



**Citation:** Alberghina, D.M. (2023). Smelting Metals, Enacting Rituals. The Interplay of Religious Symbolisms and Metallurgical Practices in the Ancient Eastern Mediterranean. *Asia Anteriore Antica. Journal of Ancient Near Eastern Cultures* 5: 3-22. doi: 10.36253/asiana-2134

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**Data Availability Statement:** All relevant data are within the paper and its Supporting Information files.

**Competing Interests:** The Author(s) declare(s) no conflict of interest.

## Smelting Metals, Enacting Rituals. The Interplay of Religious Symbolisms and Metallurgical Practices in the Ancient Eastern Mediterranean

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**Abstract.** The archaeological discourse on the development of metallurgy in Anatolia, the Levant and, more generally, the Eastern Mediterranean region has extensively focused on crucial aspects such as procurement routes, technological developments, manufacturing strategies, and socio-economic connotations of metal consumption. On the other hand, potential symbolic and ritualistic aspects permeating mining and metal-making activities have rarely been taken into consideration, largely due to the ephemerality of such traditions and practices in the material record. Extensive studies have analyzed the ritual dimensions of iron and copper metalworking across different belief systems and social structures, from pre-industrial sub-Saharan Africa to pre-classical Andean cultures, from Bronze Age Central Europe to China. Drawing on the contemporary anthropological and archaeological debate on the subject, this contribution identifies and analyzes recurrent semantics of ritualization in metalworking processes, looking at different lines of epigraphic and material evidence from the Chalcolithic and Bronze Age Eastern Mediterranean. The aim is to discuss patterns of correlation between belief systems, ritual behavior, and socioeconomic organizations and to prompt more comprehensive analyses on the complementary technological and symbolic aspects of ancient metallurgical practices.

**Keywords:** Late Chalcolithic, Bronze Age, metallurgy, ritual production, craft, technological systems, Near Eastern Archaeology, Eastern Mediterranean, religious symbolism.

### 1. INTRODUCTION

Discussion on the technological and socio-economic facets of metal production has occupied a central position in the archaeological debates on the development of Near Eastern societies, especially with the maturation of extractive and smelting metallurgy during the Late Chalcolithic and Bronze Age phases (i.e., mid-5<sup>th</sup> millennium to late 2<sup>nd</sup> millennium BC).

Concepts such as procurement networks and transfer of knowledge, technological experimentation, and modes of production all play a pivotal role in broader analyses of the interdependence between metallurgical development and wider socio-political and cultural phenomena (Di Nocera 2010; Brysbaert 2011; Lehner and Yener 2014). Similarly, the study of ritual behaviors and belief systems has also been integrated in the investigation of complementary aspects of social organization, political centralization, cultural hybridity, and resilience. Religious and ritual ideologies are complex and dynamic, constantly evolving in connection to changes in the contemporary sociopolitical and cultural *milieus*. When looking, for instance, at the gradual and non-linear processes of increasing social complexity and economic diversification that characterized the ancient Near East throughout the Chalcolithic period, important shifts in ritual foci (from communal to private, central to dispersed, architectural-based to object-based) become evident at various scales (Hackley, Yıldırım and Steadman 2021). Subsequently, the alternating cycles of political centralization and social competition observed from the first spread of urbanism in the 4th millennium BC, through the rise of city-states and regional states in the Early Bronze Age (hereafter EBA), to the establishment of complex, supra-regional political entities during the Middle and Late Bronze Age (hereafter MBA and LBA) triggered crucial changes in the ways cosmogonies, mythological traditions, and ritual practices were used to regulate status, mitigate conflict, and invest natural and anthropogenic landscapes with new meanings (Kristiansen and Larsson 2005).

Despite the shared connection with the investigation of socio-economic, cultural, and political facets, archaeometallurgical research and ritual studies are very rarely discussed (let alone pursued) in combination with one another. When the words ‘ritual’ and ‘metals’ appear together is almost always exclusively in the contexts of the usage of metal artifacts and related tools as either ritual paraphernalia or as part of funerary assemblages. Rightly so, the symbolic function of metal objects in burial contexts and hoards has been thoroughly studied under different lens. Far from representing solely a powerful means of social status’ representation, these often embodied pivotal aspects related to the negotiation of ethnic affiliation and identity, economic strategies, cultural changes, and systems of economic and ritual value<sup>1</sup>. The sophisticated metalwork known from EBA funerary contexts in central, north, and southeastern Anatolia well represents this point (Frangipane *et al.* 2001; Dardeniz and Yıldırım 2022). On the other hand, the phenomenon of the so-called ‘smiths’ burials’ is another element bridging the funerary and metallurgical spheres that has caught scholars’ attention. Graves characterized by the presence of tools related to metalworking activities (i.e., casting moulds and crucibles, whetstones, nozzles, ore fragments and metal ingots) are known from disparate regions and periods, from the Chalcolithic and Middle Ages in Central Europe to Bronze Age Cyprus (Schuster-Keswani 2005; Belgiorio 2009). Oftentimes, these have been interpreted as indicators of prestige status and/or affiliation to a distinct social or ethnic class enjoyed by metal specialists, even in the absence of other elements from the socio-cultural contexts the graves refer to (Rowlands 1971; Nessel 2013; Ježek 2015). Indeed, both examples do underline the existence of more than one tie between the ritual sphere and that of metal production, ties that go beyond the spatial association of artifacts and demand a wider discussion of religious systems, economic organizations, and socio-political structures.

In this contribution the adopted focus shifts from object to practice, from the use of metal-made artifacts in ritual contexts to the conferment of ritual symbolisms to metallurgical settings and practices. Building upon long-standing anthropological debates on the subject<sup>2</sup>, the primary aim is to trace ways in which ritual ontologies might

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<sup>1</sup> Among different examples, the increase of metal hoards and metalwork in funerary assemblages across Near Eastern societies during the 4th and 3rd millennia BC has been attentively studied by scholars in terms of the application of diverging systems of ritual and economic value (Stork 2015). Rather than a result of fluctuating access to raw materials and finished products, the deliberate removal of conspicuous quantities of metal from exchange and production networks (via hoarding and burial practices) has been seen as a direct reflection of the symbolic value of metal artifacts to mediate, impose, and/or express wealth and power by emerging elites in comparison to the more controlled investment through similar practices enacted during the MBA and LBA (Bachhuber 2011).

<sup>2</sup> Most ethnographic and anthropological studies on the ritual symbolism of metalworking center around iron and steel-working rather than copper production. The technological and social differences between these manufacturing chains should be accounted for, as they presumably generated different symbolisms and ritual ontologies. Moreover, the comparison of ethnographic and archaeological data requires an added layer of caution. The aim here is not to impose interpretations derived from the first to the latter, but to use



**Fig. 1.** Sites and natural landmarks mentioned in the paper (map by the author).

have pervaded different aspects of ancient metallurgical production, incorporating technological advancements in pre-existing cosmological constructs, and charging them with new meanings related to the broader conceptualizations of social status, political power, gender exclusion, and cultural identity. Through the discussion of different archaeological, iconographic, and textual evidence from the Chalcolithic Levant, Bronze Age Anatolia, Cyprus, the Aegean, and the Balkans, the present analysis proposes criteria for an archaeological understanding of ‘metallurgical rituality’. The intention is to address the validity of theoretical interpretations often applied to ritual semantics and recurrent symbolisms identified across different regions and cultures, and to underline the need for more in-depth methodological and theoretic debates on this ambiguous yet fascinating subject.

## 2. MAKING AND PERFORMING: A DEFINITION OF RITUAL MODES AND SEMANTICS OF PRODUCTION

Archaeological research has often concentrated on the interaction between religious/cosmogonic systems and the cognitive, economic, and socio-political spheres they indirectly display and are constructed upon. In any given society, in fact, ritual behaviors and religious beliefs have represented important mechanisms to assert, negotiate, or

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anthropological observations to prompt questions on aspects potentially embodied by material evidence, which remains the primary base for any conclusion.

challenge political and social structures, of which production systems constitute an integral part<sup>3</sup>. However, when it comes to the study of ancient metallurgy, the potential interplay between the ritual sphere and metal-making practices has received scant attention. A practical reason is certainly the difficulty of identifying and interpreting such interplay based solely on epigraphic and archaeological evidence. A more methodological challenge can perhaps be seen in the modern dualistic view that strictly separates the domain of technology and economic/utilitarian production from that of ritual behaviors and belief systems (Gaukroger 2006; Gosden 2012).

The ‘rational’ side of rituality (i.e., its role in regulating social interactions) and the ‘irrational’ aspects of economic production (i.e., not always obeying rules of profit and practicality) have long been long acknowledged in the anthropological discourse thanks to the pioneering work of scholars like Bronisław K. Malinowski and Alfred Gell (Gell 1988). Their work has helped challenging old views that saw magic/religion and science/technology at the opposite ends of a linear scale of human progress, proposing alternative frameworks where these spheres co-exist and overlap<sup>4</sup> (Budd and Taylor 1995; Radivojević and Rehren 2016). This aspect becomes extremely relevant when it comes to the study of ancient metallurgical processes. It is easy, in fact, to fall into the trap of simplistic views that focus only on the rational, practical, ‘trial and error’ factors boosting technological changes and overlook complementary sensorial, ritualistic, and socio-cultural aspects (Kuijpers 2018). But how to define an approach that combines both? What terminology can be used to address the possible ritualistic significance of production systems, more generally, and metallurgical processes specifically?

