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Organising smelting places. A keynote on Iron Age copper smelting in the Oberhalbstein (Canton of Grisons, Switzerland)

ABSTRACT: *Since 2013, systematic archaeological investigations in the Swiss valley of Oberhalbstein, Grisons, have been conducted in order to contextualise long-known traces of primary metallurgical activities. The present paper highlights some of the first archaeological features excavated, focussing in particular on copper smelting technology. The discussed features present strong evidence for an extensive copper metallurgy, and it is the aim of this paper to comprehensively introduce the local metallurgical operational sequence (chaîne opératoire). The features allow reconstructing separate processes as part of the metal age smelting technology. Even a small number of finds facilitates a preliminary integration of the material into the wider tradition of Alpine copper processing.*

KEYWORDS: GRISONS, OBERHALBSTEIN, PRIMARY COPPER PRODUCTION, COPPER SMELTING, ROASTING BED, FURNACE, IRON AGE

Introduction

The present paper discusses the most relevant archaeological features documented as part of the 2013 to 2016 excavations in the Oberhalbstein valley, Switzerland, conducted by the University of Zurich in collaboration with the Archaeological Service of Grisons/Graubünden (ADG) as part of a SNF-DACH project (SNF Projekt Nr. 100011E-153668). The aim of this paper is to present features which can be seen as archaeological evidence of the different stages of ore processing, roasting and smelting. The focus lies primarily on the site Gruba I due to the high quality of data recovered from the site. Additionally, the sites of Alp Natons and Val Faller, Plaz, with their relevant central features, including a roasting bed as well as smelting furnaces, will be discussed.

It is our goal to show evidence for the local processing of copper, and to add to the existing, diverse body of literature concerning Alpine copper technology (e.g. Eibner, 1982; Hanning et al., 2015; Reitmaier-Naef, 2018; Reitmaier-Naef, 2019).

Especially for Gruba I and Val Faller, Plaz, distinct patterns of organisation are discernible, relating to different stages of work. Detailed discussions regarding slags in the context of copper smelting can be found in Reitmaier-Naef`s (2019) contribution to this volume, while Oberhänsli et al. (2019) discuss the dendrochronological data[1].

Methodology and site selection

The selection of sites (Fig. 1) is a result of a systematic survey of the terrain. The applied field strategies (Della Casa et al., 2016) are based on those used in classical archaeological surveys, and focus on evidence such as slags and ores visible above ground as indicators for ore mineralizations and smelting sites.

Geophysics is used to pinpoint the exact location of slag heaps and to supplement the preparatory work process ahead of the excavations. Of great importance is also the relocalisation of known sites based on literature research, a catalogue of which had already been published (Schaer, 2003). Last but not least, cooperation with local associations, farmers and residents constitutes a cornerstone of our research and provides many leads regarding promising sites in the area based on oral history.

Alp Natons

The site Alp Natons has been known previously based on finds of slags. The excavation described here is situated exactly between the two sites Alp Natons I and II (JbAS 102, 2019, p.175), as described by Schaer (2003, No.51-52), at 1947 m above sea level. The site had been

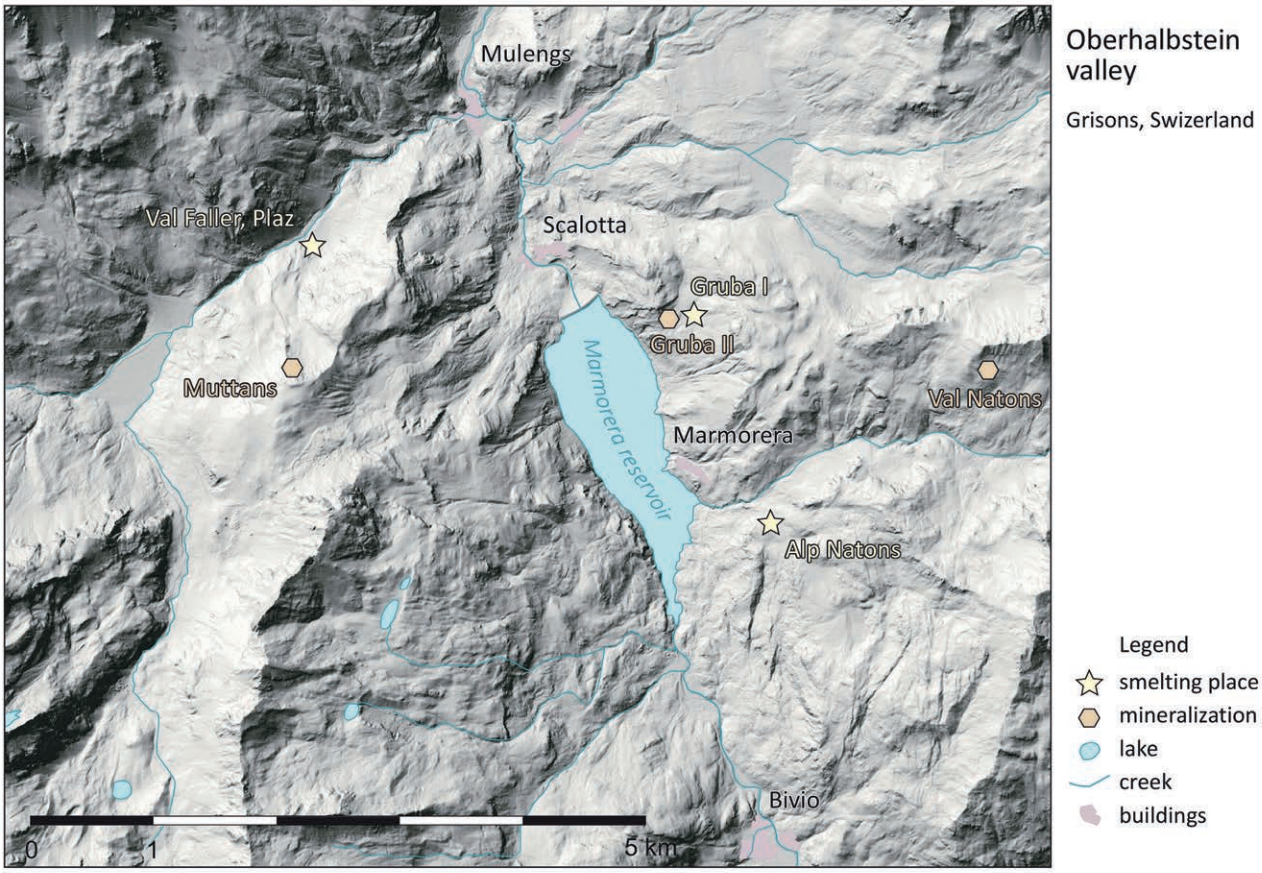

Fig. 1: Map of the Oberhalbstein, "upper valley", showing mineralization and smelting places mentioned in the text (graphic: Anja Buhlke, Rouven Turck/UZH).

identified during a systematic survey when remnants of a structure were discovered immediately underneath a public footpath.

Gruba I

The site Gruba I has been documented by Schaer (2003, No.37, there labelled "Ried südlich Gruba I"), and is one of the well-known sites mentioned many times before in abridged reports (e.g. Fasnacht, 2004). The site was selected for excavation because of possible remnants of a smelting furnace and a slag heap identified and visible above ground. It lies at 1850 m above sea level and has been described recently in JbAS 99 (2016, p.187).

Val Faller, Plaz

This smelting site had been previously exposed by road construction work resulting in the discovery of slags (Schaer, 2003, No.26). Due to this incident, an excavation and documentation of the site was in the interest of the ADG. A concrete localisation of suspected features was realised by geomagnetic survey beforehand (Della Casa et al., 2016 fig. 9). The site, lying at 1770 m above sea level, has been published in an abridged report (JbAS 100, 2017, p.219).

Research Summary

The Oberhalbstein valley runs from the metal age settlement of Motta Vallac in the north (Bradler, 2018), at an elevation of 1300 m above sea level, up to an elevation of 2500 m above sea level at Avagna (Reitmaier-Naef et al., 2015, pp.46-47).

Alleged prehistoric finds from smelting contexts are known for the Oberhalbstein since the 1950s and were discovered during building work around the Marmorera reservoir. They were first thought to be evidence of iron technology (Zindel, 1977). Only a mineralogical analysis of slags (Geiger, 1984; Geiger, 1988) finally pointed towards local copper smelting.

A few isolated radiocarbon dates vaguely suggested a prehistoric context for the smelting sites (Geiger, 1984). This interpretation was relevant in two ways: In the valley itself, the casting of metal artefacts is known from settlement contexts dating to the Bronze Age (Rageth, 1986; Fasnacht, 1991). Secondly, medieval smelting and smithing activity is also evidenced (Eschenlohr, 2012), which is why the systematic dating of sites is of great importance.

