Examination of analysis results of Oltu stone/side rock samples

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Abstract- Oltu-stone is a stone variety and is used as ornamental material. The carbon ratio is high and resembles lignite coal. The oltu-stone is found in the mountainous areas with a small amount around the Oltu districts of Erzurum. Mining activities are made by taking long efforts. Since it is fragile, special hand tools are used for removal and processing. Although it is very soft when removed from the soil, it has a hardening property when it comes in contact with air. Its processing is easy and fast. It shines as it is used. It is usually black and brown. When it is burned, it burns out like a hart in a flameless manner. It has the ability to attract light objects by electrifying with friction. It is known that there are more than three hundred mines in the region. In this study; Oltu-stone samples are taken from the mining area operating in the region of Oltu of Erzurum province. Then, element % weight ratios, X-ray, SEM of oltu stone samples are determined and examined with graphics. The elements which are generally known as a sediment and used as a semi-precious gemstone in the construction of ornamental material are examined.
Keywords –Oltu stone, Micro analysis test, X-ray, SEM, enrichment

I. INTRODUCTION

Oltu stone, which was extracted as a semi-precious stone in the districts of Oltu and Olur, northeast of Erzurum(Turkey); It is an organic lignite-type stone formed by the carburization of vegetable remains in the underground for millions of years. In other words, Oltu stone is also known as a type of amber stone. Oltu stone is easy to process. It hardens as it is processed and shines as it is used. Oltu stone, Olur dere formation in the part of the early Eocene (55 million years ago), which is under the influence of the high pressure along the fault line, the part of the coal veinlets by the effect of heat and pressure gelling and stone has occurred. This fossilization took millions of years [1]. Fig. 1 shows, Oltu district Dutlu Mountain slopes.

Figure 1. Oltu district Dutlu Mountain(Yeşilbağlar) slopes

The Oltu-Narman Tertiary basin is NE-SW oriented, approaching 14km in width and approximately 82km in length [2]. The unit, which also includes Oltu-stones, shows the characteristics of Alpine Orogenic Zone, in terms of tectonic and dimantological conditions [3]. Oltu stone mine is produced in Kabakuş Mevkii in Oltu district of Erzurum, Dutlu Mountain, Dutlu, Hankaskışla, Güzelsu, Alatarla, Sülünkaya, Günlüce, Ormanağzı, Taşlıköy and Çataksu villages. Oltu stone beds are found in the galleries of 70-80 cm diameter which are opened vertically on the southern slopes of the Dutlu Mountain, north of the Oltu district. Oltu stone veins stuck under pressure, horizontally continues in the form of lenses [4, 5]. Figure 2 shows, oltu stone mine entrance.

Figure 2. Oltu stone mine entrance

Oltu stone reserves are estimated at an height of 1600-1800 m. It is covered with steep slopes and pine forests. It is very difficult to mine in rough terrain. Oltu stone mines are estimated to be around 600 in the region. The oltu stone is removed by the local people from the old ways [1]. The material is mined from mountainous areas perpendicular to the general surface with galleries of 70-80 cm in diameter where only two or three miners can work. Some basic apparatus, such as digging, short handled shovel, hammer and chisel are used for the gallery creating process [6-13]. If a mine is found, cylindrical tunnels extend to 150–200 m by following the veins. Inside galleries, lighting is provided with illuminator or pocket flashlight mounted on the picnic tube. In tunneling work; used as a shovel, shovel, pickaxe and hammer. A boat-shaped wheel is used to remove the excavated soil and the mine. The boats are in the form of a wheelbarrow which is moved with a rope. There are minerals such as lignite, clay, pyrite and resin in the Oltu stone. Oltu stone is very soft when it comes out of the soil but it hardens when it comes into contact with air. Therefore, it is stored in a moist environment until it comes out of the gallery and processed and polished. This mineral weight is extracted with great effort and sold to workshops. It has an important place in the production of jewelry, rosary and ornaments [1]. The actively working mines are located in the villages of Dutlu, Güzelsu, Güllüce and Yeşilbağlar. Although the galleries are not encountered in the mine, the quarry is abandoned in about 150 meters or in case of excessive water from the galleries [14,15]. Figure 3 shows the oltu stone/side rock.

Figure 3. Images of oltu stone/side rock.

