# The archaeology of antimony mining: a resource assessment

In metallurgy, antimony was used in alloys for printer's type, in the preparation of anti-friction metals and for hardening lead. It was also used as an alloy, at from 5 to 10 per cent, with tin in the production of Britannia metal. Antimony compounds were also used as a de-oxidiser and colourant in glass, pottery, pigments and dyes. From an early period antimony compounds were also used in cosmetics and for medicinal purposes, and, as such, can turn up in the archaeological record (Watson 2013, 21). A small number of mines in the 19th century and earlier, primarily in Cornwall, produced antimony concentrates as a co-product and a few were promoted with antimony as their principal product.

## Geological background

The principal ore of antimony is the sulphide stibnite ($Sb_2S_3$) although the antimony-lead sulphosalt ($PB_4FeSb_6S_{14}$) has been worked in some mines.

The antimony at the Louisa Mine, in Dumfries and Galloway, is associated with stratiform arsenopyrite-pyrite mineralisation in a Silurian greywacke sequence with similarities to that in the Clontibret area, County Monaghan (Gallagher et al. 1983, 24). The latter is associated with gold, and antimony has been associated with gold mineralisation in the vicinity of Port Isaac, Cornwall. Work by Clayton and others (1990) links the antimony in that part of Cornwall to stratiform pre-granite mineralisation and whilst there has been little or no investigation of antimony mineralisation in south-east Cornwall it is probably of a similar origin (See Scrivener and Shepherd 1998 on stratiform mineralisation in general in Cornwall). In Cumbria, to the north-east of Bassenthwaite, work by Fortey and others (1984) again links the antimony to stratiform mineralisation similar to that in Dumfries and Galloway.

## Historical background

Very few mines in Britain produced antimony ores in significant quantities and they appear to have been confined to Cornwall, Cumbria and parts of Scotland. Antimony mineral are reported elsewhere but with no known record of production. In Cornwall, at Wheal Leigh near Pillaton to the north-west of Saltash, antimony is said to have been worked from the late 16th century (Beer 1988, xxi). A mine or mines in the Pillaton area reportedly produced 25 tons of ore in the 1770s and over 130 tons of ore in the 1820s. Around Port Isaac in north Cornwall, and particularly in the parish of Endellion, antimony was being worked by the mid-18th century with production levels from Wheal Boys in the 1770s of around 95 tons (De La Beche 1839, 615-16). Lysons' (1814, 194-216, citing Pryce, Mineralogia

Cornub.) noted that a works for producing *regulus* of antimony was set up by a Mr. Reed at Feock, close to Falmouth, and De La Beche (1839, 616) gives a date of 1778 for the works. A small number of mines in both these areas of Cornwall continued to produce small amounts of antimony ore in the second half of the 19th century (Burt et al 1987, xxxii). Small amounts of ore were also produced from mines in Cumbria, to the north-east Bassenthwaite on the western edge of the Caldbeck Fells. These were worked prior to 1816 (Lysons 1816, cxi) and again in the 1840s but information on the extent of those workings is limited.

The best study of antimony mining and the processing of the ores in Britain comes from the south-west of Scotland and the working of the Louisa Mine at Glendining, in Dumfries and Galloway, and the work there can inform that which should be carried out in England. The history of the Louisa Mine, the antimony at which was first worked in 1793, was researched by McCracken (1965) at about the same period that it was examined by Charles Daniel in connection with other work in the area. Slag from the smelting process on site was analysed by Tylecote (1983), and the site was subsequently surveyed and included in the RCAHMS publication on the historic landscape of eastern Dumfrieshire (RCAHMS 1997, 276-77).

**Technological background**

The mining and ore preparation methods employed in working antimony ores were little different to those used in the other hard rock non-ferrous metal mining sectors. Stibnite, the antimony sulphide, had a specific gravity well below that of galena, the lead sulphide, with which it was commonly found in mixed ore deposits and could therefore be easily separate by conventional methods. Jamesonite, the antimony-lead sulphosalt, was a different matter with the lead and antimony in chemical combination, where the antimony would be separated after smelting. Smelting of antimony ores to a metallic regulus was a specialist liquation process, carried out on site at Glendining in the 1790s and described in detail in the contemporary Statistical Account of Scotland (Sinclair 1791-99, II, 525-27). The process was evidently also carried out on at least one mine in Cornwall, Pengenna, near Port Isaac, where 'old smelting works remain at Watergate, near the adit mouth, where much slag, rich in antimony, still lies' (Dewey 1920, 50). Processing was also carried out at Feock in Cornwall, albeit away from the mining sites (Lysons 1814, 194-216) but little detail is available and the site of the process has not been investigated.

