Technologies of Jewelry at Ur: the Physics & Metaphysics of Skilled Crafting

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Introduction

My primary contribution to the scholarship of the Ur jewelry has focused on a detailed study of the materials and techniques used to create Pu-abi's jewelry (Figure 1), most particularly her gold ornaments (Figure 2), for which I relied on my training and skill as a practicing goldsmith. The many ornaments fashioned from gold appear on the surface to be of rather simple manufacture, made primarily of undecorated, hammered sheet; however, by examining these pieces closely, under a microscope when possible, it became apparent that the methods used to hammer and assemble the pieces were deceptively complicated and time-consuming and that they required exceptional skill. There seems to have been some sort of premium placed on fashioning the ornaments from a single piece of gold whenever possible, even at the cost of additional labor-intensity, presumably due to specifications that called for seamlessly produced objects. The making of this jewelry is also noteworthy for a prescriptive-like consistency and repetition of technique, seemingly intended to enhance properties of purity and shine already embedded or coded in the materials themselves. The process of production thus required not only substantial material resources but also a considerable and coordinated investment of human energy consisting of craftspeople both skilled in mechanical techniques and knowledgeable in the techniques of seemingly dictated specifications. A certain amount of advanced planning would therefore have been necessary to form Pu-abi's assemblage because the individual pieces were clearly made in a highly prescriptive way that suggests that they were conceived together.

Figure 1. Current reinterpretation and display of the majority of Pu-abi's attire at the University of Pennsylvania Museum of Archaeology and Anthropology (photo courtesy the Penn Museum, image no. 184431)

Analysis

Although a complete analysis of the materials and methods used to create all of Pu-abi's jewelry, as was done for my doctoral dissertation (Benzel, 2013), is not feasible here for reasons of space, I will present two examples of the jewels in question and describe how they were fashioned. Beginning at the top of Pu-abi's body with the

Figure 2. a) Pu-abi's head ornaments as reconstructed on mannequin and as separated into individual pieces (image courtesy of the Penn Museum, no. 152100). b) Pu-abi's comb, c-e) three of Pu-abi's wreaths, f) beaded ornament (Cat. no. 61a-e, photos by Anna Marie Kellen, courtesy of Richard L. Zettler, Associate Curator-in-Charge, Near East Section, University of Pennsylvania Museum of Archaeology and Anthropology)

large hair comb (Figure 2b), a close inspection shows that a tremendous effort was made to create this large and heavy ornament out of as few pieces of gold as possible, and without evident use of any joining medium other than the purely mechanical. The body of the comb was made out of very large and thick sheet gold that most likely began as a solid mass, probably in an elongated shape. In order to plan for and achieve from a single piece of gold the wire pin at the one end and the wide splay into seven prongs at the other, the goldsmith must have possessed an intimate knowledge of the mechanics and movements of gold as it was hammered repeatedly.

While the comb appears simply made in the sense that its body has no decoration or ornamentation, the process of hammering such a large piece of gold requires tremendous feel for the metal as well as time and patience. All metals harden and become brittle as they are worked, especially by hammering. They require constant heating and reheating (called annealing in modern technical terminology) to regain their malleability for further hammering or for other kinds of manipulation. If they are not annealed properly and often enough, metals simply stop responding or become so brittle that they show cracks and fissures.

In the case of the comb, I imagine that the goldsmith would have begun hammering at one of the short ends of the elongated solid gold mass – first to secure enough length for the wire pin at the one end, then to continue with the large flat surface that makes up the body. He or she would have needed to anneal the metal scores of times, for this much gold to remain malleable enough to be hammered successfully into the sizeable body of its completed form. The process of annealing each time is not a particularly speedy one, in addition to being highly repetitive. The metal must be heated evenly and carefully so as to achieve maximum compliance but not to melt or blister it. The constant annealing required in order to proceed with hammering is deceivingly labor intensive and takes great skill and sensitivity. Unlike intricate decorative techniques such as granulation or filigree, which immediately present themselves to the viewer as difficult and time consuming, the hammering of metals does not "advertise" the labor and expertise involved. The technique and the process are largely hidden and silent within the final product.

What is also hidden within a final product made in this manner is the fact that if, at the end of the hammering process, the mass of gold had not been sufficient for the desired design, then the goldsmith would have had to begin from scratch or resort to soldering or brazing additional sections to the main body. This is an important technical point when evaluating the procedural decision not to use any means of solder or baser alloy and the consequent implied skill of the goldsmith. Thus, while one's first impression of the comb is that, although quite large and lovely, it is rather simply made from undecorated sheet gold, it becomes clear from even this abbreviated analysis that its manufacture was anything but simple.

