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Exhumation of large volumes of oceanic lithosphere during subduction: Examples from the Western Alps

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The Western Alps provide key insights into the behaviour of a portion of oceanic lithosphere during subduction and exhumation. The Zermatt-Saas (ZS) and Monviso eclogitized ophiolitic nappes (sandwiched between the Dora Maira and Grand Paradiso internal crystalline massifs and the upper, non-eclogitic Combin and Queyras Liguro-Piemontese units) provide a record of the detachment and subsequent exhumation of very large volumes of oceanic material along the subduction interface. We herein present a comparison of their structure, P-T paths and discuss potential mechanisms for detachment from the downgoing slab and exhumation processes.

ZS unit is internally made up by a series of several tectonic slices detached from the slab at ca. 80 km deep (550°C, 24 kbar; Angiboust et al., 2009). It is proposed that a particularly pervasive hydration of this portion of the Tethyan ocean floor led to the crystallization of lighter eclogite-facies assemblages, thus facilitating the later detachment of this relatively continuous portion of slab (∼70km-across; Angiboust & Agard, 2010).

Detailed petrological and structural analysis on the Monviso ophiolite revealed the presence of relatively continuous boudins showing homogeneous P-T conditions (530-560°C; 25-27 kbar). These observations contrast with the common view that the Monviso ophiolite corresponds to a (chaotic) subduction melange. Moreover, we emphasize that many similarities exist between the Monviso and ZS ophiolites (200 km apart) in terms of parageneses, P-T-time conditions and overall structure. We propose a similar mechanism for the detachment and stacking of these two ophiolitic domains in a partially serpentinized subduction channel, which could also apply to the other large pieces of oceanic lithosphere found in the Western Alps.