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Milena Gošić

Archaeological Division
Ben-Gurion University of the Negev
mgosic@post.bgu.ac.il

Skeuomorphism, Boundary Objects and Socialization of the Chalcolithic Metallurgy in the Southern Levant*

Abstract: Metalworking emerged in the southern Levant as a new ritual practice during the late phase of the Ghassulian culture, ca. 4300–3900 BC. Ghassulian metalworkers cast objects in both pure and alloyed copper. All the artifacts produced during this time span were ritual. The aim of the present paper is to discuss the socialization process of the Ghassulian metallurgy and its copper objects, by using the concepts of skeuomorphism and boundary objects. Ghassulian copper artifacts can be divided into two groups. The first group consists of artifacts, such as maceheads, chisels and axes, which were produced in stone before the Ghassulian metallurgy appeared. The second group consists of artifacts produced only in metal, including scepters, standards, "crowns" and horns, which were decorated by motifs found on various other early and late Ghassulian ritual artifacts. The artifacts of the first group are skeuomorphic objects, the morphology of which was widely recognized in early and late Ghassulian contexts. These were boundary objects, belonging both to the realm of the new social world of metallurgy and the preexisting world of Ghassulian ritual behavior. Their purpose was to introduce metallurgy to people, both in the Beer Sheva settlements and in other parts of the southern Levant, who did not practice it, as a technology firmly rooted in the Ghassulian tradition. The second group consists of more innovative objects that demonstrated the transformational potential of metallurgy and the superior control metalworkers had over the material world.

Keywords: Ghassulian culture, Levant, Chalcolithic metallurgy, ritual, skeuomorphism, boundary objects, socialization

The Ghassulian culture, named after the site of Teleilat Ghassul (Neuville 1930), emerged in the mid–5th millennium BC and lasted roughly till the end of the millennium (Gilead 2011, 14). The sites are widely distributed throughout the Northern Negev, the Dead Sea basin, the southern and the central Coastal

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Plain, the Shephella and the Jordan Valley (Gilead 2011, 13, Rowan and Golden 2009). The Ghassulian culture is the best documented Chalcolithic entity in the southern Levant. Also, considering that there is no evidence for metallurgy in either the Besorian, a predecessor of the Ghassulian (Gilead 2007), or in the roughly contemporary Timnian (Rosen 2011, Rothenberg and Glass 1992) and the Golanian (Epstein 1998) cultures, the Ghassulian culture is not only the first Levantine metallurgical culture, but also the only one during the Chalcolithic period. The Ghassulian sites and assemblages have been extensively studied since the late 1920s and are relatively well known (e.g. Bourke *et al*. 2001, Elliott 1977, Gilead 1988; 1993; 2011, Levy 1986, Rowan and Golden 2009). The most prominent features of the Ghassulian culture are underground and surface architecture, pottery vessels such as churns, cornets, hole-mouth jars and V-shaped bowls, flint tools such as bifacials and sickle blades, bone tools, the ground stone industry, ivory carving and, above all, the copper metallurgy which is the center of the discussion below.

The focus of the present paper rests on Ghassulian metalworking, which has been researched extensively. Smelting and production of copper artifacts have been studied from the technological and socio-economic aspects (Golden 2009a, Golden, Levy, and Hauptmann 2001, Goren 2008, Levy and Shalev 1989, Shugar 2000; 2001; 2003, Tadmor *et al*. 1995), while finished artifacts have been the subject of symbolic and stylistic analyses (e.g. Bar-Adon 1980, Beck 1989, Golden 2009b, Goren 2008, Ilani and Rosenfeld 1994, Merhav 1993, Moorey 1988, Tadmor 1989). However, the research on ritual aspects of Ghassulian metalworking is only starting to emerge (Gošić and Gilead 2015). My intention here is to examine how copper metallurgy was socialized, or, in other words, incorporated into the Ghassulian society.

Ghassulian Metallurgy: A Chronological Perspective

In order to discuss social integration of metallurgy in the Ghassulian culture, it is essential to understand its internal chronology and the place of metallurgy within it. Chronologically, the Ghassulian may be divided into two phases. The earlier phase consists of the bulk of the Ghassulian strata at Teleilat Ghassul, and of sites in the north-western Negev such as Gilat, a few of the Nahal Besor sites and Grar. This phase is radiometrically dated to about cal. 4500–4300/4200 BC. It is followed by a later Ghassulian phase, *ca*. cal. 4300/4200–3900 BC, which is best represented by sites along the Nahal Beer Sheva, such as Abu Matar, Bir es-Safadi, Horvat Beter and Shiqmim (Gilead 2011, 20). Extensive remains of metallurgical activities have been excavated at these sites (Eldar and Baumgarten 1985, Perrot 1955, Shalev and Northover 1987, Shugar 2000), including smelting furnaces, crucible fragments, large amounts of slag, etc., as well as copper artifacts.

Metallurgical finds are completely absent from the early Ghassulian sites. It has even been suggested to label this phase "*Premetallic*" (Golden 2009a, 47). Although copper maceheads are mentioned in the initial paper on Gilat (Alon 1977, 64), it was likely a mistake as it is never mentioned in the subsequent papers (e.g. Alon 1990, Alon and Levy 1989, Joffe, Dessel, and Hallote 2001, Yellin, Levy, and Rowan 1996) or in the final report (Levy 2006). Also, hematite maceheads are found at Gilat (Rowan *et al*. 2006, 590). Considering the similarity in the appearance of maceheads made of hematite and alloyed copper (cf. Bar-Adon 1980, 120), it is possible that those pieces are the source of confusion. Radiometrically and culturally Gilat is early Ghassulian (Gilead 2011, 20). The issue of copper artifacts found at Teleilat Ghassul is more complicated as it is certain that the excavations during the 1920's and 1930's yielded eight awls, a fishhook, a pure copper axe head and an additional bronze axe (Mallon, Koeppel, and Neuville 1934). However, both Golden (1998, 55) and Shugar (2000, 66) question whether the metallographic analysis conducted during 1930s was accurate. It seems highly unlikely that copper was processed at the site, as the extensive excavations there never provided any clue of copper working. Notably, the copper objects from Teleilat Ghassul are significantly different from those of the northern Negev. Golden (1998, 111–112) even suggests that Teleilat Ghassul copper artifacts were imported before the Ghassulian metallurgy fully developed. A single copper awl has been found in a late sixth millennium context at Tel Tsaf (Garfinkel *et al*. 2014), suggesting that, centuries prior to the local introduction of metallurgy, there was some contact with metal artifacts, albeit very limited. Although the context of the Teleilat Ghassul artifacts is not dated with certainty, it is plausible that there is some relation between those artifacts and the awl from Tel Tsaf. Most layers at Teleilat Ghassul date to the early Ghassulian (Gilead 2011, 20), but the possibility that there are remnants of an ephemeral late Ghassulian settlement cannot be excluded. That both Gilat and Teleilat Ghassul are *premetallic* becomes more convincing when the sites are compared to the late Ghassulian sites in the Nahal Beer Sheva that feature abundant metallurgical remains, including smelting and casting debris, as well as finished copper artifacts that are described below in more detail.

