Heterogeneous Production and Enchained Consumption: Minoan Gold in a Changing World (ca. 2000 BCE)

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Supplementary Appendices on AJA Online

Early and Middle Minoan goldwork has sparked numerous studies, with particular emphasis on possible foreign influences and the role of gold in the development of social hierarchies. This paper contends that the value and uses of gold can only be understood in connection to the broader organization of production and distribution. Through a biographical approach, we focus on the high-resolution study, including chemical and microscopic analyses, of 90 samples from gold assemblages found at Mochlos, Sissi, and Hagios Charalambos. Our results show that beneath the apparent simplicity in designs and techniques, there is a variety of technological choices and skill levels that are suggestive of the involvement of multiple hands. Our technical analyses reveal objects with long life histories of uses, reuses, and repairs, as well as instances of deliberate fragmentation through cutting, tearing, or separation of object parts. With complex life histories of shared production, curation, reuse, fragmentation, and recontextualization that did not conclude with burial, gold artifacts connected the dead and the living in a way that strengthened predominantly horizontal relationships. This evidence should therefore be considered in discussions of the emergence of social complexity. Our approach shows promise for studies of life histories of metalwork elsewhere.[1]

INTRODUCTION

Some of the most iconic artifacts known from the Aegean Bronze Age were fashioned in gold. The ways in which these visually striking objects combined

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particular production techniques and unique iconographies have captured the attention of modern audiences. Cretan goldwork comprises, collectively, the largest gold assemblage known in the Aegean. Already in the Early Bronze Age / Early Minoan period (fig. 1), despite the narrow set of techniques available, objects were carefully designed to impress, showcasing their cultural importance. In the Middle Bronze Age / Middle Minoan period, the fashion continued, but the engagement of more complicated techniques and new iconographic languages suggest significant changes in the social role of gold.[2]

There is a long history of research on the Cretan gold assemblages. Considered as works of art, they have attracted iconographic approaches to the mysteries of their motifs[3] and technological studies[4] of their craftsmanship. Since gold does not naturally occur on the island, the source of the metal[5] and the diverse ways in which the raw material and finished items may have reached Crete have also been studied.[6] Recent studies have revisited the transfer of goldsmithing techniques from the Near East[7] and raised questions about indigenous technical developments used to produce idiosyncratic objects that were appreciated outside the island (e.g., the necklace of Khenmet in Middle Kingdom Egypt).[8] Such novel approaches dovetail with recent developments in the study of consumption patterns[9] that are changing our understanding of the role of gold items in the development of the first complex societies in Crete and, by extension, in Europe.

This article builds on these separate approaches and presents new analyses to offer an integrated study of Prepalatial and Protopalatial Cretan goldwork, taking a particular interest in the relationships among technology, exchange, and consumption. Our aim is to better understand the role of gold in a period of rapid and substantial transformation on the island and the surrounding world ca. 2000 BCE.[10] We have chosen a group of relatively well dated and well understood archaeological contexts for a high-resolution study: namely, the gold deposit and other artifacts discovered in Mochlos in the 1970s,[11] items recently unearthed at Sissi,[12] and a selection of the gold items from the Hagios Charalambos cave[13] (fig. 2). This core data is complemented with information from relevant objects from Platanos, Koumasa, and other Pre- and Protopalatial tombs, several of which we were able to study macroscopically. Combining chemical analyses with microscopic evidence for manufacture, use and modification, and information about depositional contexts, we investigate Minoan goldwork through a biographical approach. We contend that Early and Middle Minoan gold needs to be reconsidered not only as a marker of exclusivity and difference but also as

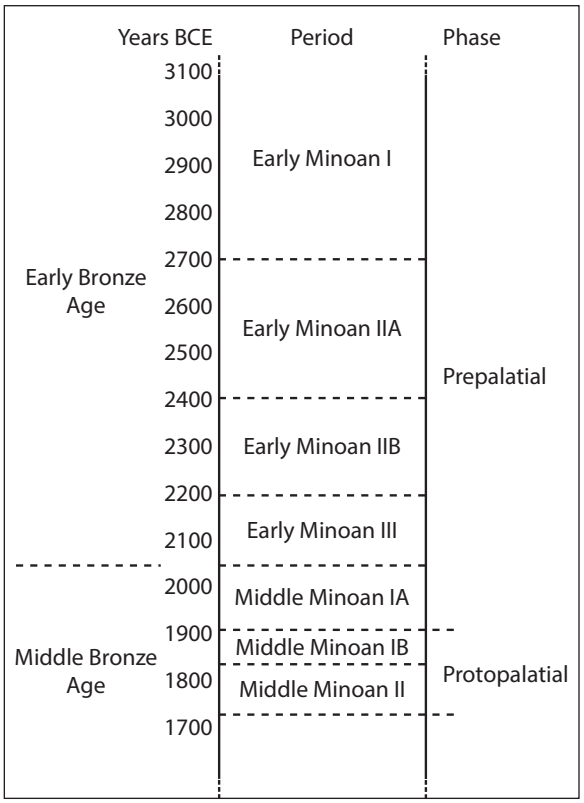

FIG. 1. Schematic chronology of Early and Middle Bronze Age Crete.

[2] Davis 1977.

[3] E.g., Weinberg 1969; Richards 1974; Hood 1976; Davis 1977; LaFleur et al. 1979; Kitchell 1981; Bloedow and Björk 1989.

[4] E.g., Politis 2001; Hickman 2011; Giumlia-Mair and Soles 2013.

[5] Branigan 1983; Muhly 2015.

[6] Legarra Herrero 2014a.

[7] Morero and Prévalet 2015.

[8] Quirke 2015, 240–41.

[9] Branigan 1991; Colburn 2011; Legarra Herrero 2014a; 2018a.

[10] Broodbank 2013, 348–55; Manning 2018.

[11] Davaras 1975.

[12] Schoep et al. 2013, 42–48; Driessen et al. forthcoming.

[13] Muhly 2014.

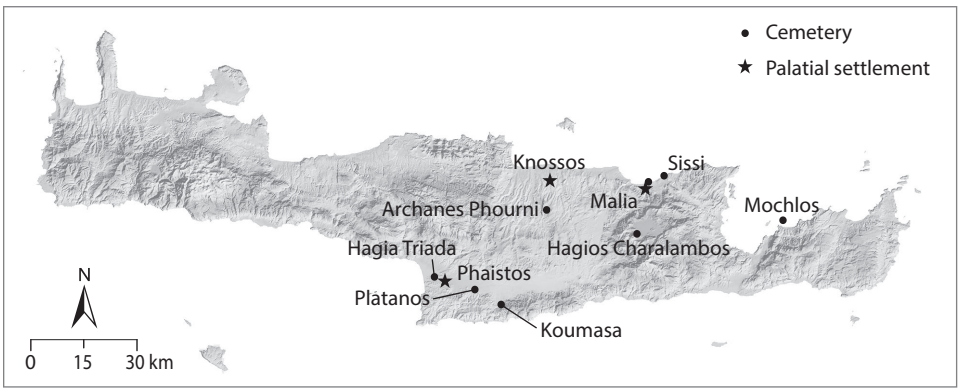

FIG. 2. Map of Crete (above) and the Aegean (right), with locations of main sites and other sites mentioned in the article (base maps from European Environment Agency).

an important element in establishing and negotiating both equal and unequal relationships at the community level. The data show great variability in production methods, which matches the heterogeneity of the burial contexts where the gold items were found. Our work also highlights the convoluted lives of the gold items. The deposition of gold items in tombs was just part of their longer life histories. Processes of deliberate fragmentation, curation, and possible reuse extended the life of certain gold items beyond the tombs, bridging and further negotiating relationships between the dead and the living.[14]

GOLD AND ITS ROLE IN THE STUDY OF CRETAN SOCIETIES

The first excavations on Crete at the beginning of the 20th century already showed that gold was a significant part of Pre- and Protopalatial funerary assemblages. Early excavators such as Xanthoudides considered that gold expressed the "wealth and ease" of Cretan society.[15] In his report on the excavations at Mochlos, Seager already recognized the social importance of gold: "If so small a settlement possessed precious metal in such abundance, what must we imagine was the case in the capital cities?"[16] Since then, Cretan gold has featured prominently in the discussion of hierarchization processes on the island.[17] The concentration of gold in certain burial assemblages has traditionally been considered to mark powerful individuals in Cretan society who were able to build an increasingly hierarchical order by controlling the acquisition and use of this and other precious materials.[18] Gold, unique in its material properties and foreign to the island, and its conspicuous consumption were seen as the materialization of the links of certain individuals

[14] We understand these processes under the broad concept of enchainment (Chapman 2000), in which fragments of items but also successive use by different people and in different contexts create social links among those involved, including the deceased.

[15] Xanthoudides 1924, 133.

[16] Seager 1912, 104.

[17] Branigan 1991; Colburn 2011; Hickman 2012; Legarra Herrero 2018a.

[18] Soles 1988; Branigan 1991; Colburn 2008.

with exotic cultures of Egypt and the Near East[19] that helped these individuals achieve a new commanding status in Cretan communities. As our ideas about elites and social hierarchization evolve,[20] the role of gold is also being reconsidered.[21] The fact that a significant number of gold items remained in the communal tombs, even when these were cleared for more burials, suggests that the presence of this metal in the tombs was important for the communities using the cemeteries and that the value of gold was not merely economic. As a recognized prestige material, gold can be assumed to have been part of multiscalar social and political negotiations among several agents, including those who helped obtain the gold and turn it into artifacts, those buried with it, the groups the deceased represented, others who would participate in or observe the funerary rituals, and those who cleared and curated the tombs.

Our starting premise is that we cannot fully understand the value and uses of gold without a consideration of its supply and manufacturing methods as well as the broader organization of production and distribution. However, no research has hitherto attempted to bring together a range of analyses of Cretan goldwork to reconstruct contextualized life histories from acquisition to deposition. It is also rare to find studies that consider whole assemblages rather than specific items and explore the relationship between gold artifacts and the rest of the funerary assemblage. The few examples of the latter, focused on the hoard from Kolonna on the island of Aegina[22] or the assemblage from Tholos Gamma at Archanes Phourni,[23] prove that contextual associations provide crucial information about the social uses of gold.

The first of our three assemblages comes from the Prepalatial cemetery of Mochlos. The tombs were first excavated by Seager in 1908 and published soon after.[24] This material is deposited in the Archaeological Museum of Heraklion, where we were kindly given permission to study several of the gold items macroscopically but were not able to conduct chemical composition analysis. Our main focus of analysis has been the gold items discovered in the Mochlos cemetery in 1971, published in 1975, and deposited in the Hagios Nikolaos Museum.[25] The group is composed of one diadem, 10 gold strips, 29 leaves, one bead, and a few other metal fragments (fig. 3; online appx. 1),[26] all contained in a silver vessel found outside Complex IV/V/VI. The vessel was inside a recess in the rock above the east wall of Chamber VI, squashed with its contents. It was not clear whether this was the primary depositional context.[27] The assemblage has been dated to Early Minoan (EM) II–III based on the ceramics found inside the recess near the vessel.[28] Additional items recovered outside Complex IV/V/VI and published in 1975 were also analyzed (see online appx. 1);[29] these were primarily small fragments of gold sheet. A further two artifacts from the 1970s and 1980s excavations and cleaning of the Mochlos tombs were analyzed: a small disk (HNM 7178) from Tomb XXII,[30] and one small leaf (HNM 7180) reported to be from Tholos Gamma (see fig. 3).[31]

Our second group of objects comes from Sissi. Two small items have been published from the Sissi cemetery, both of them from Burial 8 in Space 9.2: one earring and one small spherical bead.[32] The tomb is dated to the Middle Minoan (MM) IB–II, and therefore this context is later than the tomb at Mochlos. We also analyzed a further 15 unpublished gold fragments from the recent excavations at Sissi (fig. 4; see online appx. 1). Most of these seem to come from Prepalatial contexts, but exact dates of the deposits are not available yet.[33]

[19] Colburn 2008.

[20] Schoep 2010; Schoep and Tomkins 2012; Legarra Herrero 2016a; 2016b.

[21] Legarra Herrero 2018a.

[22] Reinholdt 2008.

