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Linked magmatic events in central Turkey: geochemistry and geochronology of the Beypazari and Sivrihisar granitoids

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Turkey is comprised of multiple crustal fragments due to the closure of branches of Tethyan oceans. Deciphering the tectonic history of the region requires key information regarding the timing of the closure of these oceans and understanding when multiple subduction-related systems were active. Here we report geochemical, textural, and geochronological data from two subduction-related granitoid plutons ∼70 km apart (N/S) in central Turkey: the Beypazari and Sivrihisar plutons. These bodies vary significantly in composition and emplacement. For example, the Beypazari has been reported to be granite to diorite and has intruded into metamorphic rocks of Turkey's Sakarya Zone, whereas the Sivrihisar pluton is granodiorite to monzonite and has contact relationships with the subducting Tavsanli slab. All plutons have a range of ages in the geological literature from the Late Cretaceous to mid Eocene. In this study, we apply detailed cathodoluminescence imaging and ion microprobe dating of individual zircons in thin section to better understand the reason for the age range. Overall, ages of zircons from both plutons overlap, suggesting they share a similar source and history. We find Sivrihisar zircons are Late Cretaceous to mid Eocene, whereas those from the Beypazari pluton are Early Cretaceous to mid Eocene. Another plutonic body adjacent to the Sivrihisar granite yields mid Eocene to Early Oligocene results. Two concordant ∼5 Ma zircon ages are found in one sample of the Beypazari granite, likely related to metamorphism during subsequent extrusional or extensional activity. These granites show ample evidence for magma mixing, including different K-feldspar to plagioclase reactions, shocked plagioclase cores, and a range of textures and geochemical signatures from single outcrops. We speculate that they were initially metaluminous, magnesian, alkalic, volcanic arc rocks derived from a subducting slab that became more peraluminous, ferroan, and calcic over time. Fractional crystallization occurred during maturation of their source and rocks later mixed with syn-collisional and/or crustally derived melts. In our model, the rocks are sourced from the subducting Ayfon slab under the HP/LT Tavsanli Zone, recording the closure of a southern branch of the NeoTethyan Ocean.