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Research Article

PETROLOGY STUDY OF ALMOQLAQ INTRUSIVE BODY IN NORTH OF ASADABAD IN HAMEDAN PROVINCE

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ABSTRACT
The study area is located in the West of Iran and in the north of Asadabad. This is the range between Eastern lengths of 00', 48˚ to 15', 48˚, and northern latitudes of 45', 34 to 00', 35˚. This range is limited from north to the asphalt road of Hamadan Qorveh, Sanandaj, and from the East and Southeast, to Asadabad of Kermanshah-Hamedan road, and from the West to Chahardoli plain and from the south to the plains and the town of Asadabad. According to the geological map of the study area, intrusive outcropping of diorite – gabbro of Almoqlaq, and quartz syenite at Almoqlaq mountains. Based on field and petrographic studies, igneous rocks of the study area were named as following, alkali granite, quartz and alkali syenite, quartz syenite, quartz hornblende syenite, syenite, monzonite and diorite hornblende. In geochemistry studies, based on normalized spider diagram with the upper crust, typical of the study area belong to this model, and most of the elements are placed near or on standard line of 1.

Keywords: *Almoqlaq, Geochemistry, Intrusion, Alkali Granite, Quartz Syenite, Hornblende Diorite, Spider Diagram*

INTRODUCTION

The study area is located in the West of Iran and in the north of Asadabad. This is the range between Eastern lengths of 00', 48˚ to 15', 48˚, and northern latitudes of 45', 34 to 00', 35˚ (Figure 1). This range is limited from north to the asphalt road of Hamadan Qorveh, Sanandaj, and from the East and Southeast, to Asadabad of Kermanshah - Hamedan road, and from the West to Chahardoli plain and from the south to the plains and the town of Asadabad.

In the North region, there are located Qeshlaq and Pahnebar and Hamekasi, and in the East it is limited to the villages of Ali Baba, Akhtehchi, Lower hand Tajiabad and DEHNO and from the southeast it is limited to, Rasulabad village, from the west it is limited to the villages of Qarakand, Poshtdarband, Gholdareh, Pirmalu, Charuq, and from the south it is limited to villages of Tarkhinabad and the town of Asadabad (Figure 2).

Access to the Area

From Hamedan, this area is accessible by two paved roads. One by Hamedan -Asadabad road, in which, the study area is located in its West, and from Hamadan to the highest point of the road in Asadabad Gorge which is about 35 km away, and from there, via dirt road which was constructed by Department of Telecommunications, and then, by the ways paved for native access, access into the mountains of Almuglaq.

Other road is from Hamadan to Sanandaj, from asphalt way to Hamekasi village, with a length of 25 km, and from there, to the village of Baba Ali, and lump iron ore. Also, by dirt- gravel roads, from Asadabad or from Hamekasi village, everyone can access to the plain of Chardoli and to Qarakand village, and then, by a narrow dirt road again to foothills of Almoqlaq (Figure 2).

Almoqlaq peak height is 2993 meters above sea level. Irregularities in the area are in the connection with lithological characteristics and tectonic phenomena, and from the perspective of the formation geomorphological Almoqlaq cone of High Mountain located in the proximity of Mount Alvand, its slope is moderate, and overall appearance is affected by the intrusion of Almoqlaq and evokes a dome-shaped

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bulge in the mind. Almoqlaq area, from the perspective of structural geology of Iran, is located in Sanandaj - Sirjan and has general characteristics of this zone.

