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Geochemistry and tectonic setting of the Golabad granitoid complex (SW Nain, Iran)

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ABSTRACT

The Oligo-Miocene Golabad granitoid complex intrusive into the Eocene volcanic rocks occurs in the Urumieh-Dokhtar Magmatic Arc (UDMA) in Iran. According to microscopic and chemical studies, the granitoid complex consists of three different rock types: 1) plutonic rocks comprising diorite, quartz diorite, granodiorite and granite; 2) volcanic rocks composed of basalt, andesite basalt, ± pyroxene bearing andesite and rhyolite, and 3) pyroclastic rocks. The main mineral constituents of these rocks are mostly plagioclase (oligoclase and andesine), quartz, K-feldspar, amphibole (magnesio-hornblende and actinolite-hornblende) and Mg-biotite. In addition, apatite, titanite, zircon, and opaque minerals are common accessory minerals. The studied enclaves are classified as mafic micro-granular enclaves (MME) with monzodiorite compositions. Geochemically, the rocks in this study represent medium to high-K calc-alkaline series, metaluminous and I-type nature.

Plotting, the chemical composition of plagioclase on the An-Ab-Or ternary diagram, the temperature of crystallization is estimated to range from 700 to 900 °C at a pressure of 4.5 Kbar. High TiO_2 values of biotites from the Golabad granitoid complex suggest magmatic origin and the crystallization temperature is estimated to range from 700 to 750 °C. The amphiboles according to their chemical analysis, are classified as igneous amphiboles generated in high oxygen fugacity conditions. The chemical data of the amphiboles and biotites pointed out to the I- type nature of the Golabad granitoid complex emplaced in an active continental margin subduction setting. The amphibole crystallization pressure was estimated by Al in amphibole varies from 1.09 to 2.28 Kbar. Using the calculated pressure the depth of the formation of the Golabad granitoid complex estimated from 4 to 9 Km.

1. Introduction

The collision of the Eurasian plate and the Afro-Arabian plate during the late Mesozoic and Cenozoic formed the Urumieh-Dokhtar Magmatic Arc (UDMA) (Richards and Sholeh, 2016). The UDMA along with the Sanandaj-Sirjan zone and the Zagros folded-thrust belt are the three main geological subdivisions of the Zagros orogenic belt (Alavi, 2004). The UDMA is the result of the several events including opening, subduction and closure of the Neo-Tethys Ocean. Carboniferous and Permian plutonic events in Sanandaj-Sirjan zone are considered related to the rifting and formation of the Neo-Tethys (see in Alavi, 1994). Some workers believe that the tectonic setting of UDMA is related to the continental rift (Emami, 1981; Sabzehei, 1994) whereas, others believe that its tectonic setting is associated with a subduction zone (Berberian and Berberian, 1981). Some geologists suggested that the calc-alkaline magmatism ended around 5 Ma (Late Miocene) and was replaced by alkaline magmatism associated with slab break-off (Ghasemi and Talbot, 2006; Honarmand et al., 2014). The Eocene volcanism in Iran and throughout the Middle East and the Mediterranean regions is related to the opening of back-arc basins (Kazmin et al., 1986). The beginning of most of the magmatic activities in UDMA occurred in the Eocene and continued in Middle Eocene until Plio-Quaternary formed a variety of igneous rocks (Berberian and Berberian, 1981; Ghasemi and Talbot, 2006; Torabi, 2009). Therefore, these features are the reasons for studies and investigations of this zone (UDMA) by researchers. The study area is part of the 1:250000 geological map of Nain prepared by Amidi and Alavi (1978). Mansouri Esfahani and Norbehesht (1997) studied the

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