Geochemistry & petrogenesis of Meshkin shahr granitoid (Khanbaz-khankandi), NW IRAN

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Abstract

Meshkin shahr granitoid (Khanbaz -Khankandi) belong to west Alborz – Azarbaijan zone with age of Oligocene is located in northwest of Iran. These rocks are intruded into volcanic rocks with age of Eocene. This pluton contains granite, monzonite, quartz monzonite, monzondiorite and quartz monzondiorite with subvolcan rocks such as micromonzonite and micromonzondiorite. Textures in these rocks are granular, myrmekite and perthite. Chemical and petrographical similarities between Eocene and Oligocene magmatism can be a reason for genesis relation between plutonic and volcanic rocks. Hydrothermal solution has produced alteration zones in north of this area and affected on the granitoid and volcanic rocks. Existence of two kind of feldspars and aqueous minerals such as biotite and hornblende in these rocks which are produced at high water vapor pressure, show that the granitoid intrusion is subsolvus. Geochemistry studies of the rocks detect that they are high K calk - alkaline serie and based on alumina saturation index (ASI) are meta-aluminous. This zone is situated in Alpine-Himalaya post collision orogenic belt therefore it's proposed post collision magmatism in the area. This granitoid is Caledonian I-type that may have hybrid genesis.

Keywords: *granitoid; Meshkin shahr; Iran; I-type; subsolvus; Post collision*

1. Introduction

Khanbaz-Khankandi area is located in 25 kilometers northwest of Meshkin shahr, between 47°, 23′- 47°, 28′ eastern longitude and 38°, 29′ - 38°, 42′ northern latitude. This area is located in west Alborz – Azarbaijan zone with age of Oligocene. These rocks contain granite, monzonite, quartz monzonite, monzondiorite and quartz monzondiorite together subvolcan rocks such as micromonzonite and micromonzondiorite. The most important petrologic study in area includes Talaei [5], that he worked on the granitoid and volcanic rocks in southwest of Meshkin shahr. The goals of this research include determining of kind and genesis of granitoid corresponding to field geological relations, mineralogy and geochemistry also presenting a tectonomagmatic model for this area.

2. Discussion

Petrography of granitic mass: In macroscopic sample, granites are medium to coarse grained holocrystalline with granular structure. In macroscopic sample they have subhedral plagioclases with polysynthetic and carlsbad twinning together anhedral quartzes and alkali feldspars with carlsbad twinning. There is micrographic texture in granits because of syn-crystalline quartz and alkali feldspar in eutectic and low temperature. Mafic minerals in these rocks include biotite and hornblende, that biotites are more than 10 %, also there are accessory minerals such as sphene, zircon and apatite. Plagioclase has alterated to calcite and epidote, alkali feldspar to clay minerals and serecite also hornblende to chlorite and calcite.

Petrography of monzonitic mass: These rocks contain monzonite and monzodiorite with less than 5% quartz and quartz monzonite and quartz monzodiorite with 5-10% quartz. There are subhedral plagioclases with polysynthetic, carlsbad and pericline twinning, alkali feldspar with carlsbad twinning and anhedral quartz. Mafic minerals based on frequency contain biotite, hornblende and augite. These rocks are affected by hydrothermal alteration similar to granites. King band in biotite and plagioclase shows plutonic rocks intruded into volcanic rocks. Other texture in these rocks are myrmecite, antirapakivi and perthite. Emplacement of rock bodies in lower depth formed subvolcanic rocks such as micromonzonite and micromonzondiorite with geochemical similarities.

Reasults of Geochemical studies (base on table 1.)

