The study and apply geochemical criteria to determine tectonical environment and magmaic origin of the ophiolite of Mashhad

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Abstract

The ophiolite complex of Mashhad with outcrops of mafic and ultramafic rocks are being widespread in southwest to northwest of Mashhad. This complex has been separated in two main ranges, one of which is located in south and southwest with majority of igneous and sedimentary fragments and the other one is located in northwest near the Veirany village including mafic and ultramafic rocks from ideal ophiolite complex. The chemical and spider diagrams which have been drawn from major and trace elements of this complex identified geochemical origin of tholeitic, tectonical position of ocean floor and existence of harzburgite residuals in base of this complex with high partial melting and high extensive velocity. Studies show this ophiolite complex is related with HOT harzburgite type. The existence of fragments in ophilitic complex and metamorphic rocks accompanying them are inside the upper Permian granites of Mashhad to Triassic showing replacement of the ophiolitic complex on Iran's crust which has been occurred before Triassic.

Keywords: *Tholeitic, HOT type, Ophiolite complex, Mashhad, Harzburgite*

1) Introduction

Iran's ophiolites are parts of paleo-thetis and neo-thetis stroke from Cyprus, Russia, Turkey and Iran inside of Oman (Ghasemi et al, 2002) . The region of the case study locating in Binalood plate and 1:100000 geological maps Mashhad between 33, 59 altitudes and 33, 36 latitudes which are favored by geologists for a long time and more studies have been done in this region. The mentioned region is located in SW to NW of Mashhad and we can access it via the main Mashhad – Torghabeh road and Mashhad – Shandiz road in SW. Using 1:100000 Mashhad – Torghabeh maps (Fig1), field studies occurred in seven major geotraverses from SW of Hesar-E-Sorkh, Veirany, SW of Pir-Kakhky, south of Safiabad, west of Ghasemabad, south of bachenar and Kheirabad village and three geotraverses from Majooni mountains. Ophiolite complex of Mashhad which has tholitic nature belongs to harzburgite type.

2) Methodology

By using 1:50000 aerial photos and 1:100000 maps of Mashhad and Torghabeh (Fig 2), field studies have been occurred. From intact specimens which have been studied after microscopic studies for identification petrogenetic, tectono magmatic and geochemical studies by applying XRF and XRD methods, geochemical analysis were resulted. Then using the FPT and Newret and the results of the specimens geochemical analysis, various diagrams have been drawn and they are used to analyze the magmatic and tectonical ophiolite nature of Mashhad.

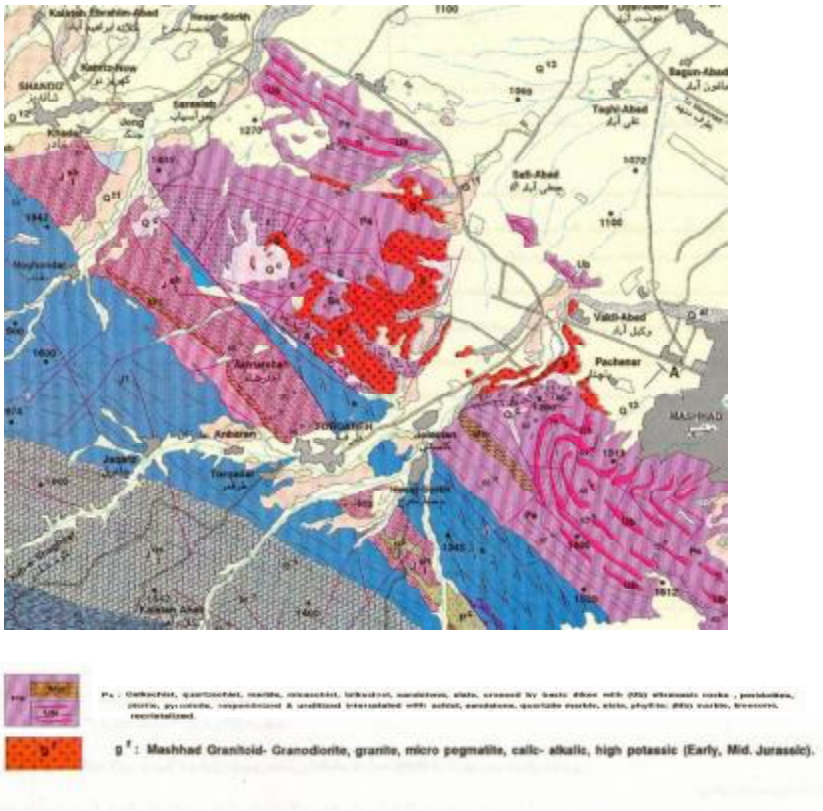

Fig 1) Map geological 1:100000 Torghabeh Geological Map

Fig 2) Aerial Photo Torghabeh

3) Geochemistry and Tectonical Position

The geochemical study of mafic and ultramafic rocks complex of Mashhad ophiolite are based on analyzing specimens which are studied with XRF method. The peridotites of this complex show rare changes in such a way that the ratio of Mgo/Mgo + Feo of them is about one and amount of Mgo is near to 30%. The existence of Mgo-olivine from Forstrite type and also existence of Mg-pyroxenite like hypresthene and enestite prove these issues.

