Advances in Bioresearch
Adv. Biores., Vol 6 (5) September 2015: 163-172

Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
ICV 7.20 [Poland]

ORIGINAL ARTICLE

Petrogeochemistry and Gnesis of Dehchah Gneisses, East Neyriz, Iran

M. Ghadami [1*],M.Yazdi [2], K.Noori [3],M.Karimi [3]
1- Ph.D Student of Economic Geology, Islamic Azad University, North Tehran Branch,Iran
2- Earth Science Faculty member, Shahid Beheshti University,Tehran,Iran
3- Earth Science Faculty member, Islamic Azad University, Shiraz Branch, Iran
*Corresponding Email: ghadami1361@gmail.com

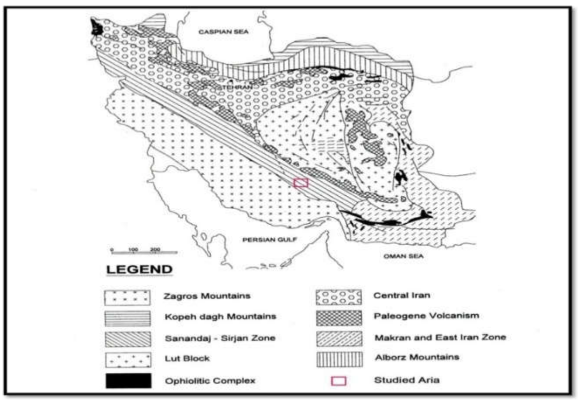
ABSTRACT
The Deh-Chah metamorphic complex is situated approximately 265 km east of the town of Shiraz and 62 km east of the town of Nayriz, Fars province, in the south of Iran. The age of the metamorphic rocks is middle Paleozoic and the initial granite intrudes into the micaschists and amphibolites and cause the garnet and tourmaline mineralization. There are in the massive outcrops of gneiss in north of Deh-Chah that are located in Sanandaj-Sirjan metamorphic zone. In this paper, in terms of geochemistry, gneisses and related minerals, as well as their genesis were examined. The results of chemical analysis and diagrams related geochemical ICP.MS indicate that Dehchah granite gneisses of which is formed in calc-alkaline volcanic arc (VAG) and subduction (Syn) that is also evident in spider diagrams of rare earth elements. . Also, the primary types of granite genesis of Dehchah are magmatic type (I). In some cases garnet frequency is more than 35%, with regarding the 10% of economical, so the garnet frequency is important.
***Keywords**: Gneisses, Sanandaj-Sirjan, volcanic arc, Dehchah, Iran*

Received 07.05.2015 Accepted 30.07.2015

How to cite this article:
M. Ghadami, M.Yazdi, K. Noori, M.Karimi. Petrogeochemistry and Gnesis of Dehchah Gneisses, East Neyriz, Iran. Adv. Biores., Vol 6 [5] September 2015:163-172. DOI: 10.15515 /abr.0976-4585.6.5.163172

INTRODUCTION

The study area is situated approximately 62 km east of the town of Nayriz, with geographical coordinates 30 ° 54 to 40 ° 54 'east longitude and 25 ° 29' north latitude and 30 ° 29 in the south of Iran (Fig 1).
The study area is located in the southern of Sanandaj-Sirjan metamorphic zone. The metamorphic rocks of the area belong to the middle Paleozoic (Devonian period) [13]. In the north of the Dehchah village outcrops gneisses are present in the metamorphic rocks and mica schist. After magma differentiations of gneiss, in the border aplitic and silica was created, which in contact of mica schists cause some mineralization such as Garnet and tourmaline. In this study we conducted a mineralogical, geochemical and associated mineralization in it that will be discussed in the following sections.



