

Petrogenesis of Pseudo-colored mélangé of middle Zefreh fault (Isfahan, Iran)

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Abstract

Variety of igneous rocks and condition of their occurrence in the Uromieh-Dokhtar zone has aroused curiosity of many researches in the past decade. Role of Zefreh fault in the middle part of this zone and the basic influence of it in the formation of this area, in conjunction with extensional activity of so called area during the magmatism have produced the outcrops of major lithological units in a belt with several kilometers length and hundreds of meters width. Outcrop of this plutonic and volcanic units formed a pseudo-colored mélangé with about 500 meters width. Consideration and comparison of analysis on the sample gathered along the Uromieh-Dokhtar zone in indicate paragenesis of both series in this area.

1.Introduction

The studied area is located in an area of 12 km², in E52° 15' to E52° 09' and N33° 00' to N33° 11', nearby Bagham village and Komshecheh (in Ardestan, Isfahan) and it is belonged to the structural zone of Uromieh-Dokhtar, along with the west of Central Iran (Fig. 1). According to Hesami (2007), Zefreh fault have a clockwise strike slip with a rate of 2 mm/y. Various igneous rocks and condition of their occurrence can be found in the Uromieh-Dokhtar zone. Role of Zefreh fault in the middle part of this zone and the basic influence of it in the formation of this area, in conjunction with extensional activity of so called area during the magmatism have produced the outcrops of major lithological units in a belt with several kilometers length and hundreds of meters width. The target area have a various lithological units including marble and calcite, andesitic lavas, rhyolite and rhyodacite, andesitic tuff, andesitic basalt, basalt and microgabbro intrusion (Fig. 2). In the east of the Zefreh (from Aliabad to Ardestan), Jamali (2002) have defined the Uromieh-Dokhtar lithology as andesitic basalt, trachyandesite, trachyte, dacite, rhyolite, gabbro intrusions and monzodiorite with calcite filled fractures. This lithology is also reported from the west of the Zefreh fault (in the east of Lart-Paghari) (Fig. 1). In this paper, the word of "pseudo colored mélangé" is used for the studied lithology in the east of Lart-Paghari.

2.Analytical Methods

Representative specimens were selected for geochemical analysis after macro- and microscopical observations. A quantitative chemical analysis of whole rock was carried out

by XRF method at geological survey of Iran and Isfahan University. Analytical data of 16 samples are available in table 1.

3. Discussion

3.1. Petrography

Outcrop of this plutonic and volcanic units formed a pseudo-colored mélange with about 500 meters width. Both area lithologies are similar consisting of basalt, andesite, dacite and rhyolite, andesitic tuff, gabbro and monzodiorite. However, microscopical studies indicated that samples from both similar areas are different in some few petrographical features. For example, olivine is observed just in the gabbros from the pseudo colored mélange (the west of the fault) (Fig. 3). This might be occurred because of a lower rate of crystallization in the gabbroic melts of pseudo colored mélange.

3.2. Geochemistry

Application of whole rock geochemical data indicated that both area rocks have a similar magmatic trend and lithology, but the basic rocks from the west of the fault (pseudo colored mélange) are a little more basic, with lower alkali content in compare to those from the east of the fault. This caused the samples from the east of the fault to be high-K calcalkaline while those from the west are medium-K calcalkaline. This calcalkaline nature is resulted by the alteration and magmatic differentiation. However, that might be related to the higher degree of contamination with the crust, in the samples from the west (pseudo colored mélange), and subsequently their deeper source. In addition, presence of olivine crystals in the former group shows a higher rate of extrusion and depth.

4. Conclusions

According to the wide variety of rocks from acidic to basic composition, caused we called the west of the Lart-Paghari as pseudo colored mélange. Petrography and geochemistry of both studied area (pseudo colored mélange and the east of the fault) revealed that basic rocks from the west of the fault (pseudo colored mélange) are a little more basic, with lower alkali content in compare to those from the east of the fault. Consideration and comparison of analysis on the sample gathered along the Uromieh-Dokhtar zone in indicate paragenesis of both series in this area.