The distribution of Ghassulian copper artifacts also supports the division into an earlier pre-metallurgical and later metallurgical phase of the culture, excluding the possibility that copper artifacts were imported during the earlier phase and that only production of copper is unique to the later phase. Apart from the production sites already mentioned, copper artifacts have been found at Givat ha'Oranim (Namdar *et al*. 2004), which is dated to the later phase (Carmi and Boaretto 2004), as well as from several burial caves, including Nahal Qanah (Gopher and Tsuk 1996), Peqi'in (Gal, Shalem, and Smithline 2011), Palmahim (Gophna and Lifshitz 1980).

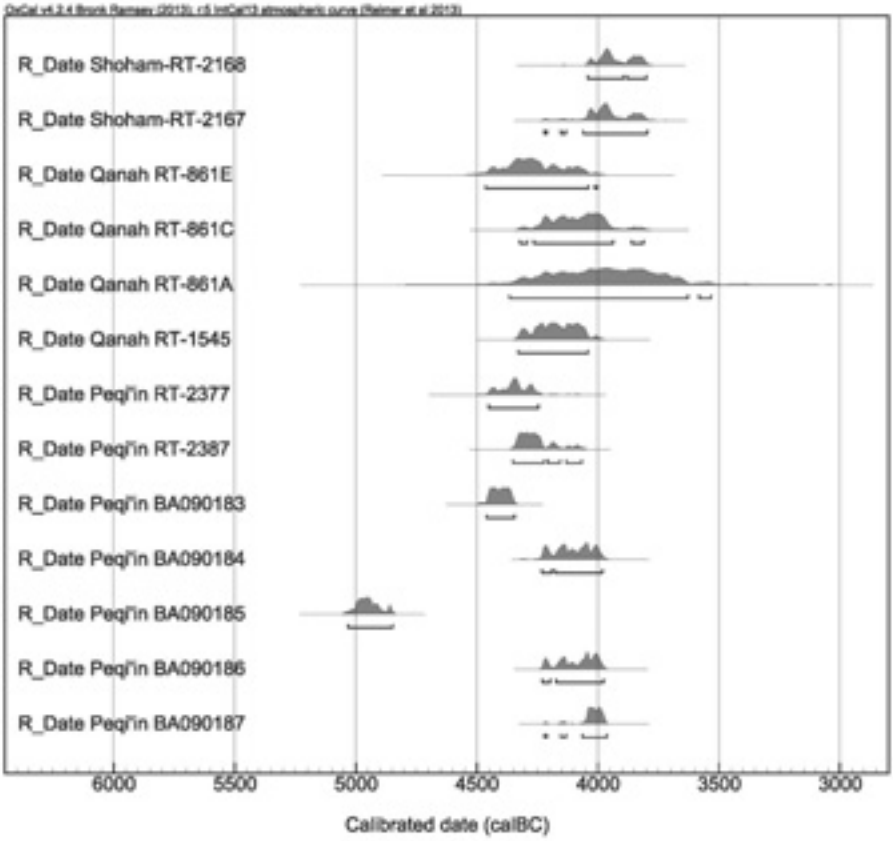

Fig. 1. Calibrated ^{14}C dates from Ghassulian burial caves. OxCal Version 4.2.4.

Radiometric dates from Ghassulian secondary burial sites are still few (Fig. 1). Currently, ^{14}C dates are published only for Shoham (North) (Carmi and Segal 2005), Nahal Qanah (Carmi 1996) and Peqi'in (Segal *et al*. 1998, Shalem, Gal, and Smithline 2013, 413–415). The two Shoham (North) dates fall neatly into the late Ghassulian culture and their average ranges (72.8%) is 4042–3930 cal. BC (all calibrations are based on Bronk Ramsey, Scott, and van der Plicht 2013, Reimer *et al*. 2013). Almost of an identical range are the unpublished dates from the Horvat Qarqar South cemetery in the southern Shephella. The four dates from this site in a 2-sigma range (70.3%) fall between 4076 and 3975 cal. BC (Fabian, personal communication).

Five dates are available from the Nahal Qanah "passage" (Carmi 1996, 206) in which the gold/electrum and other Ghassulian metal artifacts were unearthed (RT–861A, B, C, E and RT–1545). However, one of them, RT–861B, which is centuries earlier, is said to be indicative of another episode of use of the cave (Carmi 1996, 206) and is thus not discussed within a Ghassulian context. The

ranges of the four dates from the "passage" probably represent more than one occupational event, but they mainly indicate a late Ghassulian use of the cave.

Once we remove the clear outliner date (BA090185), the seven ^{14}C dates from the burial phase at Peqi'in (Shalem, Gal, and Smithline 2013, 413–414) seem to indicate that the cave was used as a burial ground throughout the early and the late phase of the Ghassulian culture. However, while the first two dates (RT–2377 and RT–2387) come from charcoal samples, the remaining dates come from human remains and three out of four of them are clearly from the late Ghassulian phase. Since the dates of all the other burial caves clearly indicate a late Ghassulian use, the possibility that the main burial phase at Peqi'in is late Ghassulian cannot be excluded (Gošić and Gilead 2015, 163–164).