[23] Papadatos 2005, 39–42. Excavations of Tholos Gamma were undertaken by the Archaeological Society of Athens under the direction of Yannis Sakellarakis between 1972 and 1973 and published by Papadatos in 2005. Items mentioned from the tomb follow the catalogue conventions in Papadatos 2005.

[24] Seager 1912.

[25] Davaras 1975.

[26] See AJA Online for supplementary appendices.

[27] Davaras 1975, 101.

[28] For a detailed discussion of the dating of the tomb deposits, see Watrous 2005 and updated discussion in Legarra Herrero 2014b, 101–3.

[29] Items HNM 3107–09, 4366, 4367. These were published together with the hoard; see Davaras 1975.

[30] Soles 1992, 86–87, no. XXII-5.

[31] This leaf was deposited in the Archaeological Museum of Hagios Nikolaos at the same time as the previous item, with a note that locates it near Tholos Gamma; to our knowledge, it has never been published.

[32] Schoep et al. 2013, 27–51.

[33] Driessen et al. forthcoming.

FIG. 3. Gold artifacts from Mochlos analyzed in this study, deposited in the Archaeological Museum of Hagios Nikolaos, each labeled with its HNM number; excav. 1971.

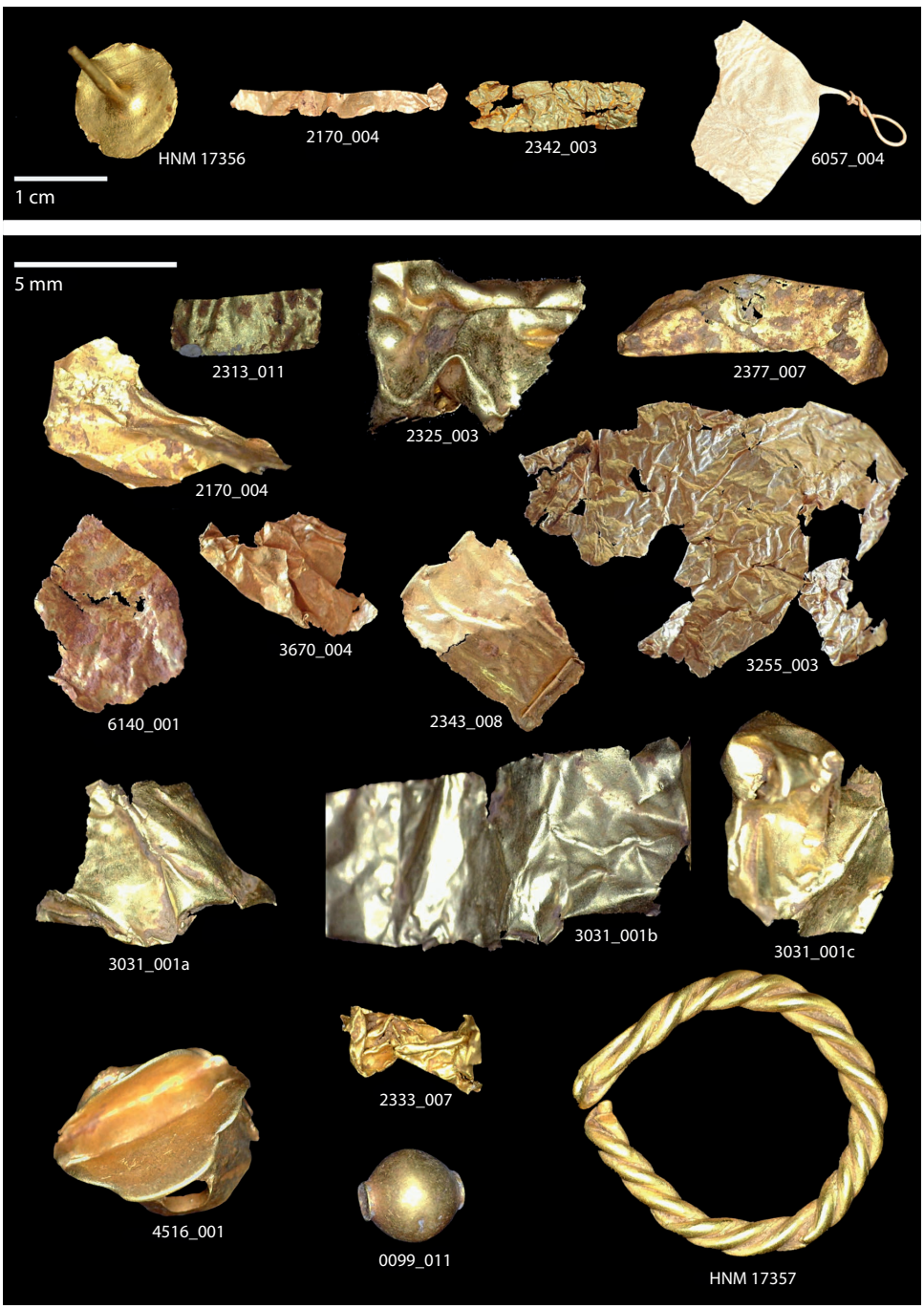

FIG. 4. Gold artifacts from Sissi analyzed in this study, each labeled following the Sissi Archaeological Project inventory system; top left and bottom right objects, deposited in the Archaeological Museum of Hagios Nikolaos, are labeled with their HNM numbers; all excav. 2009 to 2019 and still under study by excavators.

FIG. 5. Gold artifacts from Hagios Charalambos analyzed in this study, in the Archaeological Museum of Hagios Nikolaos, each labeled here with its HNM number; excav. 1976–83 and 2002–3 (see n. 35).

The third group of objects belongs to a complex deposit excavated from the cave of Hagios Charalambos in two different excavations separated by several decades.[34] Of the 19 gold objects originally published,[35] seven were available for this study (fig. 5; see online appx. 1). The excavators believe that the final arrangement of the material and bones took place in MM II in a major event that cleared and ordered the existing Final Neolithic-to-MM II mortuary deposit before the cave was sealed.[36] Dating the goldwork in these secondary deposits is not easy, but there are indications to suggest an EM III–MM II date for the gold items. While there is ceramic material in the cave ranging from the Final Neolithic to the MM II period, more than 75% of the dated published material belongs to the EM III–MM II periods, and the MM I period is the best represented period in the ceramic assemblage (fig. 6).[37] The sealstones found in the assemblage have also been dated to the EM III–MM II periods, with most belonging to MM I–II.[38] In addition, Betancourt dated gold ring HNM 11868 to the MM IIB period based on the decoration parallels with ceramic vases of that period.[39] It seems reasonable to assume that most of the gold was deposited with the bulk of the material in EM III–MM II before the cave was sealed. This would suggest that the Hagios Charalambos goldwork assemblage can be considered of slightly later date than the Mochlos assemblage, although individual items cannot be accurately assigned to a specific period.

CHEMICAL COMPOSITION AND GOLD SOURCES

The geographic origins of the gold used by prehistoric societies in the Aegean remains a mystery.[40] Gold occurs in small quantities in several locations around the Aegean, and some could have been exploited leaving little evidence behind.[41] From classical sources, we know of auriferous rivers in Chalkidiki and Mount Pangeion west of modern Thessaloniki and in west Anatolia (the Pactolos and Hermos Rivers; see fig. 2).[42] Gold extraction also took place on Thasos and Siphnos, but it remains unclear whether these sources were exploited in the Bronze Age.[43] Since silver was mined and cupellated in Siphnos in the Early Bronze Age[44] and possibly used on Crete,[45] it is plausible that gold was also mined on the island and moved to Crete at an early period. Egyptian gold is another possible candidate,[46] although this is unlikely to have arrived in Crete before the end of the third millennium BCE.[47]

Unfortunately, for several reasons the question of where the gold comes from may never be solved. First, original sources may have been exhausted or

[34] Betancourt et al. 2014, 21.

[35] Excav. 1976–83 and 2002–3, see Betancourt 2011; also Betancourt et al. 2014; Muhly 2014.

[36] Betancourt 2014, 98.

[37] The nature of the secondary deposits does not allow for detailed connection of the gold material with particular ceramics, but the techniques used in the goldwork (see Morero and Prévalet 2015) are consistent with dates in the EM III–MM II period.

[38] Betancourt and Ferrence 2014.

[39] Betancourt 2011, 118–19.

[40] Muhly 2015.

[41] Muhly 2015.

[42] Williams and Ogden 1994; Vavelidis and Andreou 2008.

[43] Wagner and Weisgerber 1985, 69–77.

[44] Papadopoulou 2011.

[45] Stos-Gale 1998.

[46] Colburn 2011.

[47] Cherry 2010.

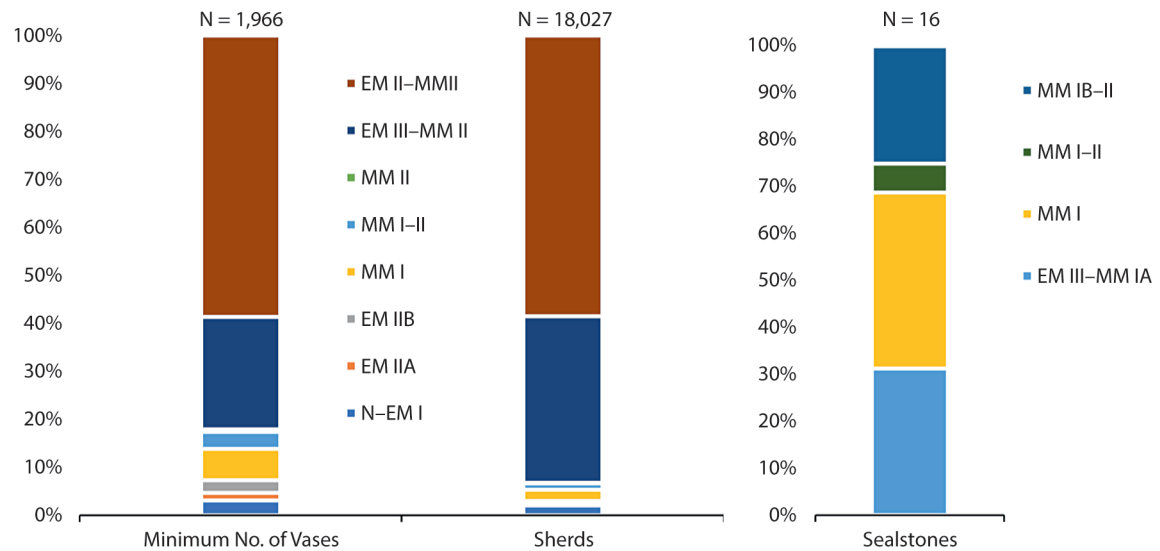

FIG. 6. Chronological breakdown of published pottery and seals from Hagios Charalambos (data from Betancourt and Ferrence 2014; Langford-Verstegen 2015).

obliterated by later mining, leaving little or no evidence for us. Second, alloying and mixed recycling may obscure geochemical fingerprints. Third, the processes of panning or mining, and the subsequent melting and refining of gold, may modify the chemistry of the metal to the extent that it may no longer match that of natural nuggets or ores, even in the absence of deliberate metal mixing. Fourth, the isotopic and trace element analyses that are optimum for sourcing require invasive sampling[48] or, at least, the transportation of objects to a laboratory, which prevents large-scale projects. Notwithstanding these challenges, the chemical analysis of archaeological goldwork may help as a negative method to rule out potential candidates. Chemical analyses may also provide important insights into the possible selection of alloys, spatiotemporal changes in the origins of the metal, and other aspects of production beyond geological provenance.

For this project, we employed portable X-ray fluorescence (pXRF) as a fast, noninvasive technique that allows the quantitative analysis of goldwork directly on object surfaces (online appx. 2 gives details of the method). The resulting database includes 90 objects, object parts, or fragments analyzed here for the first time (see online appxs. 1, 2).