References

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Table 1: Whole rock analysis data from XRF of 16 samples of basalt, andesite and gabbro in the Zefreh fault area. Major elements are in weight percent and the others are in ppm.

Rock Type	Basalt	Basalt	Basalt	Basalt	Trachy andesite	Trachy andesite	Andesite	Andesite	Dacite	Rhyolite						
Sample	B5	j5	B7	B1	j10	j8	j4	B2	j6	j7	B3	j3	j2	j1	j9	B6
SiO ₂	46.03	50.19	50.77	51.19	54.83	58.66	57.88	59.51	67.30	64.20	69.46	69.81	70.25	71.22	72.60	74.55
TiO ₂	0.84	1.78	0.88	0.94	0.60	0.49	0.84	0.50	0.29	0.32	0.21	0.20	0.19	0.12	0.18	0.14
Al ₂ O ₃	18.80	16.51	18.30	18.34	20.31	18.58	16.89	17.52	15.44	17.40	14.90	14.72	15.23	14.58	13.91	13.70
FeO	0.00	0.08	0.00	0.00	0.16	0.28	0.11	0.00	0.22	0.45	0.00	0.10	0.15	0.15	0.19	0.00
Fe ₂ O ₃	10.76	7.42	9.10	9.53	6.70	6.37	2.62	5.20	1.71	3.36	2.72	2.31	0.78	0.89	0.83	1.13
MnO	0.18	0.39	0.19	0.17	0.17	0.12	0.23	0.13	0.09	0.09	0.07	0.11	0.07	0.05	0.07	0.01
MgO	7.21	7.22	4.56	4.13	3.01	0.40	3.58	1.93	2.38	1.90	0.63	0.71	0.41	0.32	0.60	0.18
CaO	10.19	7.54	9.63	8.90	6.94	2.10	5.54	5.43	3.08	4.56	2.63	2.53	1.31	1.45	2.37	1.61
Na ₂ O	2.66	2.33	2.62	3.19	4.12	4.89	1.57	4.10	2.96	3.57	3.81	2.89	3.77	3.73	3.55	4.33
K ₂ O	0.39	2.25	1.24	1.47	2.70	4.62	5.15	1.75	3.52	2.97	3.10	3.71	3.96	4.66	3.90	2.58
P ₂ O ₅	0.19	0.32	0.16	0.17	0.20	0.14	0.29	0.21	0.17	0.11	0.09	0.23	0.24	0.14	0.08	0.04
LOI	2.54	nd	2.30	1.79	nd	nd	nd	3.51	nd	nd	2.07	nd	nd	nd	nd	1.48
Total	99.79	96.03	99.75	99.82	99.74	96.65	94.70	99.79	97.16	98.93	99.69	97.32	96.36	97.31	98.28	99.76
Ba	nd	636	nd	nd	640	630	670	502	620	703	797	611	610	613	616	743
Rb	nd	57	nd	nd	61	75	60	37	95	92	56	111	127	104	108	73
Sr	381	397	355	389	411	420	403	389	382	410	440	391	358	328	400	245
Cs	nd	1	nd	nd	1	1	1	nd	nd	1	nd	nd	nd	nd	nd	nd
Ga	nd	nd	nd	nd	nd	nd	nd	nd	14	nd	nd	11	12	10	10	nd
Ta	nd	1	nd	nd	1	1	1	nd	1	1	nd	1	1	1	1	nd
Nb	nd	6	nd	nd	6	6	6	nd	9	10	nd	11	10	14	13	nd
Hf	nd	5	nd	nd	5	5	5	nd	4	5	nd	4	4	3	5	nd
Zr	89	143	96	104	148	161	140	118	150	201	118	178	147	131	196	104
Y	nd	23	nd	nd	24	24	28	nd	23	20	nd	21	20	22	20	nd
Cr	178	nd	nd	nd	nd	nd	nd	nd	nd	nd	178	nd	nd	nd	nd	226
Se	nd	15	nd	nd	14	14	14	nd	nd	12	nd	nd	nd	nd	nd	nd
Cu	152	nd	136	160	nd	nd	nd	88	nd	nd	88	nd	nd	nd	nd	72
Zn	145	nd	112	145	nd	nd	nd	80	nd	nd	72	nd	nd	nd	nd	nd
S	nd	nd	104	nd	nd	nd	nd	140	nd	nd	144	nd	nd	nd	nd	164
La	nd	16	nd	nd	17	14	12	nd	13	10	nd	15	16	13	16	nd
Ce	nd	15	nd	nd	17	20	21	nd	12	31	nd	19	12	16	25	nd
Nd	nd	24	nd	nd	29	22	21	nd	nd	18	nd	nd	nd	nd	nd	nd
Sm	nd	5	nd	nd	5	6	6	nd	13	6	nd	15	14	16	19	nd
Eu	nd	2	nd	nd	2	1	2	nd	nd	2	nd	nd	nd	nd	nd	nd
Tb	nd	1	nd	nd	1	1	1	nd	nd	2	nd	nd	nd	nd	nd	nd
Yb	nd	3	nd	nd	2	2	2	nd	nd	2	nd	nd	nd	nd	nd	nd

