The Reconstruction of the Organization of Space and Work through Iron-Working Micro-Residues Distributional Analysis: the Case of the Roman Smithy of Montebelluna (Treviso, Italy)

Leonardo Bernardi*

Abstract

The archaeological investigations on the site of Montebelluna, loc. Posmon (Treviso, Italy), carried out by an interdisciplinary équipe of the University of Padua (Dept. of Cultural Heritage), led to the discovery of a Roman forge used during the 1st and 2nd centuries AD. This paper deals with the typological and distributional study of iron-working micro-residues. This kind of debris, being indicators of production often left in primary deposition, led to identify which activities were carried out and how the smithy was used. The use of a grid, the total collection of the soil strata with micro-residues and a subsequent magnetic separation have allowed to draw up distribution maps; the comparison between these maps and the archaeological remains allowed to reconstruct two preferential blacksmith's working position and to assume the function of the permanent features. Typological study, supported by preliminary diffraction analysis (XRPD), led to compare the micro-residues found with those already present in the specialized literature.

The Site of Montebelluna, loc. Posmon: the Building and the Smithy

Excavations carried out between 2006 and 2010 by an interdisciplinary équipe of the Department of Cultural Heritage of the University of Padua led to the discovery of a Roman building used during the 1st and 2nd centuries AD and progressively abandoned during the 3rd century AD.[1]

The building is characterized by a rectangular shape of almost 210 mq and consists of 7 rooms (A, B, C, D, E, F and G) arranged around a central courtyard (I) and a small room in the North-East corner (H) (fig. 1).

The distinctive character of the building is the great number of technological permanent features; there are six fireplaces (three in room A, one in rooms C, E and F), a small oven in room B and two water tanks, one of rectangular shape inside room D and one large and ellipsoidal outside the building. Rooms E and probably F had to have domestic purposes; in the other rooms the permanent features had a productive destination, but it is not possible to clarify if they were or not connected to the main activity carried out in the building.

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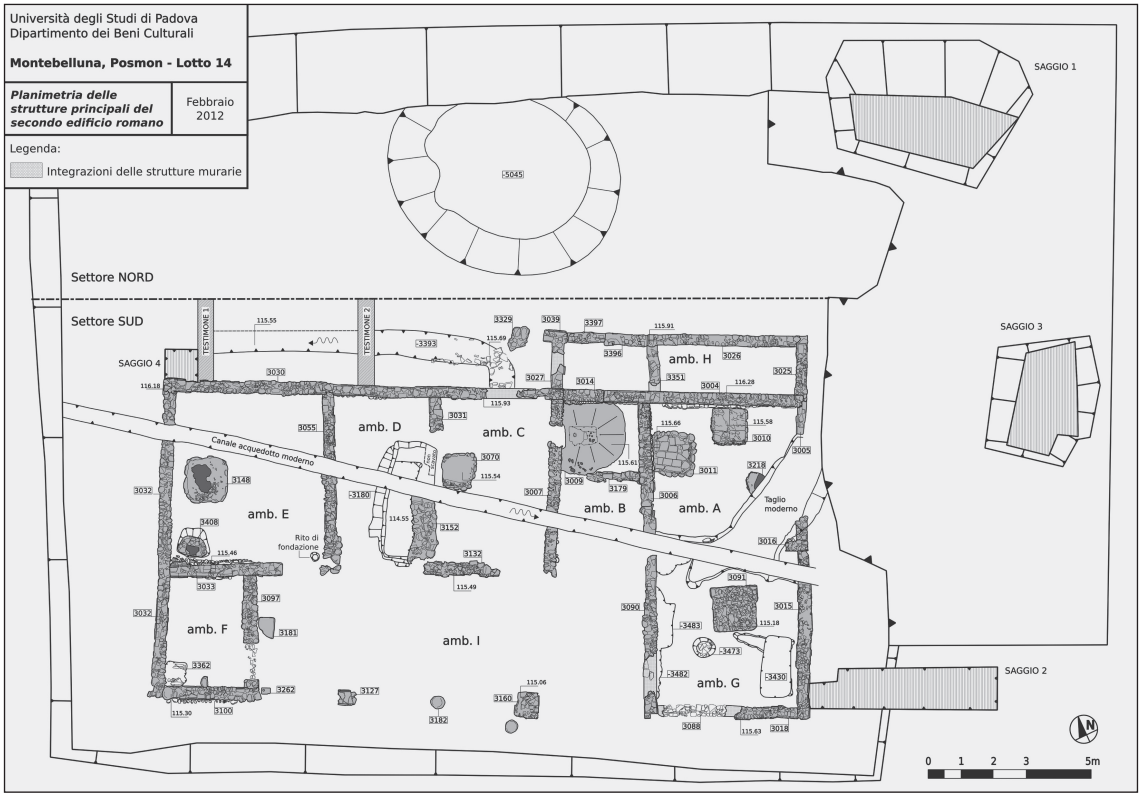

Fig. 1: Montebelluna, loc. Posmon: plan of the building.

