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The ruby stone in the Arab scientific heritage from the Umayyad Era to the end of the Mamlūk ERA (41- 923 AH/ 662-1517: A cultural historical study

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Abstract

The objective of this study is to shed light on the achievements of the Arab and Muslim scholars who wrote in the field of rubies, explaining its characteristics, benefits, applications, and places of occurrence during a specific time period in Islamic history that starts from the beginning of the Umayyad era until the end of the Mamlūk era (41-923 AH / 662-1517 AD). The study focused on specific elements that revolve around the origins and names of the ruby stone, its various types and forms, and various uses, and traced the ruby mines and their different locations in the Islamic world during the specified research period. Furthermore, the study discussed rubies extraction methods, physical properties, and market value during these Islamic historical periods, along with rubies defects, and their methods of treatment. The study adopted the descriptive, critical, analytical historical research method, where scientific material was collected from various historical sources, which are then arranged, classified, and presented in the form of a descriptive, analytical, and critical study, supplemented by comparisons with the scientific material contained in contemporary sources. The study concluded with the most important findings extracted therefrom.

Keywords: Arab scientific heritage, Ruby stone, The Mamlūk Era, The umayyad Era.

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1. Introduction

The best thing that can be presented and displayed to the future Arab and Muslim generations, to serve as an incentive and support for them in the field of creativity and excellence, is to disseminate and highlight the greatest creative

achievements of their brilliant and innovative early Arab and Muslim scholars who have contributed greatly to the various fields of humanities and applied sciences, including those related to gemology.

The importance of this study stems from the fact that it is the first scientific study – to the best of the researcher's knowledge – concerning the knowledge of Arab and Muslim scholars about rubies and their mines from the Umayyad era to the end of the Mamlūk era. What further illustrates the importance of rubies is that they are mentioned only once in the Holy Quran, in the verse: "As if they were rubies and coral" (Quran 55/58). Allah Most High likens the houris in Paradise to rubies and coral, due to their purity, the beauty of their appearance, and their splendor. Quran commentators have stated that rubies are distinguished by their purity and transparency, while coral is characterized by its beautiful white and red color. Through this likening, Allah Most High combines the purity and transparency of rubies with the beauty of coral to describe the women of Paradise.

1.1. Research Significance

The significance of this study stems from the fact that it is the first scientific study – to the best of the researcher's knowledge – concerned with the knowledge of Arab and Muslim scholars about rubies and the places from which they have been mined from the Umayyad era up to the end of the Mamlūk era.

1.2. Research Objectives

The main objective of this research is to highlight the most important scientific achievements of Muslim scholars in identifying the origins, properties, benefits, and applications of ruby stone.

1.3. Research Questions

The research will answer a major question, as follow: What are the novel scientific and practical additions that Arab and Muslim scholars have added to the science of the ruby stone from the dawn of Islam until the end of the Mamlūk era? Four questions branch out from this major question as follows:

1. Have there been any previous studies about the Muslims knowledge of ruby stone, and to what extent is this knowledge fulfilling?
2. What is the value of ruby stone and what are its applications compared to other precious stones during the various Islamic eras' subject matter of this study?
3. Where are the locations of ruby mines as identified by Muslim authors?
4. When did the ruby trade start to flourish in the Muslim world?

1.4. Research Methodology

This research adopted the historical research method in which scientific material is collected from the most reliable sources and then arranged, classified and presented in the form of a descriptive, analytical and critical study, while comparing it with the scientific material contained in the contemporary sources.

1.5. Research Structure

This research is broken up into a number of sections, including an introduction that outlines the research objectives, methodology, questions, and previous studies; then the body of the research in which includes the rubies origin on earth, types of rubies and sapphires, mines, methods of extraction, physical properties, value, uses; ending up with the conclusion, which summarizes the key findings and highlights the most significant scientific recommendations.

2. Recent Arabic Studies on Arab Knowledge of the Ruby Stone

We found only two studies on the ruby stone, namely:

1. The study of Dr. Buthaina Jalkhi entitled "The Ruby Stone in the Arab Scientific Heritage". This study is in the form of an article that was published in the Journal of Arabic Manuscripts, Issue No. 2, 2nd half of the year 2021.

The article addressed the presence of ruby stone in the Arab scientific heritage, discussing their status among other precious stones and their importance in Arab scientific manuscripts. It also reviewed the views of Arab scholars on ruby stone types, properties, and uses.

2- The study of Dr. Youssef Qasim entitled "Rubies and Pearls in Arab Mineralogy". This study was published from a local scientific conference at King Saud University, Riyadh, in 2022. This study is a comparative one linking the various instances of ancient Arab understanding of rubies and pearls. The researcher examined primary sources such as "The Book of Stones" by al-Qazwini and "The Mountains" by Jabir ibn Hayyan.

Neither study was as extensive or in-depth as our current one which covers a specific time period from the Umayyad era to the end of the Mamlūk era, which was the time when most ruby mines were identified by Arab heritage sources.

3. The Origin of the Arab Name "Yakut" (Ruby)

The word "yakūt" (ruby) is not of Arabic origin, but rather derived from the Persian word "yakand" [1]. Al-Birūni quotes Hamza ibn al-Hasan al-Asfahani who says that the Persian name for ruby is "yakand". The Indians called it "dam rakak", and they used to prefer the pure, transparent, and saturated red color types of ruby. "Dam rakak" in Indian language is the name given to red water lily"[2]. In his book, "The Book of Pharmacology", Al-Birūni says that the Persians used to call it "sabj asfarj" or (sabj asmur), meaning "plague repeller," because the Persian word for plague is "sabj" [3].

Ruby stone has been given several names including "al-jawhar," (the jewel) “al-kibrit” (sulfur) and "asjad" (gold). The ancient Persians called it "the stone of heaven," or "the heavenly stone," because they believed that the Earth's axis rested on a large piece of ruby [4]. The term "sky stone" refers to the sapphire with an “asmanjonic” (dark blue or sky-blue) color. The word "asmanjonic" is of Persian origin, composed of two parts: "asman," meaning sky, and "joni," meaning color, i.e., "the color of the sky."