Overall, and with some exceptions discussed below, the chemical composition of the Cretan objects is relatively homogeneous, with silver values ranging from 8% to 33% but most frequently clustering around 19%, and copper values almost invariably under 1%. These compositions correspond with the lime or pale yellow colors that characterize Early Minoan gold, in contrast to the warmer colors of goldworking traditions that employ more copper or the whiter shades of more argentiferous alloys (fig. 7). While this compositional range is consistent with natural unalloyed and unrefined gold, this cannot be taken as conclusive evidence for the absence of artificial alloys. Indeed, the objects with ≥1% copper, although a minority, may well constitute artificial alloys since natural gold with copper levels of ≥1% is extremely unusual. In other cases, slightly higher than average copper values on object surfaces may result from joining techniques involving copper, for example if copper salts were applied locally and heated in a reducing atmosphere so that metallic copper diffused in the joint.[49] Similarly, some of the silver-rich objects may result from the mixing of metallic silver with relatively low-silver gold.

In order to offer a broader comparison, we compiled a database of previous analyses of natural gold or goldwork around the eastern Mediterranean and plotted the silver and copper values, which are the key elements included in most publications (figs. 8, 9). Our

[48] Pernicka 2014.

[49] For more information about the technique, see Scrivano et al. 2017.

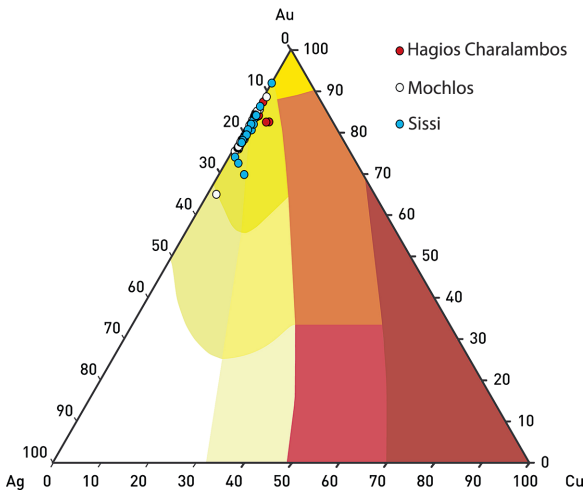

FIG. 7. Ternary plot of the composition of the gold artifacts studied. The background provides an indication of the metal colors corresponding to the different compositional regions. All the Cretan goldwork falls in the bright yellow area.

comparison is marred by the scarcity of data available for western Anatolia and the Levant. As expected, there are no clear-cut patterns, but some interesting observations emerge. While there is no obvious match for the core cluster of Cretan gold items, there are overlaps between this and the broader scatter of compositions of goldwork recovered in the Aegean (see fig. 8), particularly in the southern regions, and notably including many items in the Early Bronze II–III assemblage from Kolonna.[50] The geological data from Siphnos, with lower copper levels (0.01–0.07%), does not fit well with the Minoan assemblage, but, given the variability in the few samples published (with silver concentrations ranging 6–19% in just three samples),[51] more data would be needed to rule out this source. Data from other Aegean sites, particularly from the north,[52] generally show lower silver (and often, copper) values than the Cretan data, with the exception of a cluster with higher copper and silver values that is mostly represented by the Troad assemblage (see fig. 8). Assuming that no silver was artificially added to the gold we find in Crete, their relatively high silver levels would seem to suggest a primary (i.e., underground or hypogene) source, as opposed to an alluvial deposit (secondary, alluvial deposits tend to have lower silver levels due to leaching during weathering and transport). Interestingly, the composition of most of the Cretan goldwork is notably different from that of Egyptian artifacts dated to Middle Kingdom Egypt (roughly contemporaneous with our Cretan assemblage) or earlier (see fig. 9). Furthermore, Egyptian goldwork often bears inclusions of platinum group elements (microscopic nodules of noble metals with very high melting points that never melted during processing), and none was observed in the objects we studied under the microscope.[53]

Another observation emerging from the comparison in figures 8 and 9 is the relatively narrow range of variation in the composition of Cretan goldwork (particularly for Mochlos) when set against the often more scattered distributions of artifacts from other regions. Two explanations may be proposed for this, which are not mutually exclusive. First, it is possible that the metal deposited in Crete had undergone multiple instances of recycling and mixing by remelting, which would progressively lead to compositional homogenization. This scenario is consistent with the lack of gold sources on the island (potentially forcing economization and recycling), but it would seem at odds with the goldworking techniques documented below. Specifically, there is very little evidence that the manufacture of gold objects before the Middle Bronze Age involved the use of high temperatures.[54] The almost exclusive use of mechanical techniques to produce and decorate gold objects may indicate that gold was not routinely subject to the pyrotechnologies typical for copper and silver, including melting and mixing (see below). Even in the early Middle Bronze Age, the use of high temperatures is very limited, mainly employed for joining. As a second explanation, the narrow compositional range may simply indicate that the large majority of the analyzed objects derive from a relatively small number of metal batches that arrived on the island and were then used for a multitude of objects. This hypothesis is further explored below.

It is interesting to note that the earlier Early Bronze gold items from Mochlos and Kolonna have a similar composition to the Middle Bronze I–II items at

[50] Reinholdt 2008.

[51] Wagner and Weisgerber 1985.

[52] Vavelidis and Andreou 2008; Andreou and Vavelidis 2014.

[53] Ogden 1976; Klemm and Klemm 2012, 44; Troalen et al. 2014, 222–23; Tissot et al. 2015.

[54] But see Soles (2009, 9–10) for possible evidence in EM II Mochlos for the use of pyrotechnology in the production of gold.

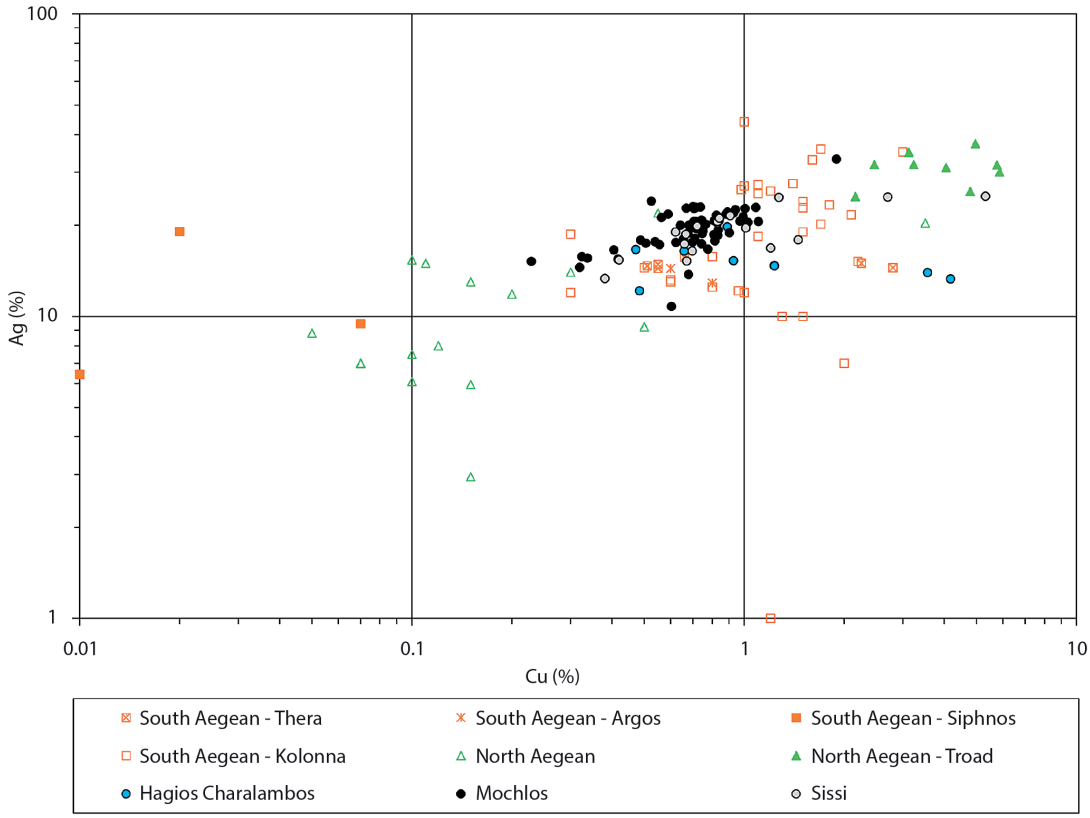

FIG. 8. Logarithmic scatterplot comparing the levels of copper and silver in the Cretan gold artifacts with other gold objects from the Bronze Age Aegean. Some of the published data have been amalgamated into larger groups to simplify visualization (comparative data from Wagner and Weisgerber 1985; Swann et al. 1997; Pantazis et al. 2003; Karydas and Zarkadas 2008; Fitton et al. 2009; Andreou and Vavelidis 2014; Philippa-Touchais and Touchais 2016).

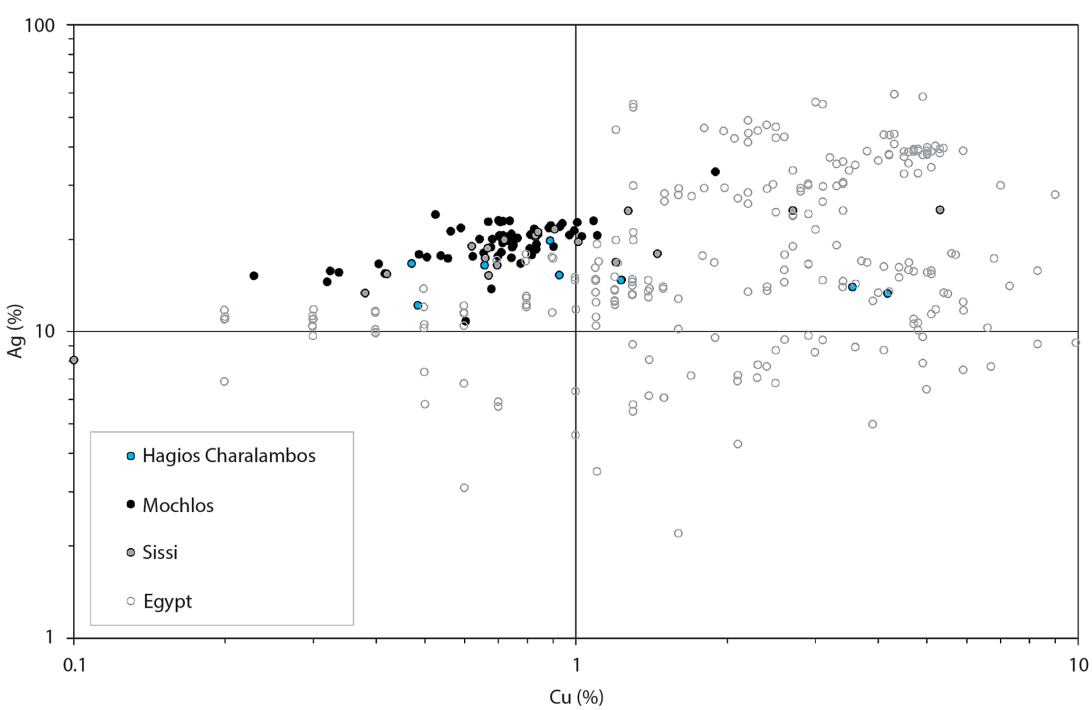

FIG. 9. Logarithmic scatterplot comparing the levels of copper and silver in the Cretan gold artifacts with Egyptian gold artifacts dated from the Early Dynastic period to the Middle Kingdom (comparative data compiled in Guerra et al. forthcoming).

