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The *mélange* zone at the slab-mantle interface has been proposed as important contributor of material to the source region for arc magmas. Additionally, hybrid *mélange* rocks are rich in accessory phases that may act as a carrier for trace elements across the slab-mantle interface during *mélange* diapirism. Chlorite-actinolite schists, such as those from Syros, Greece, represent a mature *mélange* matrix composed of ultramafic, mafic, and sedimentary components. Chlorite-actinolite schist sample SY404 contains titanite (6 wt %), apatite (4 wt %), magnetite (4 wt %), and minor pyrite, zircon, monazite, and rutile. In this study we characterize trace element zoning of large (0.5–1 mm) idiomorphic titanite grains. In the field these honey-yellow titanite grains are most abundant in distinct (cm scale) zones in the outermost sections of reaction rinds of mafic and metasedimentary blocks.

Trace element concentrations in titanite were determined by LA-ICP-QQQ-MS using a NWR193UC excimer laser ablation system coupled with an Agilent 8900 mass spectrometer at the University of Maine MAGIC Laboratory. Concentrations in titanite were determined relative to the NIST610 glass reference material. NIST612 glass and BLR-1 titanite were analyzed as quality control materials. Major and trace element concentrations in titanite show two distinct zones: (1) high-Al cores enriched in Rb, Y, and HREE, and (2) low-Al rims enriched in Na, Sr, Nb, Ta, and LREE. In a closed system, decreasing Rb, Y, and HREE may reflect fractionation of trace elements during titanite growth; however, in an open system they may also be a function of changing trace element partitioning conditions (i.e., a trace element response to metasomatic replacement) or an evolving fluid composition. Increased Nb and Ta in titanite rims is likely related to rutile breakdown during rind formation. Additionally, positive correlation of Nb with Na and negative correlation of Nb with Al + Fe suggests the coupled substitution of Nb^{5+} plus Na^+ for Ti^{4+} plus Ca^{2+} . This contrasts with the proposed substitution for 5+ cations (e.g., Nb, Ta) in titanite which is balanced by $(\text{Al}, \text{Fe})^{3+}$ for two Ti^{4+} cations.