Geochemical insight into subduction initiation, element mobility in metamorphism, and provenance signal bias in clastic rocks

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Recent and ongoing geochemical studies in the Franciscan subduction complex, California give insight into physical and geochemical processes along convergent plate boundaries. High-grade (thrust sheets and block-in-mélange) metabasites were metamorphosed by partial subduction during Franciscan subduction initiation, analogous to subophiolitic metamorphic soles. Trace element and isotopic data from these rocks show that their protoliths formed in a supra-subduction zone (SSZ) environment, similar to that of the structurally overlying Coast Range ophiolite [1,2]. This indicates that the high-grade rock protoliths and Coast Range ophiolite formed over a pre-Franciscan subduction zone. Key geochemical signatures in subduction complex metabasites of a variety of metamorphic grades show no correspondence with metamorphic grade, indicating that the protolith signature of the high-grade rocks is not an artifact of element exchange during subduction zone metamorphism [3]. Our data show no evidence of chemical exchange between metabasites and co-subducted pelagic or clastic ("continental") sediments [1-4]. Trace element data reveals some graywackes with minimal continental signature and some with more significant continental components, without a systematic correspondence with depositional age, or detrital zircon age populations [4]. Systematic provenance signal bias appears to reflect chemical weathering at the source.

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