The Arabs called it "the master of stones"[5].

In any case, the Arabic word "yakūt" is not of Arabic origin, but derived from Persian.

4. Rubies Origin on the Earth

Ruby stone is a pure type of corundum, and may rank above diamond when it is of high quality. It is made up of aluminum oxide or alumina, with the chemical formula [Al_2O_3], [6] and it forms as part of metamorphic rocks such as gneiss at temperatures in the range of 600-800°C. Corundum can also form in some cases of contact metamorphism in limestone, where hot, alumina-rich solutions within crystallized marble form magnificent crystals of rubies and sapphires [7]. Ruby stone also occurs in nature as bipyramidal crystals or hexagonal prisms. Sometimes it may contain iron and chromium impurities [8].

The first Arab theory that tells about the origin of ruby was presented by Jabir ibn Hayyan (d. 200 AH / 815 AD), in which he said: “When red and green stones, such as agate and jasper, retain enough moisture, they eventually turn into ruby stone. However, if they retain too little or too much moisture, or if they are excessively dry or not dry enough, or if they lack moderation, they never reach the peak and do not turn into ruby stone. Here, they take the shape of red stone, which gives them various names and forms. All of these stones have been on the path to becoming rubies, but as the path is frequently not completed, they will not all eventually reach the summit and turn into rubies” [9].

Some parts of that spot become water, and the water dissolves in that place, and travel through some pathway through which other materials also travel, just like a tree that draws moisture from the depths of the earth through its roots to its stem and branches, with that moisture mixing with other substances leading to the formation of a fruit [10].

Al-Birūni cited the belief of some people that lightning increases the growth of rubies [3].

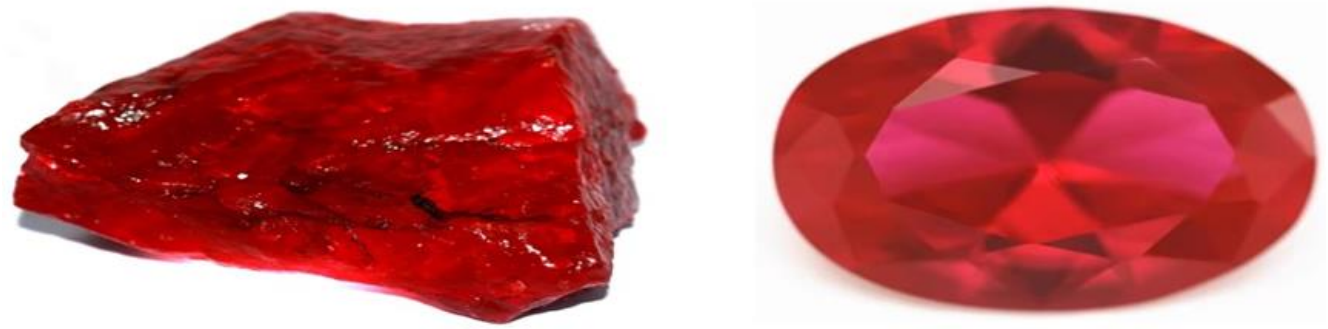

Figure 1.
A raw red ruby along with a polished red one.

5. Types of Rubies and Sapphires

Shihab al-Din Muhammad ibn Ahmed ibn Mansur al-Abshihi (d. 852 AH/1448 AD) described rubies and the four colors that they may have, namely: red, yellow, blue, and violet. Many other colors come from these colors, the most balanced of which is pure red that resembles red pomegranate seeds. This is followed by the red that is tinged with white, then pink, burgundy, saffron, and the worst of them is the blue, whose color resembles iris blossoms, and the least valuable is the white [5].

There are four famous types of rubies:

5.1. Red or Bahramani Ruby

This is the most valuable type of ruby, which when exposed to fire, it increases in redness and beauty, and if it has a black dot, it is often erased by fire. In general when a gemstone gets the name of "ruby", this usually refers to the red ruby, [11] hich is not affected by Iron files [7]. Figure 1 shows a raw red ruby with a polished red one [12].

5.2. Yellow Sapphire (Topaz)

Yellow sapphire, or glenary, is a gemstone characteristic of the pegmatite stage. It is found in granite, and is therefore sometimes called "granite topaz." It develops under the influence of fluorine-rich gases released in the earlier stages of magma differentiation, and is therefore found in phreatites and quartz veins. It usually takes the greenish-yellow, pink, red, and blue colors [13].

Perhaps the name "topaz" is originally a Sanskrit word meaning fire or shining, or from the word "thomas," meaning goodness or righteousness. It may have also been derived from the name of an island in the Red Sea whose name is “Topazion”[12]. The chemical formula of the yellow sapphire is [$Al_2(F.OH)_2SiO_4$] [6].Yellow sapphires are less resistant to fire than red sapphires [11]. Figure 2 shows a yellow ruby (endnote 15).

Figure 2.
A yellow ruby.

5.3. Sky Blue and Violet Sapphire

Transparent blue corundum is called blue sapphire (zapphire, sapphire, or sāpphire) [8]. According to some Arab sources, this type of sapphire cannot withstand fire [11]. Al-Birūni believes that people only cared about red rubies because "blackness in the face and skin is a symptom of the suffocated and the afflicted, while yellowness is a characteristic of the apostate and the fearful" [3]. Figure 3 shows raw blue, polished blue and polished violet rubies (endnote 15).

