The Bell Beaker Rock Sanctuary Pigloner Kopf (South Tyrol, Italy): Burnt Offerings and Local Metallurgy in the Eastern Alps

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Abstract: The archaeological site Pigloner Kopf (Vadena/Pfatten, South Tyrol, Italy) has revealed unexpected elements related to the local Bell Beaker culture, like the local production of shaft-hole axes, typologically linked to the Balkans and the Danube region. The site also shows the oldest evidence of ritual burnt offerings in the Eastern Alps. The mostly burnt animal bones, cereals, flint tools and fragments of pottery could be interpreted as the remains of a rock sanctuary with burnt offerings. The site can be considered as a prototype of the alpine places of worship and mountain sanctuaries. These burning rituals were practised from the beginning of the Bronze Age until the late Roman Empire.

The aim of the paper is to present the results of the study of materials and their analyses, focussing on the metallurgical industry, composed mostly by objects produced with local copper, such as 10 miniaturised shaft-hole axes, 7 awls and a pin and also by imported objects like a dagger blade and spiral ornaments. The deposition of copper tools in hoards in association with burnt offerings suggest a ritual interpretation of the site, dated to the late Copper Age with Bell Beaker elements in lithics and pottery.

Keywords: Eastern Alps, archaeometallurgy, copper hoard, shaft-hole axes, melting, Bell Beaker common ware, burnt offerings, archaeozoology

1. The archaeological site

The site, Pigloner Kopf, is located in the municipality of Vadena/Pfatten in the Adige valley (South Tyrol, Italy). Discovered in 1995, the site sitting upon a rock tower (Figure 1) was initially interpreted as a late Neolithic settlement in an exposed position (Oberrauch, 1996; Niederwanger and Oberrauch, 2001). The field research was authorised by the Ufficio Beni Archeologici of Bolzano/Bozen and the South Tyrol Museum of Archaeology in eight archaeological excavation campaigns overall, conducted between 1995 and 2013. The site is divided in two main areas (Figure 2): the platform on top of the rock tower has an extension of 60x30m and is dated to 2900 BC (Rame 1/2) and the rock shelter at the foot of the rock tower, a triangular area delimited by enormous rocks with an extension of 50m, is radiocarbon dated between 2700-2300 BC (Rame 2/3). The rock shelter was filled with a secondary deposit containing the Bell Beaker elements, which can be identified in the pottery (Bell Beaker as common ware) and lithic industry, associated with burnt animal bones and deposits of copper objects.

2. The geothermal phenomenon

The geology of the Monte di Mezzo/Mitterberg, the central hill in the Adige valley, reveals that it is composed of different strata of porphyry of Permian volcanic origin. The upper geological layer, where the site Pigloner Kopf is located at an altitude of 550m, is formed by a porphyritic sandstone, known as 'Formazione di Tregiovo' (TGV). This type of rock has the property of being divided by many cracks and crevices. A continuous warm airstream of 15°C effuses from some of them during the wintertime, thus the nomenclature 'warm holes' (Andergassen, 1981). This geothermal phenomenon (Figure 2, 1-9) is based on the difference of temperature inside and outside the cavity and pressure between the upper and the lower mouth of the deep rock crevices. The airstream inverts during the summertime, when a cold airstream effuses from the lower mouth, thus known as 'ice holes', often used as natural cellars in the Middle Ages.

3. The platform on top of the rock tower

The first phase of occupation of the rock tower Pigloner Kopf falls in the beginning of the 3rd millennium BC. The findings on the platform of the rock tower Pigloner Kopf, divided in two parts by a central rock crevice, consist of mostly coarse pottery decorated with fingerprints, a millstone, and tanged arrowheads, often fragmented by impact. Two hoard finds of flint tools were also discovered: hoard 1 is homogenous and contains 8 leaf-shaped points (Figure 3), hoard 2 is heterogenous and is composed of 6 semi-finished points, 3 scrapers and 4 blades. Both hoards are made

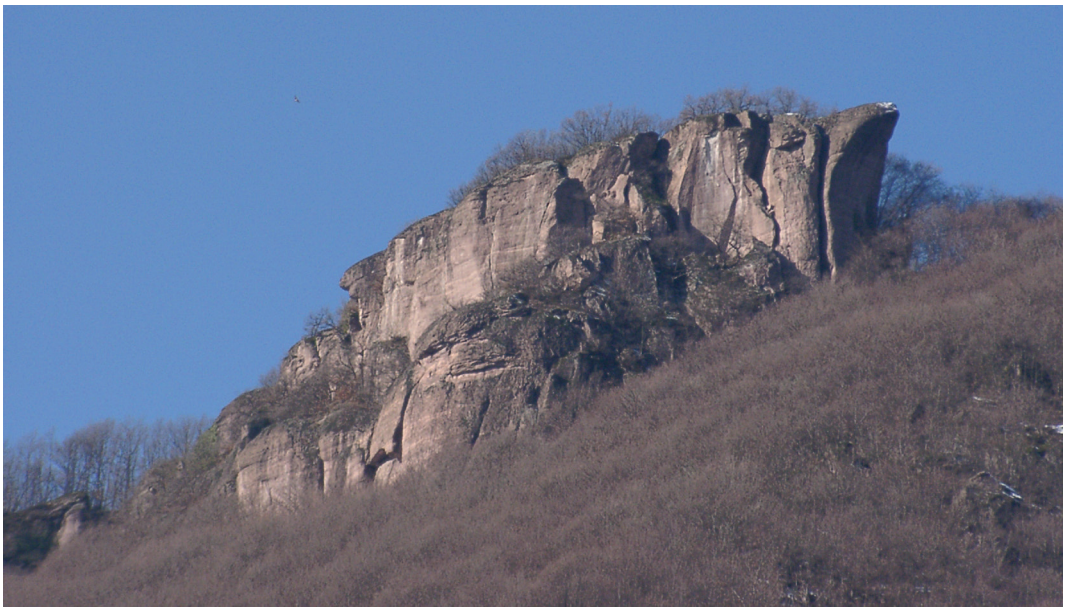

Figure 1: The rock tower Pigloner Kopf, South Tyrol, Italy (photo credit: H. Oberrauch)

