

Archaeology

Newly Discovered Culture Centers Related to the Metallurgy of Non-Ferrous Metals in Eurasia (Express Information)

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The Archaeological Museum of Batumi had the opportunity to become the discoverer of a completely new culture in Eurasia, which is related to the metallurgy of non-ferrous metals (5th-2nd millennia BC). On the example of Ajara, more than 60 ancient centers have been traced. Innovations bring to life a whole new kind of megalithic culture. It is confirmed that in accordance with the increase of demand for metals in the international market, creative metallurgists of the South Caucasus introduce innovative ways and methods using water energy to speed up the processes of flotation and crushing of raw materials from the deposits, and to increase labor productivity to almost industrial level. The priority of creating the first simple mechanism in the history of metallurgy belongs to them. The area of spread of new culture is widespread in Spain, Austria, Turkey, Georgia, India, etc. The contribution of the South Caucasus, rich in polymetals, to the formation processes of Eastern civilizations is great. There are contacts spanning thousands of years. The prospects for the latest research are great. There is no longer any doubt that the latest discoveries have given rise to the research of the most pressing problems of the transcontinental mega-culture. © 2023 Bull. Georg. Natl. Acad. Sci.

megalithic culture, metallurgy, non-ferrous metals, hollow, stone trough

Batumi Archaeological Museum was allotted to become the discoverer of a new culture in archaeological science which is related to the metallurgy of non-ferrous metals in the Bronze Age. It is particularly significant that innovations enliven new varieties of megalithic culture. The newly-discovered megalithic culture, which covers a vast area, features three major characteristics, or

components that brought about revolutionary changes in the metallurgy of non-ferrous metals in the Bronze Age. The innovations echoed with epochal challenges, historical processes taking place worldwide. The contribution made by the early miners and metallurgists of our country to the treasury of human civilization is immense.

Preliminary calculations of genius metalworkers, the idea of arranging manufacturing centers in barely imaginable rocky river canyons cause utter surprise (there are up to 2,575 rivers registered in our country).

After completing certain preliminary works, skillful quarryman carved artificial canals and waterfalls of various widths and depths into almost vertically descending rocks and precipices of the hydrographic network. Heights of some are impressive, reaching 50 meters. In this way it was possible to concentrate the current of water and, accordingly, dramatically increase the force of falling and hitting. As a rule, all of them are followed by, or merged with reservoirs cut into rock in relatively flat areas. The canal-waterfalls of high velocity and hitting force poured into them. They are found in rather considerable numbers – the numbers and dimensions at certain units vary according to the efficiency of production processes. About 25 waterfall-hollows arranged in cascades have been recorded in Tetrobi (Khulo Municipality). Their length varies between 26-20-15-10-5 and 3 meters, width – 7-4 and 2 meters. We are unable to provide precise data about the depths – it is impossible to clean many of them up completely due to jammed logs and sand and rubble. At some sites we reached the depth of 1.5-2 – 2-2.5 and 3 meters during field works.

The question arises about the definition of the complex. What could have conditioned the motivation for doing stonework of such a scale, often risking lives? A whole complex of novelties opened up in front of us. From the very beginning, research was carried out in the right direction. The key was tracked down. As they say, Gordian knot was unloosed. A novel discovery was made in the history of polymetal metallurgy. While elaborating the conception, attention was, first of all, paid to the fact that the rock-cut waterfall-currents of great hitting force were directed towards the center of the hollow-reservoirs which produced a whirlpool effect. We came to the conclusion that it was in

these reservoirs that the creator-metallurgists accommodated ore lumps extracted from mines for flotation. As it is widely known, primary rocks contain a lot of various kinds of barren admixtures.

The innovation played a huge role in the history of humankind. It led to unprecedented increase in work productivity; direct coparticipants of such innovations are professional metallurgists residing on the territory we are looking into. In accordance with epochal challenges, they appear to be one of the major providers of vitally important non-ferrous metals to eastern civilizations on the international market. Prior to the new discovery, we had known that mechanical methods had been exploited during flotation works, as well as extremely exhausting customs of applying fire and water.

