

## Comparative analysis of works on mineralogy of Central Asia

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**Abstract:** This article is highlighted a comparative analysis of important manuscripts that provides valuable information on mineralogy and geology of Central Asia from the 11th to 19th centuries, as well as it supports about the types of minerals in them, their quality levels, varieties, historical locations of mines, size, differentiation of minerals, their value, about the healing aspects and harmful aspects for human. Sources discuss the process of formation of minerals and certain ores of world-famous quality, mining methods of this ore, ways of processing metals and stones, and valuable varieties.

**Keywords:** minerals, mineralogist, important source of minerals, mines, turquoise, iron, silver and gold mines, copper, ruby, emerald, metals, sulphur, mercury.

Today, the attitude to the study of the heritage of the past ancestors has changed. Studying our real history based on original sources has become an urgent task. In the "Development Strategy of New Uzbekistan for 2022-2026", which was adopted on January 28, 2022, the 73rd goal of the large-scale direction plan was clearly defined as "to study deeply and advocate widely of the rich scientific heritage of our great ancestors", and 100 scholars's works from our country were set to implement the folk translation [1:21]. This, in turn, ensures the continuity of our work, such as the further development of the study and promotion of the history of Uzbekistan. In the Middle Ages, during the study of natural sciences in Central Asia, knowledge about underground minerals and mines was accumulated. Knowing how to use minerals means the development of human life and scientific knowledge. This is the criterion that determines the standard of living of these peoples who lived on this land. In this regard, several scientists who lived in Central Asia conducted deep research and wrote several works. These are Abu Rayhan Beruni "Minerology" (XI century), Umar Khayyam (1048-1123) wrote a special work on the science of gemology called "Mezon ul-hikma" ("The criterion of wisdom"). Al-Hazini (died around 1121-1122) "Kitab mizan ul-hikma", Nasriddin Tusi (1204-1274) "Tansuqnama", Muhammad ibn Mansur's "Javahirnama" (15th century), Sultan Muhammad Balkhi's "Majmua' al-gharayib" "(The complex of strange things, 16th century)", "Bahr ul-asrar fi manaqib ul-ahyor" (The sea of secrets about the bravery of noble people, 17th century) by Mahmud ibn Wali, "Ajaib at-Tabaqat" by Muhammad Tahir ibn Abulqasim ( Wonders of the earth's layers, 17th century), Abulfazl Alami "Ayini Akbari" (17th century), Omonullah "Mir'at ul Jawahir" (Mirror of Jewels 17th century), Ibn Mubarak Muhammad al-Qazvini "Javahirnama", Aminaddin Khan bin Sayyid Abulmakorim Amirkhan al - Husayni al-Hirawi "About knowing the value of jewels" (XVII century), Najmiddin Ali bin Usar al-Qazvini al-Katibi's the fifth part of the fourth article of the collection "Reasons for the creation of mountains and mines" were written.[2]. Some of them are completely dedicated to minerals, while some are part of collections related to different scientific fields. Even in Central Asia, there are works on the art of distinguishing some jewels from natural minerals, artificial stones, and creating such stones and minerals by chemical means.

Muhammad ibn Mansur (15th century) wrote an important book called "Javahirnama". As written at the end of the text of the work, it was copied by a calligrapher named Muhammad Salih in 1624, followed by a calligrapher named Mulla Muhammad in 1821, and we used his copy, which was copied in Kufi ajamiya script.

Beruni's "Minerology" was translated into Russian by A.M. Belenitsky wrote: "It was not known to us that the work in which the subject we are interested in (mineralogy) was written after the

16th century. However, we can find information about the weight of precious stones at the end of the 16th century and the beginning of the 17th century in the book "Oyini Akbari" dedicated to the description of the empire of King Akbar by the Indian historian Abulfazl Alami. A special chapter on the position of treasures of this book describes the weight and value of a number of precious stones and metals. As a result, Beruni's discovery became known to all of Europe in the 19th century."

