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The initial superposition of oceanic and continental units in the southern Western Alps: constraints on geometrical restoration and kinematics of the continental subduction wedge

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The tectonic contact separating continental and oceanic units is preserved at outcrop in many locations within the Western Alps. The contact has experienced prolonged and progressive deformation during Oligocene collision and subsequent 'extrusive' contraction which is approximately westerly-directed (Dumont et al., 2012). Despite variable metamorphic grade, this tectonic contact displays a relative consistency of tectonostratigraphic and structural characteristics. Removal of the Oligocene and younger deformation is a critical requirement to allow assessment of the kinematic evolution during the Eocene continental subduction phase.

The best preserved relationships are observed near the base of the Helminthoid Flysch nappes, in the footwall of the Penninic thrust, or in the external part of the Briançonnais zone. Here, the oceanic units are composed of detached Cretaceous sediments, but they are underlain locally by an olistostrome containing basaltic clasts. Further to the east, the internal boundary of the Briançonnais zone s.l. (including the 'Prepiedmont units'), is frequently marked by breccia or megabreccia, but is strongly affected by blueschist-facies metamorphism and by approximately easterly directed backfolding and backthrusting. At one locality, there is compelling evidence that the oceanic and continental units were already tectonically stacked and metamorphosed (together) ∼32Ma ago. Some megabreccias of mixed continental/oceanic provenance can be interpreted as a metamorphic equivalent of the external olistostrome, products of the initial pulses of tectonic stacking. The overlying units are composed dominantly of metasediments, containing distributed ophiolitic megaboudins (Tricart & Schwartz, 2006). Further east again, the tectonic contact separates the Dora-Maira continental basement from the Mt. Viso units which are predominantly composed of oceanic lithosphere. Both the Dora-Maira and Mt. Viso units are eclogitic, but the HP peak is apparently older in the oceanic rocks (Malusà et al. 2015). Finally, further SE, the Voltri massif shows a huge volume of serpentinized mantle which locally overlies continental basement (strongly metamorphosed), and is interpreted as an exhumed remnant of the subduction channel (Federico et al., 2007).

In all these localities the transport directions during initial pulses of stacking were consistently oriented generally towards the NW to N, taking into account the subsequent Oligocene and younger collision-related deformation (complex folds, thrusts, backfolds and backthrusts, and block-rotations). It is thus possible to attempt reconstructing an early stage continental subduction wedge involving these different elements from the subduction channel to the most frontal part of the accretionary complex. However, this early Alpine orogen which was active throughout the Eocene is interpreted to have propagated generally towards the NW to N, prior to subsequent pulses of more westerly directed deformation from the Oligocene onwards within the southern part of the Western Alps arc. It is therefore essential to continually improve high-resolution 3D geophysical imaging to facilitate a better understanding of the complex western termination of the Alpine orogen.

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