Source of medieval lead enrichments in natural archives of Europe: Harz Mts. (Germany)

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Anthropogenic Pb enrichments are detected in natural archives in Europe since about 4000 years. Maximum enrichments occur during the Roman Empire, in the Middle Ages and during modern industrialisation. Medieval Pb anomalies are found in lake sediments and peat bogs of central, western and northern Europe, and in ice cores from Greenland [1-5]. There are two arguments that medieval Pb enrichments in these archives are caused by the extraction of Ag and Cu from sulphidic ores in the Harz Mts. (central Germany): 1. We know 900 medieval smelting sites of non-ferrous metals in the W-Harz [1], far more than the total number of all other sites in Europe at that time; 2. Pb concentrations and inputs in medieval sections of peat and lake deposits in karst sink-holes along the Harz Mts. are orders of magnitudes higher than in the rest of Europe [1,5]. Between 1000-1200 AD modern Pb accumulation rates were exceeded several times.

First evidence of little metal extraction is known since 400 BC [4]. Significant mining and smelting activities began at about 850 AD culminating from 1050 to 1250 AD, temporary ending at about 1350 AD (Black Death period).

Ore smelting was mostly performed in the forests tenth of km away from the ore deposits because charcoal was used as energy source. Smelting temperatures up to 1050°C and high temperature metallurgical refinements caused strong emissions of volatile elements. Beside Pb, also Bi, Cd, As, Se, Cu, Sb, Tl, Zn, and sulphuric acid were released. Air, soils and sediments were extremely polluted. Until the end of the 12^{th} century the smelting happened predominantly on the top of wind exposed mountain ridges. Thereafter the introduction of waterpower shifted the smelting sites into wind-sheltered valleys lowering the export of heavy metals out of the Harz area. Very likely this can explain the decreasing Pb concentrations in lake and peat deposits of central and northern Europe after about 1200 AD.

References

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