**[title]Minoan Status Symbols: Tweezers, “Weaving Hooks,” and Cosmetic Scrapers**

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**[A-head]Abstract**

[abstract]

For this project a large number of Minoan metallurgical objects of various sizes, belonging to different classes and made of different metals, were analyzed by XRF. The items come from different sites in eastern Crete, one of which, Gournia, was excavated in the early twentieth century. The objects are mostly dated to the Early Minoan (EM) I to Middle Minoan (MM) IIA periods with several pieces also coming from Late Minoan I contexts. The exact findspots from the older excavations were seldom recorded, so a few artifacts may be slightly earlier or later.

The equipment employed for the analyses consists of a transportable XRF-source on a support with devices to control its position and stability, a transformer, a stabilizer, and a computer with dedicated software. The characteristics of the equipment and its various devices, the dedicated software, and a suitable number of standards (produced *ad hoc* by AGM Archeoanalisi), greatly enhance the precision of the system.

The composition, production techniques, and finishing processes of the artifacts have been investigated and allow for the reconstruction of the fabrication procedures and the various stages of production. Among the metal finds were some objects that are commonly interpreted as small tools, such as tweezers, the so-called weaving hooks, and cosmetic scrapers.

The analyses have shown that the copper-based alloys employed for personal ornaments and jewelry are much better refined and contain more alloying elements such as tin and arsenic than the copper-based alloys used for simple tools. Further, the tweezers, so-called weaving hooks, and cosmetic scrapers were made of the same good-quality alloys as jewelry. This fact clearly indicates that such small personal items were not simple tools, but they had high value and a special significance in Minoan society. They were apparently worn by their owners as decorative accessories, and indicated their social status. In the special case of the items heretofore known as weaving hooks, their identification as hair pins is confirmed by the existence of gold examples and painted representations in the Grandstand Fresco at Knossos.

**[A-head]Introduction**

**[main text]**

For our project on Minoan metallurgy, many objects of various sizes, belonging to several classes, and made of different metals were analyzed by X-ray fluorescence (XRF). The items come from different sites in eastern Crete, one of which is the Minoan town of Gournia, which was excavated in the early twentieth century.[[1]](#endnote-1) With the support of the University of Pennsylvania Museum of Archaeology and Anthropology (hereafter, Penn Museum) in Philadelphia and private donors, Harriet Boyd Hawes and her collaborators, Richard Seager and Edith Hall, excavated the settlement of Gournia in three campaigns in 1901, 1903, and 1904 and published the discoveries in 1908.

The settlement was situated on a low hill overlooking the Gulf of Mirabello. It thrived from the Early Bronze Age until it was destroyed at the end of Late Minoan (LM) IB (ca. 1450 BC). The town consisted of paved and cobblestone laneways among many irregularly shaped, multi-room houses. Many types of artifacts were found throughout the site including fine examples of Late Minoan IB Marine Style pottery and also earlier examples of silver and ceramic kantharoi.[[2]](#endnote-2) Stone vessels and tools came to light, such as bird’s nest bowls, rhyta, lamps, mortars, and pestles. A lapidary workshop probably existed in the town. Additionally, other utilitarian items, especially metal tools and objects such as daggers, double axes, saws, chisels, and sickles, were uncovered during the excavations. Most of these objects were incorporated into the collection of the Candia Museum, which is now the Herakleion Archaeological Museum in Crete, but a smaller number of items also was offered at that time to the Penn Museum as a gift to create a study collection in the United States. This collection is one of the most important groups of Minoan objects outside of Greece, second only to the Knossian collection of the Ashmolean Museum at Oxford University.[[3]](#endnote-3)

The wide range of types of metal objects that were found at Gournia—from ingots to sheets and strips to finished tools to scrap metal—in addition to other finds from the settlement—such as stone hammers and stone molds, which were discovered in a cache in Room Fh—indicate that the people who lived in the town probably manufactured metal objects in one or more workshops. The metalsmiths may have been housed in Rooms Ea and Cg based upon the sheer number of metal objects that were found in those rooms.[[4]](#endnote-4)

The collection of the Penn Museum contains over fifty cataloged metal items, most of which likely date to the time of the destruction of the town at the end of Late Minoan IB. Dating metal objects, however, can be problematic because scholars have documented the continuity of tool type and morphology from the Early through the Late Bronze Age in Greece based solely on stratigraphical contexts. [[5]](#endnote-5) Also, metal objects tend to be long-lived, so the manufacture of some may actually date to earlier periods.

Hawes’s excavation report of 1908 set a high standard for quality publication in her day, but unfortunately it does not measure up to modern levels of scholarship. She did not fully catalog the majority of the objects that were found nor completely document their contexts at the site. In the final report, only 72 out of 157 copper-based objects were listed and illustrated from the entire site. The Penn Museum has over 53 of the 157 objects, but not all of them are shown in the original publication, so additional objects were clearly omitted from the final publication.

