ALPINE OPHIOLITES AND THE DIVERSITY OF MANTLE-CRUST INTERACTIONS IN OROGENIC BELTS: A REVIEW

Renaud Caby

GÉOSCIENCES, UNIVERSITÉ DE MONTPELLIER 2, FRANCE. RENAUD.CABY@GM-UNIV.MONTP2.FR

RESUMO: Examples of the evolution at deep magma-poor passive margins, ocean/continent transition and mantle exhumation are described from the Alpine belt. The south Alpine margin was characterized by the incorporation of sub-continental mantle peridotites in the granulitic crust, by younger gabbroic intrusions (280 to 260 Ma) and followed by polyphase extension (230-160 Ma). Ophiolites from the adjacent Liguria-Piemonte ocean (161-148 Ma) are characterized by: *i*) initial mantle peridotite exposure at the sea-floor; *ii*) discontinuous MORB basalts, *iii*) lack of sheeted dyke complex and gabbroic Layer 3, and *iv*) uniform oceanic cover of radiolarian cherts. The analogy with modern ultra-slow spreading ridges and comparisons with Oman-type Fast-Spreading Ridges are emphasized. The ocean/continent transition is described from several localities of the Alps, with special reference to mylonitic serpentinites, frictional breccias, ultramafite-derived proximal sediments and turbidites, and ophicalcites. Slices of upper continental crust adjacent to Jurassic oceanic lithosphere represent extensional allochthons later involved in the Alpine nappes of Tertiary age. Peridotites from ocean/continent transition settings record extension-related tectonic-metamorphic evolution along low-angle km-scale shear zones, indicating that the subcontinental mantle was progressively exhumed to the sea-floor during passive lithospheric extension. Peridotites from more internal oceanic settings show extreme compositional heterogeneity due to melt-peridotite interaction processes which were induced by percolation of MORB-type basaltic melts from the asthenosphere through the extending mantle lithosphere. Exhumed mantle and ocean/continent transition are also described from the Hercynian Mauritanides and the Pan-African belt of Eastern Mali.

The reconstruction of the evolution of the volcanic-poor Iberia-Newfoundland passive margins represents a complex sequence of both high-angle and low-angle normal faulting during the 160 to 110 Ma period, that resulted in extreme thinning of the continental crust leading to the exhumation of the sub-continental mantle. The continental crust is delimited below by a *ca.* 5 km thick layer of serpentinites grading downwards to "infiltrated mantle", on top of asthenospheric mantle.

The ocean/continent transition is also described from the Pyrénées, an intra-continental chain where the emplacement of the type locality lherzolites (110-105 Ma) generated thermal metamorphism in adjacent Cretaceous sediments, and was followed by deposition of Late Cretaceous ultramafic sediments also emplaced into fissures within the brecciated carapace of the peridotite. Granulitic crust attached to diapiric mantle is also exposed during incipient ocean opening (*ca*. 20 Ma old Zabargad peridotite, Red Sea). In contrast, the 22 Ma old Ronda and Beni Bousera Orogenic Peridotites that are also fringed by aureoles of felsic granulites were emplaced shortly after Tertiary HP subduction metamorphism in the thinned crust of the Betico-Rifan arc. Graphitic material and pseudomorphs after diamond with biogenic C signature are present in both massifs. Refertilization processes of the former sub-continental mantle related to upwelling of asthenospheric mantle are well documented. The Alpe Arami garnet peridotite (*ca.* 5.9 GPa, 1180 to 800 °C) was emplaced upward in a narrow channel of the eclogitic Alpine continental root (*ca.* 43-36 Ma) at a rate of 2 to 5 cm yr^{-1}.