Finally, the largest assemblage of Ghassulian copper artifacts comes from the Nahal Mishmar hoard (Bar-Adon 1980). The 13 radiometric determinations are available from the hoard, mostly from the matt in which the objects were found. Considering that some of the dated samples are of questionable quality and that all the available dates spread over more than two thousand years, the hoard cannot be dated with absolute certainty. However, it seems most probable that it should be dated to the later phase of the Ghassulian culture (Gilead and Gošić 2014, 20).

It is clear that metallurgy appears during the later phase of the Ghassulian culture. While there are other changes that happen between the two phases, some of which are mentioned above (such as the establishment of new settlements and abandonment of old ones, or the appearance of secondary burial practices in caves), there is a clear continuity between the two phases (Gilead 2009, 349). This continuity is also reflected in research on Ghassulian social organization and symbolism. Several authors (Epstein 1978, Levy 1995, Rowan and Golden 2009), for example, discuss these aspects for the entire Ghassulian time-span, without mentioning either phases of the culture, or its internal chronology. Once we consider this strong continuity on the one hand, and the fact that metallurgy was introduced only in the later phase on the other hand, it becomes obvious that the technological innovation of metallurgy was accompanied by a process of its socialization within the existing social context. The metallurgy needed to be incorporated into the Ghassulian society and, in return, it changed some aspects of it.

Technology and Iconography of Ghassulian Metal Artifacts

Ghassulian metalworkers practiced two distinct casting technologies: open mold and lost wax casting. The process of copper smelting and open mold casting is best documented at Abu Matar (Golden 2009a, Shugar 2000) and Shiqmim (Golden, Levy, and Hauptmann 2001, Shalev and Northover 1987). Evidence

of both smelting and casting is scattered in numerous loci across these sites. At Abu Matar, archaeometallurgical debris has been documented in numerous units (Gilead, Rosen, and Fabian 1992, Perrot 1955, 25, 29, 33–34, 79), few of which are defined as workshops (Golden 2009a, 126, Shugar 2000, 244–252). Ore, slag, crucible fragments and finished artifacts, were also spread out over the entire excavated area of Shiqmim (Shalev and Northover 1987, 366), where another smelting furnace has been excavated as well (Golden, Levy, and Hauptmann 2001, 956).

Ghassulian metalworkers casted objects in pure copper and in complex metals. Complex metals, in the case of Ghassulian metallurgy, are alloys of copper with various amounts of arsenic, antimony and nickel (Golden 2009a, 3). Pure copper was produced from ore from Feinan, at the Nahal Beer Sheva sites (Hauptmann 1989, Shugar 1998, 114). The provenance of the complex metal ores used for lost wax casting (Shalev and Northover 1993, Tadmor *et al*. 1995) is unknown, although several locations have been suggested, including Anatolia, Caucasus, Iranian Plateau, Sinai and Zagros mountains (Ilani and Rosenfeld 1994, Key 1980, 242, Rothenberg 1991, 7, Tadmor *et al*. 1995, 141–142). Considering that none of these sources could have possibly been the only source of complex metals used in Ghassulian metallurgy, it is probable that ores from different origins were smelted (Shalev and Northover 1993). No ingots have been found so far and the small amorphous lump of arsenic rich metal found at Nahal Qanah resembles a byproduct of production rather than ingot (Golden 2009a, 56). A possible exception is a rectangular object made of copper rich in arsenic, antimony and lead, discovered at Bir es-Safadi (Golden 2009a, 144). Suggested loci of lost wax casting are the Beer Sheva sites (Moorey 1988, 186, Shugar 2000, 216). This is supported by the arsenic detected in the furnace and the crucible slag in Abu Matar (Shugar 2000, 204), the possible ingot from Bir es-Safadi (Golden 2009a, 144) and the finished artifacts (e.g. Eldar and Baumgarten 1985, Namdar *et al*. 2004, Shalev *et al*. 1992, Shalev and Northover 1987). Goren's (2008) recent suggestion that a copper industry operated in the En Gedi shrine or nearby cannot be supported since no metallurgical remains were recovered there.

Ever since the publication of the Nahal Mishmar hoard, the Ghassulian copper artifacts have been divided into two groups: utilitarian and prestigious (Potaszkin and Bar-Avi 1980, 235). According to this division, utilitarian artifacts were cast in open molds from pure copper, and the prestigious ones were cast in the lost wax technique from alloyed metals. The division is not entirely consistent since, in few instances, pure copper was casted using the lost wax technique and vice versa (Key 1980, 239, Moorey 1988, 185). Dividing copper artifacts into prestigious/ritual on the one hand and utilitarian on the other hand, seems even less valid. First, flint tools such as axes and adzes were widely used

during the Ghassulian (Rosen 1997, 93–98, 106). Second, the so called utilitarian copper tools, lack use-wear and are either too thin or too long to be practically used (Tadmor *et al.* 1995, 97). Use-wear analysis of well-preserved copper chisels and axe heads from Giv'at ha-Oranim and one object from the Nahal Mishmar hoard indicate that they were not used for daily tasks (2004, 81–83). In addition, copper artifacts of both groups are found in the same archaeological contexts: already listed production sites, burial caves (Gal, Smithline, and Shalem 1997, 145, Gopher and Tsuk 1996, Gophna and Lifshitz 1980, 8, Perrot and Ladiray 1980, 41, Fig. 142.1, Segal 2002) and in Nahal Mishmar (Bar-Adon 1980, 24–133). In fact, the Nahal Mishmar hoard, with its 423 copper objects, constitutes most of the Ghassulian copper assemblage, which is why most studies, both of technology and style, have been conducted on these objects (e.g. Bar-Adon 1980, Beck 1989, Elliott 1977, Epstein 1978, Gates 1992, Tadmor 1989, Tadmor *et al*. 1995).