Oltu stone is a local economic value for the people of the region. Due to the limited agricultural, industrial and tourism areas, the development of the Oltu stone sector is of great importance for region. Oltu stone embroidery has been carried out by local people for centuries in single and single workshops with simple and simple methods [14,15]. In this study, the microanalysis tests of Oltu stone/side rock samples taken from the Yeşilbağlar quarry of oltu district of Erzurum are interpreted in detail.

II. EXPERIMENTAL PROCEDURE

Oltu stone is a coal type such as stone coal [11-16]. Oltu stone contains 77.95% C, calorific value is about 8064kcal and volatile matter ratio is 45.35%with chemical analyses. Oltu stone includes dominantly carbon organic (amorphous) matter and it includes resinite, semifusinite and fusinite. There are pyrite and hematit minerals [12]. According to the results of chemical analysis; Na_2O- 2.8%, MgO-3.3%, Al2O3-14.3%, SiO_2-42.4%, P_2O_5-0.3%, K_2O-1.6%, CaO-8.2%, TiO_2-0.7%, MnO-1.1%, Fe_2O_3-8.2%, A.Za(glow loss)-8% was determined [16]. Samples used in the experiments were taken from the oltu stone mine in Erzurum's Yeşilbağlar-Olur Areas. In this study, about 6 different oltu stone/side rock and pebbles samples were taken from Erzurum / Oltu stone quarries. Samples were sent to MTA (Mineral Research and Exploration) Laboratories. Here, the microanalysis of the samples X-ray analysis, SEM analysis of the contents of the mineral contents were determined. Then, the application of enrichment methods according to the content of minerals in different areas was investigated.

III. EXPERIMENT AND RESULTS

Sample-A

Sample-A tests; table 1 shows the oltu stone-black tone x-ray micro analysis elemental analysis results. When the results are examined, as seen in Figure 4, C% weight of the sample is observed at around 90% Si value is about 4%.

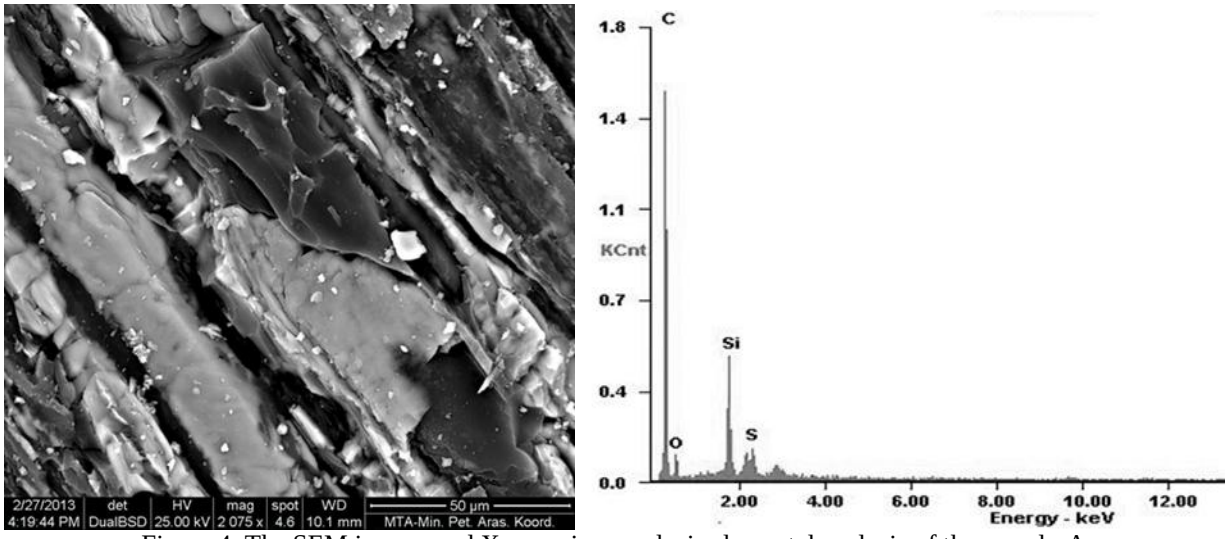

Figure 4. The SEM images and X-ray micro analysis elemental analysis of the sample-A

Table -1. Micro analysis elemental analysis of the sample-A

Element	Wt %	At %	K-Ratio	Z	A	F
C K	87.85	92.19	0.459	1.00	0.52	1.00
O K	7.11	5.60	0.009	0.99	0.13	1.00
Si K	4.12	1.85	0.035	0.95	0.90	1.00
S K	0.92	0.36	0.008	0.95	0.97	1.00
Total	100	100				

kV: 25.00 Tilt: 0.00 Take-off: 35.12 AmpT: 102.4
Det Type: SUTW, Sapphire Res: 128.70 Lsec: 20

Sample-B

Sample-B tests; table 2 shows the micro elemental analysis results. When the results are examined, as shown in Figure 5, it is observed that about 45% of the C content of the sample is around 45%. Oxygen weight is about 27% and Si ratio is about 23%. In addition, trace amounts of Na, Mg, Al, Cl, Ca and Fe elements are found in the sample.

