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Project Gallery

Mysterious red: cinnabar from the Chervony Mayak burial ground, Ukraine

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Analysis of the particulate and chemical composition of a red pigment discovered in grave 155 (burial 2) at Chervony Mayak in the Kherson Region of Ukraine identified the substance as cinnabar. This is the first definitive identification of this mineral in a Late Scythian context.

Keywords: Lower Dnipro, Kherson Region, Late Scythian, SEM-EDS, x-ray diffraction, red pigment

Introduction

The Chervony Mayak burial ground is part of an archaeological complex located on the right bank of the Dnipro River, in the Kherson Region (Figure 1). It is attributed to the Late Scythian culture, which developed in this territory between the second and mid-third centuries AD. The cemetery was discovered and excavated for the first time by O.V. Bodianski in 1975, and subsequent research was conducted by E.A. Symonovich (1976–1977), O.O. Gei (1986–1988) and a team sent by the Archaeology Institute of the National Academy of Sciences of Ukraine, led by O.V. Symonenko (2011–2021) (Symonenko *et al.* 2015; Gei & Symonovich 2019; Symonenko 2021; Gei 2023). So far, 177 graves have been excavated. One of them—grave 155—contains lumps of an intensely red pigment. Pigments of different red hues are sometimes discovered in graves attributed to the Late Scythian culture, but these substances are rarely subjected to archaeometric analyses (but see Nesterovskyi *et al.* 2018). Here, we present the results of particulate and chemical analysis of the substance from Chervony Mayak.

Grave 155

The funerary feature is a catacomb structure. The oval entrance pit (1.45m × 1.1m) led to the burial chamber, which is rectangular with rounded corners (2.1m × 0.75–1m; estimated

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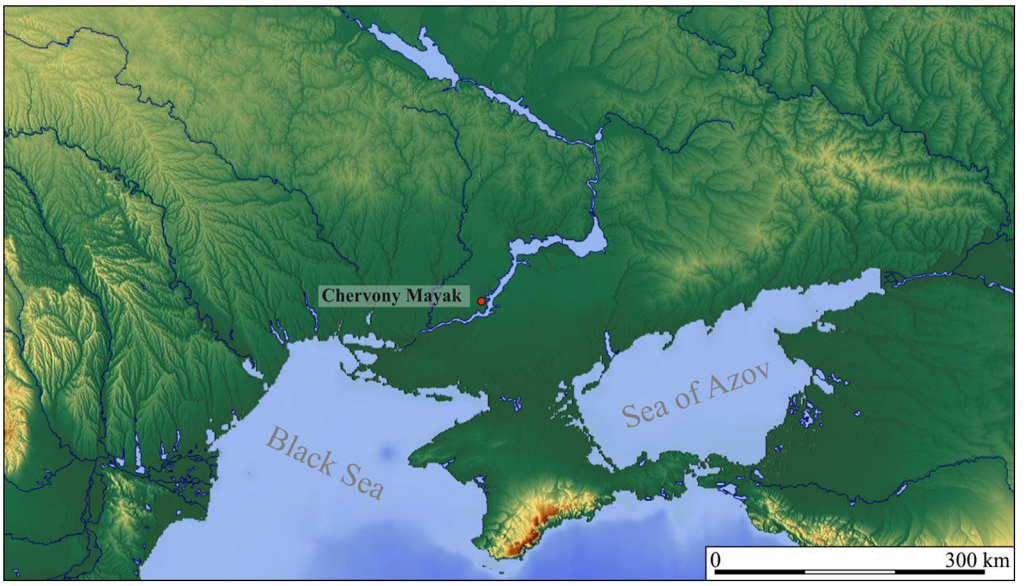

Figure 1. Location of the Chervony Mayak burial ground, Kherson Region, Ukraine (figure by authors, based on https://maps-for-free.com).