All of the metal finds from Gournia that are housed in the Penn Museum have been analyzed with XRF, but we will focus here on a few select pieces, namely the small copper-based tools and personal items such as tweezers, cosmetic scrapers, and the so-called weaving hooks. The composition, production techniques, and finishing processes of the artifacts have been investigated and allow for the reconstruction of the various stages of fabrication.

**[A-head]Methodology**

Each object chosen for analysis was visually examined under various magnification (x50, x100, x200) devices to determine its current state of preservation and to identify the best locations on the surface for performing the analytical measurements. Comprehensive visual examination also reveals evidence for manufacturing techniques and even indications for the attachment of organic handles that have long since disappeared. Wherever necessary, the chief conservator of the museum removed a small area of the patina layers before taking measurements.

XRF was chosen for the scientific analysis because it is a non-destructive method perfect for use on museum pieces. The particular system employed was also transportable and was specially developed for the analysis of cultural heritage objects. The equipment consisted of an XRF-source on a support with devices to control the position and stability of the X-ray beam, a transformer, a stabilizer, and a computer with dedicated software. The characteristics of the equipment, the dedicated software, and the standards specifically created for use with ancient metal alloys (produced *ad hoc* by AGM Archeoanalisi) greatly enhanced the precision of the system. Each measurement illuminated a spot on the object with X-rays for a short time, usually about 15 minutes, but longer if the location was very small. The irradiated zone measures approximately 1.5–2.0 mm in diameter, but it can be reduced or enlarged depending upon the size and surface texture of the object. An acoustic signal indicates when the distance from the sample is correct and a laser pointer marks the exact location to be measured.

A wide range of elements—particularly metals and alloys—can be quantified with precision, if proper standards are used.[[6]](#endnote-6) Those utilized in our analytical program represent various compositions of ancient metal alloys. They are an important aspect of evaluating the XRF results. During the project at the Penn Museum, the standards were run each day at regular intervals. Drift and any interference therefore could be identified and accounted for while gauging the results. This procedure maintains precision and assures reliable results. This system is transportable, yet it is as accurate as any classic laboratory XRF.

**[A-head]Results: Composition of Small Decorative Objects of Personal Use**

Personal ornaments made of metal were an important type of object during the Cretan Bronze Age. This class commonly shows a better quality of manufacture than everyday objects and tools. Their presence in mortuary contexts dating back to the beginning of the Early Bronze Age indicates that the Minoans had a long history of exhibiting social status through personal adornment with metal items.

The XRF results (**table 30.1**) show that a small group of four hook-shaped pins (MS4203–MS4205 [**fig. 30.1**], MS4740), which have been called “weaving hooks” or jewelry in the literature,[[7]](#endnote-7) contain a relatively high amount of tin, at 2–5 percent, with measurable arsenic in a couple of the specimens. The four pieces were manufactured with different techniques. Two of the pins are square in section and therefore seem to have been simple cast objects; the other two examples (MS4203, MS4205) are round in section, so they were most probably hammered into shape after casting. Furthermore, one of these pins (MS4203) was created using a third technique, namely twisting together two lengths of wire, as evidenced by the spiral-form seam visible under magnification. The shaft was hammered and then polished with an abrasive tool. The fabrication techniques rendered delicate decorative forms, while the composition of the alloys containing relatively high amounts of tin with some arsenic would have resulted in a lighter color of the metal, perhaps imitating gold or silver.

Hook-shaped pins from the Minoan culture have been construed at times to be weaving hooks, but the metallurgical composition and method of manufacture of those from Gournia are comparable to those of decorative objects instead of utilitarian tools. Furthermore, according to scholars who specialize in textiles of the Aegean Bronze Age, so-called weaving hooks do not actually exist in the repertoire of tools necessary for the fabrication of cloth.[[8]](#endnote-8)Our hook-shaped pins from Gournia are paralleled by examples from other sites made of gold, silver, and ivory.[[9]](#endnote-9) Specifically, a total of ten ivory pins were excavated in a Late Minoan I house at Mochlos, a Minoan harbor town near Gournia, along with an ivory box filled with amethyst, carnelian, and lapis lazuli beads.[[10]](#endnote-10) The entire set must have belonged to a very important lady who was not unlike those depicted with hair accessories in frescoes from Knossos in Crete and Akrotiri on the island of Thera. The Miniature Grandstand Fresco at Knossos[[11]](#endnote-11) illustrates two ladies with hook-shaped pins adorning their hair (**fig. 30.2**). The “injured adorant” in the Xeste 3 wall paintings at Akrotiri wears a hook-shaped pin in her coiffure that ends in the form of an iris.[[12]](#endnote-12) These painted parallels support the idea that metal hook-shaped pins probably were not simple tools. They had a special social meaning because the ladies in the frescos certainly held an elevated status in Minoan society. The use of these decorative items as personal ornaments therefore seems much more logical than as a textile tool without a single parallel.