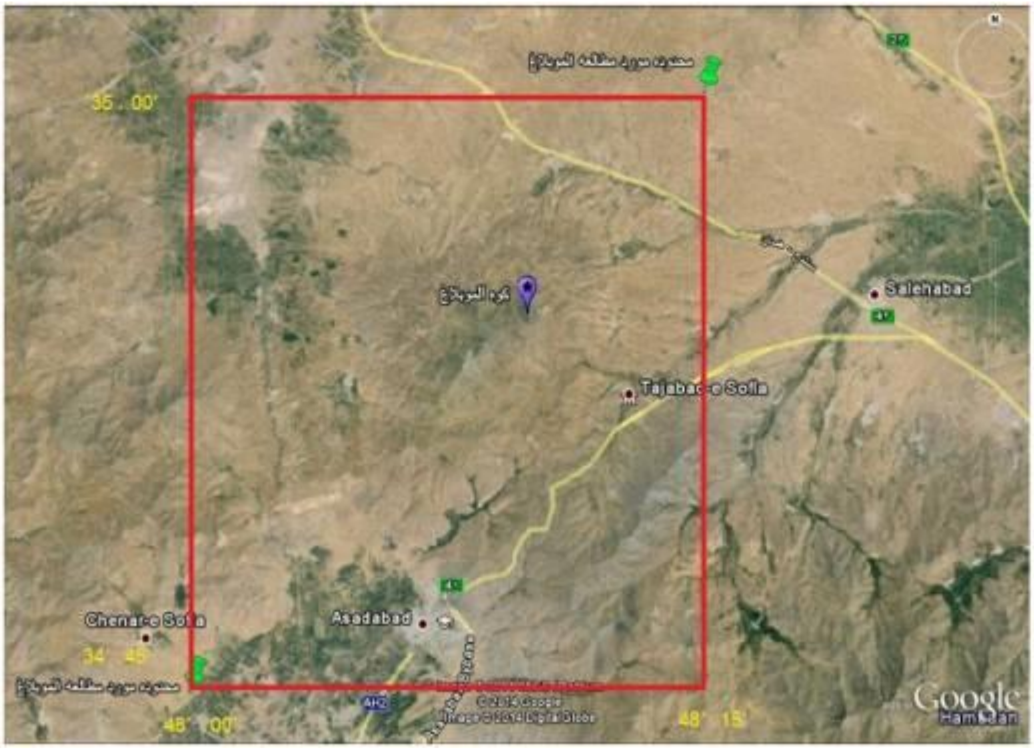

Figure 1: Satellite Image of the Study Area *(Source: Google Earth)*

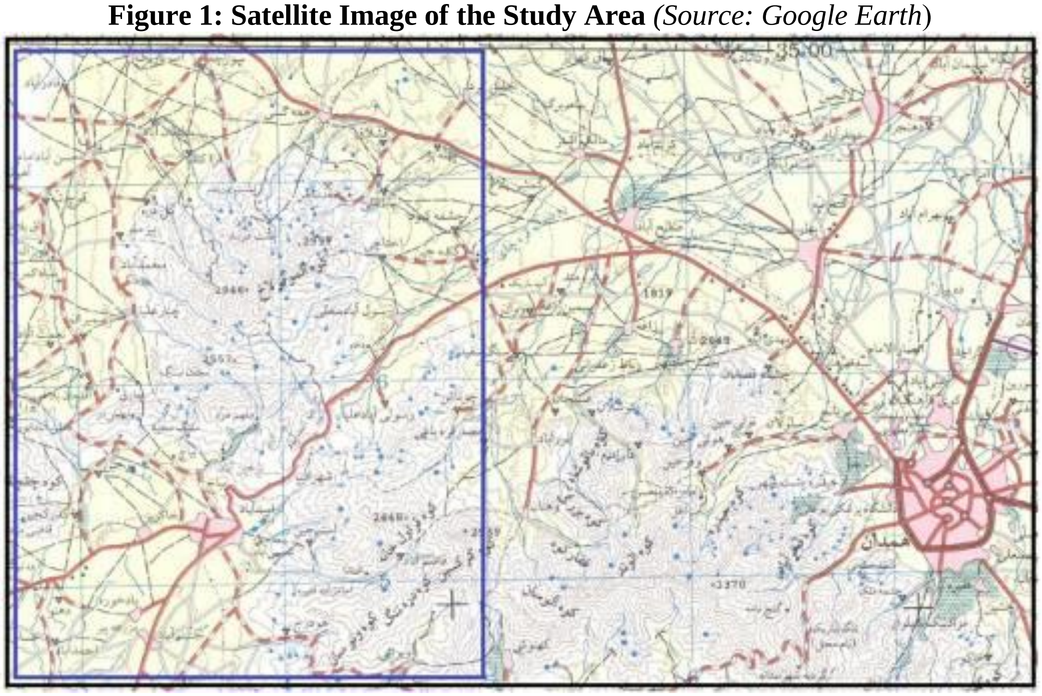
Figure 2: Map of Access Roads to the Study Area (topographic map 1: 250,000 Hamadan, Armed Forces Geographical Organization, 2001) [PERSIAN WORDS MUST BE REPLACED WITH ENGLISH WORDS]

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Intrusive Bodies of Study Area

A - Almoqlaq Masses of Diorite – Gabbro

This mass is exposed at three points, but from the perspective of development, is much smaller than the mass of Alvand gabbro.

Among these deposits, there are a number of dikes or Apophyses with microdioritic – dolerite combinations, which have genetic ties with the masses of diorite - gabbro of Almoqlaq. Stones related to the mass are more likely from gray to light gray with green and sometimes dark spots. The masses, in 17 ± 144 million years (late Jurassic), had experienced a slight-average change.

B - Mass of Quartz Syenite in the Mountains of Almoqlaq

In Almoqlaq Mountains, there are many outcrops of quartz syenite rocks which are a combination of different cognitive stone, inclusion quartz syenite, granodiorite and quartz micro Monsosyenite. These rocks have gentle topography and for the most part, they are covered by debris. Sometimes, in small quantities, they are cut by alkaline granites veins.

