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FEATURES OF THE HAJAR AL-ASWAD, BLACK STONE OF MAKKAH, SAUDI ARABIA

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Highlights

- The Black Stone is possibly the most respected rock in the whole world, but its features and origin has not been constrained very well.
- The size of gravel and its constituents in the Black stone of Kaaba were determined by an image process software. Modal mineralogical composition of the Kaaba stone in Edirne was also determined, with the size of its minerals.
- It is suggested that the Stone in Edirne could be from the Yemeni Corner of Kaaba originated from Makkah batholith, and different from those of İstanbul and Kaaba based on its colour and texture the origin of the black stone remains the subject of speculation due to a lack of analyses of modern scientific techniques

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ABSTRACT: The Black Stone is composed of several dark-coloured gravels (9.7-27 mm) held together by a silver frame in the eastern wall of the Kaaba (Makkah). It contains long prismatic white crystal (0.64-1.11 mm) and short prismatic black (0.33-0.85 mm in length) crystal in an equigranular texture. Six and one additional pieces of the Black Stone are claimed to be in Istanbul and Edirne, Turkey. The stone of Edirne is composed of quartz (0.45-6.57 mm, 47.02 %), white plagioclase (0.81-2.97 mm, 38.49 %) and black amphibole (0.9-2.43 mm, 14.49 %) crystals in a coarse-grained texture, with the composition of tonalite. It is suggested that the stone could be from the Yemeni Corner of Kaaba originated from Makkah batholith, and different from those of İstanbul and Kaaba based on its colour and texture. In the whole world, the Black Stone is possibly the most respected rock believed to be as old as Adam and Eve, and an "Object from Heaven". It is suggested to be glass, granite, agate, pseudometeorite or most popularly stony meteorite. But the origin of the black stone remains the subject of speculation due to a lack of analyses of modern scientific techniques.

Keywords: *Hajar Al-Aswad, Meteorite, Kaaba, Makkah*

1. INTRODUCTION

The Hajar al-Aswad is located on the eastern wall of the Ka'ba in the centre of the Grand Mosque, Islam's most important mosque, in Makkah, Saudi Arabia. It is named as "Object from Heaven, Star of the Paradise and The Black Stone". It contains seven or eight small black pieces of distinct rock cemented together and encased in a silver frame, which leaves an area of [1] ~30 cm in diameter, 1.5 meters above the ground (Figure 1-2).

Besides, six and one additional pieces are believed to be in Istanbul and Edirne, Turkey; four are exhibited in the Sokollu Mehmet Pasha Mosque (Figure 3), one in the mihrab of the Blue Mosque (Figure 4), and one above the entrance of the tomb of Sulaiman the Magnificent (Figure 5). During the preservation of Hacer-ül Esved stone was being renovated, pieces with a total length of 10 cm were torn off from its edges and used in the Sokullu Mehmet Pasha Mosque in Istanbul, which completed its construction in 1571. A sample exists in the Grand Mosque in Edirne (Figure 6), Northwestern Turkey.
The Black Stone is considered to be as old as Adam and Eve, and "Object from Heaven", to serve as the world's first temple, Ka'ba. Muslims traditionally kiss or touch the stone during their pilgrimage to Makkah, known as the Hajj and Umrah. It is considered to be a representation of the unity of all Muslims and one of the most important symbols of Islam. The stone is also possibly the most revered rock in the world. Though various origins have been suggested for the stone; from granite through agate and most likely a stony meteorite, its features and origin is still subject to speculation. Thus, it is aimed to characterize the Black stone, both in Makkah and in Turkey in the light of previous studies with its macroscopic features.

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Figure 1. Black stone in Kaaba.