Equally interesting is another innovation. It is crumbling and smashing of the raw material that had already gone through flotation with the aim of accelerating the processes of melting in the furnace. In this respect, too, we became witnesses of another hugely important, epochal innovation during field archaeological investigation. From the very beginning, our attention was drawn by the fact that stone troughs of different sizes (see Figs. 1, 2) that had been cut into rock often emerged in the cliffs together with the above-mentioned artefacts. Their number reached a thousand. Another unique innovation in non-ferrous metallurgy, megalithic culture was recognized. We were privileged to be the first to define it, to identify its function and to launch it into the scientific circulation. Among the finds full of novelties this type of artefacts occupied the leading place. This innovation was given the proper scientific explanation taking various data into consideration. We had known that in the early stage, fragmentation of cleaned metals took place in stone mortar-troughs with the aim of accelerating the process of melting, or liquidizing in furnaces [1]. Arduous and exhausting work produced modest results which met only self-sufficient demands. The demand for polymetals considerably increased in the oriental world, which covered a

boundless area. Our country, which participated in the world historical processes, ended up being an active coparticipant of new challenges. Rich in minerals, the Caucasus appears to have become one of the most active providers of the international market of ancient Orient. Having inexhaustible fantasy, the innovator metallurgists found unimaginable ways and means for creating infinite stocks of metal products. This time they implemented completely novel methods using water energy. According to our interpretation, following the early simple stone troughs, they offered other innovations, finds and inventions to mankind that facilitated fragmentation of the metal, which had gone through flotation, and prepared it for casting in furnaces. With the aim of increasing labor productivity, they went even further. Most importantly, they invented one of the earliest mechanisms of accurate calculation in the history of technics which endured millennia. Its construction and, accordingly, the essence of its function is as follows: intending to create a simple mechanism through advance calculations, the metalworkers erected a pole of the proper height and a movable wooden bar was fixed horizontally on top of it. A waterproof woven vessel of proper capacity was hung on its one end, and a stone hammer (see Figs. 3, 4) directed towards troughs of different capacities – on the other. In starting condition, the stone hammer was placed in the trough, while the water vessel was hanging above. At the beginning of the process of work, a certain current of water was channeled through a specially carved wooden groove towards the mouth of the vessel. It was gradually filled up and descended pulling the hammer upwards. On filling up and reaching the critical limit, the water immediately spilled over and the hammer attached at the other end suddenly fell and hit the trough filled with lumps of ore which had gone through flotation. The strong hitting force, indeed, smashed and crushed the lumps, while the water vessel returned to its starting condition. On the craftsmen's supervision,

prior to receiving desirable results of the newly created mechanism, fragmentation of the ore continued uninterrupted. It was a genius invention which was the turning point in the history of metallurgy of non-ferrous metals. Productivity enjoyed unprecedented increase almost reaching the industrial level. Correctness of our interpretation was underpinned by a stone trough (N6) discovered at Sarpi metallurgical center. It is 1.3 m deep, rim diameter – 0.8 m. A four-faceted hammer made of a strong type of stone (basalt) lay widthways in situ: weight - 99 kg, height – 57 cm, diameter of the ends – 30x20 cm, facets – 16-16-35-30 cm [1]. Part of the hammers are spherical or hemispherical, the majority are prismatic with four and six facets. In order to attach them to the end of the bar of the mechanism, some are surrounded by specially carved grooves. Size and weight of the stone hammers vary according to the volume of the troughs – starting from two or three dozen of kilos to 300 kilos. We have not managed to transport heavier ones so far. Moreover, professional metallurgists were equipped with extraordinary natural ability to select strong types of stone for hammer, and the places in the rocks suitable for the long-term use of troughs. Such finds belong to particularly interesting and unique innovations in the history of technics and megalithic culture. It is essential to admit that they formed continuous, inexhaustible base for providing the ancient Eastern society, the creator of a new economic formation, with absolutely necessary metal. Foundations were laid for mutual partnership contacts. In addition, we are dealing with unlimited increase of labor productivity. Early steps of origin of some fields of exact sciences can also be identified [2].

