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METALLURGY OF THE ANCIENT USTRUSHANA IN THE MIDDLE AGES

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Annotation
This article analyzes some features of ancient and medieval metallurgy of Ustrushana, which is considered a historical and cultural land in Central Asia. Geographically, Ustrushana territory was considered a contact area between the inhabitants of the ancient steppe culture and the representatives of the settled culture. Metal raw materials and products were considered the main support of relations between them. The article compares the results of the physical analysis of the samples taken from the metal melting furnaces and the spectral analysis of the samples taken from the Miq monument. As a result of this comparison, preliminary estimates are presented. Conclusions are made based on the information provided by Arab tourists and preliminary estimates regarding Ustrushana metallurgy.

Keywords: Ustrushana, Old Khovos, metallurgy, Bronze Age, Andronova culture, Kairakkum culture, mining, metallurgy, iron ore, metal extraction furnace, krits, slag, Aksikent, Molguzar mountains, Middle Ages, Miq, physical analysis, spectral analysis.

According to the formation of the anthropogenic landscape, the territory of ancient Ustrushana can be divided into three historical-geographical zones: mountainous, hilly and steppe-desert plains. Their characteristics differ from each other in many ways due to the nature of the landscape and natural-climatic conditions. Step-shaped plains rise towards the mountains from the north and northeast. This country is a unique micro-region of Uzbekistan consisting of high and medium-altitude mountains, oases of plains at the foot of the mountains, salt and desert landscapes [Алибеков, Нишанов. 1978. 6-8 п.].

Ustrushana region is geographically convenient in Central Asia, located at an important point where the main branches of the Great Silk Road intersect. This area has long attracted people with its natural geographical conditions and wealth. In particular, for mining and ore extraction, representatives of the ancient bronze age, such as Andronova, Karasuq, and Tagar, settled here and started mining and processing metals such as copper (Cu), lead (Pb), tin (Sn) and antimony (Sb). At the same time, the study of the history of this field in the Ustrushana area, gathering important information for further research is one of the urgent issues for today. A large part of the Ustrushana region is located in the mountainous and sub-mountainous steppe zones. Molguzar and Nurota mountains of the Turkestan mountain range are rich in black and non-ferrous metal ores.

2. Methods and level of study:

Although no major practical work has been carried out on the study of ancient metallurgical issues in the Ustrushana region, some detailed studies have been conducted on the metallurgy of the Kayrakkum Bronze Age culture bordering the eastern part of the region [Литвинский, Окладников, Ранов. 1962. 171-]. Preliminary studies on the metallurgy of the medieval period in the Ustrushana area L. M.

Sverchkov carried out a spectral analysis of ferrous and non-ferrous metals of the materials of the Mik fortress [Sverchkov, 1991]. His research gave preliminary conclusions on the question of metallurgy of this region. L. M. According to the information given by Sverchkov, geologists who studied the territory of the Turkestan mountain range confirmed that the Southern Fergana and Molguzar mountains are the two areas with concentration of iron ores [Сверчков, 2013. С 75-86].

3. Research results:

Since there is no information about the period in which metalworking began in the Ustrushana region, it is permissible to cite information about the peoples of Central Asia in the sources of antiquity. Herodotus, the father of historians of ancient times, says that the massagetians were armed with swords, spears, bows, and armor for horses, and their headdresses, belts, belts, and other jewelry were made of gold; "they don't use iron and silver at all, these metals are not found in their land, but gold and copper abound." A little later, Strabo describes that "they have no silver at all, little iron, and a lot of copper and gold." It appears that the Massagetae learned to use iron. In general, there is literally no information about the mining of our country in the centuries before and after AD in Western and Eastern sources. Only when the remains of Cretan iron objects are found in the Kushon era layers of ancient Termiz, it will be possible to assume that iron production and mining were formed in our country two thousand ears ago [Массон. 1953. С. 12]. Archaeologist N.A., who studied the culture of Bronze Age metallurgists in the Zarafshan Basin. It is permissible to quote Avanesova's scientific conclusions. Here, the whole process of production, from mining raw materials to the production of finished products from ore solution and metal is shown. In the 3rd millennium BC, the Sarazmians controlled the rich mining raw materials of Zarafshan, and in the 2nd millennium BC - the Andronovans. The owners of the area satisfied their needs for copper, tin, lead and gold from these mineral deposits. In turn, this situation changed the character of economic relations of this period. Mining mines here attracted not only the population of the Eurasian desert region, but also the attention of the settled farmers of the Middle East. Permanent relations between them played an important role in social processes [Аванесова, 2012. С. 3]. At the end of the 2nd millennium BC, the population of the steppe region of Central Asia developed in the field of metalworking. All the cultures discovered in this period from the northern regions of Central Asia had metal. Wide use of brass with a high tin content is a characteristic feature of the metallurgy of the tribes of the northern steppe regions. Geochemical analysis of ore deposits in these areas and chemical analysis of metal objects help to determine which metallurgical centers they belong to. V.D. According to Ruzanov, representatives of the Kairakkum Bronze Age culture played a significant role in the development of metallurgy in this region [Рузанов, 1987. С 201]. Researchers believe that in these regions, the centers engaged in metalworking in the Bronze Age, including the Chust culture, served as a source of raw materials for metalworking - Varzik, the Tuya-Muyin mines for the Southern Fergana tribes, and the Arpa ore mines served as a base for the Arpa tribes [Литвинскй, Окладников, Ранов. 1962. С. 171]. It is necessary to take into account the selection of places close to copper deposits and several other factors in the geography of the territories where the Bronze Age tribes settled.

