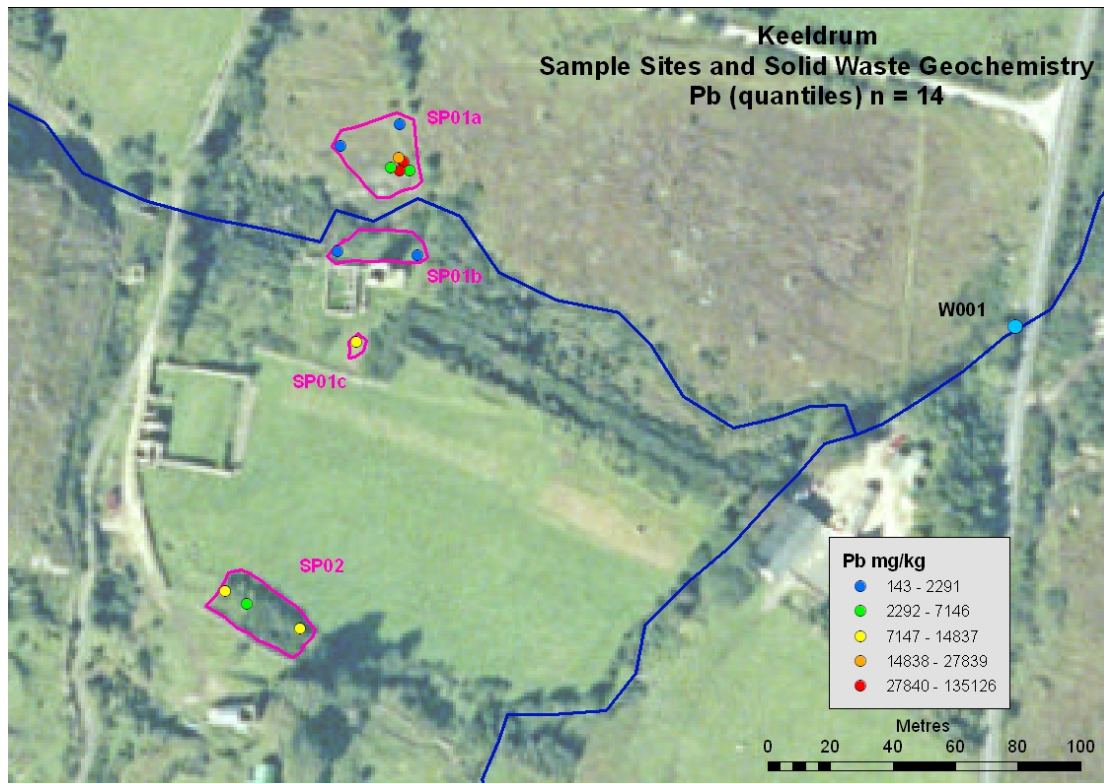


Fig. 2 Keeldrum Geochemical sample sites

4. Solid waste

Thirteen *in situ* solid waste XRF analyses were carried out on the Keeldrum site, seven on the main waste heap (SP01a) to the north of the site, three around the engine house (SP01b, c) and three on the waste heap to the south of the site (SP02) (Fig. 2). Table 2 summarizes the results. The highest Pb concentration (13.5%) was measured in SP01a in fine grained processing waste. This waste contains high measured concentrations of sulphur (up to 1.6%). The waste heap at the southern end of the site (SP02) has high Pb concentrations (7146 – 14837 mg/kg). Other elements are not particularly enriched in the waste, confirming the general absence of significant quantities of other sulphides such as sphalerite and chalcopyrite (OBrien 1951). Although As was measured by the XRF in concentrations up to 4075 mg/kg, peak analysis of the X-ray spectra suggest that the high measured As concentrations reflect interference from overlapping Pb peaks and that As is unlikely to be present in significant concentrations in the waste. One analysis from SP01a gave 103 mg/kg Ag but peak analysis does not confirm it.

Table 2 Summary statistics, *in situ* XRF analyses, Keeldrum

mg/kg	Pb	Zn	Cu
n	13	13	13
Minimum	143	0.0	0.0
Maximum	135126	1072	155
Median	7146	108	0.0
Mean	26443	202	31

5. HMS-IRC Site Score

Table 3 Site Scores for Mine Waste, Keeldrum

Waste	SP01a	SP01b,c	SP02	Total
1. Hazard Score	20	16	38	74
2. Pathway Score				
<i>Groundwater</i>	1.71	1.19	3.22	6.12
<i>Surface Water</i>	4.28	3.36	3.30	10.94
<i>Air</i>	0.00	0.00	0.01	0.01
<i>Direct Contact</i>	0.06	0.03	0.16	0.26
<i>Direct Contact (livestock)</i>				
3. Site Score	6	5	7	17

The total site score for Keeldrum is 17 (Class V), with essentially equal contributions from each of the solid waste heaps. Heaps SP01b and SP01c, located around the engine house, were amalgamated to increase the number of analysis points. Although individual heaps have high Pb concentrations, notably SP01a, the relatively small volumes of waste present on the site gives rise to a low total site score. The surface water and groundwater pathways account for most of the score, with the higher surface water pathway score a consequence of the proximity of the site to surface drainage.

6. Geochemical overview and conclusions

Keeldrum operated as a lead mine for a total of around 10 years in the 19th century, producing less than 2,000 tons of ore. The site is largely grassed over but small amounts of solid waste remain on the site. There are no mine water discharges or evidence of downstream contamination of surface water. Solid waste contains high concentrations of Pb (median 7146 mg/kg) with the highest concentrations (up to 13.5%) found in processing waste. A leachate test on the solid waste yielded an extremely high concentrations of Pb (19,860 µg/l) and suggests potential for groundwater contamination in the vicinity of the site.

References

- Pyne, J. (1975). Summary of Keeldrum, Geological Survey of Ireland Mine Records, Box No. 61-3.
- Cole, Grenville A. J. (1922). Memoir and Map localities of Minerals of Economic Importance and Metalliferous Mines in Ireland.
- OBrien, M.V. (1951) Handwritten report of field visit, 17 November 1951, GSI Mine Records, Box No. 61-3.