The mentioned book "Ayini Akbari" by Abulfazl Alami is written with certain practical goals in mind and is intended for experts who deal with precious stones and metals[3]. Manuals similar to "Ayini Akbari" were also written in the XVII-XVIII centuries. Such works were written mainly in Central Asia and India.

The work "Mir'ot ul Jawahir" (Mirror of Jewels) dedicated to Nuriddin Muhammad Jahangir (1605-1627)[4] by a scholar named Omonullo, and "Pamphlet on Jewels" written in Uzbek by an unknown author are among them.

A manuscript copy in Uzbekistan of the work "Mir'ot ul Jawahir" (Mirror of Jewels) by a scientist named Omonullah, dedicated to Nuriddin Muhammad Jahangir (1605-1627) from the Baburites, is shown to be Muhammad Obid as the calligrapher, and Qori Fakhridin is as the proof-reader of this work, and it is shown that the book was prepared in 1685 AD (1096 Hijri). . According to the introduction, this book consisted of 12 chapters - "salk" – threads.

In Central Asia, there were also manuals compiled for treasurers and jewelers. For example, "Javahir as-sanoi"(Jewels of Artifacts) is devoted to the creation of artificial precious stones and the art of jewelry[5]. In turn, it provides a lot of information about the science of distinguishing artificial from natural stones.

In the geo-cosmographic works of the XVI-XVII centuries, special chapters of some books, and in some cases the whole part, are devoted to the science of gemology. Here we will discuss some of these works.

One more work is "Javahirnama"[6], which is written in Persian, written in nastaliq script, and Ibn Mubarak Muhammad al-Qazvini was shown as the author of the manuscript on page 5b. In the book, each mineral is highlighted in red ink, xycycan there are 20 different levels of jewels, these are: "1. 2. ruby, 3. emerald, 4. sapphire, 5. diamond, 6. Alhar, 7. dull, 8. turquoise, 9. pozhar (animal stones), 10. aqiq, 11.-12 some stones similar to ruby, 13. magnet, 14. shanbd, 15. dahna (malachite), 16 Azure. 17. coral, 18. crystal and some of its types go up to 20 degrees in the book. The second type of minerals is the eight metals that make up this treasure. They are categorized as following: 1- Gold, 2- Silver, 3- Copper, 4- Tin, 5- Asrab (israb), 6- Iron, 7- Chinese Khorsini, 8- Metals of complex composition.

He also wrote the varieties of each mineral, their names in Arabic, Persian, Turkish, and sometimes in Greek, their characteristics, appearance, features that distinguish them from other minerals, whether they are useful for health and in which cases they can be harmful[7]. He describes metals as appearing from sulfur and mercury[8].

Another such work is an article "About knowing the value of jewels" which was written by Aminuddin Khan bin Sayyid Abdul Makarim Amir Khan al-Husaini al-Hirawi, Academy of Sciences of the Republic of Uzbekistan, Institute of Oriental Studies named after Abu Raykhan Beruni. No. 5050/ III. It is a small part of a comprehensive book on various other subjects. The work was written in Persian-Tajik, and it was not indicated when it was written. But at the end of the work, it was noted that the calligrapher copied in 1880. The article consists of pages(138 a-142a), each page contains of 13 lines[9]. This article provides information on how gemstones are priced based on their weight, size, rarity, quality, color, spotting or transparency. Most of this value is relatively cheaper where the ore is mined. But it turns out that most of the polished and worked stones were released at a fixed price for foreign trade.

