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Exhumation of oceanic blueschists and eclogites in subduction zones: timing and mechanisms

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High-pressure low-temperature (HP-LT) metamorphic rocks provide invaluable constraints on the evolution of convergent zones. Based on a worldwide compilation of key information pertaining to fossil subduction zones (shape of exhumation P-T-t paths, exhumation velocities, timing of exhumation with respect to the convergence process, convergence velocities, volume of exhumed rocks,...), this contribution reappraises the burial and exhumation of oceanic blueschists and eclogites, which have received much less attention than continental ones during the last two decades. Whereas the buoyancy-driven exhumation of continental rocks proceeds at relatively fast rates at mantle depths ($\geq$ cm/yr), oceanic exhumation velocities for HP-LT oceanic rocks, whether sedimentary or crustal, are usually on the order of the mm/yr. For the sediments, characterized by the continuity of the P-T conditions and the importance of accretionary processes, the driving exhumation mechanisms are underthrusting, detachment faulting and erosion. In contrast, blueschist and eclogite mafic bodies are systematically associated with serpentinites and/or a mechanically weak matrix and crop out in an internal position in the orogen. Oceanic crust rarely records P conditions $>$ 2.0-2.3 GPa, which suggests the existence of maximum depths for the sampling of slab-derived oceanic crust. On the basis of natural observations and calculations of the net buoyancy of the oceanic crust, we conclude that beyond depths around 70 km there are either not enough serpentinites and/or they are not light enough to compensate the negative buoyancy of the crust. Most importantly, this survey demonstrates that short-lived ($<\sim$15 My), discontinuous exhumation is the rule for the oceanic crust: exhumation takes place either early (group 1: Franciscan, Chile), late (group 2: New Caledonia, W. Alps) or incidentally (group 3: SE Zagros, Himalayas, Andes, N. Cuba)

during the subduction history. This discontinuous exhumation is likely permitted by the specific thermal regime following the onset of a young, warm subduction (group 1), by continental subduction (group 2) or by a major, geodynamic modification of convergence across the subduction zone (group 3; change of kinematics, subduction of asperities, etc). Understanding what controls this short-lived exhumation and the detachment and migration of oceanic crustal slices along the subduction channel will provide useful insights into the interplate mechanical coupling in subduction zones.