height 0.6–0.7m). Thus the plan of the entire structure resembled letter 'L'. The entrance to the burial chamber had been originally covered, which is indicated by the presence of a small stone that was probably moved in order to bury new bodies after a certain period of time (Figure 2). Two individuals were inhumed in the burial chamber, though not simultaneously. Burial 2 is the earlier inhumation, containing the skeleton of a 35- to 45-year-old female, which was slightly disturbed by the later addition. On the right humerus, there was a fragment of pottery containing an animal bone (Figure 2, no. II), while beads were discovered on the neck and under the skull (Figure 3, no. 13), items made of copper alloy were located between the ribs (Figure 3, no. 14). Near the skull and upper ribcage, three lumps of a red pigment were also found. Burial 1 contained the remains of an 18- to 20-year-old female. A piece of pottery was found near the right elbow (Figure 2, no. I) and earrings made of copper alloy were discovered on both sides of the skull (Figure 3, nos. 1 & 2). On the neck and near the ankles there were beads (Figure 3, nos. 3–12). Based on the inventory, the grave was dated from the first century to the first half of the second century AD and is attributed to the Late Scythian culture.

Methods

A sample of the pigment discovered in grave 155 was examined under a microscope to determine its structure. A Keyence VHX7000 digital microscope (property of the ArchaeoMicroLab at the Faculty of Archaeology, Adam Mickiewicz University in Poznań) was used. Phase identification of the pigment was based on SEM-EDS (scanning electron microscopy with energy dispersive x-ray) and on x-ray diffraction. Distribution maps of elements, imaging and EDS spectra were performed using an FE-SIGMA VP electron microscope (Zeiss Microscopy).

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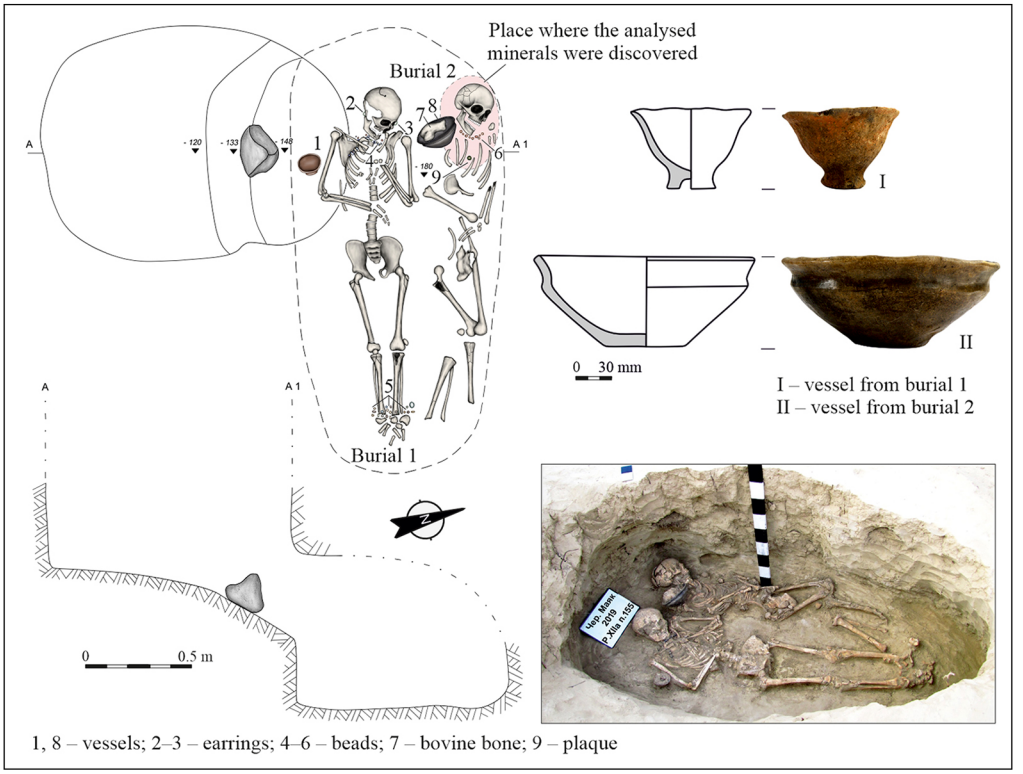

Figure 2. Layout of grave 155, with detail of the two vessels from burials 1 and 2 (figure by authors & M. Podsiadło).