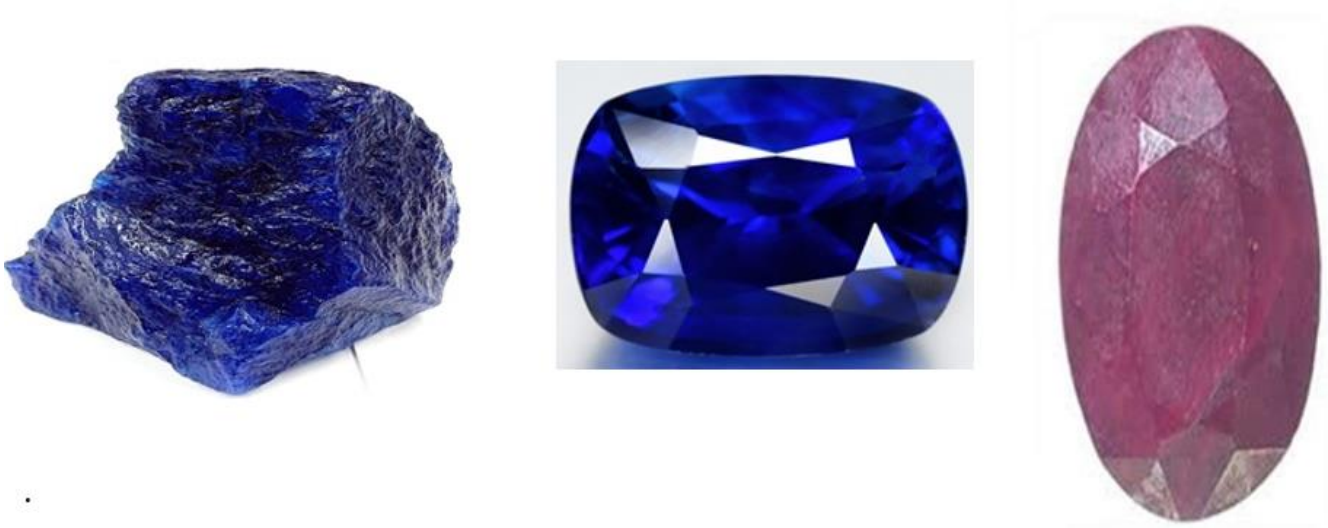

Figure 3.
Raw blue, polished blue and polished violet rubies.

5.4. White Sapphire

White sapphire is a colorless variety of corundum, which is made up of the same mineral that forms blue sapphires and rubies. It is a precious gemstone characterized by hardness and durability, scoring 9 on the Mohs scale of hardness, making it the second hardest gemstone after diamond. White sapphire is often used as an alternative to diamond in jewelry, especially in engagement rings, because it is less expensive but still has a beautiful brilliance. White sapphire is the worst type of sapphire and is undesirable, and hence it is traded for low prices. Figure 4 shows a white and black sapphire (endnote 15).

Figure 4.
A white and black sapphire.

Shams al-Din al-Ansari, aka Sheikh al-Rabwah (d. 727 AH/1327 AD), offered an extensive and important explanation of the primary and secondary types of ruby stone, saying: "Knowledgeable scholars in this field have indicated that sapphire is the leading minerals and the master of insoluble stones. It has four major colors: red, yellow, azure-blue, and cerulean-white. Each color assuming a higher genus with many color species and varieties arranged into four gradations between each color and the one that follows. The following classifications are offered by Al-Ansari:

- The best and most balanced of them in color is the pure, bright red, the Bahraman that is similar in color to the color of pomegranate seeds. Then comes the soft, transparent, blood-red, and clear, free of any tendency toward dullness, reddish-blackness, or toward a reddishness that leads to whiteness, or toward yellowness, or toward blondness. This red ruby, the one described as Bahraman, is the most noble of its kind. Stones usually weigh about twelve mithqals while in rare cases they weigh twenty mithqals.
- Every ruby stone is called a mountain, whether large or small. A weight of half a mithqal is called half a mithqal mountain, and a weight of twenty mithqals is called twenty mithqals mountain. Thereafter comes the pure red color which is similar to the color of the pomegranate seeds, shining with a slight whiteness, then a color that tends to be bright to white, then the transparent pink color, then the pink color close to the white, then color after color till we come to the pure, brilliant white color, which is the worst kind of ruby. It is said that a white ruby is worth an egg.
- The sky blue sapphire is similar in color to the blue lily, and this blue hue typically has a tint of red. It is similar to the color of the necks of some blue-ringed pigeons or to the color of the marwazi's clothing, which has a red weft and a blue warp. It is also similar to the color of some peacock feathers of the same hue and similar to the color of polished iron when it is heated in fire.
- Following this color is a pure blue that leans towards the white, followed by a pure red and finally a blue-tinged one, until we arrive at the red Bahrman color and lastly the pure dazzling white. The pure yellow sapphire also takes on a golden yellow hue that is similar to an owl's eyes in terms of brilliance, transparency, and brightness.
- This quality level, which boasts resistance and endurance, is the third one. A purer yellow color follows, then one that is even purer than this one, and then we reach the color of lemon, which tends to turn whiter, and finally a pure, beautiful white. Better hues, such as a shade halfway between this and red amber, are assumed by yellow sapphires above this level. This sequence of colors starts with an orange hue, then moves on to a redder than orange hue, pomegranate, reddish saffron, reddish with a hint of yellow, and lastly red amber.

Similarly, as we have shown from the previous color gradation, there are wine-colored intermediates between the red and blue rubies, with a propensity towards a predominance of either blue or red. Red and blue are more valuable than any of the other colors. White is the clearest, cleanest, and most diluted color. These include varieties of rubies that are called the balkhish, the bijadi, the indigo, and the kohl-yellow, which is the weakest and least valued of these colors. Rubies of all varieties have the toughness property of being capable of eroding and subduing all other types of stones except for diamond, which can eat away at the ruby's body. They cannot be worked on with abrasives, sandblasting, or anything else.

Rubies may be heated by fire and then cooled when the embers are extinguished, but they are not calcified by fire like other stones. Rubies with a polish that no other type of polish can match are Yemeni agates. To make these rubies more transparent and polished than other transparent stones, they are first burned until their light fades out, then they are placed on a copper plate and covered with agate lime that has been diluted with water. They are then allowed to stand until they

glitter, and finally they are rubbed off and then rubbed onto the plate till it becomes more transparent than any other of transparent stones.

The reason for the differences in rubies colors is attributed to the differences in the regions of the earth in which the rubies are formed. The formation of rubies is attributed to the heavenly water that falls on the ruby stone and takes it deeper to further depths, and it remains there for a long time. Sometimes it is afflicted by the dryness and heat of the earth coupled with the original heat of the mineral and the heat derived from the sun along with some characteristics embedded in its essence specific to that spot, in which case the ruby stone is colored accordingly depending on the degree of heating. When the heat is excessive, its external part turns black while its internal part will be still red due to the moderate heat that it has absorbed. When the heat is moderate, it turns red just like an emerald stone, and when heat is insufficient, it turns yellow. When the moisture is excessive, the ruby stone turns white.