A first suggestion would be to distinguish between what modern economists and anthropologists define as ‘economics of ritual’ and ‘rituals of economy’ (McCleary and Barro 2006; Watanabe 2007). While the first term describes all manufacturing processes necessary to enact specific rites (from surplus production linked to feasting activities to the making of votive objects and paraphernalia), the latter addresses the adoption of religious symbolism and ritual behavior to structure specialized craft production, and to control social interactions between production units and the society they are part of (Miller 2015; Costin 2001). Archaeological research has explored in detail examples of the first, often addressed in academic literature as ‘ritual modes of production’ (Spielmann 2002). It is the second concept, here addressed as ‘ritual semantics of production’, that the next sections will apply to the analysis of ancient metallurgical practices.

Given the complex networks and many levels of symbolism hiding behind this topic, it is rather challenging to present data in a clear, organized form. The most forgiving way appears to be one which follows the primary and secondary technical stages of metal-making practice from mining to smelting, metal refining, and consumption. Different ritual ontologies will be discussed in light of their potential social and cultural significance, identifying the means (objects, people, and settings) through which they manifest, and the symbolic meanings they potentially carry forward.

### 3. VIOLATION AND PROCREATION: RITUAL ONTOLOGIES IN METAL MINING

Despite the danger of generalization threatening any holistic discussion on the degrees of symbolism related to metallurgical activities across time and space, striking recurring elements can be recognized across differently structured cultures and societies. One of them is certainly the presence of gender-based taboos, fertility symbolism, and narratives of violation and atonement associated to mining and primary-processing activities (Eliade 1978; Blakely 2006).

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<sup>3</sup> It is beyond the scope of this contribution to analyze in detail the many theoretic models developed to explore cognitive mechanisms behind the ritualization of behaviors, spaces, and things. The reader is referred to the rich anthropological literature on the subject. See for instance the foundational works of Marcel Mauss (Mauss 1950) and Claude Levi-Strauss (Levi-Strauss 1966), or more recent overviews as those provided by Catherine Bell (Bell 1992) and Olivier Gosselain (Gosselain 2011).

<sup>4</sup> One of the most discussed concepts in the anthropological literature on craft and technological production is that of the ‘enchantment of technology’, which address the interplay of rites and beliefs, aesthetic properties, and functionality in technological manufacture. See Gell 1992.

The basic assumption upon which the engendered nature of metallurgical activities is built is the association of metal deposits and metal-bearing ores with the well-known metaphor of the 'Earthmother' and the image of the 'fertile womb' (Eliade 1978). On one hand, the human alteration of matter and the process of creation enacted during the smelting of ores (i.e., the 'transformation' from stone to metal) plays a pivotal role in the symbolic juxtaposition of primary metallurgical processes and birth (Swenson and Warner 2012). On the other, the interference in the mysterious, sacred rhythms of nature, represents a violation that requires purification rites to be counterbalanced (Rotea *et al.* 2011).

One of the primary ethnographic case-studies upon which scholars have built their observation is that of iron-working pre-Colonial tribes from sub-Saharan Africa (Haaland *et al.* 2002; Gošić and Gilead 2015). Sexual taboos and access restrictions, erotic songs and 'engendered' tools are recurrent elements in cultures well known for their progressive iron making, such as the Tanzanian tribe of the Fipa, the Phoka in Malawi, the Shona in Zimbabwe, and the Yeke in Congo (Childs and Killick 1993). A curious game of female fertility evocation and female exclusion plays a central role in the act of ore processing and smelting through both performative and material elements (Blakely 2006). As those of the other tribes, Fipa's furnaces are gynecomorphic, shaped and/or decorated to represent the female body through incised and plastic decorations representing naval marks, breasts, and the uterus. Stressing this metaphor, the single parts of the furnace are named after female anatomic parts, with tuyeres and bellows associated to phallic symbols. Interestingly, the powerful evocation of female fertility is balanced by precise rules of exclusion concerning female presence during smelting processes. Women are forbidden to participate, and access to open-air smelting areas is strictly prohibited for reasons linked to pollution and interference with the procreative process enacted by male smiths through the furnace (Budd and Taylor 1995). According to anthropologists, gender and age were the two main axes around which metal production was regulated in many sub-Saharan cultures (Childs and Killick 1993). The first, centering around concepts such as female fertility cycles and reproductive powers, was crucial in 'transferring' those powers to a male counterpart through either taboo (i.e., exclusion of women from technological processes) or symbolic appropriation (i.e., use of anthropomorphic tools). The latter, playing with the conceptual pairs of youth/strength, age/wisdom, and ultimately life/death, was crucial in assuring a regulated division of labor and the presence of a defined hierarchy.

When it comes to the study of ancient cultures developing in the Eastern Mediterranean, it becomes extremely difficult to assess the presence of similar ritual beliefs, rites, and traditions applied to mining communities and processes. One can only look at sparse textual references, and scanty material evidence coming from few identified mining sites in order to draw some comparisons.

The association of metal ores with the embryos, and of primary smelting activities with acts of birth, appears (both directly and indirectly) in Sumerian, Hittite, and Neo-Assyrian traditions. Sumerian texts from the Early Dynastic Period (early and mid-3<sup>rd</sup> millennium BC) do contain different epithets for the Mother Goddess Nin-hursag (the Mamma/Mammitum of Assyro-Babylonian tradition), among which that of «URUDU.NAGAR of the land» (translated as 'copper-smelter of the land') appears together with titles associated to protection in child-bearing («Shakumakh», translated as 'exalted midwife'. Dalley 1987). The exact attribution of these epithets to the same female deity has been challenged by other scholars, but even if the criticisms hold true, the attribution of these titles to different goddesses, all listed together and all linked at different levels to female procreation and metal craft, is still an interesting element to consider (Lambert 1991). With reference to LBA Anatolia, Hittite cosmogonic and mythological traditions contain numerous references to mountains as both deified entities and sacred places of worship (Bachvarova 2019). Deified peaks mentioned in Hittite ritual texts count natural landmarks located both in the heartland of the Hittite power (as Erciyes Dağ and Kizildağ) and in 'peripheral' regions (as western Anatolia, with Ak Dağ/Mt. Hargha and Türkmen Dağ/Mt. Suwara worshipped throughout the LBA and Iron Age). Although some of these peaks are located in areas known for a florid metallurgical production during the EBA-MBA<sup>5</sup>, there is no direct evidence of correlation between mining activities and the ritualization of

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<sup>5</sup> As in the case of Mt. Suwara/Turkmen Dag in the modern-day provinces of Kuthaya and Eskisehir (Turkey). See Barjamovic 2011: 359-407; Pernicka *et al.* 2003; Massa, McIlpatrick and Fidan 2017).

mountainous areas until Hurro-Hittite narratives are taken into account. These reveal an interesting interplay of male/female imagery applied to mountains and ‘living rocks’ in light of metallurgical activities as processes of gestation and birth, as well as ejaculation (Bachvarova 2019). It would be tempting to hypothetically link the Hurrian origin of these myths to the importance of the southeastern and eastern regions of Anatolia (especially the Tauride Range) for local and inter-regional networks of metal procurement, but in the absence of more solid evidence this remains highly speculative.

An example that has been widely mentioned and used when discussing fertility-based symbols in association with metal smelting is that of the Neo-Assyrian term «*ku-bu*» (‘embryo, fetus’). According to a diffused interpretation, first and foremost defended by M. Eliade, this term is reportedly used in a series of incantations performed to propitiate metallurgical activities. In these mentions, which list a series of measures spanning from ritual cleansing to restricted access and libations, the ‘embryo’ in question directly refers to a metal-bearing ore placed in the furnace to be roasted and smelted (Eliade 1978). More recent readings of these Neo-Assyrian texts interpret the term in a significantly different way. «*Ku-bu*» appears to be used as the epithet of an underworld deity associated to still-born children and invoked to ensure protection from miscarriages. It is indeed mentioned together with kilns and libations in 7th century BC texts but in the context of glass-making rather than metal smelting (Stol 2000). Although Assyriologists do not exclude that various technological processes, including metallurgy, might have retained connections to the symbolic spheres of death/rebirth and fertility embodied by the metaphorical and literal placement of the «*Ku-bu*» near the furnace, there is no strong material evidence supporting the idea that primary metallurgical activities were directly linked to gendered taboos and metaphors of procreation in the Neo-Assyrian ritual tradition. Findings such as faunal and human neonatal remains in association with metal smelting furnaces, as attested in pre-historic Andean sites, might reinforce such interpretations (Zori 2019). However, to the best of the author’s knowledge, with the exception of bone caches and infant burials found in association to firing installations and floor surfaces in many Neolithic sites across Anatolia and Mesopotamia, direct associations between metal smelting installations and fetal/neonatal remains are not attested at present.