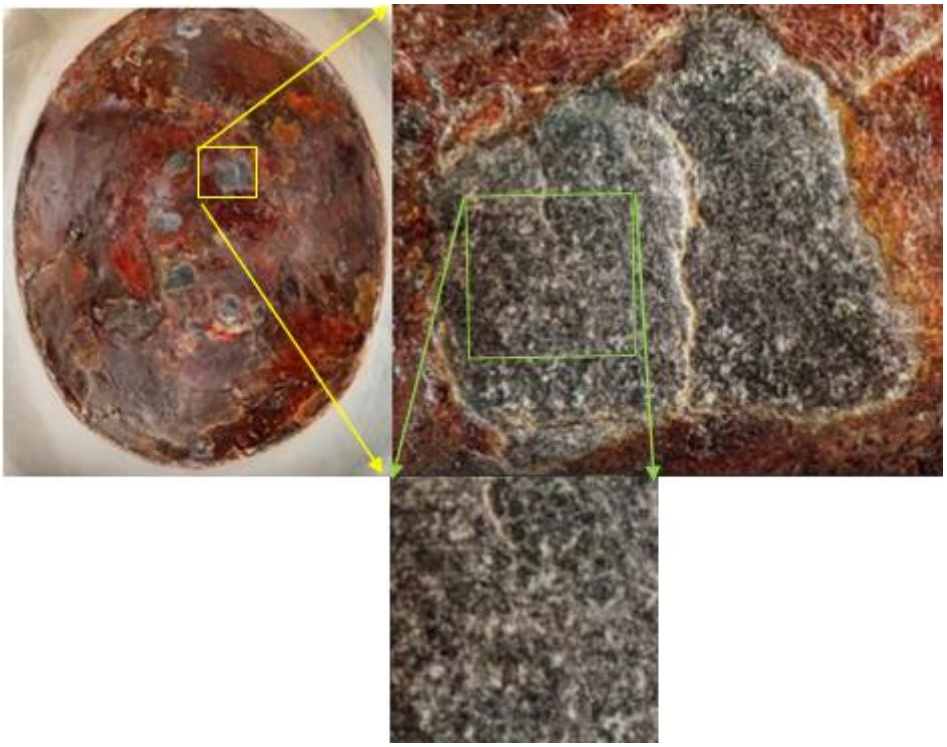

Figure 2. Photograph of the Black stone

2. MATERIAL AND METHOD

The Black stone in Kaaba is the most sacred object in Islam, hence no sample is available to study on. But the detailed pictures of the Black Stone taken by Saudi Government, and that of the stones in Istanbul and Edirne evaluated on the light of the previous studies. An image processing software (Kameram

1.6.1.3) is applied to the Black stone in Kaaba to determine the size of gravels and their crystals. The software was also applied to the Edirne sample to measure the sizes of its constituents and to constrain its modal mineralogical composition.

