DIRTY POTS REVEAL COOKING PRACTICES OF EARLY FARMERS IN NEOLITHIC POLAND

July 24, 2015 DavidAltoft Neolithic,Science Bristol, David Altoft, Linearbandkeramik, Lipids,Neolithic, NeoMilk, Organic residue analysis, Palaeodetective,Poland, pottery

Today, like most Fridays, is the culmination of a week's work in the lab. I am a PhD student in the Organic Geochemistry Unit (OGU) at the University of Bristol working on the European Research Council-funded 'NeoMilk: The Milking Revolution in Temperate Neolithic Europe' project. NeoMilk is an interdisciplinary collaboration of researchers at the Universities of Bristol, Exeter, College London and Poznań (Poland), and the National Museum of Natural History, Paris, researching the development of dairying practices in Neolithic Europe by archaeological, chemical, zooarchaeological and statistical analyses. These interdisciplinary proxies will provide a window on the cultural, environmental and temporal variables of cooking and subsistence practices, to better understand the context of the Linearbandkeramik (LBK) culture in the development of agriculture in Central Europe.

My role is to analyse organic residues from food and other organic materials absorbed in pots from sites in and around Poland from a variety of environmental and cultural contexts, and compare results on inter- and intra-site levels (individual households, chronologies and vessel typologies).

In order to find out what these residues are, I have to prepare the potsherds. The following is a typical week for me in the lab:

Monday:

Take sub-samples from potsherds I wish to analyse next. Only 1-2 grams of ceramic material is required for organic residue analysis, so only small areas of each sherd are sub-sampled, nearly always allowing the profile of the sherd or any areas with surface decoration to be left intact. A modelling drill is used to remove a very fine outer layer of the sherd on all sides that it will be sub-sampled from, so the presence of any surface contaminants from handling or contact with plastics can be minimised. I then use a hammer and chisel to remove that part of the sherd and then wrap it in foil until it is ready for analysis.

David using a modelling drill to prepare a small area of a sherd for sub-sampling

Tuesday:

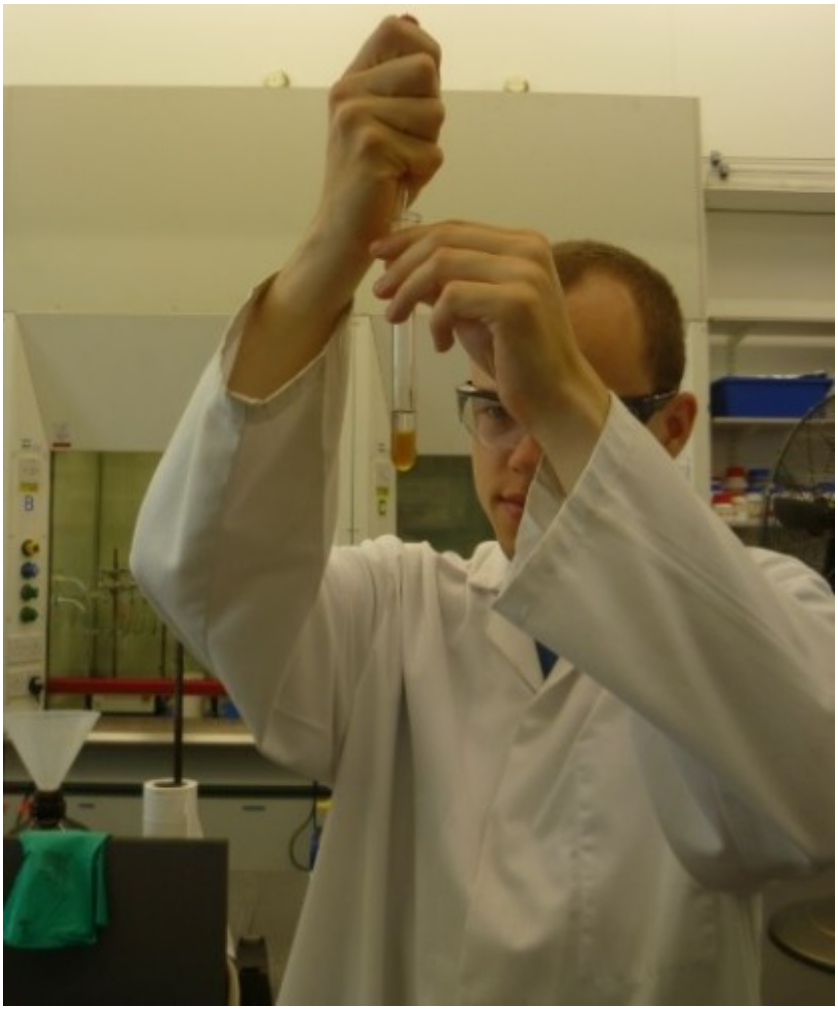
Crush and weigh the sherd fragments I've sub-sampled. Knowing the mass of the ceramic material lipids will be extracted from will allow me to calculate the concentrations of the lipids, which is useful as the analytical instruments are very sensitive and won't work optimally if the lipid extracts are too dilute or concentrated.