While textual evidence does somehow contain elements for consideration, archaeological evidence is rather scarce and sparse. This does not mean that indicators of ritual behavior, although with no direct connection to the fertility and gendered sphere, are virtually unknown in mining sites across the region of interest. Fragmentary zoomorphic ceramic altars depicting a deer and/or a ram, ritually broken and buried once the mines went in disuse, have been identified at the site of Rudna Glava (present-day Serbia), where copper veins were in use from the mid-5<sup>th</sup> millennium BC. These have been interpreted by excavators as indicators of rites conducted by miners to ensure protection, and to honor an unspecified ‘earth goddess’ (Boric 2009; O’Brien 2015). Animal sacrifices and votive offerings of figurines and Spondylus shells were widespread at prehistoric mining sites in the Andes, where such rites were deemed a necessary payment to supernatural forces to counterbalance the violation perpetrated by miners with the extraction of ores (considered bodily fluids, ‘flesh and blood’ of mountain deities. Zori 2019).

These examples paint quite a complex picture. On one hand, it is not farfetched to envision a scenario where the rhythms of agricultural and mining cycles enforced the application of dichotomies such as life/death, procreation/violation, overground/underground, and wilderness/domestic through enacted rituals and symbolic objects. On the other, the paucity of evidence from investigated mining sites and related first-tier production centers makes it impossible to propose more grounded suggestions on the existence and nature of specific symbolisms connected to primary metallurgical processes.

#### 4. LIMPING GODS AND THE DEMIURGIC POWERS OF METALSMITHS

If certain ritual ontologies appear to be conveyed through artifacts used in metallurgical practices (from metal-bearing minerals and slags to tools), others take shape through myths, demiurgic powers, and sacred knowledge shared by tutelary deities and craftsmen. The presence of gods and goddesses linked to craft activities, more generally, and metallurgy, in the specific, is hardly surprising. Across many Eastern Mediterranean cultures, gods and

semi-gods related to mining and metal production are portrayed in ways that place them closer to mankind, both physically and behaviorally as they often lack the perfection and beauty of other deities when not openly showcasing physical deformities (Dalley 1987; Eliade 1978). The image of the ‘limping god’, famously represented by divine smiths such as the Greek Hephaistos, the Egyptian Ptah, and even the Aztec Tezcatlipoca, can perhaps be interpreted as either a caricatural reflection of the physical appearance commonly characterizing miners and smiths in antiquity, as a symbolic rendition of the ‘brute’ strength potentially associated to mining and metalworking, or simply as a combination of all these factors (Aterman 1999). Of course if one postulates that the high risk of physical injuries and long-term health issues to which miners and smelters were exposed finds a mythological rendition in the figure of the limping gods, it is natural to look for anthropological and paleo-pathological studies on human remains that might corroborate this hypothesis. Data from EBA Jordan and Late Chalcolithic Israel cast some light on this point.

At the site of Wadi Faynan, where the renown Roman mining site of Phaino is located, evidence for the exploitation of copper veins and deposits dates back to the 7<sup>th</sup> millennium BC, with peak exploitation phases during the 3<sup>rd</sup> millennium BC and the Roman Imperial period. Archaeometallurgical evidence attested at the site during the EBA I-II phases indicates a gradual intensification in the local scale of production, with the transition from small-scale crucible smelting to more intensive furnace-smelting of copper-bearing ores conducted within the settlement. Despite the limited exposure to dangerous fumes one can postulate for limited smelting operations, research conducted on human remains from the contemporary funerary contexts points to a different scenario. Analyses targeting copper and lead intake in the skeletons showed enhanced values of heavy metal concentrations in the femoral bones, especially when compared to human remains from sites in the region that were distant from mining and smelting localities<sup>6</sup> (Pyatt *et al.* 2005). A more recent study has targeted lead absorption measured in the tooth enamel of individuals buried in the same EBA necropolis via LA-ICP-MS, confirming not only significant variations between one another but also within different life phases for the same individual, consistent with varying degrees of exposures to lead and arsenic poisoning in connection to metallurgical activities (Dolphin *et al.* 2022). Similar results were produced at the Chalcolithic site of Shiqmim (Israel), where evidence of on-site copper smelting (mainly carried out in secluded courtyards within the settlement) dates to the late 5<sup>th</sup>-early 4<sup>th</sup> millennium BC. Analyses on skeletal remains from the nearby cemetery complex revealed that specific groups of individuals, buried together in stone-lined circular pits, exhibited significantly higher concentrations of arsenic compared to other sampled individuals buried in different contexts (Oakberg, Levy and Smith 2000). In both cases, the results were compatible with the hypothesis of long-term exposure to metal poisoning resulting from mining and smelting activities, and other causes as post-mortem diagenesis (i.e., contamination between the bones and the soil) could be excluded.

Antithetical to these examples, ICP-MS analyses conducted on 90 skeletal remains from the EBA III cemetery of Iziktepe (northern Anatolia) yielded similar results but different interpretations. The concentrations of copper, arsenic, and lead registered in femoral bones of male adults were statistically higher than those characterizing infants, children, and female adults, but they also appeared consistent with those of soil samples taken from the respective funerary contexts. The results have thus pushed scholars towards the possibility that post-mortem contamination occurred through diagenetic intake (Özdemir, Erdal and Demirci 2010). In other words, the individuals buried at Ikiztepe do not appear to have been connected (or exposed) in any way to prolonged smelting activities, and this does indeed reflect the rest of the archaeological evidence in hand. That is, unlike the aforementioned sites, attested on-site practices at Ikiztepe consisted mainly of alloying, casting, and hammering of metal artifacts. Unlike the miners and smelters buried at Wadi Faynan and Shiqmim, local craftsmen would thus have not been exposed to the same dangers of heavy metal poisoning, at least not to the same extent (Özbal *et al.* 2008). While

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<sup>6</sup> The question of long-term environmental pollution affecting mining and metal-working regions in pre-industrial eras plays also a crucial role in the understanding of the cultural and economic impact metallurgical development had on local communities. Although limited, archaeological records of deforestation and bioaccumulation of heavy metals in soil and water generated through extensive environmental studies are available for some regions of intensive copper-exploitation as the 3<sup>rd</sup> millennium BC Iberian peninsula (Nocete *et al.* 2005; Williams 2009).

no direct evidence of body dysmorphia has been pinpointed for these examples, these studies show how lead and arsenic metal poisoning can be a direct cause of stress-markers and signs of trauma on bones, as well as osteoporosis, general decrease in bone strength and optimal development, while possibly having repercussions on male and female infertility (Martinez-Garcia *et al.* 2005; Martin 2017).

More data is needed to push forward the idea that physical conditions and illnesses affecting ancient metal miners and smelters would have found an echo in myths and theological systems, but the *fil rouge* connecting archeological, mythological, and iconographic data is far too interesting to be completely dismissed. The current debate does in fact extend not only to evidence coming from the Anatolian peninsula and the Southern Levant, but also to the Aegean and Egypt. Myths and descriptions related to the cult of the Kabeiri *daimones* (and the god Hephaistos) in Classical Greek tradition have been directly linked by some scholars to those of the dwarf-smiths, the Pataikoi, of Egyptian mythology (Aterman 1999). The similar iconographic rendition (i.e., physical deformity, short stature, limping) and the shared skills and divine attributes (i.e., metallurgical knowledge, protection from evil, and healing powers in relation to fertility) are commonalities that could point to a connected mythological and ritualistic tradition forming prior to the Iron Age (Blakely Westover 1999). The *daimones*, for instance, are closely associated with the discovery of iron metalworking, and the mythological tradition identifies their birth-places respectively in Rhodes (southeastern Aegean), the Troad (northwestern Anatolia), the islands of Samothrace, Imbros, and Lemnos (northeastern Aegean), and Crete (Blakely 2006). This peculiar provenance has pushed some scholars to interpret the *daimones* as the mythic representations of itinerant specialized metallurgists traveling along LBA trade routes crossing Anatolia and the Eastern Mediterranean (Blakely Westover 1999; Zaccagnini 1993). Although speculative, this is certainly an element of great interest: the origin of semi-gods placed along known sea routes connecting Mainland Greece with Cyprus, Crete, Anatolia, and the Balkan region might very well reflect the known importance of these regions for trade exchange, in general, and metal procurement in the specific<sup>7</sup>. On the other hand, the ethnic affiliation of these *daimones*, and the actual role played by metallurgy in local cults and rites, are more nuanced than admitted by some scholars, advising caution in the interpretation of their presence as a direct reflection of religious symbolism attached to metallurgical production in these regions (Blakely 2012). Regarding medical knowledge, the power of *daimones* appears to be linked strictly to metals and their properties. Lead and iron, but also gold and other types of metals, were used as amulets to increase sexual drive, cure infertility and enhance female fertility, protect pregnancy or, on the contrary, prevent it. Curative properties assigned to raw materials and specific metals are traits common to many cultures, as also Hittite textual evidence indicates (Alparslan and Doğan-Alparslan 2011; Siegelová 1993). The purifying properties of silver, the strength and purity of gold, of which the ‘eternal bodies of the Gods’ are made (KBo 4.1 vs. 41-43, in Alparslan and Doğan-Alparslan 2011), and the general symbolic value of metal objects acquired as war booty, tribute, and taxes are all strong evidence of specific ritual meanings attributed to metals in the Hittite culture, as proved by their occurrence in propitiatory rites and dedication ceremonies (Giorgadze 1988; Siegelová 1993).

