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Geochemical characteristics of lawsonite blueschists in tectonic mélange from the Tavşanlı Zone, Turkey: Potential constraints on the origin of Mediterranean potassium-rich magmatism

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Abstract

The petrology, mineralogy, and geochemistry of lawsonite blueschists from the Tavşanlı zone in northwest Turkey—one of the best-preserved blueschist terranes in the world—have been comprehensively investigated. The blueschist samples contain lawsonite + sodic amphibole + phengite + chlorite + titanite + apatite ± aragonite ± quartz ± relict igneous pyroxene ± Mn-rich garnet and opaque phases. Lawsonite is a significant repository for Sr, Pb, Th, U, and REE, whereas phengite carries the most large-ion lithophile element (LILE), titanite hosts the highest Nb and Ta as well as considerable amounts of high field strength element (HFSE), and apatite strongly controls Sr. Two groups of blueschist have different origins—enriched continent-derived terrigenous origin and mid-ocean ridge basalts (MORB)-like submarine basalts—assigned on the basis of whole-rock major and trace element compositions and initial Sr-Nd-Pb isotopic results. Lawsonite in blueschist with enriched origin exhibits strong Th/La fractionation, raising the possibility of the involvement of blueschist facies mélange to explain the origin of Mediterranean potassium-rich magmatism because similarly high Th/La ratios are also observed in the Mediterranean potassium-rich lavas. We propose that subduction-induced tectonic imbrication took place entirely at shallow depths (<80 km), giving rise to a newly formed lithosphere where oceanic and continental crustal materials, sediments, strongly depleted peridotite blocks, and metamorphic rocks are all imbricated together, and in which many of the compositional characteristics of the lawsonite blueschist are sequestered. Subsequent melting of the fertile and enriched components in this new lithosphere would result in the generation of potassium-rich post-collisional mafic magmas with diagnostic geochemical affinities.

Keywords: Lawsonite blueschist, Sr-Nb-Pb isotope, protolith of blueschist, the Tavşanlı zone, K-rich magmatism, high Th/La