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An O-isotope profile through the HP–LT Corsican ophiolite, France and its implications for fluid flow during subduction

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Abstract

Subduction zones are important sites for fluid generation as the downgoing slab undergoes progressive high-pressure metamorphism. These fluids are thought to play an important role in the generation of arc-magmas, but their affect on the subducted slab itself is less clear. In this study, the stable isotope geochemistry of the Corsican ophiolite, which is variably affected by subduction-related metamorphism, was investigated to assess the impact of subduction zone fluid flow on the downgoing slab. A total of 170 stable isotope analyses (oxygen and carbon) showed the following features: (1) overall, the ophiolite preserves the same oxygen isotope profile with depth as unmetamorphosed ophiolites; (2) the variation in oxygen isotope values for different areas does not correlate with metamorphic grade; (3) oxygen and carbon isotope values for calcite in the ophiolite are not in equilibrium with the ophiolite but are similar to those of the overlying calc-schists (Schistes Lustrés); and (4) hydrogen isotopes indicate that serpentinitisation of ultramafics occurred during sub-seafloor hydrothermal alteration and probably also during tectonic emplacement of the ophiolite. These features indicate that large-scale fluid flow did not affect the Corsican ophiolite during subduction zone metamorphism. Calcite in the ophiolite was probably precipitated from CO_2-bearing fluids derived from decompression dehydration reactions affecting the overlying Schistes Lustrés during exhumation of the ophiolite-bearing Schistes Lustrés nappes. Given that ocean crust must undergo at least some dehydration during prograde subduction zone metamorphism, the evolved fluids must be either highly channelled or exit the slab relatively quickly so as to not interact with it. The results of this study indicate that the important fluid pathways on Corsica have yet to be identified, but are probably the shear zones and fault systems that bound different slices of the high-pressure nappe stack.

Keywords: Fluids; Ophiolites; Corsica; Subduction; Oxygen isotopes

1. Introduction

Subduction zones play a critical role in the global geochemical cycle, being the location at which chemical components are both recycled into the mantle (through subduction) and returned to the atmo-

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