Brittle deformation during exhumation of eclogites and blueschist of the Bantimala Complex, Sulawesi: evidence for intra-slab shearing

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The Bantimala Complex of SW Sulawesi (Indonesia) exposes HP and UHP metamorphic rocks, which derive from a subduction zone that was active during the Cretaceous. During this time the oceanic crust of the Ceno-Tethys was subducted beneath the Sundaland continent in the north (Parkinson et al., 1998). The complex is composed of tectonic slices that are interlayered and composed of either sediments (e.g. cherts) or metamorphic rocks (blueschists, eclogites, micaschists). Different metamorphic processes can be studied in these rocks as the prograde blueschist-eclogite transformation during subduction of the oceanic crust and the fluid-rock interaction processes that took place during uplift and retrogression.

The aim of this study is to unravel the formation of different kinds of breccias, which show evidence of brittle deformation during uplift. The deformation started at eclogite-facies conditions but continued through the blueschist facies up to the greenschist facies. Brecciated eclogites with rehydrated glaucophane-bearing material in the matrix between the clasts indicate a brittle deformation phase during uplift from eclogite-facies to blueschist-facies conditions. Whereas blueschist-facies clasts in a greenschist-facies matrix reflect lower grade conditions during deformation.

Thermobarometric calculations show that different blueschist and eclogite samples derive from different subduction depths within the slab. In addition, because some of the samples were formed under similar pressure conditions (2.6-2.7 GPa) but varying peak temperatures (ΔT=150°C) and assuming that these rocks were formed during the same subduction process at nearly the same time, they seem to derive from different depths (original vertical) within the lithospheric slab.,.The breccias of the mafic rocks of the Bantimala Complex reflect an exhumation process that was driven by imbrication of different slices of the subducted slab.

The formation of the breccias during uplift and retrogression of the slab rocks and the observation of the displacement of the former stratigraphy within the slab argues for an exhumation of the HP/UHP rocks during compression. The HP/UHP rocks are not embedded and therefore were not carried by a low viscosity and low density matrix (e.g. serpentinite)., Therefore, exhumation was driven by intra-slab shearing and upward directed motion of single slices. This kind of exhumation is similar to that described by Angiboust et al. (2012) for ophiolites of the western Alps. As in the case of the Bantimala Complex even UHP rocks were exhumed, it becomes evident that this exhumation mechanism is effective even at great depth.

References

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