Yellow rubies and jasmine are white when placed in fire, a color which they keep and does not change. A yellow type found in some places as they say, may weigh thirty mithqals or even forty mithqals in some rare cases. The violet ruby is the oily type, of which there are some types that weigh fifty mithqals. There is also the male type, which is the smallest type of ruby [14].

6. Ruby and Sapphire Mines

Current sapphire mines are distributed across many countries around the world. There are major areas where sapphire of various types is mined:

6.1. Historical Areas Renowned for their Rubies Quality:

- Kashmir (India): Velvet blue sapphires (currently limited production).\
- Myanmar (Burma): High-quality blue sapphires.
- Sri Lanka: A wide range of colors (including padparadscha).

6.2. Areas Currently with Large Production

- Madagascar: Large quantities of many colors.
- Australia: Large quantities of deep blue and green sapphires.
- Thailand: A center for cutting, crafting, and trading gemstones.
- Tanzania and Kenya: Production of sapphires of variety of colors.
- Montana (USA): Sapphires of unique colors.

Other countries with sapphire mining include Afghanistan, Cambodia, Cameroon, China, Colombia, Ethiopia, Laos, Malawi, Mozambique, Nigeria, Rwanda, and Vietnam. Figure 5 shows locations of ruby stone in the different parts of the world [15].

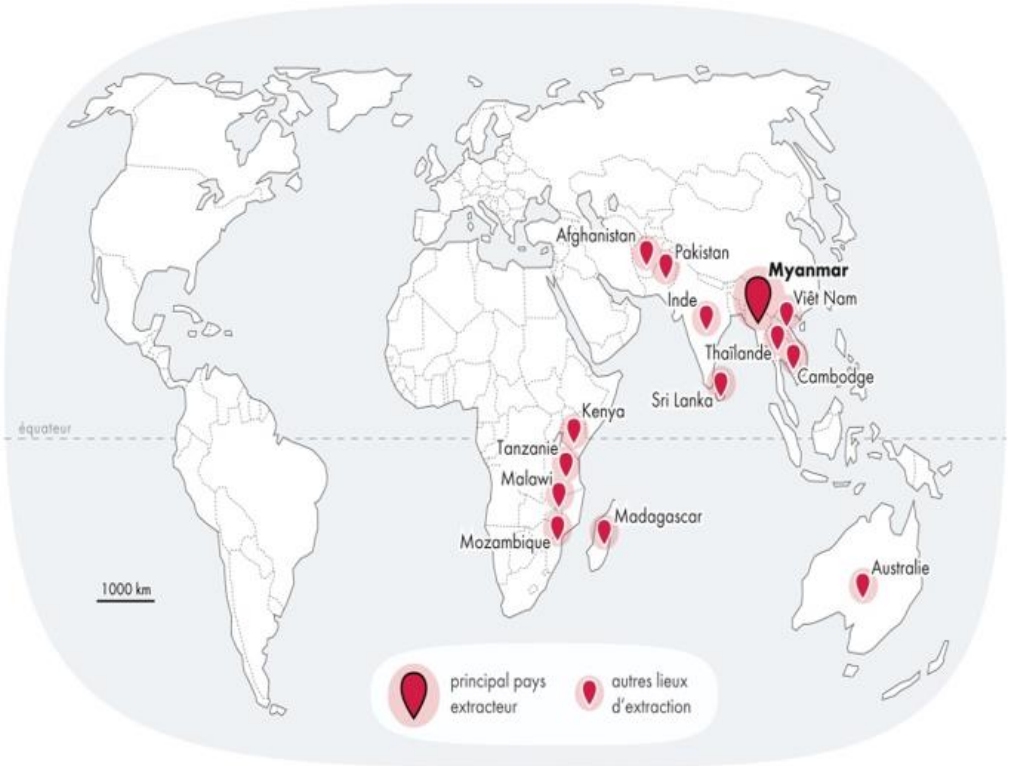

Figure 5.
Locations of ruby stone in the different parts of the world.

According to some Arab historical sources, rubies have been extracted from certain areas of Badr [16]. recounted that Iram and Alexandria are some of the paces from where they have been extracted. Others recount that Iram, the city of pillars like no other on land, was located in Yemen between Hadhramaut and Sana'a. It was built by Shaddad ibn Aad, and it is said that it has been a paradise city in its own right. He directed the diggers to extract rubies, emeralds, and other gems, of which they extracted enormous quantities [17]. Mount Kawkaban, near Sana'a, contained a palace built of silver and stone, while the interior of the mountain was adorned with rubies and other gems. These rubies and gems glittered at night like a star, thus giving the mountain its name [18].

Rubies were extracted in abundance from the mountains of Afghanistan [16].

Sri Lanka (Ceylon) was one of the most important ruby-producing countries to the extent that early Muslims called it during their trade with the Near East the "Island of Rubies"[7]. witnessed the abundance of rubies on the island of Ceylon [19]. Ahmed ibn Yahya al-Baladhuri (d. 279 AH/892 AD) claimed that the reason for giving it the name of the “Island of Rubies”, is not because of the abundance of rubies in the island, but rather because of "the beautiful faces of its women [20]." t is also claimed that there are deadly snakes on the Island of Rubies guarding the ruby pebbles that were abundant on the island. The people of the areas where rubies were abundant used to hunt for them using various tricks [21].

The island of Sapphire is located in what is now known as the Indian Ocean. It is not an island in the real sense, as it is connected to the mainland from the west, and the route is difficult because it is surrounded by mountains which are difficult to climb except with great effort, and the island is also difficult to descend to except with the equal effort [22].

