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Macro to Micro Stratigraphic and Artefactual Evidence From an Early Iron Age Smithy at the Pungrt Hillfort (Central Slovenia)

DATA PAPER

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ABSTRACT

The dataset presented in this paper includes data about macro- and micro-stratigraphy, as well as macro- and micro-artefacts from the Early Iron Age smithy (Building 24, phase IIb2) at the Pungrt Hillfort, Central Slovenia. The data were collected during the archaeological excavation and geoarchaeological sampling at the site, followed by laboratory processing and analysis of the gathered samples. All the data are stored at the Repository of the University of Ljubljana. Their potential lies, on the one hand, in further validation of results presented in the research paper [1] on Building 24 at Pungrt. More importantly, they act as a reference base helpful in recognising distinct lime floor coats and washes, interpreting various micro-stratigraphic earthen and lime-based floor sequences, and identifying micro-refuse materials, especially those related to blacksmithing.

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(1) OVERVIEW

CONTEXT

This paper presents data from the Early Iron Age smithy (Building 24) at the Pungrt Hillfort in central Slovenia (Figures 1–2). The hillfort is situated on the eponymous hill overlooking the small town of Ig on the southern outskirts of Ljubljana Marsh. The fortified settlement extends across an area of 10 hectares enclosed by an elliptical rampart that follows the hill's topography. Archaeological research conducted so far within the settlement has revealed a long-lived urban settlement which functioned during the Iron Ages and the Early Roman period.

The site itself is significant for several reasons. Firstly, with 8,800 m^2 of the settlement's interior excavated during the development-led excavation in 2020–2021, it is the most extensively excavated hillfort in the area of present-day Slovenia. Secondly, it is also the first hillfort with a documented urban layout dating to the Early Iron Age, thus providing important pioneering insights into the development of early urbanism in the south-eastern alpine region [2]. Thirdly, the excavation at the site was accompanied by an extensive geoarchaeological sampling programme enabling the ongoing integrated micro-archaeological analyses that, for the first time in the region, provide high-resolution insights into the lifeways at such a settlement [3]. In addition, publications on the Early Iron Age smithies are few and far between (e.g. [4, 5, 6, 7]). Therefore, open-source data from such contexts are highly significant for studying early iron metallurgy.

SPATIAL COVERAGE

The data presented in this paper was collected from the stratigraphic phase IIb2, dated to the Late Hallstatt period, in the area of Building 24 and the adjacent Road 1 (Figure 2).

