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Geochemical signatures of Pan-African intrusives along the Najd Fault system, Saudi Arabia

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Orogenic belts are characterized by the occurrence of intrusive rocks which mark different magmatic cycles during the tectonic evolution of the belt. The Arabian-Nubian Shield is considered to be one of the largest Neoproterozoic juvenile continental crust exposures on Earth which was formed due to the collision between East- and West-Gondwana. This orogen was cut by one of the largest shear zones on Earth, the Najd Fault System. Different relationships between intrusives and the Najd Fault System are observed: (1) some igneous bodies predate the activity of the shear zone, (2) others intruded during the shearing process and (3) some intruded after the activity of the Najd Fault system. The intrusive rocks along the Najd Fault system in the study area display a geochemical and compositional diversity. Magmatic rocks with dioritic composition were derived from meta-aluminous tholeiitic magmas around 700 Ma related to a volcanic arc environment. Granodiorite-tonalite intrusions belobg to the medium K-series with calc-alkaline affinity and display a meta-aluminous to per-aluminous character (ca. 700 and 660 Ma) typical for a syn-collisional volcanic arc environment. The magmatic activity terminated with per-aluminous calc-alkaline intrusives which belong to a syn-collisional to within-plate environment. The granitic rocks have an emplacement age of 605-580 Ma. These magmatic events are identical for the whole Arabian-Nubian Shield, however contamination from crustal material or different rates of fractionation are recorded in the investigated samples which are responsible for systematic variations in the geochemical signature of the intrusive rocks.