

Études d'archéologie 20

**FORGING VALUES**  
METALS TECHNOLOGIES  
IN THE AEGEAN AND BEYOND  
FROM THE 4th TO THE 1st MILLENNIUM BCE

Nerantzis Nerantzis (ed.)

Bruxelles  
CReA-Patrimoine  
2023

**Éditeur**

CRéA-Patrimoine

© Centre de Recherches en Archéologie et Patrimoine (CRéA-Patrimoine)

Université libre de Bruxelles

50, av. F.D. Roosevelt | CP 133/01

B-1050 Bruxelles

crea.centresphisoc.ulb.be

ISBN : 978-2-9602029-7-7

Impression : Snel

Mise en page : Nathalie Bloch (CRéA-Patrimoine)

**Couverture**

Londres, British Museum 1846.6-2945, Keyside Painter, artisans blacksmiths (drawing by N. Bloch (CRéA-Patrimoine), after W. Nicoll, *A Catalogue of the Greek and Etruscan Vases in the British Museum*, Londres 1851, n° 668, pl. XXIII.)

Études d'archéologie 20

# CONTENTS

Preface	7
Foreword	9
Acknowledgments	11
1. Introduction: Metals Technology in North Aegean Societies - the early steps Nerantzis NERANTZIS	13
2. Different scales of archaeometallurgical research at the sites of Dhaskalio and Kavos on Keros: site survey, excavations, and island-wide survey Myrto GEORGAKOPOULOU	23
3. The Development of Copper-Based Metallurgy in the Bronze Age of the Iranian Plateau: transition from Arsenical Copper to Tin Bronze during the Third and Second Millennium BC Omid OUSBASHI and Mathias MEHOFER	41
4. A periphery? The role of Northern Greece in the development of metallurgy in the Bronze Age Zofia Anna STOS-GALE	53
5. Changing patterns in the exploitation, use and significance of gold in the Northern Aegean (1200-600 BCE) Elon D. HEYMANS and Samuel VERDAN	63
6. Ore processing techniques in Thasos during antiquity Sabine NODIN	81
7. Urban Metallurgy at Pistyros: investigating the contexts of production Nerantzis NERANTZIS, Sabine NODIN and Stratis PAPADOPOULOS	93
8. Slags Reinventing themselves: from metallurgical waste to ingredients in pharmacological preparations Effie PHOTOS-JONES	107
9. Metal Artifacts and Jewellery in the Strymon River Plain: two archaic “Thracian” Graves from the Amphipolis Region Ioannis CHALAZONITIS and Dimitria MALAMIDOU	113
Contributors	128



## PREFACE

The significance of early metallurgy, its organisational complexity and the associated far-reaching networks for exchanging its valuable products have been central themes in archaeological research since long ago. Regions rich in mineral deposits became a focus for researchers who study mining and metallurgical processes by employing various interdisciplinary methodologies and interpretative tools. In the context of previous research frameworks stratified societies, states or kingdoms have been often described as important consumers stimulating demand and circulation of metals as either raw materials or finished products. Crafts production manifested in the rural mining regions could have been somewhat different from the urbanised areas where crafting was often dependent on specialised labour under administrative control and such issues are deemed crucial in the study of ancient metal “industries”. In this context, itinerant craftsmen are often seen as crucial agents of exchange and spread of technological knowledge crossing cultural boundaries.

The north Aegean represents one such region where natural resources and mobility of populations have apparently favoured a long-lasting metal producing tradition emerging in the Late Neolithic and growing in significance particularly during the Hellenistic and Roman periods. However, interpretations based on neo-evolutionary ideas describing “progress” as a slow transformative process from simple to gradually more complex technological stages, do not seem to be supported by actual archaeological evidence. Moreover, such models had direct influence on the way we understand social organisation following linear progressions from simple to more complex forms. Since technology could be described as an embedded set of social acts, entangled with culturally conditioned practice, the study of particular contexts becomes important in offering concrete examples on how production and consumption of metals are socially determined. In the north Aegean, at least during the early stages, metals do not seem to signify social order while metallurgical technology operates in contexts upon which no apparent control was exercised as discussed in the first chapter of this book. The geographical location of Greek Eastern Macedonia and Thrace, connecting the Aegean with the Balkans and Anatolia, the rich mineral deposits and vibrant interactions of local communities with incoming populations played a crucial role in technological exchange. Production of base and precious metals seems to have been an identity forming element for

this region as hinted in the recurring references to its rich metalworking tradition by several ancient authors. The Marie Skłodowska-Curie funded project *Metals Technology in North Aegean Societies (ME.Tech.NAS.)* focused on metals production and consumption in this region while exploring the possible connections with neighbouring or more distant lands. Attempting at a more thorough understanding of complex processes involving the maintenance of supra-regional networks, it was decided to posit metals production and evidence for connectivity from the study region into a broader geographical perspective. Keeping such considerations in mind the International Symposium “*Forging Values*” was held at Brussels on the 15th and 16th of April 2021 as an online event. It focused on mining, ore processing, metallurgy, trade and deposition of metals from the Late Neolithic/ Early Bronze Age to the Hellenistic period in Greece and surrounding regions aiming to attempt a vivid demonstration of current and ongoing research. Participants to the conference addressed important issues such as the production and trade of copper and silver during the Bronze Age, the emergence and adoption of iron technology, the importance of gold and silver used as pre-monetary media for transactions and the large-scale extraction and purification of precious metals during Classical antiquity.

This volume presents a selection of papers covering part of the presented research topics and its scope is to contribute to the field of interdisciplinary studies on ancient metallurgy (archaeometallurgy) with new results, methodological approaches and novel interpretative tools. The chapters that follow cover a wide chronological span that starts at the end of the Neolithic in the late 4th millennium BCE and ends up to Hellenistic times in the 4th c. BCE.

The first chapter presents the early steps of metal production in north-eastern Greece starting with the earliest example of copper smelting from Late Neolithic Promachon-Topolnica, and followed by metalworking evidence at Sitagroi and Dikili Tash. Discussion is also focused on the island of Thasos with its rich mineral deposits that yielded the earliest evidence for silver extraction in the North Aegean. Georgakopoulou presents a thorough study of archaeometallurgical assemblages from several seasons of survey and excavation projects at Dhaskalio and Kavos on Keros in the Cyclades. Important new data are presented, contributing in this way to the growing body of evidence on EBA Cycladic metallurgy for the production of copper, lead and silver. Oudbashi

and Mehofer present an overview of analytical results on a large number of copper-based artefacts to showcase the emergence and development of tin bronze technology during the Bronze Age in Iran. In this context the transition from arsenical copper to tin bronze metallurgy is thoroughly discussed. Stos-Gale attempts a reassessment of the available lead isotope data on metal artefacts from sites in the Aegean, dating between the LN and LBA, in view of the recent discoveries of evidence for early metallurgy of copper, silver and lead in northern Greece. Heymans and Verdan discuss the role of natural gold sources and their exploitation in the changing societies of the northern Aegean between the end of the Late Bronze Age and the archaic period. Their approach follows a historical/cultural perspective to help untangle the ways by which metal resources helped shape new values and how changing patterns of exploitation and use, as well as the human interactions involved, can be tied to changes in history and culture. Nodin focuses on a large corpus of stone tools used in ore processing from the ancient city of Thasos. The article presents important findings on typological associations, and the evolution of techniques for crushing and grinding mineral ores as revealed through the use of such toolsets. Nerantzis and co-authors present an investigation of the contexts that yielded a significant amount of metallurgical

debris in the city of Pistyros during the ongoing systematic excavation project. The overwhelming volume and wide distribution of finds related to metallurgy across the excavated Hellenistic layers, and some preliminary analytical results are used in a first attempt to interpret the evidence. Photos-Jones offers an overview of terms encountered in ancient literary sources to denote metallurgical residues of different sorts. She argues that examining how ancient craftspeople called their by-products is fundamental in attempting to reconstruct the complex *chaînes opératoires* for producing metals and eventually pharmacological preparations. At the same time the article offers a critical re-examination of long enduring misconceptions founded on the misuse of modern industrial terminology in an attempt to understand ancient practices. Chalazonitis and Malamidou cover the topic of consumption of metals in burial contexts with the example of two graves in the Strymon River plain. The important issue of communicating social roles or “elite” identities through preferential consumption in funerary assemblages offers an interesting interpretative tool in understanding social organisation through material culture.

Nerantzis Nerantzis  
2022

## FOREWORD

The Proceedings of the symposium “Forging Values” edited by Dr Nerantzis Nerantzis is the 10th publication in the field of Greek archaeology in the series of “Etudes d’Archéologie” of the CReA-Patrimoine and the 1st volume that concerns ancient Greek metallurgy in the same collection. These figures reflect the important role played by Dr Nerantzis together with Dr Ioannis (Yanos) Chalazonitis, in the development of this area of expertise at the CReA-Patrimoine.

From the very beginning, the studies in Greek archaeology at the CReA-Patrimoine focused on social and economic aspects of craft productions, especially pottery, in ancient societies, including a large spectrum of productions (fine, cooking and coarse wares) along with wide geographical areas (Egypt, Near East, Greece, Roman) and chronological periods (from the Archaic to the Medieval period). The present volume shares this interest in cultural and economic issues of craft productions, but it expands the discussion to the metal production and consumption in the North Aegean during a wide chronological span, from the Late Neolithic to the Hellenistic periods. It further lays emphasis on technological questions about craft organisation, trade and distribution networks, with a specific interest in ancient metal technology, providing us with a real interdisciplinary approach that discusses questions about mining, ore processing, the emergence of new technologies and their impact on trade and cultural exchanges.

Nerantzis Nerantzis joined the CReA-Patrimoine in the frame of a Marie Sklodowska-Curie postdoctoral grant, funded by the European Union’s Horizon 2020 research and innovation programme. During his stay in Brussels, Nerantzis successfully organized one workshop and an international symposium, both events resulting from several questions he was discussing in his own research on the role played by the development of ancient technological knowledge and the spread of metallurgical traditions. This volume that resulted from the international symposium brings together the leading scholars in the field and will certainly become a reference on the subject.

I would like to use the opportunity of this foreword to warmly thank Nerantzis for his fruitful collaboration at the CReA-Patrimoine and for the numerous exchanges and discussions with all the research fellows. Many thanks are also due to the successive Directors of the Centre, Sebastien Clerbois and François Blary, for providing us with an unfailing assistance to all initiatives related to ancient Greek archaeology. I am also very grateful to my old friend and colleague, archaeologist-infographist, Nathalie Bloch, who prepared the manuscript for publication with her well acknowledged talent and care, despite the difficult circumstances. Last but not least, I would like to thank the Université libre de Bruxelles (ULB) for its continuous support to the development of our studies in the field.

Athena Tsingarida





## ACKNOWLEDGMENTS

*The Symposium “Forging Values” was conducted in the framework of a research project that received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 840894 – Metals Technology in North Aegean Societies (ME.Tech.NAS). The editor wishes to thank warmly Prof. Athena Tsingarida for her insightful supervision, coordination of research and the excellent cooperation. Thanks are also due to the following colleagues: S. Nodin, S. Papadopoulos, E. Photos-Jones, Y. Bassiakos, E. Filippaki, Ch. Koukouli-Chrysanthaki, D. Matsas, C. Kallintzi, D. Malamidou, S. Dadaki, M. Tasaklaki, D. Terzopoulou, N. Arrington, D. Tsiafaki, V. Evangelidis, N. Epitropou, D. Vivier, K. Neeft, V. Saripanidi, I. Chalazonitis, T. Manolova, C. Judson, A. Attout and N. Bloch.*

The volume is dedicated to the memory of our dear colleague Myrto Georgakopoulou.

## 5. CHANGING PATTERNS IN THE EXPLOITATION, USE AND SIGNIFICANCE OF GOLD IN THE NORTHERN AEGEAN (1200-600 BCE)

Elon D. Heymans and Samuel Verdan

### INTRODUCTION

Since the 1980s, archaeological, archaeometallurgical and geological research has made a huge impact on our knowledge of mineral resources, such as metal sources, in the ancient Aegean.<sup>1</sup> However, scholarship on the exploitation of such resources, and the history of mining in general, has often focused on technological or economic perspectives, upholding an artificial distinction between human actors and a passive natural world, whereby metal resources are implicitly perceived as waiting in the earth's crust until the technological and/or economic conditions are ripe for exploitation and the metal can be put to a set use. By contrast, if we turn our perspective around and emphasize the dynamic relation between human populations and their natural environment in the ancient world, we have a lot to gain in understanding how metal resources helped shape new values and how changing patterns of exploitation and use, as well as the human interactions involved, can be tied to changes in history and culture.<sup>2</sup> To this end, we will focus on the role of natural gold sources and their exploitation in the changing societies of the northern Aegean between the end of the Late Bronze Age and the archaic period.