The smithy (room G; 4.35 m × 4.75 m) (fig. 2) represented, in fact, the productive core of the building; located in the South-East corner, it was equipped with an independent access from the South.

Thanks to an accurate excavation and archaeometrical analyses on slags and wall forge remains found in an outer discharge, planned in collaboration with the Department of Geoscience (University of Padua),[2] numerous permanent features related to iron-working have been recognized in this room. In the North, a square basement (UG 3091; 1.45 × 1.40 m) was preliminary interpreted as a base for a raised forge, a type of structure represented in the iconographic sources but not so easily identifiable on the field; to the South-West, a concentric series of ellipsoidal cuts (UG −3473; diam. 70 cm) was presumably the location of a stump for the anvil. Against the western wall, two different negative traces (UG −3482 and UG −3483) have been attributed to wooden structures, that is a tool rack and a work bench. Finally, in the South-East corner there was a rectangular tank (UG −3430; 1,90 m × 0,90 m); between the tank and the square basement a triangular trace (UG −3509) has been interpreted as the print left by a bellows or by its support.

The floor consisted of a series of light and dark alternating layers: they correspond to layers made up of silt-clay matrix laid out voluntary to restore the floor and dark levels

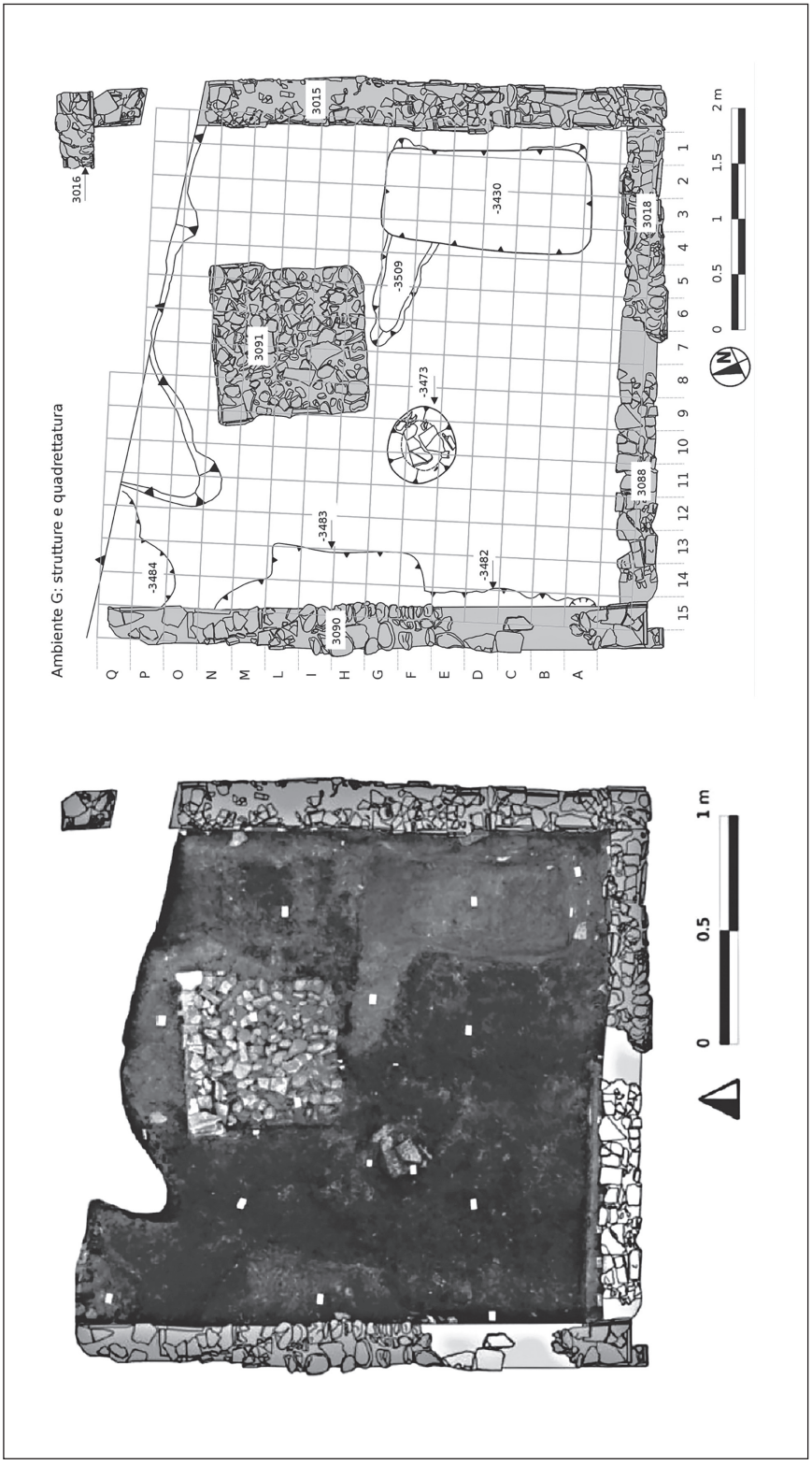

Fig. 2: Zenithal photo and plan of the smithy (room G) and the technological permanent features linked to iron-working.

composed of charcoal, ashes, slags and, above all, micro-residues produced during the metallurgical activities.

Iron-Working Micro-Residues: the Distributional Analysis

The Materials

Iron-working micro-residues include mostly hammerscale, that are the sparks emitted by hot iron when struck with a hammer at the anvil. They are divided, according to their macroscopic appearance, in flake hammerscale and spheroidal hammerscale: if the former is generated by the detachment of the oxidation layer present on the object being processed, the spheroidal ones are formed preferably during welding operations.[3]

Micro-residues include also other materials characterized by a prevalent scoriaceous aspect and composition, whose formation is due to internal dynamics of the forge.[4]

The deposition of these material creates black strata within the smithy that, if not removed, are most of times left in primary deposition context; thus, these materials can be used to understand the spatial organization of the smithy.

Methodology

The presence within the smithy of dark layers rich of micro-residues made it necessary to adopt an excavation strategy that aims at reconstructing, afterwards, distribution maps of their concentration.

The state of the art shows some examples of distributional analysis of micro-residues and they all applied the same methodology: excavation following a grid and measurement of the magnetic concentration.[5]