nd = not determined

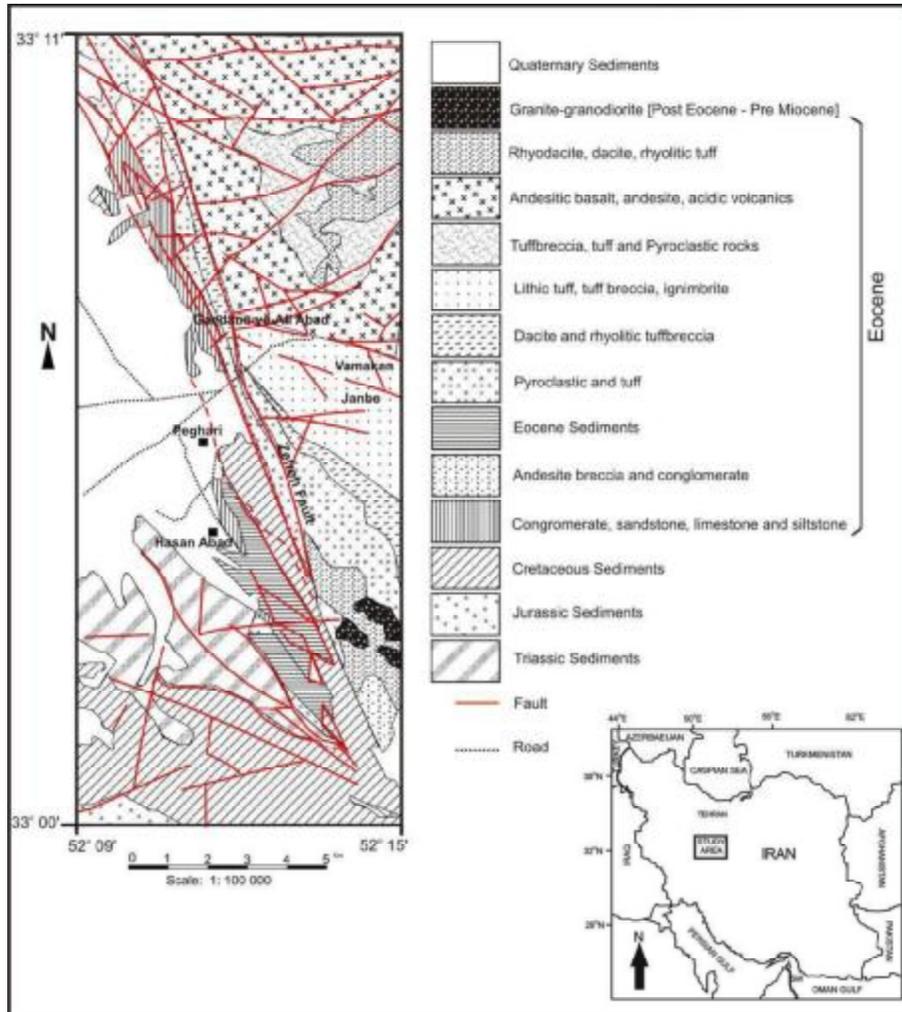


Fig. 1: Geological map of the Zefreh fault with an NW-SE trend (adopted from ardestan 1:100'000 map sheet, by Geological Survey of Iran).