Description: Slovenia, Ljubljana basin, Ig, Pungrt hill, Building 24

Northern boundary: +/– 462786,832 91035,054

Southern boundary: +/– 462790,338 91026,706

Eastern boundary: +/– 462792,19 91034,101

Western boundary: +/- 462784,94 91029,431

TEMPORAL COVERAGE

ca. 550–450 BC

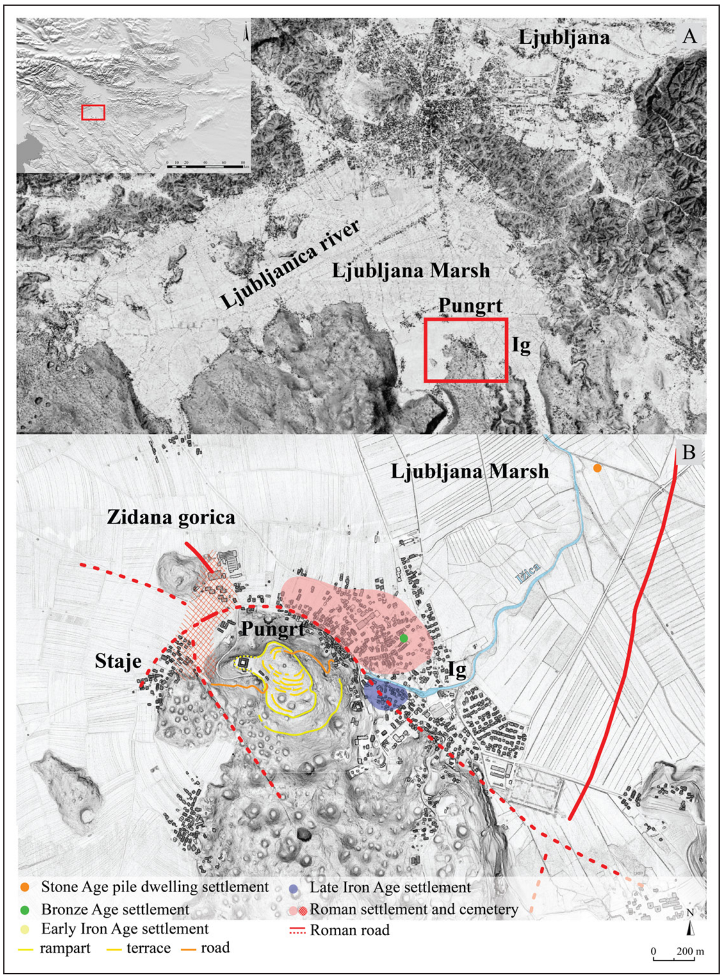

Figure 1 Pungrt Hillfort: A) location and B) broader archaeological context (open source base maps by the Environmental Agency of the Republic of Slovenia).

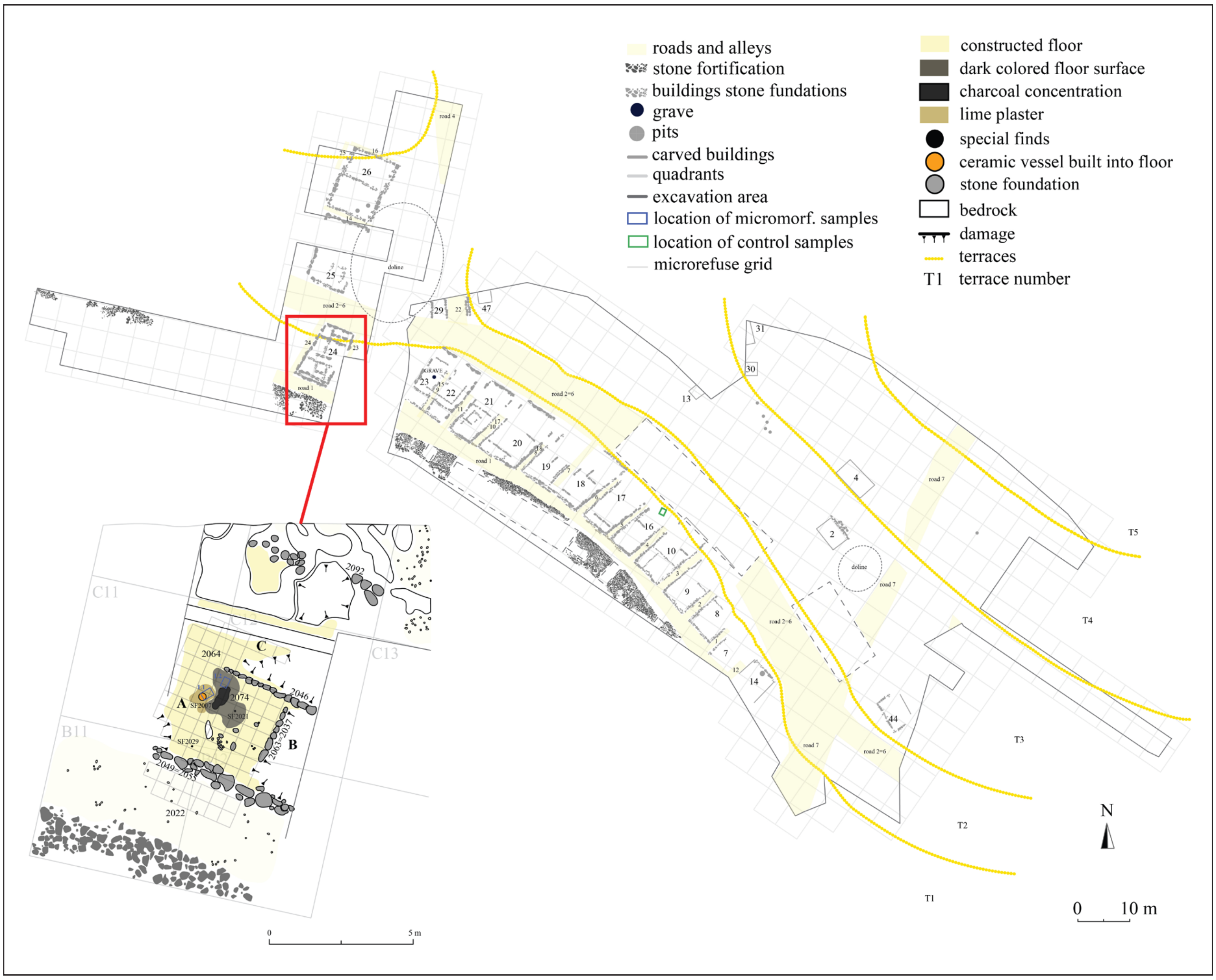

Figure 2 Pungrt Hillfort. Late Hallstatt period composite plan of the excavated area and a detailed plan of the Late Hallstatt period Building 24 in its IIb2 phase.