The northern Aegean is rich in natural gold sources. Numerous primary and placer gold deposits were known in antiquity, such as the various gold-bearing rivers and streams around the Thermaic gulf and western Chalkidiki.<sup>3</sup> Prominent among these are

the Haliakmon, Axios and Gallikos rivers, passing through the central Macedonian plain before flowing into the Thermaic gulf (Fig. 1). While gold sources were long known in the area, presumably going back to the Neolithic,<sup>4</sup> it is not in and of itself evident that they were continuously exploited or that gold was even used and valued in a context and on a scale that reflect long-held perceptions of its role as a primary commodity of value and status marker. Rather than seeing gold sources as a static presence in the landscape, we would do well to keep in mind that gold might not have always been easily available for exploitation and that exploitation can also lead to exhaustion. Moreover, it is important to state that human interest in gold mining is neither natural nor self-evident, but emerged (and could subside) under specific circumstances. This is, among other reasons, due to the fact that conceptions of value and the related demand for certain commodities need not be stable or follow a linear evolution.

Nonetheless, limited interest in gold, especially if readily available, should appear counter-intuitive to the modern observer. Gold is the material of which wealth is made and its aesthetic qualities and durability have long insured its use as a status marker. If gold could be collected from riverbeds, would it not be considered advantageous to do so? This brings to mind what anthropologist Raymond Firth wrote about the bonito hook, which was used as a so-called primitive currency among the inhabitants of Polynesian Tikopia:

“I have always thought it remarkable that the Tikopia do not make more bonito-hooks. The question why some sharp individuals do not accumulate a stock for trading purposes and why all men do not put in more labour in the production of them is difficult to answer. It seems that the attitude of the Tikopia

\* We want to thank Nerantzis Nerantzis for his efforts in organising the Brussels conference and the other participants for their critical comments.

1 See VAXEVANOPOULOS *et al.* 2022 for a recent example.

2 Cf. LECAIN 2019.

3 Gold sources in the northern Aegean, in particular those within the borders of modern-day Greece, have been explored extensively, especially by professor M. Vavelidis, and the literature on the topic is vast. For references, see e.g. VAVELIDIS

and ANDREOU 2008; ANDREOU and VAVELIDIS 2014.

4 ANDREOU and VAVELIDIS 2014, 455-459.

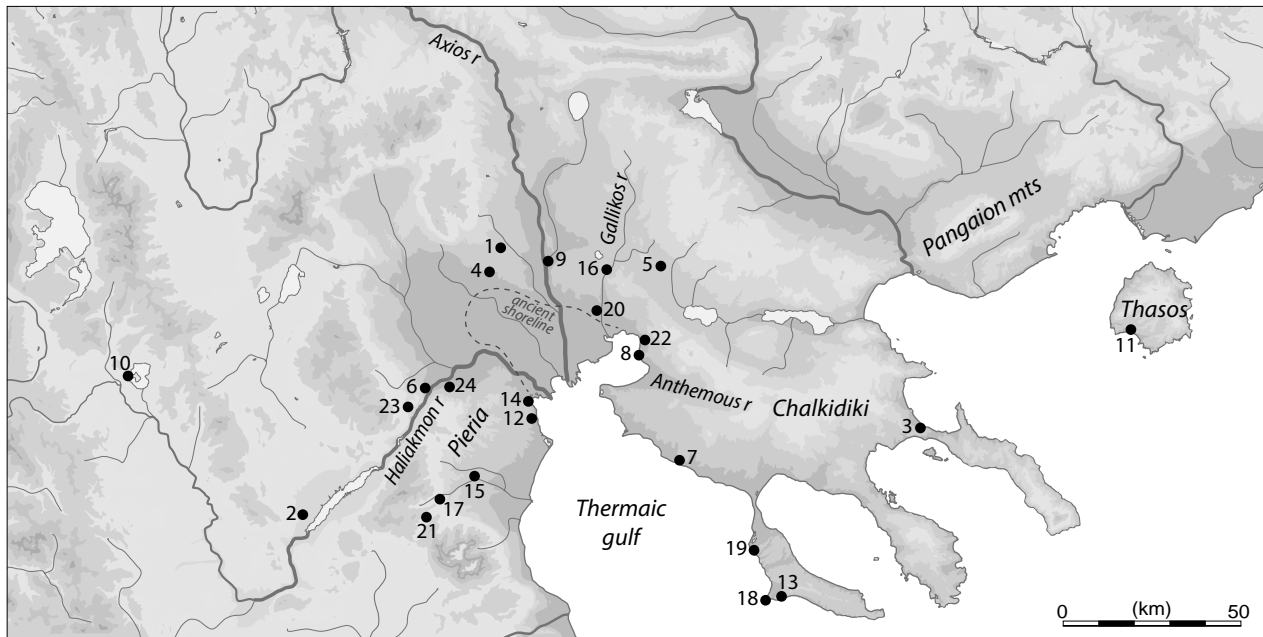


Fig. 1. Map of the northern Aegean with sites mentioned in the text: 1. Agrosykia, 2. Aiani, 3. Akanthos, 4. Archontiko, 5. Assiros, 6. Assomata-Tsardaki, 7. Dikaia?, 8. Karabournaki, 9. Kastanas, 10. Kastoria-Dailaki, 11. Limenaria, 12. Makrygialos, 13. Mende, 14. Methone, 15. Moschochori, 16. Nea Philadelphia, 17. Petra-Treis Elies, 18. Cape Poseidi, 19. Sane, 20. Sindos, 21. Spathes, 22. Thessaloniki Toumba, 23. Tzamala, 24. Vergina.

in this is governed by other factors than those mentioned. Supply does not necessarily respond to demand because of indifference which is the result of attitudes towards time, labour, and material objects which themselves are part of a wider scheme of social values – indeed, almost of a philosophy of life.”<sup>5</sup>

Similarly so, historical examples indicate that communities need not always demonstrate a clear interest in or preference for gold and that specific historical or social circumstances can lead to change in this respect, whether caused by new consumption patterns or the profitability of its exploitation for an emerging external demand. Recent research, for example, has demonstrated a collapse in the consumption of gold objects in the Caucasus – a region rich in gold sources – during the Late Bronze and Iron Age (1500-700). Compared to the Middle Bronze Age, both the quantity and the level of complexity of gold working declined, not as a result of the availability of resources or demographic change but because the conspicuous elite display of gold, associated with the Middle Bronze Age social hierarchy, lost its relevance as a social strategy.<sup>6</sup>

Another striking case to consider are the Akan in western Africa. While gold sources are relatively widespread in sub-Saharan Africa, African societies generally never displayed much interest in it, preferring copper as the primary metal of value.<sup>7</sup> A conspicuous exception are the Akan, in the region of modern Ghana and western Ivory Coast, where gold increasingly featured as a currency since the 17th century, being weighed out as gold dust using a system of cast brass weights.<sup>8</sup> Interestingly though, exploitation of the rich gold sources native to the region only took off in the 15th century as a result of contact with Mande traders from the north and was further stimulated as European colonists were drawn into the gold trade.<sup>9</sup> Increased production of gold, peaking in the 17th century, gave way to new expressions of social and political hierarchy, and resulted in political developments such as the emergence of the Asante empire, which managed to control much of the gold trade.<sup>10</sup> It thus appears that gold only became a primary commodity of value, symbol of wealth and status marker in Akan society *as a result* of the foreign gold trade that had such a transformative effect on the region.

5 FIRTH 1965, 342.

6 ERB-SATULLO 2021.

7 HERBERT 1984, spec. 296-303.

8 GARRARD 1980, 32, 48, 50.

9 GARRARD 1980, 1-33.

10 GARRARD 1980, 59-66, 163-166

Likewise, in the northern Aegean, exploitation of gold sources on a large scale was not continuous, nor was gold always used and valued in the same way. In this paper, we wish to show how interactions between local groups, Euboian traders and the local environment in the region played out over a longer time period, shaping the changing attitudes towards gold and its exploitation. We will suggest that interactions revolving around the exploitation of gold played an important role in shaping Euboian involvement in the region, while Euboian demand, in turn, stimulated the appropriation of gold within local regimes of value.

The suggestion that Euboians were attracted to the region due to its gold sources is hardly new: Michalis Tiverios drew attention to the exploitation of gold at Sindos over twenty years ago.<sup>11</sup> However, expanding our approach to encompass a broader timeframe and region will enable us to better contextualize the limited and often indirect evidence. This is relevant because evidence for the exploitation and use of gold is hardly ever straightforward. The processing of gold, especially from placer sources, leaves few traces and is difficult to identify in the archaeological record. Gold *itself* circulated only in small quantities and people were careful to recycle any of it, so unless deliberately deposited, we are not likely to find it in the first place. All the more extraordinary is the Late Geometric gold hoard from Euboian Eretria, the single largest gold find from the Iron Age and Archaic period. Without this chance find, our attention would probably not be focused on this issue in the first place.

Our ongoing work on the Eretria hoard provides valuable insights that enable us to contextualize the changing role of gold in the Aegean, and Euboian involvement in its exploitation. At the same time, through the hoard, our view of Euboian activity in the north can provide a model for other contemporary contexts of gold exploitation, where evidence is even more scrappy.

### NORTHERN AEGEAN GOLD: LOCAL COMMUNITIES AND EUBOIANS

During the course of the Iron Age, people from the island of Euboea appear to show an active interest in the northern Aegean, specifically the region of the Thermaic gulf and western Chalkidiki. Whether and when Euboians established permanent and autonomous settlements, and whether or not this should be understood in the framework of

colonisation or precolonisation, is part of an ongoing debate.<sup>12</sup> Nonetheless, the presence of Euboian and Euboian-style pottery suggests intensifying contacts with and an increased involvement in the region down to the beginning of the Archaic period.

The early nature of Euboian presence in the Iron Age northern Aegean is not very clear, although it is possible that contacts, established already during the Palatial period, had been maintained and rearranged in the Postpalatial and subsequent periods.<sup>13</sup> The cultic site at Cape Poseidi, west of Mende, contains an ash altar dating to the 12th century with Late Mycenaean pottery around which an apsidal cult building was established in the 10th century and was likely frequented by Euboians.<sup>14</sup> The strategic significance of the site can hardly be over emphasized: the location of the site marked the entrance to the Thermaic gulf as well as sea routes to and from the east, making the site a key stop-over for sailors and merchants.

Gold from the alluvial deposits around the Thermaic gulf – the Haliakmon, Axios, Gallikos and Anthemous rivers – could have attracted traders from the southern Aegean already during the Late Bronze Age, continuing into the Iron Age.<sup>15</sup> Interestingly, however, Macedonian sites from the period offer very limited evidence for the conspicuous consumption of gold objects. Across the region, gold objects are invariably simple and few.<sup>16</sup> Well-excavated settlement sites suggest no particular association between gold and high-status contexts, with scraps found both at the small and lower-level site of Kastanas and at the large centre at Thessaloniki Toumba.<sup>17</sup> From the latter, we also have four small stone crucibles, one of which contained traces of gold working, found in different domestic units. While providing the only evidence we

11 TIVERIOS 1998, 248-250; 2008, 21; cf. LEONE 2012, 232-233.

12 TIVERIOS 2008, 1-52; POPHAM 1994; SNODGRASS 1994; PAPADOPOULOS 1996; more Recently KOTSONAS 2012; GIMATZIDIS 2020; 2022.

13 LEMOS 2020, 803-804.

14 MOSCHONISSIOTI 1998, 260-267; cf. PAPADOPOULOS 1996; CHARALAMBIDOU 2017, 98.

15 VAVELIDIS and ANDREOU 2008; SARIPANIDI 2017, 105; see also a current project led by prof. Ernst Pernicka on Mycenaean gold ([https://www.gerda-henkel-stiftung.de/mykenisches-gold-untersuchungen-zu-herkunft-verbretung-und-echtheit?page\\_id=122228](https://www.gerda-henkel-stiftung.de/mykenisches-gold-untersuchungen-zu-herkunft-verbretung-und-echtheit?page_id=122228) ; accessed on July 18, 2022). Silver from the shaft graves was previously also argued to have originated from the northern Aegean (see STOS-GALE and MAC-DONALD 1991, 273-279; PAPADOPOULOS 2011, 123), but this has now been rejected (STOS-GALE 2014).

