4D Lead Mining up to Roman Times

Lead Ore

In prehistoric times Galena was valued simply as an unusual pretty stone, and was used in ceremonial jewellery by the peoples of North America as long as 8,000 years ago. Irregular lumps of Galena can easily be split along cleavage planes to produce cubic crystals which have an attractive appearance.

In ancient Egypt ground Galena was used from 3,500 B.C. onwards to provide a black cosmetic, Kohl, which is frequently seen as an eye decoration in ancient illustrations. Of course people were unaware then of the dangers of lead poisoning.

The first lead production

The discovery that Galena could be heated to high temperatures to produce lead was probably made independently by a number of peoples in the ancient world. The earliest technology was a sloping stone hearth to collect the molten lead. Layers of wood and ore were placed on top; heating broke the chemical bonds in Galena to produce molten lead oxide and sulphur dioxide. At higher temperatures the carbon in the fuel would react with the lead oxides to give carbon dioxide and molten lead. The preferred sites for such hearths were west facing slopes to catch the prevailing winds. The earliest improvement to the process was to use charcoal, which is virtually pure carbon, as the fuel. Straw and then the Galena were placed on top of the charcoal. As the fierce fire refined the ore, pure molten lead would trickle out across the hearth stones to be collected in clay moulds. The process required large quantities of wood, leading to deforestation, and it also released lead into the atmosphere.

Castle Ring, on a hill about one kilometre south of Snailbeach, has the remains of an Iron Age hill fort. With a large population in the immediate vicinity it is likely that the Galena at Snailbeach, contrasting with the white minerals deposited with it, would most probably have been found and exploited before the Romans came to Britain.

A record of lead production through the ages

Lead released into the atmosphere from smelting eventually falls to the earth. In most places this is washed away by rain. But in lakes and bogs, where material is only collected from what has fallen out of the atmosphere, the concentration of lead in sediments can reveal evidence of lead smelting. A significant increase in the amount of lead trapped in sediments can be traced back to almost 3,000 years ago. Analysis of deposits from Lindlow Bog near Manchester shows a continuous record of over a period of 4000 years. From around 900 B.C. there is an increase in lead deposition, showing that there was an increase in lead in the atmosphere from that time caused by the beginning of lead smelting. There is a dramatic increase in lead pollution from 200 B.C. to 200 A.D., indicating that lead production was considerable before the Roman occupation of Britain. The traces of radioactive isotopes of lead in the samples demonstrate that the source of the lead, from earliest times until the Middle Ages, was lead mined in Britain. In ancient peat bogs in Wales there are indications that lead and copper smelting had begun in Britain during the Bronze Age.

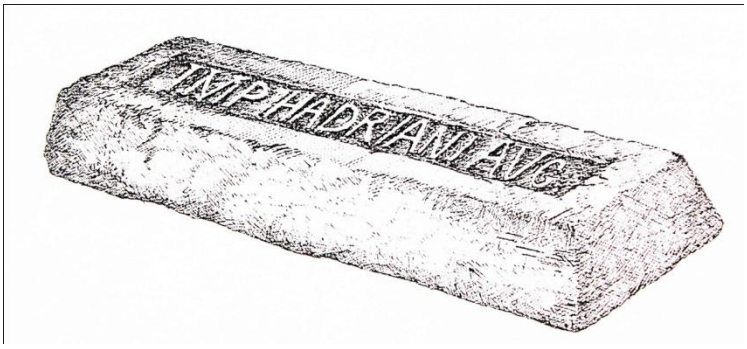
Lead pollution spread far and wide. Another significant marker of past atmospheric pollution is found in the layers of ice in the Greenland ice cap. From ice cores dated about 500 B.C. the level of lead in the samples starts to increase, reaching a peak by about 100 A.D. The quantity of lead in these samples of Greenland ice is as high as that found in ice laid down just 300 years ago. However, this does not prove that the Romans smelted as much lead as people in the 17th Century. Their primitive smelting methods were inefficient and were likely to have caused much more pollution than more modern smelting methods. It was not until about 1550 that enclosed ore hearths were developed. These controlled the temperature more closely and would not allow so much lead to escape into the atmosphere.

The Romans at Snailbeach

The Roman occupation of Britain began in 46 A.D. and exploitation of lead ores increased immediately. The Roman fort of Deva, now modern Chester, had lead water pipes. One piece of pipe found during excavations there bears the following inscription:

This lead pipe was made when Vespasian and Titus were Consuls for the ninth and seventh times respectively and when Cnaeus Julius Agricola was Governor of Britain'

Julius Agricola was Governor of Britain from A.D. 78-86. The installation of lead pipes within such a short time of the arrival of the Romans indicates that they were mining sources of lead which had already been identified and used by the local population. Had they not found the lead they would have had to use clay pipes at Deva.



Proof that the Romans mined lead at Snailbeach was found in 1796, when a Roman lead ingot weighing 87.5 kilogrammes (over 13 ½ stone – the weight of a large man) was found there, bearing the inscription IMP HADRIANI AVG. Hadrian, noted for the famous Wall, was Emperor from 117 to 138 A.D. 'HADRIANI' means 'belonging to Hadrian'. This means that Snailbeach was an imperial mine and the metal which came from it belonged to the state. Because of the value of the metal produced, mines were usually put under the control of the army. In Britain the evidence is that the Roman legions not only had the responsibility for mines, but also for the smelting of lead. Ingots from Britain have been found bearing the name of both the emperor, and the legion which smelted particular ingots.

It is claimed that evidence of Roman lead mining at Snailbeach was still visible in the 19th century, but traces of this have been obliterated by later working. Clear evidence of Roman mining was also found five kilometres south west of Snailbeach at Roman Gravels which is between Hope and Shelve.

The Roman Need for Lead

The main purpose of the extension of the Roman Empire was to supply vital resources. Spain, Gaul and then Britain were invaded in order to provide wheat and minerals for the growing needs of Rome. The Romans would have exploited places like Snailbeach because other known reserves in the

Empire had become depleted. New sources of both Galena, and timber for smelting it would be required.

It is easy to underestimate the Roman need for lead because little of what they might have used remains. Where lead is found it is easily recognised, always has a value and is easily worked into something new. It melts at a relatively low temperature, and can be moulded or rolled into new shapes. So in order to demonstrate how much the Romans relied on lead the investigation has to concentrate on sites that have remained completely undisturbed. Some discoveries of sunken ships dating from Roman times show the large range of uses of the metal. Ships uncovered close to the coast of Israel in the eastern Mediterranean have been shown to have had hulls sheathed in lead up to the water line. The lead would waterproof the hull and protect the timber against barnacles or boring organisms. It could easily be made into a smooth shape to enable the ship to travel swiftly. One ship was found to have a bilge pump made out of lead piping.

The Romans used lead cooking pots, which may have proved poisonous, particularly when boiling wine to concentrate it. Their intention was to sweeten acidic wine by boiling. It proved surprisingly effective. Lead Oxide, on the dull surface of the lead pot, reacts with acetic acid in the wine to produce a white crystalline substance with a sweetish taste, Lead Acetate. Before sugar became available Lead Acetate was used to sweeten wines, sometimes with deadly effect.

In Roman times lead oxides were used as paints. Pliny describes the use of Litharge (PbO) called red lead, which is actually the most poisonous oxide. However lead was used in paints until the 1960s. Pliny also notes the brilliant red Minium ($Pb_3 O_4$) and Massicot (PbO) which is yellowish. Women in ancient Greece used Lead Carbonate (PbCo3) as a white cosmetic. It is found as the mineral Cerrusite.