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Key role of Upper Mantle rocks in Alpine type orogens: some speculations derived from extensional settings for subduction zone processes and mountain roots

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Orogenic architecture and mountain roots are intrinsically related. Understanding mountain roots largely depends on geophysical methods and exhumed high pressure and high temperature rocks that might record snapshots of the temporal evolution at elevated pressure, temperatures and/or fluid pulses. If such high pressure rocks represent ophiolitic material they are commonly interpreted as exhumed remnants of some sort of 'mid-ocean ridge' processes. Mantle peridotites and their serpentinized counterparts thus play a key role in understanding orogenic architecture as they are often considered to track suture zones or ancient plate boundaries. The recognition that some mantle peridotites and their serpentinized counterparts are derived from ocean-continent transition zones (OCT's) or non-steady state (ultra-)slow plate separation systems question a series of 'common beliefs' that have been applied to understand Alpine-type collisional orogens in the framework of the ophiolite concept. Among these are: (i) the commonly held assumption of a simple genetic link between mantle melting and mafic (MORB-type) magmatism, (ii) the commonly held assumption that mélange zones represent deep subduction zone processes at the plate interface, (iii) that pre-collisional continental crust and oceanic crust can easily be reconstructed to their original thickness and used for reconstructions of the size of small subducted oceanic basins as geophysical data from rifted margins increasingly indicate that continental crust is thinned to much less than the average 30-35 kilometers over a large area that might be called the 'zone of hyperextension', and (iv) the lack of a continuous sheet of mafic oceanic crust and the extremely short time interval of formation results in a lack of 'eclogitization potential' during convergence and hence a lack of potential for subsequent slab pull and, perhaps, a lack of potential for 'slab-breakoff'. Here we provide a synopsis of mantle rocks from the European realm to show that inherited mantle signatures from previous orogenies play a key role for the interpretation of ophiolites, and that peridotites from present-day passive margins show striking similarities to the metamorphic equivalents in Alpine type orogens. If the dimensions of mantle exhumation and the formation of proto-oceanic crust (refertilized domains) from present-day margins such as the Iberia-Newfoundland or the Australian - Antartic margins are applicable to the Alps, then there is little room for steady-state oceanic crust in the Ligurian Tethys. Possible consequences for mountain roots will be discussed.