16 ANDREOU 2010, 651-652.

17 HOCHSTETTER 1987, 15-18.

have for gold working in the region for the 12th and 11th century, it confirms to a pattern of small-scale production within the settlement, requiring little specialized knowledge or infrastructure.<sup>18</sup>

In central Macedonia, the inconspicuous role of gold can be understood in the context of social and political norms that regulated communal life. Tall mounds, such as Assiros (Phase 6 and 7) and Thessaloniki Toumba (Phase 4), display an elaborate settlement organisation with a regular layout of streets and housing blocks with storage facilities.<sup>19</sup> There are, however, no central or elite structures that dominate the settlement, and equality and communality appear to have been emphasized over political hierarchy and elite identity.<sup>20</sup> Likewise, as funerary evidence in the region is limited to a few graves inside the settlement of Thessaloniki Toumba, treatment of the dead does not appear to have been a focus of attention or investment.<sup>21</sup> Alternatively, outside of central Macedonia, cemeteries became a prime setting for the expression of social identities, although even in the wealthy burials at Aiani and Spathes in southern Macedonia gold is absent.<sup>22</sup>

Explaining the limited interest in gold as a status marker, Andreou and Vavelidis argue that “the absence of highly complex socio-political formations and strong rules, which prevailed, particularly in communities in central Macedonia, discouraged the expression of intra-community distinctions through the excessive display of wealth in habitation and mortuary contexts.”<sup>23</sup> This, together with the relative proximity to and availability of placer gold sources, and the fact that processing or producing gold items required hardly any technological expertise, provided a context for the lower valuation of gold, both as a commodity and as a symbolic marker.<sup>24</sup>

In marked contrast stands Lefkandi on Euboia, where, especially from the MPG onwards, finds testify to the importance of gold as an expression of elite identity. Tombs of wealthy elites in Lefkandi contain many

exotic objects that reflect maritime and long-distance contacts.<sup>25</sup> The association with these graves shows that gold should not be seen as merely an expression of wealth per se, but as a form of exotic wealth. Although the many golden objects in Lefkandi could have had diverse origins, from the few cautious suggestions made so far, the northern Aegean is an option worthy to further explore.<sup>26</sup>

Contacts with the northern Aegean are reflected by a variety of finds in Lefkandi, such as transport amphorae, and Irene Lemos even stated that “in every tomb with imports from the East, there are also imports from the North”.<sup>27</sup> A good example is the wealthy LPG grave 63 at the Toumba cemetery. Among the many finds were three handmade burnished jugs with cutaway necks, likely imports from the north, and an exquisite golden necklace with quadruple spiral beads.<sup>28</sup> Although parallels are known from Kefalonia and Skyros – a waystation between Euboia and the north – the spectacle-spiral ornament is well known from northern Aegean bronzework, and the necklace could well have been imported, or locally produced, following northern Aegean models.<sup>29</sup> Slightly later, in the course of the 9th century, the same spiral motif appears again, first in two earring pendants in T.13 (SPG II)<sup>30</sup> and next in a more eclectic local adaptation; a golden crescent-shaped pendant from T.38 (SPG II-IIIa) is decorated with a spectacle spiral and triangles of granulation on the crescent-shaped plate.<sup>31</sup> It follows a slightly earlier example from Toumba grave 59 (LPG/SPG I), without spiral but with granulation, forming the earliest evidence

18 VAVELIDIS and ANDREOU 2008, 362-363; ANDREOU and VAVELIDIS 2014, 460-461.

19 WARDLE 1988, 382-384, 387; 1989, 456, Fig. 2; ANDREOU 2001, 166-168; ANDREOU and EFKLEIDOU 2011.

20 ANDREOU 2001; 2010, 649-651; 2020, 915-918.

21 ANDREOU 2010, 651; CHAVELA 2018, 163; 2022, 54; TRIANTAFYLLOU and ANDREOU 2020, 178-179.

22 ANDREOU and VAVELIDIS 2014, 460; in general, see TRIANTAFYLLOU and ANDREOU 2020.

23 ANDREOU and VAVELIDIS 2014, 461.

24 Cf. HEYMANS 2021, 229-231.

25 CRIELAARD 2006; 2012; LEONE 2012.

26 R. E. Jones (1980), in his analyses of the gold jewellery, states that the source of the gold could not be identified. For Egypt as a source of the gold, see DESCOEUDRES 2008, 306; for the Near East, see COLDSTREAM 2003, 19; for the northern Aegean, see TIVERIOS 1998, 249; LEONE 2012, 232.

27 LEMOS 2001, 217.

28 POPHAM *et al.* 1989, 120 and 128, Fig. 23; POPHAM and LEMOS 1996, pl. 68-69 and 136j; Martin Pruvot *et al.* 2010, 90-91, cat. 20.

29 COLDSTREAM 1995, 398; LEMOS 2002, 132. Northern origins of the spiral motive were already suggested by R. A. Higgins (1980, 221). Skyros: POPHAM and LEMOS 1996, pl. 157f; LEMOS 2002, 132. The term, quadruple spiral bead, follows Maxwell-Hyslop (1971, 35-36), although the earlier types she describes from the ancient Near East are produced very differently. Closer to our example are the quadruple and sextuple spiral beads from shaft grave III at Mycenae (Karo 1930, 52, 188, pl. 21.56-59).

30 POPHAM *et al.* 1979-1980, pl. 173 and 231b.

31 POPHAM *et al.* 1982, 236 and pl. 30a; POPHAM and LEMOS 1996, pl. 40 and 136a.

for the adoption of eastern techniques.<sup>32</sup> A larger, more exquisite example, adding a central band with interconnected spirals in filigree to the composition of the T.38 pendant, is known from a tomb in Chalcis.<sup>33</sup>

It is during this time, in the 9th and particularly the 8th century, that Euboian presence in the northern Aegean is more firmly established. Most notably at Sindos, the emporion or port of call on the Thermaic gulf, at the mouth of the Gallikos river, Euboians were joining the local population, as suggested by the substantial quantities of Euboian pottery in level 8 and 7 (from the late 9th/early 8th century – SPG IIIb).<sup>34</sup> Michalis Tiverios claimed with regard to this context that “there can be no doubt that the Euboians were attracted here chiefly by the gold in the Gallikos river”.<sup>35</sup> Around the same time, Euboians were increasingly formalising their strategic presence in the form of permanent settlements, such as suggested on the basis of the remains around the Vigla hill and the sea-side cemetery at Mende.<sup>36</sup>

On the other side of the gulf, Methone, located on the northern edge of the Pieria, just south of the Haliakmon river delta, provides us with the most important clues for Euboian interest in northern Aegean gold. Following possible earlier contacts, we see clear evidence of an intensification of Euboian involvement in the second half of the 8th century, corresponding to the historical tradition of the foundation of an Eretrian colony there in 733/2, as related by Plutarch.<sup>37</sup>

#### GOLD WORKING AT METHONE AND THE ERETRIA HOARD

Methone was an important regional trading centre, as indicated by the ceramic evidence excavated from the so-called *hypogeion*, a deep underground storage facility abandoned and filled in around the beginning of the 7th century – a timeframe closely following the supposed foundation of the colony. Trade amphorae and fine wares from across the Aegean, even including Phoenician transport amphorae, suggest that Methone was frequented by a diverse



Fig. 2. Methone: gold melting plate from the *hypogeion* (MEΘ 5331/ME 1483; photo I. Coyle, courtesy of Ancient Methone Archaeological Project).

community of traders and functioned as a central node in a network, connecting the Macedonian hinterland with the Aegean and beyond.<sup>38</sup> Moreover, the *hypogeion* contained important clues regarding the processing of gold at the site.<sup>39</sup> These are coarse ware sherds, identified as melting plates, also known from 8th-century layers in the area of the Apollo sanctuary in Eretria and the 7th-century phase of the Pactolus North area in Sardis. They had been used to melt gold dust from placer deposits into larger globule-shaped ingots, indicated by the tiny globules stuck in the vitrified layer and the rounded impressions left on the sherds as a result of the heavy gold ingots sinking into the molten surface (Fig. 2).<sup>40</sup> Together with a sizable nugget and two cut halves of a hammered ingot (Fig. 3), this evidence suggests that – in addition to being an important trade emporion on the edge of the Thermaic gulf – Methone (as probably Sindos) was used as a place to process the gold collected from the nearby placer sources by remelting the gold dust into larger ingots, more suitable for use and transport.

32 POPHAM *et al.* 1988-1989, 120 and 128, Fig. 25; POPHAM and LEMOS 1996, pl. 66 and 136b.

33 Currently on display in the new archaeological museum of Chalcis: see SIMOSI 2022, 220.

34 GIMATZIDIS 2010, esp. 306-308; GIMATZIDIS 2011, 101; cf. KOTSONAS 2012, 249 and 256-257.

35 TIVERIOS 1998, 248-250; 2008, 21.

36 MOSCHONISSIOTI 1998; 2017; but see now GIMATZIDIS 2022.

37 Plut. *Quaest. Graec.* 11 = *Mor.* 293 A-B.

38 BESSIOS *et al.* 2012, in particular chap. 3 (Kotsonas); for the Phoenician transport amphorae, see KASSERI 2012; ILIEVA 2019, 74-75. On Methone more broadly, see MORRIS and PAPADOPOULOS, 2023.

39 We are very grateful to Manthos Bessios, Sarah Morris and John Papadopoulos for granting us initial access to the Methone finds.

40 Sardis: RAMAGE and CRADDOCK 2000, 90, 100, 102-117, 126-127, 132-134, 160-161, 207. Eretria: MEEKS and CRADDOCK 2013, 271-273, pl. 127-129; VERDAN 2013, 148-149, pl. 114. For the Methone melting plates and a detailed description of the production process, see VERDAN 2023; VERDAN and HEYMANS 2020.