The historian and geographer Sultan Muhammad Balkhi's work (1573 (died on May 3, 1574) is called "Majmua' al-gharayib" (Complex of Strange Things). This work was written by the order of Shaybani Pirmuhammad Khan (1546-1566), the governor of Balkh.[10] The work was preserved in many copies, according to estimates, 100 copies of the work are preserved in world libraries. The work contains valuable historical, geographical, as well as astronomical and gemological information. The version we know of the work consists of 16 chapters. The full name of the author of the work is Sultan Muhammad ibn Darwesh Muhammad al-mufti al-Balkhi. It was copied in 1815, and it was re-copied by Abdurahman Khoja in 1839 from the copy written by Khaybullo Khoja Domila. The fourteenth chapter of the work is devoted to the issues of jewelry science. It contains a scientific classification of stones with a range of value (ruby, emerald, turquoise, diamond, pearl) and medium value (magnotus, khajar jalib li-l matar, that's rain-calling stone, kharoz al-hayt means snake stone). Descriptive in nature, the author of the treatise has written this special chapter with a practical purpose in mind, and as the preface of the work states, it is written for "precious stone connoisseurs" (javahiryah sahib iyor) and "preciators of precious stones in today's markets" (saffaroni rozgor).

The information given by Sultan Muhammad Balkhi was largely based on the works of Abu Yaqub al-Kindi (801-866), Abu Rayhan Beruni (he is called Haja Abu Rayhan) and the above-mentioned Muhammad ibn Mansur, as well as factual materials collected by himself. The information from the works of other scientists is mainly stories about precious stones, sometimes their types and varieties, as well as materials about identifying and correcting their defects. For example, stories about a knife with a ruby handle brought to Ghazna as a gift from Khorezm, as well as valuable pearls kept in the treasury of Sultan Mahmud of Ghaznavi (988-1030) and his son Sultan Mas'ul (1030-1041) were taken from "Mineralogy" of Abu Raikhan Beruni[11]. The information about the ruby-handled knife is preserved in "Mineralogy", but the information about the precious pearls in the treasures of Sultan Mahmud and Sultan Mas'ud is not in Beruni's "Mineralogy". But surprisingly, the information about this has been preserved in the book "Majmua'- al Gharayib" by Sultan Muhammad Balkhi, which we mentioned above. We give this information, "According to the narration of Khwaja Abu Rayhan, in the treasury of Sultan Mahmud there were three misqals[12] and two doniks[13] " in a weight and an experienced iyyar (a specialist who examines the fakeness or purity of stones is called "iyyar") was a piece of pearl valued at 100 thousand dinars[14]. There were 50 large pearls hanging in the treasury of Sultan Mas'ud. Each one of them is valued at 20,000 dinars by an experienced expert who checks whether the stones are fake or pure.

The description of precious and medium-value stones is similar to the description given in the works of Muhammad ibn Mansur. First, a description of the stones, then information about their types and varieties, their value, deposits, and properties. But the varieties, types and value is discussed in more detail. For example, Sultan Mahmud gives information about five types of turquoise, namely Nishapuri, Ghazni, Ilahi, Kirmani and Khorezmi varieties. According to the scientist, the best of them is Nishapouri, which in turn has seven varieties: Obi ishaqi, Azhari, Sulaimani, Zarkhuni, Khoki, Abdulmajid and Andalusian varieties. The best of them are the Ishaqi and Azhari varieties, the price of which is somewhat higher. [If the turquoise] weighs half a misqal, it is said by Sultan Muhammad Balkhi - it was valued at 7-10 dinars. If it weighs one misqal, it is valued at 20-30 dinars, if it weighs two misqals, it is valued at 50-70 dinars, and if it weighs three misqals, it is bought for 100-150 dinars.

Sultan Muhammad Balkhi also mentioned the healing (for example, it makes the eyes clear) and magical properties of turquoise. For example, he says: "It is said that in ancient times, scientists used to look at turquoise on the day of the new moon. [Therefore] whoever has a turquoise, he has gained respect in the eyes of people and won over his enemy. The kings brought turquoise to their meetings when the sun was equal day-night in the sky, and [the people of the meeting] look at it in turn. Then those who threw it into a glass of may, which has the quality of a drink of heaven, and those who took a sip of it, considered this custom sacred to the owners of the throne.