What all these examples suggest is not only the inclusion of metal-making practices among crafts protected by divine entities, but most of all the close link existing between medical and ‘magical’ properties of metals in their raw and worked form, the subsequent ‘powers’ and skills characterizing specialists who work with them, and the need of protection/ritual cleansing to reestablish the natural equilibrium between procreation and death, natural cycles and human manipulation. If the diverse traits shared by many gods and semi-deities could be interpreted as a symbolic generalization of the physical conditions characterizing mining and smelting metalworkers, the inevitable following question would touch upon the significance of this diversity in relation to the socio-economic status of actual metal specialists.

In many central and western Asian cultures smiths are often equated with shamans in their role of custodians of oral traditions, genealogies, and epic compositions (Rotea *et al.* 2011). Similarly, medical knowledge and healing powers are assigned to metallurgists in African, Asian, and Classical Greek traditions (Amzallag 2009). If skilled

<sup>7</sup> Plenty of archaeometric research points to complex metal procurement networks connecting Anatolia, the Aegean, the Pontic Area, and Cyprus already during the EBA and especially in the mature phases of the LBA (Niemeier 2000; Athanassov *et al.* 2020).



technical knowledge is in itself a form of power, the different conception of human demiurgic capabilities triggered by smelting metallurgy (and the subsequent ability to shape matter) potentially affected the entanglement between metal craftsmen and the surrounding communities. Ethnographic research on pastoralist and agricultural communities in pre-Colonial Africa, for instance, has observed how metal specialists often witnessed a process of segregation and exclusion from the rest of society that entangled both positive and negative aspects (Eliade 1978). Smelters and smiths were respected but also feared, and while their knowledge was considered necessary for the existence of economic and social structures, it was also portrayed as potentially dangerous for their balance, and thus in need of ritual regulation and control (Rowlands 1971; Blakely 2006). In the case of Chalcolithic and Bronze Age communities across the Eastern Mediterranean, it is of course difficult to envision a scenario where the minor or major social status of smelters and smiths was not correlated to the role played by metal production in the general economic structure of ancient communities. Ritual ontologies do invest various stages of metal production, and a complex network of dependence must have existed between the social status of metal specialists and factors like seasonality and specialization, centralized power and political competition, the impact of metal exchange, ethnicity, and religious traditions (Swenson and Warner 2012).

## 5. NEGOTIATING SOCIAL ROLES: RITUAL PRODUCTION IN THE LEVANT AND CYPRUS

The previous sections examined the limited, yet existing textual and archaeological evidence related to ritual symbology and traditions linked to mining landscapes and communities, smelters and deities related to metal production. Additionally, it delved into metaphors of seclusion and fertility. The discussion now shifts to another pivotal aspect of metallurgical activities and rituality, that of the involvement of metal specialists and metal production in communal performances and ritual settings.

Any discussion touching upon these subjects cannot exempt from the examination of the striking examples coming from the Chalcolithic Southern Levant, in particular from the Late Ghassulian culture. The rich metallurgical production characterizing the Late Ghassulian phase (i.e., 4200/4000 BC) has attracted scholars' attention since the 1950s, when Childe first proposed the Syro-Palestine macro-region as a pioneering and independent core of experimentation in early metalworking (Levy and Shalev 1989). Based upon the striking material evidence uncovered at settlements and burial caves, research has focused on various aspects of regional metallurgy, from technological experimentation in copper alloying and gold manufacture to procurement, to the relationship between high quality metallurgy and processes of increasing urbanization and social complexity. The aspect analyzed here concerns, however, the proposed relation of metalworking and cult activities advanced by some scholars (Goren 2014; Gošić and Gilead 2015).

The astonishing metal hoards uncovered at the sites of Nahal Mishmar, Giv'at Ha-Oranim and Shiqmim represent the most interesting examples for the analysis of the cultic character of Ghassulian metallurgy (Amzallag 2022). For instance, the hoard of the Nahal Mishmar cave consisted of more than 400 copper artifacts (both unalloyed and alloyed), with various types of cultic and 'utilitarian' objects ranging from maceheads and standards to scepters, horns, cylinders, and axes (Gošić and Gilead 2015). Looking more generally at evidence coming from other Ghassulian sites and stressing the synchronic occurrence of metalworking and new burial traditions, Gošić and Gilead argue that all elements attest a significant change in ritual behaviors, a change that the sophisticated and precocious copper metallurgy mastered by local communities contributed to trigger. In pre-industrial societies ritual often plays a crucial role in coordinating craft production, especially when this embodies newly established cultural and social identities. In the case of the Ghassulian Chalcolithic communities, the production of astonishing ceremonial and ritual objects is directly connected by these scholars to the gradual formation of new social structures, in a complex entanglement that links the act of manufacture itself, and the skilled craftsman behind it, to the negotiation of communal socio-cultural fabric through ritual and magic ontologies (Amzallag 2019; Amzallag 2022). While the emphasis on the role of metal artifacts as crucial status-markers is certainly important, one cannot help but wonder if, and in which ways, the inarguable skills required to produce them also led to a (re)



**Fig. 2.** Miscellaneous artifacts from the Nahal Mishmar Hoard, currently exhibited at the Israel Museum of Jerusalem (from Amzallag 2022).

negotiation of the social role of metal craftsmen. In other words, were smelters and smiths in any way involved in the enacting of communal rites of pilgrimage and ritual offering as those attested at Nahal Mishmar and/or sites such as Ein Gedi? So far no convincing evidence for any of these proposed ritual roles of metal specialists has

been pointed out by scholars. However, if the rationale to test is one that sees ritualization as a way to integrate and normalize the impact of metallurgical development in societies witnessing its rapid development and widespread impact on preexisting socio-economic dynamics, an example that might cast some light on this aspect can be found in LBA Cyprus.

The role of Cypriot industries in the LBA copper trade has been and remains the focus of extensive archaeological and archaeometric research (Kassianidou 2013; Charalambous 2016). The identification of deposits exploited in antiquity, the manufacturing technologies, and the trade networks established between the Near East and Levant, Anatolia, and the Aegean are all issues on which current studies focus. An aspect relevant for the present discussion regards the sociopolitical organization of metal production at Cypriot sites and its relation to the religious ideology of local communities (Knapp 1986).

The so-called 'Ingot Gods' found at Enkomi and Kourion represent the first indicators of a tight relationship between ritual and metallurgy (Kassianidou and Knapp 2005): upon their discovery these bronze statuettes, representing both male and female deities standing on oxhide ingots-shaped bases, were immediately interpreted as tutelary deities protecting miners and smelters. Interestingly, the goddess was interpreted as a symbolic representation of the fecundity of Cypriot mines by some scholars, echoing the fertility symbolism previously analyzed (Kieburg 2006). In 1985 the excavation of 12<sup>th</sup> century BC metal workshops associated with religious structures at Kition seemed to confirm that metal production was not only 'under divine protection', but also connected to religious control. One of the rooms excavated by V. Karageorghis had direct access to the main cultic building, and the team found not only *in situ* metallurgical debris but also ritual paraphernalia, suggesting that rites were performed also within the spaces devoted to metal production. Similar evidence was uncovered at the site of Athienou, where a sanctuary in use between the 16<sup>th</sup> and the 12<sup>th</sup> centuries BC revealed traces of smelting activities, and at Myrtou, Idalion, Enkomi, and Hala Sultan Tekke (Kassianidou and Knapp 2005). B. Knapp and J. Webb have recognized five indicators of the rituality of Cypriote LBA metallurgy, from the Ingot Gods and the bronze miniature inscribed ingots<sup>8</sup> to the location of workshops within ritual spaces (Knapp 1986). This last aspect, the spatial association of workshops and temples uncovered at many sites in the island, brings to the forefront of the conversation the possible involvement of metal specialist in the enactment of specific rites (Averett 2015).

However, some criticism against the actual production of copper ingots or objects in these specific settings has been raised by scholars as V. Kassianidou. The main argument proposed is the relatively 'small' quantity of slags and tuyeres found at sites like Kition and Enkomi, which would not mirror the actual scale of Cypriot production as estimated on the volume of trade. Although somehow valid, this critique can be counteracted by other observations. On one hand, the existence of other production centers (not associated with religious structures) does not exclude the close involvement of metal specialists in ritual performances. On the other, their possible role in the enactment of rites and production of ritual objects does not imply in any way that Cypriote metallurgy was overall under 'religious control', nor that different models of production catered to both local, de-centralized consumption and inter-regional trade did not coexist (Schuster-Keswani 2005). Interestingly, and almost in line with the evidence discussed for the Ghassulian culture, the data in hand strongly suggests that the cultic aspects of Cypriot metallurgical production became stronger in concomitance with the growth of local copper industries as one of the main suppliers in the entire Eastern Mediterranean around the 15<sup>th</sup> century BC (Webb and Knapp 2021).