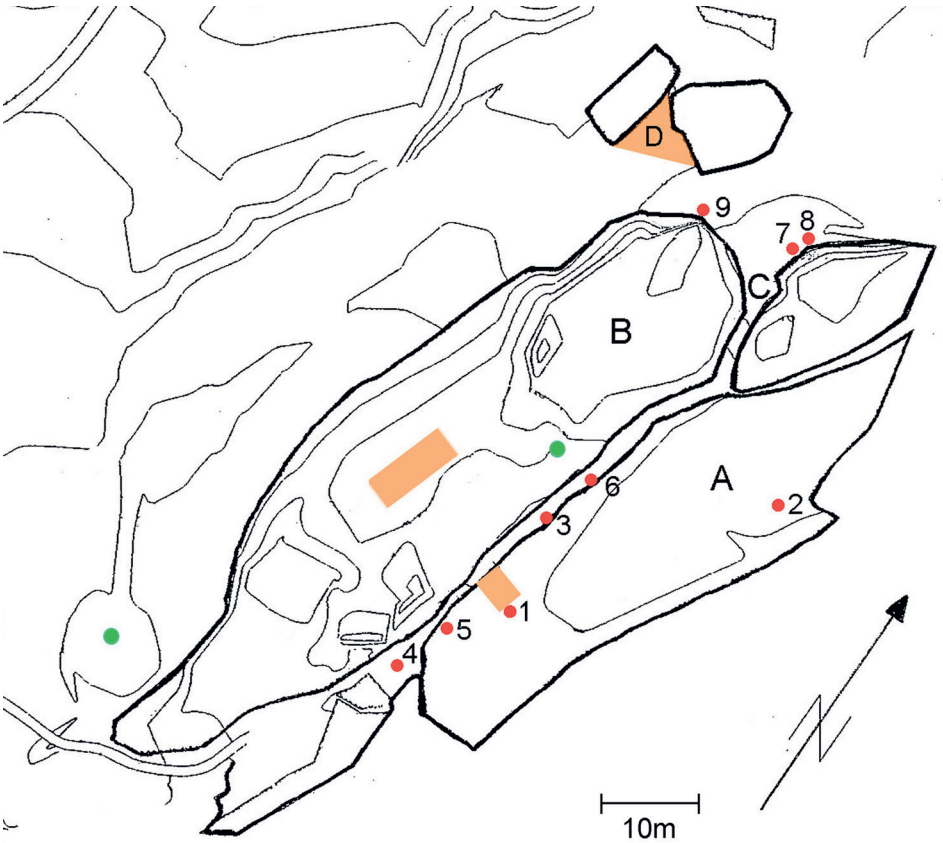

Figure 2: Location map of the Pigloner Kopf site with the eastern platform (A), the western platform (B), the entrance of the central rock crevice (C) and the rock shelter (D), the distribution of the 'warm holes' (1-9), the findings of roman coins (green circles) and the excavated areas colored in orange (graphics by H. Oberrauch)

Figure 3: Pigloner Kopf: Flint hoard no. 1 composed of 8 leaf-shaped points (photo credit: P. Chistè)

of imported maiolica flint from the Lessini/Baldo mountains, which are 120 km from the site. There are only a few hoards composed of flint points or daggers in Italy: the hoard from Doss Pipel near Isera (Rovereto, Trentino), found by Paolo Orsi in 1905 (Menghin, 1913; Barfield, 1970; Mottes, 1996), the hoard of Calendasco near Piacenza on the Po plain (De Marinis, 1990) and the hoard of Conelle di Arcevia (Marche), consisting of 8 flint daggers dated between 3350-2750 BC (Moscoloni and La Rosa, 2003; De Marinis, 2013). A hoard composed of flint scrapers was recognised at Arco-Linfano in Trentino (Mottes, 2002).

The excavation of the mouth of warm hole n.1, a deep vertical rock crevice, uncovered that it was filled by anthropic layers containing pottery, arrowheads and a deposit of birch tar fragments (hoard 3), two of which were radiocarbon dated to 2900 BC: combine 2914-2885 BC (Oberrauch, 2019). Only one copper object, the fragment of a flat axe in pure copper (Figure 8, n.15), was found on the top of the rock tower, in the filling of warm hole n. 1. This phase coincides with the transition from the first to the second phase of the Copper Age (Età del Rame 1/2 in Italian chronology) and it is dated after the extraordinary discovery of the famed Iceman, dated 3370-3110 BC, related to the Remedello 1 culture (Rame 1: 3400-2900 BC), and at the beginning of the period of engraved stelae, related to the Remedello 2 culture (Rame 2: 2900-2500 BC), followed by the Bell Beaker culture, dated between 2500-2200 BC (Rame 3). The pre-Bell Beaker phase Rame 2 is a typological gap to be filled, because pluri-stratigraphic sites are very rare, and the period was subject to a backdating due to the Iceman and his copper axe. Before the discovery of the Iceman the Italian Copper Age (eneolitico) was generally dated too late.

