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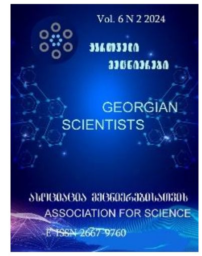

For the Etymology and Distribution of the Element Surma

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ABSTRACT

The presented paper discusses the etymology and distribution of one of the chemical elements (stibium, antimony) in nature. Emphasis is placed on the uniqueness of the forms of Surma spread on the territory of Georgia and it is noted that the spread ores contain insignificant amounts of arsenic - an element-analogue of Surma, which creates the prospect of producing metallic Surma of special purity in the reality of Georgia.

KEYWORDS: Surma, Stibium, Antimony, Etymology, Georgia, Mineral resources

1 INTRODUCTION

The etymology of the name Element Surma, as it turns out [1], is derived from the Turkish word "Surme", which means "to put on", „to apply”. The fact is that the most common natural compound of this element - Surma (III) sulfide was used at first to color eyebrows and eyelashes. This action is indicated by the Turkish word "Surme". In this regard, it is interesting to note that one of the tributaries of the Isfairam in the Kyrgyz Republic is still called Surmeta, which means Surma stone in Georgian. This fact forced geologists in the 30s of the last century to find surma rocks in the valley of the mentioned river, in order to give an opportunity - to recommend the production of elemental surma and its compounds for this deposit. But soon they discovered, instead of an antimony ore, a graphite nest that bore a striking resemblance to Stibnite. It seems that loose graphite was also used by women in ancient times to do "makeup", which is clearly indicated by the name of the location.

The Latin name "Stibium", as it turns out [1], is derived from the ancient Egyptian expression "Stimi", the Greek - "Stimi" or from the Arabic name "Stibi" - so called in the past a natural and possibly melted tricuspid surma.

The name "Antimony", widely used in Western European languages, is derived from the Greek "antimony" (English - antimony, French - antimone, German - antimon), which, according to A.Fersman [2], most probably means "flower". The fact is that the crystal minerals of glossy Surma are similar to flowers in their habitus. As it turns out, the production of this element in Western European countries - the information about its use was spread simultaneously - the name of the tricolor surma is first mentioned in the manuscripts of Constantine Africanus, which is dated to 1054. Gmelin cites a more complex version of the etymology of Surma. He argues [1] that the Arabs transformed the Latin "antimony" to match their language "itmidad" - "istmidi", from which the name "aitmadi" or "aitmond" was eventually formed. The latter became the basis for Latinization by alchemists: "Aitmodum", "Antimodium" and, finally, "Antimonium".

Surma, as an integral part of bronze, has been known since time immemorial. Archaeological excavations - Bronze Age ammunition or household items clearly indicate that as far back as 3000 - 4000 BC, people mastered metallurgy, one of the components of which Surma represented. Here is what we read in the special literature [1]: "Хальдейская посуда из района телло в Древнем Вавилоне, как показалы анализы, была изготовлена из сплава с высоким содержанием сурьмы. В Кушанском царстве (1-4 в. до н. э.) высоко ценилась посуда, изготовленная из сплава сурьмы с другими металлами, возможно, выплавленного из комплексных руд месторождений Западного Узбекистана (Кальтасай и др.)."

From this extract, it is clear that the priority in the production of surma and its compounds should be attributed to the countries of Central Asia, or the Middle East, where the first bronze items have been recorded. This may be true even if there is an obvious inconsistency that appears in the very first sentence of the quoted text. The fact is that the "Khaldean (хальдейская) pottery" belongs to the name of the inhabitants of ancient Babylon. However, Khalduri means Old Georgian, Proto-Iberian. Kalcozini is produced from this – Cu_2S", ,,Kalcopiriti – $CuFeS_2$" and, lastly, even ,,Kalcogenes ", which means ,,originator of ores", – these elmenets are: Oxygen, sulfur, selenium and tellurium. Therefore, Chaldeans or "Khalds" are considered to be the first metallurgists or, in general, the founders of metallurgy [3-11]. They inhabited the territory of present-day Turkey before our era, which is still called "Arsian". As Professor R. Gigauri finds out [12,13], according to this area (place) the arsenic element was named "Arsenicum", as well as the copper "Cuprum", which means the island of Cyprus (from here he learned - modern Europe has mastered the production - use of this element) 39]. Therefore, when we talk about "Chaldean" products, it is unequivocally implied that it (the vessel) belongs to the old Georgian tribes, which, as Mr. Zviad Gamsakhurdia finds out [14] with the prominent German scholar Humboldt, became extinct in Indo-European . This is how the "island" from the Proto-Iberian lineage of the whole Mediterranean remained, the "Iberian-Caucasian" lineage in the form of Georgians in the Transcaucasia, and the Basques in the west - in 7 provinces of Spain and France [13]. Perhaps this fact made the team of authors in the same book think that by skipping one paragraph of the above excerpt, they would signify word for word: "Археологами установлено, что все бронзовые изделия, изготовлявшиеся в древнейшие времена на территории Кавказа, сделаны из сплавов меди с сурьмой, а не с оловом, как обычно".

