

A Geochemical Perspective on A-Type Granites of Khanak and Devsar Areas, Haryana, India: Implications for Petrogenesis

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Abstract : Granites from Khanak and Devsar areas, a part of Malani Igneous Suite (MIS) were investigated for their geochemical characteristics to understand the petrogenetic aspect of the research area. Neoproterozoic rocks of MIS are well exposed in Jhunjhunu, Jodhpur, Pali, Barmer, Jalor, Jaisalmer districts of Rajasthan and Bhiwani district of Haryana and also occur at Kirana hills of Pakistan. The MIS predominantly consists of acidic volcanic with acidic plutonic (granite of various types), mafic volcanic, mafic intrusive and minor amount of pyroclasts. Based on the field and petrographical studies, 28 samples were selected and analyzed for geochemical analysis of major, trace and rare earth elements at the Wadia Institute of Himalayan Geology, Dehradun by X-Ray Fluorescence Spectrometer (XRF) and ICP-MS (Inductively Coupled Plasma- Mass Spectrometry). Granites from the studied areas are categorized as grey, green and pink. Khanak granites consist of quartz, k-feldspar, plagioclase, and biotite as essential minerals and hematite, zircon, annite, monazite & rutile as accessory minerals. In Devsar granites, plagioclase is replaced by perthite and occurs as dominantly. Geochemically, granites from Khanak and Devsar areas exhibit typical A-type granites characteristics with their enrichment in SiO₂, Na₂O+K₂O, Fe/Mg, Rb, Zr, Y, Th, U, REE (except Eu) and significant depletion in MgO, CaO, Sr, P, Ti, Ni, Cr, V and Eu suggested about A-type affinities in Northwestern Peninsular India. The amount of heat production (HP) in green and grey granites of Devsar area varies upto 9.68 & 11.70 μWm^{-3} and total heat generation unit (HGU) i.e. 23.04 & 27.86 respectively. Pink granites of Khanak area display a higher enrichment of HP (16.53 μWm^{-3}) and HGU (39.37) than the granites from Devsar area. Overall, they have much higher values of HP and HGU than the average value of continental crust (3.8 HGU), which imply a possible linear relationship among the surface heat flow and crustal heat generation in the rocks of MIS. Chondrite-normalized REE patterns show enriched LREE, moderate to strong negative Eu anomalies and more or less flat heavy REE. In primitive mantle-normalized multi-element variation diagrams, the granites show pronounced depletions in the high-field-strength elements (HFSE) Nb, Zr, Sr, P, and Ti. Geochemical characteristics (major, trace and REE) along with the use of various discrimination schemes revealed their probable correspondence to magma derived from the crustal origin by a different degree of partial melting.

Keywords : A-type granite, neoproterozoic, Malani igneous suite, Khanak, Devsar

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