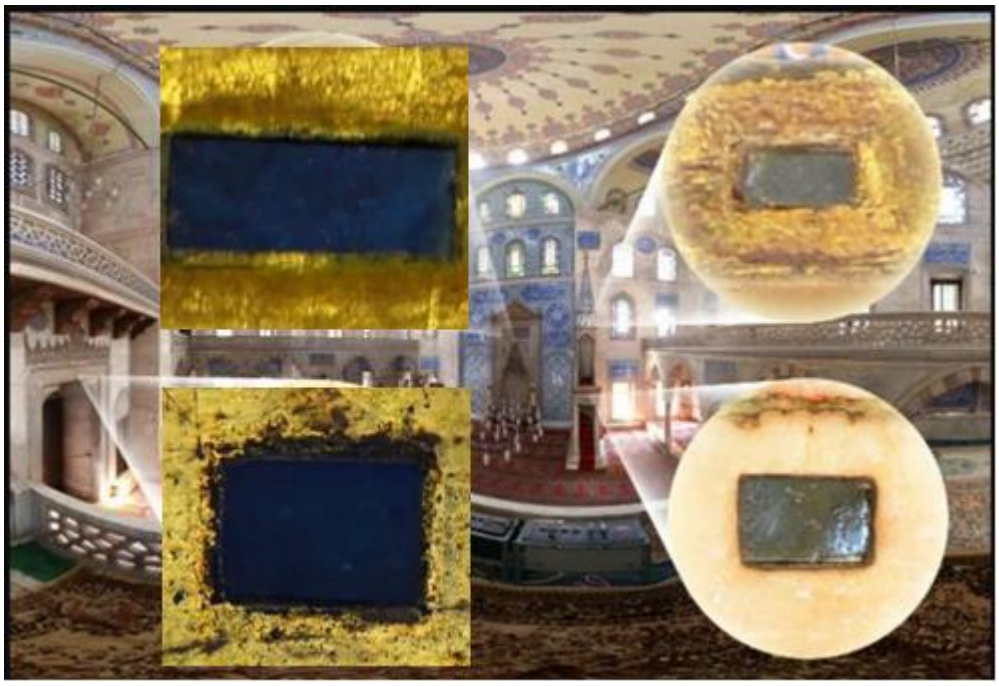

Figure 3. The Sokollu Mehmet Pasa Mosque

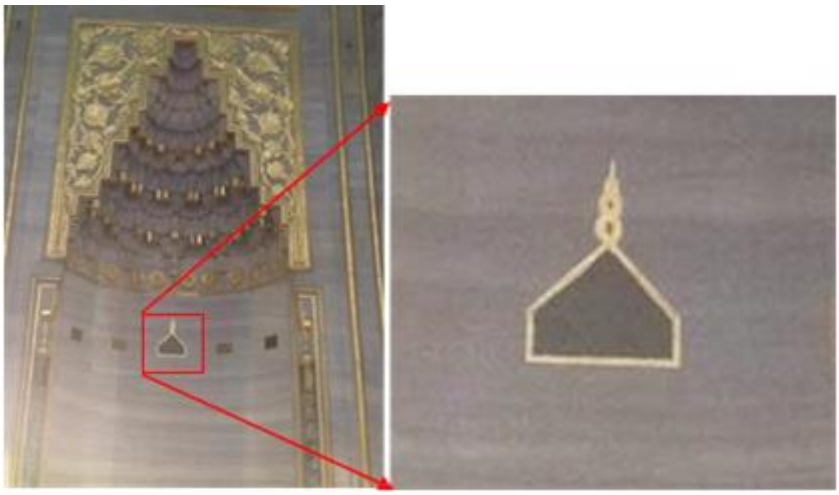

Figure 4. Blue Mosque.

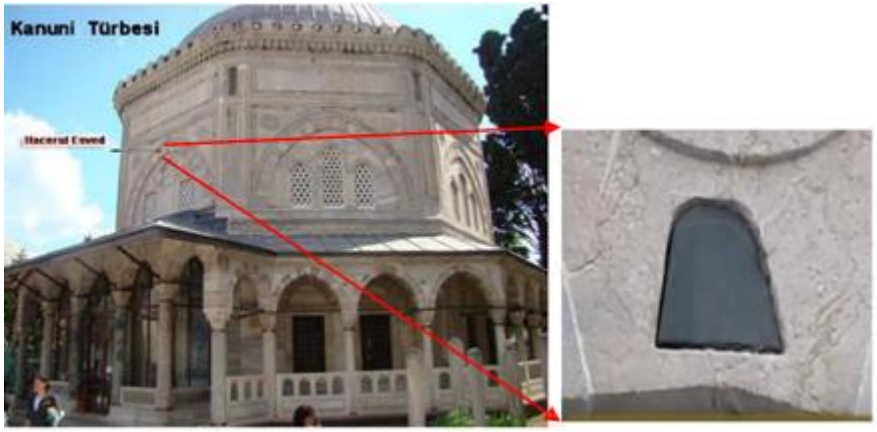

Figure 5. The tomb of Sulaiman the Magnificent

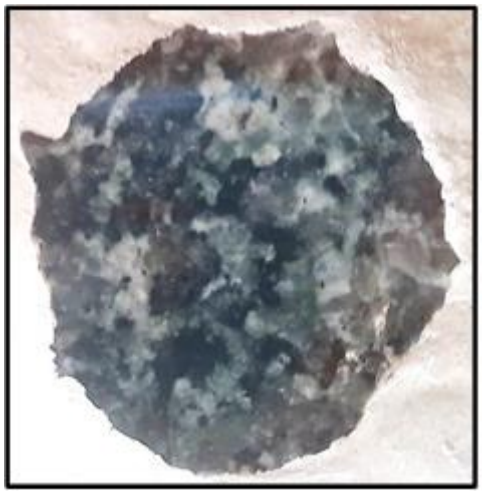

Figure 6. Kaaba stone from the old mosque in Edirne. The figure has a diameter of ~4.5 cm.

3.HISTORY

The Hajar al-Aswad was originally a complete stone. The Islamic prophet Muhammad even placed the stone as one piece into the Kaaba's wall in 605. However, the stone suffered from considerable damage over with time; cracked, repaired, stolen and even burnt: The stone was broken into three pieces by a fire during the Umayyad Caliphate's siege of Makkah in 683 [3]. From Bahrain, Qarmatian warriors led by Abu Tahir al-Qarmati stole the Hajar al-Aswad in 930, kept it in all-Hasa, (Medieval Bahrein) and restored to its original location after twenty-three years, which induce breaking the stone into seven pieces [4]. The Kaaba was burned at an early date, and the stone may have broken into three pieces. The stone included 15 pieces in 1825 [al-Kurdi, 1875; in [5]] (Figure 7). Therefore, the missing pieces can be covered with cement from previous restorations, or they might be lost. Because of this, it is challenging to describe the Stone's original shape and dimensions, but it may be assumed that they were at least 25 X 20 X 20 cm [1]. The Kaaba was burned during Mohammed's rule, between A.D. 570 and A.D. 632, which may have caused the stone to break in A.D. 1050. A man of Al-Mustansir Billah, Egyptian caliph broke to numerous minor pieces in A.D. 1050. In 1626, Mecca was seriously flooded, leading to the fall of three of the walls of the Kaaba [6].

