

## PETROLOGY AND PETROGRAPHY OF VOLCANIC ROCKS IN NORTH-EAST SAVEH, IRAN

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**Abstract-** This paper is related to the geology of implementation studies master range area of 100 square kilometers located in the North-East of Saveh, Iran. The range at East longitudinal between 50° 25' to 50° 36' and the North latitude is 35° 7' to 35° 10'. Youngest rocks were of the area related to Oligocene and oldest rocks ancient most are related with age Eocene. The faults crop out with trends: north, north East and more are dikes in units andesite and rhyolite that related to the Eocene age and, most of them are andesite and rhyolite. Based on the charts have been determine the tectonic environment of within the study area arc islands and active continental margins.

**Keywords:** Petrology, Petrography, Volcanic Rocks, North-East Saveh.

### I. INTRODUCTION

The region of study is in the eastern lengths of 50° 25' to 50° 36' and northern widths 35° 7' to 35° 10' in the 15 km to north east of Saveh in the Markazi province, Iran which the area of the mentioned region is 100 k squares meter. In this region there is a wide range of igneous rocks made of a various of intrusive and outputs to the tertiary age and some sedimentary units with Eocene-Oligocene ages and younger than that. In this research the output igneous intrusions were studied.

These intrusions have got a various lithology including rhyolite, rhyodacite, trachyandesite, andesite, quartz andesite and andesite that rhyolites have the most volume among them. In Iran structural-geological divisions (Eshtocklin, 1968; Nabavi; 1355; Berberian and King, 1981) this region is belonged to the Urmia volcanic belt-Dokhtar and a part of central Iran zone. This region has got desert weather. The average precipitation in the last 30 years in this region was equal to 50.8 mm and regarding the average weather temperature, the maximum temperature is about 24.13 Celsius degrees and the minimum of that is around 18.42 Celsius degrees during a year.

The topography of this region is rugged and there is no river, just there are many flood channels in this region, the maximum height of the region is 1556 m and the minimum of that is 1209 m from the sea level.

The main objectives of this research contains identification and nominating all the types of output rocks of the north east of Saveh, Iran and reviewing the structural and stratigraphic connections between these rocks and other units of the region, also description of the Lithology and Petrographic of these units and submission of geochemical charts and diagrams and petro logical interpretation of under study region rocks.

For achieving these objectives, firstly we needed to collect different information containing previous existing reports of the region, topographic maps of Saveh and Farajabad with the measure of 1:50000; Geological map of Saveh by the measure of 1:25000 (Figure 1).

After librarian studies and literature reviews and reviewing all the existing information, planning for desert operations and sampling was started. During the desert operations 80 sample rocks were picked that thin section was taken from 50 of them. After petrographic studies 10 samples were chosen for the XRF chemical analysis. Data derived from the chemical analyses were processed by GCDkit software and at last by use of derived results, the petrographic, geochemistry and petrology reviewing were started.

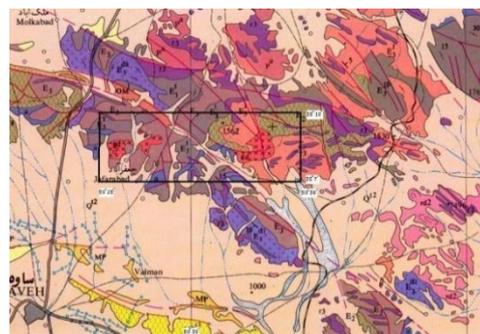


Figure 1. The geological map of the under study region (Derived from the Saveh map in measure of 1:25000, Kaya and et al, 1978)

The access way to the region is through the highway of Tehran-Saveh and the under study region is in the both sides of the road. This region is located between the old road of Saveh-Jafarabad and Railway tracks of Tehran-Qom (Figure 2).

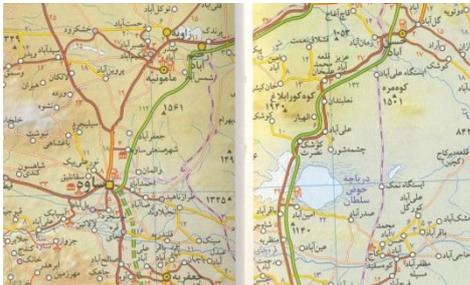


Figure 2. Road connections of the under study region

## II. GENERAL GEOLOGY OF THE REGION

The region is in the 15 km of north east of Saveh and this is a part of central Iran zone and mainly is made of igneous rocks of (diffusion and output) Tertiary Urmia-Dokhtar zone. According to the geology 1:250000 square map of Saveh (Kaya and et al, 1978), the original stone sculptures of this region consist of sedimentary and igneous bodies. Output structures of the North East Saveh are belonging to the Eocene and after that and consists of rhyolite and basaltic andesite units. This region must be known as a poor wrinkling region but has many faults. Most of the faults in this region are linear faults.