This mass is affected by the change processes, Metasomatism and tectonic stress and greatly altered, and has endured at least a change event in the green schist.

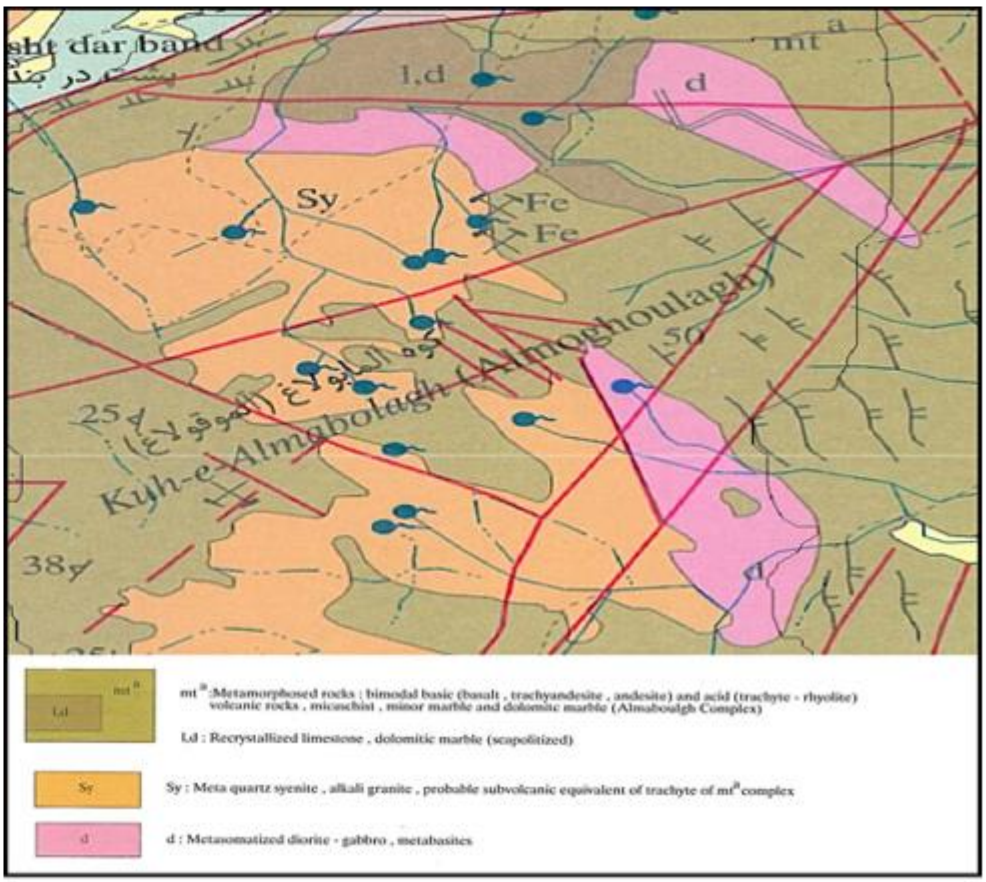

Figure 3: Map of the Rocky Units of Almoqlaq Mountain (Geological Map 000/100: 1, Tuyserkan Sheet Geological Survey, 2003)

Alvand and Almoqlaq intrusive and the shape of many of the deposits in the area, especially schist, phyllite and Micaschist have caused the mechanism of fault in the study area are well recognized. Overall, global fault and large drift in this area are not known.

Most of the faults are in the NE-SW and NW-SE, however, the main structures are toward the general trend of Zagros and Steep slope of layers and foliations are more to the northeast.
In Almoqlaq Mountain, dominant foliation with the construction of the dome, are in relative harmony and the general direction of layering and foliation are formed parallel to syenite mass.
Known mineral indications in the study area in summary includes the mineral iron, which is in the area of the north, exposed in the village of Baba Ali and Chinar Abbas Khan. Iron ore of Baba Ali Cutie is relatively high and is in operation.
Mentioned mass is located in skarn deposits of metasomatized and is gained by Penumatolitic fluids and hydrothermal solutions.

MATERIALS AND METHODS

Methodology

In order to systematically describe the texture of rocks and minerals of the area under study, the petrographic study of igneous rocks, factors and conditions involved was conducted and these factors cause the diversity of igneous rocks Area. Almoqlaq protrusions in the region are inner igneous rocks and Outer igneous rocks.
Igneous rocks of Almoqlaq mountains make up the bulk in which petrographic taken place on them. In the next step, to investigate the geochemical elements and change detection elements during the freezing process, and also determine the type of magma mass, it was selected a few examples of healthy and altered sections of the masses, and it was tried that spatial distribution systems influence on the set. Selected samples were tested by XRF method, chemical analysis of the data in different petrological diagrams in order to understand better the evolution of magmatic processes, as well as situational awareness of Geotectonic.

