

Introduction of Alunite mineral of Mashhad Granitoids

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Abstract

The acidic mass from granodurite to tonalite material is at 17 km west-north Mashhad at Binalood Structural zone that has penetrated in the ophiolite series and zone regional metamorphic rocks and it has resulted a contact aureole at it's around at pyroxen - horenfels facies limit.

The microscopic and chemical evidences indicate the existence of alunite mineral in these masses.

This mineral which belongs to aluminum sulfate minerals group indicating that these masses have a type S and have been emerged from upper Crust rocks.

The chemical analysis from a Region masses indicates that these masses belong to per-alumina group and have emerged with a combination of Calc - Alkaline at continental collision zone.

Key words: Alunite – Mashhad – Granodurite – Tonalite _ type S

Introduction

Mashhad geology sheet area at 1:100,000 scale is located at East North of Iran and at distances limit of 59°30' _60° longitude and 36° _36° ,30 ' latitude.

The set of Granitoids rocks consisting Granodurite – Tonalite and Monzogranite have expanded at Vakil Abad – Bande Golestan – Dehno Shandiz and Koohsangi (figure 1).

An along with the detailed field studies, a systematic sampling has been performed from rock of these areas. These samplings have been issued based on a geology maps by the state geological organization and at 1:100,000 scale from Mashhad and Torqabeh regions have been performed. These rocks having mass structure have had a little alteration and they include mafic mineral like: Biotite and Hornblende.

Discussion

At field studies, 50 samples have obtained from the above Granitoids. These rock which have resulted rather high morphology in this region, are seen at dry color at a fresh level. At some of them are seen a little weathering and at other are seen a severe weathering. The existence of minerals such as Chlorite – Epidot – Zuezit – Sersite and Kaolen in these rocks indicate a low to high weathering.

The existing pieces of mafic and Ultra mafic and also Schist inside of these rocks indicate that Granitoids are a younger than them. These rocks have resulted a contact metamorphism at a region.

The use of different diagrams of geochemistry like diagram (figure 2) shows that these mass are from Calc – Alkaline type. These rocks have been used from a different geochemistry diagrams in order to review Tectono – Magmatic.

Diagrams (figure 3) and (figure 4) indicate that these Granitoids belong to continents concurrence range zone.

The petrography studies of these masses that have textures such as Myrmekite and Graphic indicate the existence of Quartz , Plagioclase (Oligo Clause) , Feldspat from Ortuz and Microcline type as a main minerals and also Biotite, Mosquite and Hornblend as an usual minerals and also Sphen , Apatite and Zircon as minor minerals in these rocks. The petrography evidences (figure 5) and (figure 6) show Alunite mineral at longitudinal and transverse in these rocks, that the existence of Alunite mineral is one of the important evidences of petrography at these rocks.

Alunite or white alum that is refered as rock alum, is from Aluminum Sulfate family with chemical formula as $KAl_3(SO_4)_2(OH)_6$ that has devitrified at Trigonal system and includes Hydroxil agent (OH).

There are $K_2 = 11.4\%$, $Al_2O_3 = 30\%$, $SiO_2 = 38.6\%$, $H_2O = 13\%$ at it's chemical compound.

Alunite is melted with Cobalt Nitrate and become a blue color, that it indicates the existence of Aluminum. it easily dissolve at sulfuric Acid ; but it slowly dissolve at Chloridric Acid. A crystalline masses as fine granule of this mineral may confuse with some white hydrated minerals, and the best way of it's recognition is the use of chemical tests for this reason. we have found the existence of Alunite mineral at Tonalite and Granodurite rocks at Mashhad X-ray diffraction (figure 7) and (figure 8) and also magnetometry experiments (figure 9) and (figure 10) and (figure 11). This mineral is an important source for preparing alum aluminum sulfate. Table 1 shows a chemical analysis of region Alunite acidic rocks that the chemical analysis of rock samples has been performed by ICP method at Canada.

Economic cases and Alunite consumption

At the past, from Alunite was used for preparing Alumina and Potassium Sulfate. The Alumina Sulfate is used at paper – making and tektile industnes and Potassium Sulfate is used for preparing chemical fertilizers. Now it is used from Alunite for preparing Aluminum and also Potassium Sulfate and Sulfuric Acid.