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Let's remember another story about ruby types, properties and price: "There are six types of ruby: red, yellow, black, white, magenta (green), clear blue. The best is red, then yellow, zardoli(apricot) colour, then carrot colour and black. The price of a white ruby is equal to the price of a crystal... The price of a ruby is three dinars per tasuj[15] weight, half a piece - 7-10 dinars. Three tasuj weights - 20 dinars, one grain - fifty dinars. The price of a pure red ruby weighing one misqal is 5 thousand dinars... and a yellow ruby, if it is of good quality, is also valued at 5 thousand dinars."

The property of the ruby is that if it is carried by a person, it protects against plague and other diseases. If it is held in the mouth, it strengthens the heart. It keeps sadness away, [a person] does not feel thirsty, he is always happy.

Another work on the science of jewelry is "Ajayib at-Tabaqat" ("Wonders of the "Earth's layers)" by Muhammad Tahir ibn Abulqasim[16]. The book was written by order of Nadir Muhammad Khan (1606-1642), governor of Balkh. "Ajayib at-Tabaqat" is widespread but understudied. "Ajayib at-Tabaqat" is in many ways a compilation, a collection in different fields of science. It is based on the works of Muhammad Zakariya al-Qazvini (1203-1283), Hamidullah Qazvini (1281-1349) and the above-mentioned Sultan Muhammad al-Balkhi and other geographers. But the material about jewels and metals (fillizzot) is accompanied by information about the countries that are in the inhabited quarter of the world.

For example, in the chapter about Tashkent, it is said that the surrounding mountains have deposits of oil, turquoise, iron, silver and gold, and important information about the deposits is given.

There is another important feature of the work - it contains more information about precious stones than "Majmu' al-ghayib". In addition to the description of precious, medium-grade and other characteristic stones, "Ajayib al-Tabaqat" also provides important information about metals, alloys, their extraction, properties and prices.

The important point of Muhammad Tahir's work is that thanks to him, it is possible to learn about the general situation of the mining industry in the 16th-18th centuries. The information presented in the work indicates that the land of Mavoraunnahr is rich in various natural minerals. For example, gold, silver, copper, iron, mercury, turquoise were found in Andijan and Fergana at that time; in Osh - ganch and iron, in Ustrishon (Oratepa) - turquoise; in Tashkent - oil, turquoise, iron, silver, gold; in Turkestan - gold and silver; in Samarkand - Nashvadil (Nashatir); in Qubodiyon - healing salt; gold, silver, ruby, lapis lazuli and natural crystal were mined in Badakhshan[17].

In this work of Muhammad Tahir, information is given about many types of turquoise, different from other works related to the science of jewelry, in particular, "Majmuai al-gharaib" by Sultan Muhammad Balhi. "It should be remembered," writes the scientist, "there are different varieties of turquoise (in particular) Nishapuri, Tusi, Ghazni, Ilaqi, Kirmani, Khorezmi, Ustrishani and Farghani." But the varieties of turquoise are not limited to this, its varieties are more than what Sultan Muhammad and Muhammad Tahir thought. The reason for this largely depends on where the author is from and where the work was written. For example, Sultan Muhammad Balkhi knew the varieties known only in Balkh, and Muhammad Tahir in Ferghana.

In Muhammad Tahir's work, we find some passages taken from Abu Rayhan Beruni's "Javahirnama", but which are not found in his surviving copies.

For example, Abu Rayhan said that a piece of pure red ruby without cracks was sold for 5 thousand dinars, a dark red ruby was sold for one third of the price of a pure red ruby, a peacock colored one was sold for one tenth of its price, and a green ruby was sold for one twentieth of a pure red ruby. If the ruby is smooth, clear and beautiful, they sold it for 50 dinars. Other types of rubies are sold based on this price.

In fact, there are a number of fragments taken from Beruni's work, but preserved only in the pages of "Ajaib at - tabaqat". It seems that he used a complete copy of Beruni, which has not come down to us.

In this work of Muhammad Tahir, we also find very valuable information about the healing properties of jewels and metals. Here are some examples: "A crushed emerald repels poison. A person who carries a piece of it with him and often looks at it will have clear eyes. Crushed copper mixed with antimony and poured into the eyes stops water coming from the eyes and makes the eyes clear. If copper powder is sprinkled on the wound, it will stop the bleeding. Copper is a cure for cancer, spleen, liver and stomach diseases. "Lead also cures cancer."