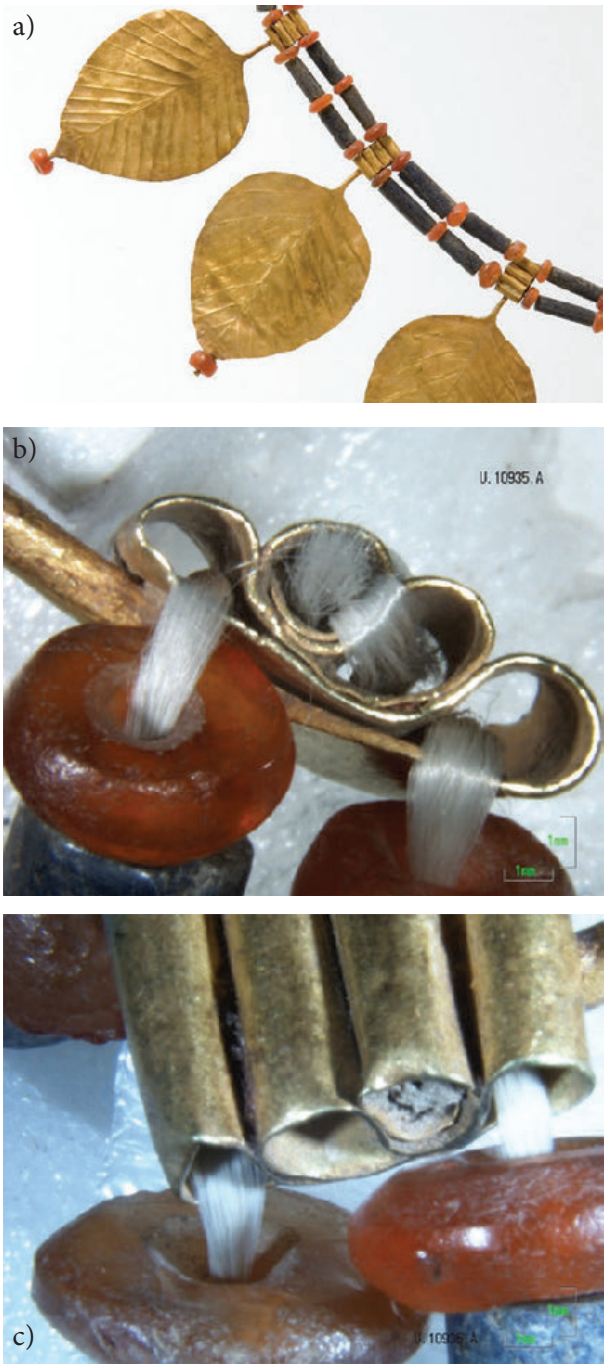

Figure 3. a) detail one of Pu-abi'spoplar wreaths (photos by Anna Marie Kellen, courtesy of Richard L. Zettler, Associate Curator-in-Charge, Near East Section, University of Pennsylvania Museum of Archaeology and Anthropology); b-c) microphotography details of one of the suspension loops (photos by Kim Benzel)

Figure 4. Selection of ornaments from various tombs, Ur, Mesopotamia, ca. 2500 B.C.E., British Museum, London (Aruz and Wallenfels, 2003, Cat. no. 74a,b,c,d; Cat. no. 72a,b,d,e; Cat. no. 73a,b,d © The Trustees of The British Museum)

Looking at the botanical wreaths that adorned Puabi's head (Figure 2c-2e), the predominant technique employed to make the gold elements of the wreaths is once again hammering. The goldsmith fashioned the majority of the many leaves from a single unit of gold, hammering in one direction to make the leaf shape and in the other direction to form the suspension loop for stringing – much like the comb was hammered in one direction to form the pin end and in the other to make the body with splayed prongs. In the case of the wreath pendants the shaping of each leaf was a fairly simple procedure since individually they did not involve the large amount of gold and surface area that the body of the comb did. Nonetheless, frequent annealing was required both for the hammering of the shape and for the chasing that was done to delineate the veins.

By examining the suspension loops that belong to each leaf element and that were formed from the same piece of gold as the leaf, the procedural aspect becomes more significant. As with the allotting of gold for the comb, the hammering of the gold leaves entailed planning not just for the leaf design but also for the narrow strip of gold that continued beyond the fine stems and served as the suspension loop for each leaf once it had been folded into the desired shape. While the three separate wreaths have three separate design variations of this loop, they share a fundamental aspect of technique: the use of a single, continuous – and seamless – piece of metal whenever possible.