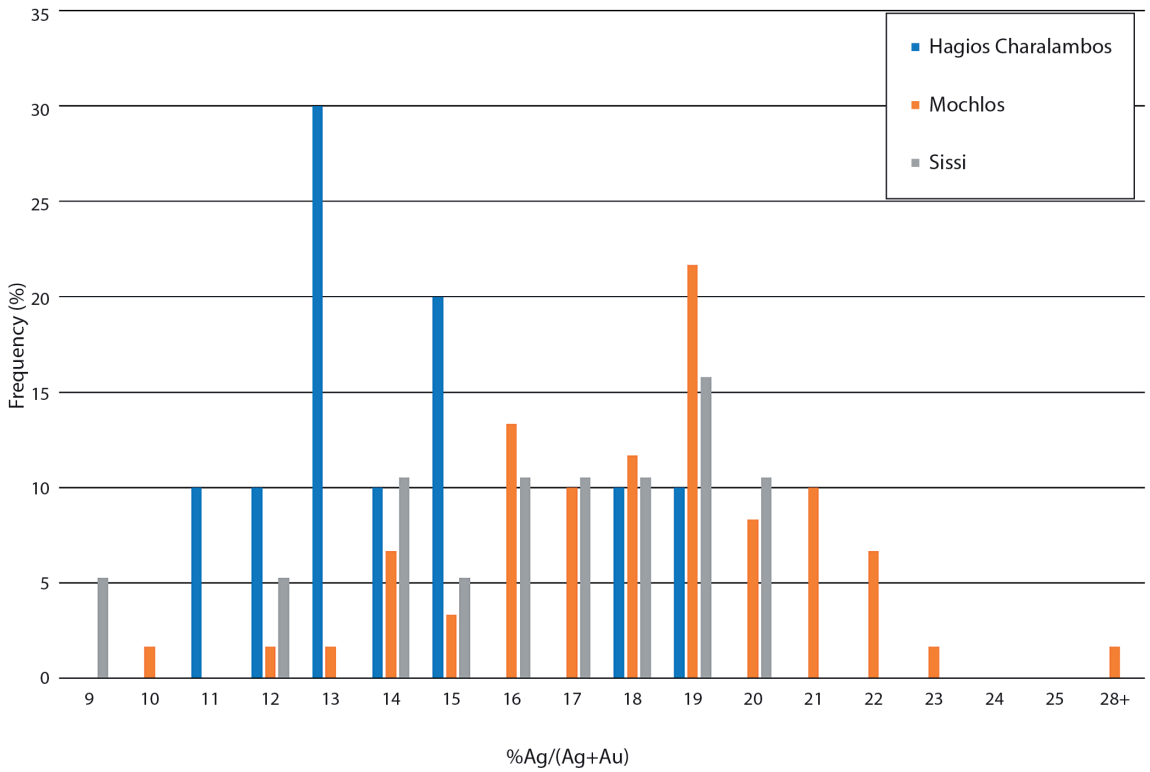

FIG. 10. Frequency distribution histogram of the silver values for the Cretan artifacts, classified by site. The amount of silver is expressed as a percentage of silver in the sum of silver and gold, %Ag/(Ag+Au), which allows a comparison of the silver in a gold-silver alloy, ignoring the copper. Frequencies are expressed as a percentage of the analyzed assemblage for each site.

the same sites, suggesting continuity in the origin of gold in both periods. Having said this, the analyses do reveal differences among the three sites analyzed on Crete (fig. 10). The Mochlos assemblage samples generally contain more silver than those from Hagios Charalambos (median silver is 19.9% for Mochlos and 15.2% for Hagios Charalambos), while the Sissi material straddles the two groups (median silver 19.0%). The slight variation may indicate a different origin for the gold used at each site within the heterogeneity of the Mediterranean scale mentioned above. There is a larger proportion of artifacts with copper levels >1% in the later assemblages from Sissi and (also possibly later) Hagios Charalambos, suggesting a higher incidence of artificial copper additions (see fig. 7). It is tempting to suggest that the Hagios Charalambos group, which is the most clearly distinct, announces changes in exchange networks in the MM I period,[55] although it should again be noted that the chemical data has little overlap with gold from Middle Kingdom Egypt (see fig. 9), which has been hypothesized as a source for the Cretan goldwork.[56] In any case, these differences provide a first indication of local variability already at the point of acquisition of the metal. Further observations derived from the chemical analyses at the site level are presented below, combined with the typological and technological examination.

PRODUCTION TECHNIQUES AND ORGANIZATION

Most of the Minoan gold artifacts are rather small and light (see online appx. 1) and relatively simple in their technical requirements. Most objects are made of extremely thin metal sheets that were cut, engraved, or embossed with simple designs and joined mechanically. Examples of technical virtuosity such as complex castings, granulation, filigree, or high-temperature joints are the exception rather than the norm. This simplicity of execution applies to the well-known HNM 4313 diadem with antennae (see fig. 3) as well

[55] Cherry 2010.

[56] Colburn 2011; Muhly 2015.

as to a myriad of other objects: clearly, there was a concern with maximizing the surface area that could be obtained out of the metal employed, and the resulting artifacts are so fragile that they must have been used while sewn or otherwise attached to structural supports. The lightness and thinness of most objects should be emphasized: although we lack specific information about the weight of many items (see online appx. 1), we should not forget that, overall, the amount of gold recovered at these sites is relatively small.

Even within this relative simplicity, it is possible to observe variability. In the Mochlos assemblage, two loop-in-loop chains were recovered together in the silver pot (fig. 11). These are chains made from wire loops or links that were manufactured individually before being woven into one another. In HNM 4301 (see fig. 11, left), the wires show helicoidal lines that are indicative of wire manufactured by twisting, and the joints in each link are almost imperceptible and quite probably achieved by diffusion bonding with no added metal. In contrast, HNM 4302 (see fig. 11, right) shows faceted wires of variable diameter that were made by hammering, and many of the joints display conspicuous lumps of metal that seemingly derive from imperfect attempts at hard soldering—that is, joining with the addition of extra metal. Loop-in-loop chain HM 338,[57] also from Mochlos, shows soldering lumps but also failed joints and other errors and repairs, and other chain loops such as those in HM 221[58] (with larger links consistently joined by overlapping seams) and HM 340[59] (with soldered, circular links) add further diversity. Importantly, the example of the chains illustrates not only variability in skill but also in the choice of techniques for the production of typologically identical artifacts. While not all pieces were necessarily made contemporaneously, the variability demonstrates the involvement of different hands with different skill levels and the presence of relatively different technical traditions. This impression is reinforced if we consider more artifacts, for example bead HNM 3107 from outside Complex IV/V/VI (fig. 12), which is made of three wire spirals joined together around a central metal tube. In this object, the heat treatment required for joining probably helped obtain a rounder section in the wire by surface tension (i.e., the cohesive force that leads metals to contract as they begin to melt), and it thereby removed surface marks that would help disclose how the wire was made; the multiple, complex high-temperature joints are notable in their fineness, in spite of the remarkable fact that, unlike the case of the loop-in-loop chain links, here all the joints had to be made at the same time with careful temperature control. This object presents an interesting contrast to the technical skills of the assemblage in the silver vase, adding to the variability in technical traditions and their evolution through time.

FIG. 11. Details of two gold loop-in-loop chains from Mochlos, illustrating different manufacturing and joining techniques: *left,* HNM 4301; *right,* HNM 4302.

FIG. 12. Detail of gold bead HNM 3107 from Mochlos.

Detailed examination of the diadems from Mochlos reveals further diversity of techniques and skills. In the wild goat[60] diadem HNM 4313 (see figs. 3, 13), the animals and additional decoration on the diadem itself

[57] Seager 1912, 32, no. II.30.
[58] From Hagia Triada: Banti 1933, 194, no. 168.
[59] Seager 1912, 32, no. II.36

[60] The animal depicted is sometimes called an *agrimi*, the Greek name for the Cretan wild ibex.

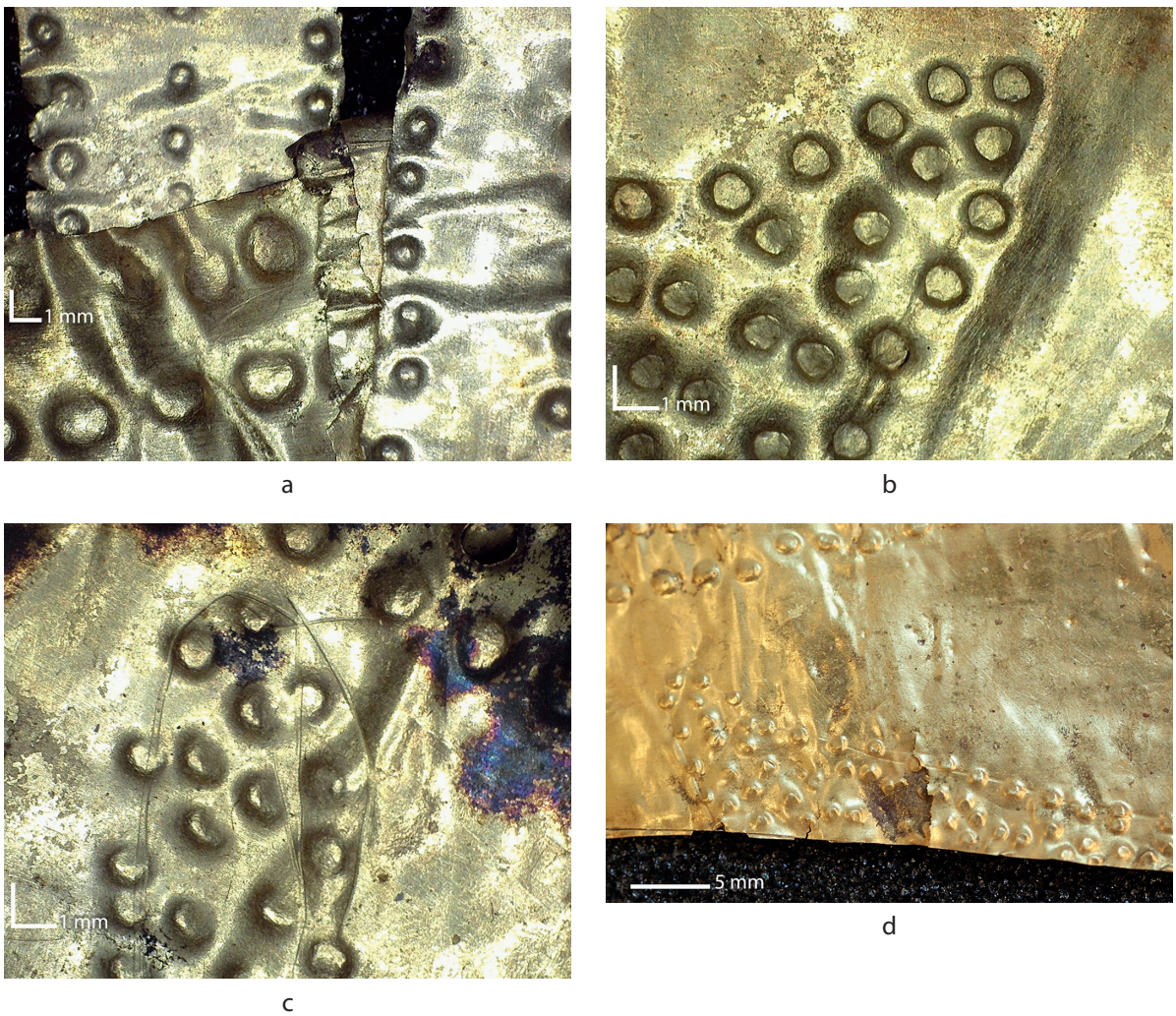

FIG. 13. Details of the wild goat diadem HNM 4313 from Mochlos showing indications of techniques: *a*, on the back side, at the joint between the diadem proper (bottom left) and one antenna; *b,* on the back side of the diadem; *c*, on the front side of the diadem; *d*, on the front, lower area of the diadem.

are achieved by embossing multiple dots with a punch. These dots vary in diameter and depth, but they are typically polygonal in outline and show sharp edges, and sometimes the metal has ruptured under the pressure. Conversely, the antennae show smaller and shallower dots achieved with a tool ending in a rounded tip (see fig. 13a, b). In the dog diadem HM 269,[61] the punch was held at an angle, rather than perpendicular to the metal sheet, creating oblique bosses (fig. 14). In the wild goat diadem HNM 4313, faint engraved lines are often visible on the back surface (see fig. 13b) that outline the shape of the animals and presumably served as a guide prior to embossing.[62] More peculiarly, however, corresponding outlines were also marked on the front (see fig. 13c, d). The purpose of these lines is hard to explain as they are hardly visible. In contrast, in the dog diadem HM 269 (see fig. 14), the front outline marks are chiseled in multiple strokes rather than engraved in continuous lines, and they are sufficiently deep to be noticed from the front but also, presumably, to act as guides when embossing from the back (unfortunately, we could not examine the back of this object).

One of the most striking aspects of the gold assemblage published from Mochlos[63] is the variation in

[61] Seager 1912, 26–27; Hickman 2011.

[62] De Checchi 2006.

[63] Seager 1912; Davaras 1975.