Schaer (2003) was the first to summarize all of the potentially prehistoric smelting sites, numbering to about 40. Due to the absence of systematic field work, the Oberhalbstein was soon listed as one of the Metal Age copper mining districts (Bartelheim, 2013, Fig. 2; Trebsche & Pucher, 2014, Abb. 1), but its scientific potential was usually estimated low because of the lack of research data (O`Brien, 2015, p.105).

The area under observation stretches from around Stierva, Tiragn (Naef, 2013) to the surroundings of Bivio near the peaks of the Julier Pass (JbAS 99, 2016, p.184). Additionally, slag heaps are known from the neighbouring valleys of Avers (Turck et al., 2017), Bergell (Wenk et al., 2019) and the Oberengadin (Schweizer, 1982).

Fewer slag heaps are known for the northern, lower valley stage with its Bronze Age settlements (Rageth, 1986; Bradler, 2018) as first defined by Schaer (2003), ranging from an elevation of 1300 m to 1700 m above sea level, than for the higher, southern valley stage ranging to an elevation between 1700 m and 2100 m above sea level.

The cultural and historical significance of the Oberhalbstein settlement area during the metal ages, including the important Septimer Pass leading to the Bergell valley, has been presented before, most recently by Turck et al. (2014, pp.250-252). Finds and features dating to the Iron Age deserve special attention in this context (Turck, 2015, pp.134-135).

Features evidencing the chaîne opératoire of copper smelting

In the following, excavated archaeological features that allow for a near complete reconstruction of the operational sequence of primary metallurgical activities in the Oberhalbstein valley will be discussed.

Mining

Prehistoric copper mining activity had not been proven until 2013. Initial leads (e.g. Brun, 1988, pp.63-65) were followed up during fieldwork, however, they shall not be discussed in depth here. Essentially, the previously documented sites of Vals (JbAS 98, 2015, pp.197-198), Cotschens, and Avagna (Reitmaier-Naef et al., in press) denote ore mineralizations that were exploited in prehistoric times. Non-destructive methods in geophysics gave promising preliminary results for metal age mining in Gruba II with the use of "Pingen", i.e. mining pits and galleries (Ullrich et al., 2019, pp.55).

For the three sites that shall be the focus of this paragraph, the following mineralizations already described by Dietrich (1972) are relevant (Fig. 1):

Fig. 2: Val Faller, Plaz, grinding stone and plate (photo: Anja Buhlke/UZH).

Following multiple notes (Dietrich 1972, p.39; Brun, 1988, p.62; Bernoulli et al., 2003, pp.102-103, Fig. 11) it was possible to establish a promising spatial relationship between smelting site Alp Natons and copper mineralization named Val Natons (Reitmaier-Naef, 2018, p.32).

In the case of Gruba I, it was possible to draw a possible connection to the site Gruba II (Reitmaier-Naef et al., 2015, p.45; JbAS 100, 2017, pp.218-219) at 200 m distance – a series of mining-related sinkholes. Whether the mineralization exhausted in modern times (Dietrich, 1972, 26-28; Brun, 1988, pp.56-61) was already exploited in prehistoric times, is impossible to say due to modern disturbances.

It would be logical for the site Val Faller, Plaz to be connected to a mineralization at Muttans (Dietrich, 1972, pp.34-38) – but this connection can so far not be proven. Comprehensive publications addressing the topic of prehistoric mining are currently in preparation.

Ore dressing and processing

So far, evidence related to the dressing of ore is scant in the Oberhalbstein valley. A few select stone objects (so-called „Gezähe") originating from an exploited pit at Cotschens hint at the crushing of ore in the immediate vicinity of the mine (Reitmaier-Naef et al., in press). To date, Val Faller, Plaz is the only smelting site where a grinding stone and a hammerstone could be recovered (Fig. 2).

Sluice boxes for ore washing as known from Troiboden, Mitterberg and Mauken in Austria (see Timberlake, 2019; Stöllner et al., 2012, Stöllner, 2019; Goldenberg et al., 2011a, pp.69-72), could not yet be archaeologically evidenced in the Oberhalbstein. Schaer's (2003, p.15) claims about a site named „Marmorera, gegenüber Natonsbach", which was poorly documented in the 1950s, could not be verified.

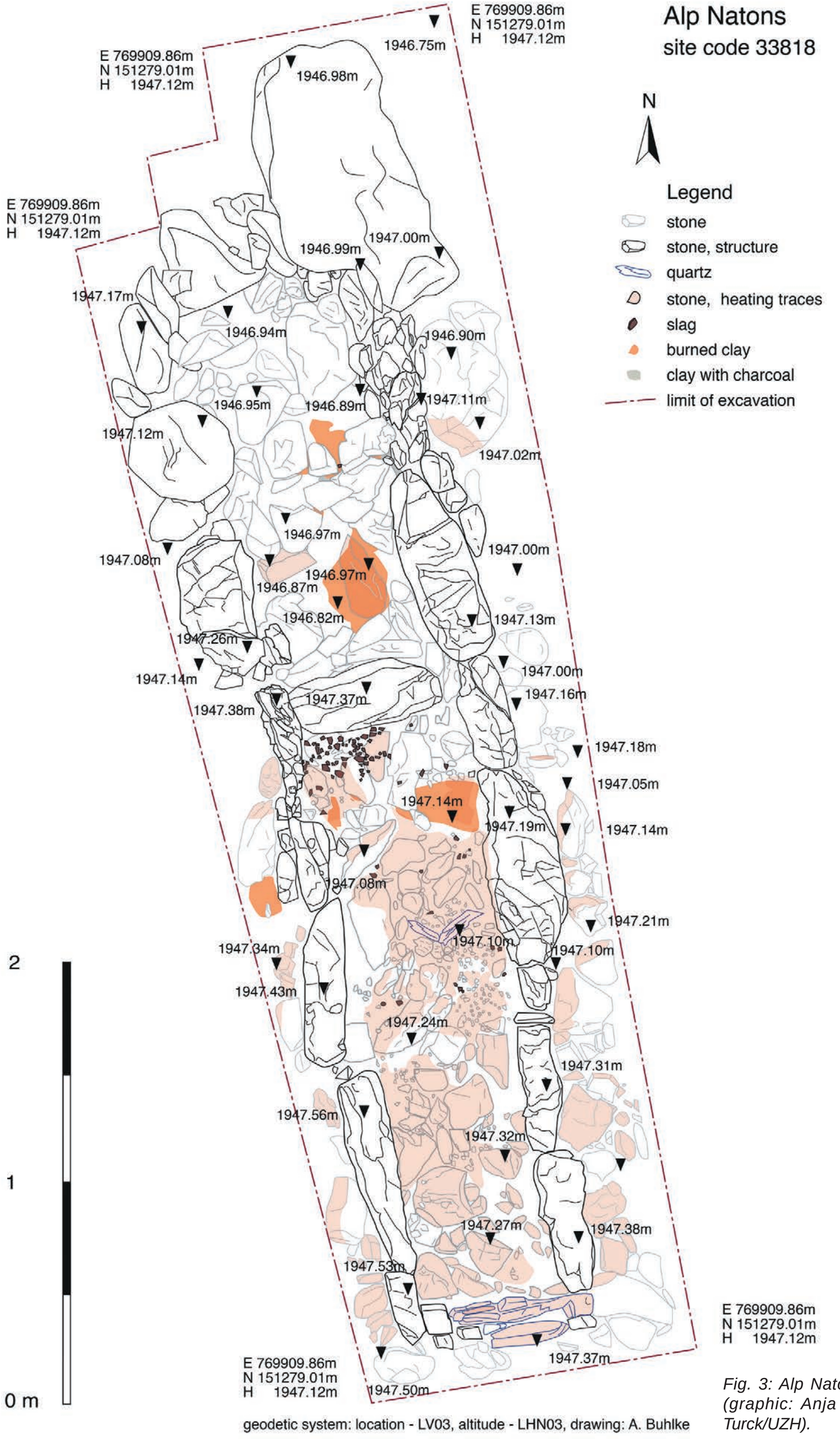

Fig. 3: Alp Natons, roasting bed (graphic: Anja Buhlke, Rouven Turck/UZH).

Roasting

At Alp Natons, as a result of the systematic survey in 2014, a roasting bed (Fig. 3) was first discovered, and then fully excavated in 2018. The feature is situated immediately below the ground surface. It measures 5.20 m in length while its internal dimensions are 70-80 cm. Its orientation runs almost along a North-South axis.

The large stones bordering the roasting bed demand special attention – they are up to 70 cm long and 30 cm thick, and many of them show reddish traces of heat.

A secondary addition to the stone bed is a large slab, which separates the feature into a northern and a southern part – 2 m and 3 m in size respectively. At first sight, the slab is reminiscent of a furnace's rear wall, like the one documented at Gruba I (JbAS 97, 2014, p.220).

On the inside, the structure contained many collapsed stones showing traces of heat in a secondary context. A multiple use of the structure is therefore evident. Slags, turned red by exposure to heat, lie in a dense cluster to the south of the stone slab. Parts of the lateral walls were smeared with clay, some of which is preserved *in situ* and also shows a reddish colour. Additionally, a clay lining could be identified. In terms of finds, charcoal, slags and burnt clay were recovered and samples taken for further testing.