In the study region, Dykes with different thickness and material are seen and the most of the outcrops of them are in the units E\_3^1 and T\_3 and their age is related to Eocene and they are made of Eocene andesite and rhyolite. Ignimbrite seen in the northwestern part of the region, are with glass mettle and a rhyolite composition and main minerals of them are plagioclase that are analyzed to Seri cite. There are a small amount of Opec minerals in these rocks. Chlorite, calcite and hematite are the Secondary minerals of these rocks.

### A. Stratigraphic of the Study Region

In the lower Oligocene, tectonic movements that have affected the whole country of Iran, also caused compressions in Saveh region that has finished the Eocene rift activity and closed it and eventually elevated the output rocks whose establishment and Replacements have been associated with the large region fractures (Aoj and Kooshk Nosrat faults). From the petro graphical point of view, generally the region rocks are rhyolite, rhyodacite and andesite sometimes calcite is located in them because alteration. There alkaline feldspar and plagioclase also have been altered.

### B. Lithology

Here the rocks of the study region will be explained.

#### B.1. Rhyolites

They have porphyritic texture. Their crystals Include quartz, alkali Feldspar and Plagioclase as well as minerals Calcite, hematite and chlorite in their structures.

Most of the crystals have a diameter of 0.5 mm to 1.5 mm (Figure 3).

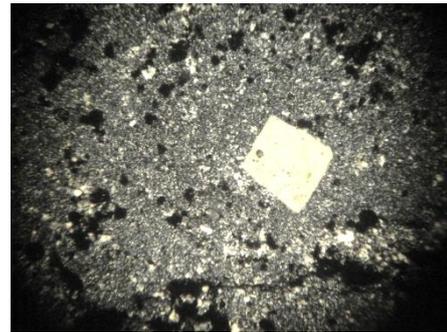


Figure 3. Microscopic section of Rhyolite (XPL, 50x)

#### B.2. Rhyodacite

It has a porphyritic texture, containing crystals of Quartz, plagioclase and alkali Feldspar and also contains OPEC minerals, chlorite and Calcite. Diameter of quartz crystals is less than 0.1 mm, Plagioclase crystals less than 1.5 mm and alkali Feldspar of Artuz type, is less than 0.5 mm. Zoning is observed as Plagioclase minerals (Figure 4).

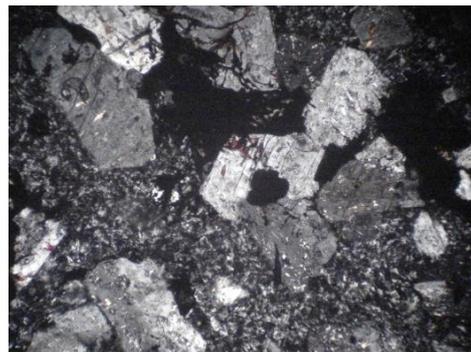


Figure 4. Microscopic section of rhyodacite (XPL, 50x)

#### B.3. Trachyandesitic

It has a porphyritic texture. The Plagioclase crystals within it are shaped to their half and have poly-synthetic form of twinning. Alkali feldspar is seen as half of the figure. Its crystals diameter is less than 0.5 mm. Crystals of quartz are seen as amorphous and granulated (Figure 5).

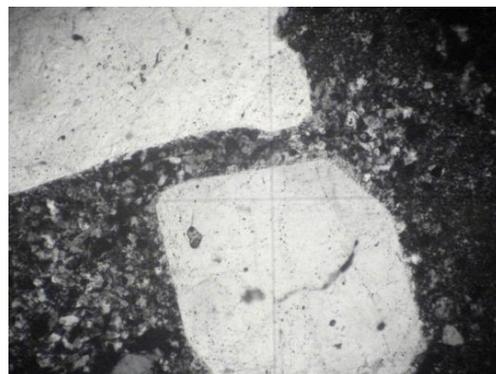


Figure 5. Trachyandesitic microscopic cross (XPL, 50x)

#### B.4. Quartz andesite

It has porphyritic texture and consists of plagioclase, alkali feldspar, quartz, OPEC, hematite and chlorite crystals. Plagioclase contains poly-synthetic twinning and crystals diameter is less than 1.5 mm. Quartz crystals are in amorphous form and they are scattered and their diameter is less than 0.5 mm. Alkali feldspar crystals are seen as fine objects and with quartz crystals (Figure 6).