Radiocarbon data of leaf-shaped points or daggers with a rounded base are available from Tolerait/Thalereit (South Tyrol), dated between 3332-3214 BC (Dal Ri and Tecchiati, 1994); the dagger found at the burial site of Acquaviva di Besenello (Trentino) is dated between 3340-2900 BC. The flint daggers from the Doss Pipel hoard were compared to a fragment found in the settlement of Isera-La Torretta (phase Isera 4), dated to the final Neolithic between 3600-3400 BC (Pedrotti, 2001). The flint dagger of the Iceman is dated to 3370-3110 BC (De Marinis, 1992) and it was compared to the dagger from Arbon Bleiche in Switzerland (Winiger, 1998), dendro-dated between 3384-3370 BC, and to the dagger from Pestenacker (Bavaria), dated to 3546 BC (Borello et al, 2002). The flint daggers from the necropolis of Remedello (Brescia) from tombs 97, 99, 107 and 102 seem to confirm its dating to the second half of the 4th millennium BC (De Marinis and Pedrotti 1997). The flint dagger from tomb 100 of Remedello was compared to the similar one from the burial of Fontaine-Les-Puits in Savoie, dated by radiocarbon to the second half of the 4th millennium BC: 3520-3190 and 3500-3090 BC (Rey et al, 2010). Flint daggers display

a long continuity of use, which is demonstrated by the burial of Ala-Le Corone (Trentino), dated by a human bone to between 2860-2470 BC (Mottes and Ziggiotti 2012) and by the burial of Orno (Trentino), where a flint dagger is associated with half-moon shaped microliths, typical for the second half of the 3rd millennium BC (Pedrotti, 2001).

Flint daggers can be interpreted as goods for transalpine trading, as shown by the daggers made of southalpine flint from the Lessini/Baldo mountains found on the northern side of the Alps: Ergolding-Fischergasse, dated between 3700-3400 BC (Tillmann, 1993; Schlichtherle, 2003), Knöbling near Dobl in Bavaria, in a context of the Cham culture, dated between 3300-2800 BC, and Schellenberg (Liechtenstein), in a settlement of the Horgen culture (Borello et al, 2002).

The presence of imported flint tools deposited in hoards on the site Pigloner Kopf, both finished and semi-finished objects, points to this trade in high-quality raw material from the Lessini/Baldo mountains. The flint trade seems to end in the middle of the 3rd millennium BC, when the flint daggers were gradually substituted by copper. The depositing of flint hoards, probably as offerings, at the site Pigloner Kopf is verified as being from the early 3rd millennium BC and it seems to be connected to the strategic position of the site along a trade route above the river Adige/Etsch and to the geothermal phenomenon of 'warm-holes'.

4. The rock shelter

The rock shelter is located at the foot of the rock tower, 25 m above the platform. The triangular area was formed during the Ice Age and is delimited by three enormous rocks (Figure 2, D). The vale was completely filled with 150 m of layers containing charcoal, ash, 17,500 fragments of pottery with traces of secondary combustion, 14,200 mostly burnt flint tools and flakes, residues of carbonised cereals and collected fruits, 64,000 fragments of burnt and calcinated animal bones and 50 copper objects.

The filling of the rock shelter can be considered as a secondary deposit with a thickness of 3 m and it is formed by three main layers of charcoal and two separate layers of sand and stones. The burnt layers are composed of loam and contain many rocks of different sizes and mostly burnt findings distributed across the whole area. The secondary deposit in the rock shelter is typologically and chronologically homogenous and it dates between 2700-2300 BC. The radiocarbon dating at the ETH Zürich of two short-lived samples of an unburnt cattle scapula and a burnt seed from cornus mas, found in the inferior layers, allowed us to restrict the phase of occupation to between the 25th-23rd century BC during the Bell Beaker period (2464-2298 BC).

4.1 The pottery

The 17,500 fragments of mostly coarse pottery, found in the rock shelter, couldn't be reassembled because of the fragmentation, the absence of decorations, the alteration of the surface colour caused by secondary combustion and the fact that not all of the vessel fragments were deposited in this area. It was not possible to assemble one entire vessel, because half of the pottery was missing, and matching pieces of the same vessels were distributed over different layers with an altitude difference of up to 2 m, indicating that the vessels were fragmented somewhere else and the fragments of the same vessel were partially thrown in the rock shelter in different moments of time during the filling.

The vessels of mostly coarse ware are decorated with impressions of fingerprints or tags on the rims and on the applied cordons. Some types can be attributed to the Bell Beaker common ware, according to the typology of Marie Besse (Besse, 2003): the handled pitcher (type 34) with a broad handle fixed on the rim (Figure 4), vessels with a cordon decorated by fingerprints (type 22) or decorated with notches (type 28), which makes up part of the local ware in the Final Neolithic tradition. Horizontal cordons immediately below the rim (type 5) or in an unknown position (type 6), vessels with a straight and flattened rim (type 63) and bowls with a flat bottom (type 19) were also present. There were some undecorated beaker-shaped vessels, but there was not one decorated beaker, which seems to be limited to burials and settlements in the region. The pottery found at the alpine burnt offering places of the Bronze and Iron Age is generally fragmented and it is mostly composed of domestic pottery, which is not different from the settlements (Steiner, 2010). At Pigloner Kopf the use of repaired vessels is proved by fragments with holes made during reparation. Fine pottery makes up only 2% of the findings, with small burnished vessels similar to the findings from Lastruccia near Sesto Fiorentino (Leonini and Sarti, 2008). Other vessels show deep incisions like type 8 and they can be compared to the vessels with the decoration 'a fori non passanti' (Piguet and Besse, 2009). Some pieces may show the influence of the typical Corded Ware decoration, like incisions similar to the decoration of the so called 'Tannenzweigamphoren' known from Sutz in Switzerland (Preuss, 1998) and from Bohemia (Buchvaldek, Novotny and Pleslová Štiková, 1988). The Corded Ware culture is thus far missing south of the Alps, but some influences could have arrived with the transalpine trading of flint and copper. Decorated beakers in the south-alpine region are very rare and often they are associated with burials like Velturno/Feldthurns (Dal Ri and Tecchiati 1994) or settlements in Trentino (Nicolis, 2001a), where they are associated