In the smithy of Montebelluna the layers rich of micro-residues were excavated following a 30 × 30 cm grid, the ground removed and collected entirely. In lab, the magnetic component was subsequently divided from the matrix, proceeding through three steps: the weighing of the soil not yet separated, the isolation of the magnetic component and the weighing of the magnetic fraction.

This operation allowed to obtain two maps of the magnetic fraction concentration: the first map shows the percentage values of the micro-residues with respect to the totality of the soil, whereas the second shows the weight value of the magnetic fraction. Not all the squares were treated, but only those according to eight preferential axes that found their center in correspondence of the negative evidence (UG –3473).

QGIS software and a geometric progression method, defined as "Geometric intervals",[6] were used to process data and to create distribution maps, where the different tones of color represent the variation in value.

Data

The excavation proved the presence of three dark strata with micro-residues, but only UG 3239, that represents the last work surface, was entirely preserved. The other two layers (UG 3449–3487 and UG 3448–3493) were partially removed and covered with a silt-clay stratum in order to restore the floor. Thus, UG 3239 give the most complete data useful to understand how processes were carried out within the smithy.

The mapping of the percentage and weight values both shows the greatest concentration of magnetic residues to the South/South-East of the concentric series of ellipsoidal cuts and their progressive decrease moving away from it (fig. 3).

Discussion and Interpretation

At first, these data confirm that iron-smithing operations took place in this room and, secondly, that the anvil was located where previously thought, that is in correspondence of the concentric series of ellipsoidal cuts (UG –3473) South-West of the raised forge.

Moreover, according to the data found during excavation and the strong comparison with the iconographic sources, the previous preliminary interpretation of the technical installations within the smithy (cfr. *supra*) has been confirmed.

But most importantly, this study allowed to place the blacksmith at work. Imagining that the micro-residues are deposited mostly beyond and on the sides of the anvil and a smaller quantity at the artisan's feet, we can place the craftsman North of the anvil, in a comfortable position to reach the forge on his left and the workbench on the right. The bellows, probably placed South of the raised forge at a sub-triangular imprint, was presumably worked by an apprentice (fig. 4) or by the same blacksmith when, by himself, he worked South of the forge with the anvil to his left, being able to work in perfect autonomy.

Iron-Working Micro-Residues: the Preliminary Archaeometrical Study

The distributional analysis of the micro-residues has been followed by a preliminary archaeometrical study.

