Geochemistry and Petrogenesis of Plutonic Bodies in Tazeh Shahr (NW of Orumieh Lake)

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Abstract

The study area is located in the northwest of Salmas district in western Azarbayjan province. This region forms a part of Mesozoic-Thertiary plutonic belt in sanandaj-sirjan zone. The plutonic rocks have been intruded into the Precambrian metamorphic complex with metamorphic grade ranges from green schist Facies to Amphibolite. Based on field, petrographic and geochemicaly studies these plutons contain intermediate-basic and acidic spectrums. Contact of intermediate-basic Plutons with Metamorphic marbles has been caused Skarnization. The rocks texture widely varies from granular to granoporphyry. Based on results of modal analysis the intermediate-basic plutons are composed of Diorite, Quartzdiorite, Monzodiorite, Quartzmonzodiorite, Monzonite and Gabrodiorite. Furthermore, these plutons consist of Plagioclase, Hornblend and pyrexon (Augite) minerals. The acidic rocks composed of Quartz and Feldspar (Plagioclase and Alkalifeldspar) ranging from Granite to Granodiorite. Mafic magmatic enclaves or Mafic microgranolar enclaves (MME) occur in the interior part of plutons with different dimensions. These enclaves have fine texture and more mafic minerals. From the geochemical viewpoint, intermediate-basic rocks show tholeitic nature while acidic rocks have Calc-Alkaline nature. Also, the Alumina saturation index indicates that rocks have the metalominouse nature. In addition, their are Calcic, Magnesian, Cordilleran I-Type characteristics. Their geodynamical quantities closely resemble Batholith 0f Peru plutons of type VAG. geochemical data indicate that intermediate-Basic plutons originate from evolutionary lithospheric mantle while acidic plutons have been produced by fraction melting of crust rocks.

Keywords*: Petrology, Geochemistry, plutonic bodies, Petrogenesis, Orumieh Lake*

Introduction

Tazeh shahr plutonic bodies are located about 30Km northwest ward from Salmas, Azarbayjan Provenance. These bodies are a part of the Mesezoic-thertiary Sanandaj –sirjan magmatism belt (Berberian and Berberian, 1981; Ghasemi et al, 2006; Mohajjel et al 2003 ; Azizi and Moinevaziri,2009). According to the petrogeraphical, geochemical and petrological studies, rock types within the studied area are dominated by intermediate-basic and acidic compositions. Lithology of Intermediate-basic rocks ranging from diorite, quartzdiorite, monzodiorite, monzonite to gabbro. Plagioclas (Andesine-oligoclase), amphibole, pyroxene (augite), quartz and alkli feldspar (orthoclase and microcline) are the main minerals in these rocks. Acidic rocks ranging from granite, granodiorite to alkali-feldspar granite in composition, and these rocks are generally Granular and grano-porphyritic texture. Common rock forming minerals of acidic rocks are plagioclase (oligoclase-andesine), quartz, alkali feldspar (orthose and microcline) with lesser amount of biotite and amphibole. There are some enclaves in these rocks which have similar mineralogical and geochemical characters to

diorites. Composition of these enclaves is diorite, quartz diorite and gabbro diorite. On the Based of Didier & Barbarine (1973) classification diagram; these microgabbroic enclaves are mafic or magmatic mafic(MME).

Discussion and Conclusion

To investigate the geochemical characteristics of these Bodies, we analyzed the major elements of a number of their instances geochemically in the manner of XRF method. Moreover, we analyzed trace and rare earth elements of those instances geochemically using ICP.MS method in ALS-Chemex laboratory in Canada. In Harker Diagrams there is a Gap between basic-intermediate and acidic bodies (Fig.1). This characteristic probably indicates that the origin of these bodies is different. All of the samples in the $Na_2O+ K_2O$ vs. SiO_2 diagram (Irvine & Baragar, 1971) have sub-alkaline characteristic (Fig.2). In AFM diagram (Irvine & Baragar, 1971) most of basic-intermediate samples and enclaves are tholeitic and acidic samples are calc-alkaline (Fig.3).