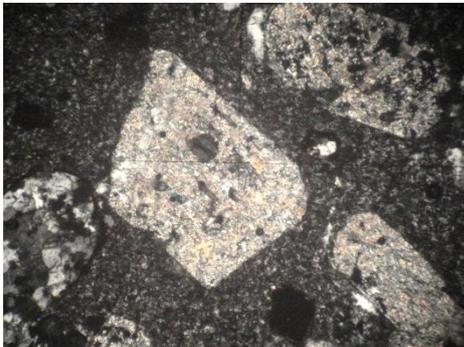


Figure 6. Quartz andesitic microscopic cross section (XPL, 50x)

#### B.5. Andesite

Their texture is from micro lytic to porphyritic (Figure 7). It includes major minerals such as plagioclase, Alkali feldspar and quartz and also calcite, hematite and opec can be seen within them. Plagioclases are seen as in the form of amorphous to half of their shape and in some places they are seen as phenocrysts (Figure 8). Alkali feldspar crystals are seen as half of the shape to amorphous and their crystals diameter is less than 0.5 mm. Quartz are seen as fine and amorphous grained.

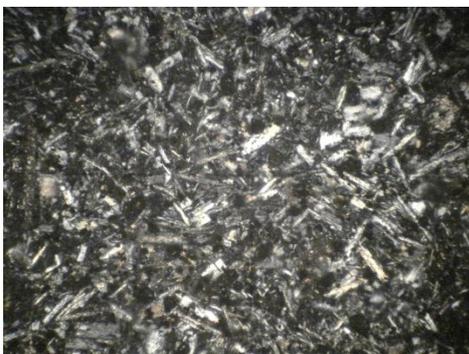


Figure 7. Andesite microscopic image (XPL, 50x) microlitic texture in andesite

### III. GEOCHEMISTRY

In the category of Normativ Cox and et al (1979) samples are within the rhyolite, Rhyodacite, trachyandesite and Andesite (Figure 9), in the Classification of Dolarush and et al. (1980) samples were in the range of rhyolite, rhyodacite, quartz latite, dacite and andesite (Figure 10).



Figure 8. andesite microscopic image (XPL, 50x)

Upon the studied samples based on chart (Na<sub>2</sub>O + K<sub>2</sub>O) - SiO<sub>2</sub> from The Manyar and Picouli (1989) are located within the peraluminous and Metaluminous range (Figure 11). At Irvine and Baragar (1971) AFM diagram they are located within the Calc-alkaline and based on the tectonic discrimination diagrams determined by Pearce et al. (1977) that the distinguishing boundaries display different types of tectonic position based on composition of volcanic rocks, study samples are mostly located in arc islands and active continental margin (Figures 12 to 13).

According to the Jenson (1967) diagram, the study samples based on the amounts of alkaline and silica are located in rhe3 range of Calc-alkaline, therefore with a high possibility magma is Calc-alkaline and according to the Lumetr (1989) diagram the study region rocks are located in the Calc-alkaline and Calc-alkaline with high potassium (Figures 14 to 15).

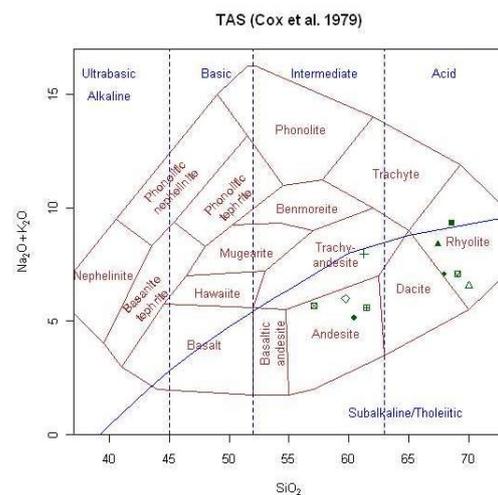


Figure 9. Diagram of Cox and et al. (1979) in this diagram rocks are located in the range of rhyolite, rhyodacite, trachyandesite and esite

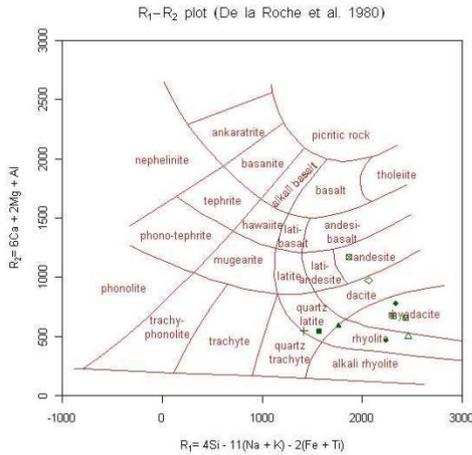


Figure 10. Diagram R2 vs diagram R1 (De La roche and et al. 1980)