In the case of the two poplar-leaf wreaths, and I show only details one of them here (Figure 2d and Figure 3), one can see that the strip of gold extending from the

leaf stem was folded and rolled, almost ribbon like, into tubes intended for strands of beads. The amount of annealing, and therefore time, needed to hammer and fold each of the many loops was again considerable. Likewise, a significant amount of feel and skill were once more required to calculate and execute the movement of a single unit of gold into both the leaf shape and the suspension loop. An easier and more practical way would have been to produce multiple tubes that could be laid side-by-side, soldered together and subsequently attached to the leaf to form the loop. In this system if something went wrong in the making of the ornament, one could replace one part rather than starting from scratch to create an entire new leaf and loop out of a single piece of gold. The sum of making the parts separately would have required less work than the making of each leaf and loop as a coherent whole. It seems that this alternate approach would have been especially relevant since there were so many of these leaves made for Pu-abi and for others in the cemetery (Figure 4). One could quite efficiently have made each type of part in an almost production-line manner and then assembled them into complete ornaments. Yet, the goldsmith chose the more difficult and time-consuming method. Was this to avoid breaking the gold into various bits and thus needing to join parts, thereby compromising the seamlessness of the pieces, both physically and conceptually? Was the goldsmith circumventing the use of solder, which would have added impurities to the gold and compromised the physical and conceptual purity? Was there a particular method prescribed for ritual reasons? These are all questions that immediately come to mind once the technology has been closely examined.

Discussion and Conclusion

From this brief examination of Pu-abi's jewelry, several technical aspects must be reiterated and stressed because they have as much conceptual as technological significance. First, the goldsmith must have been an expert at his or her craft. As we have seen, the amount of hammering into a shape such as the comb, although not a complicated technique, required considerable knowledge of the mechanics of the metal and a feel for knowing where to begin and how to hammer the gold so that the overall design of this rather large ornament could be achieved in a seamless manner. Hammering also entailed a substantial amount of time because of the need to constantly and carefully anneal the metal. The primary components of hammering are thus feel and time – technical elements that are not evident in the final result but requiring as much, if not more, expertise as fanciful decorative techniques. In other words, the expertise involved in hammering is largely hidden but far from insignificant.

Furthermore, it is crucial to note that the hammering of flat sheet is the primary metalworking technique among the ornaments produced for Pu-abi. Of particular interest to me is the design decision to favor flat sheet over ornamental details, which produced surfaces that actively enhanced the sheen of the gold being used and exploited the resulting reflection of light, or shine. On a more theoretical level, this approach created in technique the semantic equivalent to the Sumerian word for "shine" that formed part of the Sumerian term for "gold" because "shine" was deemed inherent to the metal. Furthermore, the Sumerian sign indicating "shine" could also signify "holy" or "sacred," so the two concepts were often equated. Thus, I would argue that in the case of Pu-abi's jewelry, the technology itself exhibits agency and that shine – and conceivably some aspect of the sacred – were being deliberately produced or "performed" in its very making. If indeed purposeful, and I believe strongly that the technique of hammering so much flat metal sheet was very consciously chosen or prescribed, this reinforcing of material and semantic properties in the associated technical processes represents a subtle yet sophisticated use of repetition or doubling, a conceptual operation that is well known in the visual and literary imagery of Mesopotamia, and seen here in technological form.

Seamlessness was mentioned earlier and comprises another crucial aspect of the jewelry technology at Ur for several reasons, again both physical and conceptual. For one it entailed the use of a single piece of gold whenever possible rather than multiple ones joined together. This technique preserved the integrity and relative purity of the gold as well as the visual unity of the piece. The use of separate elements would have interrupted both the material and the form, and the use of solder quite literally would have added impurities to the metal by way of the baser elements contained in solder. For instance, by hammering the prongs out of the same piece of metal as the body of the comb and the suspension loops directly out the same metal as comprised the leaves – rather than soldering, or joining by any other means – the goldsmith opted for the more difficult but purer and more holistic method. Easier means were available during this period so one must assume the choice was not by default but deliberate.

This approach has implications concerning not only the compositional or economic value of the gold but also the potential ritual value or symbolism of the finished object. Once again, the procedure chosen achieved in technical terms the semantic equivalent to the Sumerian

word for "pure" that formed part of the Sumerian term for "gold" because, like "shine," it was deemed inherent to the metal. In fact, and perhaps not surprisingly, the Sumerian sign indicating "pure" is the same one used for "shine," which you may recall is also the one used to signify "holy" or "sacred," suggesting that all three concepts could be conflated in certain contexts. Thus, one might again argue that the technique itself had agency, that "purity" – as well as "shine" and "sacredness" – were being "performed" in the very process of making.

Finally, seamlessness quite literally hides the hand of the mortal maker, thereby leaving open the question of who made the object, and how, and giving the impression that the object simply "exists" rather than being made at all. A similar operation is well known from ancient Near Eastern texts that describe the making of cult statues, where the process entailed rituals that purposefully obscured the role of the sculptor, allowing a statue to miraculously emerge in its fully finished and animated state, as if made by the gods. I believe that a related conceptual maneuver was likely being carried out in the technical processes chosen for the making of Pu-abi's jewelry.

Acknowledgements

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Reference

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