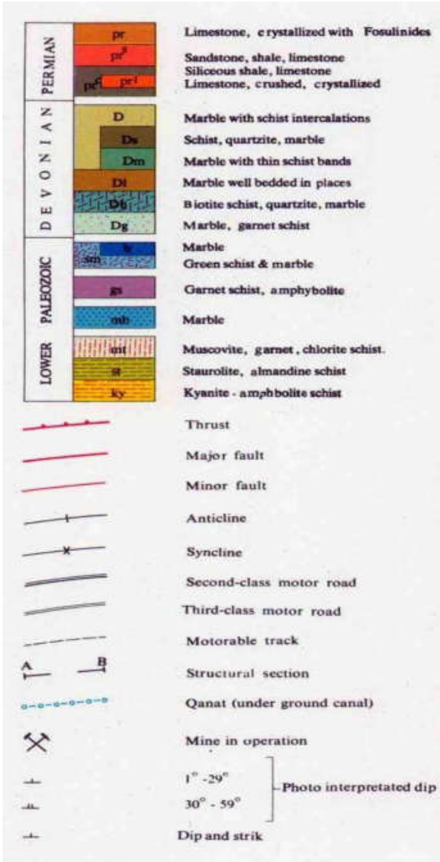


Fig.1. Location map of study area in the structural zones of Iran (Ashtvklyn, 1968)

METHODOLOGY

After collecting information for research office (geological maps, satellite imagery and geological reports) to survey and collect field samples were required. The samples thin sections (Thin section) was prepared and microscopic studies were carried out on and to understand the terms of the gneiss geochemistry ICP-MS and microprobe tests were performed.

RESULTS AND DISCUSSION

Genesis definition

Genesis may be generated by most of igneous rocks such as granite, riolite, syenite, and trachyte, nephelinitic syenite or sedimentary rocks such as feldspar sandstone and garywaks. In addition, each of the faces of the feldspar in the steady state, the gneiss will be formed. That's why most abundant metamorphic rocks gneiss can be seen from various schists [9].

Macroscopic studies of Dehchah Genesis

In field studies, it was found that the distribution of gneisses of Dehchah in the metamorphic complex is about 30 percent. The major composition of gneiss masses are y silica and feldspar and therefore have lightly brown and white outcrop (Fig. 2). This gneisses of this complex during metamorphic and in particular the Metamorphic Differentiation, felsic units was removed and finally siliceous veins and veins sometimes feldspars was remained. Also, due to the influence of differentiated gneisses in micaschist in the area, tourmaline and garnet mineralization was performed. Garnet frequency in some subareas is more than 35 percent of lithological units, with regarding the economic value of 10 percent [6], these areas could be economic. In some cases gneisses veins introduce in to mica schists that large crystals of biotite pegmatite phase begins to crystallize and have a wonderful view of the gneisses formed (Fig 3,4).

Fig. 2. Outcrops of gneisses units (white) and mica schist (brown) in the north of Dehchah metamorphic complex

Fig.3. large crystals of garnet (brown) in quartz veins of Dehchah. Garnet frequency above 35 percent in some areas that could be of economic value

Fig. 4. Outcrop area tourmaline aplitic of Dehchah

The results of ICP- MS analysis

In order to understand the geochemical conditions gneisses Dehchah, three samples of gneiss, one sample of garnet gneiss and one sample tourmaline aplitic has been analyzed by ICP-MS. Inductively Coupled Plasma emission spectrometry (ICP-MS) for the detection of very low and good accuracy, given the frequency of major and minor elements and rare earth elements are used by geologists (20). In Table 1 represent the results of the analysis and comparison of test results on samples from the study area with an abundance of shells (7).

Table 1, the results of chemical analysis by ICP-MS gneiss Dehchah in comparison with the abundance of shell elements (Kraskof, 1976) in ppm (Gn = Gneiss Ta = Tourmaline aplite Gg = Garnet gneiss CA = Crust Avrage)