RESULTS AND DISCUSSION

Observations and Results

To study the geology of the region during field studies, and preparation of thin sections of rocks, igneous rocks of studied area were named in the following types, which include: alkali granite, quartz and alkali syenite, quartz syenite, quartz hornblende syenite, syenite, monzonite and diorite hornblende. Thin sections of rocks can be seen in Figures 4 to 10.

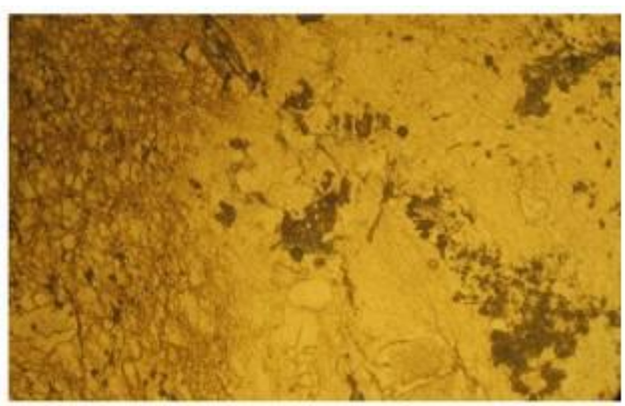

Figure 4: Quartz and Bracing in the Form of Pheno- Crystal with Variances of Orthosis Pertite in the Alkali Granite Stone
(left picture is at XPL light and the right side is in PPL light, and in both forms, the magnification is 40 and the field of view is 4 mm)

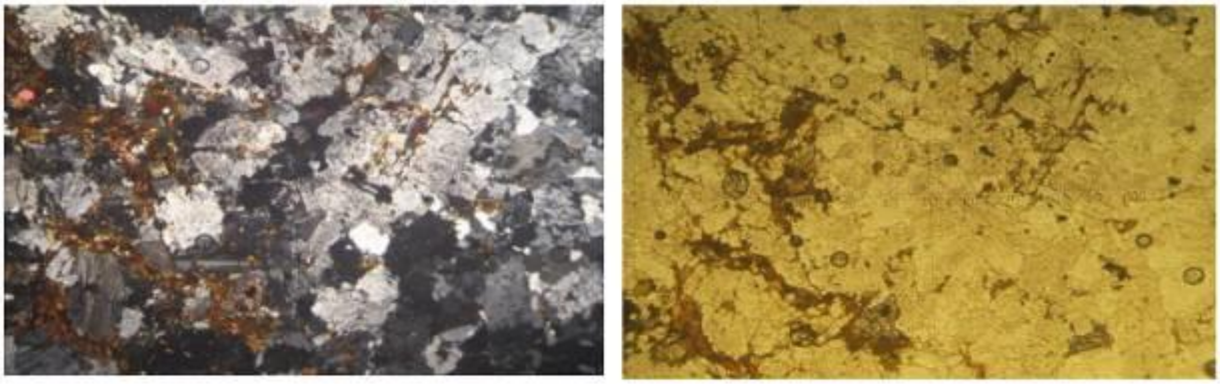

Figure 5: Alkali Pertite Feldspar, Plagioclase Twins Made with Synthetic Quartz and Biotite Quartz Syenite Alkali Rocks
(left picture is at XPL light and the right side is in PPL light, and in both forms, the magnification is 40 and the field of view is 4 mm)

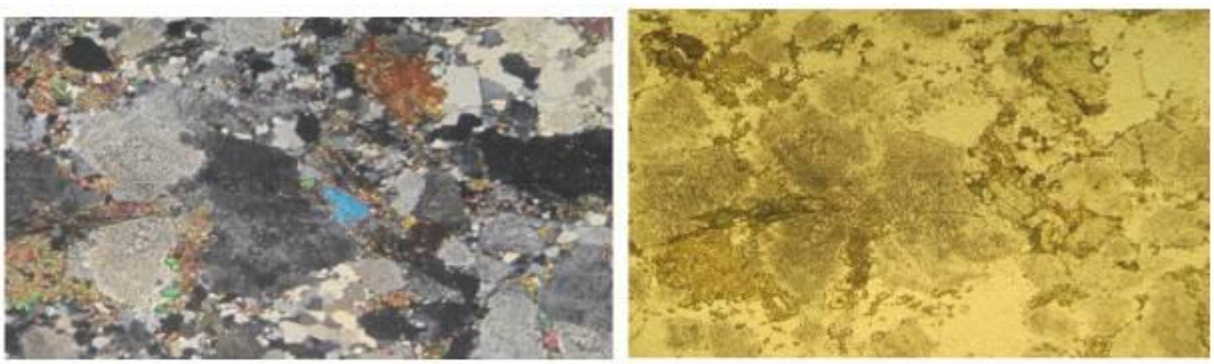

Figure 6: Feldspar, Quartz, Epidote and Chlorite and Sphene, in Quartz Syenite
(left picture is at XPL light and the right side is in PPL light, and in both forms, the magnification is 40 and the field of view is 4 mm)

