

Tools and Techniques Used by Goldsmiths in Ancient Georgia

Ermine Magradze

Simon Janashia Museum of Georgia

(Presented by Academy Member David Lordkipanidze)

The present paper reports on some tools and techniques developed by goldsmith in the workshops of ancient Georgia. The written sources concerning the processing of precious metals and special tools used for this in the jewelry practice widely known in the world are taken into consideration. On the basis of theoretical and practical data contained in these sources, as well as the results of the conducted experiments, it was shown that the so-called Trialeti goblet, an artifact dated back to the early second millennium BC, was made using the similar tools and techniques. The monument is kept at the archeological treasury of the Simon Janashia National Museum of Georgia. © 2020 Bull. Georg. Natl. Acad. Sci.

Muffle, artifact, soldering, Trialeti goblet

While studying the techniques and tools used in ancient Georgian goldsmithing, we relied on an important historical document – a treatise “On Diverse Arts” of the monk Theophilus the Presbiter (11-12 cc.), especially those chapters in which an exhaustive account of the techniques of gold-plated cloisonne enamelling and preparation of compartments is given. He also provides instruction of how soldering is to be prepared and used, how and with which instruments various jewelry operations ought to be performed. Theophilus describes in detail all handy means, including the tool for firing of gold enameling plate which consists of two parts [1].

Theophilus considers two types of soldering: gold and silver alloyed or substantial one and that of obtained by chemical means, the so-called

reaction soldering. The latter was used by advanced peoples of the old world for fabrication of the most exquisite items adorned with a fancy filigree and granulation. They prepared this soldering on the basis of natural minerals processing – chrysocola (hydrous copper silicate $\text{CuSiO}_3 \cdot n\text{H}_2\text{O}$) or malachite (hydrous copper carbonate $\text{Cu}_2 [\text{CO}_3] (\text{OH})_2$). Theophilus’s description of the composition of this soldering is extremely important because this helps to get acquainted with the procedure of obtaining this substance artificially, i.e. by using chemical reagents as it was practiced in the early Middle Ages [2].

The jewelry-making soldering technique is also mentioned by 15th-century Italian sculptor and goldsmith Benvenuto Celline. Like Theophilus, he describes in his treatise both types of soldering [3].

As it turns out, Celline was the last of the craftsmen who described the aforementioned so-called reaction soldering, which was probably passed into oblivion since that time and was not mentioned anywhere else.

In modern jewelry workshops during the soldering of gold or silver only the first one with substantive soldering is used, while reaction soldering is no longer used. As for the tools and devices needed for soldering, contemporary craftsmen use lamps operating at different gases, which vary based on tasks. The flame on such devices is regulated by special valves to increase or decrease the volume of a stream [4].



Fig. 1. Trialeti gold goblet.



Fig. 2. Reconstruction of Theophilus Presbiter's hood.

As was mentioned above, Theophilus empirically described a small iron tool for enamel firing. According to his account, it consisted of two independent parts: the first was a lower, concave tray with a handle, and the second one was a perforated conical hood placed on top with an iron ring. By interconnection of these two parts, the enclosed space, i.e. muffle is obtained. The word