(2) METHODS

The dataset includes the results of archaeological excavation, macroscopic examination of collected finds (artefacts and zooarchaeological material), micromorphological analysis of control soil samples and floor sequences, and micro-refuse analysis in Building 24 (phase IIb2).

STEPS

The procedures used to create the dataset consist of two main steps: data acquisition during fieldwork and the subsequent laboratory data processing and analysis.

The fieldwork consisted of excavation and geoarchaeological sampling. The excavation area was divided into six zones or sectors and a grid of quadrants of 5 × 5 m (Figure 2) for purposes of record keeping and collecting the finds. The excavation of archaeological layers was done manually following the principles of archaeological stratigraphy [8] and other accepted professional standards [9]. Detailed documentation, geodetic measurements and digital photography accompanied the physical excavation.

After the floor level of Building 24 in phase IIb2 and the contemporaneous Road 1 were exposed in the floor plan and documented according to the above standards, we conducted the geoarchaeological sampling for micromorphological, micro-refuse, and physio-chemical analyses. Undisturbed block samples (n = 4) were collected for micromorphological analysis (thin sections n = 4), while systematic grid sampling of the entire surface was conducted to obtain bulk samples (n = 79) for micro-refuse and physio-chemical analyses (e.g. magnetic susceptibility, pH, organic matter content, multi-element concentrations; note that results are not included in this database) (Figure 2). Both sampling procedures are described in more detail in the Sampling Strategy section below. All geoarchaeological samples were geodetically measured.

In the post-excavation phase, the geodetic measurements were processed in AutoCAD. Georeferenced photomosaics were produced and interpreted with the help of geodetic support. The recovered archaeological finds were washed, counted and sorted by the material (pottery, earthen building material, glass, iron, slag, bronze, stone and bone) and by the archaeological period. Diagnostic pieces were further analysed to establish their detailed typology and chronology. All data was gathered into a digital database using Zoot software [10] and interpreted to produce a detailed stratigraphic and chronological interpretation of the site [2, 11].

Micromorphological thin sections were manufactured at the Terrascope (Troyes, France) and the Laboratory for Mineralogy and Petrology of Ghent University (Belgium). Thin sections were photographed with a Phase One IQ4 camera with a 120 mm macro lens and 150-megapixel resolution and observed and analysed under stereo and petrographic microscopes (Leica E74 W and Zeiss Axio scope A1 A Pol) using plane polarised, crossed polarised, and oblique incident light, at magnifications ranging from ×8 – ×200. Micromorphological descriptions followed the terminology after [12], with reference to additional texts [13, 14]. Distinct micro-layers distinguished within the macroscopically documented stratigraphic units (SU) were given a number suffix (e.g. SU 2064.3–2064.9) and described separately.

Bulk samples collected in the 0.5 × 0.5 m grid were dried in a laboratory oven at 35°C. Half of the volume of each sample was retained for further pedological, geochemical and geophysical analyses, which will be presented elsewhere. Next, the volume and weight of the other halves were measured and processed by bucket flotation and wet-sieving to extract the light and heavy fractions and collect them on a 0.5 mm sieve (e.g. [15, 16]). An archaeobotanist (TT) examined the light fraction, which will be presented in more detail elsewhere. The heavy fraction was dry sieved through a series of geological sieves to separate it into 1–2 mm, 2–4 mm. 4–6.3 mm, 6.3–8 mm and >8 mm size fractions (e.g. [17]). Each size was examined separately using a magnifying glass lamp and a stereomicroscope (Leica E74 W). Fragment counting, i.e. measuring the Number of Identifiable Specimens (NISP), was used as the most appropriate and flexible method for quantifying the identified material types (see [18, 19]). All fragments were examined and identified in sizes from 2 mm to >8 mm, while only magnetic fragments were extracted and examined also within the 1–2 mm size fraction (see Quality Control).

Two radiocarbon samples (a charred seed and a cereal food fragment) were selected from among the archaeobotanical material in the micro-refuse assemblage to establish its absolute chronology. They were dated at the Scottish Universities Environmental Research Centre (SUERC) Radiocarbon Dating Laboratory in Glasgow following the methodology described in [20].