We will stop at another work that shows the general state of the science of gemology in Central Asia in the 17th century.

This work belongs to encyclopedist Mahmud bin Vali who was from Balkh (He was born in 1597 and his death is not known). The work is called "Bahr ul asrar fi manoqib ul-aher" (Sea of secrets about the bravery of noble people).[18]

It was written in Balkh between 1631-1641 by the order of the above-mentioned Nadir Muhammad Khan. The work is multi-volume, and a large part of the first volume is devoted to the science of jewelry. The advantage of the mineralogy of Mahmud ibn Vali from the above-mentioned work is that it is distinguished by its size and the abundance and importance of useful information.

The mineralogy of Mahmud ibn Vali differs somewhat in the arrangement of the material of Abu Rayhan Beruni and Muhammad ibn Mansur. For example, in the work of Beruni and Muhammad ibn Mansur, after a large introduction, after giving a description of precious, transparent, and moderately valuable stones, then metals are described in the second part of the work. In the work of Mahmud ibn Vali, it is the opposite. Brief introduction, it is said that the basis of all existence and creation is composed of four elements (Ansari Arba'), that's earth, water, air and fire. The first part of the work describes metals and various compounds, the second part describes the ratio of metals to precious stones by weight, and the third part presents the scientific description of more than 180 stones of average value and characteristics. In our opinion, this was caused by the development of commodity-money relations in the 17th century, and the increased need for metal, especially gold and silver.

Mahmud ibn Vali used many sources in writing this work, including Aristotle (384-322 AD), Jolinus (130-200 AD), Abu Rayhan Beruni and Ibn Sina, Muhammad Zakariya al-Qazvini, Hamidullah Qazvini and Muhammad ibn Mansur, as well as many explanatory dictionaries ("Kutub - i farhang"). He also used the information he gathered during his travels to Khurasan, Badakhshan, India and Movaraunnahr in his many years. At this point, it should be said that Mahmud ibn Vali supports Mahmud ibn Mansur's theory that sulfur and mercury form the basis of minerals. That's why alchemists (persons of science and chemistry) consider metal to be the mother of the soul, and sulfur to be the moisture of the body.

"Minerology" by Mahmud ibn Vali consists of an introduction and two main parts. In the introduction, the basis of any metal is considered to form sulfur with mercury.

In the first part, there is a detailed description of seven metals: gold, silver, copper, lead, tin, iron and kharchinium, that is, Chinese iron (a detailed description of the mixing of the zinc with another metal. In this, the scientist informs first one or another metal or precious stone's the Arabic, Persian, Turkish, and in some cases Greek and Indian names, followed by information on its composition, types, and varieties as Beruni and Muhammad ibn Mansur. It is important that famous mines are told about mining methods of this ore, methods of metal and stone processing[19].

Experience was considered the main criterion for determining the quality of precious stones and metals, both for Beruni and for Mahmud ibn Vali. For example, Mahsud ibn Vali recommends two simple and proven methods for the quality of gold. 1) if the gold is pure it can withstand any test

and will not lose its quality, if it is not pure, it will not withstand the test and will crumble. 2) pure gold is heavier than mercury, if it is placed in a vessel containing mercury, it will precipitate.

And also, in the first part of the same "Bahr ul-asrar", a brief description of artificial alloys is given about **white copper (sufri safidro'i), birch, tali, talikun, haftjosh, dararo and solid copper (simi sakht)**. The information of the scientist, in particular, about their (artificial mixtures) composition is important. For example, pyrite is an alloy of refined copper and is called brass; the best varieties of brass are Andalusian and Syrianiy. And thallium was formed from a mixture of lead and copper, from which they cast durable pots. There is no detailed information about this in the works of Beruni and Mahmud ibn Mansur. Beruni calls this mixture only digroy. The composition of the dorunu was especially complex. It is formed from a mixture of bronze (an alloy of copper, lead tin and aluminum), copper and baranja (pyrite). "From Daroru," writes Mahmud ibn Vali, "they often make rang bells." Solid silver was formed from an alloy of lead, silver and copper and it was used in the production of various paints.