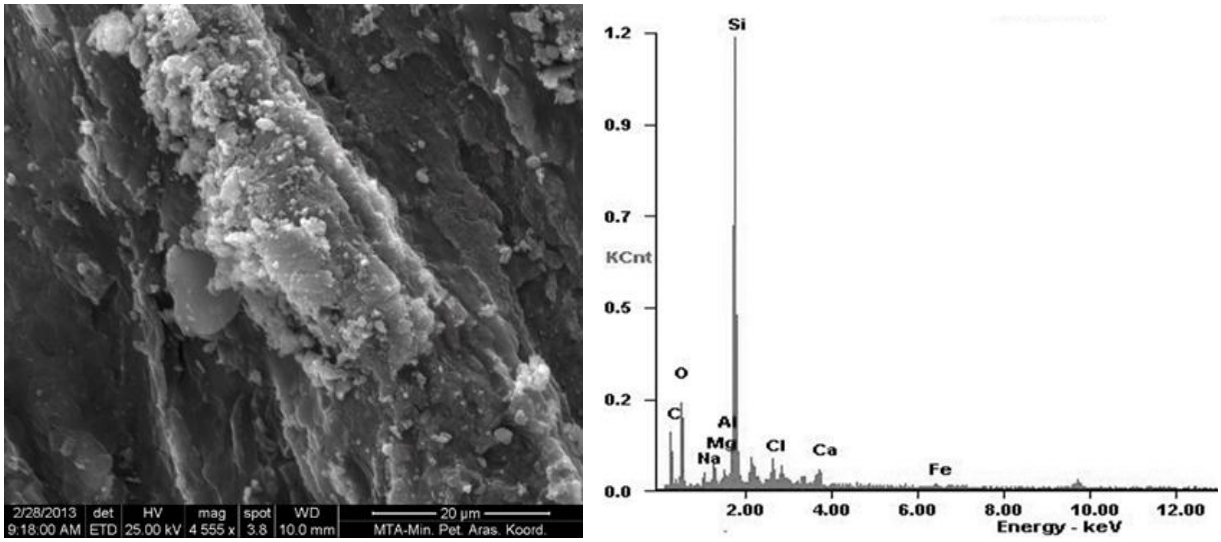

Figure 5. The SEM images and X-ray micro analysis elemental analysis of the sample-B

Table 2. Micro analysis elemental analysis of the sample-B

Element	Wt %	At %	K-Ratio	Z	A	F
C K	43.51	57.18	0.0808	1.02	0.18	1.00
O K	26.87	26.51	0.0462	1.01	0.17	1.00
Na K	0.96	0.66	0.0034	0.94	0.37	1.00
Mg K	1.72	1.12	0.0087	0.97	0.52	1.01
Al K	0.51	0.3	0.0032	0.94	0.65	1.01
Si K	22.85	12.84	0.1727	0.97	0.78	1.00
Cl K	1.32	0.59	0.0096	0.91	0.80	1.00
Ca K	1.45	0.57	0.0129	0.94	0.95	1.00
Fe K	0.8	0.23	0.0070	0.86	1.02	1.00
Total	100	100				

kV: 25.00 Tilt: 0.00 Take-off: 35.00 AmpT: 102.4
Det Type: SUTW, Sapphire Res: 128.70 Lsec: 20

Sample-C

Sample-C Tests; table 3 shows the oltu stone micro elemental analysis results. When the results are examined, as shown in Figure 6, it is observed that about 50% of the Ba weight and 16% of the C% of the sample. Oxygen weight is about 18% and Si ratio is about 2%.

