Lawsonite blueschists in recycled mélange involved in K-rich orogenic magmatism

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The origin of K-rich orogenic magmatism in the Alpine-Himalayan belt and its relationship to the large-scale elevations in several massifs of the orogen is controversial, particularly the significance of the widespread presence of a geochemical signal typical for recycled continental crust. Two competing scenarios invoke direct melting of continental crust during deep intercontinental subduction and removal of heavily metasomatised mantle lithosphere by delamination into the convecting mantle. Here we investigate the coupling of high Th/La ratio with crustal isotopic signatures in K-rich orogenic lavas that does not occur in volcanic rocks from other collisional environments to distinguish between these two models. High-pressure experimental results on a phyllite representing upper crustal composition and a detailed mineral and geochemical study of blueschists from Tavşanlı mélange, Turkey, indicate that this geochemical fingerprint originates by melting of subducted mélange. Melting of crust at the top of the subducted continental lithosphere cannot produce observed fingerprint, whereas lawsonites, especially those with terrigenous sediment origin from blueschists with high Th/La can. Lawsonites that grow in various components of a subduction mélange inherit the geochemical characteristics of either oceanic or continental protoliths.

The source regions of the potassic volcanic rocks consist of blueschist facies mélanges imbricated together with extremely depleted fore-arc peridotites in a mantle lithosphere that was newly formed during the convergence of small continental blocks and oceans. This process takes place entirely at shallow depths (<60-80km) and does not require any deep subduction of continental materials