One of the largest classes of metal objects within the Gournia collection at the Penn Museum is the tweezers (see fig. 30.1, lower left). The alloy used to create them was specially prepared with well-purified copper and the addition of higher amounts of tin. Their compositions show 2–3 percent tin, comparable to the alloys used for other personal ornaments. These alloys were commonly manufactured with refined copper that also contained noticeable amounts of tin and some arsenic. The objects were carefully finished and even repaired when broken (e.g., MS4196) instead of being melted down for recycling, indicating that the tweezers were important objects of some significance and perhaps had a special meaning. They could have been worn by the owner, maybe as a pendant or on the belt, and functioned as small personal adornments. The composition of the tweezers can indeed be compared to that of other ornaments. One of the pieces (MS4746K) in particular contains only traces of tin but a higher arsenic content of 2.4 percent. Tools composed of this alloy are just as functional as examples manufactured with tin bronze. The color of the arsenic-rich tweezer also would have been conspicuously lighter, perhaps improving its aesthetics. Unfortunately, this particular example from Gournia is in poor condition, meaning the data should be considered only indicative.

Another object from Gournia is a small “scraper” that was formed with a loop for use as a possible handle (MS4198; see fig. 30.1, lower center). Again, this small personal item was made with a similar kind of metallurgical composition. It may have been used as a cosmetic scraper of some sort, and the loop would have provided a way to wear it as a personal ornament in the same manner as suggested for the tweezers.

Two other examples (MS4190 [see fig. 1, lower right], MS4746F) from Gournia are simpler in composition. A small implement with a flaring blade (MS4190) shows evidence for careful finishing. Under magnification, one can also see that the cutting edge exhibits traces of use-wear and reworking. The blade is composed of copper with only traces of tin and no measurable arsenic, while the rivets are less refined unalloyed copper. The presence of relatively high zinc and iron in this object is only due to corrosion. The other small blade (MS4746F) was made of unalloyed copper that contained only traces of arsenic and silver.

**[A-head]Conclusions**

Our study has demonstrated that the Minoan metalsmiths were able to purify their copper whenever the need arose. For some classes of utilitarian objects, however, thorough purification was not deemed necessary, so impure copper was used. The arsenic and tin content shown in the XRF results of these copper-based objects from Gournia suggests that tin was a rare and expensive commodity and that recycling scrap metal was relatively common.

Moreover, as the smiths gained empirical metallurgical experience over time, their growing knowledge enabled them to recognize the beneficial properties of arsenic-rich copper, and to appreciate its pale silvery color. This would have contributed to their production of tools that were more resistant and harder than copper, and also to the manufacture of decorative items that could be lighter and more attractive in color.

The XRF analyses have demonstrated that the copper-based objects from Gournia presented here were actually prestige items because the alloys contain certain metals in particular quantities (one of which is a precious metal) to convey the color and status of silver and gold. These alloys used for personal ornaments and jewelry are refined to a higher degree and contain more alloying elements, such as tin and arsenic, than the copper-based alloys usually used for simple utilitarian tools. Additionally, the hook-shaped pins, tweezers, and cosmetic scrapers were manufactured with high-quality alloys comparable to those used in jewelry pieces. These small personal items therefore were not simple tools but were highly valued in Minoan society. The owners would have worn them as decorative accessories of their garments and hairstyle as an indication of their social status.

**[A-head]Acknowledgments**

We thank the Penn Museum for permission to study, analyze, and publish the metal objects from Gournia. We gratefully acknowledge funding provided by the Institute for Aegean Prehistory (INSTAP), Philadelphia, PA.

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1. Boyd 1904; Boyd Hawes et al. 1908. [↑](#endnote-ref-1)
2. Betancourt 1979; Betancourt and Silverman 1991; Fotou 1993. [↑](#endnote-ref-2)
3. Boardman 1961. [↑](#endnote-ref-3)
4. Betancourt et al. 1978, 7. [↑](#endnote-ref-4)
5. See, for example, Branigan 1974. [↑](#endnote-ref-5)
6. See Hahn-Weinheimer, Hirner, and Weber-Diefenbach 1995; Lutz and Pernicka 1996. [↑](#endnote-ref-6)
7. Branigan 1974, 35, pl. 17. [↑](#endnote-ref-7)
8. J. Cutler, pers. comm. [↑](#endnote-ref-8)
9. Branigan 1974; Soles and Davaras 2010. [↑](#endnote-ref-9)
10. Soles and Davaras 2010, 1–3. [↑](#endnote-ref-10)
11. Evans 1964, 46–57, plates XVI, XVII. [↑](#endnote-ref-11)
12. Vlachopoulos and Georma 2012, esp. 40, plate XVIId. [↑](#endnote-ref-12)