Equally interesting is the following, third set of innovations. Excavations often revealed miniature troughs and narrow canals connected to them. Size of some stone troughs are several centimeters. There also appear such centers of metallurgy where this type of artifacts occupy a leading place (Charnalis Murvaneti, Dzablaveti). We came to the

conclusion that, in parallel with large scale industry, ancient metallurgists also gathered tiny crystals of gold and other kinds of non-ferrous metals that the alluvial deposits, washed down by heavy rainfall and torrents from mountain streams into miniature troughs and randomly patterned narrow canals scattered in the hydrographic network, contained. It can be considered God's grace. The above-mentioned canals and waterfalls, hollows and reservoirs, and stone troughs cut into rock also produced wealth. These were busy during rather warm days of spring and summer, while the rest of the time they undertook the function of the miniature troughs and narrow canals. The creator - metallurgists knew perfectly well that the current of water flowing into deep and open hollows and troughs during the year would leave even more amount of polymetals. This is why stone troughs, especially big ones, are sometimes cut out directly in riverbeds. Narrow canals of certain length and depth were cut at the start of and opposite the stone troughs. It is clear that heavier masses containing ores securely sank in the hollows, while those containing useless deposits were drifted away through the last canal. This ensured the loss to reduce to a minimum.

Pragmatism of accomplished, professional metalworkers goes even further. They do not leave even shallow, big-size hollows that are arranged in relatively flat places, in the reaches of rivers with slow current, beyond their attention and, at intervals, collect even more crystals in them. In this regard particularly remarkable is a major center in Kobuleti Municipality. Alongside numerous canal-waterfalls and hollow-troughs (see Figs. 5, 6), they created a whole system of shallow hollows at a considerable length where it was possible to collect desirable amount of ready-made product washed down from nearby hills and mountain slopes. An even more interesting site was discovered in village of Abastumani, Zugdidi Municipality. Here, too, the Abashistskali flows rather slowly, almost imperceptibly on the extension of the metallurgical

center, at a distance of about 500 meters of the nude limestone riverbed. A marvelous complex is made up of shallow, around 4-5m wide quadrangular hollows separated by 50-60cm wide barriers intentionally left to separate them. It was possible to collect considerable amount of supply of non-ferrous metal all year round.

The most recent discoveries showed that alluvial gold deposits had huge importance in the pursuit of mining and processing local precious metals. Gold-bearing rocks were washed and decomposed by means of the impact of the water current at the source and in the canyons of the river, and after the natural process of enriching and flotation, the deposits disperse in the area of slow current [3].

The most recent discoveries echo with the scientific studies carried out with reference to the topical problem – the outcomes of the laboratory research of the rich tombs uncovered in the city of Ur in Troy, ancient Mesopotamia, by H. Schliemann and those of the masterpieces of jewelry art from the island of Lemnos. The research was conducted using laser rays of portable devices. The research concluded that the gold used in the items of these sites has the same origin. It was purchased from remote countries. There is an indication that Georgia could have been the country. Furthermore, it seems noteworthy in this case that, in accordance with our interpretation, mining of precious metals is related to washing gold-bearing alluvial deposits down from the hills and slopes of river gorges [4].

These are the major innovations and main characteristics of the newly discovered megalithic culture in the beginning stage. Prospects of searching for the area of distribution of transcontinental megaculture and new centers are still ahead. However, one thing is obvious – South Caucasia made important contribution to the process of formation of Eastern civilizations in the fifth – second millennia BC.

The people who took part in the world historical processes accomplished a special mission in the



Figs. 1-6. Some artifacts revealed according to archaeological fieldwork.

period of transition from the Stone Age to the Metal Age. It is proved that in accordance with the dramatic growth in the demand of metal on the international market, hardly imaginable ways and methods were found. They include: flotation of mined raw material; unprecedented growth of labor productivity through crushing and disintegrating of metal-bearing conglomerates using water energy with the aim of accelerating the process of melting in metallurgical furnaces. A simple mechanism in the history of metallurgy was created in response to the epochal challenge. The recent finds are not a local phenomenon. The area of its distribution

seems to be really vast. Research started on the example in Adjara. Over 60 centers have been found so far, and field investigation has been conducted at 12 of them. Surveys of limited scale show that the new megaculture covers all the regions of Georgia, as well as southern Black Sea coast – neighboring Turkey (the coastal line and the hilly zone from Murğul – Borçha to Samsun – Amasya – Tokat was surveyed). According to the data available to us, an ancient center of Eastern civilizations such as India also falls within this area [1, 5-9].

