

The Geodynamic Significant of the Sanandaj-Sirjan Subduction System, Iran: Implication for HFSE Enrichment in Island Arc Setting

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The tectono-magmatic evolution of the Neo-Tethyan realm in Iran began with rifting of the Neo-Tethys ocean between the Iranian Cimmerian blocks and the Gondwana during Late Permian-Early Triassic time. These rifted margins are evidenced by the presence of alkaline lavas, radiolarites and platform limestones in the Kermanshah and Neyriz regions. The subduction initiation of the Neo-Tethyan ocean in intra-oceanic tectonic environment started at Late Triassic and continued to late Cretaceous evidenced by creation of fore-arc spreading as the Hajiabad mélangé zone and Jurassic-Cretaceous arc-related magmatism within the Sanandaj-Sirjan Subduction System. These magmatic activities exposed in a 1300 km magmatic-sedimentary basin, and range in composition from transitional to calc-alkaline affinities. The volcanic suites exhibit low $^{87}\text{Sr}/^{86}\text{Sr}$ (0.7043-0.7044) and low $^{143}\text{Nd}/^{144}\text{Nd}$ (0.51281-0.51292) ratios and have more fertile mantle (E-MORB-Like) trace element patterns characterized by enrichment in high field strength elements (HFSEs) like Nb, Ta, Ti, Zr, Th, U and total REE relative to P-mantle and average N-MORB. REE modeling indicates these rocks formed by partial melting of a garnet-spinel lherzolite mantle source. However, our new trace element data suggest mantle wedge in the Sanandaj-Sirjan island arc is enriched by possible addition of melts or supercritical aqueous fluids subduction components which caused a mantle heterogeneity. The proportions of slab-derived HFSE-REE components transferred to basalt sources in the mantle wedge. Because the subduction of oceanic slab controls the arc geochemistry, so HFSE enrichment along the Sanandaj-Sirjan arc can imply residual minerals, most likely rutile or garnet, controlled extremely high HFSE partitioning into subduction-related fluids which equilibrated with mantle wedge above the subducted slab. During the closure of Arabian plate with Central Iranian block in Late Cretaceous, the Neo-Tethyan ocean and related fore-arc basin emplaced along Main Zagros Thrust as Zagros ophiolitic belt such as Kermanshah, Neyriz and Hajiabad ophiolites.