In his famous journey, Ibn Battūta recorded his observations about Ceylon, saying: “The amazing ruby, the Bahraman, is only found in this island. Some precious rubies come from a creek found there, while others are dug for and extracted from the ground. In fact rubies are found everywhere on the island. Some people dig for them while others buy them. So when a person digs for ruby stone from the ground he finds a white craggy piece of stone in whose cavity the ruby stone is found. So he takes it to a carver who will scrape it until it splits open to reveal the ruby stone which is called the white elephant. Some of the ruby stone which they call “nilam” are red in color while others are yellow and blue.

Rubies are priced in Ceylon through a bizarre custom in which rubies that weigh hundred fanems or more are taken to the sultan who buys them from their owners, while those that weigh less are kept by their owners. The exchange rate at that time was hundred fanems for six dinars of gold. All the women on the island of Ceylon have necklaces of colored rubies and they wear them on their hands and feet instead of bracelets and anklets. The sultan’s concubines make nets of rubies which they wear on their heads. I saw seven ruby stones on the forehead of a white elephant, each larger than a chicken's egg. I also saw a ruby necklace the size of a palm with aloes oil in it at the palace of Sultan Iri Shkruti, and when I showed some amazement he said, "We have something even larger than that" [23].

The Armenians (people of Armenia) used to enter the Caspian Sea and bring back Roman gems and comet stones, which are a type of ruby [24].

Muhammad ibn Abi Bakr of Cordova (died after 541 AH/1154 AD) mentioned that the Brahman ruby was brought from the island of Brahman, opposite to the island of Tarab, near China. According to him, one of the ruby stone characteristics is that when a piece of it is thrown into fire, it emerges cool, and if it is blown with bellows it does not change, but rather becomes more beautiful [24].There are various types of rubies in the Abyssinian Sea [25].

Rubies were found in Roman countries, according to Ubayd ibn Shariyyah al-Jurhumi (d. 67 AH/687 AD), who stated that: "Tubba' al-Aqran [also known as al-Aqran ibn Shammar Ya'rash [26] invaded all corners of the earth; then he went back to the Roman territories and pushed through the land until he had traversed it entirely.

When he reached that area, winter struck tere making him terminally ill, and hence he was buried there after he died. His companions returned, fearing death in that place – which was called the place of darkness – because it becomes completely dark when the sun moves away in the winter. When the sun enters the Tropic of Capricorn, those days become night with no daylight. He perished before entering that valley"[27].

According to Ibn al-Qasim al-Yamani (d. after 1099 AH/1687 AD), the lands of Spain have been rich in rubies [28]. A ruby is found in the region of Malaga, known as the Fortress of Monte Mior in the Malaga province [29].However, it is very fine and unusable due to its small size. A ruby-like stone is found in the region surrounding the city of Bejana, in a trench near the village of Nashir, which abounds in pieces of various shapes and beautiful colors that are not affected by fire [30].

The third region is 29 degrees from the equator, which is 1,933 and a third of a mile. Its length extends from the Western Sea, starting from the east, to the Dark Sea, where the Ruby Mountain is located [31].

The Ruby Mountain is located in China, [31] and a river flows from there and transverses the land of China. It is also found in Kharkhir (or Kharkhiz, Ibn Khaldūn [32] or Ibn al-Wardi, et al. [33] Khazkhiz), a region bordering with China. It is very fertile and endowed with rich settlements and plenty of water, along with rivers that flow therein from the borders of China. The city inhabited by King Kharkhir is a fortified with a strong wall, a trench and a large fort. Nearby is the island of rubies surrounded by a round mountain that is difficult to climb and its peak can only be reached with great effort. Furthermore, no one can descend from the mountain to the island, which is also infested with deadly snakes. There are many ruby pebbles on the island and the people of that area hunt for these rubies using special methods [34]. Several sources narrated these methods, but many of them rather belong to folk stories [33]. There are also various types of rubies in Qaisaran Island which is also known the "China of China"[24].

Rubies were extracted from the mountains of India [24]. Historians recounted that there is a mountain in India known by as the “Mountain of Monkeys” where there is a passage 400 cubits deep down which people descend with candles and lamps. At its bottom is a great, flowing, sweet-tasting river containing rubies like the ones mentioned above [24].

The same applies to the island of Buruj, the seventh island of the islands of India. To the south of this island there is the mountain known as the Mountain of the Serpent. This mountain has many cypress trees. No one dares to enter it because there are snakes the length of thick palm trees and even larger ones. Near this mountain, which borders with the Sindh, there is a mountain known by the name of “Maha Mountain” from which the white ruby known as Maha ruby is extracted [24].

Rubies are also found on the coasts of the Indian city of Sikander [24]. Gems are also frequently found in Sikander, [24] and various types of rubies are found on its coasts [35]. The ruby trade flourished in India as early as 800 BC [36]. Ruby mines also existed in Transoxiana [37].

Rubies were also brought from Mount Rahun in the Harkand Sea on the island of Serendib [4]. Around this mountain there are mines for mining red and yellow rubies, and jasper [38]. It is said that rubies are found on Mount Rahun, where floods and rain carry them down to the bottom to be collected thereafter [17]. Ibn Masawayh (d. 243 AH/857 AD) also identified another location near Serendib Island called Balnajran [39].

Serendib was known in Arabic geographical literature by other names: Tabarubani, [40] Tabriyani, [41] Marandib, [42] nd Balnajran [43]. Mount Rahun was also known by several other names: Ar-Rahthun, [38] Ar-Rahhun, [44] Ar-Rahn, [42] and Nawdh [45].

Rubies are also found in the Fayyum region in Egypt, and in the sands of the Nile Islands [4].Ruby ores were found in the mountains of the Levant, in Ain al-Shams [46].

Muhammad ibn Abi Bakr al-Zuhri al-Garnati related that various types of rubies were brought from Washidan Island and Rahwayh Island in the Daylam Sea [24]. The ruby stone known as Rahawi is brought from Rahwayh Island, and hence named as such [24]. There are three islands in the Daylam Sea, the first of which is known as the Island of Saqanqur, which means in Arabic the "reviver of souls". The second is known as the Island of Mazen, and the third is known as the Island of Washidan. These islands, which are not inhabited, are only visited to extract from them the various types of rubies that are found there [24].