The diffractogram was recorded using a PanAlytical X'Pert PRO MPD diffractometer (Co Kα lamp, 40kV voltage, 40mA current, from 5 to 78 2Θ, step every 0.026 2Θ). SEM-EDS and diffraction studies were performed at the University of Warsaw, Faculty of Geology.

Results

The pigment was found to be a thin layer covering sediment composed of quartz, microcline, albite and calcite—chemical compounds present in the grave fill (Figure 4). The red pigment itself is composed of small, sharp-edged particles up to 20µm in diameter (Figure 5A). SEM-EDS analysis indicates an elemental composition corresponding to mercury sulphide (Figure 5B) as the distribution of mercury and sulphur in the sample shows a clear correlation (Figure 5C & D). Zones enriched in these elements correspond to accumulations of the red pigment. As mercury sulphide forms several polymorphs (crystalline forms), diffraction studies were performed to clearly identify the phase of the pigment. They showed the presence of cinnabar in the analysed sample (Figure 6).

Discussion

The analyses clearly identified the pigmented substance found in a Late Scythian grave from the Chervony Mayak burial ground as cinnabar. This is the first time that the use of cinnabar

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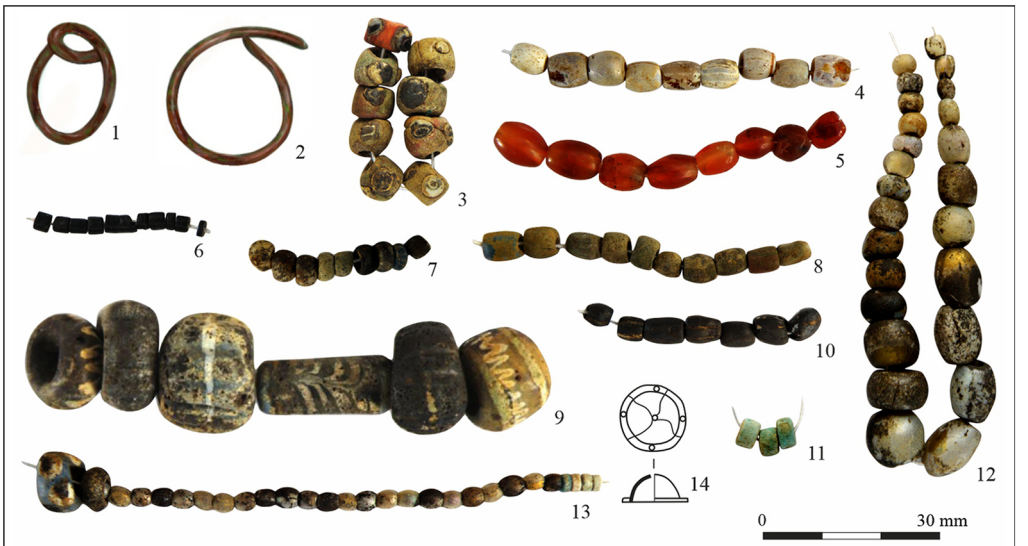

Burial 1: 1–2 – earrings made of copper alloy; 3, 8–10 – glass beads; 4, 12 – glass beads with gold foil; 5 – cornelian beads; 6 – jet beads; 7 – glass beads & glass beads with gold foil; 11 – faience beads. Burial 2: 13 – glass beads, glass beads with metal foil & faience beads; 14 – plaque made of copper alloy.

Figure 3. Ornaments from grave 155 (figure by authors & A. Żak-Snopek).

