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Geochemical and mineralogical composition of bog iron ore as a resource for prehistoric iron production – A case study of the Widawa catchment area in Eastern Silesia, Poland

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Spreading from the Near East in the declining Bronze Age from the 2nd millennium BCE onwards, the technique of iron smelting reached Eastern Silesia, Poland, in approximately the 2nd century BCE (pre-Roman Iron Age). At this time the region of the Widawa catchment area was inhabited by the Przeworsk culture. While the older moraine landscape of the study area lacks ores from geological rock formations, bog iron ores were relatively widespread and, due to their comparatively easy accessibility, were commonly exploited for early iron production. In this poster the mineralogical and elemental composition of local bog iron ore deposits and iron slag finds, as a by-product of the smelting process, are investigated.

The crystalline mineralogical composition of local bog iron ores is dominated by quartz (SiO_2) and goethite (α FeO(OH)), in contrast to slag samples in which fayalite (Fe_2SiO_4), wüstite (FeO) and quartz, with traces of goethite, represent the main minerals. Ores and slags are both characterized by notable hematite ($Fe2O_3$), magnetite (Fe_3O_4) and maghemite (γ-Fe_2O_3) contents. Analyzed bog iron ore samples show iron contents of up to 64.9 mass% Fe_2O_3 (45.4 mass% Fe), whereas the iron contents of bloomery slags vary between 48.7 and 72.0 mass% FeO (37.9 and 56.0 mass% Fe). A principal component analysis of the element contents, which were quantified by portable energy-dispersive X-ray fluorescence spectrometry (p-ED-XRF), indicates local variations in the elemental composition. Our results show that bog iron ores are relatively widely distributed with spatially varying iron contents along the Widawa floodplain but present-day formation conditions (e.g. different ground-water levels) are negatively affected by modern land-use practices, such as agriculture and melioration measures.