The macro-artefact distribution was examined in terms of densities per square metre, and the micro-refuse heavy fraction data were examined in terms of their densities, concentrations, and spatial distribution. Densities were chosen for comparability to the macro-artefact data. The fragments from all size fractions of individual types were added and calculated into the NISP density per square meter. Concentrations represent the normalised NISP counts (see Quality Control) within each size fraction. The spatial distribution analysis used these normalised NISP counts. Instead of displaying the results at the resolution of the original collection grid, we used a kriging interpolation method in Surfer software to obtain high-resolution density plots, as suggested by [21].

SAMPLING STRATEGY

Four undisturbed block samples for micromorphological analysis of the floor sequence were taken with "plaster jacketing" at two locations within the building, chosen according to the stratigraphic change and floor layer boundaries observable in a plan view. In addition, four block samples for control samples were later extracted from the natural subsoil underlying the archaeological sequence on Terrace 1 (Figure 2).

The sampling for the micro-refuse and physio-chemical analyses within Building 24 was carried out only where the floors were well preserved. It also encompassed part of Road 1 adjacent to the building. The sampling was systematically carried out in a 0.5 m grid (Figure 2). Each quadrant's surface was troweled to obtain a bulk sediment sample (ca. 1 l) from the occupation surface. This way, 79 samples covering ca. 20 m^2 were collected from the floor inside the building and the adjoining road.

QUALITY CONTROL

Four monoliths extracted from the control soil profile (Ig 1808, 1811, 1813, 1815) allowed for the comparison with and interpretation of raw materials employed in the construction and maintenance of the analysed earthen floors in Building 24 (Phase IIb2).

To aid the identification and classification of micro-refuse types, we first created a reference collection of the main types of macro-artefacts from clay, lithic and metallic materials. Thereafter, based on examining the reference collection, we established the main categories for micro-refuse classification. At this stage, it became apparent that the distinction between fragments of kiln-fired ceramic objects, mainly pottery, and burnt earthen utensils or building materials could not be made based on visual inspection alone but also required examination of their physical characteristics (see descriptions in the database: 4.1 Macro-reference collection). Unfortunately, the 1–2 mm fragments were too small to examine these characteristics and separate them into types identified in larger size fractions; therefore, we excluded most of them from the analysis. In addition, we used a neodymium magnet to identify the metallurgy-related magnetic pieces. Only these were extracted from the 1–2 mm size fraction and classified.

After the initial classification, based on visual and physical characteristics, several materials were further examined by a specialist or analysed to refine the classification and increase their interpretative value. Bone fragments were examined by a zooarchaeologist (BT), lithic material by a geologist (RB), and metallurgical materials by a metallurgist (JB). In addition, metallurgical materials, lime and a lithic grain of graphite schist were analysed and defined using scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS) analysis (ZEISS CrossBeam 500 with Octane Elite EDAX; JEOL JSM 6490LV with Oxford INCA PentaFETx3 Si (Li)). Details on the SEM-EDS methodology used are provided in the dataset.

As the bulk sample volumes slightly varied, mostly between 0.4 and 0.5 l, we normalised the NISP counts by dividing them by the bulk sample volume to ensure comparability between samples (e.g. [22, 23, 19]).

CONSTRAINTS

Pending additional analyses of certain micro-refuse materials, their classification and interpretation may be further refined in the future.

(3) DATASET DESCRIPTION

OBJECT NAME

The dataset "From macro to micro archaeological approach in settlement archaeology: a case study of Early Iron Age smithy at the Pungrt hillfort (Central Slovenia): Research data underlying the paper" is available at the Repository of the University of Ljubljana. In this paper, we present the dataset structure in a summarized form. Details on the contents of the individual sections are provided in the Data Description file accompanying the dataset.