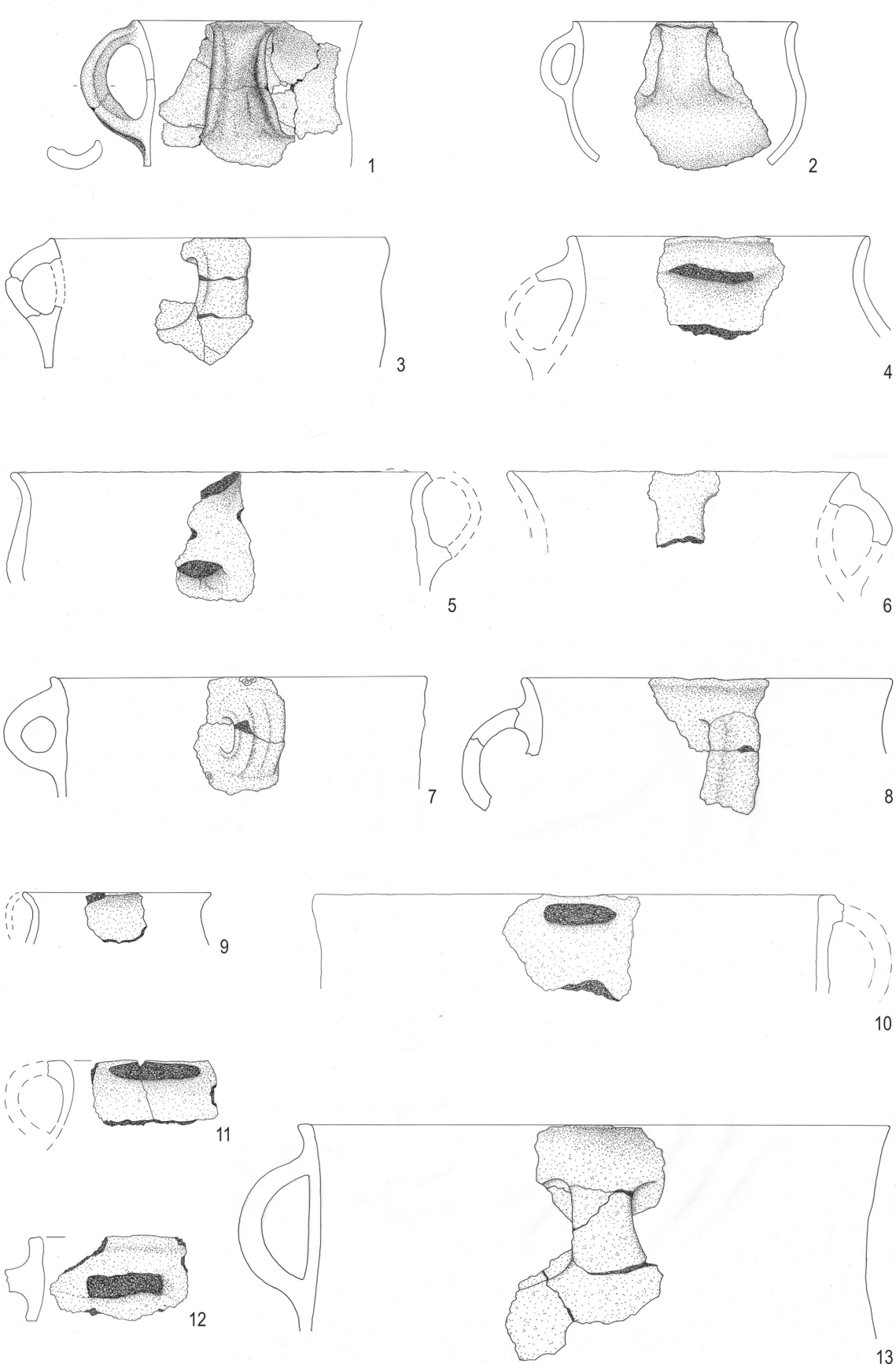

Figure 4: Pigloner Kopf: Handled pitchers of the Bell Beaker common ware (type 34 according to Besse, 2003) Scale 1:3 (drawings by H. Oberrauch)

Figure 5: Pigloner Kopf: Selection of flint arrowheads from the rock shelter (photo credit: P. Chistè)

with the Bell Beaker common ware, for example at Montesei di Serso and Monte Mezzana (Nicolis, 2001b).

4.2 The lithic industry

The 14,200 lithic findings of flint from the rock shelter consisted of 30 hollow-based and tanged arrowheads (Figure 5), some fragments of flint daggers, 130 used sickle blades, 307 geometric microliths, 100 scrapers, some cores, blades and thousands of flakes. The use of cores and the high percentage of flakes shows a rather disorganised use of the local raw material; such inconsistent flaking is typical for Bell Beaker assemblages in Northern Italy (Martini, 2008). Most (70%) of the lithic findings show traces of combustion, a change of colour and a thermally altered flint surface.

The hollow-based arrowheads with square barbs are typical for the Bell Beaker culture and can be compared to those from Monte Covolo (Lo Vetro, 2008) and from the Bell Beaker burial of Ca di Marco near Brescia (Nicolis and Mottes 1998), where they are associated with half-moon shaped geometric microliths (semilune). In the rock shelter on the Pigloner Kopf a quantity of 307 geometric microliths was found (Figure 6). The half-moon shaped microliths can be compared to the findings from the contemporary cave burials ('grotticelle sepolcrali') in Northern Italy (Poggiani Keller, 1996) and to the grave goods in the megalithic necropolis of Saint-Martin-de-Corleans in Aosta (Baioni et al, 2018) and Sion-Petit Chasseur (Gallay, 1972) in the Valais.

The sickle blades are present in different states of use: almost new blades, sickles with evident traces of usage (sickle gloss) and blades nearly completely worn down. There are flint scrapers, some borers, some fragments of flint daggers with a broad base, broken by flexion, and one fire striker, made of a secondary transformed sickle blade with two notches for fixing the handle. A polished stone axe made with a broad neck and stone tools like percussors in porphyry and sharpeners in sandstone also make up part of the lithic industry.