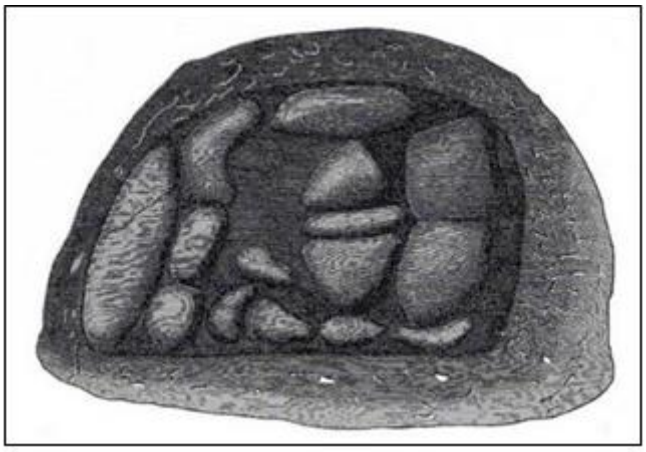

Figure 7. Views of the Black stone's front and side with ~ 16 cm by 10 cm in size [7].

The Black Stone was first pointed out in Western literature by European travellers to Arabia, who visited the Kaaba in the 19th and early 20th centuries. Johann Ludwig Burckhardt visited Makkah and described the stone in 1814 [6] as irregularly shaped oval Hajar Aswad, and about eighteen cm diameter with irregular surfaces. In 1817, Ritter von Laurin had a chance to inspect a fragment of the Stone, which was removed by Muḥammad ʻAlī Bāshā, viceroy of Egypt [8]. He described that it had a pitch-black exterior and a silver-grey, fine-grained interior in which tiny cubes of a bottle-green material were embedded. Thomas E. Lawrence, known as Lawrence of Arabia (1888-1935), had a chance to visit Kaaba [9].

4.FEATURES AND ORIGIN OF THE BLACK STONE

The stone is reported to have blackish and brownish colours. Its matrix is coloured like coal, according to "Ali Bey" [1816 in [7]]. Furthermore, the matrix contains scattered white and yellow spots, tiny, pointed crystals, and maybe feldspar phenocrysts (e.g. [5-7, 10]. However, it is problematic to define its colour as it is composed of various broken pieces. Dietz and McHone [5] point out that the stone is hummocky and "muscled," which demonstrates to considerable hardness, possibly Mohs 7, since the touches of millions of hands have not worn away the stone. The stone has mirror-like luster produced by rubbing, suggesting an aphanitic texture. Detailed picture of the stone (Figure 2) has been revealed first time in 2021 by the Saudi government. It was obtained by the focus stacking method [2] after taking more than 50 hours and producing images that were up to 49.000 megapixels in size. Using an image processing software (Kameram 1.6.1.3), the size of the gravels and its constituents were measured in the Kaaba stone. Figure 2 clearly shows various gravels (9.7-27 mm) and short prismatic black crystals (0.33-0.85 mm in length) in a brownish to reddish cement. It also shows that the stone appears to have an equigranular texture, excluding a volcanic origin.

In general, dark color is observed in all black stones from both Kaaba, and Istanbul. The Black stones in both Kaaba and Sokollu Mehmet Pasa Mosque have discernible long prismatic white crystals (0.64-1.11 mm in Kaaba), similar to plagioclase (Figure 2, Figure 3). The stone is reported to float on water [11].

Paul Partsch [12], the curator of the Austro-Hungarian imperial collection of minerals, was the first to declare the Black Stone as a meteorite stone in 1857 by extensive study. Khan [7] also considers the stone as likely a stony meteorite, and the Catalogue of Meteorites by Prior-Hey [13] lists it as a possible example. However, [5] indicate that the black stone is unlikely to be a stony meteorite as the stone floats. The stone is suggested to have high hardness, possibly Mohs 7 [5], which is also against an origin of stony meteorite. The fractured nature of the stone has also ruled out an origin of a nickel-iron meteorite [5] as nickel-iron meteorites are characterized by hard and a bit ductile structure.