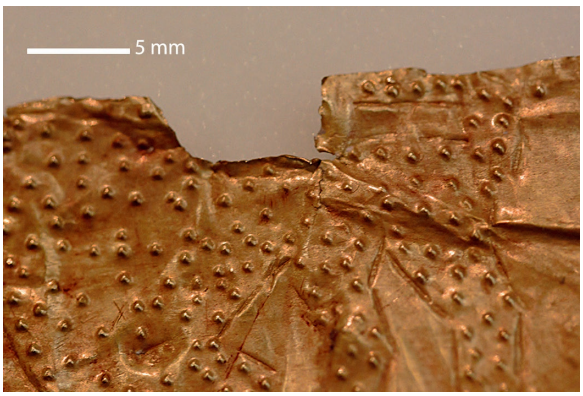

FIG. 14. Detail of the front of the dog diadem HM 269 from Mochlos.

leaf design (fig. 15). Davaras identified several types of leaves from the assemblage in Tomb VI based on shape and decoration.[64] Each of the gold leaves follows realistic natural counterparts.[65] Goldsmiths at Mochlos possibly selected different natural leaves to use as templates or models.[66] Under the microscope, some display great care in the cutting of the outline and the regular spacing of the embossed dots, whereas others show cutting errors and more haphazard decoration or no decoration at all (see fig. 15). For example, the embossed dots in HNM 4348 are much more regular in diameter and spacing than those in HNM 7180; HNM 4344 shows obvious cutting errors; HNM 4347 is notably thinner; and all leaves display different extents of polishing. Such variation is consistent with production variability at the community level.

Even though most of the leaves were found as separate objects, Davaras regrouped those of similar shape and assigned them to "sprays."[67] We revisited Davaras' attributions of separate leaves to sprays by overlaying the leaf outlines and looking at indications of variable skill in their manufacture (fig. 16), and by considering their chemical compositions. Davaras assigned four leaves to his catalogue 16 spray 6 (see fig. 16, top left);[68] we removed 4351 from spray 6 because it

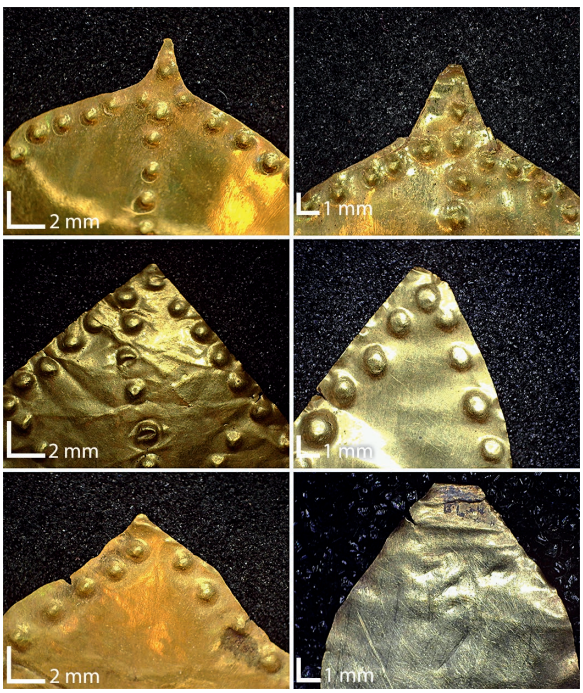

FIG. 15. Details of gold leaves from Mochlos: left, top to bottom: HNM 4348, HNM 4347, HNM 4349a; right, top to bottom: HNM 4344, HNM 7180, HNM 4356.

is smaller in size than the other three. The two leaves that Davaras assigned to his catalogue 10 spray 2 (see fig. 16, top right) are very similar in outline. However, they exhibit different skill in execution: in 4344a, scratched guide marks are visible on the outer contour, as are cutting errors; 4345a has neither. The central line of embossed dots is uneven on 4344a, while 4345a shows more uniform embossing. We therefore reclassify these two leaves as unassigned to a spray. Davaras grouped 4359, 4360, 4361, and 4362 in catalogue 17 spray 7 (see fig. 16, bottom left). Leaves 4359 and 4362 fit well with each other, but 4360 and 4361 are wider, and we dissociated them from spray 7. Two (4349a and 4352) of the three leaves in Davaras' catalogue 15 spray 5 (see fig. 16, bottom right) are good fits, but 4350 is smaller, and we reclassified this leaf as unassigned.

While our approach is certainly not foolproof, there is a notable clustering in the chemical composition of leaves assigned to the same spray, which suggests that

[64] Davaras 1975, 102–5, fig. 2.

[65] The only exception being the four leaves of HM 327, which have flat bottoms and attached stems; Seager 1912, 43, fig. 41.

[66] All the different leaf shapes find close counterparts in Cretan flora.

[67] Davaras 1975.

[68] Davaras 1975, 102–3. In his catalogue, Davaras assigned 4352, 4353, 4354, and 4355 to spray 6. Clearly this represents a mix-up between 4351 (see fig. 16, top left) and 4352 (see fig. 16, bottom right), as 4352 is completely different in type from the other leaves assigned to spray 6. The correct leaves for spray 6 are shown in Davaras' figures and plates.

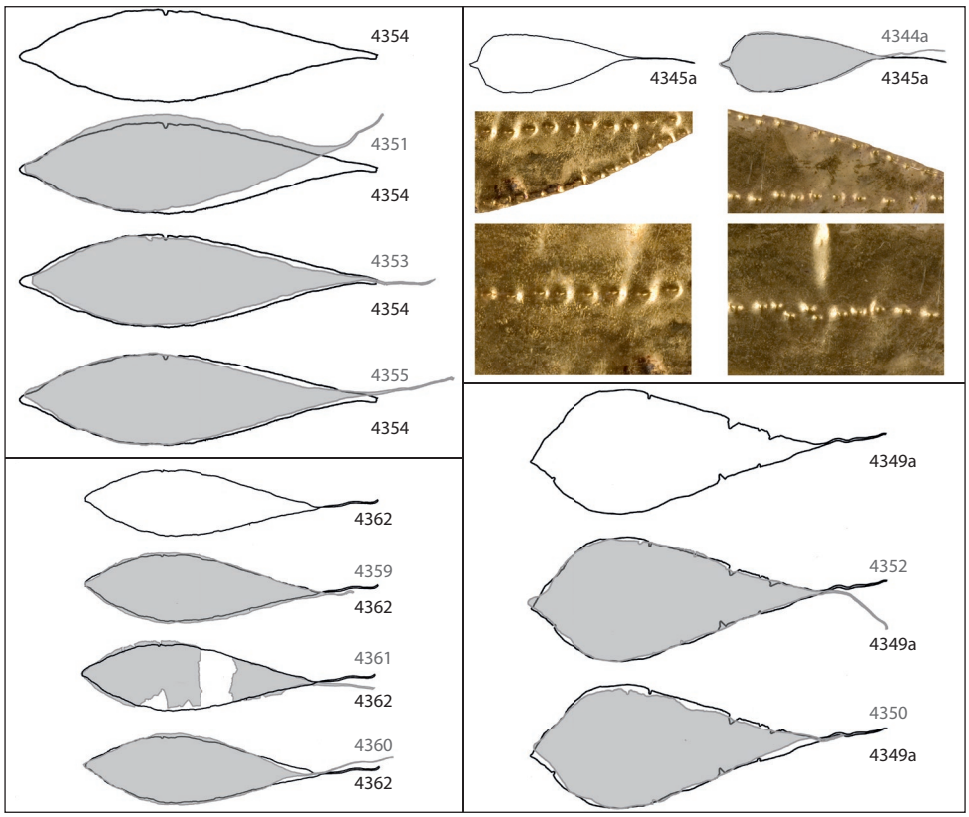

FIG. 16. Comparison of the shape and technical details of Mochlos leaves assigned to sprays by Davaras (1975), each labeled here with its HNM number. Leaves are overlaid in pairs, the color of the object number corresponding to that of the leaf in the adjacent image. Leaves in each grouping were photographed to the same scale. *Top left*, Davaras cat. 16, spray 6; leaf 4351 is smaller than the other three leaves. *Top right*, Davaras cat. 10, spray 2; two leaves and details below each; the two leaves are very close in size (the bottom leaf is almost completely invisible in each overlay), but technical dexterity is different. *Bottom left*, Davaras cat. 17, spray 7; leaves 4360 and 4361 are wider than 4359 and 4362. *Bottom right*, Davaras cat. 15, spray 5; leaf 4350 is smaller than 4349a and 4352.

identical leaves were cut from the same metal sheet in the same manufacturing event (fig. 17). Similarly, with a single possible exception, the antennae of the wild goat diadem (HNM 4313) form a tight chemical composition cluster that stands in stark contrast to the composition of the main band of the diadem (see fig. 17). This reinforces the suggestion of different materials and makers for the main band and the antennae, but it also raises the possibility that their manufacture may not have been synchronic (an issue to which we return below). Another item from Mochlos worth highlighting on the basis of its composition is the small disk from Tomb 22 (see fig. 3, HNM 7178), found together with a possible MM I sealstone;[69] the disk stands out in its remarkably lower silver content (10.8%) compared with the rest of the Mochlos assemblage, and perhaps the gold of which it is made had a different origin. At the other end of the compositional spectrum, item HNM 3108 (see fig. 3) shows the highest silver (33.2%) and copper (1.89%) levels in the assemblage and is also unique in its construction: a small hollow bead stylistically resembling a lily, this item was made by hot-joining an embossed sheet to a flat back.

The assemblage so far recovered from Sissi is smaller, and it is broadly comparable to those observed elsewhere in the occurrence of small fragments of gold sheet that were predominantly hammered, cut,

[69] Soles 1992, 86.

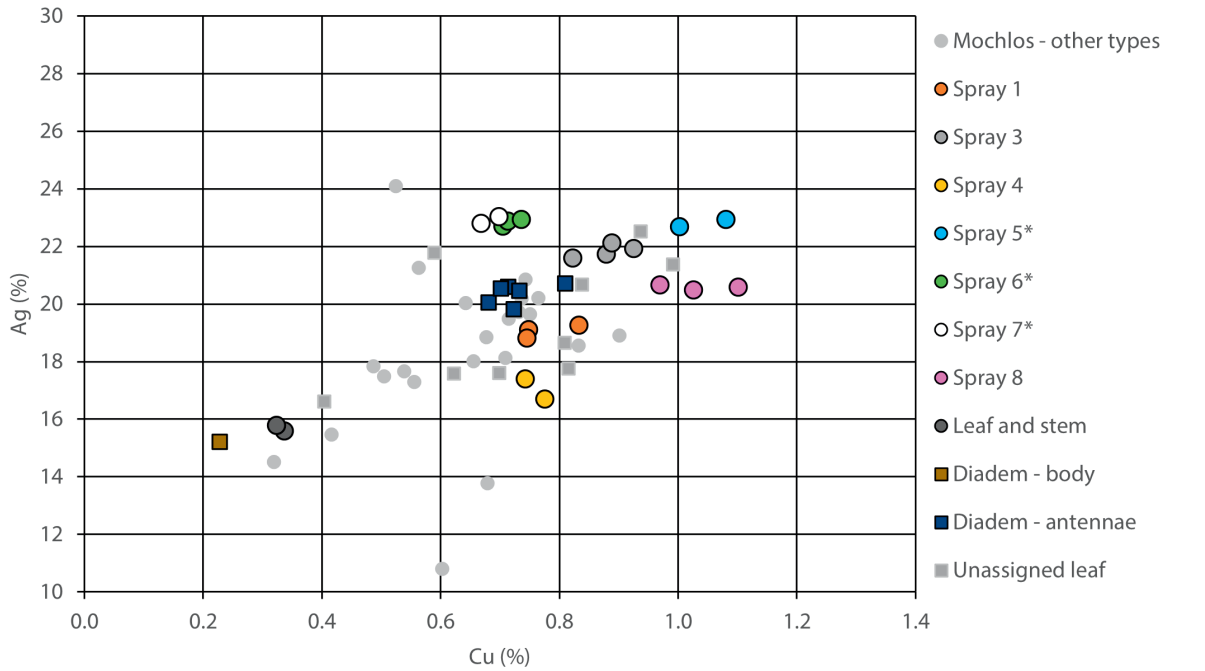

FIG. 17. Scatterplot of the copper and silver values for the artifacts excavated at Mochlos, highlighting the clustered composition of each group of objects. Spray numbers follow the groups made by Davaras (1975) with leaves of the same style; asterisks indicate sprays from which leaves were dissociated in the present study due to differences in size and execution.

and embossed (see figs. 4, 18). A few objects stand out, however, in their unusual typologies and technologies. Among these, the small ring (HNM 17357) was made with wire that was carefully hammered to produce an even thickness, as indicated by the remnants of longitudinal folds, before the three strands were twisted together (fig. 19). Stud or pin HNM 17356 (see fig. 4, upper left) has a relatively complex shape but was clearly hammered from a single piece of metal. Sissi Archaeological Project 4516_001 is a damaged small bead (diam. 5.08 mm) now missing a piece, but most likely it was made of three different elements with high-temperature joints. Particularly worthy of note is spherical bead Sissi 0099_011: barely over 2 mm in diameter, this object was made by hot-joining together two minuscule hemispheres that were previously shaped by hammering and perforated from the inside; this joint is so perfect that it is hardly visible even under a microscope (fig. 20). Interestingly, these four exceptional objects also stand out from the other items from Sissi in their composition, as they have the highest copper levels (see figs. 8, 9, top right).