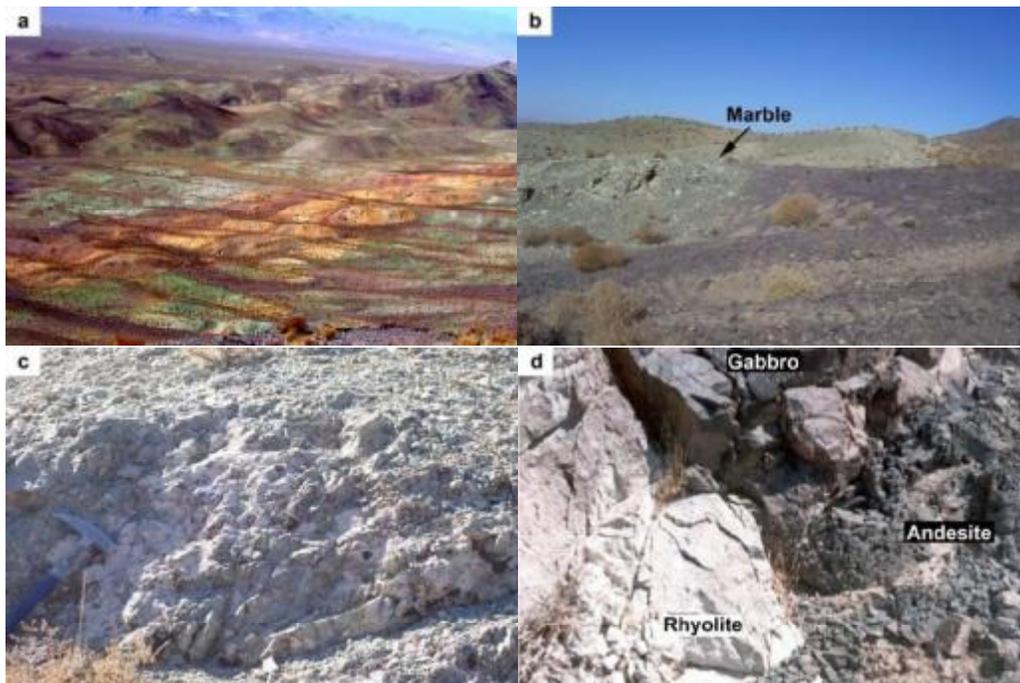


Fig. 2: East of Lart-Paghari: (a) marble and andesites; (b) a colorful view of the pseudo colored mélangé showing various lithology; (c) mylonitized rhyolitic tuff; (d) presence of rhyolite, gabbro and andesite together.

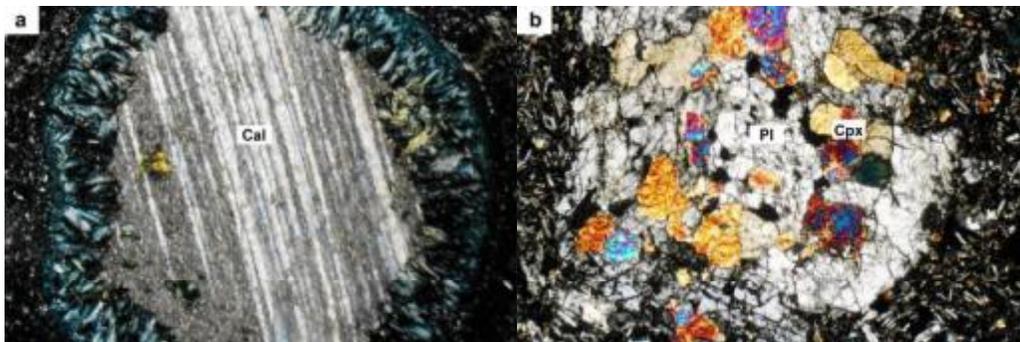


Fig. 3: Microscopic thin section of andesitic basalts and microgabbro in XPL views (40X). (a) Vesicular andesitic basalt (filled with calcite and zeolite); (b) Microgabbro (pyroxenes are surrounded in plagioclases).