- Plutonic rock bodies are high k calk-alkaline to shoshonitic serie.
- According to maniar and piccolli [4], to determine alumina saturation index (ASI), all of plutonic rocks are located in meta-aluminous part (Fig. 1).
- Corresponding to pearce diagram [3], to distinguish tectonomagamatic environment, intrusive rocks fall on post-collision granite (Fig. 2).
- According to Frost et al. [2], to separate tholeitic (Ferroan) and calk-alkaline (Magnesian) series, granites are located in Magnesian or calk-alkaline serie. Also from in MALI (The Modified Alkali-lime Index), most samples fall on alkali-calcic part. (Fig. 3 a, b).
- Based on chappell and white [1], by using of Na_2O-K_2O, P_2O_5-SiO_2 and Pb-SiO_2 diagrams, grantoids are I-type (Fig. 4 a, b, c).

Characteristics of granitoids duo to the studies of field geology, mineralogy and geochemistry:

- Intrusive rocks in area are granite, monzonite and monzodiorite.
- Alkali feldspar is pink color.
- Quartz is frequent (20-35%).
- Presence of two feldespar and aqueous minerals such as biotite and hornblende which are produced high water vapor pressure show that the rocks are subsolvus granites [6].
- Existence of antirapakivi texture can be evidence for magma mixing.
- Biotite is more than other mafic minerals and hornblende is less than biotite.
- Sphene, zircon and acicular apatite are accessory minerals. Apatite can be evidence for magma mixing.
- Presence of mafic xenolith such as augite-biotite monzonite in quartz monzonite is a definite reason for magma mixing.
- Amount of silica is 55-68% and Na_2O is around 3.03%.
- There is no corundum in norm of granitoids.
- Amount of ASI is less than 1.1 and located in meta-aluminous group.

These reasons show this granitoid is I-type and magma mixing may be indicator of hybrid genesis for magma.

3. Result

Khanbaz-Khankandi Oligocene granitoids intruded Eocene volcanic rocks. These granitoids are belong to Eocene-Oligocene orogenic belt of west Alborz – Azarbaijan zone duo to Pyrenean orogeny. Magma of these rocks is high k calk-alkaline to shoshonitic and according to influence of upper mantel melt, resulted from partial melting of continental crust.
Corresponding to this zone is situated in Alps-Himalaya orogenic belt and its subduction finished at Eocene, therefore it's proposed, Oligocene granitoid formed in post collision environment, also duo to Caledonian I-type granite produces in post collision area too, Meshkin shahr granitoid is Caledonian I-type. Existene of magma mixing symbols in these rocks can prove hybrid genesis for magma.

4. References

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Table 1. Chemical analysis data

No.	SiO_2	Al_2O_3	FeO*	FeO	Fe_2O_3	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	Rb	Pb	Nb	Y
1	55.3	16.77	6.21	2.93	3.28	7.5	4.509	4.03	4.021	0.114	0.583	57	23	21	17
2	64.84	15.55	4.37	1.95	2.36	2.64	3.366	4.9	1.877	0.122	0.294	82	202	16	16
3	58.99	18.53	4.2	1.96	2.24	6.23	3.585	4.58	1.822	0.072	0.328	92	39	24	18
4	56.81	15.33	6.19	3.19	3	7.85	3.031	3.53	4.241	0.113	0.504	56	51	17	16
5	66.86	15.1	3.25	1.34	1.91	3.22	3.901	5.91	1.405	0.062	0.103	165	37	45	29
6	67.41	15.18	3.3	1.48	1.82	2.88	3.503	4.9	1.941	0.074	0.263	83	39	17	14
7	58.79	16.23	6.52	3.24	3.28	7.77	3.188	4.14	4.741	0.109	0.592	62	32	23	19
8	55.64	16.67	6.9	3.43	3.47	7.29	3.471	3.77	4.263	0.157	0.663	55	29	18	17
9	65.44	15.24	3.51	1.54	1.97	3.58	4.517	4.33	1.941	0.61	0.273	73	28	14	14
10	61.38	15.1	5.28	2.4	2.88	5.77	3.535	3.7	3.924	0.132	0.524	55	58	14	13