Conclusion

The existence of Alunite mineral is one of the important petrography evidences at Mashhad Granitoid rocks that we can mention to this problem using it, that these acidic masses are Pre-Alumina and belong to type S granite; and it is possible that are resulted from upper Crust melt. with regard to Alunite economic cases, we can do more study in the future.

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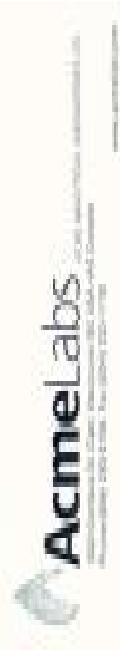


Table 1: ICP result of chemical analysis of samples having Alunite at Mashhad Granitoids

Method	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B
Analyte	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	MnO	Cr ₂ O ₃	NI	Sc	LOI	Sum	Ba	Be	Co	Cs	Ga			
Unit	%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
MDL	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.002	20	1	-5.1	0.01	1	1	0.2	0.1	0.5			
SH3C Rock pulp	64.40	16.53	5.38	1.76	4.50	2.84	2.69	0.47	0.14	0.12	<0.002	<20	9	1.0	99.84	477	2	7.1	4.1	17.9			
Y1 Rock pulp	75.47	14.20	0.70	0.09	0.64	4.21	3.65	0.02	0.17	0.06	0.003	<20	2	0.7	99.92	510	3	0.5	0.9	11.8			
D2 Rock pulp	62.87	17.20	5.84	1.76	4.65	3.06	2.50	0.54	0.18	0.12	<0.002	<20	10	1.5	99.84	427	3	7.5	6.3	19.5			

Method	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B
Analyte	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb			
Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm		
MDL	0.1	0.1	0.1	0.5	0.1	0.2	0.1	0.8	0.5	0.1	0.1	0.1	0.1	0.02	0.3	0.05	0.02	0.05	0.01			
SH3C Rock pulp	4.7	20.1	91.0	2	457.6	1.2	10.2	1.5	61	156.3	15.6	31.1	57.5	7.17	24.7	4.38	1.20	3.57	0.53			
Y1 Rock pulp	1.5	6.4	62.3	2	204.6	1.1	5.4	1.9	0.8	26.6	9.1	7.5	14.5	1.78	6.2	1.38	0.57	1.47	0.26			
D2 Rock pulp	5.1	25.5	100.4	2	450.0	1.9	10.7	1.3	49	176.2	17.6	33.7	68.5	7.69	26.5	4.66	1.27	3.96	0.58			

Method	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B	4A&4B
Analyte	Dy	Ho	Er	Yb	Lu	Mo	TOI/C	LECOA	LECO	TOI/S	TOI/S	Cu	Pb	Zn	Ni	As	Cd	Sb	Bi	Ag	Au	Hg
Unit	ppm	ppm	ppm	ppm	ppm	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
MDL	0.05	0.02	0.03	0.01	0.05	0.01	0.02	0.02	0.02	0.1	0.1	0.1	0.1	1	0.1	0.5	0.1	0.1	0.1	0.1	0.5	0.01
SH3C Rock pulp	2.69	0.48	1.49	0.25	1.49	0.24	0.03	0.03	<0.02	0.9	6.4	7.1	69	4.1	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.8	<0.01
Y1 Rock pulp	1.40	0.26	0.75	0.12	0.73	0.13	0.05	0.05	<0.02	0.3	21.0	34.5	8	1.3	1.0	<0.1	<0.1	<0.1	<0.1	<0.1	0.8	<0.01
D2 Rock pulp	3.16	0.57	1.63	0.26	1.66	0.26	0.04	0.04	<0.02	0.3	3.4	3.0	75	2.2	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	<0.01

Method	Analyte	Unit	MDL	IDX	
				TI	Se
SH3C	Rock pulp	ppm	0.1	0.5	0.5
Y1	Rock pulp	ppm	<0.1	<0.5	<0.5
D2	Rock pulp	ppm	0.3	<0.5	<0.5