Sample	Gn1	Gn2	Gn3	Ta	Gg	C.A
Co	<1	1.8	<1	<1	12	25
Ce	<1	85	105	<1	47	60
Cd	<0.1	0.1	0.2	0.1	<0.1	0.2
Ca	17875	6286	1240	2838	11758	36300
Bi	<0.3	<0.1	<0.1	0.5	0.2	0.2
Be	2.6	2.5	1.8	5.5	3.1	2.8
Ba	157	457	722	83	620	425
As	<0.1	<0.1	<0.1	0.4	3.4	1.8
Al	75512	75864	60684	44245	91511	81300
Ag	<0.1	<0.1	<0.1	<0.1	<0.1	0.07
In	<0.5	<0.5	<0.5	<0.5	<0.5	0.1
Hf	<0.5	<0.5	<0.5	<0.5	<0.5	3
Gd	0.2	3.24	4.27	0.18	2.16	5.4
Fe	2910	18386	12849	5153	31670	50000
Eu	0.36	1.3	0.87	0.19	1.37	1.2
Er	<0.05	2.13	2.25	<0.05	3.25	2.8
Dy	0.23	2.75	3.33	0.27	3.17	3
Cu	7	7	9	8	21	55
Cs	0.5	0.7	0.6	6.3	2.7	3
Cr	6	10	8	5	49	100
Nd	<0.5	26	36.2	<0.5	13.1	28
Nb	1.2	5.1	7.6	2.5	4.4	20
Na	52437	48429	2493	21056	17501	28300
Mo	1	0.4	1.6	1	1.1	1.5
Mn	28	220	48	69	1253	950
Mg	309	5977	914	462	8198	20900
Lu	<0.1	0.14	0.16	<0.1	0.28	0.5
Li	3	5	2	<1	9	20
La	<1	38	41	<1	15	30
K	8072	11382	77219	23503	29214	25900
Sm	<0.05	3.84	6.4	<0.05	1.98	6
Se	<0.5	<0.5	<0.5	<0.5	<0.5	0.05
Sc	<0.5	8	7	1.3	13.4	22
Sb	<0.5	0.6	0.8	3.5	2.9	0.2
S	<50	<50	<50	<50	<50	260
Rb	120	127	180	177	110	90
Pr	0.63	8.2	10.51	0.58	4.27	8.2
Pb	13	14	13	30	20	13
P	58	198	54	<10	548	1050
Ni	3	5	3	6	40	75
U	1.1	1.4	1.4	0.6	1.1	1.8
Tm	<0.1	0.15	0.17	<0.1	0.27	0.5
Tl	0.11	0.13	0.35	0.29	0.42	0.5
Ti	253	2176	946	111	4263	4400

Th	7.73	13.49	18.3	0.27	7.88	7.2
Te	<0.1	<0.1	<0.1	<0.1	<0.1	0.01
Tb	<0.1	0.66	0.87	<0.1	0.61	0.9
Ta	0.51	0.83	0.95	1.07	1.1	2
Sr	259	132	23	50	198	375
Sn	1.1	2.1	4.3	1.3	3.4	2
Zr	<5	<5	9	<5	6	165
Zn	12	27	7	5	41	70
Yb	<0.05	0.9	1	<0.05	1.9	3.4
Y	1.7	13.4	13	1.8	19	33
W	<0.5	1	1.7	<0.5	1.5	1.5
V	16	37	18	16	91	135

Results of element content have been used for plotting the diagrams of gneiss rock units. In this diagram the rocks which have plotted by using Minpet and IgPet, magmatic series, geological environment and the type of granite gneiss of Dehchah.

Naming of rocks

In the geological studies after microscopic and geochemical investigation the type of rock units is most important. In this part of the triangular diagram Middlemost (1985) was used. This triangular diagram based on the alkali content of the magma and the three sides CaO, Na2O and K2O is designed indicator for acid rock is named (Fig 5). As shown in this diagram, all samples are located within the granite.