Many of the Ghassulian copper artifacts are elaborately decorated with various motifs, including anthropomorphic (e.g. Fig. 2.A), zoomorphic (e.g. Fig. 2.B–C), architectural (e.g. Fig. 2.B.), motifs of tools and weapons (e.g. Fig. 2.C–D), as well as motifs that are considered to be either abstract or floral (e.g. Fig. 2.C) (Gošić and Gilead 2015, 166–168). Anthropomorphic motifs consist mostly of a form of a face with protruding nose, while the most common zoomorphic motifs are ibex horns and birds, though other horned animals are also shown, including goat (Epstein 1978, 29) and antelope (Haas in Bar-Adon 1980, 42). It is not certain which symbols should be considered floral and abstract. Merhav (1993, 35, 41) suggested that the knobs found on several standards (Bar-Adon 1980, 80–85, no. 97–111) are buds and that bubble-shaped projections on one of the standards (Bar-Adon 1980, 48, no. 20) are grafts on a tree. Gilead and I (Gošić and Gilead 2015, 169) suggest that tools and weapons, as parts of the design of standards, constitute the last type of symbols, and that these include mostly chisels and maceheads (Fig. 2.C). Probably the most frequently repeated symbol on standards and scepters is a macehead, which, on its own, is the most common object of the hoard, and the most common Ghassulian copper artifact in general as well. Maceheads on their own are not frequently decorated. However, they are often seen as parts of standards (e.g. Fig. 2.C) and, in those cases, decorative motifs found on them include animals, knobs, spiraling curves, diagonal and horizontal ridges, horizontal lines and protrusions similar to the flaring endings of standards (Bar-Adon 1980, 52–85, no. 24–111). A particularly interesting for further discussion is an axe from the Nahal Mishmar hoard (Fig. 2.D) (Bar-Adon 1980, 112), which stands out in terms of design. The axe features one sharp and one dull edge and a hole for a shaft in its thickest part. Around the hole there is an image of the rope that ties the shaft to the axe, mimicking the way a stone axe was fastened to a handle. It was cast in the

lost wax technique, out of complex metal. This axe is a skeuomorph, an object produced in one material in a way that mimics another material.

The decorative motifs of the Ghassulian copper artifacts resemble decorations of various other early and late Ghassulian ritual artifacts. Ceramic ossuaries offer the greatest variety of analogies. They have been found in numerous burial caves, such as Azor and Ben Shemen (Perrot and Ladiray 1980), Nahal Qanah (Gopher and Tsuk 1996), Peqi'in (Gal, Smithline, and Shalem 1997), and Palmahim (Gophna and Lifshitz 1980). Common motifs on ossuaries include anthropomorphic (Epstein 1978, 29, Plate 6c-d, Gal, Smithline, and Shalem 1997, 149, Fig. 3, Merhav 1993, 33, Fig. 4.5) and zoomorphic motifs (Merhav 1993, 33, Fig. 4.3, Milevski 2002, 138–140) as well as doorways (Epstein 1978, 30, Plate 6d, Gophna and Lifshitz 1980, 3, Fig. 3, Merhav 1993, 33, Fig. 4.3). Motifs found in copper artifacts are also found on pottery vessels other than ossuaries. Representations of ibexes have been found on a crater from Qarqar (Fabian 2012). Two unique bird-shaped vessels have been found at Palmahim (Gophna and Lifshitz 1980, 4–6) and the spread out wings of the birds resemble the so called bird-shaped standard (Bar-Adon 1980, 102). Two birds are also found on a pottery vessel discovered in the northern Negev (Amiran 1986) with a basket handle resembling the handles of the Nahal Mishmar copper jars. A ceramic version of the copper jar is also known from the mortuary site of Kissufim Road (Goren and Fabian 2002, Fig. 4.2). Ceramic figurines with the protruding nose have also been found (Gal, Smithline, and Shalem 1997, 153). "The Gilat Woman" ceramic figurine (Commenge *et al*. 2006, 742–746, Joffe, Dessel, and Hallote 2001) is sitting on an object similar in shape to a copper crown. Ivory figurines (Perrot 1959) discovered in Bir es-Safadi also have the characteristic Ghassulian nose. While the list of iconographical analogies is too long to be presented in detail, it is obvious that Ghassulian copper artifacts exhibit motifs widely present in the repertoire of the Ghassulian ritual.

Skeuomorphism, Boundary objects and Socialization of Technology

Skeuomorps are artifacts, or elements of artifacts, made in certain material in a way that imitates another material (Frieman 2013, 318). Production of skeuomorphs is closely related to technological innovation. It is said that some early pottery was made to resemble basketry and that with the introduction of metal, flint tools were made to mimic the metal ones (Frieman 2013). The explanation for the latter case is a desire to mimic a more prestigious material, i.e. metal, in a more common one, i.e. stone. Considering that in the case of the Ghassulian axe skeuomorph is made in the new, less available material, such explanation is

not satisfactory. The idea that the artifact made in a more prestigious material could be a skeuomorph, which is a copy, is often overlooked (cf. Roberts and Frieman 2012, 34).

One explanation is that skeuomorphs were produced because people were unable, at first, to cope with the new materials and technologies and so they made them appear more similar to what they are already accustomed to (Taylor in Frieman 2013, 319–320). This explanation seems only partial. The extensive casting techniques used by Ghassulian metalworking, including lost wax technique in which many elaborately decorated objects are made, as well as use of pure copper for casting in open or two-part molds and complex metals for lost wax technique (Goren 2008, Shalev 1991), demonstrate that Ghassulian copper workers were well aware of the properties of the materials they were using, and of the methods to process them. It is not that they were technically unable to produce copper axe without the image of ropes. They choose to produce it with them, in a highly sophisticated lost wax technique.

Production of skeuomorphs is, alternatively, connected with sympathetic magic: skeuomorphs are produced in order to take control of the original objects. In his interpretation of skeuomorphs as magical imitations, Knappett (2002, 109) compares them to artifacts such as voodoo dolls, that is, imitations of actual subjects that are to be affected by magical practices. The difference is that, instead of targets being people, in the case of skeuomorphs, the magical effect is directed towards the original products. Such a view of skeuomorphs is closely related to an understanding that objects can be social agents, which means that they have certain power to influence social dynamics (Knappett and Malafouris 2008).