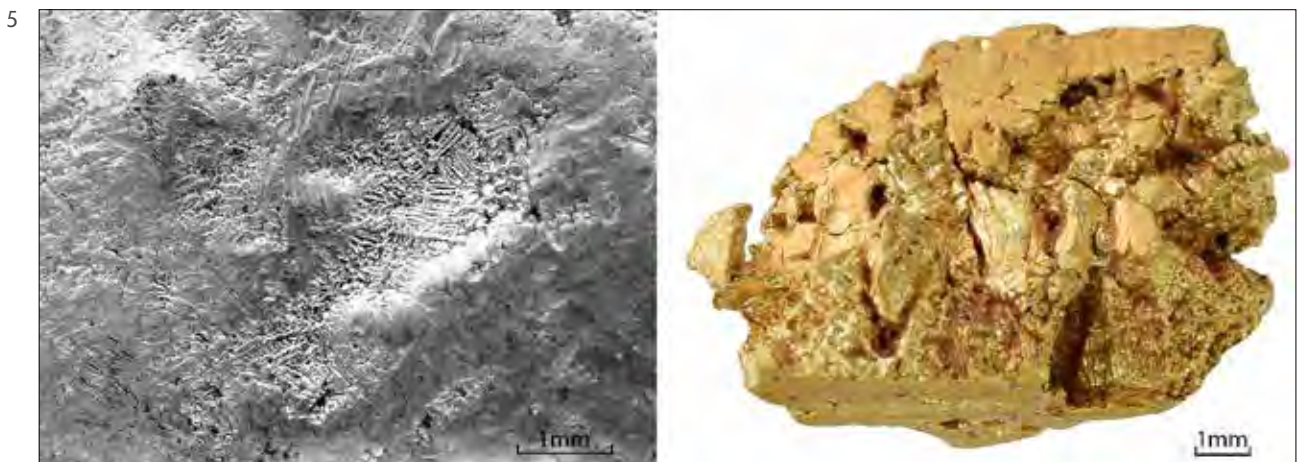
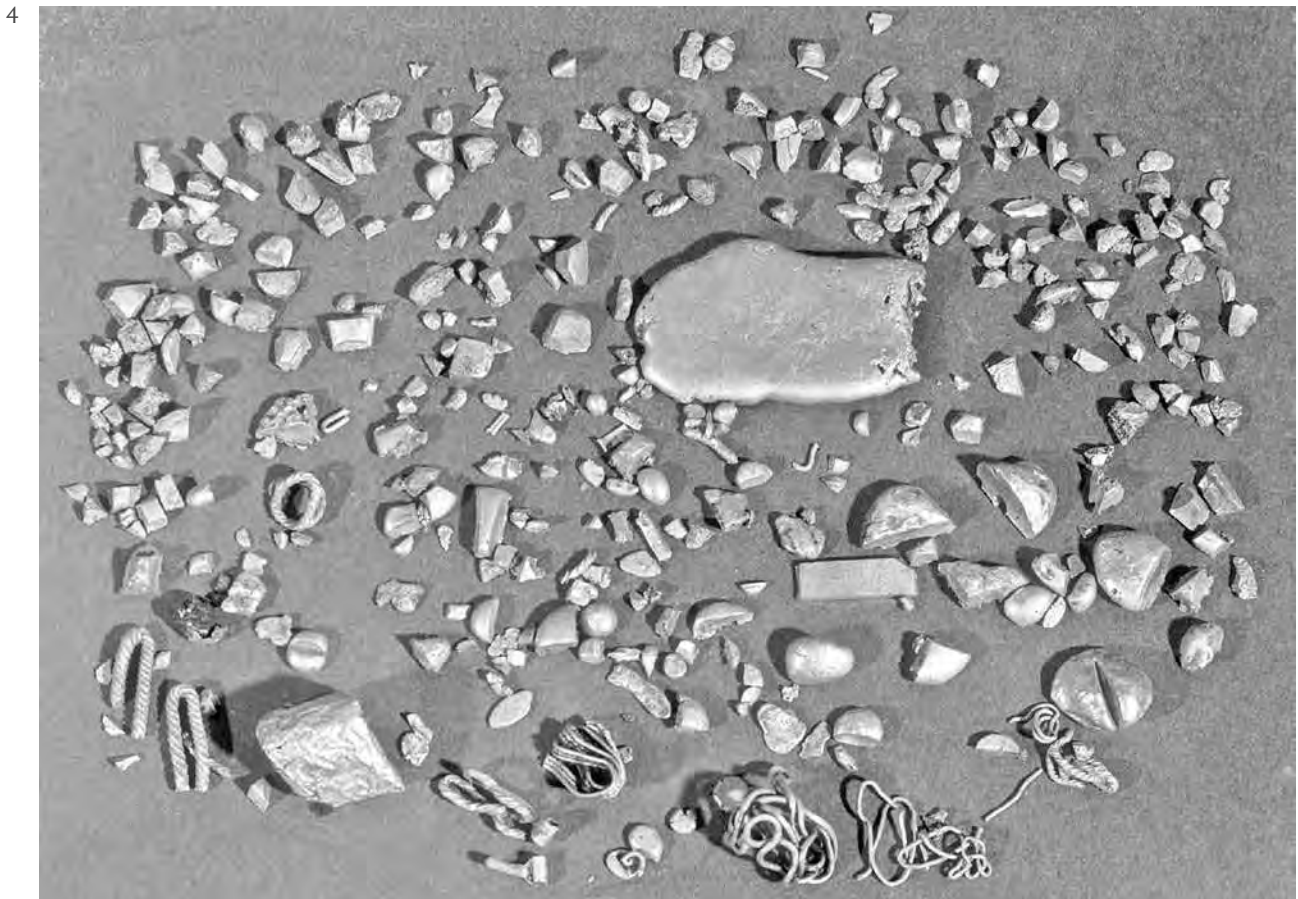




Fig. 3. Methone: nugget and two halves of an ingot (ME 1345 and ME 1346; photo I. Coyle, courtesy of *Ancient Methone Archaeological Project*).

Fig. 4. Eretria: Late Geometric gold hoard, general overview shortly after discovery (photo P. G. Themelis).

Fig. 5. Eretria hoard: left) dendrites on the upper surface of an ingot (Mus. Eret. inv. 14952/no. 5); right) dendrites visible in a cut ingot (Mus. Eret. inv. 14958/no. 300; photo P. Simon).



Importantly, many examples of such ingots, as well as gold nuggets, are present in the only hoard of its type – the contemporary gold hoard from Eretria (Fig. 4).<sup>41</sup> These ingots are often globule shaped with a slightly flat rough underside. Most of them were produced on melting plates and in many cases, dendrites are visible to the naked eye on the upper surface and in some of the cuts near the bottom surface (Fig. 5). This indicates that the ingots were not cold worked or annealed after production, but only left to cool slowly under the still burning fuel, causing the gold to solidify sufficiently slow and uneven for relatively large dendrites to form. Moreover, among several reasons, the resulting interdendritic cavities that can be observed in many cases near the bottom of the ingots made this gold unsuitable to be processed into finished objects, such as foil or jewellery, without being remelted first. This forms a marked difference with the production process suggested by the crucibles from Thessaloniki Toumba,<sup>42</sup> which must have been used for casting small portions of gold for further production into finished objects. In contrast, the melting plates from Methone, coupled with the evidence from Eretria, reflect an industry aimed at processing placer gold from the immediate Macedonian hinterland for the purpose of trade and supply of a maritime network.

As has been argued elsewhere, the gold in the Eretria hoard, dating to the end of the 8th century, was likely used as a form of money in transactions, being cut up where needed into smaller pieces to reach the required weight.<sup>43</sup> Consisting of 398 objects with a total weight of 513 gram, the objects have an average weight of 1.3 gram, but the weight distribution reflects an emphasis on very small objects, with 74% of them weighing below one gram. In fact, objects weighing between 0.1 and 0.2 gram were most numerous, suggesting these were most frequently used in transaction. As we have shown, this metrological pattern is remarkably similar to that of silver hoards from the southern Levant, dating between the late 11th and the late 8th century (Fig. 6), and indicates that the Eretria hoard is reflective of a broader phenomenon in the use and circulation of precious metal.<sup>44</sup> The monetary

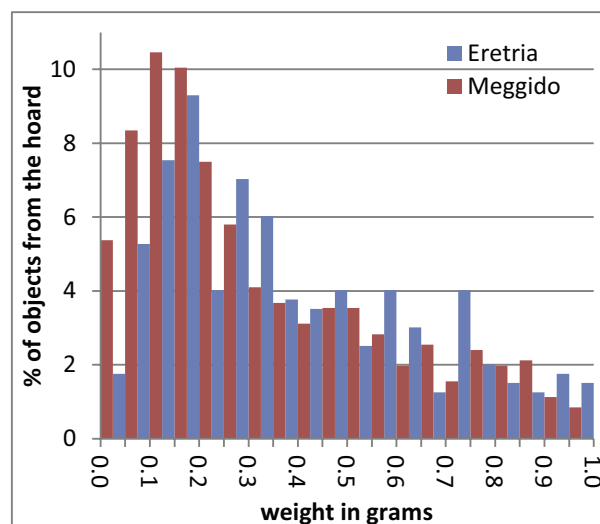


Fig. 6. Histogram of the Eretria hoard and a 10th century BCE hoard from Megiddo.

character of the hoard is furthermore confirmed by the substantial traces of wear on many of the objects, also noted in contemporary hoards from the Levant, indicating that these objects must have circulated intensively, as would be logical for money.<sup>45</sup>

Euboians, especially those engaged in long-distance trade, were no doubt already familiar with weighing out precious metal, as suggested among other things by the group of eastern balance weights from the 9th-century tomb 79 at the Toumba cemetery in Lefkandi.<sup>46</sup> The Eretria hoard though provides evidence for the use and circulation of precious metal money within a local or Aegean system. While the specific source(s) of the Eretria gold cannot at present be determined with certainty,<sup>47</sup> the presence of PGE (platinum Group elements) inclusions in several of the objects in the Eretria hoard (Fig. 7), together with 44 small nuggets (Fig. 8), indicate a placer source for at least part of the gold.<sup>48</sup> Methone, as did Sindos on the north side of the Thermaic gulf, no doubt served as a gateway for the trade in this gold, providing the Euboians – and possibly other visitors well – access to the Macedonian placer sources in its hinterland.<sup>49</sup>

41 THEMELIS 1981; 1983; LE RIDER and VERDAN 2002; HEYMANS 2021, spec. 277, with further references. We, moreover, extend our warm gratitude to Petros Themelis, for giving us permission to re-examine (t)his extraordinary discovery.

42 See note 18.

43 VERDAN and HEYMANS 2020, 287-289; HEYMANS 2021, 98-101, 205-207, 277, with further references.

44 HEYMANS 2021, 90-101.

45 HEYMANS 2021, 99-100; VERDAN and HEYMANS 2020, 289, Fig. 10.

46 KROLL 2008; VERDAN and HEYMANS 2020, 289-290.

47 On the difficulty of determining the origin of gold by means of archaeometric analysis, see PERNICKA 2014, 159-163.

48 On PGE inclusions in gold, see OGDEN 1977; CRADDOCK 2000.

49 VERDAN and HEYMANS 2020.



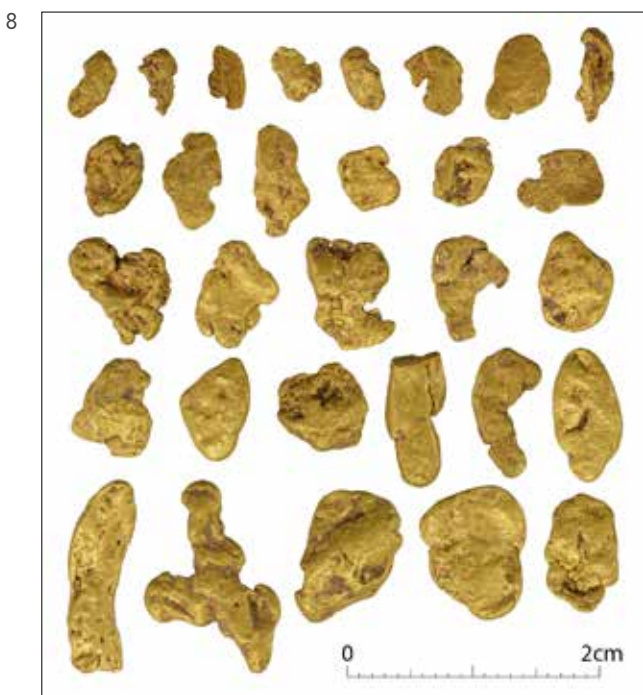
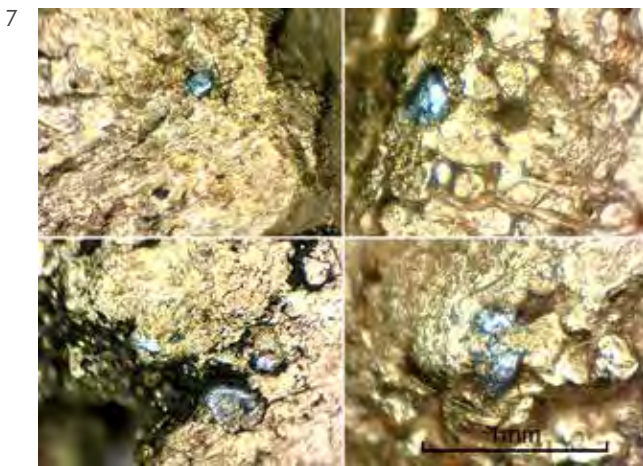


Fig. 7. Eretria hoard: PGE inclusions in gold ingots (left: Mus. Eretr. inv. 14954/no. 47; right: 14952/nos 5-6; photo M. F. Guerra).

Fig. 8. Eretria hoard: selection of nuggets (photo P. Simon).

Fig. 9. Eretria hoard: colour variability of several gold ingots (photo P. Simon).

At the same time, the heterogeneity of the Eretria hoard in terms of composition (and colour: Fig. 9) of the objects (see below) suggests that we are likely dealing with the circulation of gold from different sources, possibly processed in different ways, as well as finished objects away from their primary source, as evidenced by the folded gold foil *Zungendiadem* in the hoard.<sup>50</sup> The exploitation of gold from the area around the Thermaic gulf should thus be considered alongside that of other sources across the northern Aegean including Mysia and even Lydia, and possibly beyond.

### THE CHANGING SIGNIFICANCE OF GOLD IN MACEDONIA

With gold becoming high in demand as a trade commodity and Aegean currency, how were local attitudes towards gold in Macedonia affected by this increased demand? Around the same time as Euboian involvement in the exploitation and trade of northern gold was taking shape, local consumption patterns of gold appear to have shifted. Bronze was clearly still the most important metal of value, used for prestige goods such as jewellery and weapons, but simple gold objects were starting to appear as luxury items.