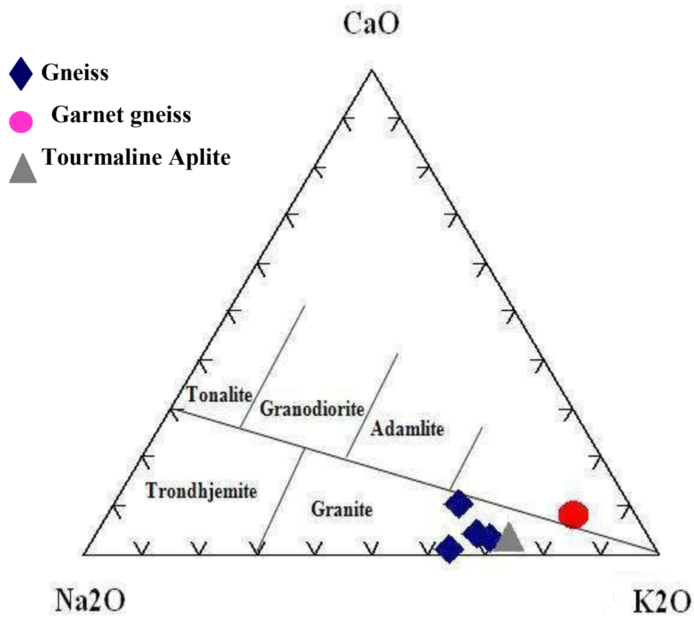


Fig. 5. Middlemost triangular diagram (1985) to name the ten wells acidic rocks.

Magmatic series

According to the AFM diagram Irwin and Baraga (1971), the granites of Dehchah are fall in to calc-alkaline series and just garnet sample is placed within the tholeiitic domain (Fig 6). This is the type of garnet zone by microprobe examination, was accepted as Almandine. According to Irwin and Baraga (1971) alkaline series are related to subduction zone. So the Dehchah granite gneiss are as the result of Snandaj-Sirjan subduction.

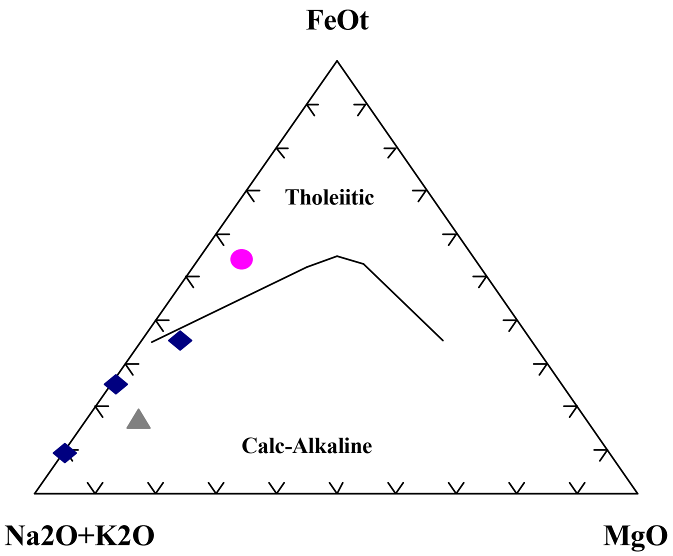


Fig 6. Diagram of Irwin and Baraga (1971) for determining the magmatic rocks of granitoid series of Dehchah

Determining the geological environment

Tectono-magmatic setting for the granite gneiss of the Dehchah Pierce et al (1984) diagram located in volcanic arc granites (VAG) and Subduction(Syn) (Fig 7). This confirms that these rocks in subduction zones. The low proportion of yttrium and niobium features related magmatic arc rocks that formed the subduction zone (15).