The concept of agency was initially introduced to archaeology as a framework for discussing the role of individual human action on social dynamics (Johnson 2000, 212). Gell (1998, 17–19) insisted that objects can have agency as well. He considers objects to be able to influence – as agents – people and, through them, social structure. Gell (1998, 20–21) makes a distinction between *primary* agency of human social agents and *secondary* social agents – objects. This division emphasizes both hierarchy and interdependence between different agents; while primary agents have the power to act and affect world and society, either intentionally or unintentionally, they do so in a material world – a world of objects. Secondary agents provide a medium for the primary agents to act with. Thus, following both Gell's view on objects as secondary agents and Knappett's view on skeuomorphs, it is possible skeuomorphs were produced in order to, through the actions of people who manipulated them, influence the original object.

Another concept that appears to be of help with understanding the role of skeuomorphs is the concept of *boundary objects*, which is essential for tackling

the issue of socialization of objects and technologies. The concept was introduced by Star and Griesemer (1989) who make use of it as a conceptual framework for organizing and managing museum collections. They define boundary objects as objects that occupy several intersecting social worlds in which their meaning might vary (Star and Griesemer 1989, 393). Yet, the structure of such objects is recognizable across these social worlds, which grants them the ability to act as a form of translator between those worlds. Boundary objects are concrete objects, but they represent several abstract concepts which they translate across social worlds (Star and Griesemer 1989, 408). Thus, each social world dominates certain aspects of objects, while the object, on the whole, becomes a ground on which those worlds are negotiated (Star and Griesemer 1989, 412). Since its introduction in 1989, the concept of boundary objects has been used extensively in various disciplines (Trompette and Vinck 2009), including the roles that flint and metal daggers had in the introduction and socialization of metallurgy in northern Europe over a time span of two millennia (Frieman 2012).

Frieman (2012) discusses skeuomorphs and boundary objects in regards to flint and bronze daggers from 4000 to 1500 BC, with emphasis on fishtail flint daggers and metal-hilted daggers of the early second millennium BC, and their role in introduction of metallurgy across Northern Europe. While it has become customary to interpret the flint daggers as skeuomorphs of the metal ones (see in Frieman 2012, 441), Frieman (2012, 454) argues that flint and metal daggers were symbols of newness and innovation, without the former being a copy of the latter. Frieman (2012, 451–452) emphasizes that the innovation seen in design of flint daggers is rooted in, and developed out of, the local flint knapping technology. All daggers should be regarded as boundary object between societies that adopted metallurgy and those who did not. They did so by sharing the common "dagger idea," which, according to Frieman (2012, 455) means they shared a same technological background of being innovative objects made of precious material in specialized and standardized manner. Thus, in Neolithic Northern Europe, daggers communicated the idea of innovation and specialization of production. They were used in different cultures, by different people and in various manners, yet they were recognizable across these contexts as daggers. Using objects of similar design, even if produced in different material, had a purpose of connecting different cultures and easing the tensions between them, and, even though it might have not been intentional to produce daggers for such purpose, this is why they became so intensively produced and utilized (Frieman 2012, 458).

There are several differences between Frieman's case of daggers as boundary object and the case of boundary objects in Ghassulian metallurgy: she discusses the daggers as objects connecting between various cultures, during long time spans, while the present paper discusses the case of the Ghassulian culture and role the of boundary objects within it. More specifically, it discusses the

role of boundary objects in the socialization of metallurgy both within the communities that practiced it, as well as in the wider sphere of the late Ghassulian, as at some of the sites, such as Giv'at ha-Oranim, only the finished artifacts are found, with no production remains. Also, metal artifacts were found as far north as the Upper Galilee (Shalem, Gal, and Smithline 2013), making it likely that communities north of Beer Sheva were aware of their new technology. This means that it was not socialized only in the Beer Sheva sites, but also in other areas, still comparatively small compared to Northern Europe. Also, she regards daggers produced in both flint and stone to be boundary objects, while in the case of the Ghassulian, and for reasons discussed further below, only metal artifacts are regarded as such. However, shared by both is the role of boundary objects in facilitating the integration of metallurgy in societies, a process I call socialization of metallurgy, or, more generally, of technology.

Socialization of technology means the processes that enable the integration of a new technology into the social fabric. The concept of socialization is generally used to describe the way children are introduced and incorporated into sociocultural system (Clark 2000, 98, Jones 2007, Joyce 2007, Rowlands 2007), as well as to describe how rock art was used in a process of integrating landscapes in societies (e.g. Bender 2000, 207 and references therein, Fontijn 1996). However, studies of socialization of technology are scant and limited to how the use of lithic technology and tools by early hominins was developed and socialized (Carbonell, Mosquera, and Rodríguez 2007, Olivier 1999). Mauss (in Olivier 1999, 181) considered the socialization of technology to be inseparable from the process in which humans learned how to use their bodies and, as such, is not necessarily defined by the use of tools, but can also be expressed through the body. Carbonell, Mosquera, and Rodríguez (2007) discussed the socialization of lithic technology by confronting the ideas of invention of technology as a single cultural event and the invention of technology as a gradual evolution. Siding with the latter, they state that it is necessary for certain time to pass from the moment of a technological invention until it is socialized – fully integrated into the society (Carbonell, Mosquera, and Rodríguez 2007, 233). While the discussion of hominins adoption of technological behavior deals with time spans expressed in hundreds of thousands of years, the present paper aims at discussing socialization of a single technology, i.e. Ghassulian metallurgy, during a comparatively short period of time of late Ghassulian culture (ca. 300–400 years).