This can be observed in the funerary evidence from at least the 8th century, perhaps going back even to the 10th century.<sup>51</sup> From the Iron Age tumuli cemetery at Vergina, dating from the 10th to the 7th century, at least 391 burials have been uncovered.<sup>52</sup> These contained over two thousand grave goods, of which some 60% constituted metal objects, predominantly bronze jewellery and dress ornaments,<sup>53</sup> but including some 36 golden hair coils and 10 golden rings/earrings found in 26 tombs.<sup>54</sup> Similar golden hair coils are known from at least nine other cemeteries in Macedonia, albeit in smaller numbers.<sup>55</sup> An

50 Diadem: see THEMELIS 1981, 197-200, Fig. 18-19; THEMELIS 1983, 163, Fig. 14.

51 See in general CHEMSEDDOHA 2019, 248, Fig. 15.

52 ANDRONIKOS 1969; BRÄUNING and KILIAN-DIRLMEIER 2013; CHEMSEDDOHA 2019, 380-395; 2020, 260.

53 CHEMSEDDOHA 2019, 392, Fig. 86; 2020, 260.

54 ANDRONIKOS 1969, 259, pl. KG1-5; BRÄUNING and KILIAN-DIRLMEIER 2013, 54-56, 99, Tab. 29, 48, and Beil. 9-10; CHEMSEDDOHA 2019, 394, Fig. 90. The exact number of objects is uncertain, because there is no table summarising the whole dataset and because the distinction between hair coils and rings has not always been clearly made.

55 In her recent survey of Iron Age funerary evidence CHEMSEDDOHA (2019, 248, Fig. 15) reports eight other sites with golden hair coils: Kastoria-Dailaki (*ibid.*, 299-300),

interesting example is Agrosykia, some ten kilometres north of Pella. Within a small burial group there, consisting of eleven tombs and dating mostly around the 8th century, four hair coils and a small electrum spectacle-spiral ornament were found in three tombs (one was found with no clear context). Also here, bronze grave goods were the most important class of objects, including an exquisite belt lined with bronze pendants from grave ΣΤ.<sup>56</sup> Presumably also from the 8th century are three graves with gold objects from an Iron Age cemetery at Karabournaki, two of which contained a pair of golden earrings, while one contained a hair coil and some pieces of foil together with Euboian-style skyphoi.<sup>57</sup>

While burial customs in Iron Age Macedonia were characterised by a degree of diversity,<sup>58</sup> gold remained rare, as illustrated by the case of Nea Philadelphia. At this extensive cemetery, in use mainly between the 9th and late 7th/early 6th century, a sheer 2.228 graves were investigated over an area of twelve acres, of which only some 40% contained grave offerings. Most of the jewellery was made of bronze or iron and only a handful of golden objects were retrieved, including a pair of earrings, and several mouthpieces.<sup>59</sup>

These lozenge-shaped mouthpieces made out of gold sheet point us to a new phenomenon on the horizon. They appear from the late 8th and 7th century, not only at Nea Philadelphia, but at several other sites around the Thermaic gulf,<sup>60</sup> and presage a surge in the use of sheet gold in graves in the region during the 6th century, most notably in the cemeteries of Archontiko and Sindos, when gold objects in several instances outnumber bronzes.<sup>61</sup> Golden mouthpieces from the 8th and 7th century are known also from Cyprus, Rhodes and Attica,<sup>62</sup> and from the Late Geometric period onwards gold foil ornaments, such

as diadems, and gold grave goods in general became more widespread across the Aegean, in particular in the southern Aegean.<sup>63</sup> This has prompted the suggestions that gold foil grave goods in the northern Aegean were introduced at this early date by Greek colonists settling the region or appeared as a result of southern, i.e. Euboian, influence, giving a new expression to the southern Greek phenomenon of the “princely” or “heroic” burial.<sup>64</sup>

While Euboian colonial involvement in the area of the Thermaic gulf might have had manifold consequences, the emerging use of gold in grave offerings need not only be seen as an imported custom. Rather, local circumstances offer an important context for understanding the shifting significance of gold. Following the rather egalitarian structure of local communities during the Late Bronze Age, indications for social stratification and the emergence of a political hierarchy are becoming visible in the 9th and 8th century. At Nea Philadelphia, a large rectangular building (17.80 x 10.30 m) with various spaces and a storage function was constructed on a hill, and has been interpreted by the excavator as the residence of a local ruler.<sup>65</sup> And at Assiros Toumba, a large apsidal building (c. 15 x 8 m) was erected at the summit of the mound in Phase 1 during the 8th century.<sup>66</sup> It is hardly a coincidence that such developments appeared alongside an increased investment in funerary practices including the dedication of bronze and gold objects, highlighting a stronger emphasis on status and inequality.<sup>67</sup>

The changing use of gold thus appears to have been related to an increase in social complexity and hierarchy. However, while increasing social complexity need not have been prompted by the initial appearance of Euboian colonists on the scene,<sup>68</sup> both the emergence of an elite class and the role of gold in shaping and expressing their status should not be seen in isolation from the impact that gold trade likely had on the region. The visibility of structures reflecting political hierarchy in a place like

Agrosykia (*ibid.*, 348), Archontiko (*ibid.*, 352), Tzamala (*ibid.*, 376), Assomata-Tsardaki (*ibid.*, 379), Makrygialos (*ibid.*, 400), Moschochori (*ibid.*, 401), Petra-Treis Elies (*ibid.*, 407). To this list we can add Karabournaki (see text and n.57).

56 CHRYSOSTOMOU 1991; CHRYSOSTOMOU *et al.* 2007.

57 PANTI and VASILEIOU 2018, 105, 107, 110-111, 120, 131.

58 CHEMSEDDOHA 2017, 389-390; 2019.

59 MISAILIDOU-DESPOTIDOU 2008, 36-40.

60 DESPINI 2009, 34-35; SARIPANIDI 2017, 106; CHEMSEDDOHA 2019, 248 (Fig. 15) and 259-262 (Fig. 19).

61 CHRYSOSTOMOU and CHRYSOSTOMOU 2012; SARIPANIDI 2017, 81-89, 134, Fig. 7; 2019; DESPINI 2016; HATZOPOULOS 2020, 19-23. For the cemetery near Thessaloniki Toumba, see CHAVELA 2022, 56-58.

62 SARIPANIDI 2017, 98-99, 106-107.

63 Gold foil ornaments: OHLY 1953. Eretria: BLANDIN 2007, vol. 1, 92-98. Increased popularity of gold grave goods in the southern Aegean was no doubt also stimulated by Phoenician contacts with Crete and the Dodecanese, although the question where this gold came from remains unexplored.

64 DESPINI 2009, 35-38; SARIPANIDI 2017, 106-108.

65 MISAILIDOU-DESPOTIDOU 2008, 28-34.

66 WARDLE and WARDLE 2000.

67 ANDREOU 2020, 928-930

68 GIMATZIDIS 2020.

Nea Philadelphia, an upstream settlement along the gold-bearing Gallikos river, certainly counts as an indication for this: this settlement, no doubt active in the exploitation of placer gold, flourished between the 9th and 7th century as a result of the gold trade.

### EUBOIAN DEMISE?

After the early 7th century, evidence for Euboian colonial and maritime activity decreases. This has often been explained with reference to the so-called Lelantine War, which would have exhausted its main players, Chalcis and Eretria, although the historicity of this conflict has been contested.<sup>69</sup> After the start of the century, the export of Euboian pottery, the main indicator of Euboian maritime activity, appears to have dropped but decreased visibility of Euboian pottery in the archaeological record need not indicate an abrupt downturn. Firstly, identifying Euboian vases from this period is complicated by the fact that they have fewer distinctive features than in the Late Geometric period. Secondly, local production shows a decline in quality, in terms of both fabric and decoration, explaining why it became less interesting for export. This is particularly the case for banquet vessels (craters, drinking vases), which had previously circulated in large numbers. Yet, if we accept the evidence as representative of a downturn, it would also reflect a dearth in long-distance maritime activity: Euboian pottery disappeared in the Levant mostly after 700, and even at Al Mina, East Greek pottery appears to have replaced Euboian pottery by 670 (level 6) at the latest.<sup>70</sup> Moreover, other indicators also signal the loss of Euboian colonial supremacy. No new Euboian colonies were established in the region after the early 7th century (with the possible exception of Dikaia)<sup>71</sup> and Euboians were superseded by other colonisers, such as Andrians, Parians and Corinthians.<sup>72</sup> These changes were no doubt the result of multiple and complex factors, and we can hardly aim to consider these here in full. We do, however, want to address one potential aspect of this perceived demise.

While the Gallikos river was still referred to in the 5th century by Herodotus as the *Echedoros* – gift bearing, no ancient source makes an actual mention of its gold content.<sup>73</sup> It could well be the case that large-scale exploitation of placer sources around the Thermaic gulf had become less profitable in the course of the 7th century and that the Gallikos was no longer actively exploited in later times, with only the name reflecting its former wealth. Euboian demand for gold over the course of two centuries or more had stimulated exploitation by local groups, also testified by the prospering of local settlements upstream such as Nea Philadelphia. Especially since large-scale exploitation before the Iron Age is uncertain if not unlikely, efforts to exploit the gold must have been very profitable at first. However, natural resources are not historically static and replenishment through erosion or geological events could most likely not keep up with exploitation. As a result, these placer sources were bound to become exhausted beyond profitability at some point.<sup>74</sup> Whether that point was reached for the Euboians during the 7th century is hard to tell. While new evidence for melting plates at Methone from the Archaic workshop area (c. 675-550) suggests that gold processing could have continued at least into the 7th century,<sup>75</sup> it is possible that the yield of the deposits diminished and that Euboian traders lost interest as silver replaced gold as the dominant Aegean commodity of value and currency in the later 7th century.<sup>76</sup> It is also possible that exploitation continued but that they simply lost any preferential access to the gold they might have had. The prominence of gold in wealthy burials of the 6th century in Archontiko and Sindos could indicate continuity in local exploitation, although this gold could have come from other primary and placer gold deposits across the northern Aegean as well.<sup>77</sup> In any event, it is more relevant to note in this regard that in order to produce large pieces of foil only small bits

69 PARKER 1997, 91-92; COLDSTREAM 2003, 182; WALKER 2004, 89-92, 161-163; cf. HALL 2007, 1-8; VERDAN and HEYMANS 2020, 291.

70 FANTALKIN 2006, 201; VACEK 2017.

71 VOUTIRAS 2008 (dating the foundation after 470); *contra* TIVERIOS 2013, 100 (8th century).

72 There is evidence that (local) Chalkidians joined others, such as the Andrians in their foundations of Sane and Akanthos, but this is usually considered as a sign of weakness from the Chalkidians. See Plut. *Quaest. Graec.* 30; GRAHAM 1978, 96; TIVERIOS 2008, 52-66.

73 Hdt. 7.124, 127; cf. Skyl. 66; Apollod. 2.5.11.

74 Several sources in fact note the exhausted gold mines. When touching upon the gold mines of the ruined city of Astyra, in the Troad, Strabo (13.1.23) notes that “these mines are now scant, being used up, like those on Mt. Tmolus in the neighbourhood of the Pactolus River.” Elsewhere (14.5.28), he relates that the Lydian kings got their wealth from mines “in Lydia and from the region between Atarneus and Pergamum, where is a small deserted town, whose lands have been exhausted of ore.” (transl. Loeb).

75 We thank Sarah Morris and John Papadopoulos for generously sharing this information with us. On the Archaic workshop area, see MORRIS *et al.* 2020, 699-702.

76 Cf. Heymans 2021, 217-225.

77 Cf. VAVELIDIS and ANDREOU 2008, 362, Fig. 1, cf. SARIPANIDI 2019, 181.

of gold are needed, and that the gold in these burials thus cannot possibly compare to the quantities that had been traded earlier by the Euboians, such as that preserved in the Eretria hoard.

### A WIDER PHENOMENON

Now, should the Euboian endeavour to secure access to gold resources be regarded as an isolated phenomenon? Euboians might have been the first but they were certainly not the only group to take an active interest in northern gold sources in the early Greek world. As suggested earlier, Euboian involvement in regions around the Thermaic gulf can be understood in a broader context of emerging efforts to exploit gold resources and the increase of its use within the Aegean.

A starting point here is to look again at the Eretria hoard. As noted, the composition of the objects in the hoard is diverse, with gold ratios varying between 99.6% and 45.5%.<sup>78</sup> Considering the evidence for the intensive circulation of the objects, could it be that the hoard contained gold from diverse provenances, not unlike a later mixed coin hoard? The hoard could have served to carry out transactions of the sort that took place in Methone, involving traders from across the Aegean and beyond, and thereby potentially absorbed metal from various sources.