The analysis of flint provenance, made by Stefano Bertola, has demonstrated the use of different sources of the raw material. The arrowheads and the fragments of flint daggers are all made of imported flint from the

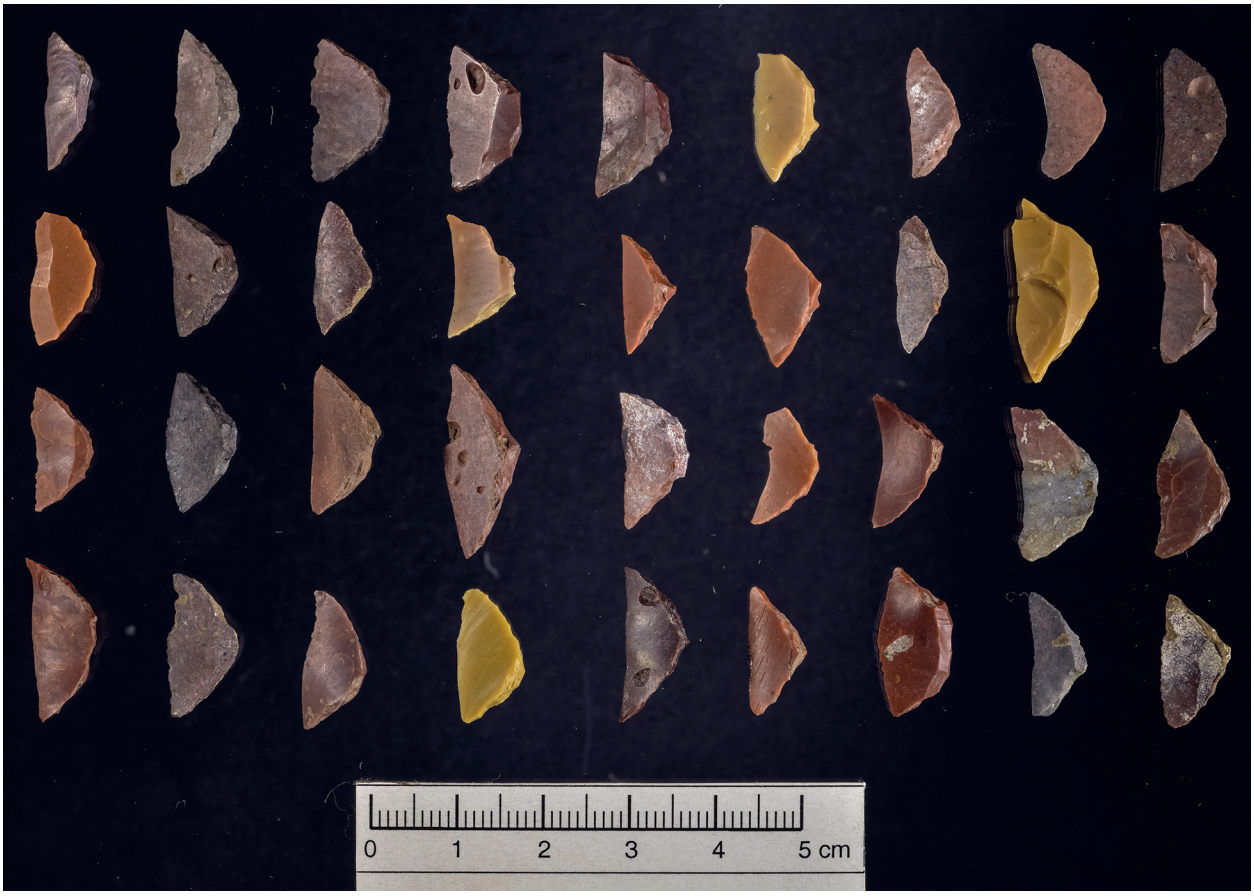

Figure 6: Pigloner Kopf: Selection of flint halfmoon-shaped microliths (photo credit: P. Chistè)

Lessini/Baldo mountains. Otherwise, the used sickle blades, the geometric microliths, the scrapers, the cores, blades and the numerous flakes are all made of local flint from the Non valley (Val di Non), 15 km from the site.

The explanation for the presence of 14,200 lithic finds in the rock shelter is that the flint tools and flakes with clear traces of combustion in this particular case made up part of the burnt offerings such as the animal bones, the pottery fragments and the copper objects.

4.3 The animal bones

The faunal remains were determined by U. Tecchiati (Riedel and Tecchiati, 2007) and his team of archaeozoologists (S. Eccher, S. Bandera and A. Zanetti). The 64,000 mostly fragmented animal bones can be attributed to many different species. 95% of them are burnt or calcinated and cut marks are also present. 70% are wild animals and only 30% are domestic animals. The high percentage of combustion and the composition of the animal species is very unusual for the period if compared to contemporary settlements in the alpine region and in Tuscany (Perusin et al, 2008). The most represented animal is the deer (30,1%), followed by pig and boar (27,5%). Some bones can be attributed to deer or cattle (7,1%). Domestic species are sheep/goat (9,5%), cattle (3,9%) and dog. Other wild species are roe deer (4,6%), wolf (dog/wolf 2,1%), birds (2,5%), tortoise (2,3%), bear (1,9%), fish (1,5%), badger (1,4%), hare (1,2%), beaver (1,1%), and fox (1%). Other species present below 1% are: chamois, ibex, wild cat, marten, otter, and sweet water mussels like *Unio* and *Anodonta* bivalves. The malacofauna was determined by A. Girod. There is only one perforated sea snail (*Nassarius*) of Mediterranean origin. Part of the findings are also burnt tools made of bone and antler like a burnisher made of a deer bone (metatarsus), awls, a bone spatula and a probable punch made of deer antler. The deer, the roe deer, chamois and ibex, the bear, the pig/boar and the dog/wolf, all represented in the rock art of Val Camonica associated with copper weapons, are animals with a symbolic value (Fossati, 1994). The different species of animals live in different areas, they were hunted on the valley floor near the Adige river or Lake Caldaro/Kaltern (beaver, tortoise, otter, fishes, mussels), in the middle altitudes (deer, roe deer, boar) and in the high mountains (chamois, ibex). The prevalence of wild animals indicates well-organised hunting and we can deduce that, in this sanctuary, bloody sacrifices with the slaughtering of animals

