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GEOCHEMISTRY, PETROLOGY AND THE ORIGIN OF SHAHR-BABAK OPHIOLITE, CENTRAL IRAN

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ABSTRACT

The Iranian ophiolites have been divided into four groups (Takin, 1972; Stocklin, 1974; McCall, 1997; Ghazi and Hassanipak, 1999): i) ophiolites of northern Iran along the Alborz range; ii) ophiolites of the Zagros Suture Zone, including the Neyriz and the Kermanshah ophiolites, which appear to be extensions of the Oman ophiolite emplaced onto the Arabian continental mass; iii) ophiolites and coloured melanges of the Makran region which are located to the south of the Sanandaj-Sirjan microcontinental block, including unfragmented complexes such as Sorkhband and Rudan, and iv) ophiolites and coloured melanges that mark the boundaries of the internal Iranian microcontinental block, including some of those in the Makran region (e.g., Band-e-Zeyarat, Dar Anar, Ganj) and those inside of the Sanandaj-Sirjan microcontinental block (Shahr-Babak, Nain, Baft, Sabsevar and Tchehel Kureh). The Shahr-Babak ophiolite is a highly dismembered ophiolite complex located along the Nain-Baft fault zone, which marks the western border of the Central Iranian microcontinent. The Shahr-Babak ophiolite is considered to be one complexes of the internal Iranian group of ophiolites and coloured melanges (Fig. 1).

The igneous rocks of this complex consist of both mantle and crustal suites. The mantle rocks include peridotites (lherzolites, harzburgites and dunites), serpentinites and webstrite-pyroxenites. The crustal rocks include both plutonic and volcanic sequences. The plutonic rocks consist of gabbros, diorites, and plagiogranites. The volcanic sequence exhibits a wide range in composition from basaltic andesite to rhyodacites-rhyolites and trachyandesites. Also present are extensive units of radiolarian chert which are interbedded within the basaltic andesites. A combination of petrographic observations and analyses of incompatible trace elements and rare earth elements (REE) indicates the presence of at least three different types of extrusive rocks in the Shahr-Babak ophiolite (Fig. 2). The chemical data on these extrusive rocks clearly shows that the extrusive rocks were formed from two distinct magmatic sources; i) the melts that produced the basaltic andesites and rhyodacites were generated in an island arc type environment, and ii) the melt that produced the trachyandesites was generated in a within-plate environment (e.g. intraplate-oceanic island). The geochemical data suggest that the basaltic andesite melt was generated either by a large degree of partial melting (ca. 40%) of a mantle lherzolite source or by a lesser degree of partial melting (15-20%) of a previously depleted mantle source. The data also suggests that the gabbros, diorites, plagiogranites, basaltic andesites and rhyodacite-rhyolites are petrogenetically related and were produced by fractionation controlled by removal of plagioclase and to a lesser extent clinopyroxene. The presence of compositionally diverse extrusive rocks (basaltic andesite, andesites, rhyodacite, rhyolites and trachyandesites) intercalated with a variety of Triassic-Cretaceous sedimentary rocks indicates that the Shahr-Babak ophiolite has both island arc and intra-oceanic components. These components were brought together during northeast dipping subduction of a narrow belt of oceanic lithosphere under the Central Iranian microcontinent and Eurasia. This seaway was part of the southern Tethyan ocean which surrounded the Central Iranian microcontinent.

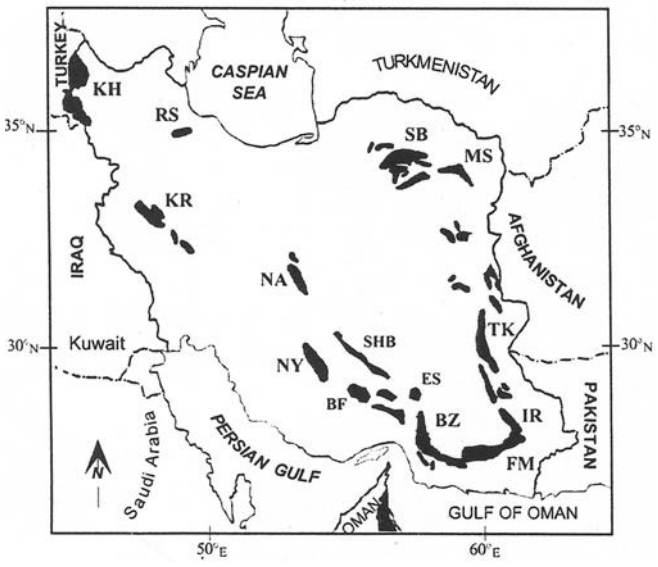

Figure 1 - Distribution of Iranian ophiolites showing locations of major ophiolite complexes. KH: Khoy, KR: Kermanshah, NY: Neyriz, BZ: Band-e-Zeyarat, NA: Nain, SHB: Shahr-Babak, BF: Baft, ES: Esphandagheh, FM: Fanuj-Maskutan, IR: Iranshahr, TK: Tchehel Kureh, MS: Mashad, SB: Sabzevar, RS: Rasht.

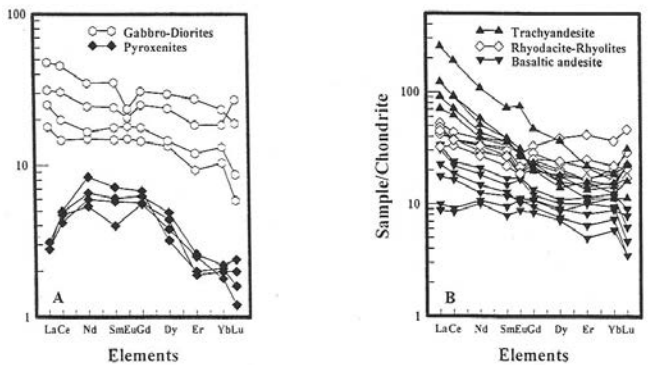

Figure 2 - A) Chondrite-normalized REE patterns for the gabbros-diorites, and the ultramafic units from the Shahr-Babak ophiolite, B) Chondrite-normalized REE patterns for the extrusive units from the Shahr-Babak ophiolite.

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