Unminted gold objects, typologically similar to the globule and token (flattened globules) ingots in the Eretria hoard, and dating at least from the third quarter of the 7th century are known also from the Artemision at Ephesus, which was an Aegean seaport. Significantly, these were found together with the first minted coins.<sup>79</sup> Slightly later, dating to the late 7th or early 6th century, an inscribed lead tablet from the sanctuary preserves a record of the sanctuary's financial administration, indicating the use of unminted gold and silver in maritime trade.<sup>80</sup>

78 XRF analyses were carried out in the framework of our ongoing study of the hoard. This project is undertaken in cooperation with Maria Filomena Guerra, whom we thank warmly for her invaluable help and input, and would not have been possible without the support of Angeliki Simosi, head of the Ephorate of Antiquities of Euboea, and Athena Athanassiadou, of the Ephorate of Antiquities of Pieria, whom we gratefully acknowledge. We are furthermore thankful for the support provided by the Swiss School of Archaeology in Greece and the Mediterranean Archaeological Trust.

79 HOGARTH 1908, 119; ROBINSON 1951, 156, 166-167; KERSCHNER and KONUK 2020, 94-95, 102, 107-108, 111-113, figs 5.1, 7.83, 8.A-G, 9.

80 KROLL 2020.

Was Euboian exploitation of gold and adoption of gold money in the context of trade paralleled by other players in the Aegean? Little direct evidence survives of an early Phoenician involvement or presence at Thasos. Herodotus relates that the Phoenicians were the first to exploit primary gold deposits on the island,<sup>81</sup> and John Graham suggested more than fifty years ago that Phoenicians exploited the metal sources on the island before a crisis in Phoenicia proper following the destruction of Sidon in 677 by the Assyrians led them to retreat, after which Parian colonists came to settle the island.<sup>82</sup> Much later, Pliny the Elder records that gold mining and smelting would have been invented by the Phoenician Kadmos at Pangaion, and also Strabo associates Kadmos with the precious metal sources in the region, noting that he gained his wealth from the mines “around Thrace and mount Pangaion.”<sup>83</sup> One wonders why these traditions focus specifically on gold, if the exploitation of silver sources on Thasos and the area of the Pangaion was certainly no less important and, moreover, had considerable antiquity, with evidence for cupellation at Limenaria on Thasos dating already to the late fourth millennium.<sup>84</sup>

An answer to this question could be sought in the fact that until the mid-7th century silver was presumably not yet exploited on a significant scale. Industrial production of silver demanded a much higher investment and bigger scale of organisation in order to become profitable, while exploitation of primary and placer gold could be profitable on a relatively small scale. The amount of labour and fuel needed for mining and the processing of argentiferous lead ores in order to produce silver on an industrial scale presumes a serious level of investment and organisation. On the contrary, gold exploitation requires no complex logistics and can be undertaken on a small scale with a proportionate yield.<sup>85</sup> Could it be that these traditions

81 Hdt. 6.47.

82 GRAHAM 1978; cf. MORRIS 1992, 144-145; TIVERIOS 2008, 74-76, 126; SANIDAS *et al.* 2018.

83 Plin. *HN* 7.197; Strab. 14.5.28.

84 E.g. BASSIAKOS *et al.* 2019.

85 BORG 2014. Non-industrial mining, generally referred to artisanal and small-scale mining (ASM) is common still today and most widespread in developing countries. Artisanal and small-scale gold mining accounts for 20% of the global supply. See [https://www.worldbank.org/en/topic/extractiveindustries/brief/artisanal-and-small-scale-mining#:~:text=Artisanal%20and%20Small%20Scale%20Mining%20occurs%20in%20approximately%2080%20countries,to%2020%25%20of%20diamond%20mining;ASGM report 2022 – World Gold Council \(https://www.gold.org/esg/artisanal-and-small-scale-gold-mining#registration-type=google&just-verified=1\)](https://www.worldbank.org/en/topic/extractiveindustries/brief/artisanal-and-small-scale-mining#:~:text=Artisanal%20and%20Small%20Scale%20Mining%20occurs%20in%20approximately%2080%20countries,to%2020%25%20of%20diamond%20mining;ASGM%20report%202022%20-%20World%20Gold%20Council%20(https://www.gold.org/esg/artisanal-and-small-scale-gold-mining#registration-type=google&just-verified=1)).

emphasising gold reflect memories of a period – in the 8th and early 7th century – during which silver did not yet function as an important currency and trade commodity and Phoenicians maintained access to the region’s gold?

Recent research now also highlights Lydian interest in gold sources in northwestern Asia Minor – Mysia, Aeolis and the Troad – from at least the early 7th century on. Under the early Mermnad dynasty, Lydia expanded its presence into these regions, with the likely purpose of controlling its gold sources.<sup>86</sup> Its ruler, Gyges, was referred to by his contemporary, Archilochos, as “rich in gold” and Strabo would later note that Gyges (and Alyattes and Kroisos) based his wealth on the mines in Lydia and in the region between Atarneus and Pergamon.<sup>87</sup>

Gold must have been of good use to the Lydians already in the early 7th century and, shortly after, this led them to produce their famous coinage. While it was long thought that Lydian royal issues were produced from natural electrum in the Pactolus river, it is now clear that these coins were artificially manipulated and the supply of gold from the much wealthier sources of the northwestern Aegean must have played an important role in their production.<sup>88</sup> So, arguably, what appears to have started with Euboian interest in gold sources around the Thermaic gulf can be understood in a broader context of exploitation and use of gold in the northern Aegean, including – in the second half of the 7th century – the introduction of coinage in Lydia.

## CONCLUSION

The purpose of this article was to show how the significance and value of gold changed between the 12th and the 10th century, and again between the 10th and the 7th century for the different players involved in the exploitation and trade of gold in the northern Aegean. At the same time, tracing the role of gold allowed us to see how its sources and the interactions revolving around it shaped the different societies across the colonial environment, while in turn, broader developments in these societies gave rise to changing regimes of value and the appropriation of gold in that context. While this article is not primarily concerned with colonial interactions, it is clear that

the interplay between local communities, colonial groups and the environment was key to the changing role of gold. Taking explicit account of these three factors, we can outline our understanding of this development in the following way.

The presence of placer gold sources in the region around the Thermaic gulf formed one of the reasons that Euboians were drawn to the area early on. Local societies of the Late Bronze Age in central Macedonia appear to have had conspicuously little use for the precious metal as a status marker, because their social structures afforded limited space for emphasising inequality. In Euboia, however, gold played an important role as a prestige good and contacts between early Euboian visitors/settlers and local groups in the north provided a way to acquire gold, as communities started to systematically exploit placer deposits. Increased productivity, paralleled by the intensification of interactions revolving around the exploitation of gold, including the establishment of a Euboian colonial presence, in turn enabled the adoption of gold as a form of money by the 8th century.

Having secured access to gold sources through their colonial presence in the region and local contacts, Euboians enjoyed the benefits of its use in Aegean trade. At the same time, increasing social complexity in local communities impacted by the colonial environment went hand in hand with the appropriation of gold within local Macedonian regimes of value, a development that would continue into the Archaic period. In this way, long-term interactions between Euboians, local groups and their environment ended up shaping both local attitudes towards gold, and the changing role of the metal among Euboians.

This was not an isolated phenomenon, and the adoption of gold as an Aegean form of money was likely contingent upon the exploitation and use of gold by other players in the Aegean. Although limited evidence is available, other gold sources in the northern Aegean – in Thrace, Mysia and the Troad, appear to have become the focus of interest by the 8th and early 7th century, as electrum became the preferred metal of value in the Aegean.

86 CAHILL *et al.* 2020, 312–320.

87 Archil. fr. 19; Strab. 14.5.28. See CAHILL *et al.* 2020, 317, for additional references.

88 CAHILL *et al.* 2020, 312–320; VAN ALFEN and WARTENBERG 2020, 4–5.

## BIBLIOGRAPHY

- S. ANDREOU, “Exploring the patterns of power in the Bronze Age settlements of northern Greece”, in: K. BRANIGAN (ed.), *Urbanism in the Aegean Bronze Age*, London, 2001, 160-173.
- S. ANDREOU, “Northern Aegean”, in: E. H. CLINE (ed.), *The Oxford Handbook of the Bronze Age Aegean (ca. 3000-1000 BC)*, New York and Oxford, 2010, 643-659.
- S. ANDREOU, “The Thermaic gulf”, in: I. LEMOS and A. KOTSONAS (eds), *A Companion to the Archaeology of Early Greece and the Mediterranean*, Hoboken NJ, 2020, 913-938.
- S. ANDREOU and K. ΕΦΚΛΕΙΔΟΥ, “Η πανεπιστημιακή ανασκαφή στη Τούμπα Θεσσαλονίκης, 2008”, *Το Αρχαιολογικό Έργο στη Μακεδονία και τη Θράκη* 22, (2011), 323-328.
- S. ANDREOU and M. VAVELIDIS, “So rich and yet so poor: Investigating the scarcity of gold artefacts in Bronze Age northern Greece”, in: H. MELLER, R. RISCH and E. PERNICKA (eds), *Metalle der Macht – Frühes Gold und Silber. Metals of Power – Early Gold and Silver*, 6. *Mitteldeutscher Archäologentag*, 17-19. Oktober 2013, Halle, 2014, 451-465 [*Tagungen des Landesmuseum für Vorgeschichte Halle* 12].
- M. ANDRONIKOS, *Βεργίνα Ι. Το Νεκροταφείον των Τύμβων*, Athens, 1969 [*Βιβλιοθήκη της εν Αθήναις Αρχαιολογικής Εταιρείας* 62].
- Y. BASSIAKOS, N. NERANTZIS and S. PAPADOPOULOS, “Late Neolithic/Early Bronze Age metallurgical practices at Limenaria, Thasos: Evidence for silver and copper production”, *Archaeological and Anthropological Sciences* 11/6 (2019), 2743-2757.
- M. BESSIOS, I. TZIFOPOULOS and A. KOTSONAS, *Μεθώνη Πιερίας Ι. Επιγραφές, χαράγματα και εμπορικά σύμβολα στη γεωμετρική και αρχαϊκή κεραμική από το “Υπόγειο” της Μεθώνης Πιερίας στη Μακεδονία*, Thessaloniki, 2012.
- B. BLANDIN, *Les pratiques funéraires d'époque géométrique à Érétrie. Espace des vivants, demeures des morts*, Gollion, 2007 [*Eretria* XVII].
- G. BORG, “Gold is where you find it – Zeitgenössischer artisanaler Goldbergbau in Afrika als Analogie (prä-) historischer Goldgewinnung”, in: H. MELLER, R. RISCH and E. PERNICKA (eds), *Metalle der Macht – Frühes Gold und Silber. Metals of Power – Early Gold and Silver*, 6. *Mitteldeutscher Archäologentag*, 17-19. Oktober 2013, Halle, 2014, 53-69 [*Tagungen des Landesmuseum für Vorgeschichte Halle* 12].
- A. BRÄUNING and I. KILIAN-DIRLMEIER, *Die eisenzeitlichen Grabhügel von Vergina. Die Ausgrabungen von Photis Petsas 1960-1961*, Mainz, 2013 [*Monographien des Römisch-Germanischen Zentralmuseums* 119].
- N. CAHILL, J. HARI, B. ÖNAY and E. DOKUMACI, “Depletion gilding of Lydian electrum coins and the sources of Lydian gold”, in: P. VAN ALFEN, U. WARTENBERG, W. FISCHER-BOSSERT, H. GITLER, K. KONUK and C. C. LORBER (eds), *White Gold: Studies in early electrum coinage*, New York and Jerusalem, 2020, 291-336.
- X. CHARALAMBIDOU, “Viewing Euboea in relation to its colonies and relevant sites in northern Greece and Italy”, in: A. MAZARAKIS AINIAN, A. ALEXANDRIDOU and X. CHARALAMBIDOU (eds), *Regional Stories Towards a New Perception of the Early Greek World, Acts of an International Symposium in honour of Professor Jan Bouzek, Volos 18-21 June 2015*, Volos, 2017, 85-119.
- K. CHAVELA, “Transformations and formations around the Thermaic gulf in the Late Bronze and Early Iron Age: The evidence of burial practices”, in: S. GIMATZIDIS, M. PIENIAZEK and S. MANGALAGLOU-VORTUBA (eds), *Archaeology across Frontiers and Borderlands: Fragmentation and Connectivity in the North Aegean and the Central Balkans from the Bronze Age to the Iron Age*, Vienna, 2018, 159-186.
- K. CHAVELA, “‘Poor’ indigenous and ‘wealthy’ Macedonians (?). The evidence of burial practices around the Thermaic gulf (Thessaloniki)”, in: U. KELP and W.-R. TEEGEN (eds), *Wealthy and Healthy? Methodological Approaches to Non-Élite Burials, Proceedings of the 19th International Congress of Classical Archaeology, Cologne/Bonn 22 – 26 May 2018, Archaeology and Economy in the Ancient World, Panel 1.2*, Heidelberg, 2022, 53-70.
- A.-Z. CHEMSEDDOHA, “New perspectives on the burial customs in Macedonia during the Early Iron Age”, in: A. MAZARAKIS AINIAN, A. ALEXANDRIDOU and X. CHARALAMBIDOU (eds), *Regional Stories Towards a New Perception of the Early Greek World, Acts of an International Symposium in honour of Professor Jan Bouzek, Volos 18-21 June 2015*, Volos, 2017, 381-394.
- A.-Z. CHEMSEDDOHA, *Les pratiques funéraires de l'âge du Fer en Grèce du Nord: étude d'histoires régionales*, Bordeaux, 2019 [*Scripta Antiqua* 121].
- A.-Z. CHEMSEDDOHA, “Connections between the Balkans and the Aegean”, in: M. GAVRANOVIĆ, D. HEILMANN, A. KAPURAN and M. VERČÍK



(eds), *Spheres of Interaction: Contacts and Relationships between the Balkans and Adjacent Regions in the Late Bronze / Iron Age (13<sup>th</sup>–5<sup>th</sup> Centuries BCE)*, Rahden/Westf., 2020, 253–269.