was not practised, because massive animals like deer, boar or bear cannot be brought alive or intact to the site. In fact, they were likely hunted farther away and then brought to the burning sanctuary. Only the domesticated species could be brought alive to the site. The archaeozoological analysis shows cut marks, the presence of all parts of the animals and there is no sign of a selection of the extremities (skull and femora) of the skeleton similar to the more recent alpine burning rituals where mostly domestic animals are present as they can be brought alive to the sanctuaries, as is known from ancient Greece (Pausanias, 2010; Krämer, 1966). Burial rituals can be excluded because human bones are completely missing.

4.4 The botanical remains

The archaeobotanical analysis was made by K. Oeggl and J. Gattringer (Gattringer, 2006) at the University of Innsbruck. The charcoaled seeds from the rock shelter can be attributed to different types of cereals (triticum dicoccum; triticum sp./aestivum; hordeum vulgare), linseed (linum usitatissimum) and the collected fruits of wild plants: acorns from the oak (quercus), hazel nuts (corylus avellana), cornus mas, wild cherry, sambucus, vitis sylvestris and prunus spinosa. The anthracological analysis has shown that the forest, in the first phase of occupation on the platform of the rock tower around 2900 BC, was composed of oaks (quercus robur, 41,8%), pines (pinus sylvestris, 46,7%) and ash (fraxinus, 11,3%). In the second phase of occupation, in the rock shelter dated between 2700-2300 BC, the forest changed, probably due to human impact: the pines (1,5%) almost disappeared and the wood for combustion in the rock shelter was composed of oak (54,5%), ash (25,4%), lime (12,4%) and elm (4,1%). An interesting point is that 65% of the charcoal derives from lumber and only 35% from collected dead wood showing traces of fungal infection. We can observe that the burning rituals and metallurgical activities were planned with the organisation of the appropriate wooden material for combustion.

4.5 The metallurgical industry

The remains of metallurgical industry consist of many different copper pieces: finished objects like 7 awls, one dagger blade, a pin with enrolled head and 3 ornaments in copper wire, semi-finished objects like 10 miniaturised shaft-hole axes (Figure 7) and many melting residues of copper casting.

On different levels two hoard finds were uncovered, each containing 5 copper axes. The first hoard (hoard 4) was distributed throughout the superficial layer (US2) and shows traces of secondary combustion, the second hoard (hoard 5) was found concentrated in the inferior ashy layer (US7).

Two of the miniaturised shaft-hole axes from hoard 4 were radiocarbon dated by charcoals included in their burnt surface: axe n.1 (2586-2281 BC) and axe n.2 (2703-2466 BC). The small and impractical axes of the Fresach type are known from 5 sites in the Eastern Alps: 3 sites in Austria (the Fresach hoard in Kärnten, composed by 7 axes, two axes found on the rock tower Rainberg in Salzburg and one axe from Dürrnberg near Hallein), one in Bavaria (Germany) and one in South Tyrol (Italy). Indeed, some authors have expressed their doubts about the practical use of these small axes, and rather they were considered as pre-monetary items of value (such as ingots) or as utensil money (Mayer, 1977; Franz, 1929). Collectively, the 21 axes of the Fresach type known in the alpine region have a length between 7-11cm and a weight between 34-108g. They seem to be semi-finished objects, not worked on after the casting and they have some casting errors. They probably can be interpreted as not-standardised ingots, destined for trading and subsequent melting to produce finished objects. Otherwise, they were deposited in hoards.

The alpine copper shaft-hole axes, typologically influenced by shaft-hole axes of the Kozarac type, known from the Balkans and the Danube area, represent the western limit of their waste area of diffusion in Eastern Europe to the Caucasus (Rahmstorf, 2010). Some casting moulds, found in Salzburg (Hell, 1943) and Trentino (Perini, 1972), evidence the local production of shaft-hole axes, also represented in the rock art of Val Camonica (Casini, 2001). The distribution map of shaft-hole axes shows that they were often found in hoard finds in the Balkans and in the Danube area. In some cases, they appear as grave goods in tumulus-burials (Bátora, 2003) and in graves containing the casting mould for shaft-hole axes (Kaiser, 2005), which can, based on the grave goods, be interpreted as graves of metallurgists. An interesting point is that the two hoards from Pigloner Kopf, composed of similar axes (their weight oscillates between 45-65g) have nearly the same weight all together: 272g and 286g. The number of 10 axes may indicate a decimal system and the use of a simple balance for the miniaturised copper axes.

Two copper axes and one awl were analysed with ED-XRF by E. Pernicka in 1999 (97-99% Cu with traces of Pb and Ag). A large number of copper objects were analysed with PXRF at the University of Trento. This method was useful to select samples from a large scale of artefacts for further investigation.

The archaeometric analysis by SEM-EDS and EPMA on microsamples of 4 axes of both hoards, provided by G. Artioli, I. Angelini and C. Canovaro from the Dipartimento di Geoscienze of the University of Padova, attest that they consist of almost pure copper (99,35-99,87%) with traces of sulfur (0,01-0,07%), arsenic (0,06-

Figure 7: Pigloner Kopf: The copper axes from hoard no.4 (left) and hoard no.5 (right) and the dagger blade (photo credit: P. Chistè)

0,12%), antimony (0,01-0,07%) lead (0,10-0,16%), zinc (0,02-0,51%) and silver (0,14-0,26%).