Possible vestiges of another roasting bed, which had already been perturbed in prehistory, have been found at Gruba I, sector 55 (Fig. 4). A two-layered stone structure (upper Pos. 624 and lower Pos. 639) of a length of 2 m could be identified in the southeastern part of a 14 m^2 sondage. The lower layer shows intense traces of heat, while for the upper layer those traces are rather weak. Nevertheless does the upper layer show signs of tool use, making it likely that the stones were worked intentionally. More stones showing similar traces could be identified throughout the whole excavation area (e.g. Pos. 674).

A stone negative is located at a right angle towards the bounding stone (Pos. 649/650), indicating that a stone belonging to the construction was possibly removed.

The eastern and northeastern part of the stone structure is characterised by a large, charcoal-rich pit (Pos. 607), which damaged the original construction. In the northern part of the pit, right at the bottom, another stone negative (Pos. 647/648) could be identified. It is therefore possible that the pit impaired the roasting bed. If we interpret the second stone negative as evidence of the far end of the roasting bed, the structure would have measured at least 4 m in length – dimensions that roughly fit those found at Alp Natons. The two layers of the stone structure (Pos. 624 and 639) evidence the two-phase character of the construction.

For Val Faller, Plaz, the features are not as easily interpreted (Fig. 12): East and southeast of the smelting furnaces two ambiguous, rectangular stone structures (No. 1 and 2) could be identified. By dimension, these rectangular features find their counterpart in the structures discovered at Mauken and Jochberg in Austria (Goldenberg, 2004; Goldenberg et al., 2011a), but the absence of verifiable traces of heat on either stones or clay makes an unambiguous interpretation of the features impossible.

Smelting

The first smelting place presented here is Gruba I. Furnace 1 and its nearby slagheap were published in a preliminary report (Turck et al., 2014, pp.250-254; see also JbAS 97, 2014, p.220; JbAS 98, 2015, pp.196-197; JbAS 99, 2016, p.187). The features discussed below were excavated between 2013 and 2015 (Figs. 5-8).

The first prehistoric smelting furnace (Figs. 5-6) to be discovered in the Oberhalbstein was made up of two to three extant layers of stone, built up against a stone slab at right angles (Pos. 530). The front of the furnace had been destroyed immediately after its latest use. The front was surrounded by a stone structure with heat marks (Pos. 562). The furnace was dug into a pit (Pos. 539/547) measuring 50-60 cm in depth. A number of slag fragments, flakes of charcoal and some burnt stones were found inside and outside the furnace. The furnace bottom was covered with small stones (Pos. 601). A grey compound (some sort of "seal", Pos. 541) containing small flecks of charcoal and slag was worked into the left gap between the side and back walls, suggesting that it was used to repair the furnace. The rear wall of the furnace was dug vertically into the ground (Pos. 530) and intentionally fixed with wedges (Pos. 538). Three postholes located to the north (Pos. 528A and 528B, Fig. 5 and 7) and northwest (Pos. 577, Fig. 7) indicate a roof build over the work area.

The related slagheap (Pos. 563 and Pos. 614, Figs. 7-8) situated 2.5-3 m southwest of the furnace was partly surrounded by a layer of stones (Pos. 570).

Most tuyère fragments were found close to the southern part of the furnace (Fig. 8). Several fragments of burned clay associated with smelting activities in the furnace were located to the south and northwest of the furnace. Within this activity area, two pits of ca. 60 cm diameter each had been dug (Fig. 7; Pos. 616 and Pos. 621). The first pit was mostly filled with charcoal and some slags, while the second pit was lined with partly burned stones and clay. Lots of small quartz fragments could be documented therein.

The dense distribution of ceramic tuyère fragments directly south of the smelting furnace 1 at Gruba I is noticeable. We may be looking at a work site where damaged tuyères were kept or discarded to the right side of the furnace (Fig. 8).

Taking the whole context of the 2013-15 excavations at Gruba I into account, the density map (Fig. 9) permits the hypothesis that more smelting furnaces could be located in sector 56/8, and even more so in sectors 60 and 62. This predictive observation will need to be verified.

An overview over the numerous ceramic tuyère fragments can be found in Nüssli (2018), where a convincing tuyère reconstruction has also been advanced.

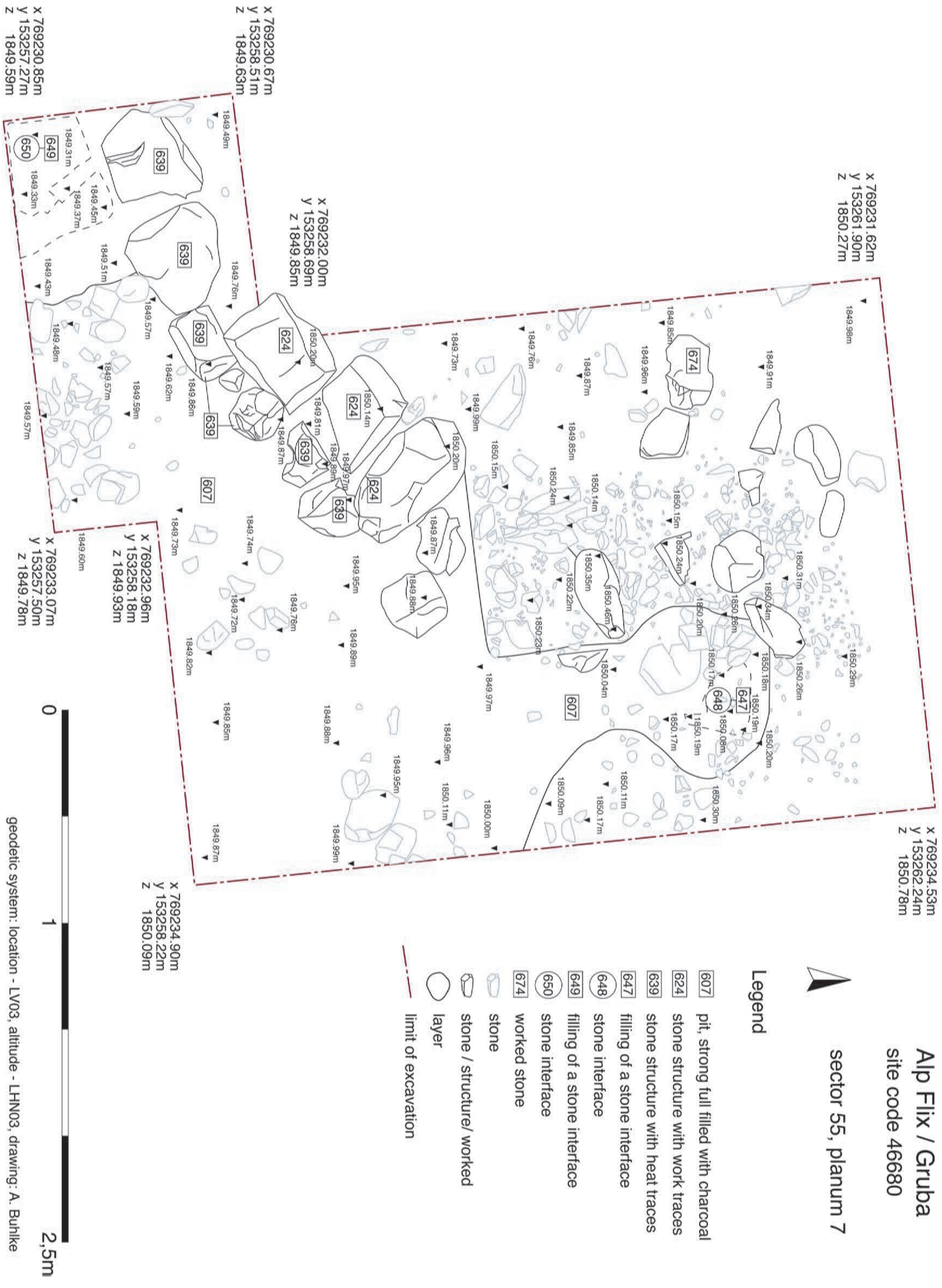

Fig. 4: Gruba I, roasting bed ? (graphic: Anja Buhlke, Rouven Turck/UZH).