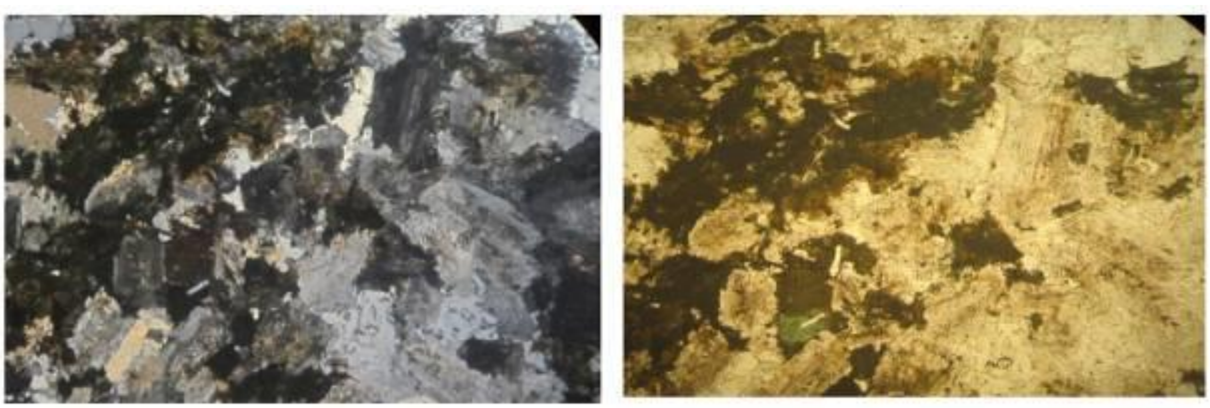

Figure 7: Feldspar, Quartz, and Green Hornblende and Apatite in Quartz Hornblende Syenite Rock
(left picture is at XPL light and the right side is in PPL light, and in both forms, the magnification is 40 and the field of view is 4 mm)

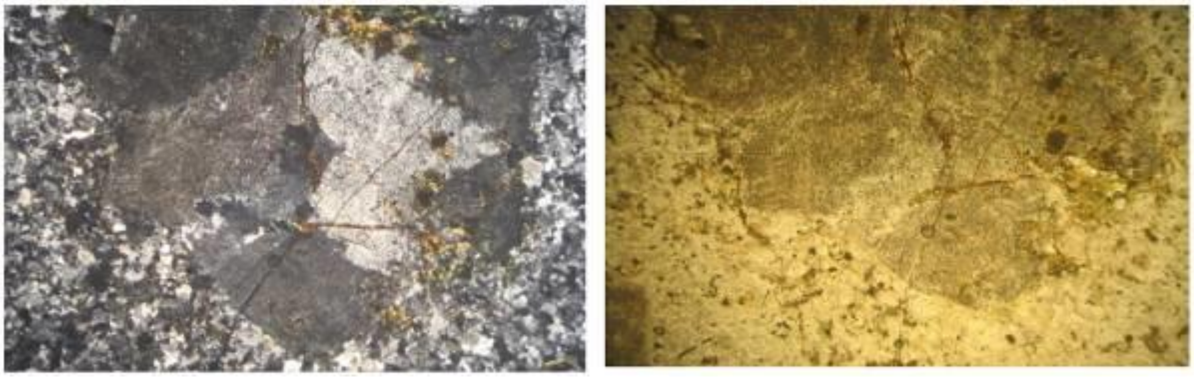

Figure 8: Porphyritic Texture, Coarse Crystals Ectomorph, and Sub Atomorph Feldspar, Quartz, Chlorite Apec in Syenite Rock