The collection from Hagios Charalambos (see fig. 5), in addition to gold sheet fragments, includes a rolled sheet (HNM 13862) that might have been used as a tubular bead similar to HNM 13882, as well as some more technically complex or uncommon objects. There is a tiny spherical bead (HNM 13867) with a very well achieved joint between the two halves; unlike the Sissi example, here both perforations are in the same hemisphere. Also notable is a pair of embossed disks (HNM 11901); the outer edges of these are curved as if they once wrapped around a substrate made of another material. Last, the finger ring (HNM 11868)[70] has a flat hoop onto which was soldered a bezel decorated with miniscule cockleshells formed by chasing and embossing (fig. 21); besides its special technology and design, the two components of this ring also yielded the highest copper values for the site.

Production technologies with gold appear to have evolved significantly at the beginning of the second millennium BCE. Before the turn of the millennium, as illustrated by the assemblage from Mochlos, artifacts were manufactured using a relatively simple set of techniques, predominantly hammering of thin sheets, cutting, stamping, and embossing. Occasionally, these techniques were applied skillfully to produce remarkable items (e.g., HNM 3109 or HNM 4313, the wild goat diadem; see fig. 3), but overall,

[70] The ring has been discussed in detail in Betancourt 2011.

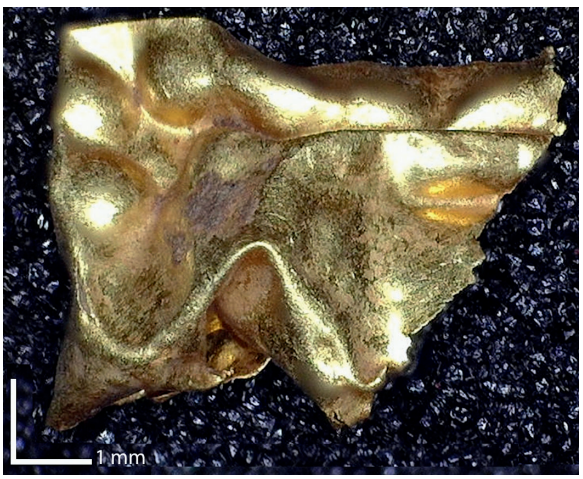

FIG. 18. Detail of small sheet fragment Sissi Archaeological Project 16/10/2325/003, with embossed decoration at top left and a rough edge on the right suggesting it was ripped from a larger item.

FIG. 19. Detail of ring HNM 17357 from Sissi.

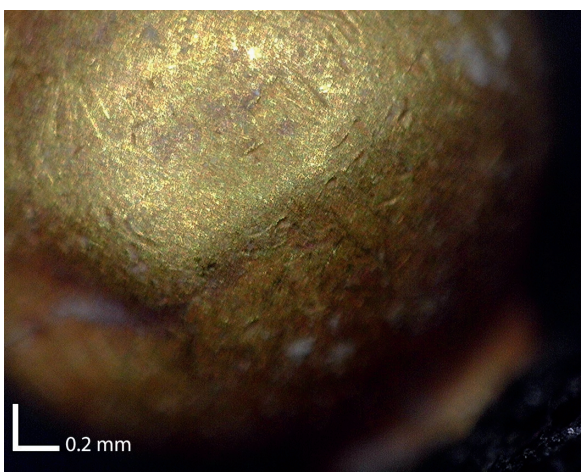

FIG. 20. Detail of spherical bead Sissi Archaeological Project 0099_011. The joint between the two halves (running diagonally from the top right) is almost imperceptible.

FIG. 21. Detail of finger ring HNM 11868 from Hagios Charalambos with cockleshell decoration.

and notwithstanding the variable levels of dexterity exemplified by the artifacts, these techniques were not difficult to learn or master. The assemblages from Sissi and Hagios Charalambos, which extend into later dates, include objects from the same tradition but also a higher frequency of three-dimensional designs, complex shapes, and joins that must have demanded more advanced skills. It is at the beginning of the Protopalatial period when granulation seems to have been introduced to the island,[71] a technique that documents a widening of the technological repertoire. As we have argued, gold items from Hagios Charalambos, which in general are produced with more complex techniques than those from Mochlos, are likely be dated to the MM I–II period based on associated material.

These observations allow some inferences about the organization of the goldworking craft. The involvement of multiple hands with variable skill sets and using different techniques to achieve the same results (e.g., in the case of wire making at Mochlos) argues strongly against the existence of specialist workshops where knowledge transmission was vertical and tightly structured. The latter should be conducive to higher

[71] Politis 2001; Morero and Prévalet 2015, 62.

standardization than is evident in our assemblages. This picture is consistent with the evidence from Prepalatial copper daggers, another culturally important item; their production has been characterized as heterogeneous and displaying differing local technical choices.[72] The patterns we see in the gold objects are more consistent with a mode of production by nonspecialists, with peripheral participation perhaps at the household level,[73] that involved a range of individuals who may have shared designs, materials, and ideas but clearly did not operate as a single specialist workshop. The occurrence of new and more complex techniques during MM I–II, often coupled with the use of gold of slightly different chemical composition, may indicate a movement toward specialization. It is hard to ascertain whether this movement was related to the arrival of foreign specialists or, perhaps more likely, to exposure to exotic objects that inspired technical innovations, but the increased specialization seems concurrent with evolving social structures that demanded more exclusive items.

CONSUMPTION CHOICES: FRAGMENTATION, CURATION, AND ENCHAINMENT

It has long been recognized, because of the heavy wear apparent on certain items, that many if not most of the gold artifacts found in the Cretan tombs were in use before their final deposition.[74] Our study confirms use wear on several objects; for example, gold band HNM 4303 shows worn perforations, and leaf HNM 4349a has notably worn edges (both from Mochlos, see fig. 3). In some cases, such as the very fragile leaves HNM 4343–62, there are no conclusive signs of wear, and the possibility that these objects were made specifically for burial deposition cannot be ruled out. Scraps of gold found in nonfunerary contexts at Sissi[75] could signify nonfunerary uses for gold items, but we have no particular evidence for nonfunerary uses, and it is possible that gold items were kept among the living for use in mortuary practices.

It is probable that sheet-gold items were used in combination with other materials, probably attached to garments that provided structural support. The perforations in HNM 4303, HNM 4304 (see fig. 3), and other bands and diadems were most likely used to fasten them to cloth or leather. In some of these, the cut edges were folded backward before embossing, clearly prioritizing the aesthetics of the front view (fig. 22). The thin antennae of the wild goat diadem (HNM 4313, see fig. 3) would not have had the tensile strength to stand on their own, although there is no evidence of how they were supported with any other material as they bear no sewing holes. In strip HM 272b (fig. 23),[76] the burrs (raised edges) around holes indicate that they were pierced from both sides of the metal, as if the sheet was sewn onto a layer of softer material, perhaps fabric or leather, that would act as support. Perhaps more significantly, objects such as strips HM 272b,[77] HM 277,[78] and HM 296[79] display a rather large number of perforations of at least three different diameters adjacent to one another, which could represent the use of several needles, most probably at different moments in the artifact's life history. These features suggest that gold items may have been detached and reattached to one another, and to other substrates, in connection with different uses, changes of users, or repairs. Detachment and reattachment may explain the technical and chemical differences noted above between the wild goat diadem HNM 4313 and the associated antennae (see fig. 17).

Since at least some of these delicate items were in use for extended periods, they would be expected to show damage. However, wear and tear alone cannot explain the fragmentary nature of these artifacts. Seager already recognized that the antennae had been ripped from the diadems he recovered, as shown by the tears left on the top edges of some diadems; the tears seem too regular to be explained by accidental damage or taphonomic processes, and diadems with such tears have invariably had all their antennae removed.[80] Davaras also recognized this phenomenon,[81] and Hickman subsequently suggested that three perforations on the dog diadem were drilled in order to secure it together with wire or thread after it was broken and before its final deposition.[82] Based on our examination of a wider range of artifacts that reveal crude tearing but also cutting with tools, we propose that deliberate

[72] Tselios 2008.
[73] Lave and Wenger 1991.
[74] Seager 1912, 27; Davaras 1975, 111.
[75] Driessen et al. forthcoming.
[76] Seager 1912, 27–28, fig. 8, no. II.10.
[77] Seager 1912, 27–30, no. II.10.
[78] Seager 1912, 27, no. II.6.
[79] Seager 1912, 30, no. II.11.
[80] Seager 1912, 27.
[81] Davaras 1975, 110.
[82] Hickman 2011, 99.

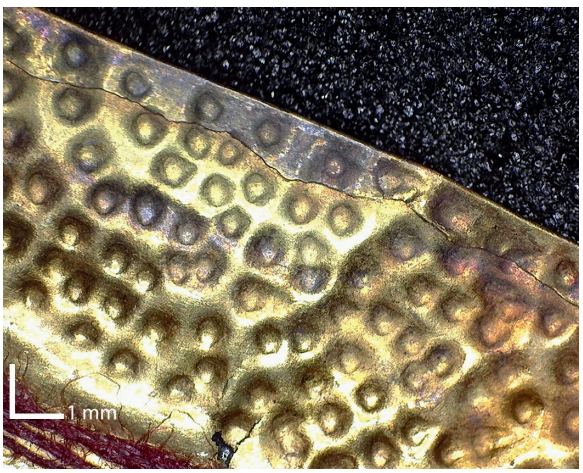

FIG. 22. Detail of the back side of gold band HNM 4304 from Mochlos, showing the edge of the sheet carefully folded back before the dots were embossed (red textile visible at the bottom left is part of the modern consolidation treatment).

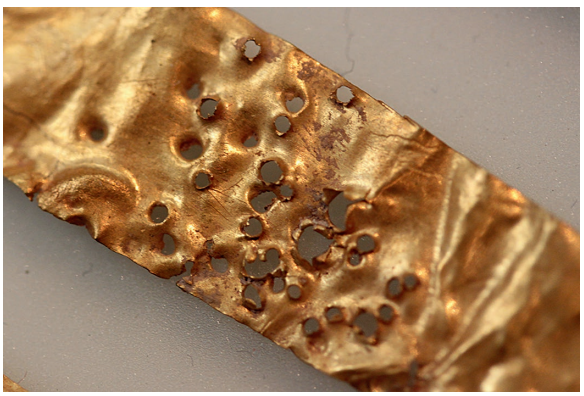

FIG. 23. Detail of gold band HM 272b from Mochlos.

fragmentation was much more common than hitherto noted and that many gold items in the Cretan tombs underwent some form of preburial fragmentation or detachment of their component parts. Such processes, including curation and redeposition, indicate that gold items were not always expected to remain buried and that they maintained an important social role after their first burial.

