Expulsion tectonics and return flow during continental subduction: P-T-deformation constraints from Oman.

Philippe Agard (1), Mike Searle (2), Ian Alsop (3), and Benoit Dubacq (4)
(1) ISTeP, Université P.M. Curie – Paris 6, UMR 719, Paris, France (philippe.agard@upmc.fr), (2) Dept. Earth Sciences, Oxford University, UK, (3) Dept. of Geology & Petroleum Geology, School of Geosciences, University of Aberdeen, UK, (4) Dept. Earth Sciences, Cambridge University, UK

The northeastern continental margin of Oman in the Saih Hatat region is characterised by high-pressure (HP) chloritoid- or carpholite-bearing meta-sediments and highly deformed mafic eclogites and blueschists in a series of tectonic units bounded by high-strain ductile shear zones. New data on the upper, carpholite-bearing cover units of this HP nappe stack indicate that all of them underwent similar P conditions to the underlying Hulw structural unit (with a cooler exhumation P-T path). Early SSW-directed crustal thickening during ophiolite emplacement created recumbent folds and strong schistose fabrics in these Permian–Mesozoic shelf carbonates and was followed by later NNE-dipping normal sense shear zones (namely the Hulw, Al Wudya, Yenkit, Al Hamriyah shear zones) and normal faults. In particular, the Mayh unit shows high strain in a 15-25 km long sheath fold that likely formed at carpholite grade pressures of 8-10 kbar and depths of ∼30 km. We show that there are no significant P differences across the Hulw shear zone (‘upper plate – lower plate discontinuity’) or the overlying Mayh, Yenkit-Yiti and Ruwi units, nor between them. Post-peak metamorphic exhumation of the HP rocks was therefore accomplished by bottom-to-SSW (rather than top-to-NNE) active footwall extrusion beneath a fixed, static, passive hanging-wall. Footwall uplift beneath these passive roof faults resulted in progressive expulsion of the HP rocks from depths of ∼80-90 km (eclogites) and mainly 30-35 km (blueschists and chloritoid/carpolite-bearing units) during the Campanian – Early Maastrichtian. Oman thus provides a detailed record of how continental material (thick platform shelf carbonates) progressively jammed a subduction zone and emphasizes the contrasting behaviour between cover units and their underlying basement. HP ductile shear zones evolved into brittle normal faults with time during exhumation towards the surface.