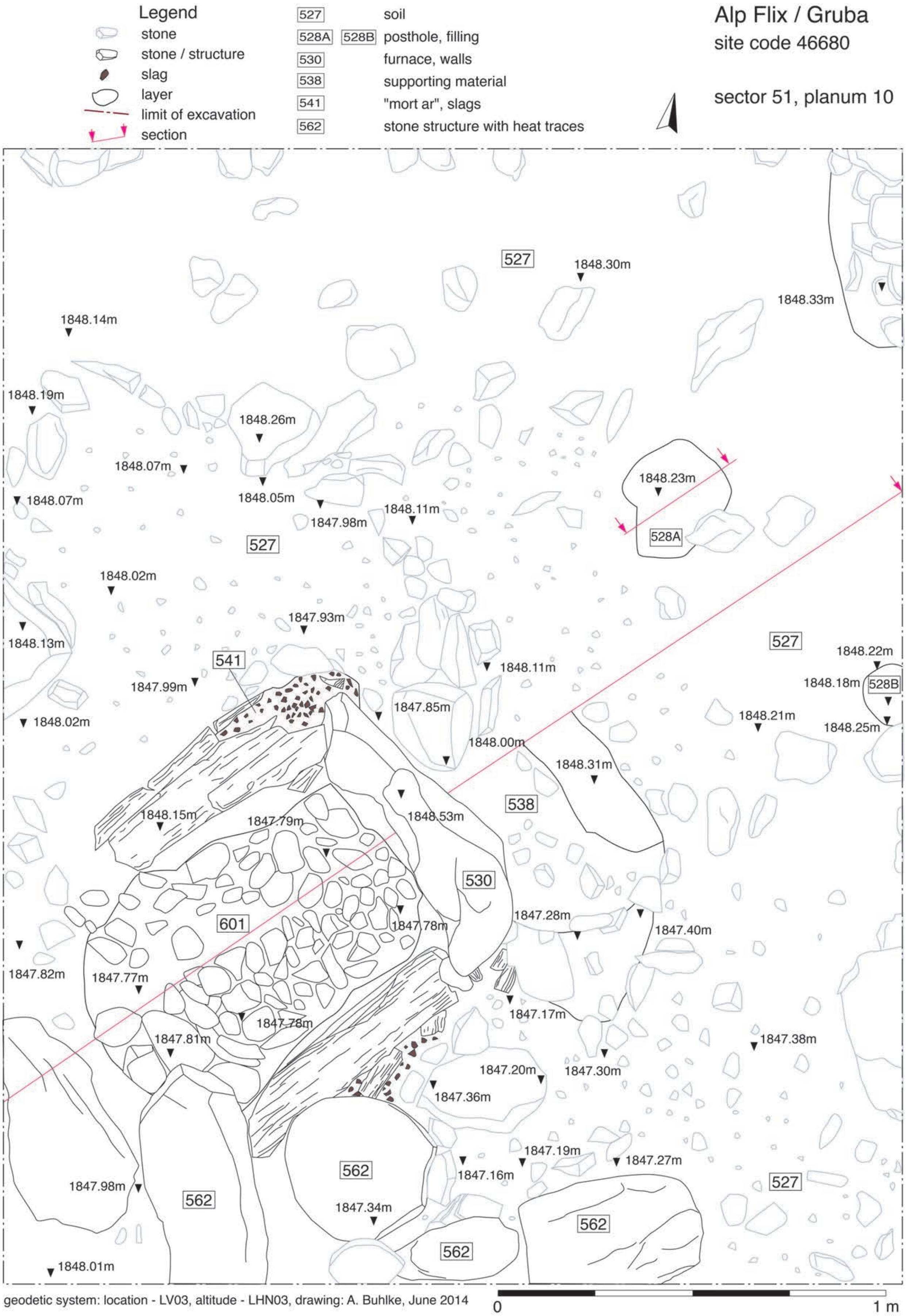

Fig. 5: Gruba I, furnace 1 (graphic: Anja Buhlke).

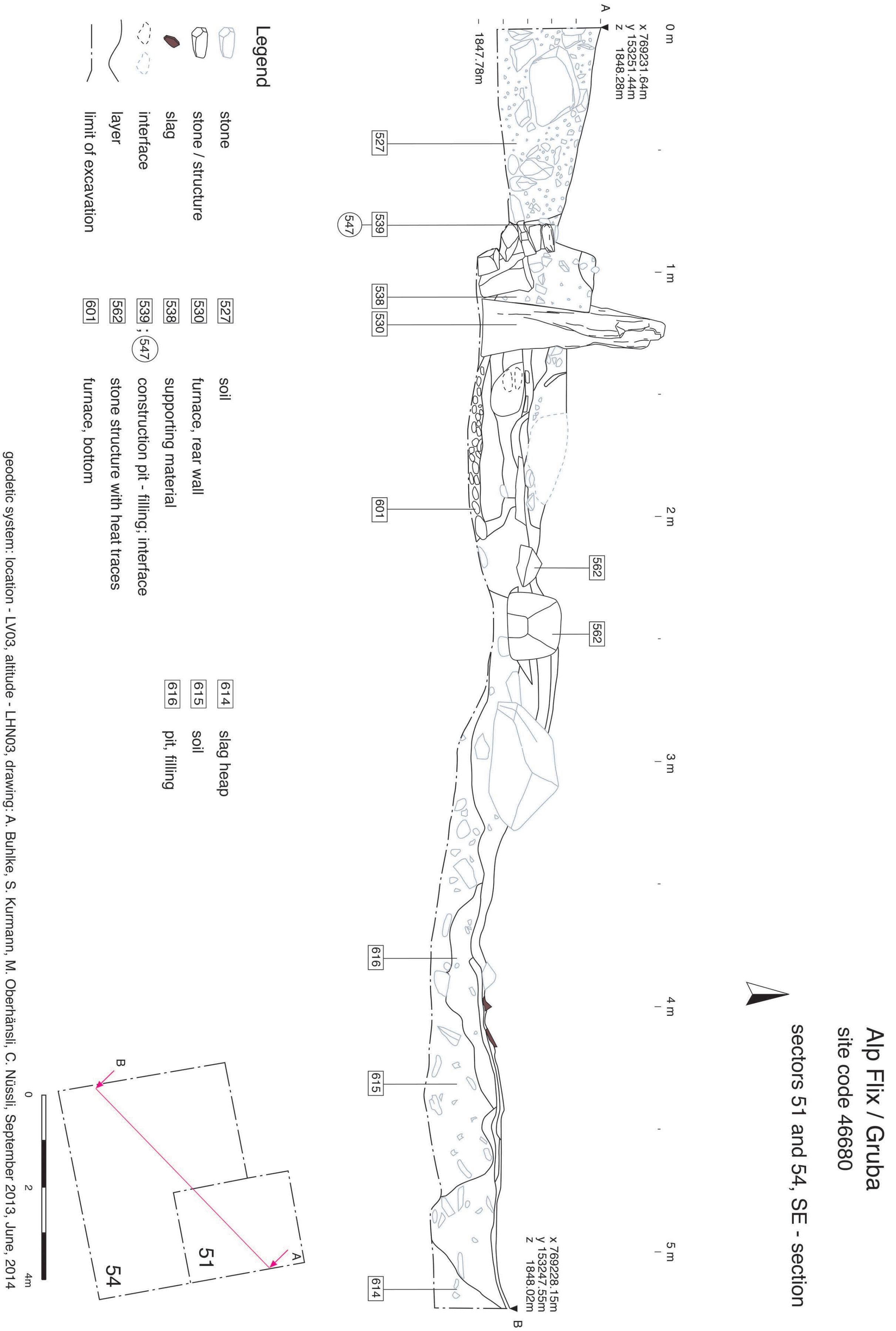

Fig. 6: Gruba I, SO-Profile, furnace 1 (graphic: Anja Buhlke, Simon Kurmann, Carlo Nüssli, Monika Oberhänsli/UZH).

