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Textural implications of high-pressure fluid flow controlled by pre-subduction deformation and alteration patterns

J.A. Miller[a,*], I.S. Buick[b], I. Cartwright[1,a]

[a]*Department of Earth Sciences and VIEPS, PO Box 28E, Monash University, Clayton, VIC, 3800, Australia*
[b]*Department of Earth Sciences and VIEPS, La Trobe University, Bundoora, VIC, 3083, Australia*

Abstract

Pillow lavas from the Corsican ophiolite (France) were metamorphosed to eclogite-facies conditions during the Alpine Orogeny. The mineralogical and textural evolution of these pillows, the patterns of fluid infiltration around and through them, and their mechanical response to subduction zone metamorphism and subsequent exhumation were primarily controlled by the pattern of intrapillow fracturing that occurred during sub-seafloor alteration during much earlier crustal accretion. Primary rheological differences established on the seafloor between pillow clasts and intrapillow fracture zones played a fundamental role in controlling the extent of subduction-related fluid flow during Alpine Orogenesis in these units.

Keywords: pillow lavas; sea-floor alteration; high-pressure metamorphism; fluid flow; deformation

1. Introduction

The heterogeneity of development of high-pressure mineral assemblages in the Corsican ophiolite (France) attests to the important role early seafloor alteration has in controlling the mineralogical and textural recrystallisation of rocks during high-pressure metamorphism in subduction zones. In this study, we examine a series of variably deformed pillows from the Corsican ophiolite, that have been metamorphosed up to eclogite-facies. The development of eclogite-facies mineralogies in these pillows has been strongly controlled by the pattern of brecciation and fracturing developed during prior seafloor alteration. This process has also controlled how the rocks have deformed during Alpine high-pressure metamorphism, and subsequent retrogression and exhumation. Along with the preservation of seafloor isotopic signatures (Miller and Cartwright, 2000a,b), these data suggest that fluid flow within the ophiolite during the Alpine Orogeny was extremely limited.

2. Regional geology

The Corsican ophiolite is one of the series of ophiolites within the Alpine Chain that represent the remains of the Tethyan Ocean crust destroyed during the Alpine Orogeny. The Corsican ophiolite forms part of the Pennine Zone of the Alps. In general, ophiolites within this zone contain high-pressure–low-temperature (HP–LT) parageneses that are thought to have developed in response to intra-oceanic subduction associated with the convergence of the European continental margin and the Apulia

* Corresponding author. Fax: + 61-3-9905-4903.
E-mail addresses: jmiller@earth.monash.edu.au (J.A. Miller), geoisb@pop.latrobe.edu.au (I.S. Buick), icart@earth.monash.edu.au (I. Cartwright).
[1] Fax: + 61-3-9905-4903.

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