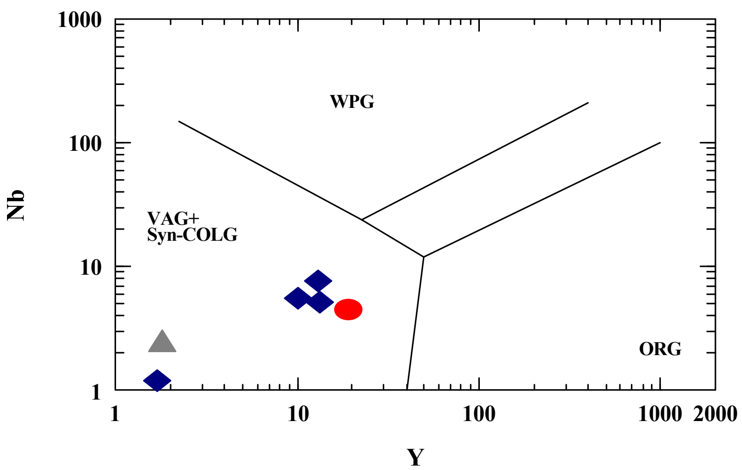


Fig 7. Diagram of modifications Rb versus Y (Pearce *et al*, 1984) to determine the granite gneisses

Type Granite

According to the Withe & Chappel (1983) diagram, the initial granite of Dehchah is in the area granite granite magma (type I) (Fig8). This is due to the granite of the calc-alkaline magmatic series obtained is entirely consistent with the calc-alkaline magma series are often acidic granite type I form (3).

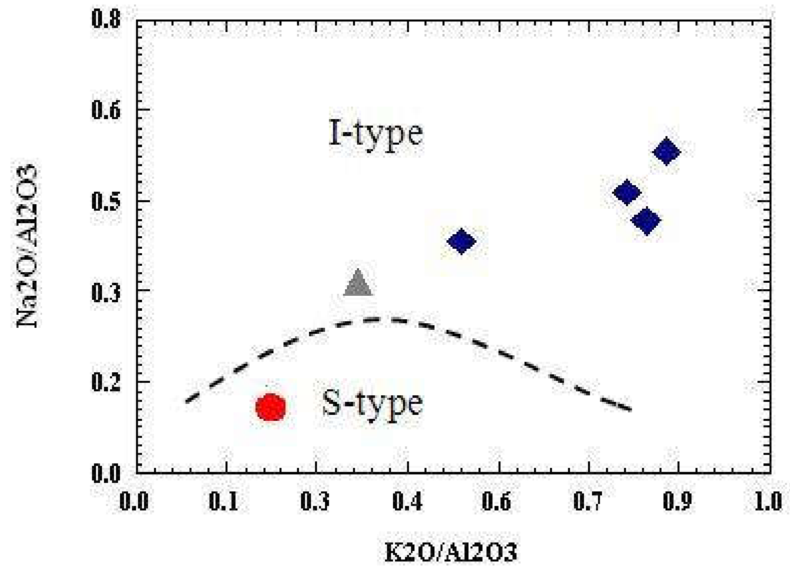


Fig. 8. Withe & Chappel (1983) plot for the identification of sedimentary magmatic gneiss granite and gneiss on the major elements of Dehchah

Spider diagrams of rare earth elements (REE)

In both graphs (Figure 9 and 10) the slope of the light rare earths and heavy rare earth elements that represent low degrees of partial melting in the magma is. In each diagram element Eu depletion observed that due to the intense activity of this element and replace to replace the element Ca and the combined company minerals garnet, and plagioclase is Hornbland. Plot normalized REE distribution gneiss in the lower crust is very similar to the lower crust and the crust below the continental subduction zone characterized by acidic magma is formed.

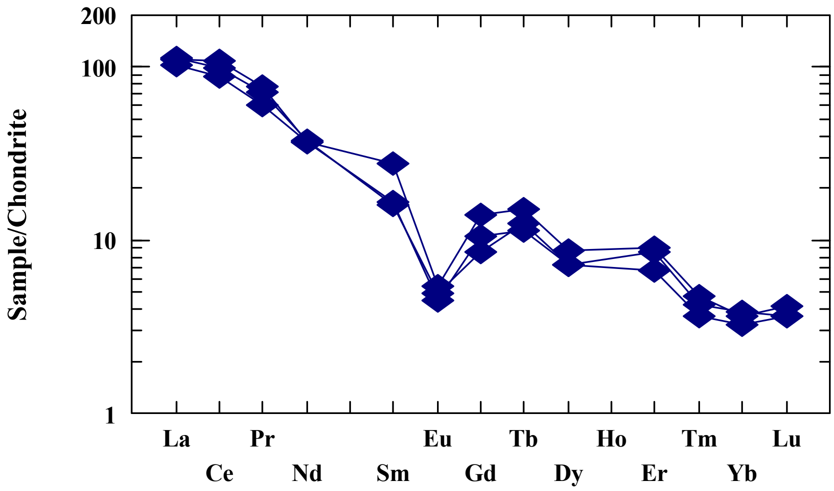


Figure 9) normalized spider diagram of rare earth elements (REE) of Dehchah with acid rock chondrite