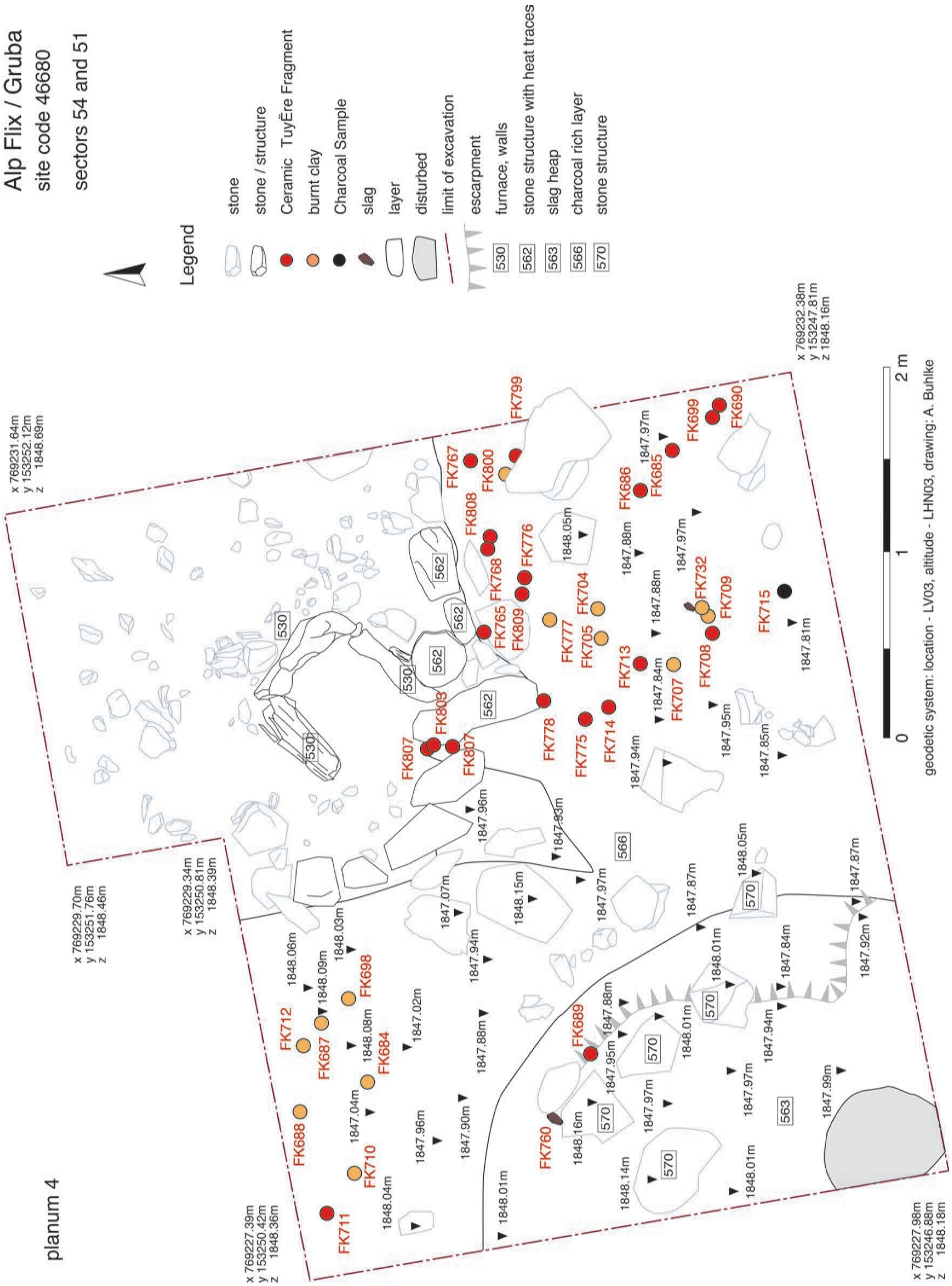

Fig. 7: Gruba I, furnace 1, slag heap 1, findings: tuyères (graphic: Anja Buhlke).

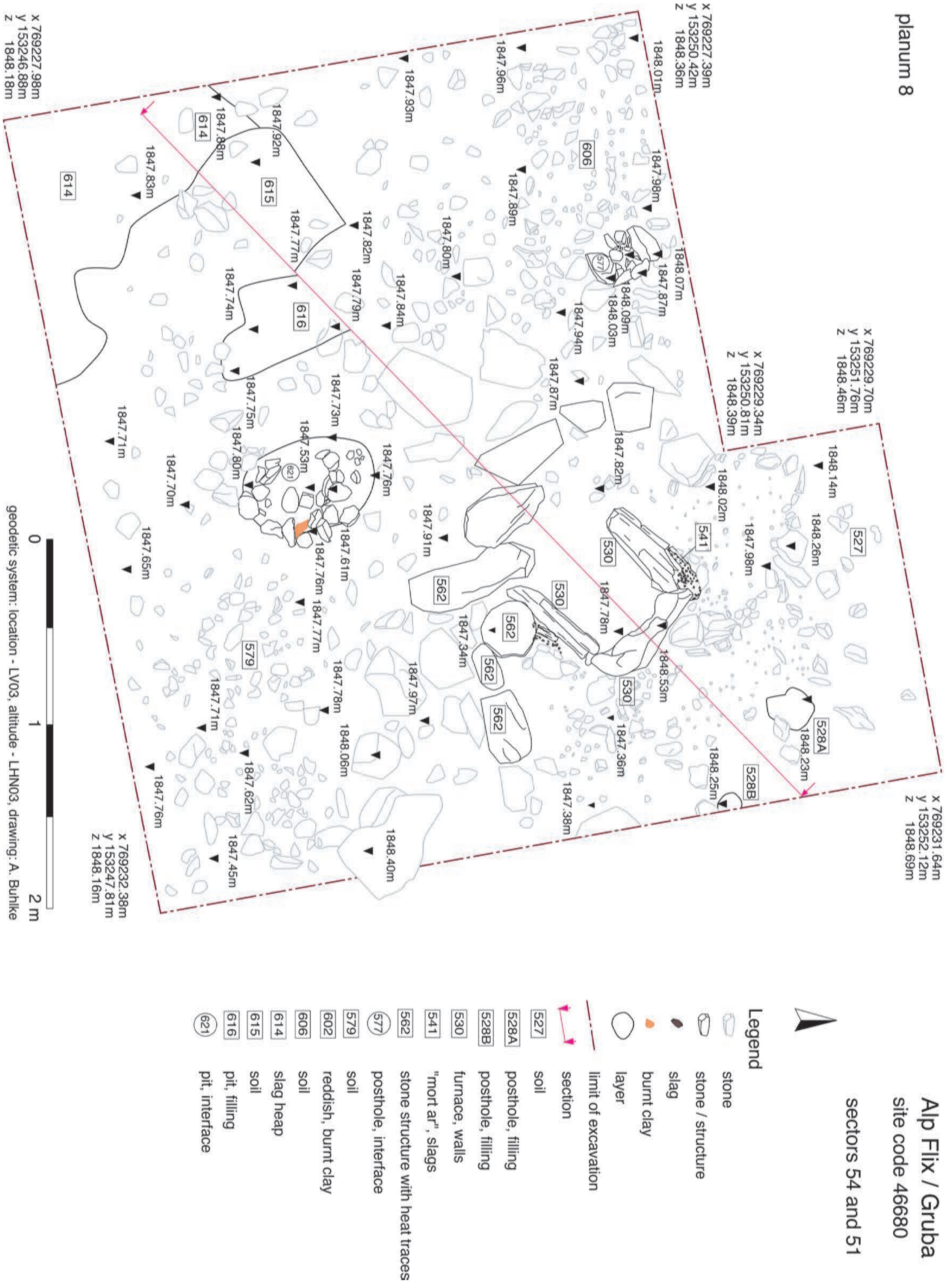

Fig. 8: Gruba I, post holes and pits (graphic: Anja Buhlke).

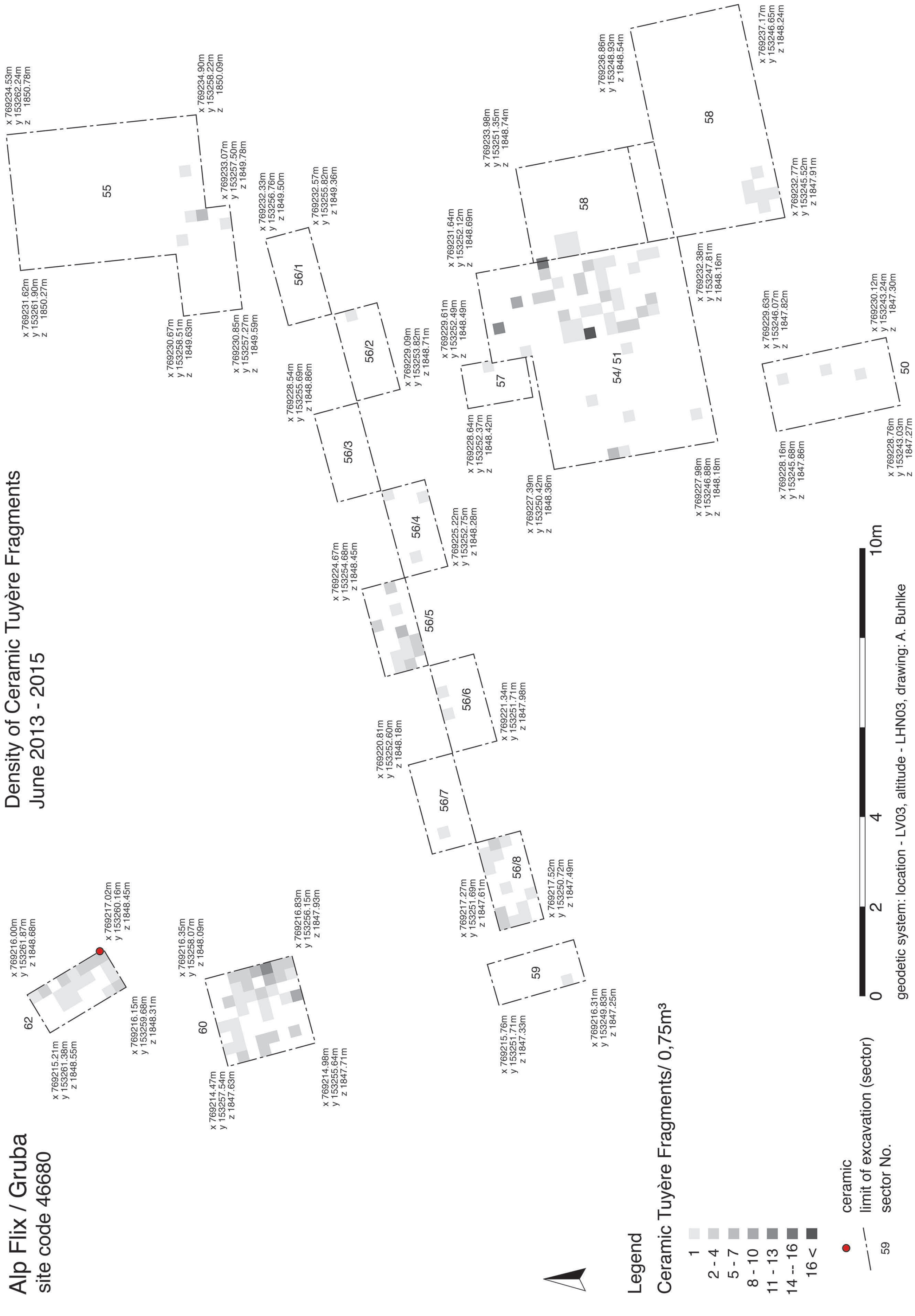

Fig. 9: Gruba I: tuyères, density map (graphic: Anja Buhlke, Carlo Nüssli, Rouven Turck/UZH).