The structure of the dataset:

1. Macro-stratigraphy
    - 1.1. Photographs
        - 1.1.1. Orthomosaic
        - 1.1.2. Oblique photos
    - 1.2. Geodetic measurements
        - 1.2.1. DWG
        - 1.2.2. SHP
2. Micro-stratigraphy
    - 2.1. Sampling locations
        - 2.1.1. Building 24 IIb2
        - 2.1.2. Control profile
    - 2.2. Thin section high-resolution photos
        - 2.2.1. Thin section description
    - 2.3. Microphotographs
3. Macro-artefacts
4. Micro-artefacts
    - 4.1. Macro-reference collection
        - 4.1.1. Macro photo ceramics and slag
        - 4.1.2. Micro photo ceramics and slag
    - 4.2. Sampling grid
    - 4.3. Raw data
    - 4.4. Grouping
    - 4.5. Photographs
        - 4.5.1. Lithic
            - 4.5.1.1. Limestone and dolomite
            - 4.5.1.2. Sandstone and conglomerate
            - 4.5.1.3. Other
        - 4.5.2. Ceramic
            - 4.5.2.1. Coarse pottery
            - 4.5.2.2. Fine pottery
            - 4.5.2.3. Daub
            - 4.5.2.4. Burnt clay
            - 4.5.2.5. Vitrified and sintered clay
                - 4.5.2.5.1. Red to black (vitrified clay)
                - 4.5.2.5.2. Yellow to brown (vitrified clay)
                - 4.5.2.5.3. Sintered
        - 4.5.3. Lime
            - 4.5.3.1. Lime type 1
            - 4.5.3.2. Lime type 2
        - 4.5.4. Metal
            - 4.5.4.1. Magnetic
                - 4.5.4.1.1. Hammerscale
                - 4.5.4.1.2. Slag
            - 4.5.4.2. Weakly-magnetic
                - 4.5.4.2.1. Hammerscale
                - 4.5.4.2.2. Slag
            - 4.5.4.3. Non-magnetic
                - 4.5.4.3.1. Hammerscale
                - 4.5.4.3.2. Slag
        - 4.5.5. Faunal
            - 4.5.5.1. Unburnt bone
            - 4.5.5.2. Carbonised bone
            - 4.5.5.3. Calcined bone
        - 4.5.6. Natural
    - 4.6. SEM-EDS
        - 4.6.1. Hammerscale
        - 4.6.2. Slag
        - 4.6.3. Lime
        - 4.6.4. Graphite Schist
    - 4.7. Radiocarbon dating
    - 4.8. Spatial analysis
        - 4.8.1. Hammerscale
        - 4.8.2. Lime 1
        - 4.8.3. Lime 2

DATA TYPE

Primary data, secondary data, processed data, interpretation of data.

FORMAT NAMES AND VERSIONS

JPG, JPEG, BMP, TFW, TIF, XML, PNG, LAN, DWG, XLSX, DOCX, TXT, RTF, GSR2.

CREATION DATES

10/2020–10/2024

DATASET CREATORS

Luka Gruškovnjak, Agni Prijatelj, Petra Vojaković

LANGUAGE

English, Slovenian.

LICENSE

CC BY 4.0, Creative Commons Attribution 4.0 International.

REPOSITORY LOCATION

PID: 20.500.12556/RUL-164943
URL: https://repozitorij.uni-lj.si/IzpisGradiva.php?id=164943&lang=eng

PUBLICATION DATE

18/11/2024

(4) REUSE POTENTIAL

The dataset provides additional validation of the results presented in the paper and can be employed in further analyses. Its main reuse potential, however, lies in the reference materials provided for the micromorphological analysis of earth and lime-based floor sequences and micro-refuse analysis.

Due to the constraints of the scientific paper form, the number of micromorphological observations that can be visually represented is limited. Here, we provide high-resolution photographs of the entire thin sections (in PPL) (e.g. Figure 3: A), along with microphotographs of various features referenced in the original paper (e.g. Figure 3: B–C). Such sharing of micromorphological research data is rare, but we believe that a more widespread practice would significantly aid the micromorphological scientific community (see also [24]).

Similarly, descriptions and especially visual representations of individual types of materials identified during micro-refuse analysis are typically limited. Here, we describe the individual types of materials and a collection of their photographs taken under the stereomicroscope (e.g. Figure 3: D–G). These can be used as reference material to aid the identification process at other sites. We especially point out the potential utility of metallurgical materials and, among these, the miscellaneous hammerscale, which is rarely represented in published works (e.g. [25]).