Yes, the authors of the work can not deny that the first metallurgists - the discoverers of bronze - were people of Proto-Roman descent, [15] but they are also biased: they consider the Caucasus to be inhabited only by the Caucasus, while their original habitat included the entire Mediterranean basin, Including the Middle East [14]. Unfortunately, the location of the old Georgian metallurgists is now mainly occupied by Turkey, but this does not mean that the Georgians used to be limited to the territory that we now occupy - the southern slopes of the Caucasus Mountains. The fact that the main Georgian tribes were the main producers of bronze and, therefore, of Surmi, was reflected in the role of Turkey in providing this element and its products to the world market: Turkey has been a major producer of Surmi in the world for a long time since the beginning of the last century. Thus, for example, from 1914 to 1926, metallurgy produced by Turkey amounted to 400 tons per year [1], and in 1948 it reached 3000-5800 tons. Such a development of production was obviously facilitated by the local fragrant buds, the highest condition of which was (and now is!) Siva vilayet, where this element is obtained by the well-proven - "paternal" method. Currently, in addition to the relatively outdated methods of production of surfactants, modern advances in science and technology are widely used in Turkey, which is manifested in pre-increasing the quality of the concentrate by methods such as flotation method, combined sawing - mixed flotation and dispersion, allowing Increase to 60 - 65%. It should also be noted that the deposits discovered on the territory of Turkey are already distinguished by the high content of the dominant element, ie they are already in high condition: the Gemiusker deposit discovered in 1969 alone is almost 1 mil. It contains a ton of surma, while one kilogram of this special purity metal sells for about $ 4,600 on the London Stock Exchange [16].

As for the distribution of its own desire and the production of its compounds, this issue is best discussed by Georgian researchers - A.Khidasheli [17] and M. Samkharadze [18] qualification papers, which were performed at TSU Department of General and Inorganic Chemistry. Here we can only add that the formation of the Surya krill on the southern slopes of the Greater Caucasus took place under completely different conditions than geologists suggest in other countries distinguished by the Surmi deposits: South Africa, Bolivia, Mexico, Italy, Morocco, Australia, USA, England, Belgium, France, Thailand, Canada, Japan and India [1]. As a distinctly chalcophilic element, surma is found in all of these countries mainly in the form of sulfide forms, but not in the mono-elemental form but in the polyelemental form, creating common nests in the relationship between both precious and non-ferrous metals.

As we have mentioned, the formation of Surma minerals on the territory of present-day Georgia is an exception [19,20]. Until the 1940s, the ores of present-day Georgia were considered as ores of

Kazbegi, Zemo Racha, Zemo - Svaneti and Kvemo Svaneti - such were the zoning of these areas [21] according to the distribution of ores. The wells identified to date and relatively more thoroughly studied are divided into: Svaneti ore region, Racha - Ossetian ore zone and South Ossetia ore region. As it turns out, the discovery of the Surm's nests on the Tskhinvali side is considered to be the ore region of South Ossetia, as it was during the Soviet period - the territory of Georgia was referred to as the territory of non-existent South Ossetia. And this is so that the Ossetian separatists invaded the so-called They even created the "Independent Republic of South Ossetia" (!).

Surma is also spread in the form of sulfide forms on the territory of Georgia. The ore formation belongs to the hydrothermal type and includes two formations: ferrite-antimony and quartz-antimony.

Ferrite-antimonite formation is a transition with tungsten-forming formation [22]. This formation includes pits in which quartz, antimonite, and ferrite form a sustained paragenetic association, forming the major mineral part of the ore. These formations include the deposits of Nodisi, Sageba, Mamison and other deposits on the southern slopes of the Caucasus in the territory of Racha-Ossetia [20]. Often the length of the ore is from a few meters to several kilometers, and the ore content - such that it is quite conducive to targeted production. Barrier inserts are permeated in the Upper Racha area and, in addition to their own taste, include arsenopyrite (FeAsS), pyrite (FeS2), and sometimes even galena (PbS).

There are three types of minerals: wedge-shaped, prismatic and rhombic. [23] The first - two, according to F.Nadiradze et al. [24], it is characteristic only for Racha ores. As it turns out, such nests are distinguished by a high content of the dominant mineral and, which is often crucial, by the relatively low composition of the impurity elements.