This period was the beginning of metallurgy, and the following types of metals were cast and used. Copper (Cu), lead (Pb), tin (Sn) and antimony (Sb) are considered to be the main components of brass tools, and their percentages varied. Bronze Age metals and metalwork developed from the middle of

the 2nd millennium BC to the middle of the 1st millennium BC, and the influence of metalworking traditions of the steppe during this period can be given as a clear example. This can be seen in the reflection of elements of the Andronovo, Karasuq and Tagar cultures of that time in metalworking and metal products.

By the beginning of Christ, the Central Asians began casting cast iron (a type of metal formed from a mixture of iron and carbon. Only it has a slightly higher carbon content of more than 2.14%. Cast iron contains carbon without cementite (iron carbide) or graphite (modified carbon mineral)). adopted [Бубнова, 1975. п5].

In 1988-1989, the preliminary archaeological excavations at the monument were carried out by the Sirdarya archaeological detachment of the Institute of Archeology of the Academy of Sciences of the Republic of Uzbekistan. Later, in 2003-2004, 2014-2021 stationary scientific studies were conducted. As a result, the archaeological resources obtained from the lowest layers of the monument (although they did not reach the ground) showed that the settlement appeared at least in the 1st century BC and the 1st century AD. In other words, it has been proven that old Khovos has a history of at least two and a half thousand ears and it is the oldest urban ruin in the entire Syrdarya region [Гритсина 1989, п. 31-51]. Archaeological studies conducted here testify that life in the monument continued almost without interruption from the 4th century BC to the 20th century [Гритсина А.А., Иванитскй И.Д., Ракҳимов, 61-65 б; Гритсина А.А, Матбабаев Б.Кҳ. 17, пп. 48-51].

As a result of the conducted archaeological research, a total of more than 30 excavations were conducted in the area. During these excavations, a lot of material objects testifying to the hidden secrets of our ancient history were obtained. It is impossible to "talk" about these objects without studying them from all sides, without conducting laboratory analyzes based on modern technologies. Therefore, in cooperation with the employees of the Samarkand Institute of Archeology and the Institute of Nuclear Physics, samples were taken from the metal melting furnaces found in the places where the excavation of the monument was conducted, and chemical and physical analyzes were conducted. In this work, the chemical composition of furnace walls and metal residues (slag) in the workshop belonging to the Middle Ages (I-V centuries) were studied by neutron activation analysis and radioactivity by gamma spectral analysis. In particular, the artifacts from the 3rd excavation (R-3), 8-11 excavations (R-8, R-11) were examined. From 3 excavations, samples were taken from 2 non-ferrous metal smelting furnaces, from 11 excavations, slag samples were taken from the iron smelting furnace and its surroundings. Materials from BC and ancient times were found in excavation area 3 of the areas where this excavation was carried out, and it is more ancient than the rest of the excavation areas, which was reflected in the conclusions of previous studies.

