Quaternary basalts of Bijar area along the Zagros Fault

Sahar Maleki*, M.A., Earth Sciences Research Center, Iran
Mohammad-Hashem Emami, Associate Professor, Earth Sciences Research Center, Iran
Monireh Kheirkhah, Assistance Professor, Earth Sciences Research Center, Iran
Abdollah Saeedi, Assistance Professor, Earth Sciences Research Center, Iran

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Extenden Abstract

Intruduction

The research specifically examines the Quaternary magmatism of Kurdistan (Bijar) and its relationship with the region's tectonics. Due to parallelism with Zagros main fault and continental collision zone, it seems that such magmatism indicates continental collision zone as well. But the reason of this magmatism is not clear. However, there are examples in the world that can represent magmatism in this region continued even with 15 million years interval. Considering the breadth of the magma composition, thickness of the lithosphere can be an important parameter in understanding of magma petrogenesis. Reported thickness of the lithosphere in the study area is about 150-200 km. The thickness of lithosphere causes changes in the composition and chemistry of magma in the region. One of the points in this research is phase delay activing after the closure of Neotethys Ocean till Quaternary magmatism. Allen *et al*. (2013) provided a model for melting involving subduction and dewatering of sediment of Arabian passive margin beneath the Eurasian plate as a result of melting of the Eurasian lithosphere. In this study, it was necessary to consider more precisely these three reservoirs of magma in terms of petrography and chemistry and then rising of these magmas and its relation with Area's tectonic. Observations show three sources of magma in different combinations and sometimes different chemistry. So, magmatism of Bijar can provide a good view of the processes that control the composition of the continental lithosphere.

Materials and Methods

Field study and systematic sampling were performed in vertical and horizontal orientation from the volcanic flows. 70 samples were taken in order to thin section preparation and petrography. 30 samples were selected for chemical analysis and investigation of major and trace elements. Samples from new units and nonmethamorphic area were analyzed by the methods like XRF (S4) (in determination of major elements), ICP (in determination of trace elements) and XRD (in order to mineralogy of powder samples) in geological survey of Iran.

Results and Discussion

Bomb fragments, Lapilli, ash and scories can be seen around the crater of the volcano. The Gneissic xenoliths in Quaternary basalts can be seen. It created Porphyiric texture that contains fine-grained or sometime glassy context with big crystals in it. Although in some thin sections, Microlite and intergranular texture were observed. The main minerals are Olivine, Pyroxene and Plagioclase. Subsidiary minerals are visible as apatite and Opak minerals. According to geochemical investigations, rocks in this area are located in Sodic-Potasic alkaline or potasic zone. In the process of some of the elements such as MgO, SiO_2, TiO_2, Sr, Rb, Zr, Y, Th, Pb, Zr/ Y, Rb/ Th increasing

* Corresponding Author: maleki.geologyst@yahoo.com Tel: +98 9126507489

and in some of the elements such as CaO, Co, Ga reduction can be seen. In some cases on the variation diagrams, samples are sporadic and do not show a clear linear trend. The slope of diagram of REE distribution pattern- chondrite (Nakamura, 1974) in the rocks of the area is negative and LREE elements are more enriched than HREE elements. The rocks do not show negative Eu anomaly. In the distribution pattern diagram of trace elements of the area rocks versus mantle rocks (Wood *et al*., 1979) Titan depletion is observed. Niobium and tantalum also show a slight depletion. Given that the basalts of the area were alkaline, they got compared to alkaline basalts of the Afar and Kenya Rift (Eastern African Rift). Tectono-magmatic diagrams are also used somewhat to determine tectonical environment associated with eruption of these magmas.

Microscopic studies show that the texture of rocks in this area is more *hyaloporphyry*, microlitic porphyry, hyalomicrolitic porphyry, and sometimes intergranular. Phenocrysts of clinopyroxene, olivine and plagioclase in Microlitic context are made of the same minerals and glass. Petrographic studies show that differentiation, digestion and pollution have contributed to the formation of rocks in this area. The evidence of differentiation in these rocks is presence of minerals like Glomeroporphyritic and Glomerocryst and also the presence of olivine, clinopyroxene, Plagioclase with Labradorit- bentonite composition in basaltic rocks. Evidence for digestion and pollution is presence of quartzic Gezenocrysts with reactive margin of pyroxen and presence of gneiss zenolite.

Conclusion

According to the major elements diagrams, the rocks belong to the series of alkaline basaltic. In terms of amount of potassium, they located in the range of potassium from moderate to high. According to the major elements changes diagram versus DI, crustal contamination and subtraction have been effective in the process of rocks formation.

Considering the trace elements changes diagram versus DI, it can be also concluded that differentiation process has been effective in the formation of rocks. According to the distribution that is sometimes seen in these diagrams, and the high average of crustal elements abundance (Elements that have a high concentration in the crust, such as Rb) and vertical trends, it can be said that in addition to differentiation, the phenomenon of magma contamination with crust is also effective in rocks formation. The selective diagrams of trace elements also indicates that in addition to differentiation, other processes such as magma contamination have been involved in the petrogenesis of intermediate magmatic rocks. It can concluded from the negative slope of REE diagram namely the high LREE versus HREE, the difference between pattern of rocks in this area with diagonal basalt pattern, similarity of the sedentary element pattern like Y, Yb, Sr to the OIB alkaline basalts pattern (resulting of low grade partial melting of the enriched asthenospheric mantle) and also the alkaline composition of basalts in this area which the origin of basaltic magma was not from a depleted mantle source but rather originated from an enriched mantle source and is a result of relatively low degree partial melting. The high LREE is not necessarily the reason for the low component melting and generally factors such as magma origin (asthenosphere or lithosphere). Mineralogy and composition of minerals entered during melting, the degree of partial melting, fractional crystallization, magma subtraction and the volatiles can cause this condition. Considering distinctive tectonical diagrams and evidences in continental crust, tectonical environment is a continental inter plate environment. These diagrams reinforce hypothesis of rocks formation in a tensile environment. Especially that these lavas belong to Quaternary and there is not any active subduction system in Iran right now.

Keywords: Alkaline, digestion, gneiss, pollution, volcanism.