Table 3. Micro analysis elemental analysis of the sample-C

Element	Wt %	At %	K-Ratio	Z	A	F
C K	15.75	39.64	0.0312	1.15	0.17	1.00
O K	18.18	34.33	0.0485	1.13	0.24	1.00
Si K	2.06	2.21	0.0089	1.09	0.40	1.01
S K	13.48	12.7	0.0874	1.08	0.60	1.01
Ba L	50.54	11.12	0.4437	0.84	1.05	1.00
Total	100	100				

kV: 25.00 Tilt: 0.00 Take-off: 35.04 AmpT: 102.4
Det Type: SUTW, Sapphire Res: 128.70 Lsec: 20

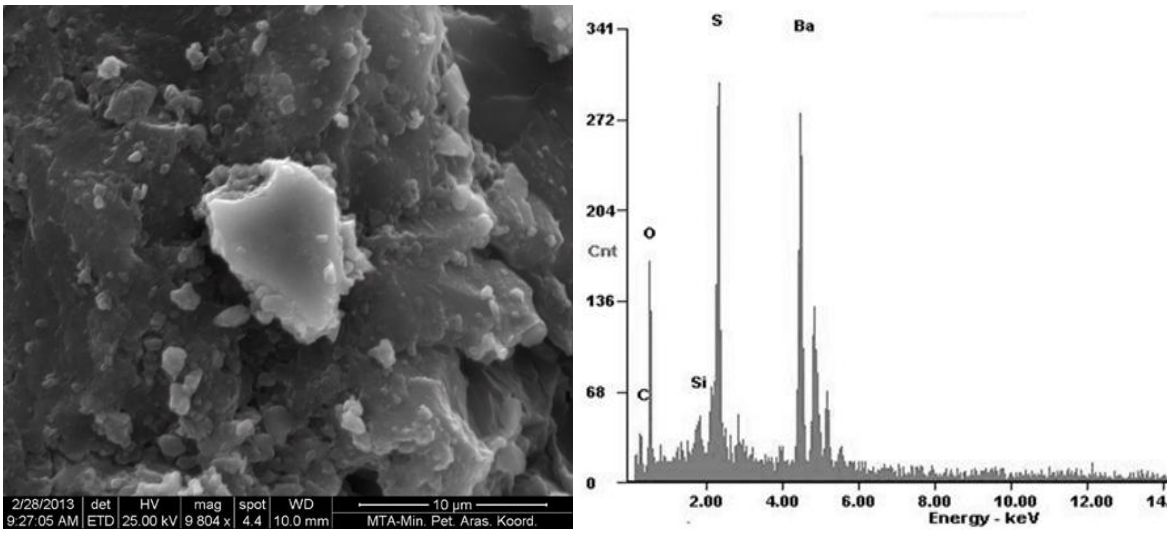

Figure 6. The SEM images and X-ray micro analysis elemental analysis of the sample-C

Sample-D

Sample-D Tests; table 4 shows the oltu stone micro elemental analysis results. When the results are examined, as shown in Figure 7, It is observed that about 41% of the O% of the sample and 25% of the S% of the sample are observed. Magnesium weight is about 11% and Si ratio is about 5%. In addition, Al and Ca elements are found in % 1.

