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Geochemistry, petrogenesis, and tectonic setting of the Almoghlagh batholith in the Sanandaj–Sirjan zone, Western Iran

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Abstract

The Almoghlagh batholith in the northern Sanandaj-Sirjan magmatic–metamorphic zone comprises three intrusive bodies (gabbroic diorite, quartz syenite, and quartz monzonite) that were generated during the northeastward subduction of Neo-Tethys beneath the Iranian sector of the Eurasian plate. These bodies intruded at different time phases and are related to post-collision magmatism. The quartz syenite and quartz monzonite rocks with specifications of metaluminous, generally ferroan, alkalic to alkali-calcic types, high content of Na₂O+K₂O, Zr, Ce, Ga, Y, Nb, Ta, and rare earth elements, and depleted in Eu, Sr, and Ti show borderline characteristics between A₁ and A₂ types granitoids but with more affinity to A₂ type. The gabbroic dioritic rocks show borderline specifications between A₁ and I types rocks but with more affinity to I type. Distinctive spiked peak patterns in spider diagrams accompanied by (La/Yb)_{CN} values equal to 2.44 to 6.11 and a Ba/La ratio >3 indicate the magmatism activity in the volcanic arc environment. The characteristics (Ba/Rb)_{PN} < 1, (Ba/Th)_{PN} < 1, and Th/Ta ratio from 3.18 to 8.42 suggest the magmatism activity of the continental margin setting. The specifications of post-collision magmatic activities, ¹⁴³Nd/¹⁴⁴Nd > 0.512638 in some samples, ε_{Nd}^t > 0, ε_{Sr}^t > 0, and high content of Nb, Ta, and Zr (589 ppm) demonstrate the involvement of the mantle source, subducted slab fluids, high flux of mantle-derived halogen-rich volatiles, and contamination within the crust during the petrogenesis of intrusions. After the initial collision, the operation of minor subduction (with slab break-off) or foundering of the lithospheric mantle (delamination) occurred because of asthenospheric upwelling and heat flows in the mantle in the Sanandaj-Sirjan zone. Stretch and local disruptions were created by these heat flows; simultaneously, magma was formed and ascended upward.

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