Recent advances in the application of organic petrology to archaeology

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INTRODUCTION

From the beginning of the 1980s, Marko Tischtmicher began to use organic petrology to solve archaeological issues (Rosthain et al. 1981; 1985). The purpose of characterizing the organic-rich sediments which were used in Europe, particularly during the Iron Age, to produce dark or black polished ornaments, especially armlets, and to determine their natural and their geographical provenance in order to reestablish the Celtic trade connections.

During the 1990s, published in 1992 and entitled “Organic Petrology in the Service of Archaeology”, demonstrates the extent of her work in the field of research. Also, the article reveals the potential of organic petrology in connection to the study of these kinds of archaeological objects. The aim of this article is to present some examples of our work in this field of application of organic petrography to archaeology. We will focus primarily on the methodology used for the identification of the sources of the raw materials (oils, shales, bituminous coals) of these archaeological objects.

The second part of the paper is dedicated to the application of organic petrology in archaeology, namely the petrographic analysis of the organic matter in combustion features, as well as an isotopic approach to these kinds of archaeological objects. The third part is focused on the investigation of ash and waste horizons from Middle Ages, and to analyze the potential of organic petrography in the study of these kinds of archaeological objects.

In numerous Eastern Mediterranean archaeological sites, as well as in South Africa Middle Stone Age sites, organic petrography has been used in the study of the remains of ornamental objects. The article reveals the potential of organic petrography in connection to the study of these kinds of archaeological objects.

Celtic black or dark brown archaeological objects in Europe

Materials and methods

In Germany

1. Germany: Hunsrück (Sieg) and Siegen: 2 armlet fragments (Early Iron Age)
2. France: 2 aur in armlet fragments (Hettia-Citadelle) 3 Aur in armlet fragments (Early Iron Age)
3. Switzerland: 1 iron armlet fragment (Final Bronze Age)
4. Italy: Liguria: 1 iron armlet fragment (Final Bronze Age)
5. Austria: 1 iron armlet fragment (Final Bronze Age)
6. Poland: 1 iron armlet fragment (Final Bronze Age)
7. Germany, 1 iron armlet fragment (Final Bronze Age)
8. 1 iron armlet fragment (Final Bronze Age)
9. 1 iron armlet fragment (Final Bronze Age)

The investigated archaeological material - armlet fragments and 1 ring - was collected from 8 sites in Germany, France and Switzerland and dated from Final Bronze to Final Iron Age (see map above). For the organic petrographical investigation, polished sections - perpendicular to bedding - were microscopically analyzed, both under reflected light and with fluorescence mode. In order to respect the value of the archaeological artefacts, only fragments in the range of a few mm² were sampled from the ornaments. For determining the source and provenance of the raw material, the organic-mineral micromorphology of each artefact was described, with respect to its structure and composition. For determining the provenance of the raw material, reference material was collected in several oil shale basins of France, as well as at the Donau coast of Southern Germany. In general, these raw materials were collected regarding accessibility during the relevant archaeological times and the existence of signs of workshops and remains of armlet production.

The Material shows a dominant maceral group of bituminite groundmass. In contrast to "traditional" oil shales, the bituminous groundmass is mainly argillaceous. Botryococcus algae and faunal relics appear in ashes from fire experiments... plant materials; mixture of plant materials and bones; bones) (Schiegl et al. 2005). A number of studies focused on the organic petrography to determine the origin and the use of organic petrography in the study of these kinds of archaeological objects.

APPLICATIONS OF ORGANIC PETROLOGY IN ARCHAEOLOGY:

- Organic petrography confirmed that a major organic constituent of the sediment at Sibudu is charcoal. Inorganic and organic constituents of the sediment are characterized by the presence of different kinds of organic petrography. The investigation of the archaeological ornaments and the relevant reference materials revealed that there are four known sources for raw materials, three of which are oil-shale from the Permian basin in France, a marine oilshale, called Blackstone, from the Kimmeridge Clay Formation in Dorset, South England. The only source for raw material could not be determined so far. For this reason, the description of the organic petrography of the materials should be seen as an initial result of the research.

- The investigated material is composed of organic constituents, characterized by organic petrography. In general, thesearbonaceous components are characterized by their organic petrography. The organic petrography is either carried out on fine polished thin sections or on polished blocks.

- Organic petrography identified the organic constituents of the sediment at Sibudu in South Africa. The analysis of the organic constituents of the sediment at Sibudu has been carried out using FT-IR spectroscopy for the characterization of the organic constituents of the sediment at Sibudu to determine the origin and use of organic petrography in the study of these kinds of archaeological objects.

- The sample was collected in the lea of Israel (photomicrographs bottom left). The latter could have been originally found in the lea or in the cultural layers of the site. The latter could have been exposed to a complete degassing process but have since undergone a second combustion, i.e. the site and the second stage of organic combustion is characterized by the presence of different kinds of organic petrography. The same field: note the decrease in reflectivity measurements on the charcoal and the fat-derived char particles in the reflected light and with fluorescence mode. The calculated temperatures of fusinite formation range from 1.27 to 1.40%. Low reflecting charcoal particles ranging from 0.35 to 0.38% reflectance have been found so far. The latter could have been discovered in the lea of Israel (photomicrographs right).

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