A. CHRYSOSTOMOU, “Νεκροταφείο της εποχής Σιδήρου στην Αγροσυκιά Γιαννιτών”, *Το Αρχαιολογικό Έργο στη Μακεδονία και τη Θράκη* 5 (1991), 127–136.

A. CHRYSOSTOMOU and P. CHRYSOSTOMOU, “The “gold-wearing” Archaic Macedonians from the western cemetery of Archontiko, Pella”, in: M. TIVERIOS, P. NIGDELIS and P. ADAM-VELENI (eds), *Θρεπτήρια: μελέτες για την αρχαία Μακεδονία, Threperia: Studies on Ancient Macedonia*, Thessaloniki, 2012, 491–516.

P. CHRYSOSTOMOU, I. ASLANIS and A. CHRYSOSTOMOU, *Αγροσυκιά: ένας οικισμός των προϊστορικών και ιστορικών χρόνων*, Veria, 2007.

J.N. COLDSTREAM, *Geometric Greece, 900–700 B.C.*, London, 2003 [1977].

J.N. COLDSTREAM, “The Rich Lady of the Areiopagos and her contemporaries: A tribute in memory of Evelyn Lord Smithson”, *Hesperia* 64/4 (1995), 391–403.

P.T. CRADDOCK, “The Platinum Group Element Inclusions”, in: A. RAMAGE and P.T. CRADDOCK and Craddock (eds) *King Croesus’ Gold. Excavations at Sardis and the History of Gold Refining*, Cambridge, 2000, 238–244 [*Archaeological Exploration of Sardis* 11].

J.P. CRIELAARD, “Basileis at sea: Elites and external contacts in the Euboean gulf region from the end of the Bronze Age to the beginning of the Iron Age”, in: S. DEGER-JALKOTZY and I.S. LEMOS (eds), *Ancient Greece from the Mycenaean Palaces to the Age of Homer*, Edinburgh, 2006, 271–297 [*Edinburgh Leventis Studies* 3].

J.P. CRIELAARD, “*Hygra keleutha*. Maritime matters and the ideology of seafaring in the Greek epic tradition”, in: *Alle origini della Magna Grecia. Mobilità, migrazioni, fondazioni, Atti del cinquantesimo convegno di studi sulla Magna Grecia, Taranto 1–4 ottobre 2010*, Taranto, 2012, 135–157.

J.-P. DESCOEUDRES, “Central Greece on the eve of the colonisation movement”, in: G.R. TSETSKHLADZE (ed.), *Greek Colonisation: An Account of Greek Colonies and Other Settlements Overseas*, vol. 2, Leiden and Boston, 2008, 289–382.

A. DESPINI, “Gold funerary masks”, *AntK* 52 (2009), 20–65.

A. DESPINI, *Σίνδος III: το νεκροταφείο, ανασκαφικές έρευνες 1980–1982. Μάσκες και χρυσά ελάσματα, κοσμήματα, μικροαντικείμενα και στλεγγίδες, είδη σπλισμού*, Athens, 2016 [Βιβλιοθήκη της εν Αθήναις Αρχαιολογικής Εταιρείας 309].

N. ERB-SATULLO, “Technological rejection in regions of early gold innovation revealed by geospatial analysis”, *Scientific Reports* 11 (2021), <https://doi.org/10.1038/s41598-021-98514-7>.

A. FANTALKIN, “Identity in the making: Greeks in the eastern Mediterranean during the Iron Age”, in: A. VILLING and U. SCHLOTZHAUER (eds), *Naukratis: Greek Diversity in Egypt. Studies on East Greek Pottery and Exchange in the Eastern Mediterranean*, London, 2006, 199–208.

R. FIRTH, *Primitive Polynesian Economy*, London, 1965 [1939].

T.F. GARRARD, *Akan Weights and the Gold Trade*, London, 1980.

S. GIMATZIDIS, *Die Stadt Sindos: eine Siedlung von der Späten Bronze- bis zur Klassischen Zeit am Thermaischen Golf in Makedonien*, Rahden/Westf., 2010 [*Prähistorische Archäologische in Südosteuropa* 26].

S. GIMATZIDIS, “Counting sherds at Sindos: Pottery consumption and construction of identities in the Iron Age”, in: S. VERDAN, T. THEURILLAT and A. KENZELMANN PFYFFER (eds), *Early Iron Age Pottery: A Quantitative Approach, Proceedings of the International Round Table, Athens 28–30 November 2008*, Oxford, 2011, 97–110 [*BAR IS* 2254].

S. GIMATZIDIS, “The economy of early Greek colonisation in the northern Aegean”, *Journal of Greek Archaeology* 5 (2020), 243–262.

S. GIMATZIDIS, “Early Greek Colonisation in the Northern Aegean: A New Perspective from Mende”, in: C. COLOMBI, V. PARISI, O. DALLY, M. A. GUGGISBERG and G. PIRAS (eds), *Comparing Greek Colonies: Mobility and Settlement Consolidation from Southern Italy to the Black Sea (8th–6th Century BC), Proceedings of the International Conference (Rome, 7–9.11.2018)*, Berlin, 2022, 52–67

A.J. GRAHAM, “The foundation of Thasos”, *BSA* 73 (1978), 61–98.

J.M. HALL, *A History of the Archaic Greek World, ca. 1200–479 BCE*, Chichester, 2007.

- M.B. HATZOPOULOS, *Ancient Macedonia*, Berlin and Boston, 2020.
- E.W. HERBERT, *Red Gold of Africa: Copper in Precolonial History and Culture*, Madison and London, 1984.
- E.D. HEYMANS, *The Origins of Money in the Iron Age Mediterranean World*, Cambridge, 2021.
- R.A. HIGGINS, “The jewellery”, in POPHAM *et al.* 1979-1980, vol. text, 1980, 217-225.
- A. HOCHSTETTER, *Kastanas. Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens 1975-1979. Die Kleinfunde*, Berlin, 1987 [Prähistorische Archäologie in Südosteuropa 6].
- D.G. HOGART, *Excavations at Ephesos. The Archaic Artemisia*, London, 1908.
- P. ILIEVA, “Phoenicians, Cypriots and Euboeans in the northern Aegean: A reappraisal”, *Aura* 2 (2019), 65-102.
- R.E. JONES 1980, “Analyses of gold objects from the cemeteries”, in: POPHAM *et al.* 1979-1980, vol. text, 461-464.
- G. KARO, *Die Schachtgräber von Mykenai*, Munich, 1930.
- A. KASSERI, “Φοινικικοί εμπορικοί αμφορείς από τη Μεθώνη Πεερίας”, in: E. ΚΕΦΑΛΙΔΟΥ and D. ΤΣΙΑΦΑΚΙ (eds), *Κεραμέως παίδες. Αντίδωρο στον Καθηγητή Μιχάλη Τιβέριο από τους μαθητές του*, Thessaloniki, 2012, 299-308.
- M. KERSCHNER and K. KONUK, “Electrum coins and their archaeological context: The case of the Artemision of Ephesus”, in: P. VAN ALFEN, U. WARTENBERG, W. FISCHER-BOSSERT, H. GITLER, K. KONUK and C. C. LORBER (eds), *White Gold: Studies in Early Electrum Coinage*, New York and Jerusalem, 2020, 83-190.
- A. KOTSONAS, “What makes a Euboean colony or trading station? Zagora in the Cyclades, Methone in the Thermaic gulf, and Aegean networks in the 8th century BC”, in: J.-P. DESCOEUDRES and S.A. PASPALAS (eds), *Zagora in Context: Settlements and Intercommunal Links in the Geometric Period (900-700 BC), Proceedings of the Conference, Athens, 20-22 May 2012, MeditArch* 25 (2012), 243-257.
- J.H. KROLL, “Early Iron Age balance weights at Lefkandi, Euboea”, *OJA* 27, 1 (2008), 37-48.
- J.H. KROLL, “The inscribed account on lead from the Ephesian Artemisium”, in: P. VAN ALFEN, U. WARTENBERG, W. FISCHER-BOSSERT, H. GITLER, K. KONUK and C. C. LORBER (eds), *White Gold: Studies in Early Electrum Coinage*, New York and Jerusalem, 2020, 49-64.
- T.J. LECAIN, “Environmental history and global mining: Towards a neo-materialist approach”, in: S. BERGER and P. ALEXANDER (eds), *Making Sense of Mining History*, London, 2019, 283-301.
- I.S. LEMOS, “The Lefkandi connection: Networking in the Aegean and the eastern Mediterranean”, in: L. BONFANTE and V. KARAGEORGHIS (eds), *Italy and Cyprus in Antiquity: 1500-450 BC, Proceedings of an International Symposium held at the Italian Academy for Advanced Studies in America at Columbia University, November 16- 18, 2000*, Nicosia, 2001, 215-226.
- I.S. LEMOS, *The Protogeometric Aegean. The Archaeology of the Late Eleventh and Tenth Centuries BC*, Oxford, 2002.
- I.S. LEMOS, “Euboea”, in: I.S. LEMOS and A. KOTSONAS (eds), *A Companion to the Archaeology of Early Greece and the Mediterranean*, Hoboken NJ, 2020, 787-813.
- B. LEONE, “A Trade Route between Euboea and the Northern Aegean”, in: J.-P. Descoedres and S. A. Paspalas (eds), *Zagora in Context: Settlements and Intercommunal Links in the Geometric Period (900-700 BC), Proceedings of the Conference, Athens, 20-22 May 2012, MeditArch* 25 (2012), 229-241.
- G. LE RIDER and S. VERDAN, “La trouvaille d’Érétrie: réserve d’un orfèvre ou dépôt monétaire?”, *AntK* 45 (2002), 133-152.
- C. MARTIN PRUVOT, K. REBER and T. THEURILLAT, *Cité sous terre: des archéologues suisses explorent la cité grecque d’Érétrie*, Gollion, 2010.
- K.R. MAXWELL-HYSLOP, *Western Asiatic Jewellery c.3000-612 B.C.*, London, 1971.
- N.D. MEEKS and P.T. CRADDOCK, “Scientific examination of two sherds with gold particles”, in VERDAN 2013, 271-273.
- V. MISAILIDOU-DESPOTIDOU, “Νέα Φιλαδέλφεια, οικιστικές εγκαταστάσεις και νεκροταφεία στην ενδοχώρα της Θεσσαλονίκης”, in: G. ΑΙΚΑΤΕΡΙΝΙΔΗΣ (ed.), *Αρχαιολογικές τροχιοδρομήσεις από τη Θεσσαλονίκη στον Πλαταμώνα*, Athens, 2008, 24-69.



S.P. MORRIS, *Daidalos and the Origins of Greek Art*, Princeton, 1992.

S.P. MORRIS and J.K. PAPADOPOULOS (eds), *Ancient Methone 2003-2011*, 2 vol., Los Angeles, 2023 [*Monumenta Archaeologica* 49].

S.P. MORRIS, J.K. PAPADOPOULOS, M. BESSIOS, A. ATHANASSIADOU and K. NOULAS, “The Ancient Methone Archaeological Project: A preliminary report on fieldwork, 2014-2017”, *Hesperia* 89 (2020), 659-723.