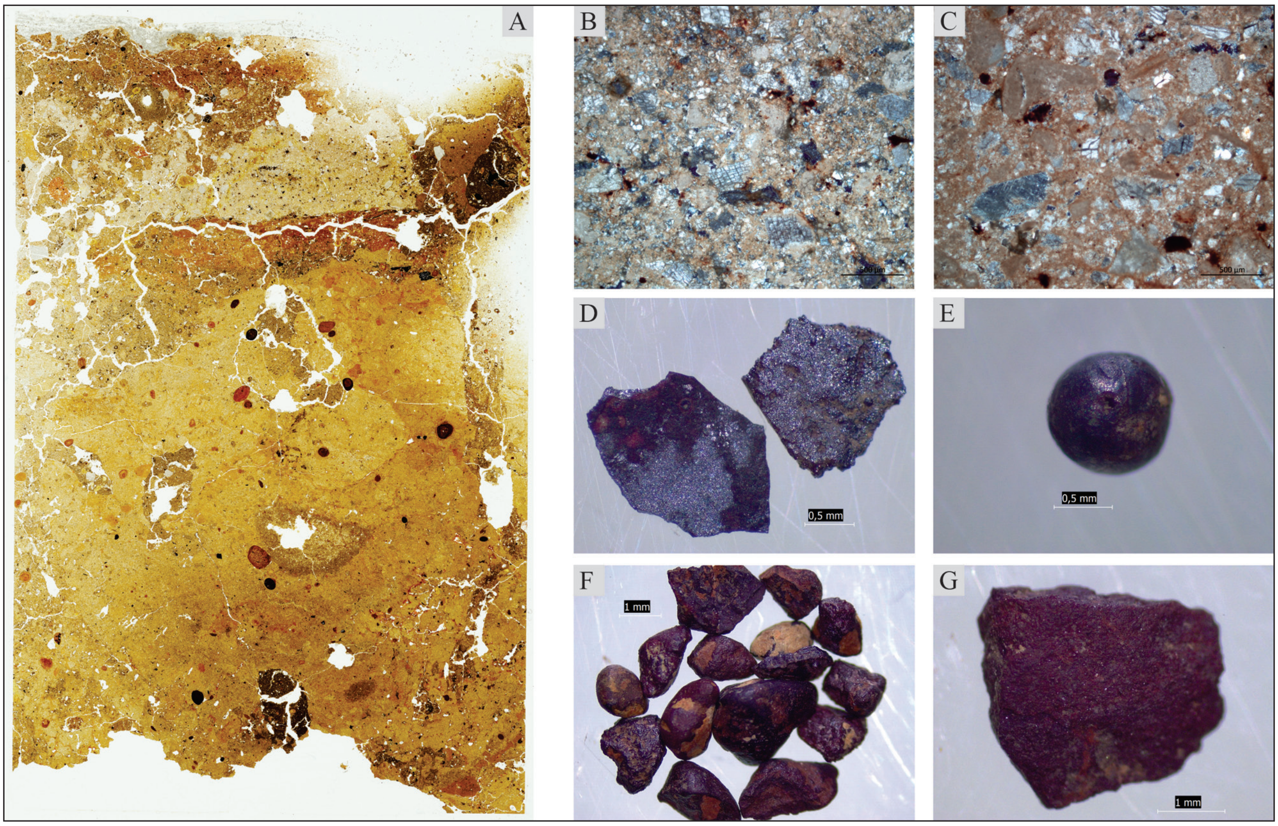

Figure 3 Pungrt Hillfort, Building 24, phase IIb2. Examples of micromorphological and micro-refuse reference materials in the database: **A)** High-resolution photograph of thin section Ig 3 (PPL). **B–C)** Microphotographs of clay-lime floor plaster (XPL). **D–G)** Photographs of different types of hammerscale (D: magnetic flake, E: magnetic spheroid, F: magnetic miscellaneous, and G: weakly magnetic miscellaneous).

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

- Luka Gruškovnjak: Conceptualization, Methodology, Formal analysis, Writing – Original Draft, Writing – Review & Editing, Visualization, Funding acquisition
- Agni Prijatelj: Conceptualization, Methodology, Formal analysis, Writing – Original Draft, Writing – Review & Editing, Visualization
- Petra Vojaković: Conceptualization, Methodology, Formal analysis, Writing – Original Draft, Writing – Review & Editing, Visualization
- Jaka Burja: Methodology, Formal analysis, Writing – Original Draft, Visualization
- Barbara Šetina Batič: Methodology, Formal analysis, Writing – Original Draft, Visualization
- Rok Brajkovič: Methodology, Formal analysis, Writing – Original Draft, Visualization
- Borut Toškan: Formal analysis, Writing – Original Draft
- Tjaša Tolar: Formal analysis
- Helena Grčman: Resources, Writing – Original Draft, Project administration
- Matija Črešnar: Conceptualization, Writing – Review & Editing, Resources, Project administration, Funding acquisition

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