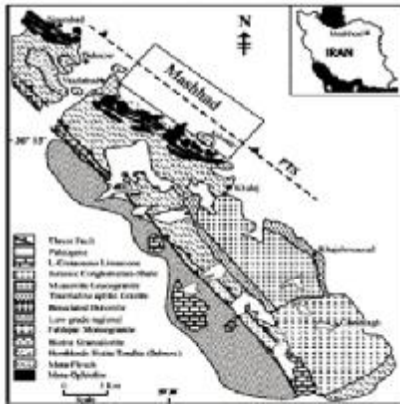


Figure 1 : Geology map of Mashhad Granitoids

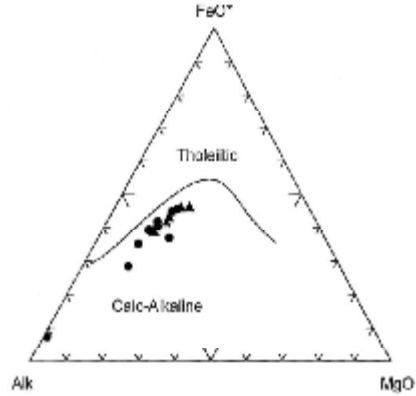


Figure 2: AFM ternary diagram for determining series of Magmatic of under study area rocks

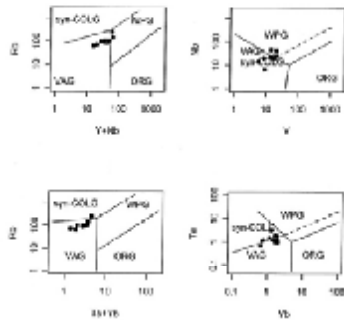


Figure 3: Discrete diagram of region Granitoids tectonic site

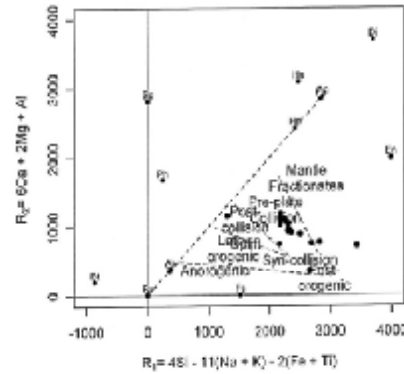


Figure 4: Discrete diagram of region Granitoids tectonic site



Figure 5: A: Longitudinal and transverse cross-section Alunite at (PPL) light.



Figure 5: B: Longitudinal and transverse cross-section Alunite at (XPL) light.



Figure 6: Zircon crystal inside region Alunites



Figure 7: General XRD analysis of Granitoides sample having Alunite at region.

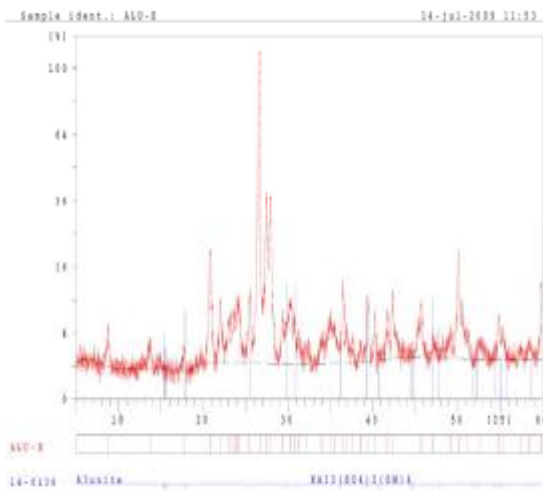


Figure 8: XRD analysis indicating Alunite peak at region Granitoides

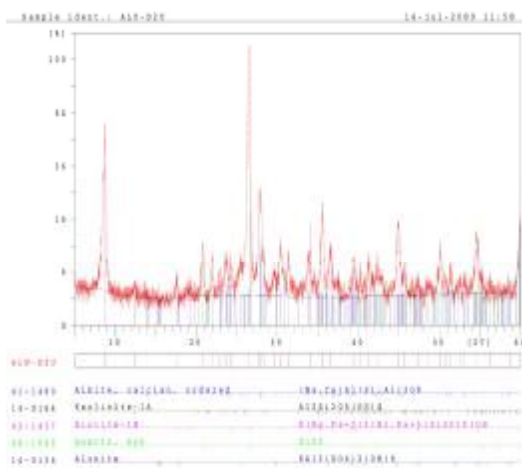


Figure 9: A: Alunite peak at high magnetometry (Magnetism separation) (UP)