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Obduction initiation: evidence from the base of New Caledonia ophiolite

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Obduction, whereby fragments of dense, oceanic lithosphere (ophiolites) are presumably 'thrust' on top of light continental ones, remains a poorly understood geodynamic process, in particular with respect to 1) obduction initiation and 2) effective ophiolite emplacement.
Most of our knowledge on obduction initiation comes from the amphibolite to granulite facies high-temperature metamorphic soles welded to the base of non-metamorphic large-scale ophiolite thrusts (e.g., Oman, N.Caledonia, Balkans,...), which are interpreted as witnesses of the subduction inception stages preluding to obduction.

We herein report for the first time the existence of deformed amphibolites near the base of the ophiolite ($\sim$ 50-100 m above), yet within the mantle peridotites proper, from the classic New Caledonia ophiolite (Plum beach, SE of Noumea).
These amphibolites correspond to several cm thick thin bands of sheared mafic rocks showing highly deformed to mylonitic textures, which are embedded within well-preserved to strongly serpentinized peridotites. Large-scale shear bands (>100m long in places) show impressive, very consistent deformation patterns and shear senses on the outcrop scale in favor of reverse displacements.

Amphibolites and peridotites are both strongly sheared with the common observation of strongly boudinaged peridotites in the core of the largest shear bands. Some gabbroic pods and plagioclase-rich veinlets are spatially associated to the amphibolites, but appear to have formed slightly later based on cross-cutting relationships. Preliminary mineralogical observations indicate complex, successive recrystallisations stages, with olivine-bearing clasts, at least three generations of amphiboles and late stage talc-chlorite associations.

Although still preliminary, several interpretations can be proposed for the origin of such structures. They could correspond to (1) very-high temperature sole "amphibolites" deformed (tectonically mixed with the mantle; and possibly partly melted) during strong shearing at the base of the obduction thrust, (2) mafic melts intruding (and later sheared; possibly almost coevally) at the base of the ophiolite sequence, (3) ingression of hydrous fluids producing local melting of the peridotite. Based on several field observations, and on the need for unrealistically high temperature for hydrous peridotite melting (i.e. $> \sim 1100°C$), the last hypothesis seems less likely.
Whatever the hypothesis, we stress that it is yet unclear if this deformation relates to subduction processes accompanying early obduction stages or to structures inherited from oceanic stages (e.g., deformation structures at the vicinity of major transforms and/or oceanic detachments). In the latter case, this discovery would indicate that the localisation of deformation during subduction/obduction initiation reworks ancient zones of deformation.