Provenance investigations of ancient iron slag in what is now Poland – a preliminary study

The aim of the proposed project is a preliminary identification of chemistry of ore and slag from selected Pre-Roman and Roman Period sites in what is now Poland and an isolation of regional groups. C. 400 slag and ore samples from c. 40 sites will be examined, including those from renown regions of ancient metallurgy: the Holy Cross Mountains, Masovia, and Central Silesia. The project thus intends to advance further provenance studies on old iron in this part of Europe. The final result of the project will be a monograph with a discussion of the chemistry of regional ore and slag groups in what is now Poland in Antiquity.

Research on ancient metallurgy in Poland has a long tradition. Several smelting regions from the Pre-Roman and the Roman Period were identified, such as the Holy Cross Mountains (one of the largest ironmaking centres in the Barbaricum), Masovia and Silesia. However, the situation is worse concerning provenance studies. A provenancing method proposed in 1963 by J. Piaskowski proved untenable in the light of later research. In the recent 20 years, a huge progress was made in iron provenance studies, due to the application of multivariate statistics and taking new variables (major and trace elements, isotopic ratios of osmium and lead) into consideration. Regrettably, these methods have not been applied in research on finds from what is now Poland. The proposed project aims at filling this gap and at opening the way for further studies.

On the basis of purely archaeological evidence it was possible to isolate three significant iron smelting regions in what is now Poland in Antiquity. As they operated during the period of some hundred years, different types of ores and smelting technologies must have been used. Therefore, the first step is an isolation of sub-regions on the basis of purely archaeological and geological evidence, concerning types of local ores.

Slag and ore finds will be pulverised, dissolved and their chemical composition will be examined. The analyses will be carried out in the laboratory of Le Service d'Analyse des Roches et des Minéraux (SARM) in France. The research could greatly benefit from using such finds as iron blooms or bars, as well as from isotopic analyses. However, this would increase the cost of the project. It was therefore decided to postpone such examinations until results of preliminary identification of regional smelting centres are known. Previous provenance studies which solely used slag and ore finds proved successful. It is planned to consider elements discussed in previous scholarship but a final decision will be made after the chemistry of slag and ore is known. Eventually, ore and slag data will be statistically examined, with a preliminary filtering with the use of MnO, P_2O_5 and MgO, and then using multivariate methods, that is, methods which allow to analyse numerous variables at the same time.

The following research methods will be used:

- mass spectrometry for measuring the contents of major and trace elements
- numerous statistical approaches will be tested in order to assess their performance. For calculation purposes, it is planned to use open source R Project for Statistical Computing software (https://www.r-project.org/) and commercial Xlstat software (https://www.xlstat.com/en/). The author of the present proposal has tested several analytical methods on the basis of available experimental smelting and archaeological data

It is hoped that a successful completion of this project will introduce the most up-to-date research standards into archaeometallurgical examinations on ancient iron manufacturing in the territory of Poland. By means of offering a preliminary identification of metal provenance, it will also lay firm foundations for further research on old iron.