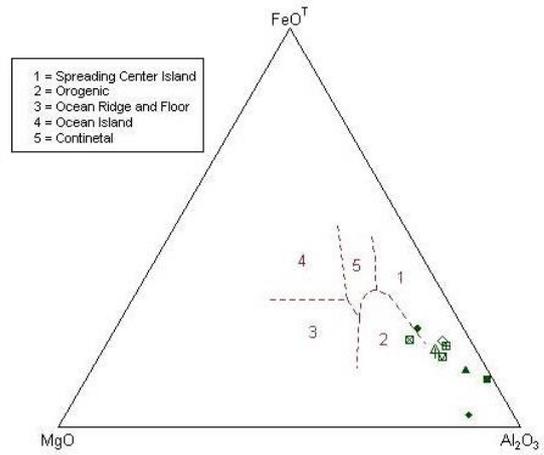


Figure 13. Piers and et al (1977) diagram

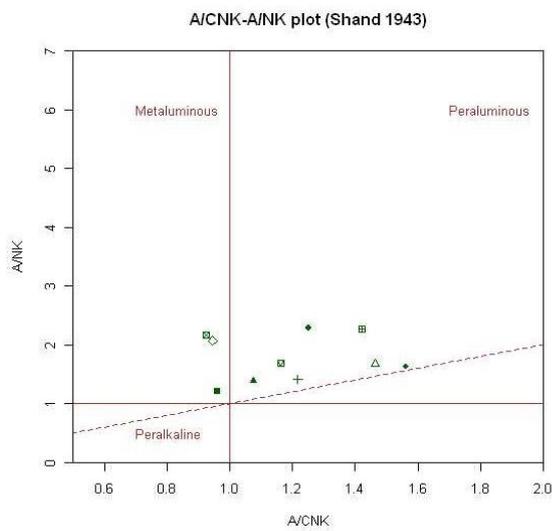


Figure 11. Determination of the enrichment degree of Aluminum in the intrusive rocks of the region based on the diagram of  $(Na_2O + K_2O) - SiO_2$  Maniyar and Picoli (1989)

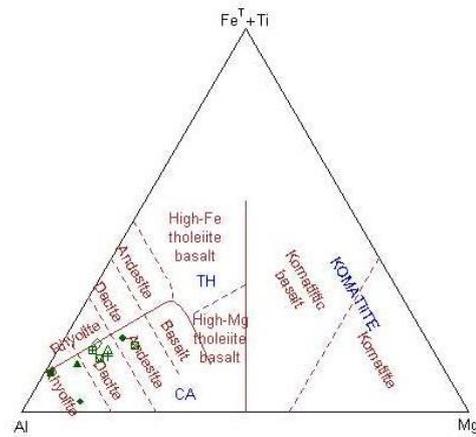


Figure 14. Jensen diagram (1976)

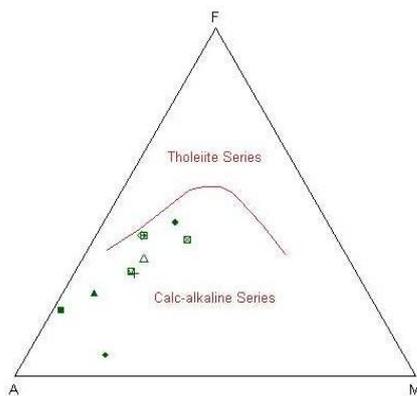


Figure 12. AFM triangular diagram Irvin and Baragar (1971)

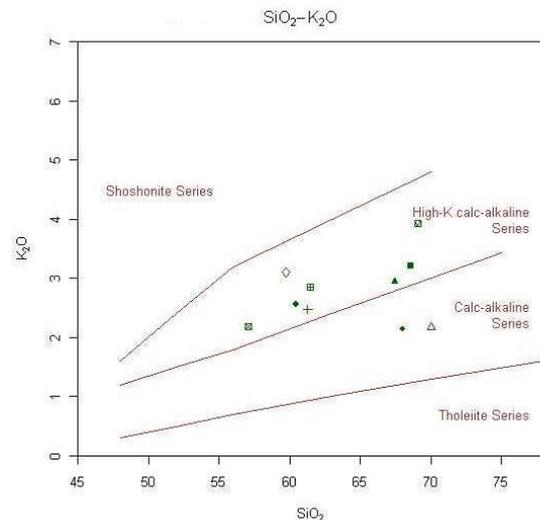


Figure 15. Lumetr diagram (1989)

#### IV. RESULTS

The study region is located in the Urmia-Dokhtar volcanic zone in the North-East of Saveh, Iran. In microscopic studies, most of the samples have porphyritic texture. According to the laboratory studies, the lavas of study region are rhyolite, rhyodacite, trachyandesite, quartz andesite and andesite.

Based on the diagram of Cox and et al. (1979), Lumetr and et al. (1989) the region rocks are Rhyolite, rhyodacite, trachyandesite, andesite and quartz Andesite. Based on the AFM triangular diagram of Irvin and Baragar (1971) rocks are located in the Calc-alkaline area. Diagram of Pearse and et al. (1977) are mainly consisting of study samples in arc islands area and Active continental margin.

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### BIOGRAPHIES



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