Fragmentation covers a range of practices[83] whereby objects are purposefully damaged, dissected, broken, or destroyed so they cannot serve their original purpose, though they may gain new uses. Objects may be detached from their original context of use or separated into their components. Our analysis found that while gold artifacts recovered from Early Minoan and Middle Minoan Cretan tombs illustrate several of these categories, they also suggest that the concept of fragmentation needs to be redefined to include a broader set of actions representing a wide spectrum of behaviors. Many items were demonstrably broken before deposition, but in other cases, the fragmentation of items could be the result of unintentional damage when new bodies were interred in the comingled Cretan burial deposits.[84] Still, even these items seem to have been curated and sometimes possibly even reused after the reopening of the tombs. These items were physically separated from their prior use and users while remaining symbolically connected with them when they were given new meanings through curation and redeposition.

The dog diadem (HM 269, see fig. 14) and the wild goat diadem (HNM 4313, see figs. 3, 13) from Mochlos were the first to spark questions about modification before final deposition. The wild goat diadem HNM 4313 was cut in a planned manner, as indicated by the guide mark scratched at the bottom edge of the diadem (see fig. 13d) prior to cutting off parts of the design. At Platanos, diadem HM 483 had its central part cut off carefully[85] in a similar manner to Mochlos diadem HM 274.[86] In other cases, object parts appear to have been ripped out rather than cut. The dog diadem HM 269 from Mochlos, for example, was found without antennae, but the square tears at the top of the diadem mark the spots where they were ripped away[87] (see fig. 14). Several loose antennae have been identified in Mochlos Tombs II and XIX, some of them carefully folded,[88] and antenna fragments were also recovered (HM 281, 283, 297, and 310 from Tomb II, and HNM 4342, found inside the silver vessel).[89] There are more possible antennae in the tombs than corresponding diadems at Mochlos, and the impression is reinforced by gold pieces identified as unattached antennae at Archanes Tholos Gamma[90] and Pyrgos Cave.[91] While we cannot be certain in all

[83] Chapman 2000; 2015.
[84] Legarra Herrero 2018b.
[85] Xanthoudides 1924, pl. LVII.
[86] Seager 1912, 27, no. II.7.
[87] Davaras 1975, 110.
[88] Davaras 1975, 110–11.
[89] Seager 1912, 30–31, nos. II.11, II.18, II.27.
[90] Objects J56 and J57; supra n. 23; Papadatos 2005, 40, fig. 25.
[91] HM 510a–c; Xanthoudides 1918, 166, fig. 15.

cases that these antennae were broken off deliberately, the differential deposition of these strips from the rest of the diadem indicate a purposeful behavior. A particularly interesting case in point here is an antenna fragment recovered at Mochlos (HNM 4342a, fig. 24), on which an animal is outlined by embossed dots with its head at the top end of the antenna, very much like the animals on the antennae currently attached to the wild goat diadem HNM 4313. Against this background, many small pieces of sheet gold recovered at all the sites examined here may be reconsidered as fragments that were ripped or cut from larger items prior to their deposition in the tombs or left behind when the larger items were recovered from the dead. Significantly, microscopic examination often reveals that these fragments bear embossed and engraved decoration, perforations, or folded edges, evidence that these were once parts of larger objects (see figs. 18, 25).

For other items, fragmentation is not so obvious, but detachment from a larger object can be posited, and the golden leaves so common in the Mochlos assemblage are good examples. Only one set of leaves was found intertwined together, forming a spray as found in the silver vase (HNM 4346b, see fig. 3). The other 27 leaves were found separated, even if we may now regroup them in subsets based on their stylistic, technological, and compositional coherence (see above and figs. 15–17). Object HNM 4343a (see fig. 3),[92] a stem with a single leaf attached, may have been part of a spray. Davaras suggested that the leaves were separated before being put inside the vase in order to fit them in.[93] Our study shows that indeed most of the leaves were carefully separated by untwisting their stems from their original arrangement in small sprays, as shown by the torsion still exhibited by most of their stems. Most likely, some of the leaves from the original sprays were not deposited with the assemblage; this is indicated by the presence of several typological outliers that do not seem to belong to Davaras' reconstructed sets. We suggest such separations might have been meaningful acts that go beyond practical reasons. Found outside the silver vessel, flower HNM 3109 (see fig. 3) has a long and bent stem that would probably have been twisted around leaves or other items, thus exemplifying the taking apart of another vegetal motif

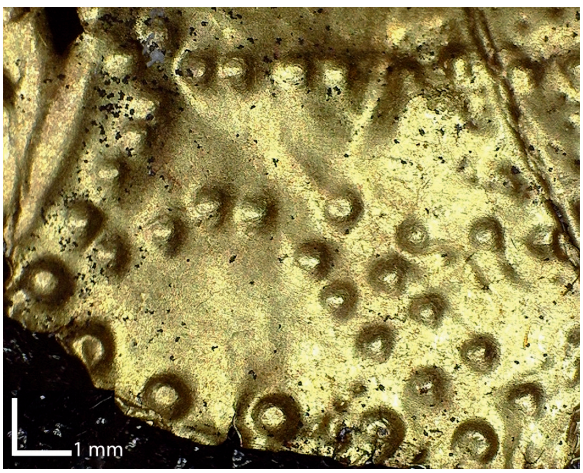

FIG. 24. Detail of the embossed decoration at the end of detached antenna head HNM 4342a from Mochlos.

with the item deposited separately from the leaves that were untwisted.

The curation of the leaves, redeposited carefully in the silver vessel that was placed outside the tombs, could be considered an act of separation and recontextualization. Even if we were to consider that the leaves were detached for the practical reason of fitting them inside the vase, this would not explain why the separation was done so carefully and why it was considered important to redeposit the detached leaves near the tomb. The person or people who removed the leaves and other items from burial deposits (or from the deceased before interment) created a new link between themselves and those buried in the tomb. Manipulating and isolating these items and then placing them in the niche above the tomb is a meaningful action that speaks of the importance of the gold items and how these were curated and given importance after their first deposition in the tombs; they were neither looted nor reused. Such redeposition may have been considered important to establish or consolidate the relationship between the deceased in the tomb and the living, by creating an opportunity to redefine identities, send messages (to the dead and the living), or reinforce social links.

The role of leaves in processes of meaningful separation is further supported by the group of leaves HM 327 from Mochlos.[94] Although we were unable to carry out pXRF analyses of these leaves, they are so similar that they were given a single museum catalogue num-

[92] Davaras 1975, 105.
[93] Davaras 1975, 102.
[94] Seager 1912, 43, no. V.k.

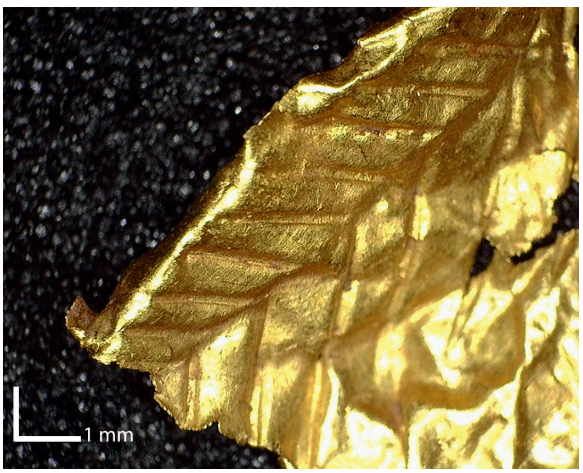

FIG. 25. Detail of a small fragment of gold sheet, HNM 13800, from Hagios Charalambos, with remnants of a herringbone decorative pattern engraved before the sheet was torn.

ber, and previous researchers have already suggested that they may be part of one original spray.[95] However, importantly, the leaves were found in different locations: one leaf was found in Tomb XVI[96] whereas the rest were recovered in Tomb V.[97] Their location in such separated deposits may be the result of an act of deliberate separation. This documented case of separate deposition opens questions about the stray gold leaves found in contexts beyond Mochlos, such as HM 217 and HM 219 at Hagia Triada Tholos A.[98] While the scarce information on these old excavations prevents a clear understanding of how intensive their recovery strategies were (e.g., did they sieve?) and the taphonomic processes, we should consider the additional possibility that these leaves were deliberately separated from larger sprays before their final deposition.

Isolated items in other assemblages may require similar reconsideration. Bead HNM 4300 (see fig. 3) is unique at Mochlos and was found isolated inside the silver vessel, but, at Platanos Tholos A, a group of beads of this type was found together as part of one or more necklaces (HM 454–67).[99] Why were HNM 4300 and other distinctive beads at Mochlos (e.g., HM 383)[100] deposited as isolated examples? Tubular beads HNM 4366a and b (see fig. 3) from the silver vessel have parallels at Mochlos in Tomb VI (HM 383),[101] though the latter appear as part of larger necklaces. It seems reasonable to think that the isolated beads were originally produced as part of a larger group and separated at some point before their final deposition in the tombs.

In a broadly similar vein, Seager suggested that the three gold strips HM 287a, b, and c from Mochlos Tomb II are missing a fourth piece that could complete the bracelet.[102] The three strips from Mochlos Tomb II are very similar to strip HM 267 from Mochlos Tomb XVI,[103] and all four could be part of the same batch or indeed cut from the same larger strip but deposited separately. Broken strip HM 491 from Platanos Tholos A[104] shows embossed decoration along one edge only. This, in addition to its irregular trapezoidal shape, could indicate that it was cut from a larger item. Even seemingly complete objects made of gold sheet may have started life as parts of larger objects; in particular, some of the narrower metal strips from Mochlos may have been cut longitudinally off wider bands. Consider, for example, wide band HM 267 from Mochlos Tomb XVI in comparison with narrower bands HM 288, HM 289, and HM 290 from Mochlos Tomb II (fig. 26);[105] in the latter three, while one of the long edges is neatly folded back, the other one runs through the middle of a herringbone pattern and looks more freshly cut.

There is further evidence of incomplete items from other tombs. In Stratum III of Tholos Gamma at Archanes Phourni,[106] two fragments of the same strip (J45 and J46) were found in different places of the tomb, about two meters apart.[107] The missing part of the broken gold strip J43 from the same stratum in Tholos Gamma is reported to have been found in the Area of the Rocks,[108] a context several meters west of the tomb that may have housed materials cleared from the tholos. While in this case the separation could be explained by an occasion of clearing out the tholos, it need not be dismissed as a meaningless, mechanical action.[109] The redeposition in the Area of the Rocks of

[95] Vasilakis 1996, 169–70; Hickman 2008, 382.
[96] Seager 1912, 77, no. XXI.16.
[97] Supra n. 87.
[98] Banti 1933, 194.
[99] Xanthoudides 1924, 110–11.
[100] Seager 1912, 55, no. VI.27.
[101] Seager 1912, 55, no. VI.27.
[102] Seager 1912, 30–31, discussion of item no. II.18.
[103] Seager 1912, 68, no. XVI.13.
[104] Xanthoudides 1924, 111.
[105] Seager 1912, 30–31, no. II.18.
[106] Papadatos 2005.
[107] Papadatos 2005, 52 and fig. 8.
[108] Papadatos 2005, 41, 52
[109] Papadatos 2005, 53.

FIG. 26. Gold bands from Mochlos as displayed at the Heraklion Archaeological Museum. Note how the narrower band HM 290 (bottom left) could have been obtained by cutting the wider band HM 267 (top) longitudinally.

at least part of the gold contents of the tomb, together with other materials from inside the tholos chamber, after the communal tombs were reorganized may have been a deliberate act to honor the significance with which these objects were endowed.

Davaras already suggested that the deliberate division of objects may have taken place at the time of burial.[110] He thought that gold could have been cut or torn from funerary objects to preserve some of the rare material for the living or that deliberate breakage was done to render the items useless.[111] Hickman seems to favor this second suggestion, and she puts forward the idea that these items were ritually mutilated or killed to prevent their use by another person.[112] In our view, it is difficult to ascertain whether modified items, such as the cut wild goat diadem HNM 4313, were rendered functionally useless. Instead, we contend that gold continued to be an important social material after its deposition in tombs, with objects and fragments materializing links between their makers and the communities and places that were engaged in their divergent life histories. The widespread occurrence of reuse, mending, deliberate fragmentation, curation, and post-depositional care indicates that the items were used to create a very dense network of links across the community. Gold leaves and beads worn by the deceased could be separated and given to some of those attending the funerals, to show gratitude or as part of gift-exchange networks; fragments of deposited items such as the missing part of the wild goat diadem HNM 4313 could be given to individuals to reinforce their link to the burial group and to construct genealogies; items removed during the clearing of the tombs could be relocated with care in order to keep good relationships with the deceased (who may have been considered to have an active role in the realm of the living). It is even conceivable, though we lack positive evidence for this phenomenon, that objects or parts were removed from tombs at some point after burial and spent time among the living before being buried again.