Both these examples underline some important points. The direct involvement of metalworkers in ritual settings of social and political competition appears to be a form of regulation of their activities within communities

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<sup>8</sup> Academic literature has recently provided interesting new insights on this category of metal votive objects using anthropological theories on miniaturization. These highlight in particular concepts such as 'enchantment' and 'ritualized alterity' in relation to paraphernalia representing miniatures of every-day tools and objects (Kohring 2011; Dehouve 2016; Oggiano 2022). According to these theories, the choice of representing something (from a ceramic plate to a metal ingot) in its miniaturized form can reinforce the idea (and illusion) of human control and connection over materiality, and ultimately over the natural world and its resources. Whether the Late LBA Cypriot miniature ingots absolved a more practical function (i.e., weights, recycled scrap metal) or a more ritualistic one (i.e., amulets, votive objects), it is not unlikely to postulate a multivariate usage for such a category of artifacts that merges the utilitarian and symbolic spheres.

characterized by a striking quantitative and qualitative level of metallurgical production, increasing social competition, and economic decentralization. The scenario would most likely be different in state societies with more centralized political and economic structures, where the major control over production might have rendered the need for ritual ‘regulation’ either redundant or, on the contrary, more strictly organized.

## 6. DISPLAYING CONTROL: METAL PRODUCTION IN LBA AEGEAN AND ANATOLIA

The association of economy, ritual, and politics in the prehistory of the Aegean has a long history of research and discussion. The ‘Palace-Temple’ model proposed by Evans has enjoyed consensus among scholars for a long time before being substituted by more nuanced approaches to the study of Minoan economy (Schoep 2010). Recent studies have challenged traditional views that applied labels such as ‘a redistributive model’ to Aegean Bronze Age societies in favor of approaches emphasizing social ‘institutions’ such as feasting, craft specialization, gift exchange and, I would add, ritualized modes of production and consumption (Nakassis, Parkinson and Galaty 2011). Here, however, the discussion focuses on aspects of continuity and change noticed for Mycenaean and Classical Greece from the perspective of metal industries and ritual settings. As pointed out by Blakely, the LBA societies of the Aegean islands and Mainland Greece show different and yet similar traits to those attested in Cyprus and examined in the previous section (Blakely Westover 1999). The main difference between Cyprus, on one hand, and Crete and Greece, on the other, consists in the different juxtaposition of political and ritual power. Evidence from Cyprus potentially attests a strict relation between copper production and rituality in the form of both tutelary deities and workshops in ritual settings. Minoan and Mycenaean cultures, instead, show strict palace control over different types of production, including metallurgy. Texts can help clarify this distinction. Linear B tablets found in the Pylos archives mention Mycenaean smiths and metalworkers in connection to the provision of metal objects to the palace (Pullen 2013; Nakassis, Parkinson and Galaty 2011). If it is possible that redistribution and market exchange were both part of the Mycenaean model (as argued by Pullen 2013), then it becomes feasible that metal specialists were employed by both the palace and the elites, while also acting as independent artisans (as suggested by Gillis 1997). A similar conclusion is suggested for Minoan metallurgy (Schoep 2010; Hakulin 2013). The spatial concentration of workshops in the Minoan palaces of Crete is in fact paralleled by the distribution of workshops in harbor towns like Mochlos and Kommos, suggesting the existence of a prosperous ‘non-palatial sector in the metal system’ (Hakulin 2013: 122; Blakely Westover 1999). The crucial role of metals in the formation of elite social identity and the economic importance of metal trade and production in the LBA Aegean contributed to the exercise of a certain degree of control over metallurgy, control that assumed ritual aspects in some ways but that never escalated to the degree observable on Cyprus (Blakely Westover 1999).

In a similar way, the pivotal social and economic role that metal production played in Hittite Anatolia generated a rather complex yet organized structure for procurement, circulation, and manufacture (Lehner and Schachner 2017). Discussion regarding ritualistic connotations attached to metallurgical production has been conducted mainly from the perspective of philological studies. The role of smiths and metal craftsmen (usually indicated with the Sumerogram <sup>LÚ</sup>SIMUG.(A) within the context of purification and foundation rituals is attested in many texts referring to the regulation of rites in Kizzuwatna, Arzawa, and the Hatti lands (Mouton 2012). The available corpus contains mainly references to the presence of metallurgists during rituals which required the usage or dedication of metal sacred objects (from effigies of the Gods to other kind of metal ritual paraphernalia). In most instances, the role played by metal craftsmen was ‘limited’ to the task of presenting and handling metal paraphernalia, statues, and other votives while the rite was performed (Kempinski and Kořak 1977; Siegelová and Tsumoto 2011). In a few examples, textual records do contain more detailed information on specific festivals and occasions in which metallurgists played a more central role as the persons enacting the rite. Prestigious schools of metalworkers were present in important Hittite religious centers such as the cities of Arinna, Karahna, and Zippalanda (where craftsmen would often bring bread offerings and sacrifice animals to the local Storm God. Pecchioli Daddi 1982: 39-40). Other than offerings and sacrifices, texts from Kizzuwatna point also to another pregnant aspect

of the direct involvement of metal specialists, stressing the role they played in the symbolic ‘birth’ or ‘appearance of a divinity’ through the dedication of effigies they were responsible for (Mouton 2012: 227). So far textual data are not corroborated by many archaeological finds hinting to on-site production at any of the sites traditionally identified as the mentioned polities. Nonetheless, the association of specialized metallurgy with localities of known religious importance in the Hittite Empire illustrates once more how ritual symbologies and practices served the important function of controlling and regulating metal production within larger macro-regional systems.

## 7. CONCLUSIONS

This contribution started with a hypothesis and many interrogatives related to it. First and foremost, it argued for a recognition of the ritual significance of ancient metallurgical practices that would embrace not only the objects themselves (and their potential usage in ritual settings) but also the actions needed to produce them, the skilled people performing those, and the natural and social contexts in which all this took place. Secondly, it raised questions on if and how the cultural and socio-political underpinnings of this ritual ontologies and their related symbolism could be identified and interpreted based solely on textual and archaeological data. There are, in fact, many examples provided by anthropological and ethnographic sources, based on direct observations, that reveal the existence of multiple, complex layers of symbolism and religious connotations attached to metallurgical practices, metalworkers, and the resulting artifacts. But is it possible to identify ritual semantics of production through the lens of textual sources and archaeological contexts only? And if so, how to interpret them? Are magical and ritualistic elements only ascribed to metallurgical craft as a way to integrate new technologies into pre-existing yet evolving socio-economic structures? Is ritualization only occurring in the context of production of ritual paraphernalia and votive objects, thus linking possible ritual ontologies only to the actual context of usage of metal artifacts? Or is it social structure, in particular the division between more egalitarian and more hierarchical societies, that affects the role and ‘power’ possibly assigned to metal specialists? When it comes to the study of rituality and metal manufacture, the nature of archaeological evidence significantly changes the perspectives from which these topics can be approached. A whole corpus of data related to performative aspects, oral traditions, gestures, symbolism, and beliefs becomes elusive, and it can be reconstructed to a certain extent only by contextualizing different pieces of evidence. Far from being conclusive, the evidence provided in this contribution aimed to trace different but interconnected layers, through whose interplay ritual significance might have pervaded the varied social and cultural fabrics woven by metallurgical production in societies across the ancient Eastern Mediterranean. Bearing in mind the unique character of every case study, some general considerations on the different layers of ritual ontologies, can be proposed.

The first layer or level of manifestation is a ‘material’ one, where symbolic attributes are attached to metals in both their raw or finished form: the magical properties related to fertility, healing, and purification ascribed to different metal objects, the metaphors of birth-giving attached to the mining and smelting of metal ores, and the ritual usage of paraphernalia and metal artifacts are all perfect examples of this, and although at different degrees and through different manifestations they appear to be present across diverse cultures and socio-political structures. If, on one hand, one could argue that the high ritual and socio-cultural value assigned to metals does reflect directly (or indirectly) on their users rather than their makers, on the other it begs the question of if and how it affected the way metal miners, smelters, and craftsmen were perceived (Helms 1993).

The second layer is therefore related to the ‘agents’, the specialists through which the ritual power of metalworking would have been expressed. Anthropological and mythological sources offer a wide array of ritual roles assigned to metal specialists, from that of shamans and healers, to that of guardians of unshared knowledge serving the entire community. The social status and ritual involvement of metal specialists varied enormously according to different factors, among which scale of production (seasonal, specialized), type of production (everyday tools, prestigious artifacts), and locality of production (temple/palace-based artisans, itinerant smiths, craftsmen working in urban or rural settlements) played a pivotal role. It is important to clarify that an important distinction

would have to be made between miners and smelters, on one side, and craftsmen working on alloying and successive manufacturing practices. If a certain degree of seclusion, and perhaps avoidance, could be targeting mining communities<sup>9</sup>, major social mobility can be postulated for metalworkers (especially in case of specialized labor<sup>10</sup>, Zori 2019). Here I propose a distinction between first and secondary metallurgical activities that exceeds the differences already imposed by factors such as localities (non-urban, urban), physical skills, knowledge, and regulations imposed on production. These, in fact, would have generated different, in some aspects complementary ritual semantic spheres. Chthonic powers and tutelary deities linked to craft and fertility, physical strength and technical skills, interference with the rhythms of nature and ability to transform matter, cleansing rituals and propitiatory rites, magic properties and alchemic powers, are all potential metaphors intertwined with each other.