S. MOSCHONISSIOTI, “Excavations at ancient Mende”, in: M. BATS and B. D’AGOSTINO (eds), *Euboica: L’Eubea e la presenza euboica in Calcidica e in Occidente, Atti del Convegno Internazionale di Napoli, 13-16 Novembre 1996*, Naples, 1998, 255-271.

S. MOSCHONISSIOTI, “The city of Mende during the late eighth and seventh centuries BC”, in: X. CHARALAMBIDOU and C. MORGAN (eds), *Interpreting the Seventh Century BC: Tradition and Innovation, Proceedings of the International Colloquium Conference held at the British School at Athens, 9th-11th December 2011*, Oxford, 2017, 355-363.

J. M. ODGEN, “Platinum Group metal inclusions in ancient gold artifacts”, *Journal of the Historical Metallurgy Society*, 11/2 (1977), 53-72.

D. OHLY, *Griechische Goldbleche des 8. Jahrhunderts v. Chr.*, Berlin, 1953.

A. PANTI and S. VASILEIOU, “Το νεκροταφείο της ΠΕΣ στην οδό Θ. Σοφούλη στο Καραμπουρνάκι Θεσσαλονίκης”, *ArchDelt* 69-70, A’ 2014-2015 (2018), 83-144.

J.K. PAPADOPOULOS, “Euboians in Macedonia? A Closer Look”, *OJA* 15/2 (1996), 151-181.

J.K. PAPADOPOULOS, “Phantom Euboians – A decade on”, in: D.W. RUPP and J.E. TOMLINSON (eds), *Euboea and Athens, Proceedings of a Colloquium in Memory of Malcolm B. Wallace, Athens 26-27 June 2009*, Toronto, 2011, 113-133.

V. PARKER, *Untersuchungen zum lelantischen Krieg und verwandten Problemen der frühgriechischen Geschichte*, Stuttgart, 1997.

E. PERNICKA, “Possibilities and limitations of provenance studies of ancient silver and gold”, in: H. MELLER, R. RISCH and E. PERNICKA (eds), *Metalle der Macht – Frühes Gold und Silber. Metals of Power – Early Gold and Silver*, 6. Mitteldeutscher

*Archäologentag, 17-19. Oktober 2013*, Halle, 2014, 153-164 [*Tagungen des Landesmuseum für Vorgeschichte Halle* 12].

M.R. POPHAM, “Precolonization: Early Greek contact with the East”, in: G.R. TSETSKHLADZE and F. DE ANGELIS (eds), *The Archaeology of Greek Colonisation: Essays Dedicated to Sir John Boardman*, Oxford, 1994, 11-34.

M.R. POPHAM and I.S. LEMOS, *Lefkandi III. The Toumba Cemetery: The excavations of 1981, 1984, 1986 and 1992-1994, Plates*, 1996, London [*BSA Suppl.* 29].

M.R. POPHAM, L.H. SACKETT and P.G. THEMELIS (eds), 1979-1980, *Lefkandi I. The Iron Age: The Settlement, The Cemeteries*, 2 vol., London [*BSA Suppl.* 11].

M.R. POPHAM, E. TOULOUPA and L.H. SACKETT, “Further excavation of the Toumba cemetery at Lefkandi, 1981”, *BSA* 77 (1982), 213-248.

M.R. POPHAM, P. CALLIGAS and L.H. SACKETT, “Further excavation of the Toumba cemetery at Lefkandi, 1984 and 1986: A preliminary report”, *AR* 35 (1988-1989), 117-129.

A. RAMAGE and P.T. CRADDOCK, *King Croesus’ Gold. Excavations at Sardis and the History of Gold Refining*, Cambridge, 2000 [*Archaeological Exploration of Sardis* 11].

E.S.G. ROBINSON, “The coins from the Ephesian Artemision reconsidered”, *JHS* 71 (1951), 156-167.

G.M. SANIDAS, D. MALAMIDOU and N. NERANTZIS, “Paros, Thasos and the question of mining and metal production before and after colonisation: Review and perspectives”, in: D. KATSONOPOULOU (ed.), *Paros and its Colonies, Proceedings of the Fourth International Conference on the Archaeology of Paros and the Cyclades, Paros, 11-14 June 2015*, Athens, 2018, 251-265.

V. SARIPANIDI, “Constructing continuities with a “heroic” past: Death, feasting and political ideology in the Archaic Macedonian kingdom”, in: A. TSINGARIDA and I.S. LEMOS (eds), *Constructing Social Identities in Early Iron Age and Archaic Greece*, Brussels, 2017, 73-170 [*Études d’archéologie* 12].

V. SARIPANIDI, “Macedonian necropoleis in the Archaic period: Shifting practices and emerging identities”, in: H. FRIELINGHAUS, J. STROSZECK and P. VALAVANIS (eds), *Griechische Nekropolen: Neue Forschungen und Funde*, Möhnese, 2019, 175-196.

- A. SIMOSI, *Αρέθουσα. Το Αρχαιολογικό Μουσείο Χαλκίδας*, Athens, 2022.
- A.M. SNODGRASS, “The Euboeans in Macedonia: A new precedent for westward expansion”, in: B. D’AGOSTINO and D. RIDGWAY (eds), *Apoikia. I più antichi insediamenti greci in Occidente : funzioni e modi dell’organizzazione politica e sociale, Scritti in onore di Giorgio Buchner*, Naples, 1994, 87-93.
- Z.A. STOS-GALE, “Silver vessels in the Mycenaean shaft graves and their origin in the context of the metal supply in the Bronze Age Aegean”, in: H. MELLER, R. RISCH and E. PERNICKA (eds), *Metalle der Macht – Frühes Gold und Silber. Metals of Power – Early Gold and Silver*, 6. *Mitteldeutscher Archäologentag, 17-19. Oktober 2013*, Halle, 2014, 183-207 [*Tagungen des Landesmuseum für Vorgeschichte Halle 12*].
- Z.A. STOS-GALE and C.F. MACDONALD, “Sources of metal and trade in the Bronze Age”, in: N.H. GALE (ed.), *Bronze Age Trade in the Mediterranean, Papers Presented at the Conference held at Rewley House, Oxford, December 1989*, Jonsered, 1991, 249-284.
- P.G. THEMELIS, “Εργαστήριο χρυσοχοΐας του 8ου αϊ. π.Χ. στην Ερέτρια”, *AAA* 14, 1 (1981), 185-208.
- P.G. THEMELIS, “An 8th century goldsmith’s workshop at Eretria”, in: R. HÄGG (ed.), *The Greek Renaissance of the Eighth Century B.C.: Tradition and Innovation, Proceedings of the Second International Symposium at the Swedish Institute in Athens, 1-5 June 1981*, Stockholm, 1983, 157-165.
- M. TIVERIOS, “The ancient settlement in the Anchialos-Sindos double trapeza. Seven years (1990-1996) of archaeological research”, in: M. BATS and B. D’AGOSTINO (eds), *Euboica: L’Eubea e la presenza euboica in Calcidica e in Occidente, Atti del Convegno Internazionale di Napoli, 13-16 Novembre 1996*, Naples, 1998, 243-253.
- M. TIVERIOS, “Greek colonisation of the northern Aegean”, in: G.R. TSETSKHLADZE (ed.), *Greek Colonisation: An Account of Greek Colonies and Other Settlements Overseas*, vol. 2, Leiden and Boston, 2008, 1-154.
- M. TIVERIOS, “The presence of Euboeans in the north Helladic region and the myths of Heracles”, *Studies in Ancient Art and Civilization* 17 (2013), 97-112.
- S. TRIANTAFYLLOU and S. ANDREOU, “Claiming social identities in the mortuary landscape of the Late Bronze Age communities of Macedonia”, in: J.M.A. MURPHY (ed.), *Death in Late Bronze Age Greece: Variations on a Theme*, Oxford, 2020, 171-197.
- A. VACEK, “Al Mina and changing patterns of trade: The evidence from the eastern Mediterranean”, in: X. CHARALAMBIDOU and C. MORGAN (eds), *Interpreting the Seventh Century BC: Tradition and Innovation, Proceedings of the International Colloquium Conference held at the British School at Athens, 9th-11th December 2011*, Oxford, 2017, 47-59.
- P. VAN ALFEN and U. WARTENBERG, “White gold and the beginnings of coinage: An introduction to the current state of research”, in: P. VAN ALFEN, U. WARTENBERG, W. FISCHER-BOSSERT, H. GITLER, K. KONUK and C. C. LORBER (eds), *White Gold: Studies in Early Electrum Coinage*, New York and Jerusalem, 2020, 1-16.
- M. VAVELIDIS and S. ANDREOU, “Gold and gold working in Late Bronze Age northern Greece”, *Naturwissenschaften* 95, 4 (2008), 361-366.
- M. VAXEVANOPOULOS, J. Blichert-Toft, G. DAVIS and F. ALBARÈDE, “New Findings of Ancient Greek Silver Sources”, *JAS* 137 (2022), <https://doi.org/10.1016/j.jas.2021.105474>.
- S. VERDAN, *Le Sanctuaire d’Apollon Daphnéphoros à l’époque géométrique*, Gollion, 2013 [*Eretria XXII*].
- S. VERDAN, “Metallurgical Ceramics from the Hypogeion”, in: MORRIS and PAPADOPOULOS 2023, vol. 1, 545-562
- S. VERDAN and E.D. HEYMANS, “Men and metals on the move: The case of Euboean gold”, in: T. CINQUANTAQUATTRO and M. D’ACUNTO (eds), *Euboica II. Pithekoussai and Euboea between East and West, Proceedings of the Conference, Ischia, 14-17 May 2018*, Naples, 2020, 279-300 [*AION n.s.* 27.1].
- E. VOUTIRAS, “La réconciliation des *Dikaiopolites*: une nouvelle inscription de Dikaia de Thrace, colonie d’Érétrie”, *CRAI*, 2008, 781-792.
- K.G. WALKER, *Archaic Eretria. A Political and Social History from the Earliest Times to 490 BC*, London, 2004.
- K.A. WARDLE, “Excavations at Assiros Toumba 1987: A preliminary report”, *BSA* 83 (1988), 375-387.
- K.A. WARDLE, “Excavations at Assiros Toumba 1988: A preliminary report”, *BSA* 84 (1989), 447-463.
- K.A. WARDLE and D. WARDLE, “Assiros Toumba: Remains of the later Iron Age”, in: P. ADAM-VELENI (ed.), *Μύρτος: μνήμη Ιουλίας Βοκοτοπούλου*, Thessaloniki, 2000, 653-673.

## CONTRIBUTORS

**Chalazonitis Ioannis**

École française d'Athènes, Athens, Greece  
CREA-Patrimoine, Université libre de Bruxelles,  
Belgium  
yhal@dhal.com

**Georgakopoulou Myrto**

STARC, The Cyprus Institute, Cyprus  
m.georgakopoulou@ucl.ac.uk

**Heymans D. Elon**

Faculty of Humanities, University of Amsterdam,  
Netherlands  
elonheymans@gmail.com

**Malamidou Dimitria**

Ephorate of Antiquities of Serres, Greece  
dimitra\_malamidou@hotmail.com

**Mehofer Mathias**

Vienna Institute of Archaeological Science, Human  
Evolution and Archaeological Sciences, University of  
Vienna, Austria  
mathias.mehofer@univie.ac.at

**Nerantzis Nerantzis**

Laboratory of Archaeometry, University of the  
Peloponnese, Greece  
CREA-Patrimoine, Université libre de Bruxelles,  
Belgium  
nerantzis.nerantzis@gmail.com

**Nodin Sabine**

Independent researcher, Perpignan, France  
sabinenodin@gmail.com

**Oudbashi Omid**

Department of Conservation of Cultural and  
Historical Properties, Art University of Isfahan, Iran  
Department of Scientific Research, The Metropolitan  
Museum of Art, USA  
omid.oudbashi@yahoo.com

**Papadopoulos Stratis**

Ephorate of Antiquities of Kavala-Thasos, Greece  
efstratiospa@gmail.com

**Photos-Jones Effie**

Analytical Services for Art and Archaeology (Ltd),  
Glasgow, UK  
School of Humanities, University of Glasgow,  
Glasgow, UK  
effie.photos-jones@glasgow.ac.uk

**Stos-Gale Zofia Anna**

Department of Historical Studies, University of  
Gothenburg, Sweden  
zofia@stos-gale.com

**Verdan Samuel**

University of Lausanne, Switzerland  
Swiss School of Archaeology in Athens, Greece  
Samuel.Verdan@unil.ch