Journal of Economic Geology
Vol. 6, No. 2 (2014-2015)
ISSN 2008-7306

مجله زمین‌شناسی اقتصادی
جلد ۶، شماره ۲ (سال ۱۳۹۳)
صفحات ۱۵ و ۱۶

Petrography and petrology of Quaternary volcanic rocks from Ghezel Ghaleh, northwest Qorveh

Alireza Bajelan *and Morteza Sharifi

Department of Geology, University of Isfahan, Isfahan, Iran

Submitted: May 22, 2013
Accepted: Oct. 5, 2013

Keywords: *Alkali basalt, Qorveh-Takab, Quaternary, Ghezel Ghaleh, iddingsite, Sanandaj- Sirjan*

Introduction

In the east and northeast of Sanandaj in the Qorveh-Bijar-Takab axis, there are series of basaltic composition volcanoes with Quaternary age. The study area is part of the Sanandaj-Sirjan zone and is located between 47°52' and 47°57' E longitudes and 35°26 and '35°30' N latitudes. Due to the location of the volcanic cone on Pliocene clastic sediments and Quaternary travertine, the age of these volcanoes is considered to be Quaternary. The cones mostly consist of low scoria, ash, volcanic bombs, lapilli deposits and basaltic lava (Moein Vaziri and Aminsobhani, 1985). Petrological and geochemical studies have been carried out to evaluate Quaternary magmatism in the area and to determine the nature of the lithological characteristics, such as the evaluation of source rocks and magma type, degree of partial melting and the tectonic setting of Ghezel Ghaleh rocks (Moein Vaziri, 1997). Simplified geological map of the study area is characterized by ER-Mapper software.

Materials and methods

In the course of field studies in the region, 40 samples were taken, 30 thin sections were prepared and polished. XRD analyses were performed on some whole rock samples. All major, minor and trace elements were assessed by ICP-MS at Lab Weft Laboratory in Australia.

Results

Based on the classification of structural zones, the area is located in the Sanandaj-Sirjan zone, hundred kilometers away from the main Zagros thrust along the NW-SE direction. After early Cimmerian orogeny, andesitic volcanic activity took place (Moein Vaziri and Aminsobhani, 1985). A major secondary mineral in these rocks is iddingsite, formed by hydration and oxidation of the olivine (Shelley, 1993). According to SiO_2 against $Na_2O + K_2O$ (TAS) diagram (Irvine and Baragar , 1971) and cationic R1 and R2 diagram (De La Roche et el., 1980), volcanic rocks of the area indicate alkaline series.

Discussion

To obtain more information on the tectonic setting of these rocks, the Zr/Y-Zr diagram by Pierce (Pearce and Norry, 1979) as well as Nb/Y versus Ti/Y diagram of Pierce (Pearce and Cann, 1973), show that alkali basalt rocks in the study area are fitted in the field of within plate basalts. To determine the genesis of rocks from melting curve of Aldanmaz and Colleagues (Aldanmaz et al., 2006) based on changes in REE (La on Sm/Yb), the samples show approximately 1 to 5% partial melting of garnet lherzolites. The spider diagrams indicate that the studied rocks are enriched in LREE and LILE, depleted in HFSE with no Eu anomaly, Cs, Sr, and Pb positive anomalies which are the characteristics of alkaline magmas and high concentrations of incompatible elements and alkaline elements in the lava, implying the melting of the lower part of the mantle source. Light rare earth elements, are incompatible with the primary crystallized phases such as olivine, clinopyroxene and plagioclase, consequently focused increasingly during phase crystallization and fractionation in the remaining fluid (Hirschman, 1998).

Conclusions

Based on microscopic and geochemical data, these rocks are alkali basalt, basanite and tephrite. The rocks contain olivine, pyroxene, feldspar, and

*Corresponding author's email: bajelan.alireza@yahoo.com

minerals such as iddingsite, opaque and secondary minerals, calcite with porphyritic texture and microlitic and glassy matrix, vesicular and some glomeroporphyritic, vitrophyric and amygdaloidal textures. Most minerals have undulose extinction which indicates mantle deformation. Geochemical data for the rocks indicate high-K alkaline characteristic of the primary magma. The spider diagrams indicate that the studied rocks are enriched in LREE and LILE, depleted in HFSE with no negative Eu anomaly, positive anomalies of Cs, Sr, Pb which are characteristics of alkaline magmas. These rocks are produced by partial melting of garnet-lherzolite rich under lithospheric mantle. Based on tectonomagmatic diagrams, they are within plate basalts and by magmatic series graphs are alkali basalts. Microscopic evidence such as disequilibrium textures in the minerals (zoned state, solution and twinning) shows a magmatic contamination in mixing volcanic mass.

References

Aldanmaz, E., Koprubasi, N.O., Gurer, F., Kaymakci, N. and Gournaud, A., 2006. geochemical constraints on the Cenozoic, OIB-type alkaline volcanic rocks of NW Turkey: implications for mantle sources and melting processes. Lithos, 86 (1–2) pp. 50–76.

De La Roche, H., Leterrier, J., Grand claude, P. and Marchel, M., 1980. A classification of volcanic and plutonic rocks using R1-R2 diagrams and major elements, it's relationships with current nomenclature. Chemical Geology, 29(1-4): 183–210.

Hirschman, M., 1998. Origin of the transgressive granophyres in the layered series of the Skaergaard intrusion, East Greenland. In: D.J. Geist and C.M. White (Editors.). Journal of Volcanology and Geothermal Research, 52(1-3): 185–207.

Irvine, T.N. and Baragar, W.R.A., 1971. A guide to chemical classification of the common volcanic rocks. Canadian Journal of Earth Sciences, 5(8): 448– 523.

Moein Vaziri, H., 1997. The history of magmatism in Iran. Tehran University Press, Tehran, 440 pp. (in Persian)

Moein Vaziri, H. and Aminsobhani, A., 1985. Study of young volcanic region being involved in –Qorveh- Takab. Tehran University Press, Tehran, 350 pp. (in Persian)

Pearce, J.A. and Cann, J.R., 1973. Tectonic setting of basaltic volcanic rocks determind using traceelements analysis. Earth and Planetary Science Letters, 19(2): 290– 300.

Pearce, J.A. and Norry, M.J., 1979. Petrogenetic implications of Ti, Zr, Y and Nb variation in volcanic rocks. Contributions to Mineralogy and Petrology, 69(1): 33– 47.

Shelley, D. (Translated by Mohamadzadeh, F.), 1993. Igneous and metamorphic rocks under the microscope, classification, textures, microstructures and mineral preferred-orientations. Chapman and Hall, Unwin, London, 445 pp.