A potter or a glacier? The influence of the source material on the spatial differentiation of ceramics production in the Younger Pre-Roman Iron Age in the southern peribalticum zone

In prehistory and today, pottery is made of a raw material containing clay. Clay is not a common raw material; it is formed by the weathering of certain types of rocks or by accumulating fine fractions, for example, in lakes. Different clay deposits have different chemical compositions. Studying the chemical composition of ceramics and clay allows one to associate vessels with places where the clay is now mined or was mined in the past. The effectiveness of such research depends on two issues. First, the raw material in a given site must have an original chemical composition, distinguishable from another site. Secondly, the production must be standardized over a long period, using the same material and recipes. Researchers have been working to link vessels with geological sites where the raw material was mined for many years. However, due to the limitations mentioned above, they were only successful in the Mediterranean and Central America, where the ceramics industry developed in antiquity and the raw material mines operated.

The raw material containing clay - glacial till - is common in Poland, and unfortunately, its chemical composition is diverse. In addition, in antiquity, Poland was an area inhabited by tribal communities, where there were no specialized pottery workshops, and the former potters took material from the immediate area. Nevertheless, despite negative assumptions, the research carried out for years in the Poznań center showed that the ceramic material obtained from different sites shows some spatial differentiation. Still, the sites' internal differences are minor then the potential material sampling sites. This means that, most likely, there were some supra-regional pottery traditions in the past, which led to the similarity of pottery paste as a result of various technological treatments.

Intensive excavation research related to the construction of the road system in Poland has provided a large amount of ceramic material. At the same time, new methods of chemical analysis are being developed that combine the speed of measurement and do not require destroying the historical material. The third element is the development of advanced artificial intelligence algorithms that allow one to search for rules and patterns in massive data sets. These components allow for a completely new approach to research - using a large amount of material, measurements, fast, non-destructive methods, and then subjecting the results to advanced numerical processing.

The project aims to answer the question: Who (what) influences the properties of the ceramic material more - the glacier, shaping the properties of moraine clays, or the ancient potter using the recipes known to him. The research will cover over 20 sites from the pre-Roman period (4th-1st century BC), when the ceramics industry has not yet developed in the area of modern Poland. Still, trends of supra-regional pottery fashions can already be observed. First, the collected ceramic material will be analyzed and described by archaeologists. In the following, ceramics will be subject to chemical measurements to determine the chemical composition, mineral recognition, and surface properties in reflected and infrared light. The results of the ceramics measurements will be compared with analogous samples of the raw material collected by geologists in the vicinity of the studied sites. The data obtained in this way will then be analyzed with advanced machine learning methods and complex spatial analysis algorithms. The results of the research will allow a new look at the process of shaping pottery traditions in this period of prehistory, which is essential in human history.