The third layer, perhaps the most intriguing for the archaeological study of ritual metallurgy, is represented by social systems. The ways communities channel the ritual significance of matter and agency, embedding it in their socio-economic structures and cultural traditions, are diverse and difficult to interpret. Similar ritual metaphors can be translated in totally different ways, and it is the interplay of social and political factors that determines it. One aspect is clear: the more central metal production becomes to the economic strategies of a specific community, the more ritual dimensions are enhanced or channeled by other members or central authorities.

Considering these three main angles (i.e., matter, agency, and society), it becomes clearer how the same ritual ontologies can be expressed through all of them, and/or each one can be characterized by its own. Fertility-themed symbology and gender-related taboos are a perfect example. Through ritualization, metal production can assume an active role in shaping or communicating gender and age-based divisions within a given society, and this is done explicitly through matter and agency, as the Fipa example shows, and as other archaeological research suggests<sup>11</sup>. The same can be said for the expression of social identity and political power: metal objects as symbols of prestige can convey important messages, but when metal production becomes part of ritual performances involving the negotiation and affirmation of social prestige through agency, as in the case of the rites at the Cypriot center of Kition, metal production becomes charged with evident ritualistic and social meanings.

While recognizing the multi-varied ways in which the different metaphors and levels of symbolism intersect with each other, a pattern can be recognized in all the examples analyzed. The economic centrality of metal production appears to be the triggering element in the development of rituality and magic symbolism, and this appears to be especially relevant in the case of social and cultural contexts in which the negotiation of power, status, and wealth is still fluid. In other words, and keeping in mind that general theoretic frameworks can only work as a basis in the interpretation of singular case studies, it is here suggested that the adoption of ritualized semantics of metal production mirrors general processes in which social competition, negotiation of status, and political control are expressed through ritual behaviors.

From the Ghassulian and Cypriot cultures to the Fipa communities, the *fil rouge* that links all examples is the impact that metal production had on the economic and social fabrics upon which such communities construct themselves. Although this statement might appear rather simplistic, it does not undermine the complexity of the topic: if, on one hand, economy affects the development of ritualized modes of metal production, on the other hand, the ways these are developed, embedded, and manifested are so diversified that the entanglements of rituality with other spheres (i.e., general cosmological beliefs, cultural contact, political developments, broader gender divisions) become evident (Constant 1993; Prescott 2000). In the case of Cyprus, for instance, the scale of copper mining, production, and trade (especially from the 16<sup>th</sup> to the 12<sup>th</sup> centuries BC) is well reconstructed through

<sup>9</sup> It is important to stress that mining activities were strictly dictated by seasonality, and that the activity of miners and smelters depended on their balance and integration with other subsistence activities carried on by communities within the region.

<sup>10</sup> It is here argued that specialization would have played an important part in the attribution of ritualistic symbolisms to craftsmen. At the same time, the concept of cross-craft interaction should be taken into account. Indicating mainly the existence of shared tools, working spaces, and know-hows across different manufacturing processes, it raises important questions about the dynamism linking different manufacturing chains, social agents, and skill sets. If this concept shows how blurred the division of labor could often be, it does not diminish the importance of craft specialization as catalyst for economic and social complexity.

<sup>11</sup> See Derevenski 2000 for an interesting study of metalwork in relation to gender identity.

archaeological and archaeometric data. Studies on settlement patterns have targeted mining areas, industrial/smelting centers, agricultural sites, and coastal/trade hubs, highlighting the main characteristics of the socio-economic and political fabric of the island (Knapp 2003). These challenge traditional views that saw an egalitarian, isolated society give space to a hierarchical, hyperconnected system with the transition from the MBA to the LBA, and instead point to a gradual, non-linear process of growth where increasing exploitation of local sources paralleled phenomena of social competition and inequality without the institution of highly centralized systems (Webb and Knapp 2021). The same degree of intra-regional variation can be postulated for Anatolia, where the LBA period saw the establishment of an ensemble of multi-layered polities (in the west), and more centralized imperial politics (in the central and southeastern regions) still showcasing different degrees of power, cultural hegemony, and resilience (Glatz 2009).

The development of ancient metallurgy did indeed follow paths dictated by disparate elements, from more practical concerns (usage, technical advancements, sources) to socio-economic factors (labor organization and division, exchange networks, control over production), and cultural ones (myths, religious beliefs. Rotea *et al.* 2011). The goal here was not to establish the ‘importance’ of one or the other, but rather to acknowledge their coexistence and interplay. Ultimately, although almost 30 years have passed, the words of Budd and Taylor still hold true. *‘The general unwillingness of archaeometallurgists to see prehistoric metal artifacts as anything other than the remnants of scientific experiments in some cumulative, progressive and rational development sequence – leading from the first tentative chemical flame-test, through copper, bronze and iron metallurgy, onward and upward to the achievements of aerospace-industry – is linked to an intra-disciplinary divide between archaeological scientist and socio-cultural archaeologists and anthropologists’* (Budd and Taylor 1995:134). It is towards this divide that future research should focus on, in the attempt to reconsider the development of ancient metallurgical production under a more holistic perspective.

#### ACKNOWLEDGMENTS

I would like to express my heartfelt thanks to Christina Luke, Christopher H. Roosevelt, and Rana Özbal for their constructive comments on this topic. My gratitude goes to the anonymous reviewers for providing insightful feedback and suggestions that greatly improved the original manuscript. Remaining errors are mine alone.

#### BIBLIOGRAPHY

- Alparslan M. and Doğan-Alparslan M. 2011, Symbol der Ewigen Herrschaft: Metall als Grundlage des Hethitischen Reiches, in Ü. Yalçın (ed), *Anatolian Metals V*, Bochum, Deutsches Bergbau-Museum: 79-84.
- Amzallag N. 2009, From Metallurgy to Bronze Age Civilizations: The Synthetic Theory, *American Journal of Archaeology* 113(4): 497-519.
- Amzallag N. 2019, The Religious Dimension of Copper Metallurgy in the Southern Levant, in H. Goldfus, M.I. Gruber, S. Yona, and P. Fabian (eds), *Studies in Archaeology and Ancient Cultures in Honor of Isaac Gilead*, Oxford, Archaeopress: 1-13.
- Amzallag N. 2022, Cultural Metallurgy – A Key Factor in the Transition from the Chalcolithic to Bronze Age in the Southern Levant, *Cambridge Archaeological Journal* 32(3): 445-465.
- Aterman K. 1999, From Horus the child to Hephaestus who limps: a romp through history, *American Journal of Medical Genetics* 83(1): 53-63.
- Athanassov B., Chernakov D., Dimitrov K., Krauß R., Popov H., Schwab R., Slavchev V. and Pernicka E. 2020, A New Look at the Late Bronze Age Oxhide Ingots from the Eastern Balkans, in J. Maran, R. Băjenaru, S.C. Ailincăi, A.D. Popescu, and S. Hansen (eds), *Objects, Ideas and Travelers. Contacts between the Balkans, the Aegean and Western Anatolia during the Bronze and Early Iron Age*, Bonn, Dr. Rudolf Habelt GmbH: 299-356.

