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U-Pb geochronology and geochemistry of Zahedan and Shah kuh plutons, eastern Iran: Implication for the late stage of the tectonic evolution of the South Sistan Zone

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The N–S trending Sistan Suture Zone (SSZ) in eastern Iran is attributed to eastward subduction beneath the Afghan continental block of an inlet of the Mesozoic Tethys Ocean. We present U-Pb zircon crystallization ages combined with petrography, major and trace element analyses, Hf isotopes, Rb-Sr and Sm-Nd isotopes of intermediate to granitic intrusions stretched along the southern segment of the SSZ. We obtained two clearly separated clusters of concordant ages, which are taken as the crystallization age of the host plutonic rocks. The first cluster, between ca 42.5 and ca 44.5 Ma from euhedral zircons of the main granodiorite to diorite and related dykes. The second age cluster span from ca 28.3 to ca 31 Ma. These ages were obtained for granites and dykes, the latter being consistently slightly younger than the country rock. The high SiO_2 content (62-75 wt %) of Eocene magmatic rocks points to melts with a high crustal contribution in consistency with their relatively high-K (3-4.4 wt %) calc-alkaline nature. The high SiO_2 and K contents in the Oligocene calk-alkaline rocks series shows adakite-like fractionation. Oligocene adakite-like rocks have relatively low to medium 87Sr/86Sr and 143Nd/144Nd ratios, which are similar to typical lower thick crust-derived adakites. The mix positive and negative εHf(T) values of all zircons from the 42.5-44.5 Ma shows mix nature of magma (the contamination of subduction related magma with partial melting of crust). The positive εHf(T) values of all zircons from the 28-31 Ma adakite-like rocks indicate that the magma was not produced from pure depleted mantle. Instead, they are consistent with a host magma source within a largely juvenile and subduction-related mafic lower crust. Eocene granitoids represent anatectic melts emplaced at higher crustal levels; in addition slab melts modified the mantle wedge and subsequent, contaminated mantle magmas fed intrusions such as the Zahedan diorite.