The chondrite and mantle-normalized trace element variation diagram (spider diagram) exhibit that granitic rocks have higher enrichment in LILE and LREE rather than diorites (Fig.4). However diorites are higher amount of HFSE respect to other types of rocks. In the granitic rocks the LREE's are enriched respect to HREE's; this pattern is comparable to calc-alkaline magma generation in continental margin basin (Wilson, 1989; Brewer et al., 1998; Kampunzu et al., 2003; Machado et al., 2005). Also the contents of K, Ba, Rb, Sr show enrichment and Ti, Nb have negative spikes in these rocks. However, spider diagram of dioritic rocks have flat pattern. In other word magmatic processing couldn't differentiate between LREE and HREE. The enrichment of incompatible elements with Larg-Ion Lithophile (LIL) such as K, Ba, Rb, Sr with negative anomaly in high field strength elements (HFSE) such as Nb and Ti is the reson that the magmatism is happened in subduction zones. (parade et al., 1999; Shaw et al.,1993). The pattern of REE and Trace elements in enclaves are similar to diorite rocks and may be they are cogenetic. Also this rocks are I-Type granite so that they have , Hornblend and Augite , Mafic microgranolar enclaves (MME), Diopsid in Norm, metaaluminous charecteries and A/CNK<1. In base of Barbarin (1999) classification study rocks are ACG type and they are Volcanic Arc Granite (VAG) in base of pearce et al (1984) diagrams(Fig.5).

The geological composition and tectono magmatic discrimination diagrams of the Tazeh Shahr granitic rocks suggest their offinity with Arc magmas formed in a continental margin volcanic Arc setting. These properties are compatible with the Berberian et al(1982) and other researchers (Mohajjel et al 2003 ; Azizi and Moinevaziri,2009;Omrani et al,2008) hypotysis. They belive that the neotethys oceanic crust subduction bench central Iranian microcontinent. Their initial magmas of intermediate-basic rocks have generated from partial melting of mantle wedge. The mafic magma ascent in to the continental crust and melt the under crust and generate granitic magma. Laramide compression phase coused to rise these plutonic bodies and replacing in under continental crust in late Cretaceuse or Miosen.

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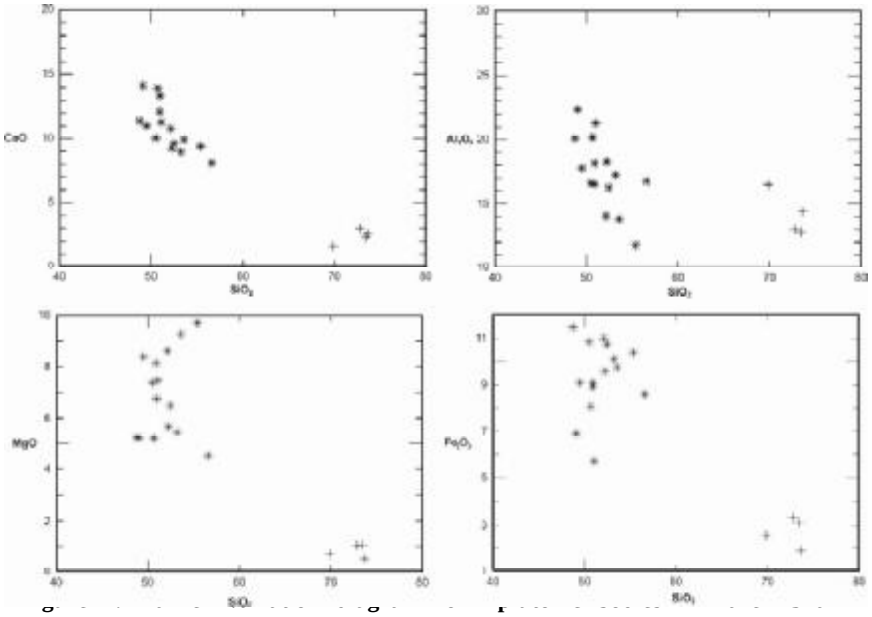