The observation of a sample in OM (Optical Microscopy) and preliminary XRPD-analyses permit to recognize 12 typologies of micro-residues. Flake and spheroidal hammerscale are mostly present, but there are also other residues with prevalent scoriaceous aspect and composition: some of them can be compared to the slags of bigger size found within the smithy and in the outer discharge (forge walls remains and siliceous slags), whereas other typologies has never been recognized but their genesis has not been understood yet.

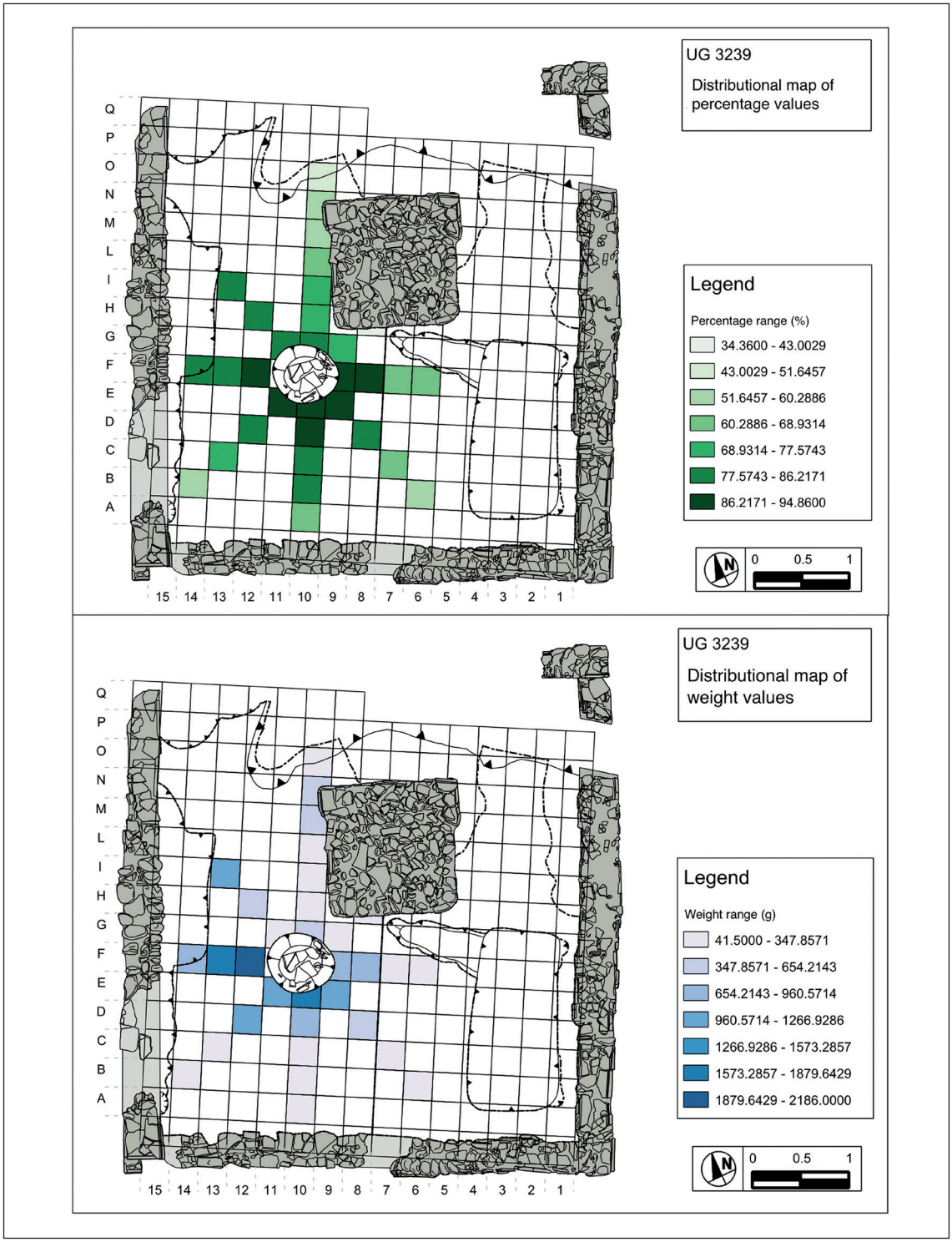

Fig. 3: Distributional maps of the micro-residues of UG 3239. On top the maps of percentage values; above the weight values.

