



**Organisation:** Uffington Heritage Watch

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**Topic:** Adopting Innovation in archaeological materials and conservation science: provenancing Roman iron

### **Background**

Since 2004, the author has been carrying out analysis of archaeological metal artefacts and metal production residues using innovative non-invasive neutron and X-ray synchrotron methods at large-scale facilities in England and other countries.

### **Case-study: provenancing Roman iron**

A Middle Iron Age to Late Roman settlement and industrial (ironworking) site on Uffington Common in the village of Uffington, Oxfordshire, was evaluated in January 2014, and then further investigated July–September 2014 by commercial contractors in order to discharge a condition for a planning consent (Cotswold Archaeology Draft Report 2015). The finds from the site were deposited with Oxfordshire County Council, Museum Resource Centre, in Standlake, Oxfordshire.

One very significant class of find – iron ore – which was present in abundance on the site, was classed by the commercial contractors as ‘natural’ stone and discarded. Iron ore is therefore not present in representative quantity in the site archive deposited with the County Council. Around 180kg of iron ore from the site was, however, recovered by a local resident and amateur archaeologist, whose property adjoined the area investigated. Over the course of several years, the local resident had excavated a pond trench approximately 2m deep and 10m x 3m in his garden, around 4m away the edge of the area cleared for investigation by Cotswold Archaeology in 2014. The ore from the site was deposited by the local resident with the author at Uffington Heritage Watch in April 2015.

The archaeological features found on Uffington Common are not normally seen together on Iron Age and Roman sites. The combination of an iron ore deposit and quarry pits, and the presence of Iron Age, Roman, and Late Roman-phased primary production slag is exceptional. In addition, low-value finished metal objects – iron nails – belonging to the Late Iron Age, Roman, and Late Roman periods, of the sort that one would expect to be locally produced, were recovered from the site. It is exceptional that all the material components of the chain of production are present on this site: ore, primary and secondary production slag, and finished metal products. The Uffington Common site provides the opportunity to test the trace-element ‘fingerprint’ method of iron provenancing that has so often been proposed in the literature but never conclusively demonstrated because of incomplete sets of evidence.

In March 2017, Late Iron Age to Late Roman clay, coal, wood charcoal, ceramic, iron ore and iron production slag samples from the Uffington site were sampled by the author for conventional metallographic, chemical (XRF), and crystallographic (XRD) analysis.

Twenty-five intact Late Iron Age to Late Roman iron nails from the site were analysed without sampling, by innovative non-invasive neutron methods at the Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory ISIS neutron source in Harwell, Oxfordshire. Ten days of neutron analysis ‘beamtime’ were funded by the STFC. The equivalent cost of this beamtime to a commercial company would have been around £90,000. In a separate beamtime proposal, iron ore samples recovered from the site during the Cotswold Archaeology fieldwork of September 2014 were analysed by neutron diffraction (one day of beamtime) and X-ray fluorescence at ISIS, along with comparative ore from the pond trench on the edge of the site, and samples of Wroxton-Banbury Ironstone (Godfrey 2015).

## Appendix 3.7

Because the Heritage Science analysis is research carried out on a not-for-profit basis and the results are to be made freely available through publication in academic scientific journals, the large-scale facilities (in the UK and other countries) do not charge the commercial cost of analysis to archaeological scientist 'facility users'. Conventional instrumental analysis equipment (XRF, XRD, SEM-EDS) is available for use by archaeological and conservation scientists at the STFC labs in Harwell, once their project has been granted neutron or X-ray synchrotron beamtime. The user has to pay the facility around £1500 for training to use the SEM-EDS. This training cost would have to be met out of post-excavation project funding. The cost for the time of the archaeological scientist would also need to be met through project funding. In the case of the *Provenancing Roman iron* project, there was no budget made available by the archaeological contractors, the developers or the site owner (a local farmer) for the project. The estimated cost to employ one MCIfA-grade archaeometallurgist to carry out the work described above and produce a report and scientific journal publication would be around £6007.50 (30 days, including 10 days of neutron beamtime, at a day rate of £200.25).

### References

Cotswold Archaeology, 2015 Station Road, Uffington, Oxfordshire: Post-Excavation Assessment and Updated Project Design, CA unpublished draft report 14434

Godfrey, E, 2015 Iron Ore from Uffington Common. Analytical report on samples from an Iron Age–Roman industrial site on Land off Station Road, Uffington, Oxfordshire. Uffington Heritage Watch