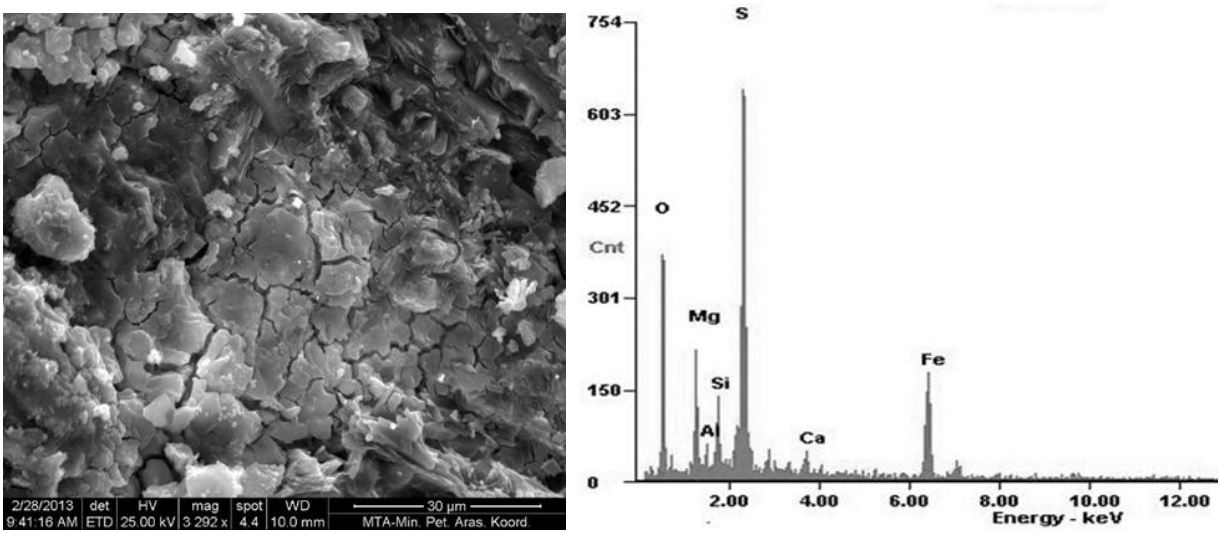

Figure 7. The SEM images and X-ray micro analysis elemental analysis of the sample-D

Table 4. Micro analysis elemental analysis of the sample-D

Element	Wt %	At %	K-Ratio	Z	A	F
O K	40.57	59.06	0.1071	1.04	0.25	1.00
Mg K	10.75	10.3	0.0382	1.00	0.35	1.00
Al K	1.42	1.22	0.0056	0.97	0.40	1.01
Si K	4.47	3.71	0.0237	1.00	0.52	1.01
S K	24.69	17.93	0.1769	0.99	0.72	1.00
Ca K	1.41	0.82	0.0117	0.98	0.84	1.01
Fe K	16.7	6.96	0.1476	0.89	0.99	1.00
Total	100	100				

kV: 25.00 Tilt: 0.00 Take-off: 35.00 AmpT: 102.4
Det Type: SUTW, Sapphire Res: 128.70 Lsec: 20

Sample-E

Sample-E Tests; table 5 shows the oltu stone micro elemental analysis results. When the results are examined, as seen in Figure 8, it is observed that about 6% of the O% of the sample and 37% of the S% of the sample are observed. The weight of iron is about 56% and the Si ratio is about 1%.

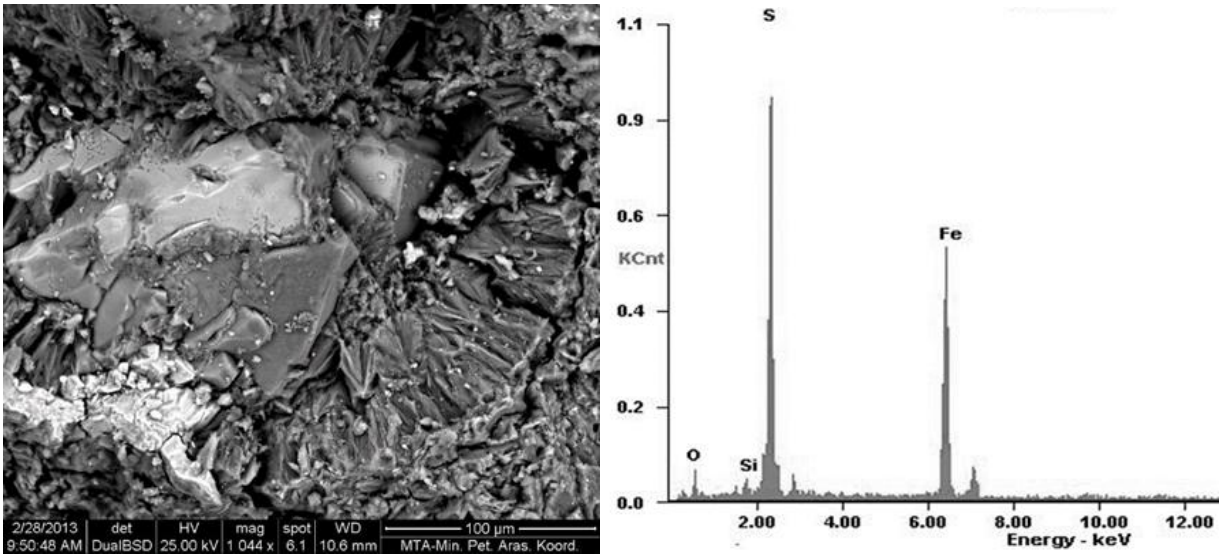

Figure 8. The SEM images and X-ray micro analysis elemental analysis of the sample-E