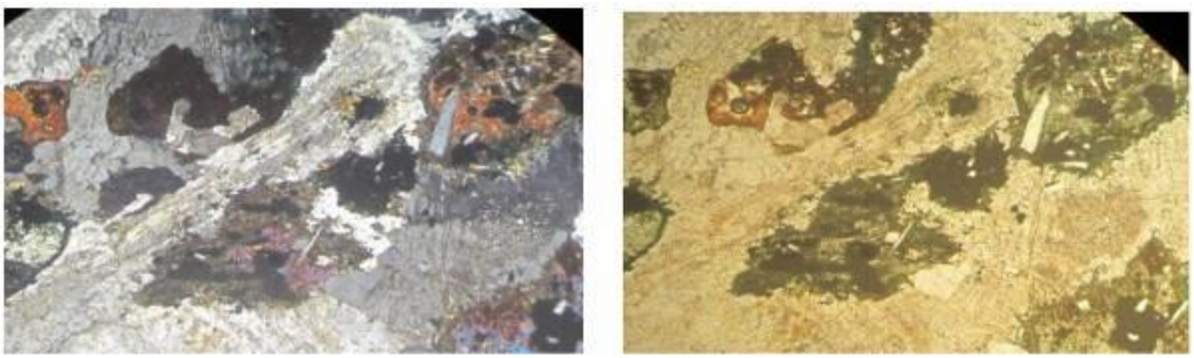

Figure 9: Arthritis, Hornblende, Apatite, Opaque, Plagioclase Cerrusite in Monzonite Rock
(left picture is at XPL light and the right side is in PPL light, and in both forms, the magnification is 40 and the field of view is 4 mm)

Figure 10: Hornblende, Apatite, Opaque, Hornblende in Diorite Epidote Stone
(left picture is at XPL light and the right side is in PPL light, and in both forms, the magnification is 40 and the field of view is 4 mm)

Geochemistry

In the diagram Middlemost (1985), it is used of alkali oxides ($Na2O$ + $K2O$) in the silica of $SiO2$ (Shkl-4). As we can see in the diagram, ten samples were used namely, four samples in quartz monzonite border, one sample in monzonite and a sample in monzonite quartz border a sample is located on the border of quartz monzonite and granite, two located within granite, a sample is located in granite and granodiorite border and a sample located within the gabbro.

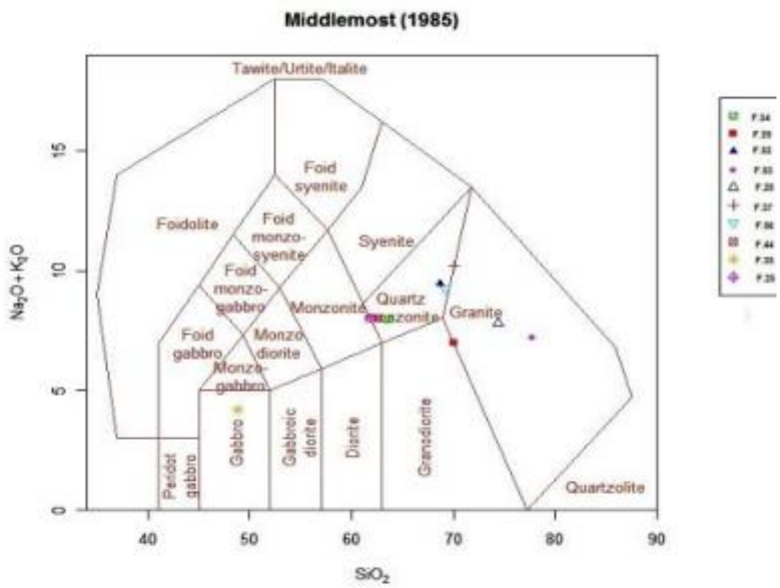

Figure 11: Total Alkali Oxide (Na2O + K2O), Against Silica (SiO2) (Middlemost, 1985)

Delarosh *et al.*, classification (1980) is based on cationic core elements ratios, and expressed as mg cation. In this category, the results are plotted on a graph of two variables of XY and using graphical parameters of R1, R2. In this diagram, R1 is placed in the X-axis, and R2 is located Y-axis. The cation graph defined by R2, R1, which is = 4 Si-11 (Na + K) -2 (Fe + Ti) R1 and R2 = 6Ca + 2Mg + Al. Based on the chart below four samples of rocks studied area, ranging from quartz monzonite a sample of gabbro, a sample is within the granodiorite, three are in the range of granite, and an example is in the range between quartz alkali syenite and granite (Figure 12).

