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U-Pb geochronology and geochemistry of Eocene and Oligocene plutons in southeast Iran: Implication for closure of the South Sistan Suture Zone

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The N-S trending Sistan Suture Zone in eastern Iran is a splay of the Tethys sutures. It represents an oceanic embayment that separated the Central Iran from the Afghan continental blocks. Structural, tectonic and petrological/geochemical evidence define eastward subduction beneath the Afghan continental block of the Sistan inlet of the Mesozoic Tethys Ocean. Mapping of the area allowed reaching and sampling intermediate to granitic intrusions stretched along the southern segment of this collisional suture zone. U-Pb zircon crystallization ages combined with major and trace element analyses, dated the series of granite-granodiorite-rhyolite at ca 40.5-44.3 Ma and ca 28.9-30.9 Ma. Isotopic geochemistry, including Sr-Nd isotopes and Hf isotope analyses, and petrological modelling suggest that the 40.5-44.3 Ma plutons crystallized from melts largely derived from the turbidites of the host accretionary wedge. Melting of the deep wedge was induced by the intrusion of mantle magmas interacting with the crustal turbiditic melts, which is responsible for the wide range of compositions. Most of the 28.9-30.9 Ma magmas were generated from mantle melting, with assimilation of the surrounding turbidites. The rare setting of within-wedge intrusions is attributed to mantle upwelling reaching wedge sediments at the inception of delamination processes, which sign the end of subduction-related deformational and thermal events in the Sistan Suture Zone. Numerical modelling of subduction – magma production – intrusion and melting of wedge sediments further constrains this collisional to post-collisional scenario.