

Distinct P-T histories in a subduction mélange reveal underplating/mixing processes at the plate interface (North Motagua Mélange, Guatemala)

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Abstract

Relicts of subducted and exhumed ocean floor preserved in suture zones record the events occurring at the plate interface. In particular, underplating and exhumation are the two main processes required to recover rocks from mantle depths.

High-grade blocks exposed in serpentinite mélanges of the Motagua Valley record evidence of past subduction events between the North American Plate and the Caribbean Plate. Previous works suggest the existence of two subduction zones during Cretaceous, with cold metamorphism (lawsonite eclogite and blueschists) in the South (South Motagua Mélange), and warmer eclogites and amphibolites in the North (North Motagua Mélange, NMM). Although little work has been done so far to characterize the P-T paths and variability of the metabasite blocks embedded within serpentinite matrix in the NMM.

Here we present new thermobarometric estimates using conventional thermobarometry, pseudosection modeling and thermometry of carbonaceous matter on a set of metabasites of different grades. There is a minimum of four kinds of P-T paths: (1) (lawsonite-bearing) garnet-blueschists with peak P-T around 2.1 GPa and 480°C, (2) "cold eclogites" at ~2.2 GPa and 550°C experiencing isothermal decompression and epidote-amphibolite overprints, (3) "warm eclogites" at ~2.3 GPa and 600°C exhumed in cold environments and affected by blueschist-facies overprints, and (4) garnet-bearing epidote-amphibolites that may represent either retrogression of some eclogites, or prograde metamorphism under warm conditions.

We find that garnet fractionation has a limited impact on isopleth-derived P-T estimates and that lawsonite breakdown may drive retrograde metamorphism and rheological switches at the plate interface.

These new P-T estimates suggest that high-pressure rocks of the NMM may be recovered from different depths of a unique subduction zone, between 65 and 80 km, and exhumed in a relatively cold (and serpentinitized) environment. This suggests a more complicated story than previously described, and calls for additional geochronological evaluation (in process).

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