

Geochemical and Sr-Nd isotopic constraints on origin of the Marivan granitoid body, northwest Iran

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The Iranian plateau is a part of the Alpine-Himalayan orogenic belt and is divided into eight main structural units. Among the units, the Sanandaj-Sirjan Zone (SaSZ) is an active continental margin located in the west of Iran. The SaSZ is situated between the Zagros Fault in the west and the Urumieh-Dokhtar magmatic arc (UDMA) in the east. The Marivan granitoid body in the northwest of Marivan city is located in the northern SaSZ, and the younger granitic body intrudes the Cretaceous sedimentary complex. This body mainly comprises granite, granodiorite, monzonite, diorite and appinitic rocks (hornblende-rich diorite). Zircon U-Pb ages for three samples show that the crystallization of the body occurred at 37.8 ± 1.1 Ma in the Eocene. The geochemical characteristics of major and trace elements indicate that this granitoid body is composed of granitic and appinitic lithologies. The granitic rocks have high contents of SiO_2 (67.1-78.9%) and alkali elements ($\text{Na}_2\text{O} + \text{K}_2\text{O}$) and low contents of TiO_2 (0.03-0.52), Fe_2O_3 (0.65-3.96) and MgO (0.04-0.95). In contrast, the appinitic rocks show lower amounts of SiO_2 (56.1-59.5) and K_2O (1.99-3.21) and higher amounts of Fe_2O_3 (5.59-6.98) and MgO (1.37-4.25). In addition, rare earth element (REE) contents in the appinites are higher than those in the granites. Based on the chemical variation diagrams, the granitic and appinitic rocks are classified as high-K series, and most of them are peraluminous to metaluminous. The granitic rocks are enriched in garnet, suggesting a relation to S-type granite, but the appinitic rocks show geochemical characteristics of I-type granite. The e_{Nd} ($t=40$ Ma) value (-3.3 to 0.0) and $^{87}\text{Sr}/^{86}\text{Sr}$ ratio ($t=40$ Ma) (0.7048 to 0.7075) for the granitic and appinitic rocks indicate that a crustal continental component such as amphibolite had a major role in the origin of the Marivan rocks. Based on the petrological, chemical and isotopic data, injection of hot mafic magma in the lower crust are probably responsible for partial melting of lower crust, leading to development of the Tertiary granitoid in the northern SaSZ.

Keywords: Iranian plateau, collision zone, granite, S-type, Sanandaj-Sirjan Zone, Marivan