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Link between magmatism and subduction-related events in eastern-southeastern Turkey

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Southeastern Anatolia is a major collisional setting related to the subduction of the Afro-Arabian plate beneath the Eurasian plate during the Late Cretaceous-Eocene phase of the Alpine–Himalayan orogeny. During the subduction, the southern branch of NeoTethyan ocean was consumed, and oceanic basin was subducted beneath the eastern Taurides (Eastern Anatolide-Tauride Platform) along the Bitlis-Zagros subduction system. Successive slab roll-back and a possible slab break-off events played an important part in the magma generation, leading to distinct chemical compositions ranging from syenite, syenodiorite, monzonite, phonolite, granodiorite, diorite, monzodiorite and gabbro during subduction and collision. The geochemical features of magmatic rocks in eastern and southeastern Anatolia have alkaline and sub-alkaline characteristics being generally of calc-alkaline composition. They have alkali-calcic to calcic, and metaluminous to peraluminous characteristics. The progression of calc–alkaline to alkaline magmatism within the transect is explained as a consequence of gradual change in the geometry of subduction and slab roll-back followed by a possible slab break-off during subduction. This led to block faulting and subsidence, and thus to the preservation of near-surface magmatic systems.

The U–Pb zircon and Ar-Ar age data for magmatic rocks define an age gradient from south to north. The Ar-Ar and U-Pb ages confirmed that there are three distinct time periods during which magma generation took place. Magmatic activity started at the southern border of the Southeast Anatolian orogenic belt (SEAOB) with the intrusion of large monzodiorite, granodiorite-granite body at 82.9$\pm$0.4 to 77.5$\pm$2.7 Ma

into metamorphosed basement rocks of eastern Taurides during Andean-type subduction. A change in the subduction geometry probably due to collision and obduction of the Malatya-Keban platform caused a hinge retreat (slab roll-back) coupled with orogen-parallel initial extension on the overriding plate and invasion of hot asthenosphere resulted in the generation of post-collisional calc-alkaline melts at 74.40±0.5 to 73.40±0.4 Ma Further increase in the roll-back or regional extension created partial melts within metasomatized mantle producing alkaline magmas and these were emplaced into the metamorphic terrains along transtensional, deep crustal structures. High precision U-Pb ages confirmed that this event took place at 71.0 ± 1.0 to 69.9 ±0.5 Ma in some of alkaline systems. The same event has been dated as 74.1 to 71.8±0.5 Ma based on Ar-Ar dating on biotites.

After Arabia and Anatolides became sutured, large scale postorogenic crustal-scale (strike-slip) faulting was accompanied by bimodal volcanism in the early to middle Eocene. The widespread post-orogenic felsic calc-alkaline to alkaline (and mafic alkaline magmatic activity along the northern (Calti-Bizmisen-Copler granitoids) and southwestern part (Horoz and Karamadazi granitoids) of the SEAOB can be explained by initiation of a rupture or detachment of slab (slab break-off process) beneath the Malatya-Keban platform (Eastern Taurides). A change in the convergence rate or further increase in the roll-back has been probably coupled with slab break-off and crustal scale structures with sub-basins bounded by faults with dominant strike-slip component and co-magmatic shallow intrusions at 54.3±1.7 to 44.43±0.6 Ma mainly along an arcute belt parallel to sinistral Yakapinar-Goksun Fault zone .

Key Words: Eastern-southeastern Anatolia, southeastern Anatolian orogenic belt, subduction, post-collision, slab roll-back, eastern-southeastern Turkey.