***: intermediate-basic rocks +: acidic**

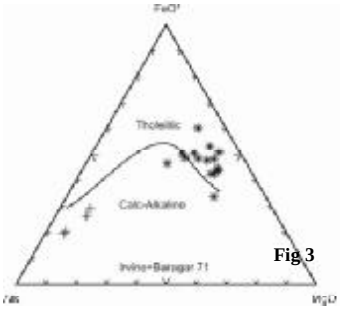

Fig 3

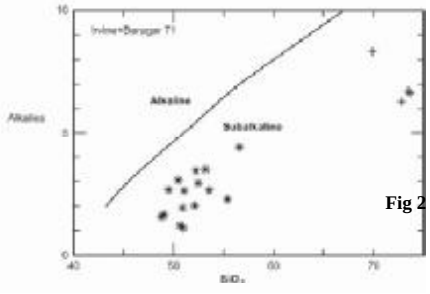

Fig 2

Figure 2. classification of the plutonic rocks of Tazeh Shahr according to alkaline versus silica contents (after Irvine and Baragar, 1971) *: intermediate-basic rocks +: acidic

Figure 3. Triangular diagram plotting MgO, FeO (total) and (Na_2O + K_2O) (AFM diagram) after Irvine and Baragar (Irvine and Baragar, 1971) *: intermediate-basic rocks +: acidic

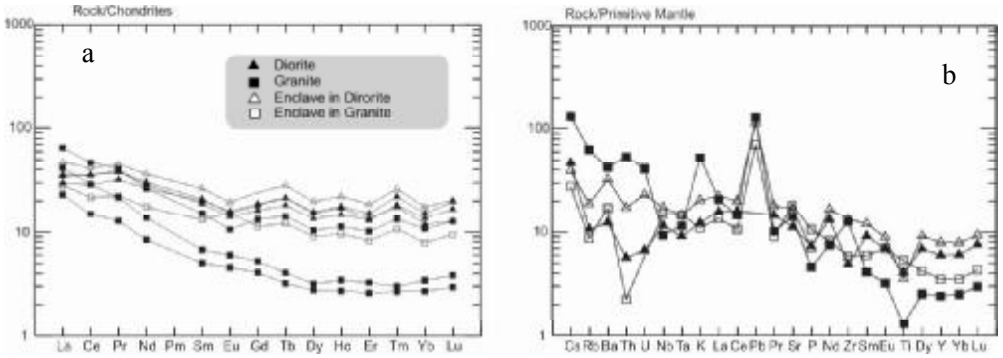

Figure 4. Plots of REE and trace element distribution patterns for plutonic bodies in Tazeh Shahr (a):spaider diagrams (normalised to chonditic reservoir, values after Sun and McDonough,1989 (b): REE diagrams (normalised to chonditic reservoir, values after Nakamora,1974

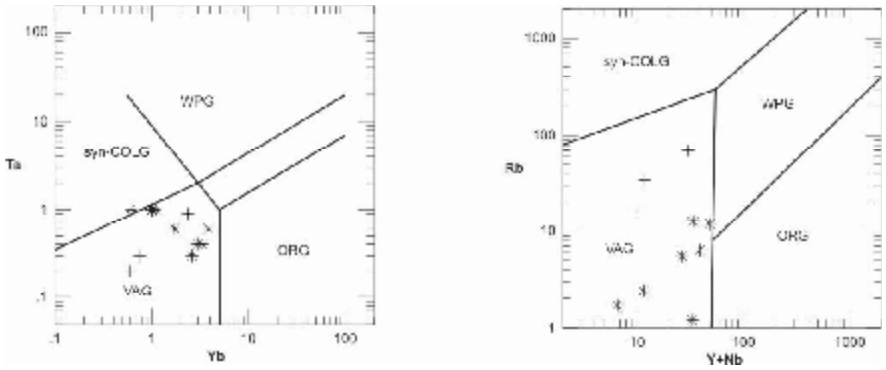

Figure 5 . Y+Nb vs Rb and Ta vs Ta tectonic setting for plutonic bodies in Tazeh Shahr after Pearce et al. 1984 *: intermediate-basic rocks +: acidic