Mafic and ultramafic rocks are rich from Fe and the ratio of Mgo/Mgo + Feo of them is less than ultramafic in this region. According to the different geochemical diagrams, these rocks belong to tholitic territories. The index of tholitic to sub-alkaline of these basalts which can be witnessed in (Irvin and Bargar) and (Miyashiro, 1974) diagrams (Fig.3, 4). By using amount of major and trace elements originated from complex ophiolite of Mashhad which used from (Pearce and Norry, 1979), (Shervise, 1982), (Pearce and Cann , 1973) diagrams suggested tectonical position of ocean floor and mid ocean ridges for this complex (Fig 5 , 6 , 7 , 8).

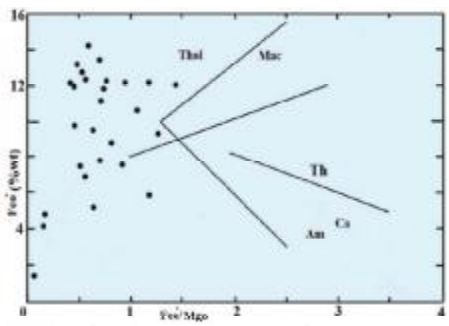

Fig 3) Diagram Miyashiro.

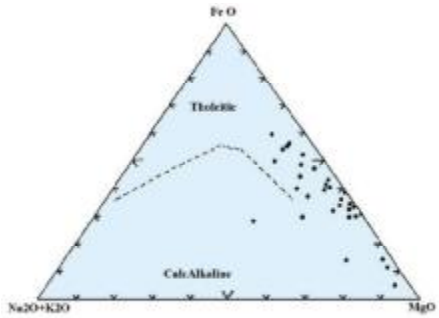

Fig 4) Diagram Irvin and Bargar.

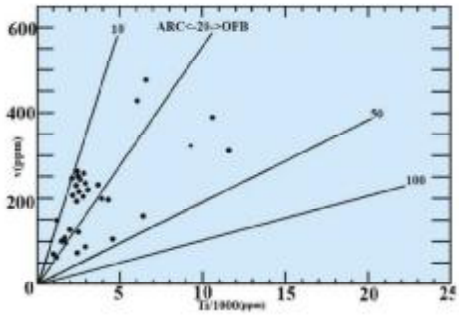

Fig 5) Diagram Shervise.

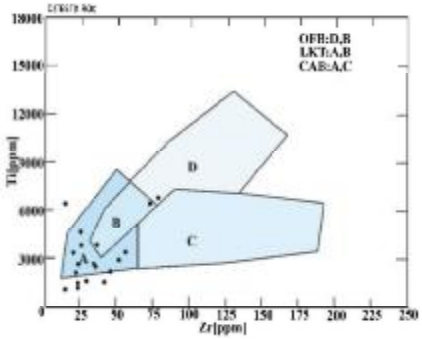

Fig 6) Diagram Pearce and Cann.

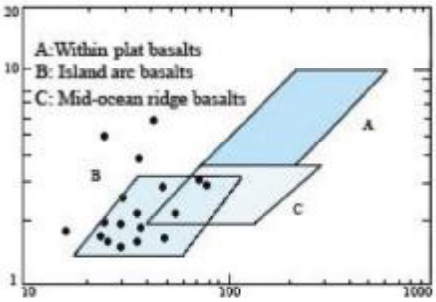

Fig 7) Diagram Pearce and Norry.

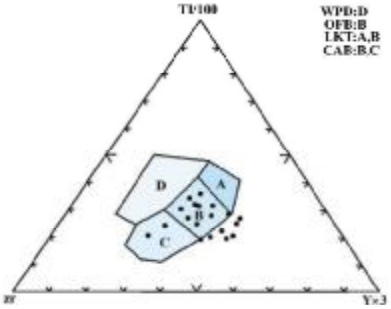

Fig 8) Diagram Pearve and Cann.

4) Spider Diagrams

The assessments amount of the minor elements in rocks have based new structures concerning study of tectenomagmaic issues in places with various geological observations in the world. For this reason spider diagrams are applied. In these studies several diagrams are used which have different order of element replacements and different normalizing units. For instance, (Thompson and Sun 1980), (Rollinson, 1993), normalized the elements of the stone according to the similar elements in condorite. Also, (wood, et al, 1979), (wood, 1980) have based the normalization on the earth's mantle compound. These diagrams have their own shapes in each of the tectonical regions. For example, the diagram belonging to alkaline basalt and related to continental reef have a very similar shape and subduction basalt diagrams have non similar shape and they are bar-shaped. All of the unadjusted elements in spider diagrams of these study regions except for a few adjusted elements in the right part of the diagram show richness in contrast with condorite meteorites. Among Sc- Rb- Sr- Ba elements, of the great group of lithophyle ion, thorium, linoleum, tantalum, potassium, and REE like zirconium, eiriom, hafizm which bear a great deal of richness in contrast with condorite meteorites (willson,1989) (Fig 6, 7).

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