Mahmud ibn Vali, when describing metals, especially gold and silver, pays special attention to their role in monetary and commodity circulation. These metals have been minted as money in most countries. The scholar notes that coins minted have sacred words (kalimai tayyiba) on one side, and the name of the supreme ruler on the reverse side in Islamic countries. In European countries, the image of a person is printed on one side of gold and silver coins. Mahmud ibn Vali calls this kind of money "budagiy".

In the second part of Mahmud Ibn Vali's book, he gives information about precious stones with certain properties. The scientist first divides these stones into three categories - high, middle, and low. According to the information provided during the period of Mahmud bin Vali, gold and silver mining decreased somewhat. Although there were many mines. There were two types of gold mines. One of these was pure gold. That is, gold deposits that were not mixed with other minerals. These were mostly located in the countries of the Maghreb, Egypt, and were at a location between 30 degrees north latitude and 65 degrees east longitude. Thus, the purest sort of gold is dahdahi (that's 100 percent pure gold) which Indians call "dahyon". Our contemporaries call him "jafari". This type of gold is rare nowadays. The second type of gold was found mixed with other minerals. It had many mines.

Mahmud ibn Vali writes about silver: "Silver deposits are so numerous that they are found in all climate countries. Some of them are working, the rest are abandoned." According to the information provided by the scientist, such deposits are found in Khutalon and Kandihor. While gold and silver decreased, iron mining continued at a steady rate. In this regard, the information provided about the iron deposits in Badakhshan is noteworthy. He points out that the increasing need for iron was the main reason for this. Because work tools and many household items were produced from it.

In the 17th century, mining of precious stones also developed somewhat. Mahmud ibn Vali writes the following in the chapter on the ruby description: "Nowadays, Nadir Muhammad Khan, the patron of Islam, who was vigilant in the affairs of kingship and khanate, may God increase his greatness, during his reign, the merchants of his highness (who are going for buying precious stones) were engaged in the mining of ruby and resembled ruby." They are looking for precious stones weighing 3-4 miskal [20].

Mahmud ibn Vali also gave important information about the value of precious and special stones found at that time. As an example, let's take the emerald and the ruby. When talking about emerald, first of all, he said that there are seven varieties of it: Zubbabiy (the color of a field rat), Raykhaniy (the color of basil), Silkyy (the color of a beet leaf), Zanjaroj (green color), Kurosaniy (the color of a mountain onion), Ohuiy (gazelle-colored) and Sabuniy (in the color of Iraqi soap). The best of them was the zubbabi variety. If it was free from various defects, one dirham was worth 50 dinars, three dirhams - 200, and five dirhams - 1000 dinars. Its basil variety is three-fourths the price

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of Zubbani. Sobuniy was half the price of one-sixth of that zubbabi[21]. The price of other types of emeralds is between Sabuni and Rayhani varieties. This information is repeated verbatim in the 15th-century work "Javahirnama" by Muhammad ibn Mansur[22]. This work was also written in Persian, and it was re-copied that it was copied by the calligrapher Muhammad Salah in 1624, and by another calligrapher Mulla Muhammad in 1821. The work was written in Nashi- Kufic script. The work is completely written up to 170 pages - 246 pages. This work also provides information about the mining of precious stones of the peoples of Central Asia, which is not found in several other works. In particular, Lojuvard's information about the knowledge of two methods of extraction[23] and 3 methods of extraction of turquoise is noteworthy[24].

As for lapis lazuli, the price of a clean piece of it in the color of scorpion (hajdumi) is estimated as follows. One bone - 2 dinars, two grains - 5 dinars, half a misqal - 10 dinars. The price of four grains is 20, five grains - 30, one misqal - 50 dinars, two - 200 dinars. There was no general valuable of the five misqals[25].