არქეოლოგია

ევრაზიის სივრცეში ფერადი ლითონების მეტალურგიასთან დაკავშირებული ახლად აღმოჩენილი კულტურის კერები (ექსპრეს ინფორმაცია)

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(წარმოდგენილია აკადემიის წევრის კ. ფიცხელაურის მიერ)

ბათუმის არქეოლოგიურ მუზეუმს წილად ერგო გამხდარიყო ევრაზიის სივრცეში არქეოლოგიურ მეცნიერებაში სრულიად ახალი კულტურის აღმოჩენი, რომელიც უკავშირდება ფერადი ლითონების მეტალურგიას (ძვ.წ. V-II ათასწლეულები). აჭარის მაგალითზე მიკვლეულია 60-ზე მეტი უძველესი კერა. ინოვაციები აცოცხლებს მეგალითური კულტურის სრულიად ახალ სახეობას. დასტურდება, რომ საერთაშორისო ბაზარზე სასიცოცხლოდ აუცილებელ ლითონზე მოთხოვნილებების მკვეთრი ზრდის შესაბამისად სამხრეთ კავკასიის შემომქმედი მეტალურგები ნერგავენ ინოვაციურ გზებსა და ხერხებს წყლის ენერჯის გამოყენებით საბადოებიდან გამოტანილი ნედლეულის ფლოტაციის და დაფშვანა-დაქუცმაცების პროცესების დაჩქარების, შრომის ნაყოფიერების მკვეთრი, თითქმის ინდუსტრიულ დონეზე გაზრდის მიზნით. მათვე ეკუთვნით მეტალურგიის ისტორიაში პირველი მარტივი მექანიზმის შექმნის პრიორიტეტი. ფართოა ახალი კულტურის გავრცელების არეალი (ესპანეთი, ავსტრია, თურქეთი, საქართველო, ინდოეთი და სხვ.). დიდია პოლიმეტალებით მდიდარი სამხრეთ კავკასიის წვლილი აღმოსავლური ცივილიზაციების ფორმირების პროცესებში. სახეზეა ათასწლეულების მომცველი კონტაქტები. დიდია უახლესი კვლევების პერსპექტივები. ეჭვს აღარ იწვევს, რომ უახლესი აღმოჩენებით სათავე დაედო ტრანსკონტინენტური მეგა კულტურის მეტად აქტუალური პრობლემების კვლევას.

REFERENCES

1. Kakhidze A. (2021) Newly discovered culture related to non-ferrous metallurgy: innovations, distribution area, main characteristics, perspectives. 5th-2nd millennia BC. Batumi (in Georgian).
2. Kakhidze A., Surmanidze N., Nagervadze M. (2016) Ajara in the Eneolithic-Bronze and early Iron ages. Catalogue, Batumi (in Georgian).
3. Inanishvili G. (2014) At the beginnings of Georgian metallurgy, Tbilisi (in Georgian).
4. Numrich M., Schwall C., Lockhoff N., Nikolentzos K., Konstantinidi Syvridi E., Cultraro M., Horejs B., Pernichkha E. (2023) Portable laser ablation sheds light on Early Bronze Age gold treasures in the old world: New insights from Troy, Poliochni, and related finds, *Journal of Archaeological Science*, **149**: 1-13.
5. Kakhidze A. (2019) Newly discovered centers of ancient metallurgy in Ajara. *Matsne* (History, Archeology, Ethnology and Art Series), 1: 90-117, Tbilisi (in Georgian).
6. Kakhidze A. (2019) Newly discovered centers of ancient metallurgy in Ajara. Georgia's Oldest Metallogenic Center (Ajara): latest discoveries, contacts with Eastern civilizations, innovations, perspectives. *Proceedings of the International Scientific Conference* (Batumi, June 25-28), 5-43, Batumi (in Georgian).
7. Kakhidze A. (2019) Georgia's ancient metallogenic center (Ajara, latest discoveries, 2014-2019), Batumi Archaeological Museum, **VIII**: 17-58, Batumi (in Georgian).
8. Kakhidze A. (2021) Earliest bronze metallurgy on the territory of Southwestern Georgia, In: *Caucasia Antiqua et Cristiana*, pp 133-150, ed. by David Kolbaia, Warsaw.
9. Kakhidze A. (2022) The earliest bronze metallurgy on the Georgian side of the south-eastern Black Sea littoral, In: *connecting the ancient west and east. Studies Presented to Prof. Gocha R. Tsetskhladze*, ed. By J. Boardman, J. Hargrave, A. Avram and A. Podossinov, Leuven/Paris/Bristol, CT.

Received August, 2023