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Abstracts

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Roman non-ferrous and noble metal mining in Kosovo

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The Deutsche Bergbau-Museum Bochum, in conjunction with the Römisch-Germanische Kommission (F. Lüth) and the Johann-Wolfgang-Goethe University in Frankfurt (F. Teichner, S. Klein), is currently carrying out research on Roman non-ferrous and noble metal mining in Kosovo. This investigation is part of a German-Kosovan research project headed by the Römisch-Germanische Kommission in Frankfurt and focuses on the Roman city Ulpiana.

Ulpiana was founded at the turn of the 1st to 2nd century AD, and in the 2nd century, it was already promoted to a *municipium*, thus gaining the status of a Roman city. The wealth of the city could be traced back to Roman gold and silver mining that must have taken place in the hinterland surrounding Ulpiana. Several mountain ranges with ore occurrences are

located to the east of the city, which have been exploited up to modern times.

The research into Roman mines in the wider surroundings around Ulpiana should clarify to what extent the still visible former mining works and other mining traces (such as ore beneficiation, smelting and processing sites) can be assigned to that period. These are being studied and recorded using modern methods and techniques. Extensive field surveys, which concentrate on the ore bodies with their mining and smelting sites, include prospection using conventional and geophysical prospection methods. In addition to the surveys, mining archaeological excavations in the Roman mining districts are also planned. A further focal point is on a comprehensive scientific analysis of the slag, ore and metal, in order

Fig. 1: Shashkoc, extensive dumps are testimony of an intensive exploitation of the ore.



to provide information about the flow of materials from the mines into the Roman city and how the associated trade network would have functioned. Possible gold mining is of particular interest. When the mine was aimed at extracting gold, their detection is aided less by the slag heaps, but instead by the mining fields with their extensive tips and associated installations for the production of ore concentrates.

A large part of the Kosovan ore bodies are located in an ophiolite belt, which stretches through the Balkan states and far into the Middle East. The ore in Kosovo can be characterized as being polymetallic. Aside from large quantities of copper, lead, silver and zinc, there is also some amount of gold in the ore bodies. In addition to sulfide and oxide ores, fahl ore also occurs. With this in mind, it is often difficult to judge from the smelting slag wastes what the desired product from the extracted ore was. This poses a great challenge for the planned investigations, in that it is not always possible to reach a clear conclusion, due to the often multivariable phase compositions. Thus, it is necessary to analyze as large a sample spectrum as possible, with particular attention paid to semi-finished and end products. Aside from conclusions about the internal operational sequence - from ore to end product - lead isotope analyses will also give information about provenience and a possible integration with long distance trade networks.

Preliminary work in the mining district of Shashkoc, which is ca 10-15 km southeast of Priština and to the southeast but within sight of Ulpiana, has supplied evidence of an extensive mining area. There are several large mining dumps, remains of open casts, as well as some mine mouths which lead to relatively small workings, some of which are still partially navigable. Some stone anvils found nearby and directly on the mining dumps are testimony for processing, in this case the on-site crushing of the ore. A series of "troughs" carved directly into the living rock could be ore beneficiation sites, at least one of these troughs had an inlet, where the ore was possibly washed. Ceramic finds, as well as an iron gad found on-site, show that mining took place here not only in Roman times, but also during Byzantine and Medieval Periods.

Selected surveys were also undertaken in the wider surroundings of Ulpiana that were concentrated on slag heaps, which were known to the local population. The associated mining district must still be located in more detail.

The survey uncovered a series of slag heaps from different time periods (Roman to Medieval) in Hajkobilë and near Marec, district Priština. At both places the smelting remains are found near running water: those in Hajkobilë are partially built over, while those in Marec are undisturbed. A series of long and partly flat dumps are found in mostly level land in wide valleys. Ceramic finds point to a Medieval period of

use. More find sites possibly dating to the Roman period include the slag heaps near Voguçincë and Mramor, district Priština. The period of use is based on ceramic finds, as well as a tegula fragment. Likewise, several dumps are located on a slight slope, in the near vicinity of a modern body of water. Due to the partial degradation of the dumps near Voguçincë, several finds came to light, which allowed them to be dated. The smelting remains near Mramor were partially destroyed by modern road construction, but contain slag, as well as furnace remains.

The slag consists of a fayalitic tap slag that can be assigned to either lead/silver or copper smelting. Some of the slag exhibits green incrustations which point to copper, while other have a whitish crust, which is typical for lead metallurgy. Although it seems easy to categorize the hand specimens, the difficulty lies in the detailed study of the thin sections. Generally, the currently analyzed slag consists of a fayalitic skeleton, sometimes associated with mostly magnetite-rich iron oxides. Drops of sulfides can often be seen in the interstices, in the best case it is possible to recognize copper sulfides. There are, however, so many phase variants that it is not yet possible to identify the whole spectrum. Worth mentioning is the presence of lead sulfides, iron sulfides, complex lead arsenic and antimony compounds, as well as zinc compounds which occur from time to time. The pieces which have a green surface only contain a bit more copper, the white ones, a bit more lead. It is possible that the associated smelting processes were not aimed at just one metal group. This, in any case, needs more clarification.