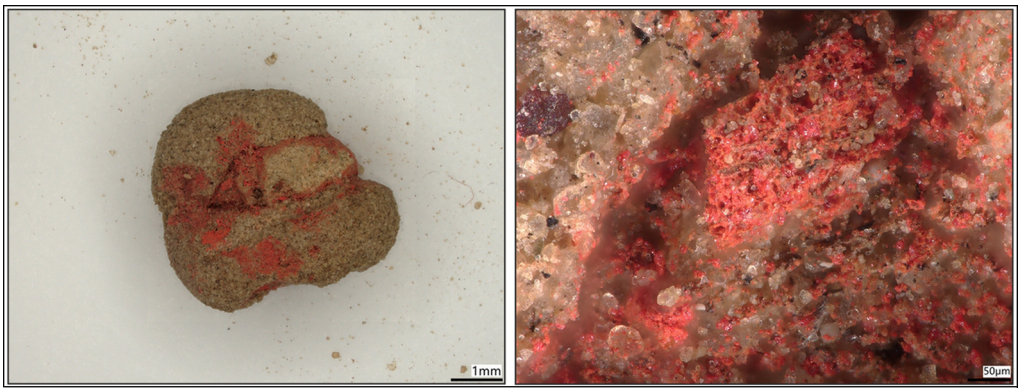

Figure 4. The analysed cinnabar sample (photographs by A. Kurzawska).

by this culture has been confirmed with archaeometric research. Although red pigments have been found in graves across the entire geographic range of the Late Scythian culture, only substances from the Zolota Balka burial ground—identified as ochre and realgar—have previously been subjected to archaeometric examinations (Nesterovskyi *et al.* 2018). Our research makes it possible to include cinnabar in this group of identified pigments, and the results confirm that the lack of such analyses undermines the validity of published data where substances are presumptively referred to as realgar, ochre or just simply 'rouge'.

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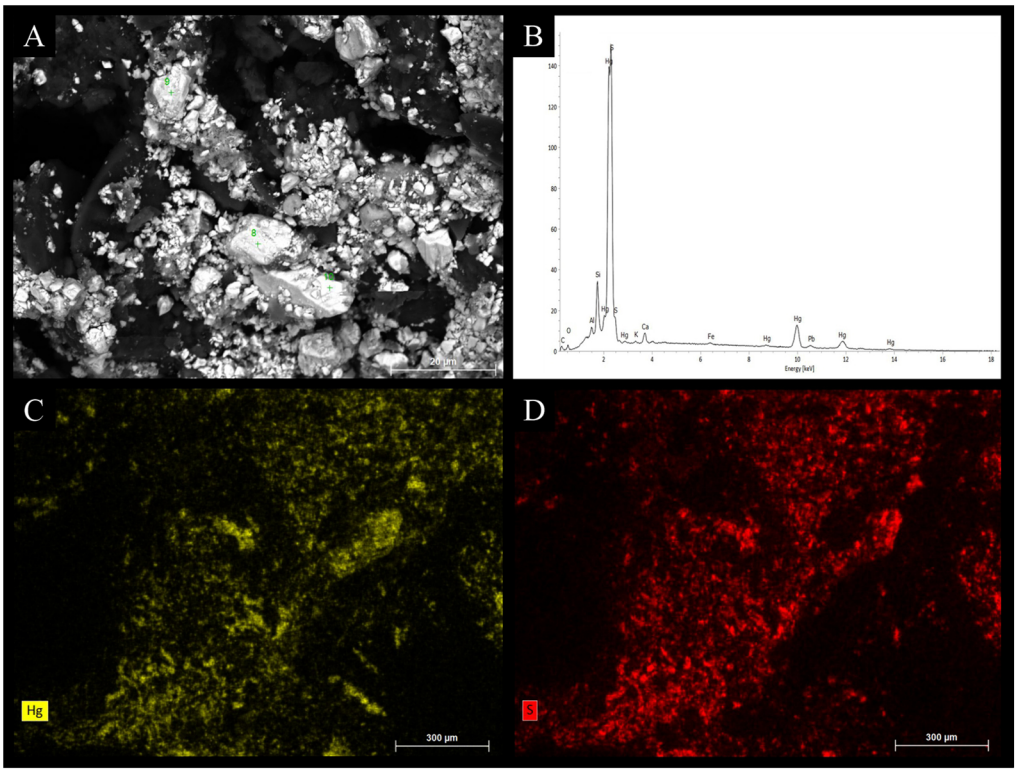

Figure 5. Scanning electron microscopy-backscattered electrons (SEM-BSE) image (A) and energy-dispersive x-ray spectrum (B) of red pigment grains. Bottom images map the distribution of mercury (C) and sulphur (D) in the red pigment (figure by authors).