Some fragments of Beruni's "Mineralogy" have been preserved in "Bahr ul asrari" of Mahmud ibn Vali. For example, "some people say that the best kind of natural gold is the one that is not mixed with anything else (zarmushti afshor), that's soft. According to others, gold that is not mixed with other things is not natural (madani), but artificial (masnu'). In any case, these days it is gold without equal (zarmushti aphshor). Abu Rayhan Beruni said "I saw such gold in the mine of Zabulistan." This passage from Abu Raikhan Beruni is found in the surviving copies of Mineralogy, especially which A.M. Bilinetsky's translation is based on the critical text published by Krenkov is absent. It mentions only gold mines in Khuttalon and Shugnan from the gold mines in Central Asia and Afghanistan.

In Central Asia, the accumulation of scientific knowledge related to the study of natural sciences, the recognition and differentiation of underground minerals, ores has a deep history. A number of works have been created on mineralogy, methods of mining, precious stones, types, their utility properties, value, and historical locations of mines. But these works were studied poorly, even some of them are in manuscript form and have not been fully translated into the vernacular language that the people understand. During our research, we tried to analyze some parts of these works related to precious stones, metals and minerals. But this cannot be fully disclosed in the scope of one article, and within the framework of the issue, we have set ourselves the task of publishing more extensive special literature. The remarkable thing about the works of medieval mineralogists is that they gave the names of any mineral in Turkish, Arabic, Persian, Greek, and Indian languages, and in explaining the information about some minerals, they researched the opinions of Eastern and Western scientists as well as Greek scientists. In the works of the Middle Ages, the famous hakim(doctor) Abu Rayhan, Sheikh Abu Ali Ibn Sina, Farabi, Tayfashi, Abu Yaqub Isa al-Kindi Abdul Majid, Muhamad Zikriya as well as Greek scholars Aristotle, Jolinus, Bilinus, Disquidus and similar famous scholars' opinions and quotations were also given. It is understood from this that Central Asian jewelers tried to collect scientific knowledge and experience about minerals collected from all over the world. Our ancestors tried to further develop knowledge about minerals by conducting special research in this regard. The information in the works on Central Asian mineralogy includes information about mining in its period, these works complement each other, provide unique information in fully revealing the development of the branch, have their own traditions of succession, and also provide information about the content of the works created before their time as well as this knowledge develops.

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11. Al-Beruni, Abu-r-Raihan Mohammed ibn Ahmed. Collection of information for the knowledge of jewelry (Mineralogy) / Translation by A.M. Belenitsky. –L. 1963- S. 186.
12. Misqol- a measure of weight equal to 4.464 gr.
13. Donik - (dong) - a measure of weight equal to 0.8 gr.
14. Dinar- is a gold coin that was used in the Middle Ages in Eastern countries and is equal to 4.235 gr.
15. Tassuj – 0. 1236 gr. = 0,12 gr.
16. In the Institute of Oriental Studies of the Academy of Sciences of the Republic of Uzbekistan, there are several copies of this work, i.e. No. in. 9454, in. No. 4287/I, in. No. 9042, in our research. The copy stored with the number No. 9042 was used.
17. Muhammad Tahir ibn Abdul Qasim. “Ajayibat at-tabakat”. Academy of Sciences of the Republic of Uzbekistan, Institute of Oriental Studies named after Abu Raykhan Beruni No. 9042, - p. 170-179 sheets.
18. Mahmud bin Wali. Bahr ul asrar fi manoqib ul- aher. (A sea of secrets about the bravery of noble men ) Academy of Sciences of the Republic of Uzbekistan, Institute of Oriental Studies named after Abu Raykhan Beruni. No. 2372 numbered manuscript 4 a-532b sheets.
19. Mahmud bin Wali. Bahr ul asrar fi manoqib ul- aher. (A sea of secrets about the bravery of noble men ) Academy of Sciences of the Republic of Uzbekistan, Institute of Oriental Studies named after Abu Raykhan Beruni. No. 2372 numbered manuscript 3286 sheets.
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