The faceted copper dagger (Figure 7; 8, n.5) was found under a rock and is considered as a single object hoard (hoard 6). This type of dagger, the first copper dagger found in the region, is not typical for the area and it is different from the Remedello and the Bell Beaker (Ciempozuelos) types, known from burials, and present on the contemporary stelae (Tecchiati, 1998) and in the rock art of Val Camonica. The chemical analysis (EPMA) shows that it consists of almost pure copper (98,63%) with an elevate percentage of arsenic (1,13%), antimony (0,43%), nickel (0,11%), lead (0,10%) and silver (0,13%). The Lead Isotope Analysis (LIA) demonstrates that it is not made of local copper, but it is an imported object from Tuscany, Liguria or Southern France. Typologically it can be tentatively compared to the facetted daggers of the Fontbouisse type, known from the French Midi (Gasco, 1980; Vaquer and Remicourt, 2012), and western Switzerland, like the examples from Saint-Blaise, Colombier and Lüscherz (Hafner and Suter, 2003).

In the rock shelter 7 copper awls with rectangular sections were found (Figure 8, n.1-4, 6-8). Some of them can be attributed to the Ig type, known from Trentino-South Tyrol (Italy) and Ljubljansko Barje (Slovenia). The chemical and isotopic analysis of 3 awls shows that they are all made of almost pure local copper (Cu 98-100%). A pin with a rolled head (Figure 8, n.9), made of almost pure local copper (99%), is similar to the Auvernier examples from Switzerland (Yvonand IV and Auvernier-Brise Lames), for which an Italian provenance was supposed (Strahm, 1994).

LIA reveals that most of the copper findings (axes, awls and the pin) fall in the field of the south-alpine ores while only the dagger and the spiral ornaments (Figure 8, n.10-12) are made of a different copper type. The LI-analyses of 4 miniaturised copper axes of the Fresach type from the site Pigloner Kopf were compared by G. Artioli to one axe of the Fresach hoard from Carinzia and to the other small axes, known from Austria (Dürrnberg and Rainberg near Salzburg), sampled by drilling by S. Krutter, R. Kastner and H. Wendling, analysed by ED-XRF and LIA at the CEZA in Mannheim. The lead isotope symbols of 7 analysed copper axes from 4 different sites on the north and south of the Alps are overlapping in the plot and it demonstrates that they have all the same south-alpine provenance. We can deduce that the small axes of the Fresach type were produced in the south-alpine region and they were probably exported as ingots to the north-alpine area.

There are 12 fragments of crucibles with traces of metal on the inner side, which were used for a step in secondary metallurgy when melting local copper ores for the subsequent casting of finished and semi-finished objects. Some samples of them were analysed by EPMA and LIA and they display the same composition and isotopic signal as the shaft-hole axes. In the rock shelter about 30 small residues of copper melting were found (Figure 8, n.16), but no slags were recovered. The analysed samples are made of almost pure, local copper, and they prove the probability of casting at the site.

The group of G. Artioli has sampled ores, slags, and finished copper objects like the axe of the Iceman from the south-alpine mining districts in northern Italy (Artioli et al, 2017), in order to determine the provenance of the copper. In the Trentino-South Tyrol region there are two known principal mining areas in the Isarco and Sugana valleys and some traces of metal working (slags) in a few settlements and smelting sites of the 3rd millennium BC (Artioli et al, 2014; Artioli et al, 2015). The site Pigloner Kopf is situated in the middle of the two mining areas. The region of the Eastern Alps is a zone of contact between the cultural areas of Bell Beakers, Corded Ware and the Balkan cultures, and is influenced by them.

According to the theory of the diffusion of metallurgy (Strahm, 2005), we can distinguish three principal phases: the first step was the import of finished copper objects (axes) from the Balkans in the 5th and 4th millennium BC (Dolfini, 2013; van Willigen, 2017); in the second phase local mining and copper production started in Liguria and Tuscany in the middle of 4th millennium BC (Maggi and Pearce 2005; Artioli et al, 2016) and in the third step the exploitation of local copper ores and the production of objects began in the Eastern Alps during the 3rd millennium BC (Dal Ri et al 2005).

Some of the copper findings from the site Pigloner Kopf are not typical for Bell Beaker metallurgy and they possess some unusual aspects: Bell Beakers in the circum-alpine region are rarely associated with copper axes and never with hoard finds of shaft-hole axes. In this case study, we can demonstrate by using LIA-analyses that the Bell Beaker people were involved in the usage of south-alpine copper ores and transalpine copper trading in the zone of contact with the Balkans and the north-alpine area.

Some findings, like the singular-facetted dagger blade which was made of a different, imported copper type, demonstrate long distance connections that may be influenced by the Fontbouisse culture in southern France. Two spiral ornaments are also made of imported copper. The fragments of crucibles and the copper residues prove the melting process on the site and the production of objects from local copper, using both oxidic and sulfidic ores.

