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Detachment and/or exhumation depth clusters in subduction zones? Highlights from W. Turkey and comparison with Oman, Corsica and New Caledonia

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Recent studies have shown that exhumation of rocks is a fundamentally discontinuous process acting over short-lived time periods (∼10 My) during the 'life' of a subduction zone. Recent advances in analytical techniques and in estimating P-T conditions now allow petrologists to attempt characterizing the subduction interface itself and better understanding the mechanisms that enable rocks to detach from the downgoing slab. Important clues would be provided by answering such questions as: (i) Is it the exhumation and/or the detachment preluding to exhumation that is rather a continuous process? (ii) Do the rocks primarily originate from specific depths (thereby pointing to particular conditions of mechanical coupling there) or from all along the subduction interface?
Obduction (i.e. emplacement of oceanic lithosphere atop continents) and associated subduction processes provide insight into mechanical coupling at the plate interface, the rheology of the lithosphere and fossilize the different steps of an evolving subduction zone. Field-based data and petrological study in western Turkey are here used to highlight processes acting in a cooling subduction zone during both oceanic and continental subduction and are then compared with other similar geodynamic settings.
In western Turkey, the Tavşanlı zone is made of oceanic lithosphere and of a thinned continental margin sequentially subducted below an oceanic plate during the Late Cretaceous. It represents an exceptionally well-preserved subduction interface thanks to later mild collision between the Anatolide-Tauride block and Eurasia.
The Tavşanlı zone is divided into three major tectonic units from top to bottom: the obducted ophiolite, an accretionary complex and the continental margin. Among these three main tectonic units, two related either to oceanic or continental subduction consist of HP-LT metamorphic units that are: (i) the oceanic accretionary complex, subdivided in three tectonic units (namely complex 1, 2 and 3 from top to bottom) with different PT conditions (200°C and < 8kbar; 300°C and 12 kbar; 450°C and 17 kbar, respectively); (ii) the cover of the continental margin, which yielded eclogite-facies conditions of 500°C and 24 kbar.
Comparisons with similar geodynamic settings (i.e. oceanic then continental subduction without collision: Oman, New Caledonia and Corsica) allow us to point out very similar maximum burial depths for each of those units sharing an equivalent structural position. In each setting up to three clusters of HP–LT conditions might be recognizable, chiefly at 300°C–12 kbar and 500°C–23kbar, and possibly at 450°C–17 kbar too. Those PT conditions show that slicing of kilometre-scale units occurs at fairly specific depths along the subduction interface. We finally tentatively relate these observations to the different seismic events documented in present-day subduction zones along the plate interface.