U–Pb dating and isotopic composition of the Tafresh intrusions in central part of UDMA, Iran: Implication for petrogenesis, the role of crust-mantle interaction and geodynamic process

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Most studies in the Urumieh-Dokhtar magmatic arc (UDMA) have focused on volcanic rocks, whereas the origin of the associated plutonic rocks is not well characterized. This paper presents new zircon U-Pb ages, Sr-Nd isotopes and whole-rock elemental geochemistry for the Tafresh plutonic rocks in the central part of the Andean-type UDMA in Iran. The Tafresh plutonic rocks consist of gabbro to quartz monzo-diorite which their U-Pb LA-ICP-MS dating of zircons yielded ages of 22 to 20 Ma for diffrent phases, suggesting emplacement at the Early Miocene time. The plutonic rocks are characterized by enrichment in LREEs relative to HREEs with negative Nb–Ta anomalies, showing geochemcial feature of subduction-related magmas. Their measured 87Sr/86Sr isotopic compositions range from 0.7046 to 0.7065, suggesting negligible crustal assimilation during fractional crystallization. They have narrow ranges of 143Nd/144Ndi (0.5125 to 0.5128) and their Nd model ages (TDM= 440 to 790 Ma) are consistent with derivation from Iranian continental crust and subcontinental lithospheric mantle of Cadomian age (500–600 Ma). Field relations and geochemistry demonstrate that all rock types are effected by fractionation. Tafresh granitoids with wide ranges of Y/Nb and low Zr/Nb ratios imply the contribution of crust (i.e. crust–mantle interaction) during magma genesis. Judging from our data, a straightforward interpretation of Early Miocene Tafresh magmatism is partial melting related to the final stages of a subduction system prior to the collision between the Arabian and Eurasian lithospheric plates.

Keywords: Urumieh-Dokhtar magmatic arc; plutonic rocks; zircon ages; Rb–Sr; Early Miocene; assimilation, partial melting