Geochemical and Seismic Insights Into Melting Under Central Anatolia

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Mantle upwelling after continental collision – whether by slab tearing or rollback, or by delamination of lithosphere – can promote melting under continents. In Central Anatolia, Turkey, magmatism after Arabia-Eurasia collision expanded progressively to the southwest, creating an ~400 km SW-NE oriented volcanic belt [1]. At its southwestern end, Quaternary-aged melt equilibration at depths of ~45–50 km coincides with shallow melt-infused asthenosphere (V_S ~4.1 km/s). Melt generation by upwelling of subduction-modified peridotitic mantle with a potential T (T_P) <1350°C was due to slab rollback and/or lithosphere delamination [2]. At the northeastern end of the volcanic belt, Anatolide-Tauride Block (ATB) volcanism was widespread during the mid-Miocene (14–20 Ma), but was more localized at ~11 Ma and ~5 Ma. Mafic compositions range from Mg-rich (Mg#=55–68) basanites to subalkaline basalts. Small-scale geochemical and Hf-Nd isotopic heterogeneity is recorded by the basanites, whereas geochemical and Pb isotope compositions of the basalts resemble those of ocean island basalts, and especially circum-Mediterranean anorogenic magmatism. Olivine and whole rock transition metal signatures suggests fO_2>QFM and additionally implicate greater pyroxenite contributions in melts generated farther from the Central Anatolian Inner-Tauride suture zone. Estimated mantle equilibration depths of 55 to 70 km for ATB basaltic melts also decrease away from the suture zone. Melt extraction near the base of the lithosphere is consistent with regional lithosphere-asthenosphere boundary depths (60–65 km), and suggests little removal of the lithosphere since the mid-Miocene. Low-velocity upper mantle (V_S ~4.1–4.25 km/s) is currently present at comparable depths (~70 km). Maximum mantle equilibration temperatures vary by >100°C and likely reflect the role of pyroxenite coupled with variable heat consumption during melting, rather than local heterogeneity in T_P. Considering the high mantle potential temperatures in Eastern Anatolia, ATB volcanism was probably generated in mantle that upwelled after slab break-off.

[1] Schleiffarth et al., submitted. *Geosphere*. [2] Reid et al., 2017. *G-Cubed,* doi:10.1002/2016GC006772.

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