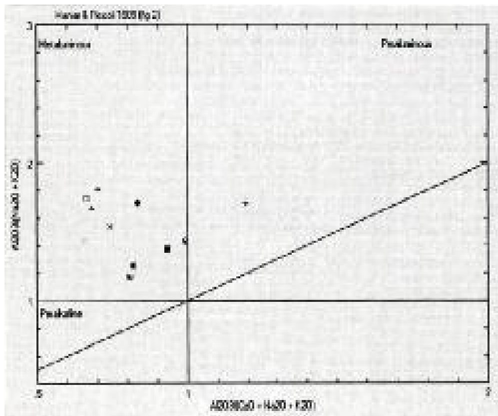

Fig. 1. Maniar and piccolli diagram [4]

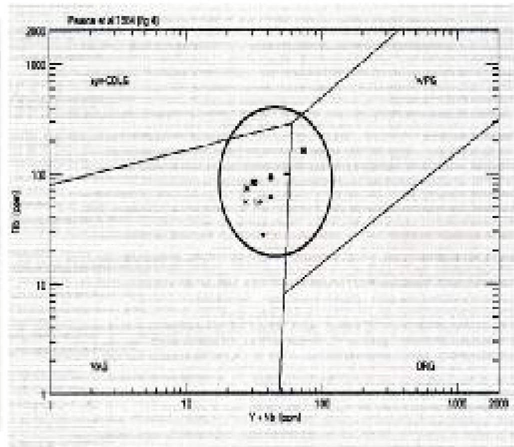

Fig. 2. Pearce diagram [3]

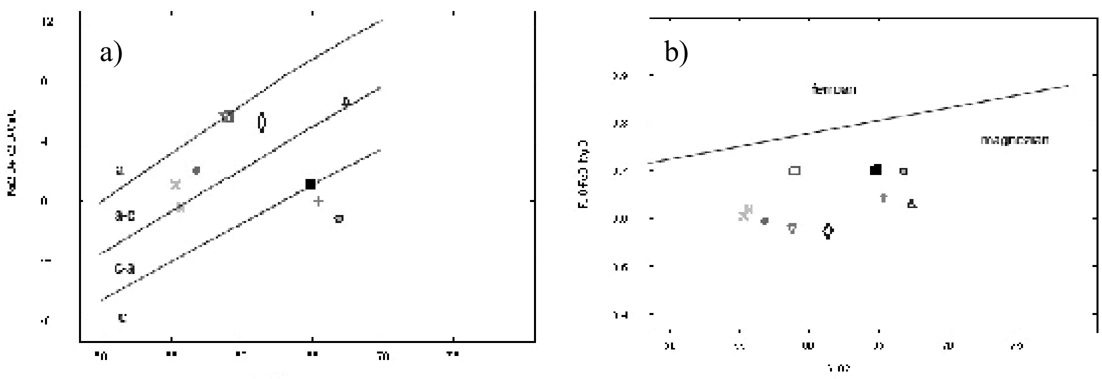

Fig. 3. Frost et al. diagrams [2]

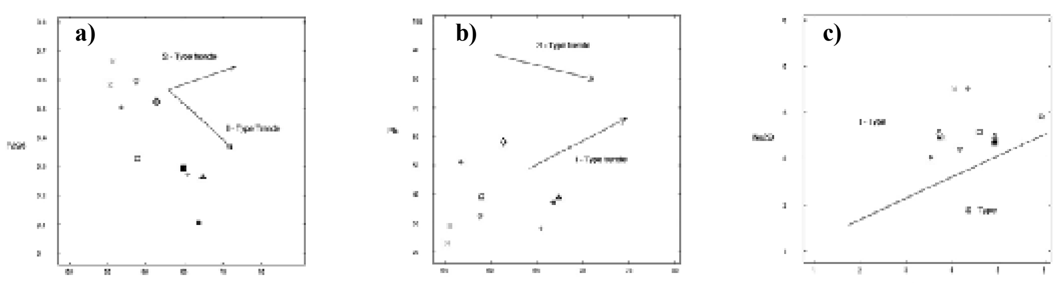

Fig. 4. Chappell and white diagrams [1]