Understanding the socialization of specific technologies, such as metallurgy, from the archaeological perspective can be challenging, because most of the material remains we encounter come from stages when metallurgy had already gone through a certain process of socialization and is already established in the society, either in its ritual or practical role. By studying modes and scale of production, for example, researchers actually discuss the way it was practiced and

the impact metallurgy had a on a society once it was adopted (Levy and Shalev 1989, Moorey 1988, Shugar 2003). Similarly, the iconographic studies of metal artifacts (Beck 1989, Epstein 1978), discusses the symbols cast in copper and their relation to Ghassulian symbolic repertoire, without explaining how copper became an adequate material for production of ritual objects.

However, once we accept that time has to pass before an invention is socialized, question remain open regarding processes that drove both the invention and the socialization. Necessity is proverbially regarded to be the mother of all inventions, meaning that technological innovations occur as a response to a specific problem, need or difficult circumstances. However, Rosen (2002) demonstrated that exactly the opposite is the case both in regard to introduction of pottery and metallurgy in the Near East. Regarding the case of Ghassulian copper metallurgy, Rosen (2002, 15–16) points out that, during the Chalcolithic period, metallurgy is used mostly for production of symbolic artifacts, and that its extensive utilization for tool production began only during the Bronze age. Thus, it was not developed because there was a necessity to which the answer was the development of new technology, i.e. metallurgy. Instead, metallurgy was developed, used for symbolic and ritual objects, and only later was its practical application developed. Indeed, practicality of even the simplest of Ghassulian copper artifacts, such as chisels, has been questioned before (Namdar *et al*. 2004, 81–83; Tadmor *et al*. 1995, 97) and Gilead and I (Gošić and Gilead 2015) have shown that all of the Ghassulian artifacts should be regarded as ritual and that the metallurgical practice itself was a ritualized process. Metallurgy was introduced, and socialized, as a new ritual practice. Since we reject the idea that it developed out of a necessity, the social processes behind this technological innovation, and its integration into the society, remain elusive. In the present paper, I will attempt to use concepts of skeuomorphism and boundary objects to explain the role of metal objects in the socialization of metallurgy in the Ghassulian culture.

The Skeuomorphism and Boundary Objects in Ghassulian Metallurgy

I would like to return now to the above mentioned skeuomorphic axe (Fig. 2.D), as it is of crucial importance for understanding the role of skeuomorphs in Ghassulian metallurgy. It is a typical example of a skeuomorph, as the rope is meant only to mimic that type of hafting on a stone axe and has no practical use. However, I would like to propose that the imitation here is not limited to the ropes, which are cast in metal, but that the whole axe is an imitation of a stone axe. Representation of ropes in metal suggests that there was never an intention

to attach it firmly to a handle and use it as an axe, but that it was actually used as one of the many Ghassulian copper standards, displayed on a staff and understood as a symbol. Indeed, I have indicated above that all of the copper artifacts are of symbolic and ritual significance, and this axe is not different. There is a possibility that both this axe and the hammer, also of the Nahal Mishmar hoard (Bar-Adon 1980, 114) are a reference to mining tools used to acquire copper ore, as perforated stone hammers have been found in Feinan in association with Early Bronze age mining (Hauptmann 2007, 149). Obviously, this can only be a suggestion, as no evidence for mining by the Ghassulians has been found, except for the Feinan ore which is abundant at the northern Negev sites (Hauptmann 2000, 168, Shugar 2000, 161).

It also appears that these are not the only Ghassulian copper skeuomorphs. Maceheads, which appear already in the Neolithic and are one of the most typical Ghassulian artifacts (Rosenberg 2010), were produced in stone first. Stone maceheads have been found at both early and late Ghassulian settlement sites (e.g. Bourke *et al*. 2000, 71, Gilead 1989, 388, Hennessy 1969, 21, Perrot 1955, 78, Scheftelowitz 2004, 67), as well as in the Nahal Mishmar hoard (Bar-Adon 1980, 116). Nevertheless, judging by the increase of copper maceheads, as over 240 maceheads have been found at Nahal Mishmar alone (Bar-Adon 1980, 116), copper and complex metals, became the preferred material for their production. It is noteworthy that stone maceheads are un-decorated too, but can, as in Gilat, be made of less common types of stone that is locally unavailable (Rowan *et al*. 2006, 590). Stone maceheads of the earlier period are considered to be ritually significant artifacts (Rowan *et al*. 2006, 585), and the ritual nature of the Ghassulian copper artifacts has already been established (Gošić and Gilead 2015). However, even if stone and copper maceheads belong to the group of ritual artifacts, the copper maceheads can be considered as the skeuomorphs of the stone ones if their ritual use is to mimic the ones made of stone. Several of the maceheads are discoid and one is triangular (Bar-Adon 1980, 96–97) and it is possible that they may be skeuomorphs of perforated flint disks, found mostly in the northern parts of the country, some of which are angular (Rowan and Golden 2009). In addition, Ghassulian copper chisels, known from several sites, all practically unused (see above), were also skeuomorphs of stone tools and one of them (Bar-Adon 1980, 114–115) is even perforated, in order to be hafted to a staff. Skeuomorphic role can also be ascribed to metal jars (Bar-Adon 1980, 108–111).

The purpose of copper artifacts was to demonstrate that metalworkers have acquired power to transform the material world and to produce in this new material all of the relevant social symbols (Gošić and Gilead 2015) and it is possible, following Knappett's understanding of skeuomorphs, that some metal objects were regarded as powerful precisely because of their resemblance to the preexisting stone tools. However, in order to fully understand the social significance

of metal objects in the Ghassulian culture, it is important at this point to emphasize the transformational quality of metalworking and how novel this skill must have been in the Ghassulian cultural context, not only because it was a practice introduced during the time span of the Ghassulian culture, but also because metallurgy itself was a radically new technology. Although pottery and lime-plaster were produced earlier, the transformational aspects of these crafts are neither as striking nor as evident as turning stone/earth into metal. The remarkable transformational quality of metallurgy was a completely new phenomenon. Ghassulian metalworkers, for the first time, gained the power to create a new material – metal. They managed to simultaneously produce different varieties of copper-based metals and find adequate technological solution for their processing. Among other things, they created replicas of objects already existing in another material.