You can walk four days in the country of Haskurah to the homes of a tribe called Hazrajah (named after a mountain called Hazrajah), which contains various types of rubies of exceptional quality and beautiful colors. They are abundant there mixed with the stones of the mountain, but they are rough and craggy, and are not affected by scraping or sandblasting [30].

In the city of Badakhshan which lies in Turkestan, [22] there are red Romani rubies [21]. Rubi stones which are brought from the mountains of Badakhshan, are called Badakhshan rubies, and the common people call them Balakhsh [23].

The city of Kankar, the seat of the great sultan of that country, is built between two mountains on a large creek called the Creek of Rubies, because rubies are abundant there [23]. Mount Qarajil, which borders the Eastern Ocean, contains gold mines where gold reserves are abundant. Other precious rubies are also found in some of these places [47].

7. Methods of Ruby Stone Extraction

Methods of rubies extracting are many; "Some of them are gathered from the soil, some from the valleys brought by the torrent rains from the Serendib Mountains, while others are found in the mud of the island and are gathered by men from there. It is said that the best rubies are those found in places inundated by the torrent rains. Good rubies are known by signs such as abundance of water, presence of pigments, and rays. On this island, there are various colors of rubies, including red rubies which are produced from all of these locations. Some are light red, while others are deep red with the deep red so predominant such that the light redness is only visible through the dark red in the form of veins"[39].

8. Physical Properties of Rubies

Rubies have several important physical properties that have been recently identified. They are very hard (9 on the Mohs scale), relatively dense, and have a high refractive index, which gives them a brilliant luster. They are mostly made up of aluminum oxide, but the red color is attributed to chromium. Arab and Muslim scientists knew their physical properties and described them according to the scientific terminology common at the time.

Al-Muzaffar ibn al-Wardi (d. 749 AH / 1349 AD) recounted that: "Pure ruby stone is very dry and hard. It comes in several colored varieties including red, white, yellow, and green. It is not affected by fire due to its low oil content, nor can it be pierced due to its high moisture content. Iron files cannot be used to scrape it due to its hardness, and it is so durable that its beauty increases with the passage of time. It is rare and prized, especially the red variety, followed by the yellow one. However, the latter is more resistant to fire than all other types of rubies. As for the green variety, it has no resistance at all"[33]. Ruby stone in general is not affected by steel or diamond, and fire does not defile it [5].

Similarly, the red ruby stone weighs more than any other colored ruby as it is not the type affected by Mars [10].

Most of the Arab scholars are unanimous in that diamonds have no effect rubies. However, the Andalusian alchemist Maslama ibn Ahmed al-Majriti (d. 398 AH / 1007 AD) asserted that diamonds can do so, and he has been proved as right, because diamonds are harder than rubies [29].

Abu Bakr al-Razi pointed out that rubies do not decompose or disintegrate with time or use, as is the case with gold and glass, due to the cohesion of their structure and the alignment of their particles [48].

9. Semi-Rubies

Among the semi-precious stones found in minerals are the semi-rubies which Ibn Masawayh calls "al-Kharīn", and are often mistaken for rubies. According to Ibn Masawayh; "Al-Kharin is found in ruby minerals. Sometimes it is red, jasper,

or of various colors, with some having a greenish tint. Each of these three types includes some that can be polished with ruby polish, which is the finest and most valuable among the semi-rubies. Others can be polished with emerald polish, while others can be polished with other stones, which are the worst. They resemble rubies and are often mistaken for them. They can stand fire to some extent only, depending on their hardness and flexibility. Merchants may buy them mistaking them for precious rubies and confusing them with each other" [39].

The term "green stone" may refer to either agate or tourmaline, both of which can have a green color:

- There is a type of green agate called tsavorite, which has a beautiful and valuable emerald green color. Another type of green agate called demantoid is rare and has a more brilliant luster.
- There is also a green tourmaline, known as verdelite, which comes in various shades of green.

The lobster ruby stone also resembles ruby stone, especially the red variety of ruby, but it cannot withstand fire. It also resembles the sapphire, but is not a type of ruby either [49]. The lobster stone is brought from the land of Sandan, and hence some of it is called Sindaba, which is the best and has more moisture than others, which are solid and red but without water, and therefore called the parched one. Others are yellowish red with some water; making them better than the parched ones, while a third type is salty and cannot be polished.

All of these commodities were sold as rubies, until during the caliphate of Al-Mahdi, when it was discovered that they are not gems at all as they cannot withstand fire, and when compared with authentic ruby, the quality of the latter became higher and the lobster stone took fire. The one who used to buy it for Al-Mahdi was Ayyub al-Aswad, a man from Basra. At that time this stone was worth five thousand dirhams. The one who offered it to al-Aswad was Awn al-Ibbadi. In this way the variety that can be polished was classified as ruby, while the ruby stone which may weigh three mithqals or less and cannot be polished was classified as a semi-ruby [39].

It appears that the Arabs had a method by which to dye rubies and conceal their flaws [50].This involves mixing goat's blood with cinnabar and dying the ruby with the mixture, after which the crystals will resemble a ruby stone [51].

"Crystal stone is as transparent as glass, and its solid body ignites fire when struck against tempered steel. It is pure white and transparent. It accepts dyes and if a colored layer is placed underneath, it becomes transparent, as in the case of glass. Valuable vessels are made of crystal. When dyed, it resembles dyed ruby stone except for being lighter, and can be used in the same way as ruby and may even replace it" [49].

10. The Value of Rubies

The gemstone market reached its peak during the Abbasid period, especially during the reign of Harun al-Rashid and his son al-Ma'mun (2nd-3rd AH/8th-9th AD). Harun al-Rashid purchased a ruby gem called "Al-Jabal" (The Mountain) for 40,000 dinars and engraved it with his name. He also purchased another ruby for 120,000 dirhams. This prompted the elite and other caliphs in the remaining Islamic kingdoms to flock to acquire gems and precious stones [52]. This may explain, on the other hand, why scholars began studying and caring about gemology at that time, and subsequently wrote books guiding people on how to distinguish between them.