Red substances are typically recovered from Late Scythian graves in the form of small lumps deposited near buried bodies, though their numbers vary from one to several specimens. They are usually found in catacomb graves, characteristic of the Late Scythian culture, near female skeletons (by the head, ribcage and feet) as well as near skeletons arranged in ways that indicate that they have been moved from other parts of a grave. Traces of red substances are also found in different containers (e.g. wooden box, shells) (Puzdrovskyi 2007; Nesterovskyi *et al.* 2018).

It is not currently possible to determine precisely the function(s) of cinnabar and the other red pigments found in Late Scythian graves, but their deposition in graves appears intentional. Different pigments may have had distinct functions, although more broadly they likely had a ritual, germicidal, as well as cosmetic and pharmaceutical role (Bârcă & Symonenko 2009; Gliozzo 2021). In funerary contexts it is probable that sulphide-based pigments played a purifying, germicidal role. Yet, it is possible that the small number of lumps recorded in graves indicates a function related to symbolic protection. The pigments found in containers might have been used as cosmetics or paint ingredients.

Though the provenance of the mineral pigment has not been determined, cinnabar deposits are located in southern and eastern Ukraine (Gliozzo 2021). Additional archaeometric analyses should determine whether these deposits are the source of the cinnabar from Chervony Mayak.

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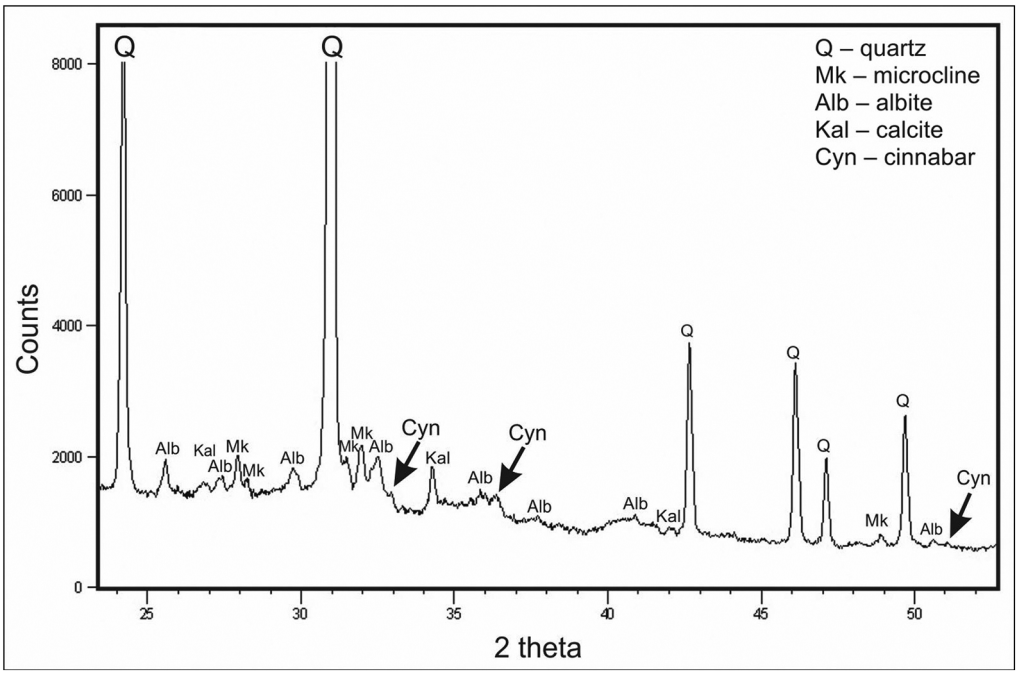

Figure 6. X-ray diffraction patterns of pigment sample from grave 155 (figure by authors).

Conclusion

The red pigment from grave 155 at Chervony Mayak is identified as cinnabar, as opposed to ochre or realgar. These results highlight the vital role of archaeometric analyses in examining and correcting the interpretation of mineral substances discovered at some archaeological sites. The application of such analyses is still rare, and further discussion of the function and provenance of pigments can proceed only with additional analyses and when the reference database is extended.

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