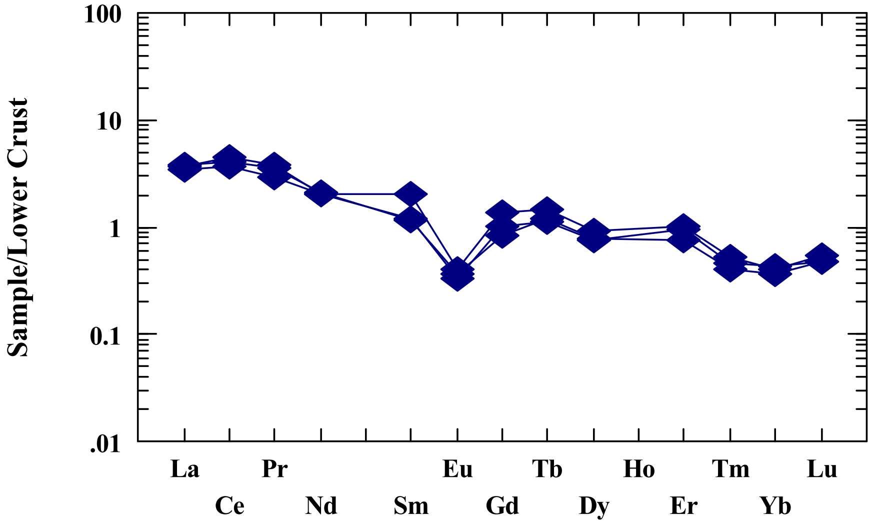
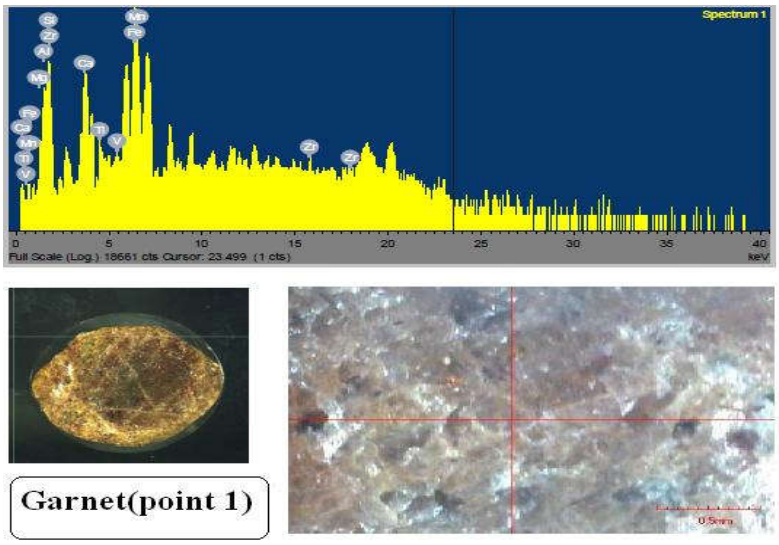


Figure 10) normalized spider diagram of rare earth elements (REE) of Dehchah acidic rocks of the lower crust

