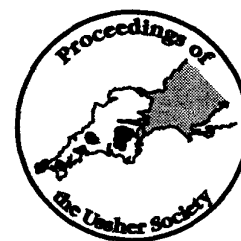


LEAD ISOTOPE VARIATION IN TIN ROLL INGOTS: DETECTING SURFICIAL CONTAMINATION USING STEP LEACHING

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Tin roll ingots were recovered from a trading vessel, the Aanloop Molengaart, which foundered off the Dutch coast in the 17th century. The roll ingots bear heraldic stamps which link their history to the tin mining region of Krusne Holy (Czech Republic). Although clean metal can be found inside the ingots, their surfaces are heavily corroded. The effect of corrosion and isotopic exchange with anthropogenic lead in a submarine environment was investigated using a step leaching procedure on two samples (AM78728 and AM731310). The combined processes are shown to have a marked effect on the lead isotope composition of the tin metal.

Step leaching uses acids of different type and molarity to remove small quantities of sample in a coherent sequence. The method makes it possible to gain qualitative information on the main isotopic components in a sample such as the presence of included/occluded bodies of differing isotopic composition. Step leaching will also exaggerate any effect attributed to the site dependency of isotopic species. The procedure of acid washing can remove small quantities of surficial material such as alteration/corrosion products, to gain the isotopic contribution from loosely bound compounds or contaminants. Step leaching has the

potential to increase the spread of isotopic ratios obtained from one sample and is therefore a good test of isotopic homogeneity.

The surficial leachates from sample AM78728 (0.77-0.79 $^{207}\text{Pb}/^{206}\text{Pb}$, 1.93-1.97 $^{208}\text{Pb}/^{206}\text{Pb}$) are closest in composition to lead measured in anthropogenic sources (Figure 1). These include aerosols from European suburban centres, industrialised rivers in northern France and European/US petrols. There is a general decrease in $^{207}\text{Pb}/^{206}\text{Pb}$ and $^{208}\text{Pb}/^{206}\text{Pb}$ as the sample mass is increased which simply reflects a higher proportion of uncontaminated lead in the sample. The surficial washings are interpreted in terms of mixing between uncontaminated lead from the tin metal and anthropogenic lead in the corroded layer.

These preliminary experiments show that step leaching of lead isotopes from corroded matrices can be used to reveal the isotopic composition of anthropogenic contamination. With further work the specific sources of lead could be identified. The unaltered composition of the tin metal lies at least 12.7% (AM78728) and 27.9% (AM731310, not shown) from the composition of the corrosion product. Such a large variation may offer the potential to study isotopic changes as monitors for incipient corrosion or solid state effects which are undetectable by trace element analysis.

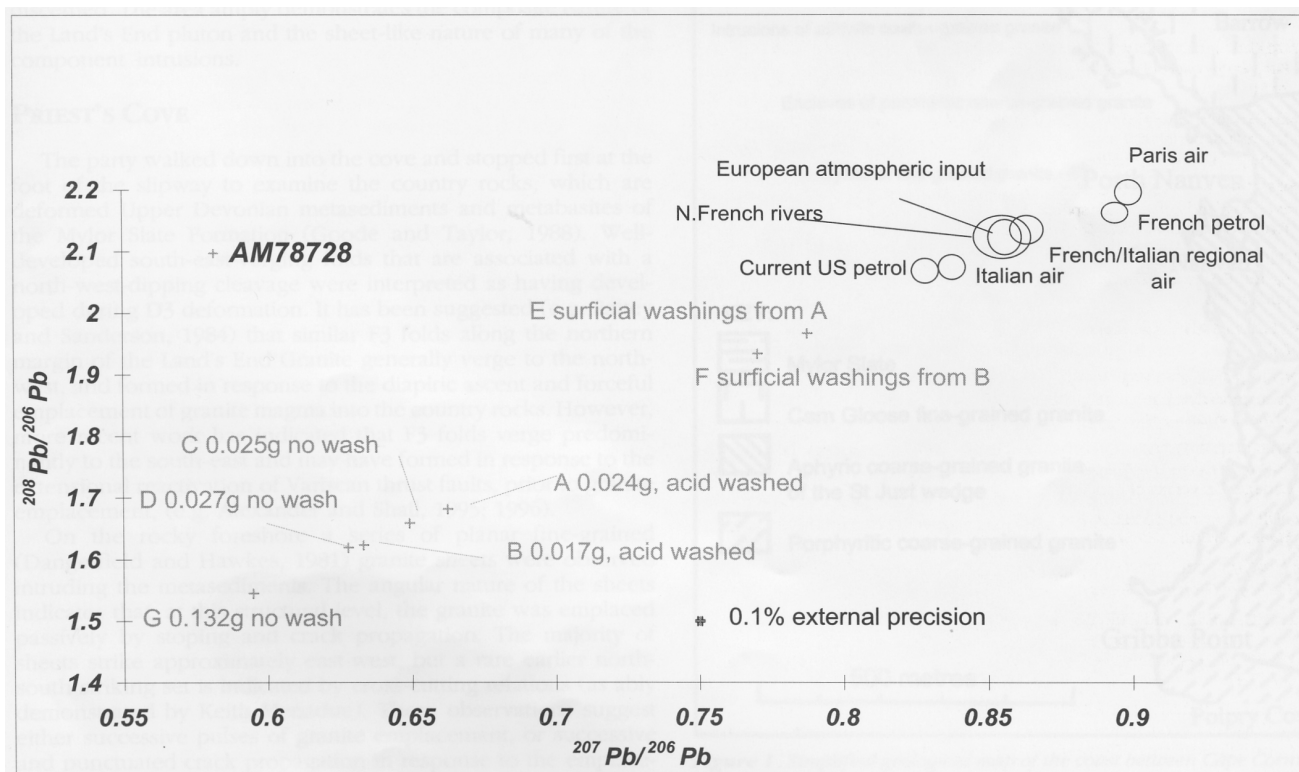


Figure 1. Duplicate analyses of a tin metal roll ingot (AM78728) showing the effects of anthropogenic contamination

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