- Averett E.W. 2015, Masks and ritual performance on the island of Cyprus, *American Journal of Archaeology*, 119(1): 3-45.
- Bachhuber C. 2011, Negotiating Metal and the Metal Form in the Royal Tombs of Alacahöyük, in T.C. Wilkinson, S. Sherratt and J. Bennet (eds), *Interweaving Worlds. Systemic Interactions in Eurasia, 7th to 1st Millennium BC*, Oxford, Oxbow Books: 158-174.
- Bachvarova M.R. 2019, Survival of “Popular” Mythology: From Hittite Mountain Man to Phrygian Mountain Mother, in S. Blakely and B.J. Collins (eds), *Religious Convergence in the Ancient Mediterranean*, Columbus, Lockwood Press: 203-230.
- Barjamovic G. 2011, *A Historical Geography of Anatolia in the Old Assyrian Colony Period*, Copenhagen, Carsten Niebuhr Institute Publications.
- Belgiorno M.R. 2009, New suggestions from Pyrgos/Mavrorachi on Cypriote 2000 BC protoindustrial society and its gender perspectives, *Medelhavsmuseet. Focus on the Mediterranean 5: 1927-1931*.
- Bell C. 1992, *Ritual Theory, Ritual Practice*, Oxford, Oxford University Press.
- Blakely Westover S. 1999, Smelting and Sacrifice: Comparative Analysis of Greek and Near Eastern Cult Sites from the Late Bronze through the Classical Period, in S.M.M. Young, A.M. Pollard, P. Budd and R.A. Ixer (eds), *Metals in Antiquity (BAR International Series 792)*, Oxford, ArchaeoPress: 86-90.
- Blakely S. 2006, *Myth, Ritual and Metallurgy in Ancient Greece and Recent Africa*, Cambridge, Cambridge University Press.
- Blakely S. 2012, Daimones in the Thracian Sea: Mysteries, Iron, and Metaphors, *Archiv fur Religionsgeschichte* 14: 155-181.
- Boric D. 2009, Absolute Dating of Metallurgical Innovations in the Vinca Culture of the Balkans, in T.L. Kienlin and B.W. Roberts (eds), *Metals and Societies. Studier in honor of Barbara S. Ottaway*, Bonn, Rudolf Habelt GMBH: 191-245.
- Brysbaert A. 2011, Tracing Social Networks through Studying Technology, in A. Brysbaert (ed), *Tracing Prehistoric Social Networks through Technology. A Diachronic Perspective on the Aegean*, New York, Routledge: 1-11.
- Budd P. and Taylor T. 1995, The Faerie Smith Meets the Bronze Industry: Magic versus Science in the Interpretation of Prehistoric Metal-Making, *World Archaeology* 27(1): 133-143.
- Charalambous A. 2016, A diachronic study of Cypriot copper alloy artifacts, *Journal of Archaeological Science: Reports* 7: 566-573.
- Childs S.T. and Killick D. 1993, Indigenous African Metallurgy: Nature and Culture, *Annual Review of Anthropology* 22: 317-337.
- Constant E.W. 1993, The Social Locus of Technological Practice: Community, System or Organization?, in W.E. Bijker, T.P. Hughes and T.J. Pinch (eds), *The Social Construction of Technological Systems. New Direction in the Sociology and History of Technology*, Cambridge (MA), MIT Press: 223-242.
- Costin C.L. 2001, Craft Production Systems, in G.M. Feinman and D. Price (eds), *Archaeology a the Millennium. A Sourcebook*, Ney York, Kluwer Academic: 273-327.
- Dalley S. 1987, Near Eastern Patron Deities of Mining and Smelting in the Late Bronze Age and Early Iron Ages, *Report of the Department of Antiquities Cyprus*: 109-110.
- Dardeniz G. and Yıldıırım T. 2022, Metal consumption of a middle-range society in the late 3rd millennium BC Anatolia: A new socioeconomic approach, *PloS one* 17(6): e0269189.
- Dehouve D. 2016, A Play on Dimensions: Miniaturization and Fractals in Mesoamerican Ritual, *Journal of Anthropological Research* 72(4): 504-529.
- Derevenski J. 2000, Rings of Life: The Role of Early Metalwork in Mediating the Gendered Life Course, *World Archaeology* 31(3): 389-406
- Di Nocera G.M. 2010, Metals and Metallurgy: Their place in the Arslantepe society between the end of the 4th and beginning of the 3rd millennium B.C., in M. Frangipane (ed), *Economic Centralization in Formative States: the Archaeological Reconstruction of the Economic System in 4th Millennium Arslantepe*, Rome, Sapienza University: 255-275.



- Dolphin A., Adams R., Yakymchuk C., Tan K., Haylock K. and Grattan J. 2022, Earliest Evidence of Human Exposure to Anthropogenic Lead Pollution: Inter-And Intra-Individual Variation Documented in Teeth from Early Bronze Age Wadi Faynan 100, Jordan. *SSRN Electronic Journal*: 10.2139/ssrn.4169576.
- Eliade M. 1978, *The Forge and the Crucible. Second Edition*, Chicago, The University of Chicago Press.
- Frangipane M., Di Nocera G.M., Hauptmann A., Morbidelli P., Palmieri A.M., Sadori L., Schultz M. and Schmidt-Schultz T. 2001, New Symbols of a New Power in A” Royal” Tomb from 3000 BC Arslantepe, Malatya (Turkey), *Paléorient* 27(2): 105-139.
- Gaukroger S. 2006, *The Emergence of a Scientific Culture: Science and the Shaping of Modernity*, Oxford, Clarendon Press.
- Gell A. 1988, Technology and Magic, *Anthropology Today* 4(2): 6-9.
- Gell A. 1992, The technology of enchantment and the enchantment of technology, in J. Coote and A. Shelton (eds), *Anthropology, Art, and Aesthetics*, Oxford, Oxford University Press: 40-63.
- Gillis C. 1997, The Smith in the Late Bronze Age. State Employee, Independent Artisan, or Both?, in R. Laffineur and P.B. Betancourt (eds), *TEXNH. Craftsmen, Craftswomen and Craftsmanship in the Aegean Bronze Age. Proceedings of the 6<sup>th</sup> International Aegean Conference, Philadelphia, Temple University, 18-21 April 1996*, Liege, Universite de Liege: 505-513.
- Giorgadze G.G. 1988, On the Word for ‘Silver’ with Reference to Hittite Cuneiform Texts, *Altorientalische Forschungen* 15: 69-75.
- Glatz C. 2009, Empire as network: Spheres of material interaction in Late Bronze Age Anatolia, *Journal of Anthropological Archaeology* 28(2): 127-141.
- Goren Y. 2014, Gods, Caves and Scholars: Chalcolithic Cult and Metallurgy in the Judean Desert, *Near Eastern Archaeology* 77(4): 260-266.
- Gosden C. 2012, Magic, materials and matter: understanding different ontologies, in J. Maran and P.W. Stockhammer (eds), *Materiality and Social Practice. Transformative Capacities of Intercultural Encounters*, Oxford, Oxbow Books: 13–19.
- Gošić M. and Gilead I. 2015, Casting the Sacred: Chalcolithic metallurgy and ritual in the southern Levant, in N. Laneri (ed), *Defining the Sacred. Approaches to the Archaeology of Religion in the Near East*, Oxford, Oxbow Books: 161-175.
- Gosselain O.P. 2011, Technology, in T. Insoll (ed), *The Oxford Handbook of The Archaeology of Ritual and Religion* Oxford, Oxford University Press: 243-260.
- Haaland G., Haaland R. and Rijal S. 2002, The Social Life of Iron. A Cross-Cultural Study of Technological, Symbolic, and Social Aspects of Iron Making, *Anthropos* 97(1): 35-54.
- Hackley L.D., Yıldırım B. and Steadman S. 2021, Not seeing is believing: ritual practice and architecture at Chalcolithic Çadır Höyük in Anatolia, *Religions* 12(8): 665-694.
- Hakulin L. 2013, *Metals in LBA Minoan and Mycenaean Societies on Crete: A Quantitative Approach*, Ph.D Dissertation, University of Helsinki.
- Helms M.W. 1993, *Craft and the Kingly Ideal: Art, Trade, and Power*, Houston, University of Texas Press.
- Ježek M. 2015, The Disappearance of European Smiths’ Burials, *Cambridge Archaeological Journal* 25(1): 121-143.
- Kassianidou V. and Knapp A.B. 2005, Archaeometallurgy in the Mediterranean: The Social Context of Mining, Technology and Trade, in E. Blake and A.B. Knapp (eds), *The Archaeology of Mediterranean Prehistory*, Oxford, Oxford University Press: 215–51.
- Kassianidou V. 2013, The production and trade of Cypriot copper in the Late Bronze Age: an analysis of the evidence, *Pasiphae VII*: 133-146.
- Kempinski A. and Košak S. 1977, Hittite Metal “Inventories” (CTH 242) and Their Economic Implications, *Tel Aviv* 4(1-2): 87-93.
- Kieburg A. 2006, Aphrodite, Hephaistos and Ares: Some Thoughts on the Origins of the Mythical Connection of the Three Gods in the Metallurgy of Late Bronze Age Cyprus, in A.P. McCarthy (ed), *Island Dialogues. Cyprus in the Mediterranean Network*, Edinburgh, University of Edinburgh: 210-231.

