

Reconstructing Anglo-Saxon immigration and residential mobility from O-, Sr- and Pb-isotope analysis

P. BUDD¹, J. MONTGOMERY², J. EVANS³ & C. CHENERY³
& D. POWLESLAND⁴

¹Department of Archaeology, University of Durham, South Street, Durham, DH1 3LE, UK (p.d.budd@durham.ac.uk)

²Department of Archaeological Sciences, University of Bradford, Bradford, BD7 1DP, UK.
(J.Montgomery@bradford.ac.uk)

³NERC Isotope Geosciences Laboratory, British Geological Survey, Keyworth, Nottingham, NG12 5GG, UK
(JE@nigl.nerc.ac.uk & C.Chenery@nigl.nerc.ac.uk)

⁴The Landscape Research Centre, The Old Bridge Barn, Yedingham, Malton, YO17 8SL, UK
(D.Powlesland@btinternet.com)

Tooth enamel O-, Sr- and Pb-isotope measurements of Anglo-Saxons from the 5th-7th century AD, West Heslerton cemetery, UK have been used to attempt to reconstruct ancient residential mobility and immigration. O-isotope data separate the population into two groups with differing childhood origins, but these are not reflected by Sr-isotope data. The range of ⁸⁷Sr/⁸⁶Sr measurements of archaeological tooth enamel for both populations is the same (~0.708-0.711). Furthermore, the Sr-isotope data, unlike those for oxygen, do not correlate with any of the large number of archaeological parameters considered. The relatively uniform Cretaceous and Upper Jurassic solid geology suggested that locally bioavailable Sr would be of very limited ⁸⁷Sr/⁸⁶Sr (~0.707-0.7085), but the presence of aeolian sands derived from fluvio-glacial deposits complicates the interpretation.

The large range of human and animal tooth enamel and soil ⁸⁷Sr/⁸⁶Sr from the site is common to large areas of the UK and northern Continental Europe potentially invalidating the use of Sr-isotope data to identify immigrants. However, the paper presents a detailed investigation of both the local Sr geochemistry at West Heslerton, and bioavailable Sr from archaeological pig teeth, to explore the potential for Sr-isotope data to refine the attribution of place of origin by O-isotope analysis in areas of high Sr-isotope variability.

The value of combined isotope measurement is further illustrated by a consideration of Pb-isotope data which show that exposure was dominated by technological Pb - highly mixed in a pattern consistent with archaeological evidence for Anglo-Saxon recycling of Roman metal. The Pb data are typical of a number of UK orefields and ores from the Harz and elsewhere in Germany which are thought to have supplied much of northern Europe during the Roman period and beyond.

Formation of Cu(I) in Natural Waters

BUERGE-WEIRICH, D., SULZBERGER, B.

Swiss Federal Institute for Environmental Science and Technology (EAWAG), CH- 8600 Duebendorf, Switzerland, (buerge@eawag.ch) (sulzberger@eawag.ch)

Introduction

Copper may be toxic to aquatic organisms or may play an important role in limiting primary production under certain conditions. In order to predict copper toxicity in natural systems, it is important to assess its speciation. Cu(I) is likely to play a crucial role for the bioavailability of copper. While many studies have been undertaken regarding Cu(II) speciation in the presence of organic ligands, little is known, hitherto, on Cu(I) stability and on its light-induced formation in surface waters.

The purpose of this study is (i) to elucidate the role of chloride in stabilising Cu(I), (ii) to study the effect of strong Cu(II) chelators on the formation of Cu(I), and (iii) to assess the effect of size-fractionation (by ultrafiltration with 1kD) of natural dissolved organic matter (DOM) on the light-induced Cu(I) formation in natural water samples.

Analytical measurements

In order to be able to measure Cu(I) at natural concentrations, a new analytical method was developed. The basis of this method is stabilisation of Cu(I) and Cu(II) by bathocuproine and ethylenediamine, respectively, as already described by Moffett et al. (1985), and subsequent separation of Cu(I) and Cu(II) with a solid phase extraction method. This method allows to preconcentrate Cu(I) and to measure it after elution with methanol by GF-AAS. Special precautions required to take Cu(I) samples in batch experiments will be discussed. To assess speciation of Cu(II), we employ ligand-exchange cathodic stripping voltammetry (Campos, M.L.A.M., van den Berg, C. M. G., (1994)).

Results and discussion

We have assessed the influence of chloride in samples from the river Scheldt. For this purpose, the river was sampled at different stations from the source to its estuary, which allowed changing salinity from 0 ‰ to 26 ‰. In the same samples, complexation of Cu(II) by organic ligands was analysed.

First results regarding item (iii), performed with Mediterranean seawater, showed that upon irradiation, higher steady-state Cu(I) concentrations were established in the low-molecular weight fraction than in the high-molecular weight fraction (different reduction mechanism than Fe(III)).

The results gained with fresh and marine water samples from different sites (River Scheldt, River Rhine, Northsea, Atlantic, Mediterranean) help to better understand Cu(I) formation and stabilisation in natural waters.

References

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Moffett J. W., Zika R. G., Petasne R.G. (1985) *Anal. Chim. Acta* **175**, 171-179.