The results microprobe analysis

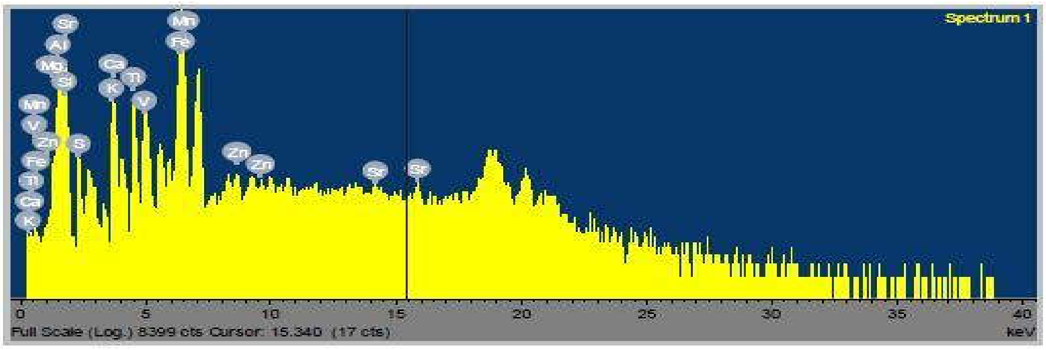
In order to complete geochemical studies, analysis of minerals using microprobe spot on the agenda because such studies can identify issues such as zoning in mineral composition, the abundance of trace elements, rare and valuable as inclusions have been published and also helped set the conditions established herein (12). For this purpose, the device is fine now scouring the EPMA Electron Microscope Laboratory of Ore Company Binalud were used. Device used to HORIBA XGT-7200 model and has been accelerating voltage 50kv. In these examples, the count of 80mS and the sample is 1mA.

Garnet and tourmaline zone spot on pure sample was analyzed by microprobe, which results are presented in the Figs (10 and 11) . According to the results of the analysis indicated that the garnet and tourmaline almandyn type is the type Shorl. Results indicate that in the contact of gneisses with micaschits and amphibolites, cause increasing the Fe content in the lithologic units and in contact of silicic hydrothermal solutions resulted from gneissic masses, cause the mineralization of garnet and Fe- rich tourmalines.

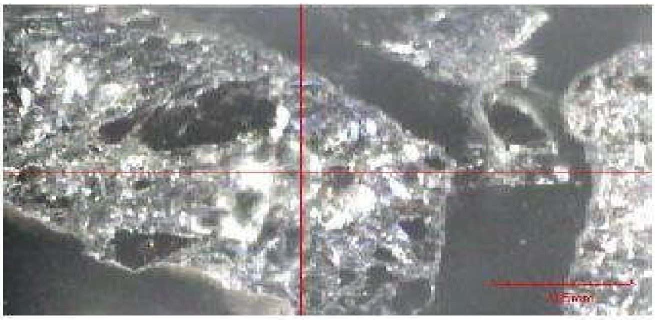


Formula	Mass[%]
MgO	4.36
Al2O3	17.78
SiO2	38.36
CaO	4.44
TiO2	0.09
V2O5	0.04
MnO	2.65
Fe2O3	32.26
ZrO2	0.02

Fig. 10. Images by the microprobe analyzes on garnets. The Dehchah. Due to the high peaks of silicon oxide, iron oxide and silicon oxide garnets Almandine is a notable and any sub-element is enriched in garnets.



Tourmaline(point 1)



Formula	Mass[%]
Al2O3	6.48
SiO2	13.72
SO3	0.83
Cl	0.21
K2O	0.62
CaO	4.09
Sc2O3	0.70
TiO2	3.18
MnO	0.35
Fe2O3	68.83
ZnO	0.74
SrO	0.23

Fig. 11. Images by microprobe analysis were conducted on Dehchah tourmaline zone. Due to the high peaks of iron oxide, silicon oxide and aluminum oxide zone tourmaline is a Shvrl. The important point is that some enriched titanium oxide, titanium-bearing minerals such as biotite criteria, released in gneisses.