According to Abu al-Fadl Ja'far ibn Ali al-Dimashqi (6th century AH/12th century AD), a ruby gem of good shape, free of defects, blood-red in color, and weighing one mithqal was worth 400 dinars. If it weighed half a mithqal, it was worth 50 dinars. If it weighed one-third of a mithqal, it was worth 15 dinars. If it weighed one-quarter of a mithqal, it was worth 6 dinars. A dyed ruby is worth a quarter of a Bahramani, while a fine-quality sapphire is worth a sixth [53].

But gold remains the noblest, best, most enduring, and most valuable of metals. Rubies are valued according to the weight of their mass. If they weigh a mithqal, their value would be a thousand. If they are ground to a fine powder, their value would be only one dinar. However, gold can be shaped and cast without its value changing [14].

11. Defects of Sapphire and Treatment Methods

There is no doubt that sapphire, like other precious stones, suffers from a range of defects depending on the conditions in which it was created. Expert Arab scientists specializing in gemology have distinguished between them. "The worst ruby color is the pinkish-red that tends toward the white, while the worst sapphire color is the porphyry that tends toward the black, and the blue sapphire that tends toward the gray which is called the "snouri," and the pale yellow sapphire that tends toward the white. The quality of all types of sapphire is affected by holes, hairs, flaws, and poor appearance. To distinguish real sapphires from fake ones, a test is performed. Real sapphires are heavy, cool quickly, and can withstand high temperatures more than other types of sapphires. If agate is applied to a sapphire, the agate will break due to the hardness of the sapphire" [53].

Ibn Masawayh listed the defects that appear in sapphires, saying: “There may be a bubble of air in the stone which is an empty space in the stone or blown air in the body of the stone. There may be a crack or an empty space which may also contain water, air or just vacuum, or may also contain good or bad clay. If a crack is forming a bubble inside the stone and can be seen from the outside, it can be treated with a drill where the drill is pressed against the crack until that defect is gone. In the same way the drill can be used to remove the air or water that have been found in the place of the bubble.

Then it is placed on fire with some defects remaining in the place of the crack. The defects will remain open and disjointed if some particles remain in it. The treatment in this case includes removing the particles or pebbles from the stone, after which the stone is pressed on both sides of the crack until they stick together, and the crack or bubble completely disappears from the stone. Then the stone is surrounded by a collection of stones from all sides, and is thrown in firewood. Thereafter, it is blown on and the firewood is buried for the longest possible time until the crafters guess that the blackness has gone. The time required from this process to complete until the blackness goes away ranges between an hour and twenty days and nights. During this time the firewood is blown on without stopping depending on the amount of

blackness therein. When it cools, it is returned to the fire until the blackness is gone. If the blowing is exceeded after the blackness has gone, it will become uniform and will not increase or decrease and will remain in such state forever.

The above is the process carried out in India and it ends up with the crafting of a piece of five mithqals of weight. Some of it may be treated in the Western countries, but that is rare. As for the blue sapphire and amber and all other rubies, they are first struck strongly with a piece of diamond, then they are cut according to what is desired, and thereafter they are polished in India or Iraq [39].

If there is a very red spot on a piece of ruby and fire was blown on it, that redness will spread in the stone, improving its luster and color. It is also known that rubies colors are not affected by iron files [30].

To improve the luster of rubies and eliminate some of the flaws that are on them, they are treated in one of two ways:

1. Either by exposing them to fire, which enhances their beauty and luster [24].
2. Or by rubbing them with onyx powder, which improves their color and makes them bright and luminous [54]. Abdul Rahman ibn Umar al-Jubari (died after 663 AH/1265 AD) suggested a detailed method for treating and polishing rubies and making them transparent, which is as follows: "To restore the luster of a piece of ruby stone, treat it with onyx powder, burn it, and finely grind it. Thereafter soak it with water laced with willow or oleander wood, which would improve its luster as well as increase its value" [55].

The mineral of ruby can be afflicted by many factors. Its exterior is dark, or sometimes most of it is tending towards blackness and sparkling. Sometimes a dark part is found inside the stone after it has been polished, perhaps the heat of the mineral did not cook it well and the rest of it did not solidify. The treatment for such an event is to take it when it is extracted from its mineral and transform it into clay and dry it after piercing it with a diamond. Then it is thrown into fire which is lit with a large amount of wood of a calculated quantity in order to purify it. When its purity is certain, it is left to stand until it cools. Sometimes the red part is extracted and heat is applied again. If the stone is blue-green or yellow, it does not need to be heated unless the blue-green tends towards yellow, in which case it is placed on fire for some time until the dark part is washed away. When it is heated more, its color is stripped from it and it takes the color of crystal, and in this case it is regarded as white sapphire.

12. Uses of Rubies

Rubies have always been used for adornment and as jewelry for both men and women. As their value was always high, only wealthy and royal classes were capable of having them. Al-Khalidian recounted that the King of India sent a red ruby bowl to al-Ma'mūn as a gift, the opening of which was one span (25 cm) and its width was one finger (approximately 2 cm), filled with 100 pearls, each weighing a mithqal. Al-Ma'mūn returned the gift with a more luxurious one: a horse with its rider and all its equipment made of agate; an onyx table with black, red, and green lines on a white ground; its opening was three spans (75 cm) wide and was two fingers thick (approximately 4 cm), it stands on gold legs; as part of the gift there were five types of Egyptian white fine fabric, Susa brocade, Yemeni embroidery, Khurasan silk, Khosravi brocade, scarlet carpets, Susangerd carpets, and 100 Hiri carpets with their cushions [56].

A ruby dagger was presented to Sultan Mahmūd ibn Sabuktigin (d. 388 AH/998 AD), which when held in hand, its two ends could be seen on either side of the hand [57].

It has been reported that Ibn Abbas used to say: "The palace of the Queen of Sheba was made of amethyst," because the Arabs call all rubies and emeralds "qawarir" (fine bottles) [39].

Rubies were also widely used in medical treatments, to the point that Abu Bakr al-Razi considered them a safe and familiar medicine [48].