The practice of deliberate fragmentation of material culture in Crete, and more generally in the Aegean, has been the subject of recent discussion.[113] In the case of the Cretan contexts, the discussion has centered around the manipulation of human remains,[114] including the removal of skulls from the tombs[115] and episodes of human bone rearrangement, such as the leg bones positioned in a grid pattern identified at Hagios Charalambos.[116] These instances remain rare, and they are unlikely to constitute a coherent set of practices given the variation in burial practices across the island as well as changes in the deposition of human remains between the EM II and MM I–II periods.[117] It has been suggested that such practices reinforced and communicated important messages about group identity and allowed the construction of new relationships among the dead and between the dead and the living.[118] The three gold assemblages studied here present a better-defined example of such a process, with a precise chronological duration (EM II–MM II) in the comparable mortuary contexts of the Cretan Pre- and Protopalatial communal tombs. Our analyses indicate that acts of fragmentation may be just part of a wider set of practices and actions, including curation, reuse, and reburial, which created forms of enchainment in which gold played a central role. The recurrent creation and modification of communal deposits could serve to reinforce communal identities by preserving and mixing human remains in comingled deposits

[110] Davaras 1975, 110.
[111] Davaras 1975, 110–11.
[112] Hickman 2011, 100.

[113] Crete: Vavouranakis and Bourbou 2015; Aegean more generally: Chapman 2015; Renfrew 2015.
[114] See Branigan 1987; Betancourt 2014, 99; Vavouranakis and Bourbou 2015; Legarra Herrero 2018b.
[115] Driessen 2010; Girella and Todaro 2016.
[116] Betancourt et al. 2014, 25.
[117] For a detailed discussion on the variability of the manipulation of human remains, see Legarra Herrero 2018b.
[118] Hamilakis 2014; Chapman 2015; Vavouranakis and Bourbou 2015; Legarra Herrero 2018b.

that were significant for the burial community that contributed to the tomb. As an almost incorruptible, easily recognizable, and relatively rare metal that does not tarnish or decay, gold provided an ideal medium to demonstrate and preserve the lasting relationships among the living and between the living and the dead.

The complex pre- and post-burial life of gold items adds to the growing impression of Cretan tombs as places where group identities were reinforced and negotiated. It is possible that parts removed from one object could be attached to another, or used as raw material to create a new item, adding meaning and depth to complex object biographies and creating new relationships between those who wore the original pieces and those who used the new ones. The fluid identity and ownership of any one item would link people together. In many ways, the separation and redeposition of gold objects constitutes a more powerful social act than hoarding. The sharing and giving of gold items or some of their parts before they were deposited in the tombs, possibly as meaningful acts during the funeral or after they were recovered from the tombs during episodes of cleaning, could create dependencies and establish social debts that could help unbalance relationships more effectively than, for example, conspicuous consumption. Gold may have mediated in many types of relationships, from kinship and descendant ties to marital networks or group alliances. The different practices (producing, displaying, curating, separating, sharing, destroying, mending) were probably designed to produce different outcomes (establish links, show compassion, mark differences). Sharing important and valuable gold could show that two people were connected while at the same time creating an idea of debt (social or economic). Receiving gold could have the opposite outcome, if those having more of it faced cultural norms against hoarding that encouraged them to share it and rebalance relationships based on access to gold. Gold items—which are breakable, recyclable, and malleable—could be manipulated to suit changing social relationships, including those among and with the dead, while always retaining the symbolic weight of their rarity and unique physical properties.[119]

GOLD BEYOND DEATH: SUMMARY AND DISCUSSION

The technical and compositional analyses of the Mochlos gold assemblage speak of a heterogeneous production that seems to have been shared across this small community and that included individuals who were not particularly skilled. The repertoire of techniques employed was rather simple, predominantly based on hammering, cutting, and embossing, with only limited occurrence of more complex techniques, such as wire making and soldering, and displaying a variety of ingenious technical solutions rather than standardized production sequences. This production pattern argues strongly against the existence of specialist workshops and instead is consistent with craft organization in groups that reinforce horizontal (or roughly equal) relationships among individuals. The combination of local production, perhaps in the household or communal spaces, the expedient and easily learned techniques, and the use of shared shapes and decorative motifs fit the picture observed by DeMarrais in heterarchical societies of South America.[120] At the same time, the use of an exotic material, more intensive labor, and incipient virtuosity in some of the artifacts evoke what Spielmann calls a "ritual mode of production."[121] In Spielmann's view, ritual production strengthens interpersonal relationships by emphasizing performance and participation rather than profit or individual expertise. Several of these features seem applicable to the Cretan case. In particular, the involvement of numerous individuals in the making, sharing, curation, modification, use, and reuse of gold is suggestive of a participatory environment that favored horizontal relationships, while still allowing for—and sometimes demanding—various levels of skill and dexterity. Spielmann further notes that, in ritual modes of production, socially valued goods are often circulated and modified as they change hands, rather than being accumulated; such practices would also be coherent with the Cretan evidence.

[119] While the study of life histories of material objects is not new (e.g., Gosden and Marshall 1999; Joy 2009), there is great potential for technical analyses to contribute to this approach. With gold artifacts in particular, it has been shown how we can differentiate, e.g., between objects freshly made for deposition (Martinón-Torres and Uribe-Villegas 2015) and others that underwent different stages of modification (Sáenz-Samper and Martinón-Torres 2017). We note in particular a recent study, focused on Middle Period goldwork from funerary contexts in the south-central Andes and using a very similar approach, that also revealed complex histories of fragmentation and modification connecting the dead and the living (Plaza and Martinón-Torres forthcoming).

[120] DeMarrais 2013.

[121] Spielmann 2002.

Some objects show evidence of having been extensively used prior to their deposition in tombs (e.g., HM 272b from Mochlos Tomb II; see fig. 23); others could have been created by recombining parts of other objects (e.g., the antennae in the wild goat diadem HNM 4313, or loose beads grouped into new arrangements). Given the fragility of most of the gold objects in the assemblages from Mochlos, Sissi, and Hagios Charalambos, it is likely that many gold items were only used on special occasions. The shared provision, manufacture, and use of gold are suggested by the presence of some gold in almost every well-known Pre- and Protopalatial tomb.[122] Small communities had access to gold, even if in small quantities. In spite of its overall scarcity and the absence of local sources, most Cretan social groups had access to the material and therefore the potential to establish social and economic networks through its use.

This situation did not preclude the production of more elaborate objects, nor did it necessarily mean a simple social organization of distributed or heterarchical power. In the funerary ritual, the interment of certain individuals with considerable amounts of gold may have served to reinforce the status or identity of the person interred, and of those entitled to be buried in the same tomb, and sent a powerful message to other people. At Mochlos, Complexes I/II/III and IV/V/VI stand out because they contained more gold than the other tombs in the cemetery plus other imported items, such as cylinder seals in Tomb I and Tomb Lambda.[123] At the same time, the two groups represented by these tombs did not have exclusive access to gold; they were not the only ones able to display it, and our research similarly indicates that production was not restricted to one group but was distributed across the burial groups at Mochlos. Thus, the cemetery mat provide evidence for open competition among the burial groups, with no group able to restrict access to foreign materials or have exclusive use of them.[124]

We should not expect a completely homogeneous set of approaches to the deposition and use of gold in the burials. The fortune of a group and community may change rapidly. It must not be forgotten that neither Mochlos, nor Sissi, nor gold-rich Platanos would lead the major changes of the Protopalatial period, and the concentration of prestige items that can be recognized in these tombs did not lead to long-term processes of social differentiation. In this regard, it may be appropriate to remember that, while many gold objects and fragments thereof had a long life of circulation and use, the eventual deposition of a finite resource in tombs may have acted as a buffer against the excessive aggrandizement of particular groups. While we cannot tell how much gold (if any) circulated in spheres outside the funerary and is thus invisible to us, we should stress that the overall impression is one of gold scarcity. Cretan artisans stretched gold very thin, literally and metaphorically, by hammering it to sheets that are barely a few micrometers thick and breaking it into a multitude of small items, some of them further fractured in later stages. We estimate that all of the gold so far recovered from Early Bronze Age Crete amounts to barely a few hundred grams and, if melted together, it would fit in a very small bag. Any suggestions of a safe and steady supply of gold to Pre- and Protopalatial Crete would seem unwarranted.

By the MM IB–II period, the social role and use of gold appear to have undergone changes, along with broader transformations in the funerary record. It is difficult to gain a clear picture of gold deposition in this period as there is a decline in tomb numbers. Well-preserved tombs from the period, such as Kamilari, seem to include fewer prestige items,[125] and our study of the MM IB–II materials at Sissi is consistent with the suggestion that more complex technologies appear in the record at this time,[126] as is also demonstrated, for example, by the well-known Malia wasp pendant.[127] Such objects required more experienced artisans who underwent longer training. Interestingly, MM IB–II Tomb 9 in Sissi and the Hagios Charalambos cave cannot be considered elite tombs, and they demonstrate that, despite changes in technology, gold was still deposited in tombs that are otherwise unremarkable and away from the major centers.

CONCLUSIONS

Three main conclusions may be derived from this study. First, we have shown that there is great scope for refining our understanding of the material culture of Bronze Age Crete by integrating technical analyses with contextual information. Raw material acquisition,

[122] Legarra Herrero 2018a.

[123] Seager 1912, 22; Davaras and Soles 1997.

[124] Legarra Herrero 2014b, 103–4; Karacic 2015.

[125] Legarra Herrero 2014b, 154.

[126] Politis 2001; Morero and Prévalet 2015.

[127] Object currently at the Archaeological Museum of Herakleion and first reported in Demargne 1930, 411–20.

production, and consumption are better understood as linked, and one cannot be truly understood without the others. For this, the study of complete assemblages is crucial. Individual artifacts may tell a story, but contextual relationships add a vital layer of information. This is true for any archaeological study, but even more so for assemblages such as those presented here, where complex life histories of curation, reuse, fragmentation, and recontextualization are the defining features. Future analytical work on gold should expand to other well-contextualized assemblages and specifically seek matching fragments. In this paper, we have only begun to unveil a variety of separation, cutting, ripping, detaching, and reuse that quite likely responded to specific stimuli in each case. By expanding the temporal and geographic span of the research, we may be in a better position to explore the role of foreign metal, objects, and technical knowledge in the diachronic evolution of Minoan goldwork, while recognizing the idiosyncratic elements that are essential to understanding local dynamics.

Second, we have demonstrated that the life of the gold artifacts did not end when they were deposited with the deceased and that posterior handling of these artifacts was neither accidental nor purely utilitarian. The evidence indicates that these items remained socially active after their deposition and that Cretans actively repurposed them. Whether fragmented before deposition, curated after deposition, or even reused after removal from the tombs (a phenomenon archaeologists would struggle to identify), gold items were redeployed in culturally meaningful ways and used to renegotiate social relationships.

Third, we conclude by emphasizing that in Early and Middle Bronze Age Crete, gold was not the material of kings or queens but rather was a powerful material that infiltrated most social groups in spite of its rarity. The decentralized dimension is apparent not just at the consumption level but also at the stage of production and probably at the acquisition of the raw material. Gold was part of the materials that mediated community relationships, and our research demonstrates a fluid and heterogeneous use of this material. Its position as a prestigious and rare material cannot be denied, and it was therefore prone to manipulation for unequal advantages. The control and display of gold related to the ritual in communal tombs; gold objects worn by the deceased reinforced key relationships between them and the kinship (or other) group to which they belonged. The shared production, use, and deposition of objects and fragments highlighted by our analyses can be seen as mechanisms that limited hoarding by a single group or individual. The power that gold conferred was exerted through its sharing—which created connections and dependencies in this world as in the afterlife—not through its hoarding. In a sense, gold was too important to be left to the discretion of just a few individuals, and as such it serves as a good reminder of the central role of group identities and horizontal relationships in the development of Cretan complex societies.

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