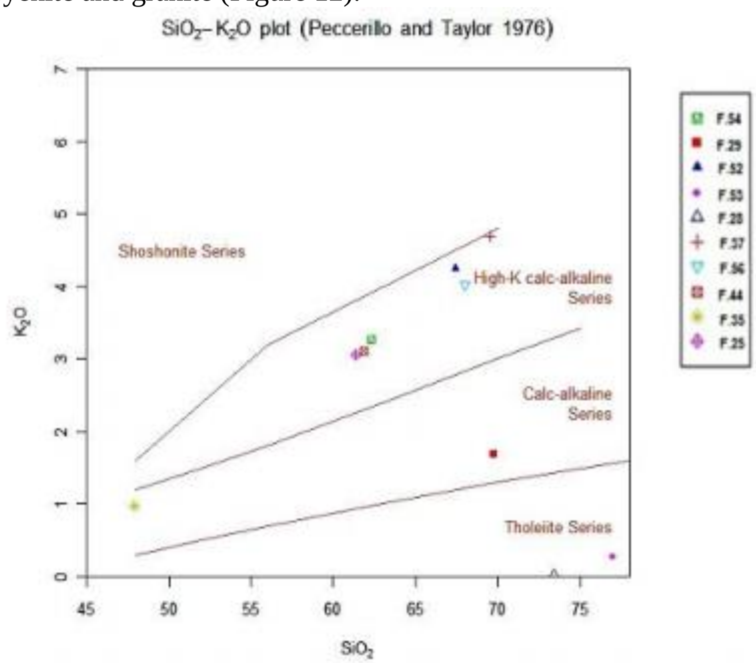

Figure 12: Classification Charts of Delarosh *et al.*, 1980

Change plot of K2O versus SiO2 (Peccerillo and Taylor, 1976) are presented by changes in weight percentage, the two oxide K2O and SiO2, and it has been shown, 4 magmatic series tholeiitic, calc-alkaline, calc-alkaline which are rich in potassium and Shoshsonitic. According to this chart, two samples of rocks are located in tholeites range, two are in the range of calc-alkaline series, six samples are located in the series of calc-alkaline and rich in potassium (Figure 13).

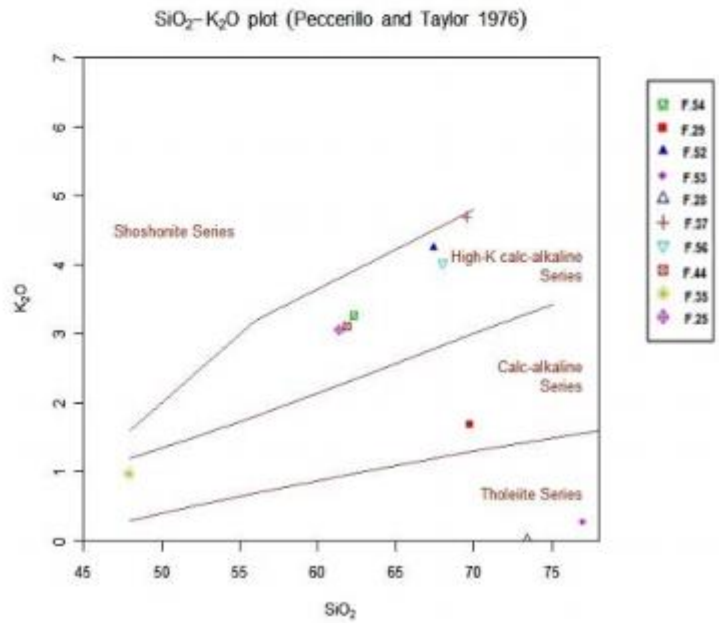

Figure 13: Change Plot of K2O Versus SiO2 (Peccerillo and Taylor, 1976)

The classification of rocks on chart, (PQ chart Debon & Le Fort) was used by parameters P = K- (Na + Ca) and Q = Si / 3 - (K + Na + 2Ca / 3). With regard to this chart of the rocks in studied area, there are placed a sample of gabbro, two of tonalite, a sample of granodiorite sample, two samples of quartz monzonite, three samples of quartz, and one sample are located out of the defined range (Figure 13).

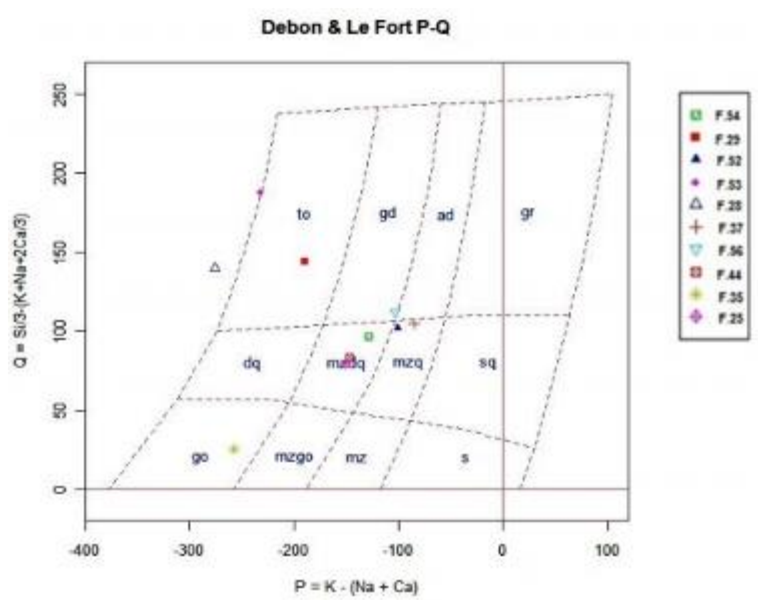

Figure 13: Classification of Rocks Based on the Diagram (Debon & Le Fort PQ)

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To evaluate changes in magma, in old than the original magma, as well as their origin and genetic relationship, the spider diagrams was used. According to this model, nearly all elements show enrichment, such as Th, U, Rb, with the exception of potassium, compared to primitive mantle. Enrichment of samples in the range of LILE, could be the result of magma fractionation and crustal contamination. Elements of Zr, Th, Y, have a positive anomaly, and these elements can indicate infection with the upper crust (Figure 14).