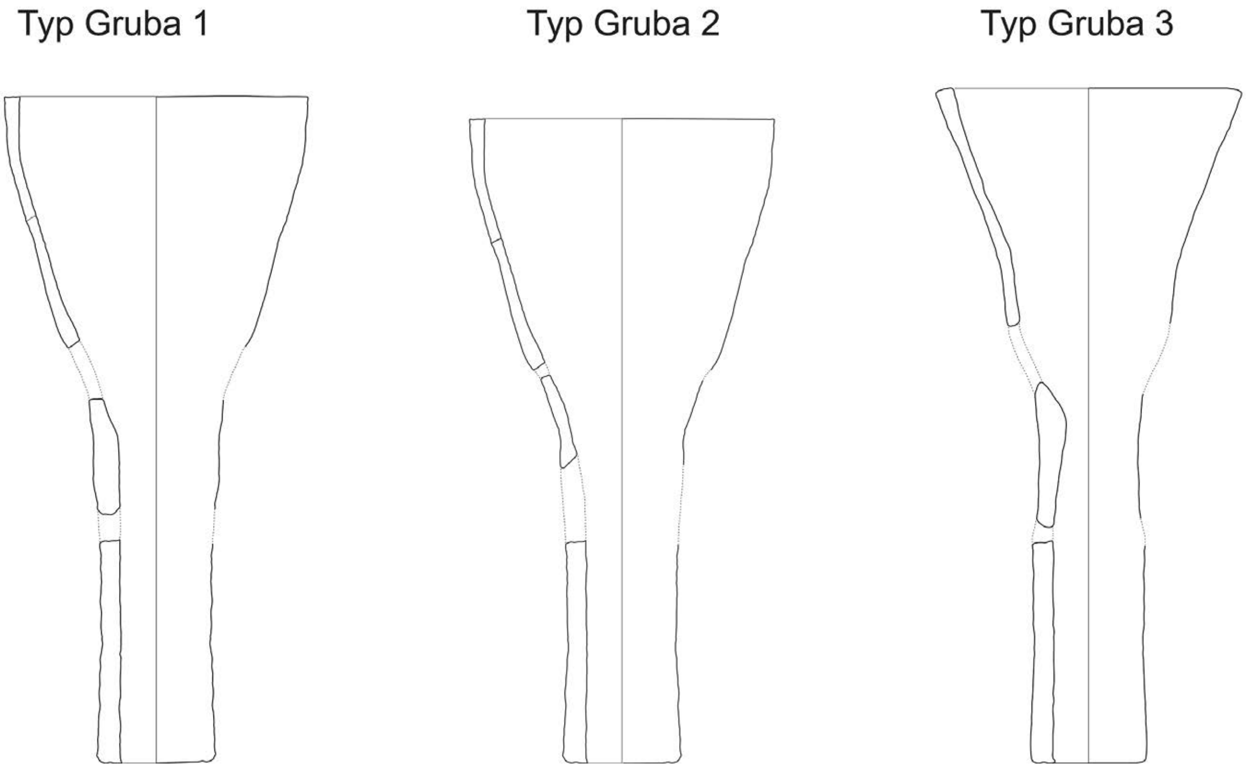

Fig. 10: Reconstruction of tuyères (graphic. Carlo Nüssli/UZH).

The ceramic tuyères with an inner diameter of 12-16 cm at their base and a length of up to 40 cm are in their basic shape (Fig. 10) reminiscent of those found in Mauken in Austria (Töchterle et al., 2013, Abb. 7), even though the burnt-in holes probably used to tie the bellows to the tuyère are missing. It has rightly been pointed out that Gruba I, with more than 500 documented tuyère fragments, from which at least 29 tuyères can be reconstructed, yielded an exceptionally large number of fragments compared to other sites of the Trentino, Mitterberg, Lower Inn Valley, etc. (Nüssli, 2018, pp.135-139). The pipe endings show traces of slagging (Fig. 11) and thus must have been inserted into the smelting furnace. Experiments regarding the tuyère's practical utilisation have not yet been conducted (cf. Goldenberg et al., 2011b; Hanning et al., 2015).

Two more smelting furnaces were uncovered at the site of Val Faller, Plaz (Fig. 12) (JbAS 100, 2017, p.219). Based on a geomagnetic survey (Della Casa et al., 2016), an area of 50 m^2 was excavated. The diameter of the documented slagheap measured more than 2.50 m. The thickness of the heap was determined by sectioning, revealing a thickness of at least 1.05 m. In the immediate vicinity of the slagheap lies a tripartite stonewall supporting the slope. Its eastern side is partially collapsed and consists of two to three layers of blocks of stone. The horseshoe-shaped furnace 1 (Fig. 13) was built into the supporting wall's northern side. Furnace 2 (Fig. 14) was instead integrated into the lower western flank of the wall structure. Furnace 1 is characterised by a kind of clay plaster covering its upper layer. The furnace's eastern side was insulated with a packing layer of slags. To the west and surrounding furnace 1, a work area was identified measuring 2.30 x 1.30 m. It is located atop the wall and runs towards the south with its central and western part boasting a layer of red and orange burnt clay.

Furnace 2, lying further to the west, resembles the shaft furnace found at Gruba I based on its stone rear wall and lateral walls attached at a right angle. Parallels to furnace 1 (Val Faller, Plaz) exist in the shape of the stone furnace floor. Both furnaces were in use at the same time.

Lying between the two furnaces and atop the northwestern part of the wall, a grindstone measuring 0.5 x 0.45 cm (Fig. 2) was discovered. The wall, including both furnaces, runs from west to east at a length of ca. 4.0 m.

To the northeast of the described features, it was possible to partially excavate a pit measuring 1.0 m in diameter and 0.5 m in depth. The pit was essentially filled with charcoal and partly lined with stones and clay. It shows similarities to the pit discovered at Gruba I, sector 55 (Pos. 607) (compare with Fig. 4) and sector 54 (Pos. 621) (compare with Fig. 8).

Comparison of the smelting sites Gruba I and Val Faller, Plaz

Both sites have similarities and differences. For Gruba I, only one furnace could be clearly identified, while Val Faller, Plaz yielded two. Both these furnaces are integrated into the natural slope by means of a dry-stone wall, while the