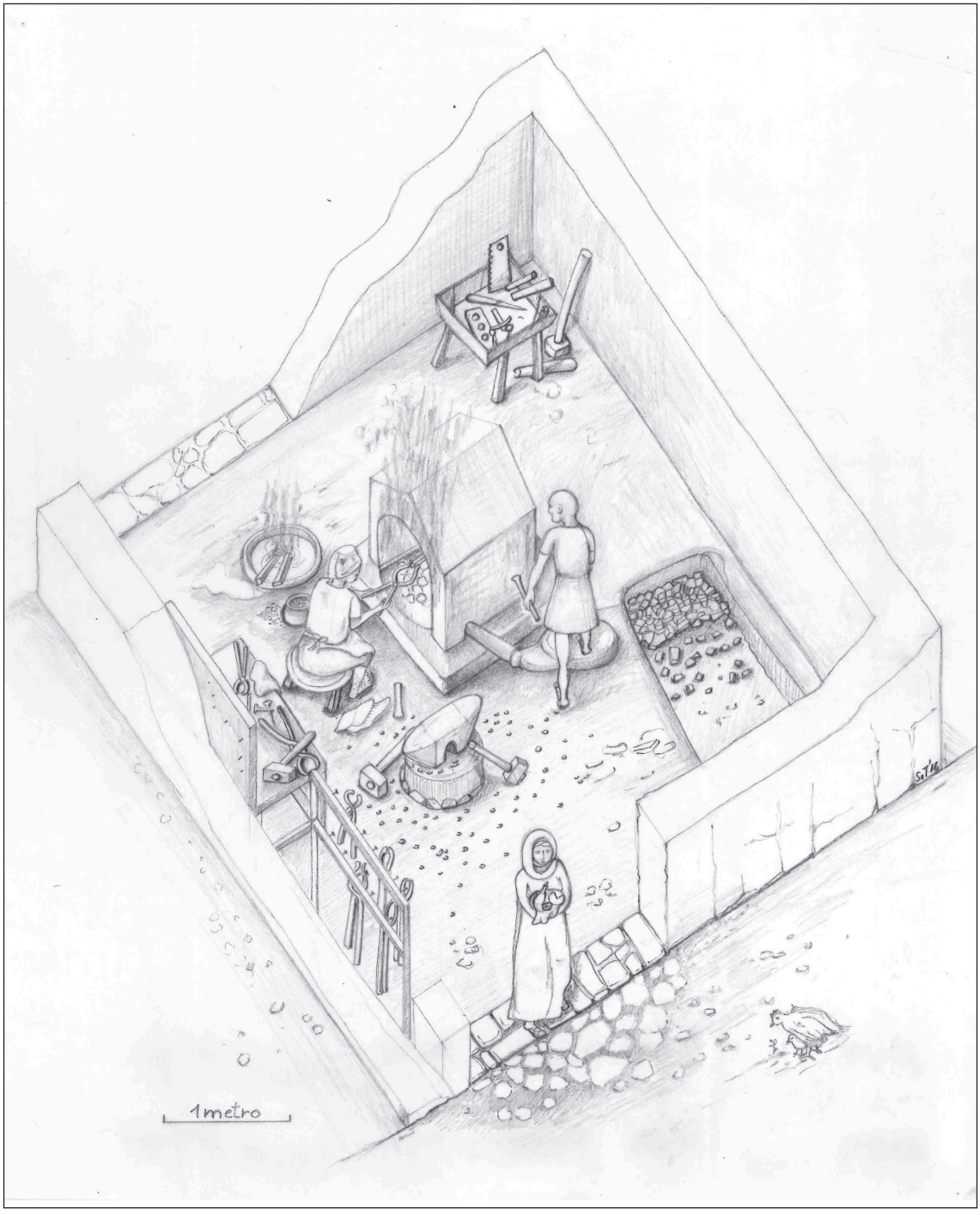

Fig. 4: Reconstruction proposal of the smithy with the permanent features and artisans at work (drawn by Silvia Tinazzo).

Conclusion

This work proves how an accurate excavation strategy, planned from the beginning of the excavation, a careful study of stratigraphic evidences and of the distributional features of materials connected to production processes and, finally, a comparison with the coeval iconographic sources, could be the right key to understand deeply and successfully the spatial organization of whatever atelier.

Notes

* Dept. of Cultural Heritage, University of Padua.

[1] Busana et al. 2012, 233–273.

[2] The archaeometallurgical analysis have been carried out in collaboration with dr. I. Angelini.

[3] Dungworth – Wilkes 2009, 33–46; Starley 1995; Unglik 1991, 92–98.

[4] Young 2011, 26–41.

[5] Paynter 2007, 15–31; Veldhuijzen – Rehren 2007, 189–201; Roames 2011, 149–155.

[6] Conolly – Lake 2006, 141–144.

Image Credits

Fig. 1: Busana et al. 2012, 238–239. – Fig. 2, 3 and 4: Bernardi 2016, 125. 137; Bernardi 2016, 138; Bernardi 2016, 145–146.

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