“muffle” means to wrap up, locked and it is derived from the Latin word *muffula*, from old French *enmoufler* (Fig. 1). It is interesting if such tool existed in Georgia. And if it existed, what it was or what material it was made from. A close examination of artifacts made possible the identification of a conical iron hood and its tray of the artifacts found in the settlement of Vani (mid-first century BC) which are preserved in the archaeological repository of the National Museum of Georgia. These items are made of forged, sheet metal. Like the muffle described by Theophilus Presbiter, they also have a lower, concave bottom, matched to it perforated conical hood, which also has an iron ring on kiln. According to these features they perfectly resemble each other (Fig. 2). After studying and reconstructing the hood described by Theophilus, it became much easier to identify the hood found in Vani. By reconstructing the described item and making multiple tests, it was found out that it met all the requirements necessary for the jewelry operations. If we put it in the fire, high temperature is reached in the interior of the chamber. With such hood one can glaze small ceramic items, as well as firing an enamel plate, soldering of the finest, delicate gold and silver items. To deepen my research, I specially fabricated a copy of the ancient enamel medallion, and soldering was performed by a specially made analogue of the mentioned hood. A positive result gave us the opportunity to conclude that this artifact of the former city of Vani is truly a masterpiece and in all parameters meets all technical requirements. I called this artifact of the Vani settlement a Colchian hood [5]. It is noteworthy that the date of the Colchian hood is almost thirteen centuries ahead of the Theophilus epoch and the muffle described by him, which testifies to the fact that while writing his treatise, Theophilus took into consideration traditional jewelry knowledge of the ancient world. To study the ancient jewelry-making processes, we specially selected an artifact of the beginning of the 2nd millennium BC – so-called Trialeti gold goblet

adorned with applications (Fig.3). It is a very original piece of fine art, created by local workshops, and, as scholars believe, no parallel was found [6].



Fig. 3. Colchian hood. Artifact.



Fig. 4. The muffle from Kvatskhela.

In order to study the chemical composition of the metal, Trialeti goblet was investigated at the National Museum of Georgia by means of a portable and destructive X-ray fluorescence (XRF) analyzer. An excess of copper substance, confirmed by the results of research in the areas of partitions and the eroded surface of gold, indicates the use of reaction soldering. The solder remaining on the bowl body, the non-melted parts of the sheets and the corresponding analyzes indicate the use of substantial soldering (Fig. 4). In goldsmithing, the most important thing for soldering operations is an appropriate furnace, with which a smith could regulate the fire. Therefore, during my research, I paid particular attention to the recreation of

soldering tools as much as possible. I made a special observation on the IV-III millennium artifact found on the archaeological site of Kvatskhela, which also looks like muffle, and unlike the Colchian hood is made of fire-resistant clay [7]. It is very similar to the Colchian hood by its design and operation principle (Fig. 5(a)). The Kvatskhela muffle consists of two parts: the first is a fire chamber and the second is a hood that reflects heat. A hollow sphere with a firing space is attached to the bottom; the sphere stands on a tripod connected by one common bottom. From below, the sphere has a hole for supplying air from which air enters the sphere, the burning wood heats the bottom and transfers the heat to the lower enclosed sphere, warming the air inside. It is known that fuel in heated air ignites several times faster, and heat is more stable under the reflective hood, creating an optimal working environment (Fig. 5(b)).

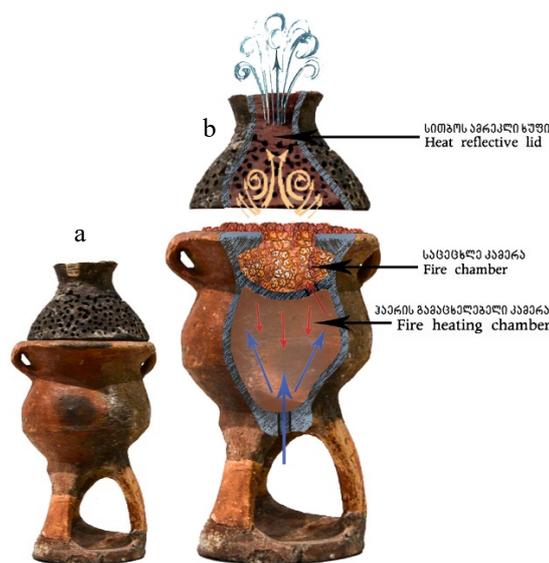


Fig. 5. a) The layer of substantial solder revealed on the goblet; b) Operating scheme of Kvatskhela muffle.