Table 5. Micro analysis elemental analysis of the sample-E

Element	Wt %	At %	K-Ratio	Z	A	F
O K	6.32	15.31	0.0145	1.10	0.21	1.00
Si K	1.41	1.95	0.0070	1.06	0.46	1.01
S K	36.4	43.99	0.2646	1.05	0.69	1.00
Fe K	55.86	38.76	0.5167	0.95	0.98	1.00
Total	100	100				

kV: 25.00 Tilt: 0.00 Take-off: 35.58 AmpT: 102.4
Det Type: SUTW, Sapphire Res: 128.70 Lsec: 20

Sample-F

Sample-F tests; table 6 shows the oltu stone micro elemental analysis results. When the results are examined, as shown in Figure 9, It is observed that about 45% of the O% of the sample and 25% of the C% of the sample are observed. It has been determined that the weight of Ca is about 31%.

Table 6. Micro analysis elemental analysis of the sample-F

Element	Wt %	At %	K-Ratio	Z	A	F
C K	24.45	36.31	0.1085	1.03	0.43	1.00
O K	44.88	50.04	0.0607	1.01	0.13	1.00
Ca K	30.68	13.65	0.2976	0.95	1.03	1.00
Total	100	100				

kV: 25.00 Tilt: 0.00 Take-off: 35.00 AmpT: 102.4
Det Type: SUTW, Sapphire Res: 128.70 Lsec: 20

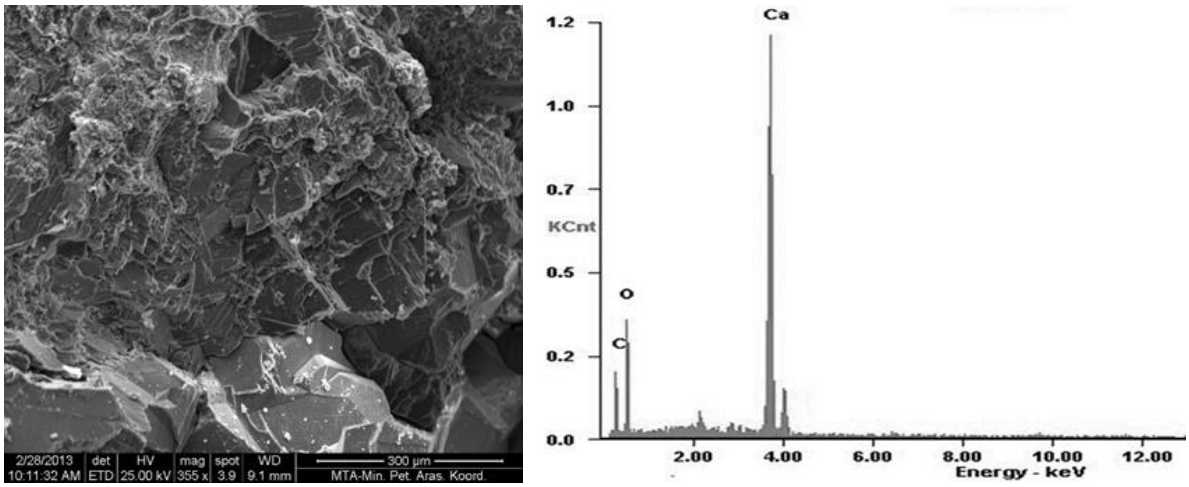

Figure 9. The SEM images and X-ray micro analysis elemental analysis of the sample-F

IV. CONCLUSION

Oltu stone samples generally show the distribution in percentage and weight of the different element. It can be said that Sample1 is pure with about 90% C. The results of the analysis are different because the other samples are taken from the layer in the Oltu stone upper and lower layers. In this work, the elements which are generally known as a sediment and used as a semi-precious gemstone in the construction of ornamental material are examined. In Sample E it is seen that the Fe ratio is very high at 55%. For this, it is advisable to separate iron from the sample by magnetic separation enrichment methods. In Sample-B, the Si ratio was observed to be around 23%. Subjected to magnetic enrichment methods, it can be said that this sample is suitable for use in cement making. Sample-C shows, Ba was detected at a very high rate of about 50%. Barium has various usage areas medicine, paper making, paint, etc. However, barium carbonate is a highly toxic compound and is commonly used in the construction of mouse poison. It is known that Sample-F has Ca content of 31% and that calcium carbonates are used in the production of various materials such as paint, chalk, ceramics and limestone.

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