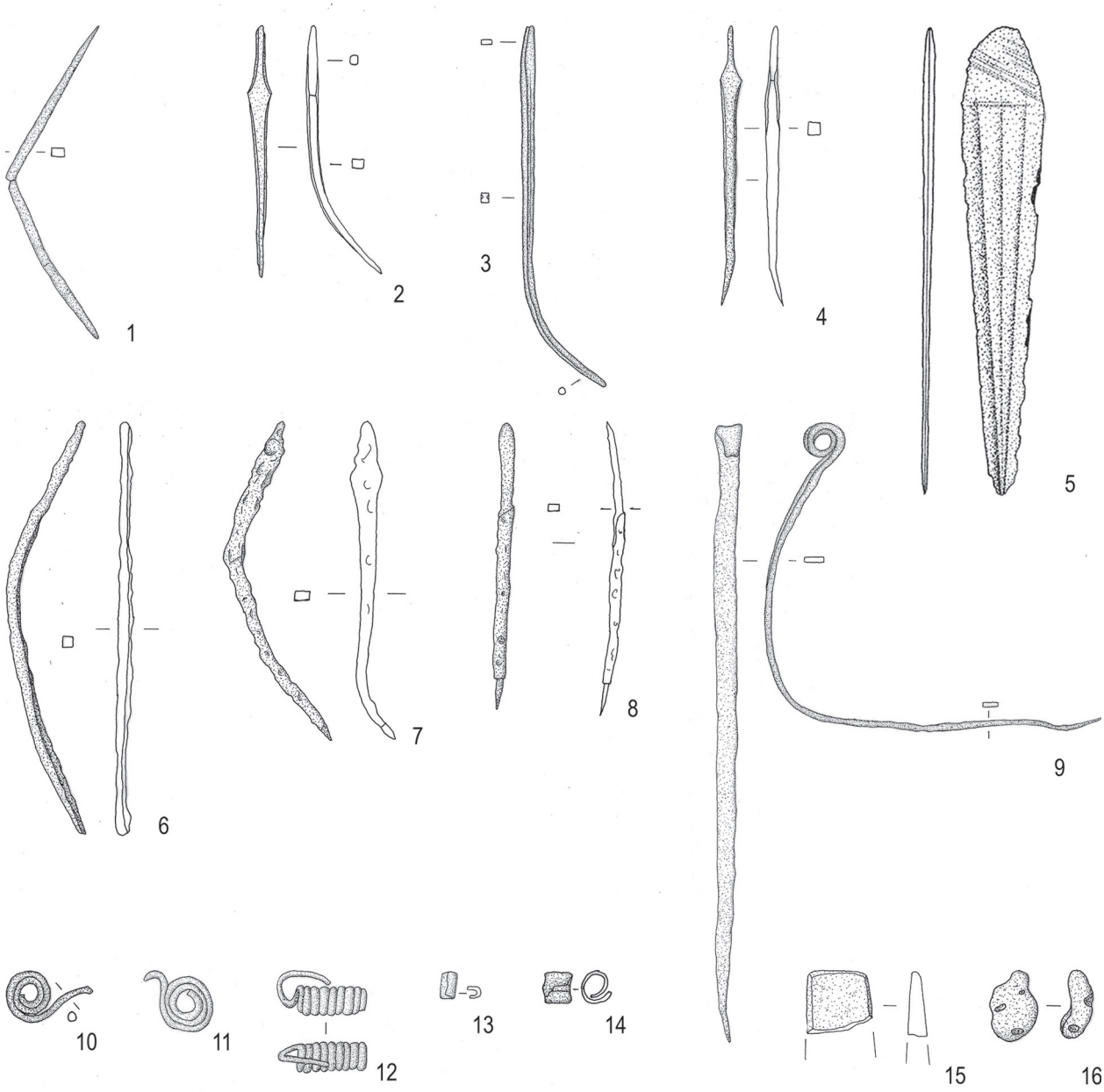

Figure 8: Pigloner Kopf: The copper awls, dagger and ornaments. Scale 1:2 (drawings by H. Oberrauch)

Conclusion

The site Pigloner Kopf shows clear evidence that the Bell Beaker people were involved in rituals with burnt offerings of animals and copper deposits. We can therefore suggest that the ritual behaviour was related to the fire cult. It seems to be the beginning of the alpine worship places of burnt offerings, known from early/middle Bronze Age until the late Roman Empire (1800 BC – 400 AD), but seem to begin even earlier around 2500 BC. The main criteria of the alpine burning sanctuaries (Steiner, 2010) are a natural, exposed archaeological site, thick charcoal layers containing calcinated animal bones, the absence of human bones, fragmented domestic pottery, metal votive offerings, food offerings (cereals, fruits) and a long period of occupation (up to 2000 years). A form of dis-continuity of offerings at the site Pigloner Kopf is proved by the depositions of an iron age Drago-fibula (6th century BC) and a small trove of 7 Roman silver coins from the 2nd-3rd century AD (Oberrauch, 2002). The presence of hoards from different periods, the burnt offerings of animal bones, flint and smashed pottery in association with the geothermal phenomenon of the so called 'warm holes' on the Pigloner Kopf suggest a ritual interpretation of the site (Dal Ri et al 2005). The interpretation of the miniaturised unemployable copper axes as ingots is based on their chemical (almost pure local copper) and isotopical analysis (they have all the same southalpine provenance), on their distribution in the Eastern Alps

(transalpine export), on their archaeological context (they were found often in hoards and near rock towers) and on the observation that they are not finished and employable objects. The shaft-hole axes of the Fresach type were compared to the small axes made of electron, which make part of the Persinari hoard from Romania (Neumann 2015).

The ritual influences of the sanctuaries with burnt offerings could have arrived from the Mediterranean islands and Greece, where some sanctuaries can be dated to the late Neolithic period, like the one on Mt. Lykaion (Starkovich et al, 2013; Romano and Voyatzis 2014). Fire is the central element for metal production and for the rituals that are connected to burnt offerings. Copper axes as trading ingots could also be used as offerings. The Bell Beaker culture is not linked to the phenomenon of hoard finds, mostly known from eastern Europe, but there is also some rare evidence in western Europe, where Palmela points or axes were found in hoards (Hansen, 2019).

Prehistoric metallurgy was not a profane activity, but it was often associated with rituals connected to mining and smelting of the copper ores (Eliade, 1980) and probably also to the casting of copper. Fire is the linking element between metallurgy and burnt offerings and both activities were practised at the rock sanctuary Pigloner Kopf, where a portion of the copper products were offered in burning rituals during the Bell Beaker period.

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