I suggest that the skeuomorphic axe and maceheads facilitated the socialization of the Ghassulian metallurgy by being boundary objects. Their skeuomorphic features enable them to exist, and be understandable, in different social worlds and to serve as the mediators between the two. Several features of the axe offer an insight into how it relates to different social worlds and how it was used to link them. The rope-like decorations associate it with stone axes and, more generally, with one of the ways stone tools were attached to a handle. The hole for the handle is not part of this association, as shafted stone tools are not common in the Ghassulian stone tool assemblages, but are a common feature in the copper artifacts, including maceheads, standards, and one hammer and one chisel from the Nahal Mishmar hoard (Bar-Adon 1980, 24–133). In fact the only known shafted stone artifacts are perforated flint disks, found mostly in the north and rarely in the Nahal Beer Sheva sites (Hermon 2008, 30) and maceheads. Either way, the skeuomorphic axe clearly shares features from the social worlds of both newly adopted metal and pre-existing stone, which makes it a perfect object to connect between the two. By producing it, the metalworkers included the flint tools in the repertoire of objects, demonstrating their ability to produce an already familiar form by the new technique and the new raw material, at the same time they gained technological superiority, as no material before metal could be cast and shaped in a similar manner. The case of the maceheads as boundary objects is even simpler, as it is literally the same artifact made in a different material. Simple in form and widespread in the Ghassulian, they were the perfect object to be made of metal in order to present metallurgy as a new, though Ghassulian, practice. The variety of skeuomorphic forms and especially the inclusion of the discoid shape not typical of the Beer Sheva area further demonstrate that their role was to present metallurgy, through these artifacts, as objects rooted in the Ghassulian cultural tradition.

The role of the remaining metal artifacts, including standards, scepters, "crowns" and horns, existed fully in the metalworking phase of the Ghassulian

culture and are not considered as boundary objects. These artifacts were produced in the metal for the first time. Even though they were decorated in motifs found in other mediums, such as stone, ceramics or ivory, they exhibit greater variety of motif than any of the other mediums show. The types of artifacts are new, which makes it likely that their production was accompanied by a new ritual behavior. Finally, it is through casting of these objects that Ghassulian metalworkers demonstrated all the potential of metallurgy and the control they gained over the transformation of the material world.

Conclusions

Metallurgy was a new ritual activity, but the objects that were produced and their iconography, were deeply rooted in the Ghassulian. Skeuomorphism holds a central place in socialization of Ghassulian metallurgy. Several types of artifacts that were produced in metal, including maceheads that are the most common metal artifacts, have been already produced in stone. The function of the originals, i.e. artifacts produced earlier in other materials, is diverse. They were either used in daily life, as the case of stone axes and chisels, or were themselves part of the Ghassulian ritual life before and after the introduction of metallurgy. Ghassulian metalworkers chose to socialize metallurgy by using it for producing ritual objects that can be divided into two groups. The first group consists of the skeuomorphic objects, the morphology of which and, at least in case of maceheads, ritual significance, were widely recognized in either early or late Ghassulian contexts. The purpose of these objects was to introduce metallurgy to the members of the Ghassulian population that did not participate in it, both in the Beer Sheva settlements and in other areas. They were boundary objects, belonging both to the realm of the new social world of metallurgy and the preexisting world of Ghassulian ritual behavior. The second group consists of more innovative objects, such as standards, crowns and scepters, decorated in symbols already familiar to the Ghassulians, but different and original enough to demonstrate all of the possibilities of the technology and the superior control metalworkers had over the material world. Whether some or all of the metal artifacts were used in sympathetic magic remains unclear. However, it is certain that their appearance in the late Ghassulian was a dramatic change that necessitated socialization, which eventually led to adaptation of metallurgy for production of everyday tools in later periods. Socialization of metallurgy was a dialectic process and, as metallurgy was shaped by those who practiced it and others who observed it, the Ghassulian society was also altered. It seems that at least some of the changes that happened between the early and the late phases of the culture are related to the rise of the sites in the Nahal Beer Sheva area, which signify the introduction of metallurgy.

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Milena Gošić
Odeljenje za arheologiju
Ben-Gurion Univerzitet u Negevu

Skeumorfizam, liminalni predmeti i socijalizacija halkolitske metalurgije južnog Levanta

Metalurgija se na južnom Levantu javlja, kao nova ritualna praksa, tokom kasne faze Gasulske kulture, ca. 4300–3900 g. p. n. e. Gasulski metalurzi su izrađivali predmete od čistog i legiranog bakra. Svi predmeti proizvedeni tokom ovog perioda bili su od ritualnog značaja. Rad teži razumevanju procesa socijalizacije gasulske metalurgije i uloge koju su metalni predmeti imali u njemu, kroz korišćenje koncepata skeumorfizma i liminalnih predmeta. Gasulske bakarne predmete možemo podeliti u dve grupe. Prvu grupu sačinjavaju predmeti, poput glava buzdovana, dleta i sekira, koji su pre pojave metalurgije proizvođeni od kamena. Drugu grupu čine predmeti proizvođeni samo od metala, kao što su standarde, skiptri, „krune" i posude u obliku roga, koji su dekorisani motivima prisutnim na ritualnim predmetima kako rane, tako i kasne faze Gasulske kulture. Predmeti prve grupe su skeumorfi, odnosno replike predmeta izrađenih od kamena, što ih je činilo prepoznatljivim u širem kontekstu Gasulske kulture. Imali su ulogu liminalnih predmeta, koji istovremeno pripadaju novostvorenoj društvenoj sferi metalurgije i ranije ustanovljenoj sferi gasulskih ritualnih praksi. Njihova uloga ogledala se u predstavljanju metalurgije, kao tehnologije koja je nastala na tekovinama Gasulske kulture, onom delu populacije, kako u oblasti Beršebe tako i u drugim delovima južnog Levanta, koji nije neposredno učestvovao u samom metalurškom procesu. Predmeti druge grupe imali su za cilj da, inovativnošću iskazanom koliko kroz materijal, toliko i kroz dizajn,

prikažu transformativni potencijal metalurgije i superiornu kontrolu koju su metalurzi ostvarili nad materijalnim svetom.