CONCLUSION

The Dehchah massive genies are located in Sanandaj-Sirjan metamorphic zone. During the metamorphic fractionation aplitic and silicic veins intrude into the micaschists and amphibolites and cause the garnet and tourmaline mineralization. The results of chemical analysis and diagrams related geochemical ICP.MS indicate that Dehchah granite gneisses of which is formed in calc-alkaline volcanic arc (VAG) and subduction (Syn). According to preliminary granite spider diagrams of rare earth elements in the region due to the low degree of partial melting of the sign is made up of a subduction zone. Also, the primary types of granite gneiss of Dehchah are magmatic type (I). In some cases garnet frequency is more than 35%, with regarding the 10% of economical, so the garnet frequency is important.

REFERENCES

1. Barker,F.(1979),Trondhjemite: definition, environment and hypothesis of origin. Development in Petrology 6,Amsterdam: Elsevier,pp1-12..
2. Barker,A.J.(1990), Introduction to metamorphic textures and microstructures, Blackie, Glasgowe, London, 162P.
3. Chen,B.Jahn,B.M, and Liu,J.B.(2002),Congnetic relationship of the Yangkou gabbro-to-granite unit, Su-Luterrance.Journal of Geological Society London,159.pp457-467.
4. Foord,E.(1976),Petrogerusis of metamorphic Rocks,(Springer).
5. Irvin,T.N& Baragar,W.R.A.(1971),A guide to the chemical classification of the common volcanic rocks,Can.J.Earth.Sci 8,P 523-48
6. Jensen,M.L,Bateman,A.(1981),Economic mineral deposits,*wiley,New York*,*380p*.
7. Kraskuf. K,Mor.F.(1976), Principles of Geochemistry, Tehran University Publications,Iran,,P:620
8. Middlemost, E.A,(1985), Magmas and magmatic rocks ,Longman Group Limited,Essex.
9. Myron,G.Best(2003),Igneous and metamorphic petrology, Brigham young University, Blackwell Publishing company, 2Edition,758p
10. Noori.K.(2005),Introduction to Metamorphic Petrology, Shiraz Navid Publications,Iran,P;345
11. Pearce,J.A.Hariis,N and Tindle,A.G.(1984),Trace element discrimination diagrams for the tectonic interpretation of granitic rocks.Journal of Petrology.25.pp956-983
12. Rollinson, H.R(1993),Using geochemical data,Longman Scientific&Technical,3edition,452p
13. Sabzeie.M, Eshraghi.S.A,Roshanravan.J.(1994),Sheet Neyriz 1/250000, Geological Organization of Iran.
14. Sctoklin, J, (1968), Structural History and tectonic of Iran. A reviw, A. P. g, Geol. Bull. Voll52. No.7
15. Temel,A.Gundogdu,M.N. and Gourgaud,A.(1998),Petrological and geochemical characteristics of Cenozoic high-K calk-alkaline volcanism in Konya,Central Antatolia,Turkey. Journal of Volcanology and Geothermal Research,85,pp.237-354.
16. Troger,J. (1982),Optical mineralogy (Schweizerbart).652p
17. White A.J.R., Chappel B.W. (1983),Granitoid types and their distribution in the Lachlen Fold Belt, southeastern Australia. In:Roddick, J.A., (ed.). Circum-Pacific plutonic terrances. Geological Society of America. 159: 21-34
18. Werner, C.D., (1987),Saxonian granulites – igneous or lithogenous. A contribution to the geochemical diagnosis of the original rocks in high-metamorphic complexes. In: Gerstenberger (ed.), Contributions to the geology of the Saxonian granulite massif. Zfl-Mitteilungen Nr 133: pp 221-250
19. Webber, K.L. Simmons, W.B. Falster, A.U. ,Foord, E.E.(1999), Cooling rates and crystallization of shallo level Pegmatite, aplite dickes, San Diego County, California American Mineralogist, V.84, pp.708-717.
20. Yazdi.M.(2013), Geochemical analysis methods, Jahad Daneshgahi Publications,Tehran,Iran,P:182
21. Zeming,Z., Yong, Y,. Zhang,j.,(2000), The commotional zoning of garnet in eclogite from western segment of Altyn Tagh, Chinese Science Bulletin 45,p 79-83