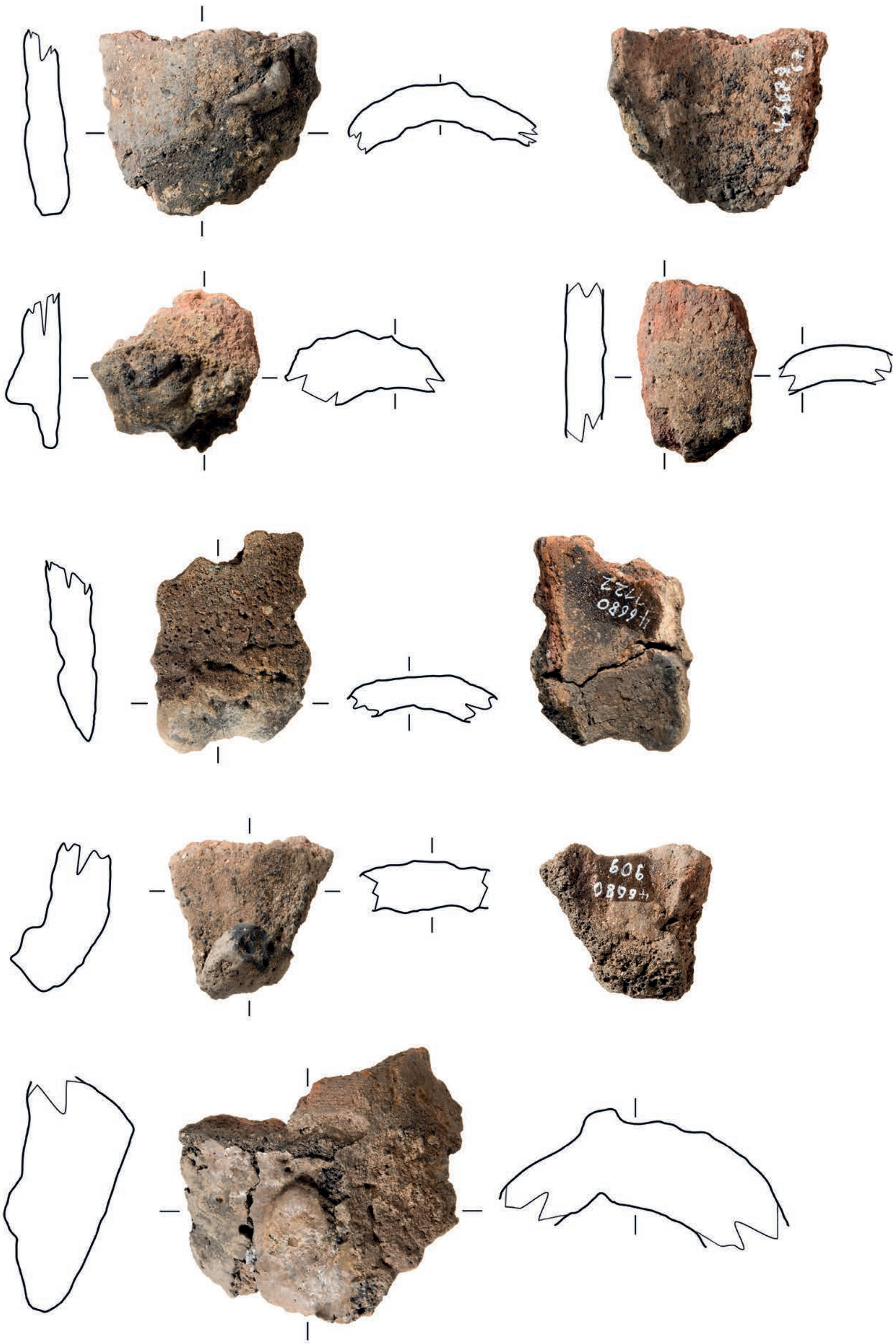

Fig. 11: Fragments of tuyères (graphic: Carlo Nüssli/UZH).

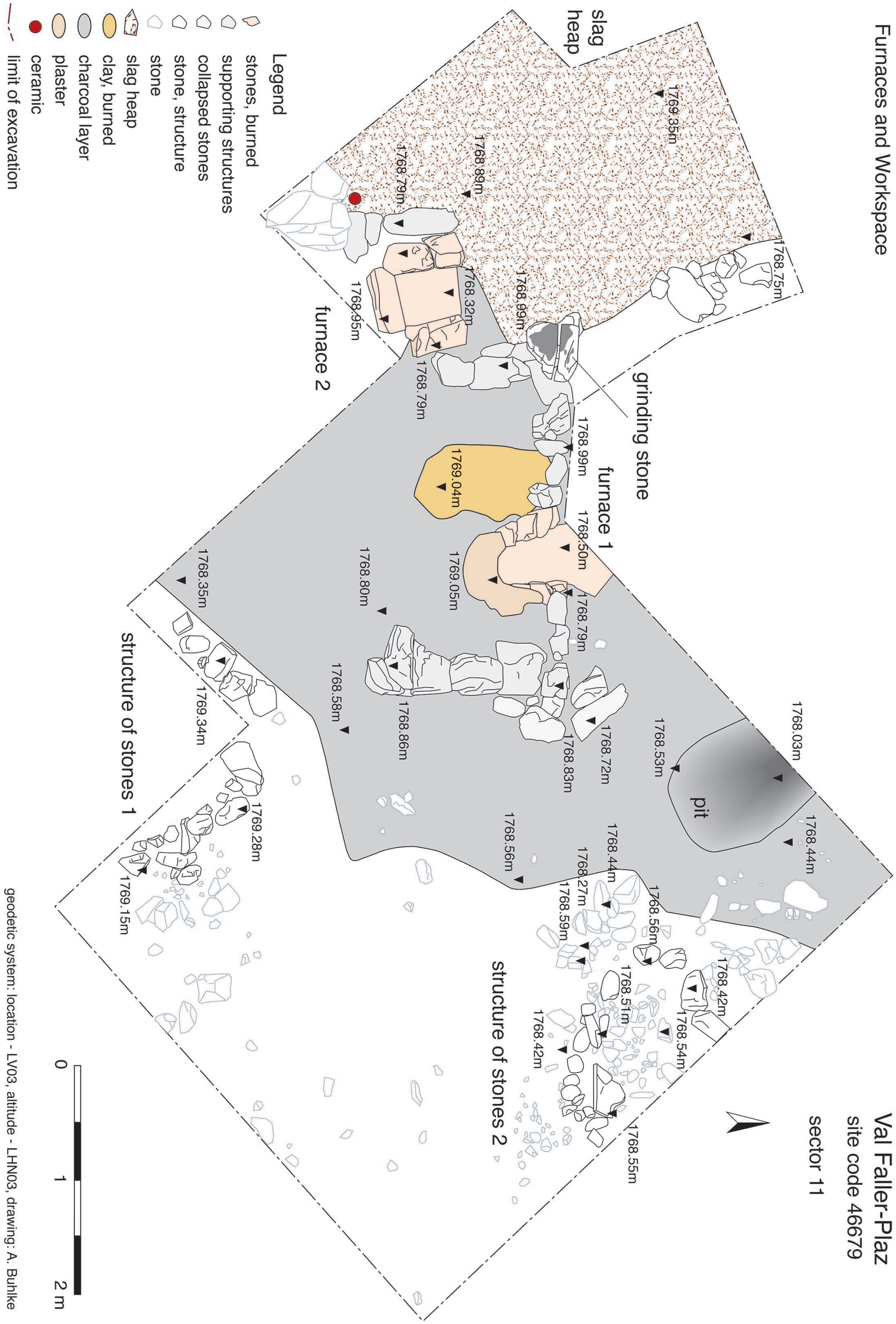

Fig. 12: Val Faller Plaz, furnaces 1 and 2 (graphic: Anja Buhlke/UZH).

Fig. 13: Val Faller, Plaz, furnace 1 (photo: Mirco Brunner/UZH).

Fig. 14: Val Faller, Plaz, furnace 2 (photo: Mirco Brunner/UZH).

furnace at Gruba I is freestanding and was constructed in a pit. For Gruba I we can assume a roofed structure covering the workspace near the furnace. For both sites, possible roasting beds can be presumed, but due to the ambiguity of the features they cannot be assigned without doubt.

The construction of pits seems to follow a systematic pattern – the pits from both sites, Val Faller as well as Gruba I (sector 55, Pos. 607), share similarities, as in each case they seem to have mainly contained charcoal, similar to pits for charcoal burning documented in medieval times (Klemm, 2010, pp.189-191; Fig. 2, pit type 2). Whether these are specific vestiges of the smelting process or charcoal burning pits, is yet to be discussed.

Pit 621 at Gruba I is much smaller and shallower, and it has been suggested that it was used to burn or crush quartz which can be used as a flux in the furnace. No similar features could be documented at Val Faller, Plaz. On both smelting sites, the slagheaps lie in the immediate vicinity of the furnaces at 2-3 m distance.

Comparison of the roasting beds and smelting furnaces

Despite the roasting bed at Alp Natons being smaller, a comparison with the bed of Flecksberg-Viehscherm published by Zschocke & Preuschen (1932, pp.76-79, Taf. III) is viable. These authors also documented a dividing block of stone or slab being integrated into the structure, resulting in approximately the same proportions. The description of layers of partially burnt clay and slags seem to follow a similar principle as described for roasting beds at Mauken (Mauk A, Goldenberg et al., 2011a, pp.74-76) or Jochberg (Goldenberg, 2004, pp.169-170). The dimension of the roasting bed of Alp Natons is much larger and its construction is more sturdy.

The three different smelting furnaces can be roughly divided into two groups: While a comparison between the furnace found at Gruba I and furnace 2 identified at Val Faller results in many similarities between the two, including nearly all aspects of their construction except the stone floor, the horseshoe-shaped furnace 1 at Val Faller, Plaz contrast sharply with the other two.

The following parallels to other smelting furnaces from the Eastern Alps can be drawn: Val Faller's furnace type 1 is, with regards to its size and shape, reminiscent of furnaces from the region of Kitzbühel (Koch Waldner & Klaunzer, 2015, Abb. 7), and to a lesser extent of the heavily fragmented furnaces discovered at Mauken (Mauk A, Goldenberg et al., 2011a). Smelting furnaces from the Eisenerzer Ramsau seem to have been constructed alike, despite being twin furnaces (Klemm, 2015).

