

SCIENCE**Notes**

Using incremental strontium isotope analysis to recreate subsistence ranges

Strontium isotope analysis has become a standard in mobility research, featuring in many post-excavation analyses of human and animal remains. While 'typical' strontium analysis is able to tell us much about movement in the past, new techniques are being applied in ways that enable us to appreciate migration on even smaller timescales. One such methodology, which we are discussing in this month's 'Science Notes', is laser ablation multicollector inductively coupled plasma mass spectrometry, or LA-MC-ICP-MS for short. This is used to assess incremental strontium isotope ratios within tooth enamel, which has the potential to identify mobility to a seasonal, or even monthly, resolution. With this data, it then becomes possible to recreate a given population's subsistence range.

ICP-MS is used in many aspects of archaeological science to assess the composition of a sample in such a way that preserves the spatial distribution of each element/isotope. For example, the last time we discussed it in 'Science Notes', the technique was used to identify the geochemical composition of sarsen debitage at Stonehenge (see CA 367). To collect the sample, a focused laser beam is used to remove sequential layers of material and vaporise them into an aerosol, which is then analysed using a special mass spectrometer.

For the technique to be able to detect small-scale mobility, the individual being sampled will have had to come from a region where the baseline strontium values have extreme variation over a relatively short distance. Such was the case for a recent study that tracked modern sheep and ibex in the Altai Mountains of Mongolia using GPS. Sequential strontium analysis of these animals was successfully able to reconstruct their monthly movements.

In testing whether this methodology can be used effectively on ancient human remains, an international team led by researchers from the University of Southampton looked at Palaeolithic samples from Portugal. Located 100km north-east of Lisbon, the Almonda karst system on the southern edge of the Mesozoic Central Limestone Massif of the Portuguese Estremadura has been found to have a high degree of geographical variation in $^{87}\text{Sr}/^{86}\text{Sr}$ values, and hence is a great location to test MC-ICP-MS's ability to detect seasonal movement in the distant past.

Two of the teeth sampled, which are from Neanderthals, were from Gruta da Oliveira, located approximately 40m above the Almonda spring (**ABOVE RIGHT**). The layers from which they came were dated using optically stimulated luminescence (OSL) and Bayesian modelling to $93,250 \pm 3,450$ years ago. This date was reinforced by the presence of Levallois stone tool technology within the same context. The third sample, a human tooth from the Magdalenian period, came from the Galeria da Cisterna, located 5m above the spring and 35m below Gruta da Oliveira, and was directly dated to $11,122 \pm 34$ BC. The team



also sampled animal remains from both caves, as well as another cave nearby, to determine the probable subsistence ranges of these hominids' prey.

While only three hominid samples were analysed, the results of this pilot study were intriguing. The two Neanderthals from Gruta da Oliveira had similar strontium isotope profiles. Both were found to have probably moved between four different geological areas, at least during the ages of 8.5-14.5 years old for the first individual – whose third molar was sampled – and the ages of 3.5-6.5 years old for the second individual – whose premolar was sampled (**ABOVE LEFT**). Conversely, the results from the Magdalenian individual from Galeria da Cisterna suggest that they oscillated between two geographically distinct areas, probably from the source of the Almonda River to the banks of the Tagus River.

To then extrapolate these results in order to determine the probable settlement/subsistence territory for each population, the area had to (a) contain the site of the sample, and (b) contain terrain with soil Sr values matching those measured in the teeth. For the Gruta da Oliveira samples, the team found this included an area of $c.600\text{km}^2$ surrounding the cave, while for the Galeria da Cisterna sample it included an area $c.300\text{km}^2$ – roughly half the size of their predecessors. This smaller range for the Magdalenian sample is supported by the materials found in the same archaeological context, approximately 80% of which come from sources within 300km^2 .

Crucially, the results from the animal bones suggested that the hominid's main prey species did not have a major change in territory between the two periods, meaning that the observed decrease in the hominid subsistence range is unlikely to have been driven by changes in hunting patterns. It is more likely, the team argue, that this diminished range is due to increasing population density during the later Upper Palaeolithic, an argument supported by an observed increase in the frequency of archaeological sites dating from this period across the Iberian peninsula and south-west France.