The study of the composition of old slag is carried out using various physical and chemical analytical methods (spectroscopy, activation analysis, etc.). This can affect the radioactivity of environmental objects, including archaeometallurgical products. For this reason, analyzes of radioactivity indicators were carried out and the specific activity of natural radionuclides producing 226Ra (Radium), 232Th (Thorium), 40K (Potassium) doses in the studied samples was determined by the gamma-spectroscopic analysis method [Шаронов И.А., Ракҳимов К. А., 2022. 177-181]. In neutron activation analysis, neutrons are used as an accelerated current. Neutron activation analysis is a nuclear-physical method of determining the elemental composition of a substance. It is based on the activation of atomic nuclei with the help of neutrons and the study of the radiation emitted by the awakened atomic nuclei of the

studied substance. In order to study archaeometallurgical objects, the artifacts found in the ancient metal smelting workshops in the territory of the Old Khovos monument were studied. In the course of studies, it was found that the substances produced in the process of metal smelting are actually the residues after the extraction of metal by melting ore mixtures [Шаронов И.А., Ракҳимов К.А.,]. However, the analysis showed that the iron content in the examined slags was high. In particular, the amount of iron in the sample taken from the 8th excavation was 34.7%, and in the sample from the 11th excavation it was 12.3%. This indicates that the slag-like samples found are not "pure" slag. The results of the spectral analysis of the metal objects of the Mik fortress, which is considered a reference monument for mining and metallurgy of Ustrushana, were obtained [Сверчков, 1991. Табле 1]. If we compare the results of both analysis, there is no big difference between them. Only in the analysis of Khovos materials, although the content of molybdenum is high, vanadium is not found at all. And in the analysis of Miq materials, there is vanadium. The amount of iron-enhancing manganese is higher in Miq materials than in Khovos materials. According to the research results, it was also observed in the analysis samples that sulfur is not found in the ore of Molguzar Mountain [Сверчков, 1991. 122]. When compared to each other, Miq materials prove to be reworked iron and Khovos materials to be semi-finished products.

It is known that the melting temperature of alloys in ancient metallurgical furnaces usually did not exceed 1150°-1200°C [9], which is lower than the iron melting temperature of 1535°C. Melting of alloys starts at 800°C, the composition concentration changes due to metals that melt at low temperature, but pure iron is not formed (it can also be called crit) [Шаронов И.А., Ракҳимов К.А.,]

In such furnaces, ancient metallurgists received not commercial iron, but only its semi-finished products in the form of crystalline and highly concentrated slags, which were later used in forging workshops to produce metal.

processed to obtain ingots and produce various products. It should be noted that light melting furnaces can be successfully used for the production of tin and copper, and later they were used for the production of copper and bronze products (the melting point of tin and copper is 232 ° C and 1084 ° C, respectively [10]). During the excavations, archaeologists discovered the site of a blacksmith's workshop in the Khovos monument. We can note that the furnaces in these workshops are not ore smelters, but workshop furnaces that process semi-finished raw materials and produce finished metal products. This is explained by the absence of ore fragments in and around the workshop. In such furnaces, ready-made iron was obtained by re-melting and processing the crucible, from which iron products (armor or work tools) were produced in the same workshops.

Most of the ores mined in Mink and Marsmand were processed on site and made into military weapons. The quality of these weapons is extremely good, and they are distributed as far as Khorasan, Iraq and Baghdad, in addition to Mowarounnahr. Ibn Havqal reports that incredible and amazing items were made here due to the abundance of iron, high skills and creativity of blacksmiths [Пардаев, Гафуров, 2016. п. 290-296]. Mink and Marsmand blacksmith V.V. Barthold expressed a slightly different opinion. He said that the iron made in Mink and Marsmand was taken to Ferghana in the form of a semi-factory, where high-quality products were made from raw materials [Бартолд, 169]. However, there is no such information in the written sources mentioned above. The iron and steel made in Ustrushana as raw materials should be exported to the markets of neighboring regions first of all logically correct. Compared to this, it is possible that Ferghana, in particular, Aksikent and Khujand blacksmiths and

gunsmiths purchased high-quality Ustrushana iron products and made various items from it, including military weapons. In fact, this craft was founded in Ustrushana at least in ancient times, according to the jewelry mold found in Munchoqtepa.

4. Conclusions:

At this point, it should be said that the iron and steel made in Ustrushona, as raw materials, was first of all exported to the market of neighboring regions, which is proven by the results of archaeological materials and physical and spectral analysis. Compared to this, it is possible that Ferghana, in particular, Aksikent and Khujand blacksmiths and gunsmiths purchased high-quality Ustrushona iron products and made various items from it, including military weapons. In fact, this craft was founded in Ustrushona at least in ancient times, according to the jewelry mold found in Munchoqtepa. Sources of information on Ustrushona metallurgy and mining and material remains of ancient industry serve as a basis for the future perspective of research. The presented article raises the issue of whether the conclusions drawn using modern physico-chemical analysis methods can serve to shed light on unexplored aspects of the problem.

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