Given that the presence of antimony could be a significant contaminant in lead, hardening it to the extent that it was brittle and no longer malleable; many producers were at pains to remove it. Softening hearths where antimony and other contaminants would be removed might be found at a number of lead smelters and Gill (2001, 95-96) describes such a hearth at Old Gang, Swaledale, confusingly known as the 'Silver House' although, as the process involved skimming contaminants from the surface of lead maintained in a molten state, it may have been confused with the Pattinson

process for silver enrichment. There is, however, no evidence that the antimony was recovered as a marketable product.

## Infrastructure associated with antimony production

There is no evidence of any elements within the infrastructure of mining in England which specifically supported the production of antimony. In Scotland, however, the settlement of Jamestown, in the parish of Westerkirk, Dumfries and Galloway, was built by the company operating the Louisa Mine in the 1790s along with an access road and bridges. The company also instituted a miners' library in Jamestown which still survives (McCracken 1965, 143-44 and Appendix).

## Archaeological assessment

There has, as yet, been no archaeological investigation of antimony mines or the preparation and smelting of antimony ores in England. The limited amount of investigation done at Glendining, in Scotland, (RCAHMS 1997, 276-77) including analysis of the slag from the smelter carried out by Tylecote (1983), with the benefit of a contemporary account of operations in the 1790s (Sinclair 1791-99, II, 525-27), could provide information relevant to the investigation of sites in England.

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## References

Beer, K E 1988 *The Metalliferous Mining Region of South-West England, addenda and corrigenda*. Keyworth: BGS

Clayton R E, Scrivener R C and Stanley C J 1990 'Mineralogical and preliminary fluid inclusion studies of lead-antimony mineralisation in north Cornwall' *Proceedings of the Ussher Society* **7.3**, 258-62 http://ussher.org.uk/journal/90s/1990/documents/Clayton_et_al_1990.pdf [accessed 16 April 2013]

De La Beche, H T 1839 *Report on the Geology of Cornwall, Devon and West Somerset*. London

Dewey, H 1920 *Arsenic and Antimony Ores*, Memoirs of the Geological Survey, Special Reports on the Mineral Resources of Great Britain **15**. London: HMSO

Fortey N J, Ingham J D, Skilton, B R H, Young, B and Shepherd T, J 1984 'Antimony mineralisation at Wet Swine Gill', Caldbeck Fells, Cumbria. *Proc Yorkshire Geol Soc* **45**, 59-65

Gallagher, M J, Stone, P, Kemp, A E S, Hills, M G, Jones, R C, Smith, R T, Peachey, D Vickers, B P, Parker, M E, Rollin, K E and Skilton, B R H 1983 *Stratabound arsenic and vein antimony mineralisation in*

*Silurian greywackes at Glendinning, south Scotland*. London: BGS Mineral Reconnaissance Programme **59** [PDF document] URL http://nora.nerc.ac.uk/11855/1/WFMR83059.pdf [accessed 16 April 2013]

Gill, M C 2001 *Swaledale, its Mines and Smeltmills*. Ashbourne: Landmark

Lysons, D and Lysons, S 1816 *Magna Britannia: volume 4: Cumberland*. London [Web documents] http://www.british-history.ac.uk/source.aspx?pubid=404 [accessed 18 April 2013]

McCracken, A 1965 'The Glendining Antimony Mine (Louisa Mine)', *Trans Dumfrieshire and Galloway Nat Hist and Antiq Soc*, **3.42**, 140-48

Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) 1997 *Eastern Dumfrieshire: an archaeological landscape.* Edinburgh: HMSO

Scrivener, R C and Shepherd, T J 1998 'Mineralization' in E B Se1wood, E M Durrance and C M Bristow (eds) *The Geology of Cornwall and the Isles of Scilly*. 36-57. Exeter: UEP

Sinclair, J 1791-99 *Statistical Account of Scotland.* 21 vols, Edinburgh

Tylecote, R F 1983 'Scottish Antimony' *Proc Soc of Antiquaries of Scotland* **113**, 645-46

Watson, B 2013 'The Princess in the Police Station', *British Archaeology* May-June 2013, 20-23