Thomas E. Lawrence (1888-1935) examine the surface of the holy stone by magnifying glass hidden in his dress during pilgrimage/umra, and confirmed that the stone was granite rock, which is dark grey,

composed of mainly quartz, feldspars and mica [9]. However, the predominant dark colour of the stone is not in favour of this suggestion. [5] also point out that an anonymous, Arab geologist who had a chance to examine the stone carefully during the Hajj, explains the existence of clearly discernible diffusion banding in the stone, which points rather clearly to its being an agate [5]. However, Thomsen [1] suggests the Black Stone to be a glass fragment or impactite from the impact of a fragmented meteorite. The crystalline texture of the stone (Figure 2) however, disagrees with this suggestion.

The stone of Edirne is distinct from those of İstanbul and Kaaba, regarding its colour and texture. The composition of the sample is also constrained by modal analysis using Kameram 1.6.1.3 software based on macroscopic features. The Edirne stone contains glassy quartz (0.45-6.57 mm, 47.02 %), white plagioclase (0.81-2.97 mm, 38.49 %) and black amphibole (0.9-2.43 mm, 14.49 %) crystals in a coarse-grained texture (Figure 8), with a composition similar tonalite.

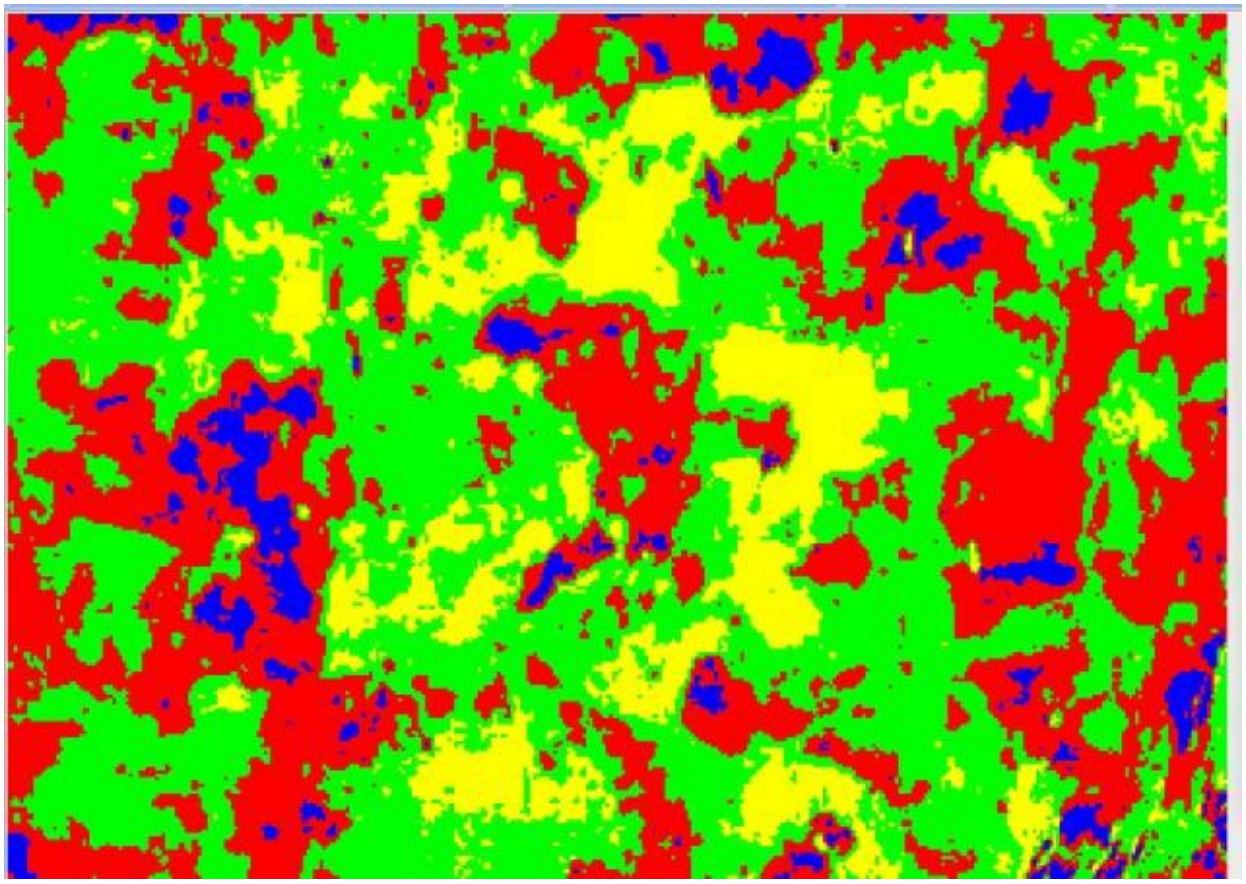

Figure 8. Modal analysis of the Edirne sample.; amphibole (yellow), quartz (green), plagioclase (red, blue)

5.DISCUSSIONS&CONCLUSIONS

Muslims consider the Black Stone as a metaphysical rather than a natural thing, therefore the meteorite suggestion is not likely to be accepted by Muslims. However, no scientific investigation exists on the basis of mineral/rock chemistry and isotopic studies on the Black Stone, its origins remain the subject of speculation.