The full results of the study were recently published in *PNAS*: <https://doi.org/10.1073/pnas.2204501120>.

'Giant' handaxes found in Frindsbury, Kent

Excavations at Manor Farm in Frindsbury, Kent – in advance of the construction of a Maritime Academy – have revealed more than 800 stone artefacts found within sediments thought to relate to a Middle Pleistocene tributary of the River Medway.

Amid the assemblage recovered by Archaeology South-East, UCL Institute of Archaeology, in 2021 were two significantly large flint tools – labelled 'giant handaxes', they have long, finely worked tips and thicker, more crudely knapped butts – probably dating to the interglacial period more than 300,000 years ago. During this period of the Palaeolithic, Neanderthals and potentially other early species of human inhabited a wooded landscape, along with familiar animals such as red deer and horses, as well as now-extinct species like straight-tusked elephants and lions.

Initial post-excavation analysis of the largest of the two handaxes (BELOW) has since been carried out, including being 3D-scanned using photogrammetry by Dr Sarah Duffy. It was found to measure 29.5cm in length and had no significant abrasions – their presence would have indicated that it had been transported far down the river channel. Instead, it could be that this handaxe was originally deposited in the stretch

of river where it was found. While these types of tools have previously been found in the Medway Valley, this is the first to be discovered during a large-scale excavation, providing the rare opportunity to learn more about these enigmatic objects and the culture in which they were produced.

Highlighting the significance of the site, Letty Ingrey from UCL Institute of Archaeology said: 'These handaxes are so big it's difficult to imagine how they could have been easily held and used. Perhaps they fulfilled a less practical or more symbolic function than other tools, a clear demonstration of strength and skill. While right now, we aren't sure why such large tools were being made, or which species of early human were making them, this site offers a chance to answer these exciting questions.'

In addition to the spectacular prehistoric finds, during the course of the excavation the team also uncovered a Roman cemetery, including the remains of 25 individuals, 13 of whom were cremated. They may have inhabited a villa that is believed to have been located 850m south of this site.

A 3D model of the larger of the two handaxes can be found here: <https://sketchfab.com/3d-models/maritime-academy-giant-handaxe-242e16a1e43e4a16bc2bfcdfeb3cdc59>. A paper describing the discovery was recently published in *Internet Archaeology*: <https://doi.org/10.11141/ia.61.6>.



IMAGE: Archaeology South-East

Finds Tray

This is a unique early Bronze Age pin, made from the first phalanx (or toe-bone) of a golden eagle (*Aquila chrysaetos*). It is the only example ever found in a Bronze Age funerary context in England, with only one other similar find recovered from a child's burial in Scotland.

This pin was also associated with the cremated remains of a child, found during excavations by Cotswold Archaeology in Eynsham, Oxfordshire, in advance of the construction of the A40 Science Transit Park & Ride. The burial had been placed in a shallow pit alongside the charcoal from the funeral pyre. No evidence of a funeral urn was identified, so it is probable that the remains were kept in some sort of organic container – such as a leather bag, wicker basket, or animal fur – that has since disintegrated.

Although the pin is broken in several places, a perforation in the wider end suggests that it may have been worn suspended, perhaps using a fibre cord. It is likely to have been part of the pyre goods specially chosen for the child, and thus may have had special significance either in life or in death. Radiocarbon dating of the burial has been carried out, providing a date range of 1881-1693 cal BC.

While the golden eagle is a fairly rare breed in the UK these days – 510 breeding pairs are known predominately in the uplands of Scotland, after a period of heavy poaching in the 19th century – it is an indigenous species and was once found much more widely. This rare pin offers a clue as to the importance these birds may have had to people in the distant past.

This burial was the only evidence of Bronze Age activity found at the site, but the team from Cotswold Archaeology discovered Iron Age settlement activity as well, including the remains of roundhouses, post-built structures, and livestock enclosures. Two triangular loom weights, which would have been used on a vertical weighted loom of a type that was common at this time, were uncovered in two of the roundhouses, suggesting that at least part of the site was probably used for the manufacture of textiles.



TEXT: Kathryn Krakowka, unless otherwise stated IMAGE: Cotswold Archaeology