David crushing a small sub-sample of a sherd prior to lipid extraction and analysis

The OGU has a weekly seminar and lab meeting on Tuesday lunchtimes which is a good opportunity to announce news, discuss any issues and tidy the lab.

Wednesday:

Chemically extract the lipids from the sherd fragments.



David extracting lipids from a sherd

We use gas chromatography, an analytical technique that screens the compounds in the lipid extract, firstly so we know lipids are present (sometimes they aren't, either because of poor preservation or because the archaeological use of the vessel didn't contribute to the absorption of lipids into the vessel – e.g. it wasn't used for cooking food) and secondly so we know whether there are also any contaminants present that may have been introduced during extraction in the lab or before when the sherd was handled or came into contact with plastics during excavation or post-excavation. We can often differentiate these sources of contamination by including a blank in each batch of sherds we extract and analyse.

Thursday:

Run the samples and a blank on the gas chromatograph (GC).

David about to inject part of a sample into a gas chromatograph

As well as separate compounds within the lipid extracts, the GC determines the abundances of each compound, which we use with the weighed sherd fragments they come from to calculate the approximate concentrations of lipids from each sherd. At this stage I can determine which samples are suitable for further analysis tomorrow. Those that are too dilute will not be viable, though those that are too concentrated for the instruments can be diluted with hexane.

Friday:

Run the selected samples on a second instrument that allows us to identify the compounds screened yesterday by finding the mass-to-charge ratios of their ions. This technique is called gas chromatography-mass spectrometry (GC/MS). GC/MS is useful for identifying compounds that are biomarkers for aquatic species.

Sometimes I run the samples on a third instrument that finds the isotopic values of two particular compounds (palmitic and stearic acid) which occur almost ubiquitously in residues. This instrumental technique called gas chromatography combustion isotope ratio mass spectrometry (GC-c-IRMS) works by comparing the proportions of carbon-12 and the heavier carbon-13 in these two compounds. I can then determine whether the lipids in that sherd derive from the meat of a terrestrial non-ruminant animal (e.g. pig) or a terrestrial ruminant animal (e.g. cow), or from the dairy products of a terrestrial ruminant animal.

I also have to wash and sterilise the various tubes I've used for extracting the lipids from all these sherds this week, so they are ready for another set of sherds next week. I usually catch up on responding to

emails and doing any writing, or I may occasionally do other work, such as photograph the 425 sherds I sampled from 14 LBK sites in north-central and northwest Poland in June.

Box containing the 425 sherds David sampled from Poland in June

Time for a well-earned weekend! Further information about the NeoMilk project is available at www.neomilk-erc.eu, and the instrumental techniques we use at the OGU at www.bris.ac.uk/nerclsmsf. Last Saturday I and three other members of the OGU exhibited a stall at the Thornbury Science Festival near Bristol, which included a game called 'Palaeodetective' that showcases the diverse research the OGU is engaged in; you can play the game online at www.chemlabs.bris.ac.uk/outreach/resources/Palaeodetectives%20Online%20Version!