Ključne reči: Gasulska kultura, Levant, halkolitska metalurgija, rituali, skeumorfizam, liminalni predmeti, socijalizacija

Skeumorphisme, objets liminaux et socialisation de la metallurgie chalcolithique du Levant du sud

La métallurgie apparaît au Levant du sud comme une pratique rituelle nouvelle au cours de la phase tardive de la culture Gasul, env. 4300–3900 av.J.C. Les métallurges Gasul fabriquaient des objets de cuivre pur et allié. Tous les objets fabriqués au cours de cette période avaient une importance rituelle. Cette étude s'efforce de comprendre le processus de socialisation de la métallurgie gasul et du rôle que les objets de métal y avaient, à travers l'utilisation des concepts de skeumorphisme et des objets liminaux. Nous pouvons diviser les objets Gasul de cuivre en deux groupes. Le premier groupe est constitué par les objets, comme des têtes de masses d'armes, ciseaux et haches, qui avant l'apparition de la métallurgie étaient fabriqués en pierre. Dans le deuxième groupe se trouvent les objets produits uniquement en métal, comme par exemple les sceptres, „couronnes" et récipients en forme de corne, décorés par des motifs présents sur des objets rituels de la phase ancienne aussi bien que la phase tardive de la culture Gasul. Les objets du premier groupe sont des skeumorphes, c'est-à-dire des répliques des objets fabriqués en pierre, ce qui les rendait reconnaissables dans le contexte plus large de la culture Gasul. Ils avaient le rôle des objets liminaux, qui appartiennent en même temps à la sphère sociale nouvellement créée de la métallurgie et à la sphère auparavant établie des pratiques rituelles gasul. Leur rôle était de présenter la métallurgie comme une technologie qui tire ses origines des productions de la culture Gasul, dans cette tranche de la population qui, aussi bien dans la région de Bersabée que dans d'autres parties du Levant du sud, ne prenait pas directement part au processus métallurgique lui-même. Les objets du deuxième groupe avaient pour objectif de présenter, par l'innovation exprimée aussi bien à travers le matériel qu'à travers le design, le potentiel transformatif de la métallurgie et le contrôle supérieur que les métallurges ont accompli sur le monde matériel.

Mots clés: culture Gasul, Levant, métallurgie chalcolitique, rituels, skeumorphisme, objets liminaux, socialisation

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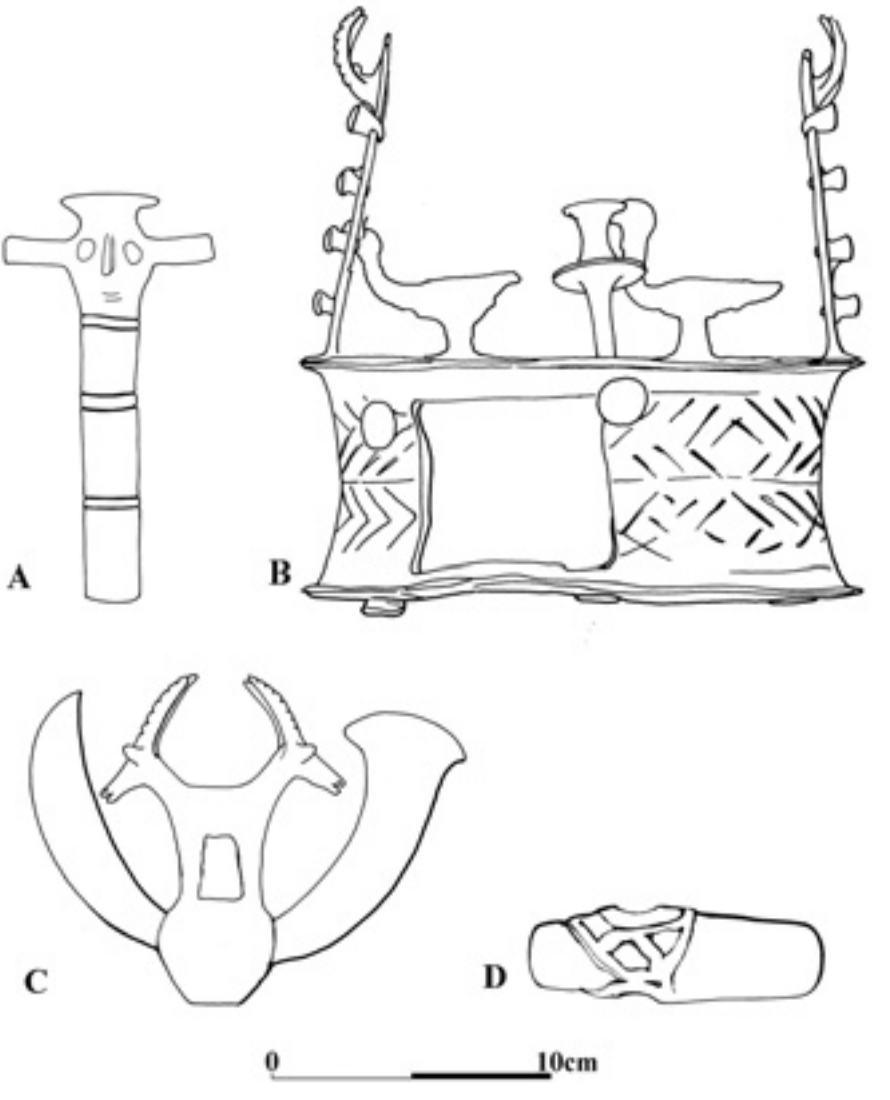

Fig. 2. Selected Ghassulian copper artifacts: A. anthropomorphic standard (after Bar-Adon 1980, 49, no. 21), B. "crown" featuring architectural and zoomorphic motifs (after Bar-Adon 1980, 28, no. 7), C. standard featuring ibexes and motifs of tools (after Bar-Adon 1980, 100, no. 153), D. skeuomorphic axe (after Bar-Adon 1980, 112, no. 163).