The texture of the stone of Edirne is different from the those of Kaaba and Istanbul and show similarities to tonalite. Similarly, Bünyamin Kerçin, Imam of the Grand Mosque in Edirne, suggests that it is not from the black stone, but pieces of the Alemanni pillar, the southern corner of the Kaaba (Rükn-ü Yemani, The Yemeni Corner) [14]. Figure 9 shows that the Yemeni corner may contain several types of

stones, but light coloured one ("a" in Figure 9), is similar to the stone of Edirne.

Figure 9. The Yemeni Corner. A refers the stone similar to the one in Edirne.

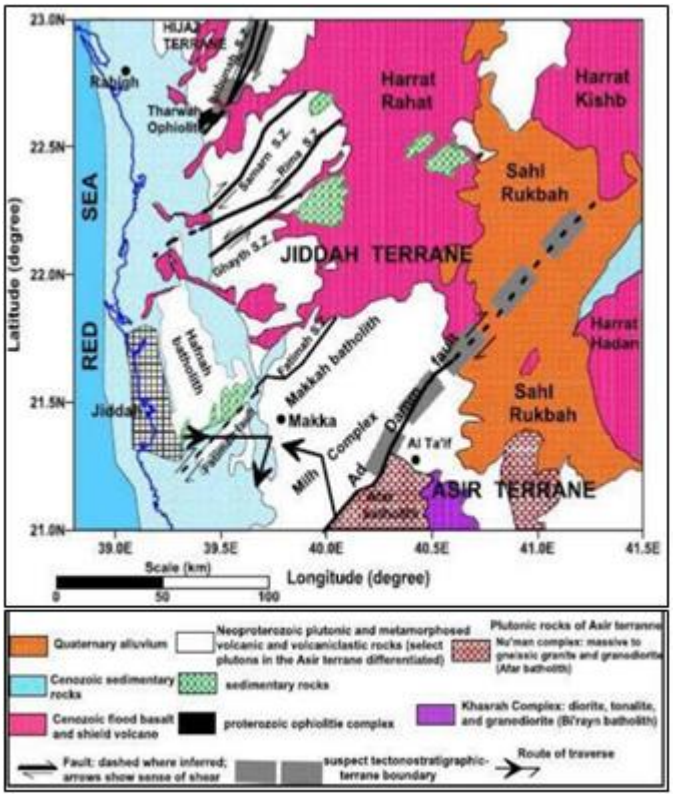

Figure 10. A Geologic map of the Makkah region [17].

Makkah city is located in the Precambrian Arabian shield, which is suggested to have ~50% plutonic and ~50% volcanic and sedimentary rocks, and that granitic rocks make up ~70% of all plutons at the surface [15].

Ju'ranah complex is exposed in the northwest of Makkah batholith (Figure 10), and composed hornblende tonalite and tonalite to granodiorite; minor biotite and biotite-hornblende tonalite [16]. Therefore, it is likely that the Edirne stone may come from the complex.

Declaration of Ethical Standards

As the author of this study, I declare that all ethical standards have been complied with.

Credit Authorship Contribution Statement

In this study, the author contribution rate was determined as 100%.

Declaration of Competing Interest

As the author of this study, I declare that there are no declarations of conflict.

Acknowledement

Thanks to A. Ayar for getting the picture from Sokollu Mehmet Pasha Mosque.

Data Availability

This study does not contain usable data.

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