It should be noted here that the described process is essentially similar to the metallurgical process produced by hot air, which, as far as I know, was introduced to Europe in the late Middle Ages. Therefore, this question is undoubtedly interesting and requires further investigation. The

research was supported by experiments: I made a copy of the Trialeti goblet and performed all the soldering operations in accordance with the analogue of the Kvatskhela artifact (Fig. 6).



Fig. 6. Soldering of the Goblet copy with the analogue of Kvatskhela muffle.

Kvatskhela muffle is a complex laboratory tool used by workshops for various needs as early as the end of the 4th millennium and the beginning of the third millennium BC. The vivid examples of the use of this tool; working on this principle and the

application of this traditional knowledge are the cone muffle from the hole, found in the Vani settlement of the early antiquity and the cast iron chamber with enamel, described by Theophilus Presbiterian in the Middle Ages.

Thus, by the varieties of soldering studied during research, it was found that Georgian masters used both known varieties of soldering. In addition, the successful results obtained as a result of the experiments to find out about the function of the Colchian hood and Kvatskhela muffle have undoubtedly proved that in the distant past, in some areas of Georgia, they perfectly mastered the technology of processing non-ferrous and precious metals and had knowledge of the manufacture of tools necessary in jewelry making.

The research was supported by Shota Rustaveli National Science Foundation of Georgia, Grant # PHDF-18-449.

არქეოლოგია

უძველეს ქართულ ოქრომჭედლობაში გამოყენებული ზოგიერთი ტექნოლოგიური ხერხი და ინსტრუმენტი

ე. მალრაძე

სიმონ ჯანაშიას სახელობის სახელმწიფო მუზეუმი

(წარმოდგენილია აკადემიის წევრის დ. ლორთქიფანიძის მიერ)

სტატიაში შესწავლილ-იდენტიფიცირებულია უძველეს ქართულ საოქრომჭედლო სახელოსნოებში გამოყენებული ზოგიერთი ტექნოლოგიური ხერხი და ხელსაწყო-ინსტრუმენტი. საიუველირო ხასიათის ძველ წერილობით წყაროებში მოცემულ ინფორმაციის გათვალისწინებით, რომლებიც შეეხებოდა ძვირფასი ლითონის დამუშავებასა და მსოფლიოს საიუველირო პრაქტიკაში გამოყენებულ საჭირო სპეციფიკურ ინსტრუმენტებს. ამ წყაროებში მოცემული თეორიული და პრაქტიკული ინფორმაციის შესწავლის, ასევე ჩატარებული ცდა-ექსპერიმენტების შედეგად დადასტურდა, რომ ანალოგიური ხერხებითა და ტექნიკური ხელსაწყოებითაა შექმნილი ძვ. წ. II ათასწლეულის დასაწყისის არტეფაქტი-მოგავარსებული აპლიკაციებით დამშვენებული ე. წ. თრიალეთის ოქროს თასი. აღნიშნული ძეგლი საქართველოს ეროვნულ მუზეუმში, სიმონ ჯანაშიას სახელობის მუზეუმის საგანძურის ფონდშია დაცული.

REFERENCES

1. Theophilus. (1979) On diverse arts. 216 p. New York.
2. Brepohl E. (1987) Theophilus Presbiter und die mittelalterliche Goldschmiedekunst. 311p. Leipzig (in German).
3. Chellini Benvenuto. (2003) Jizneopisanie. Traktati. Poezia. 617 p. SPb. (in Russian).
4. Brepol E. (1986) Teoria i praktika iuvelirnogo dela. 383 p. L. (in Russian).
5. Magradze E. (2014) Manifesting of the early antique goldsmith. Workshop in site of ancient Vani on the example of “Colchian Cover”. *Bulletin of the Georgian National Museum*, V (50-B): 323-340 pp. Tbilisi (in Georgian).
6. Kuftin B.A. (1941) Arkheologicheskie raskopki v Trialeti. 225 p. Tbilisi (in Russian).
7. Javakhishvili Al., Glonti L. (1962) Urbnisi. 114 p. Tbilisi (in Georgian).

Received January, 2020