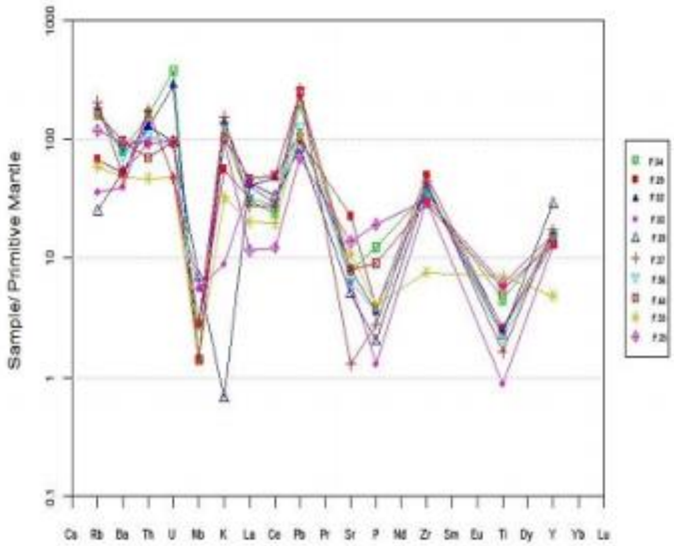

Figure 14: Charts the Norm Sample of the Study Area, with Primitive Mantle & MacDonough Sun 1989

According to this model, the Nb element has negative anomaly, and to the upper crust, suggesting the depletion. Elements of Y, Zr are also central to the case, which has enriched and the positive anomalies of these elements may indicate infection with the upper crust. Most elements are near or on the standard line 1, the Upper crust (Figure -15)

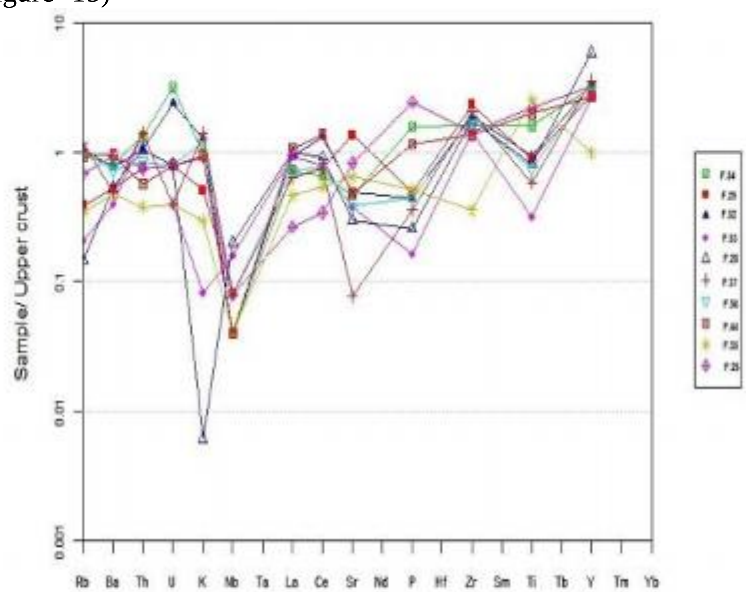

Figure 15: Normalized Charts, Samples of the Study Area, with the Upper Crust Taylor & Mclennan 1985

Conclusion

According to petrographic studies, most igneous rocks of the study area, such as:

Quartz syenite, which is a medium-grained texture and Porphyric. Syenite and quartz syenite and plutonic rocks form the bulk of the region. Quartz hornblende syenite, is a medium-grained texture, and little alteration in them. The stone, after the quartz syenite, forming the largest rocks in the study area. Alkali granite studied, mostly middle-crystal, and is a Porphyric tissue, the tissue, indicating shallow magma crystallization, and are often helococrate, or Lococrate. Other gems of the study area, syenite, which are without quartz or quartz-poor, and pur tissue. Alkaline quartz syenite, this stone is structured grain. Monzonite, monzonite of the area is gray, and has an average grain texture. Hornblende diorite, medium-grained texture, and rich hornblende and plagioclase, and the sample-and-white to gray.

These rocks are the main minerals include quartz, feldspar, plagioclase, hornblende, and minor minerals, not including Apec, and sphene, and biotite, and secondary minerals, chlorite and sericite are included. According to the graph, normalized samples studied area, with the upper crust, rocks of the study area belong to this pattern, and most elements are near or on line 1 standard.

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