A common prescription in Arabic literature about the use of rubies is that wearing a red ruby prevents wet dreams [48] . Anyone who wears a Brahman ruby or wears a ring made of such a ruby stone will not be bitten by earth vermin or mosquitoes [24].

Rubies instill awe and dignity in their wearer, [29] facilitate the fulfillment of needs (especially red amber), [14] increase saliva in the mouth, repel poison, and strengthen the heart. All rubies are beneficial for epilepsy when worn as pendants, while white rubies relax the soul [5].

Aristotle said: "Whoever wears a stone or a ring made of one of the three types of rubies (red, blue, or yellow) while living in a country where plague has struck, he will not be afflicted by the plague, he will be elevated in the eyes of people, and his needs will be facilitated and fulfilled. The nature of rubies is always related to warmth and dryness" [49].

It is strange that Al-Muzaffar ibn al-Wardi died of the plague of Aleppo. He knew that one of the purported medicinal properties of rubies is that they protect against plague. However, he did not protect himself from the plague, saying that: "Whoever wears a ring made of these types will be safe from plague, even if it spreads widely, and whoever carries one of them or wears a ring made thereof will be respected by people and honored by kings" [33].

This led Al-Majriti to criticize those who hold this belief, saying: "They claim that talismans are more effective than choices because they are used in the nature of the “whole” and are miraculous due to being of natural properties. These properties can perform miraculous actions alone, such as repelling plagues and other diseases from the wearer" [58].

Aristotle continues enumerating the therapeutic properties of ruby stone, saying: "Its luminosity helps it do miracles; it is beneficial against obsessive thoughts and palpitations, and it protects from lightning, can prevent blood from clotting as well as blood spitting when worn as a pendant. Among its properties is that it has never been seen in the hand of a drowning person. It prevents thirst when placed under the tongue. Indians say that whoever carries a ruby will pull a bow and through an arrow beyond his capacity, provided that he does so not as an experiment, but rather unintentionally and without experimentation" [59].

Some physicians have compared the ruby's medicinal properties and effects to those of the garden olive, especially the small and stinging variety, to the point that it is even more effective [60].

Ibn Sina attempted to explain the psychological effects of ruby, saying: "The testimony of the ancients regarding ruby's soothing effect when held, especially in the mouth, is an evidence that its soothing effect does not require a transformation of its essence and necessary symptoms, nor contact with the object affected by it. Rather, its soothing power is inherent in the ruby itself, but its effect is strengthened by heating and proximity, as with all other properties. It is likely that the effect of this property is determined by the ruby's ability to improve the temperament" [61].

It appears that treatment with ruby began to take a more creative approach with Ibn Sina. He made a paste of ruby and tested it, saying: "We discovered ruby's great benefits from the kings and their ilk, especially in treating the obsessive-compulsive disorder, savagery, palpitations, and heart weakness. It cured chronic ailments for which other treatments had failed; we found it to be of great benefit in treating brain, stomach, and liver ailments, as well as spleen and colic ailments in particular; and it was also beneficial in treating joint pain and chronic fevers" [62]. Later Arab physicians took this treatment method from him and applied it [63].

Ibn al-Baytar (d. 646 AH / 1248 AD) also used rubies to treat sexual disorders [64]. Ibn Masawayh stated that it preserves eye health and strengthen vision [65]. Al-Halabi used ruby powder to make miraculous, [65] proven kohl, and later ophthalmologists copied the method from him and used it [34].

The aphrodisiac properties of ruby when placed in the mouth [58] led Ibn al-Nafīs [66] (d. 687 AH/1288 AD), Al-Muzaffar [54] (d. 694 AH/1295 AD), and Ibrahim ibn Abd al-Rahman al-Azraq (died after 890 AH/1485 AD) to use it to treat melancholia, [67] sometimes known as the "gloomy disease," a state of severe depression characterized by profound sadness and despair.

Only one scholar has been found to warn against the side effects of medical treatment with rubies, who was Ibn Fadlallah al-Umari (d. 749 AH / 1349 AD), who said: "In general, it is harmful in all the cases that we have mentioned, as long as the intended amount is not used according to the temperament and the underlying causes. Therefore, its effectiveness must be examined each time, and the amount used increased or decreased according to its manifestations" [22].

13. Conclusion

This study is organized in the form of a scientific work that discusses various aspects about a single particular topic, namely the history of ruby stone during a specific period time of the Islamic history that starts from the beginning of the Umayyad era until the end of the Mamlūk era (41-923 AH / 662-1517 AD). The ultimate aim of the study is to come up with findings about the history of ruby stone during that particular time of the Islamic history citing the achievements of the Arab and Muslim scholars who passed down rich information and knowledge about the field of rubies, explaining its characteristics, benefits, applications, and places of occurrence.

Furthermore, the study highlighted the significant contributions of these Arab and Muslim scholars in the field of rubies by examining the origins, names, types, and uses of rubies, as well as specifying the locations of ruby mines in the Islamic world during that period. The study also explored the extraction methods, physical properties, market value, and treatments for ruby defects. Employing a descriptive, critical, and analytical historical approach, the study synthesized information from various historical and contemporary sources, with the objective of extracting key findings that would deepen our understanding of rubies in Islamic history.

To enrich this study and make it much more impressive, a multitude of sources have been quoted including Shams al-Din al-Ansari, known as Sheikh al-Rabwa, who offered an extensive and important account of the major and minor types of rubies, adding to the field an extensive account that was not present in the Greek books that preceded him. Moreover, Arab geographers of that time exerted strenuous effort to list all the ruby sources and mines known at that time, while some Arab and Muslim technicians of that time devised methods by which to dye rubies and conceal their defects. Some Arab and Muslim scholars explored the use of ruby stone other than that its ornamental uses, such as Al-Halabi who used ruby powder to make authentic proven eyeliner.

While Ibn Sina attempted to explain the psychological effects of rubies, Al-Majriti rejected the claim of earlier Arab scholars that diamonds have no effect on rubies, and managed to prove through experiments which he carried out by himself that diamonds do affect rubies. Al-Majriti is also one of the few Arab scholars who criticized the Arab practice of using rubies to prevent plague, which he proved as baseless and has no evidence to substantiate it.

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