Peak pressure-temperature conditions and timing of subduction of the Cycladic Blueschist Unit on Syros, Greece

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Constraining pressure-temperature (PT) conditions and timing of peak metamorphism in high-pressure/low-temperature (HP/LT) rocks is fundamental to understanding subduction dynamics and the thermal evolution of the plate interface. The Cycladic Blueschist Unit (CBU) in Greece is one of the world's best examples of an exhumed subduction shear zone; however, PT (12-22 kbar, 450-580°C) and timing of the subduction-exhumation transition (50-30 Ma) are poorly constrained. To refine the CBU's P-T-t path, we investigate Syros rocks via microstructural analyses, Quartz-in-Garnet Inclusion barometry (QuiG), Ti-in-Quartz (TitaniQ) thermobarometry, and multi-mineral Rb-Sr geochronology.

We first use microstructures and petrology to distinguish prograde from retrograde fabrics; we find (consistent with previous work) relicts of prograde subduction in mafic blueschists and eclogites, as well as in specific structural domains in retrogressed, meta-sedimentary blueschist-to-greenschist facies rocks. Raman spectroscopy analyses were collected at Virginia Tech under ambient conditions using an Ar 514.32 nm laser. We used the frequency shift of the 464cm^{-1} quartz band to calculate inclusion P; entrapment P was calculated following Ashley et al. [1]. TitaniQ analyses were collected at Arizona State University using an ^{16}O-ionbeam. We estimate T from [Ti] using the Thomas et al. [2] calibration, assuming P from QuiG and titania activity = 1 (rutile present). We find remarkable consistency in P from the QuiG barometer in different rock types across the island: ~14-16 kbar (n=86, 17 samples). TitaniQ of quartz inclusion trails in prograde-zoned garnet and epidote have stark homogeneity in [Ti], 0.2-0.6 ppm (n=28, 4 samples), corresponding to T ≈ 420-480°C. We targeted prograde domains in one mafic and one meta-sedimentary blueschist to constrain timing of peak subduction with Rb-Sr geochronology; results are in progress. Similar peak PT across Syros suggests a "subduction depth limit" of 50-55 km, perhaps controlled by the geometry of the subduction zone prior to slab rollback and regional extension.

[1] Ashley et al. (2016) *Geology* 44 (9) 699-702; [2] Thomas et al. (2010) *Contrib. Min. Pet.* 160 (5), 743-759.