- Knapp A.B. 1986, *Copper Production and Divine Protection: Archaeology, Ideology and Social Complexity in Bronze Age Cyprus*, Göteborg: P. Åström's Förlag.
- Knapp A.B. 2003, The Archaeology of Community on Bronze Age Cyprus: Politiko "Phorades" in Context, *American Journal of Archaeology* 107(4): 559-580.
- Kohring S. 2011, Bodily Skill and the Aesthetics of Miniaturization, *Pallas. Revue d'études antiques* 86: 31-50.
- Kristiansen K. and Larsson T.B. 2005, *The Rise of Bronze Age Society. Travels, Transmissions and Transformations*, Cambridge, Cambridge University Press.
- Kuijpers M.H. 2018, The Bronze Age, a world of specialists? Metalworking from the perspective of skill and material specialization, *European Journal of Archaeology*, 21(4): 550-571.
- Lambert W.G. 1991, Metal-Working and its Patron Deities in the Early Levant, *Levant* 23(1): 183-186.
- Lehner J.W. and Yener K.A. 2014, Organization and Specialization of Early Mining and Metal Technologies in Anatolia, in B.W. Roberts and C.P. Thornton (eds), *Reader in Early Metallurgy: Old and New World Perspectives*, New York, Springer Verlag: 165-174.
- Lehner J.W. and Schachner A. 2017, The Organization of Metal Production at Hattuša: a First Assessment, in Ç. Maner, M.T. Horowitz, and A.S. Gilbert (eds), *Overtuning Certainties in Near Eastern Archaeology. A Festschrift in Honor of K. Aslihan Yener*, London, Brill: 403-435.
- Levi-Strauss C. 1966, *The Savage Mind*. Chicago, The University of Chicago Press.
- Levy T.E. and Shalev S. 1989, Prehistoric Metalworking in the Southern Levant: Archaeometallurgical and Social Perspectives, *World Archaeology* 20(3): 352-372.
- Martin S. 2017, Environmental and health effects of early copper metallurgy and mining in the Bronze Age, in A. Behie (ed), *The Human Voyage: Undergraduate Research in Biological Anthropology*, Canberra, The Australian National University: 45-61.
- Martinez-Garcia M.J., Moreno J.M., Moreno-Clavel J., Vergara N., Garcia-Sanchez A., Guillamon A., Porti M., Moreno-Grau S. 2005, Heavy Metals in Human Bones in Different Historical Epochs, *Science of the Total Environment* 328: 51-72.
- Massa M., McIlpatrick O. and Fidan E. 2017, Patterns of metal procurement, manufacture and exchange in Early Bronze Age Northwestern Anatolia: Demircihüyük and beyond, *Anatolian Studies* 67: 51-83.
- Mauss M. 1950, *A General Theory of Magic*, London, Routledge and Kegan Paul.
- McCleary R.M. and Barro R.J. 2006, Religion and Economy, *Journal of Economic Perspectives* 20(2): 49-72.
- Miller G.L. 2015, Ritual economy and craft production in small-scale societies: evidences from microwear analysis of Hopewell bladelets, *Journal of Anthropological Archaeology* 39: 124-138.
- Mouton A. 2012, Les Roles du Métallurgiste dans les Ceremonies Religieuses de l'Anatolie Hittite, *Anatolica* 38: 221-235.
- Nakassis D., Parkinson W.A. and Galaty M.L. 2011, Redistribution in Aegean Palatial Societies. Redistributive Economies from a Theoretical and Cross-Cultural Perspective, *American Journal of Archaeology* 115: 177-184.
- Nessel B. 2013, The absence of smiths and founders – Why tools are rare in Bronze Age burials, in B. Rezi, R.E. Nemeth, and S. Berecki (eds), *Bronze Age Crafts and Craftsmen in the Carpathian Basin. Proceedings of the International Colloquium from Târgu Mures, 5-7 October 2012*, Mures, Editura MEGA: 139-147.
- Niemeier W.D. 2000, Milet: Knotenpunkt im bronzzeitlichen Metallhandel zwischen Anatolien und der Ägäis?, in Ü. Yalçın (ed), *Anatolian Metal I*, Bochum, Deutsches Bergbau-Museum: 125-136.
- Nocete F., Álex E., Nieto J.M., Sáez R. and Bayona M.R. 2005, An archaeological approach to regional environmental pollution in the south-western Iberian Peninsula related to Third millennium BC mining and metallurgy, *Journal of Archaeological Science* 32(10): 1566-1576.
- Oakberg K., Levy T. and Smith P. 2000, A method for skeletal arsenic analysis, applied to the Chalcolithic copper smelting site of Shiqmim, Israel, *Journal of Archaeological Science* 27(10): 895-90.
- O'Brien W. 2015, *Prehistoric Copper Mining in Europe (5500-500 BC)*, Oxford, Oxford University Press.
- Özbal H., Pehlivan N., Adriaens M., Gedik-Uluocak B. and Earl B. 2008, Metal technologies during the Late Chalcolithic and Early Bronze Age in North Central Anatolia, in Ü. Yalçın, H. Özbal, and A.G. Pasamehmetoglu

- (eds), *Ikiztepe: a Case Study in Ancient Mining in Turkey and the Eastern Mediterranean*, Ankara, Atılım University: 65-85.
- Oggiano I. 2022, The Sacred Representation of a Miniature World: Rituals with Figurines and Small and Miniaturized Pottery at the Phoenician Cult Place of Kharayeb, *Oxford Journal of Archaeology* 41(3): 229-348.
- Özdemir K., Erdal Y.S. and Demirci S. 2010, Arsenic accumulation on the bones in the Early Bronze Age Ikiztepe Population, Turkey, *Journal of Archaeological Science* 37(5): 1033-1041.
- Pecchioli Daddi F. 1982, *Mestieri, professioni e dignità nell'Anatolia Ittita*, Rome, Edizioni dell'Ateneo.
- Pernicka E., Eibner C., Öztunalı Ö. and Wagner G.A. 2003, Early Bronze Age Metallurgy in the North-East Aegean, in G.A. Wagner, E. Pernicka, and H.P. Uerpmann (eds), *Troia and the Troad: Scientific Approaches*, New York, Springer: 143-172.
- Prescott C. 2000, Symbolic Metallurgy: Assessing Early Metallurgic Processes in a Periphery, in D. Olausson and H. Vandkilde (eds), *Form, Functions & Context: Material Culture Studies in Scandinavian Archaeology*, Oslo, Almqvist and Wiksell International: 213-25.
- Pullen D.J. 2013, Crafts, Specialists, and Markets in Mycenaean Greece. Exchanging the Mycenaean Economy, *American Journal of Archaeology* 117: 437-445.
- Pyatt F.B., Pyatt A.J., Walker C., Sheen T. and Grattan J.P. 2005, The heavy metal content of skeletons from an ancient metalliferous polluted area in southern Jordan with particular reference to bioaccumulation and human health, *Ecotoxicology and Environmental Safety* 60: 295-300.
- Radivojević M. and Rehren T. 2016, Paint It Black: The Rise of Metallurgy in the Balkans, *Journal of Archaeological Method and Theory* 23: 200-237.
- Rotea M., Wittenberger M., Tecar M. and Tecar T. 2011, Bronze Age Metallurgy in Transylvania: Craft, Art and Ritual/Magic, *Acta Musei Napocensis* 45(46): 2008-2009.
- Rowlands M.J. 1971, The archaeological interpretation of prehistoric metalworking, *World Archaeology* 3(2): 210-224.
- Schoep I. 2010, The Minoan Palace-Temple Reconsidered: A Critical Assessment of the Spatial Concentration of Political, Religious and Economic Power in Bronze Age Crete, *Journal of Mediterranean Archaeology*, 23(2): 219-243.
- Schuster-Keswani P. 2005, Death, Prestige, and Copper in Bronze Age Cyprus, *American Journal of Archaeology* 109(3): 341-401.
- Siegelová J. 1993, Metalle und Metallurgie in den hethitischen Texten, in D.O. Edzard (ed), *Reallexikon der Assyriologie und Vorderasiatischen Archäologie*, Berlin, De Gruyter: 112-119.
- Siegelová J. and Tsumoto H. 2011, Metals and Metallurgy in Hittite Anatolia, in H. Genz and D.P. Mielke (eds), *Insights into Hittite History and Archaeology*, Leuven, Peeters: 275-300.
- Spielmann K.A. 2002, Feasting, Craft Specialization, and the Ritual Mode of Production in Small-Scale Societies, *American Anthropologist* 104(1): 195-207.
- Stol M. 2000, *Birth in Babylonia and the Bible. Its Mediterranean Settings*, Cuneiform Monographs 14, Groningen, Styx Publications.
- Stork L. 2015, Systems of Value and the Changing Perception of Metal Commodities, ca. 4000-2600 BC, *Journal of Near Eastern Studies* 74(1): 115-132.
- Swenson E.R. and Warner J.P. 2012, Crucibles of power: Forging copper and forging subjects at the Moche Ceremonial Center of Huaca Colorada, Peru, *Journal of anthropological archaeology* 31(3): 314-333.
- Watanabe J.M. 2007, Ritual Economy and the negotiation of Autarky and Interdependence in a ritual mode of production, in C. Wells, E. Davis and S. Karla (eds), *Mesoamerican Ritual Economy: Archaeological and Ethnological Perspectives*, Boulder, University Press of Colorado: 301-322.
- Webb J.M. and Knapp A.B. 2021, Rethinking Middle Bronze Age communities on Cyprus: "egalitarian" and isolated or complex and interconnected?, *Journal of Archaeological Research*, 29: 203-253.
- Williams J. 2009, The Environmental Effects of Populonia's Metallurgical Industry: Current Evidence and Future Directions, *Etruscan Studies* 12(1): 131-150.

- Zaccagnini C. 1993, Patterns of Mobility among Ancient Near Eastern Craftsmen, *Journal of Near Eastern Studies* 42(4): 245-264.
- Zori C. 2019, Extracting Insights from Prehistoric Andean Metallurgy: Political Organization, Interregional Connections, and Ritual Meanings, *Journal of Archaeological Research* 27: 501-556.