A comparison to the furnaces in Trentino (Cierny, 2008) seems generally possible, even though the Oberhalbstein valley does not possess furnace batteries on such a massive choro- and chronological scale as is the case in Trentino. At Sant'Orsola Val (Silvestri et al., 2015, Abb. 7) furnaces were built into the slope integrating the use of a dry-stone wall, thus resembling the Val Faller type of furnace construction.

For the rectangular construction of furnaces with massive rear and lateral walls as witnessed for furnace 1 (Gruba I) and furnace 2 (Val Faller) there are no comparative examples from the Eastern Alps.

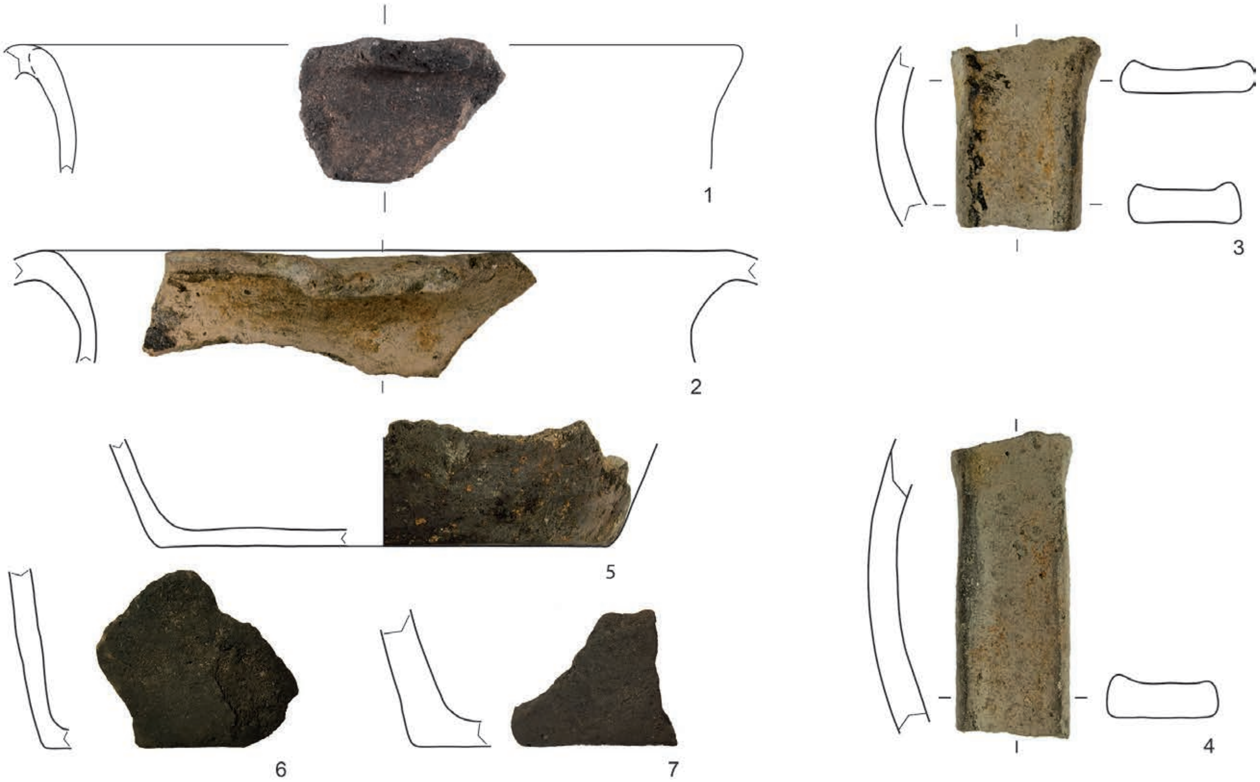

Fig. 15: Ceramics, Taminser pottery: 1. Gruba I; 2.-7. Val Faller, Plaz (photo/graphic: Michelle Bradler, Pierina Roffler/UZH).

Historico-cultural classification and relative chronology

The small numbers of domestic pottery from both excavated sites are the only diagnostic finds of all fieldwork campaigns. The two rim sherds found at Gruba I (Fig. 9; Fig. 15.1) and Val Faller, Plaz (Fig. 12; Fig. 15.2), where also two flat handles (Fig. 15.3-4) and three bases (Fig. 15.5-7) were discovered, can all be identified as pottery of the so-called “Taminser” style.

A few comparative finds from the northern Rhine valley shall be listed here exemplarily: Cazis, Cresta (Murbach-Wende, 2016, pp.162-165), the eponymous burial ground of Tamins (Schmid-Sikimic, 2002, pp.250-255), Chur, Markthallenplatz (Rageth, 1992, p.85), Wartau -Ochsenberg (Schmid-Sikimic, 2012, pp.112-114) and Montafon (A) (Klopfer, 2015, p.73). In the Oberhalbstein valley, Taminser pottery has been found at Savognin Padnal (Rageth, 2002, p.100) and Motta Vallac (Roffler, 2018, p.33). Another two fragments were found in smelting places (Schaer, 2003, Taf. 3, 90; Taf. 3, 96).

In relative dating, the pottery has been assigned to the 6th century BC, although the lack of closed finds is evident (Schmid-Sikimic, 2012, p.113; Murbach-Wende, 2016, p.162). Dating the material to the Early Iron Age matches up well with the sites’ dendrochronological results (Oberhänsli et al. 2019).

Interpretation

Based on archaeological fieldwork, it was possible to evidence some of the essential processes of the operational sequence of the copper smelting metallurgy in the Oberhalbstein valley (Fig. 16).

While the evidence for ore dressing is scarce, ample evidence for the mining, roasting and smelting of ores – as part of an at least two-stage process – exists.

As can be shown exceptionally well for Gruba I and, to a lesser extent, for Val Faller, Plaz, the smelting processes took place in a highly organised work environment. The smelting furnaces were elaborately roofed over (Gruba I) or, possibly for the sake of insulation, integrated into the slope by means of walls. The slagheaps are located in throwing distance to the smelting furnaces.

The roasting bed from Alp Natons and the furnace of type 1 from Val Faller, Plaz can be compared to Bronze Age precursors in the Eastern Alps. A rectangular type of smelting furnace as identified at Gruba I (furnace 1) and Val Faller (type 2) seems to represent a type so far unique to the Oberhalbstein valley.

The two types of furnaces show, analogous to the three types of slags defined (Reitmaier-Naef, 2018; Reitmaier-Naef, 2019), evidence of a multi-phased copper smelting process.

Oberhalbstein “chaîne opératoire“, documented features, primary copper production				
copper mining	dressing / processing, mechanical	dressing / processing, washing	roasting	smelting
✔✔	(✔)	--	✔	✔✔

Fig. 16: Features: primary copper chaîne opératoire of the Oberhalbstein valley (graphic: Rouven Turck/UZH).

Elements of a settlement based on the processing of ore („Werkplatzsiedlung”, as e.g. in the Mauken valley: Goldenberg et al., 2011a, p.76) and social and economic conditions of miners and smelters (Stöllner, 2015) cannot be convincingly advanced, as we are missing the necessary specific finds and features: No evidence of subsistence economy, food supply or other activities addressing the daily life of Iron Age mountain inhabitants could be identified so far.

Conclusion and forecast

This paper introduces all archaeological features excavated to date within the SNF-DACH project in the Oberhalbstein valley that form part of the primary metallurgical processes. Except for missing evidence regarding wet processing, and only scarce information related to ore dressing, the operational sequence is deemed complete. A roasting bed and smelting furnaces were documented for the first time in the Swiss Alps.

The sites Gruba I, including a furnace and possibly a roasting bed, and Val Faller, Plaz with its two dissimilar furnaces, are of central importance. Different work steps in the process of copper smelting could be discerned in particular at Gruba I.

The two different types of furnaces documented at Val Faller, Plaz point towards a smelting process that was made up of at least two separate steps. Both discussed smelting sites date, based on relative as well as absolute datings, to the Early Iron Age-late Hallstatt period.

Note

1 The excavations have been published regularly since 2014 as abridged reports in the Jahrbuch Archäologie Schweiz: Jahrbuch Archäologie Schweiz 97, 2014, pp.220-221; 98, 2015, pp.194-200; 99, 2016, pp.184-187; 100, 2017, pp.218-219; 101, 2018, p.195, p.198, pp.263-264; 102, 2019, p.175, p.238. On behalf of the Zurich research team including Leandra Reitmaier-Neaf and Philippe Della Casa, we would like to thank our cooperation partners from the DACH team – especially Gert Goldenberg, Caroline Grutsch und Markus Staudt – for their initial support to the fieldwork. We would also like to thank our colleagues from the Archaeological Service of Grisons (ADG), with Thomas Reitmaier being named as their representative, for their long-standing support. We are also grateful for many useful leads by Jürg Rageth and Andrea Schaer.

Abbreviation

JbAS: Jahrbuch Archäologie Schweiz

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