



Sources and speciation of sulphur and carbon in the subduction zone mélange

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Subduction zones impose a major control on the geochemical cycling between the surficial and internal reservoirs of the Earth. Subduction of pelagic sediments and altered oceanic lithosphere returns water, C, S, B, and numerous other volatiles to Earth's mantle. The recycling of these species and in particular the release of oxidizing sulphate- and carbonate-bearing fluids modifies the redox state of the mantle and controls the chemistry of arc volcanoes through the ascent of fluids from the slab into the sub-arc mantle, where they ultimately control the formation of arc-related porphyry deposits. Yet, the mechanisms of sulphur and carbon cycling within subduction zones are still unclear, in part because data are typically derived from arc volcanoes where fluid compositions are modified during transport through the mantle wedge. To better understand sulphur and carbon fluxes within subduction complexes, we analyzed the carbon and sulfur geochemistry of exhumed mafic and ultramafic samples from Syros, Greece. In particular, we use the redox-sensitive element sulphur – abundant in altered oceanic lithosphere as both oxidized (sulphate) and reduced (sulphide) phase – to track fluid sources and redox conditions, and to infer mechanisms of element redistribution in the subduction channel mélange. Comparison of isotopic data with major and trace element compositions indicates seawater-alteration and subsequent chemical exchange with a sediment-derived fluid within the subduction zone channel. We show that small bodies of detached slab material are subject to metasomatic processes during exhumation, in contrast to large sequences of obducted ophiolitic sections that retain their seafloor alteration signatures. Furthermore, our results document limited sulphur fluxes within the subduction zone channel, and that the mélange matrix does not serve as an important conduit for sulphur transfer in subduction zones.