The content of impurity elements determined by spectral analysis in the named antimony and ferritite: arsenic, silver, lead, zinc, tin, bismuth, molybdenum, tungsten. Chemical analysis of Surm sulfide of Khulando deposit showed composition (% by weight): Sb - 62 - 69, S - 15 - 24, Fe - 0,4 - 12, Cu - 0,07 - 0,04, Pb - 0,2 - 0,18, As - 0,04 - 0,03 and Mo - traces of ≥ 10-5%.

What about this digital data?

First of all, the percentage of dominant element (Sb) is exceptionally high, which indicates the dignity of this concentrate. It also has a high sulfur content - the concentrate can be a solution for the production of both sulfur and elemental sulfur. However, Georgian agriculture alone needs thousands of tons of such sulfur! It is also noteworthy that the ore contains small, one might say insignificant amounts of arsenic. So, nature itself has separated these two elements - analogous from each other - the release of this metallic desire for exceptional purity - creates the prospect of production in the reality of Georgia.

Quartz - Antimonite formation combines nests whose main constituent minerals are quartz (SiO_2) and antimonite (Sb_2S_3). This formation includes the powerful outflows of Zopkhito and Kirkishi in Upper Racha.

There are two types of minerals: 1. Quartz - antimonates and 2. More complex than quartz - antimonates.

Quartz - Antimonate mineral type is heterogeneous in its composition, the content of antimonite in it is significantly higher than quartz, often creating a monometallic discharge. Several generations are established in the Zopkhitos and Kirkisho deposits, of which elongated prismatic and needle-shaped inserts often predominate.

It should be emphasized that quartz-antimony and ferrite-antimony formations are closely related to each other, giving them transient mineral associations. The manifestation of such associations is distinctly evident in Mamison's antimony nests. Racha - In the Ossetian ore zone there is also a certain zoning, where antimonite of one formation is followed by mineral of another formation and, therefore, of other chemical composition, etc. [26]. What they have in common [27] is that all types of surmi ores are characterized by a high content of dominant elements in Georgia, in many cases exceeding the latter 60%.

There is no consensus on the physico-chemical conditions of the Surm mine in the Greater Caucasus at present, although a number of opinions have been expressed about similar ore production in other parts of the world [28,29]. It is currently established [19] that the thermodynamically advantageous state of Sb – S– (Cl) –H_2O in the system is most closely matched by Surmium (III) sulfide, which is why the latter is formed as the mineral form of the presence of this element. Existing experimental data on the solubility of antimonite (Sb_2S_3) in hydrogen sulfide-containing waters fully confirm the presence of sulfide and hydrosulfide complexes in the large pH range [30,34]. One group of authors [30,35,36,37] believes that compounds containing $Sb(HS)_3$ (or H_3SbS_3), SbS_2^- (or $H_2SbS_3^-$) and SbS_3^{3-} groupings occur at this time. The second group denies the formation of such complexes and leans more towards the formation of mixed oxosulfide compounds [30,31,32,33,35], the main constituent fragments of which are: $Sb(HS)_2(OH)^{2-}$, $Sb(OH)^{2-}$ and others. A.Kolpakova expresses a different opinion [31], according to which Surma is present in sulfide solutions in the form of thiomalids, the main anionic forms of which are: $H_2Sb_2S_4$, $HSb_2S_4^-$, $Sb_2S_4^{2-}$ and others. He also suggests their formation according to the equation:

$$Sb_2S_{3(K.)}+HS^-_{(SOL.)} \leftrightarrows Sb_2S_3\cdot HS^-_{(SOL.)}$$

The equilibrium constant of this reaction can be calculated and, based on this fact, used to estimate the stepwise dissociation constant:

$$Sb_2S_3\cdot HS^-_{(SOL.)} \leftrightarrows Sb_2S_3S^{2-}_{(SOL.)}+H^+_{(SOL.)}$$

3 CONCLUSION

From the above we can conclude that it is not essential that antimony is produced - if in aqueous solutions of oxytocin, the surfactant (ultimately) "leaks" in the form of sulfide, which is clearly confirmed by thermodynamic calculations - Sb2S3 both in terms of decreasing internal energy and increasing entropy [38]. Therefore, as it turns out, in any part of the world, where the surma is formed in the form of a mineral surma crystal, the mechanism of sedimentation of the latter must be the same everywhere, including in the territory of Georgia.

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ელემენტ სურმის ეტიმოლოგიისა და გავრცელების საკითხებისათვის

აბსტრაქტი

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საკვანძო სიტყვები: სურმა, სტიბიუმი, ანთიმონი. ეტიმოლოგია, საქართველო, მინერალური რესურსები.