Geophysical Research Abstracts
Vol. 14, EGU2012-10884, 2012
EGU General Assembly 2012

Dynamics of convergent plate boundaries: Insights from subduction-related serpentinite melanges from the northern edge of the Caribbean plate

A. García-Casco
Universidad de Granada, Mineralogia y Petrologia, Spain, Spain (agcasco@ugr.es, 34 958 243368)

Subduction-related rock complexes, many of them tectonic melanges, occur in the Central America-Caribbean-Andean belt. I review the lithology and P-T-t paths of HP rocks and offer interpretations and generalizations on the thermal estate of the subducting plate(s), the melange forming events, and the exhumation history of rock complexes formed in the northern branch of the Caribbean subduction zone (Cuba and nearby Guatemala and Dominican Republic; ca. 3000 km apart). These complexes contain high pressure rocks formed and exhumed at the convergent (Pacific-Atlantic) leading edge of the Caribbean plate during ca. 100 Ma (early Cretaceous-Oligocene), attesting for long lasting oceanic -followed by continental- subduction/accretion in the region.
Lithologic data indicate a complex melange-forming process. In most cases, the HP rocks represent subducted MOR-related lithologies occurring as tectonic blocks within serpentinite-matrix melanges interpreted as exhumed fragments of the subduction channel(s). Most of these melanges, however, contain fragments of arc/forearc-related non metamorphic and metamorphic (low-P and high-P) sedimentary and igneous rocks. While the HP blocks of arc/forearc material indicate subduction erosion at depth, the interpretation of the LP and non-metamorphic blocks is not straight forward. Indeed, tectonic blocks of HP metamafic rocks are surrounded by antigorite-serpentinite which, in turn, is surrounded by a low-P, low-T (chrysotile-lizardite) serpentinite that makes much of the mélange. These relations indicate that the melanges represent, in fact, tectonic stacks of shallow low-T forearc serpentinite that incorporate tectonic blocks/slices of the subduction-channel (high-P, high-T serpentinite and HP metamafic blocks) and of the arc/forearc crust (low-P and non-metamorphic blocks). This picture is similar to that of HP continental margin-derived tectonic stacks containing exotic slices of antigoritite-serpentine melanges (with blocks of MORB-derived eclogite) incorporated late in the convergent history when oceanic subduction was completed. Hence, incorporation of tectonic slices of the subduction channel into the shallow (low-P, low-T) melanges and subducted/accreted continental margins occur when collision-related dynamics imposed by subduction of buoyant continental or oceanic lithosphere affected the plate margin.
Aqueous fluid, sourced from both subducted sediment and metamafic/ultramafic material, was available in large quantity in the subduction environment, as indicated by massive antigoritite, rinds of metasomatic rocks around included HP metamafic rocks, retrogressed eclogite, jadeitite and hydrothermal veins within antigoritite. Such a vigorous hydrology (fluid-flow) deep in the subduction environment point to the development of wide subduction channels and explain the abundance of accreted blocks. It can also explain the scarcity of large scale (>km) slices of the subducted oceanic lithosphere in the belt, for these are likely the result of focalized distribution of deformation occurring when forearc peridotite is barely hydrated (Agard et al., Long-term coupling along the subduction plate interface: Insights from exhumed rocks and models. This session, EGU 2012). Alternatively, these large tectonic slices may have been formed by the collision dynamics caused by late-stage subduction/accretion of the continental margin (or buoyant -thick- oceanic crust).
Except maturation (cooling) of the subduction zone with time at orogenic belt-scale, no other simple generalization can be reached on the thermal state of the subducting plate and the exhumation process of the subduction channel. P-T-t paths of HP rocks indicate that slab fragments ranging from cold to hot coexisted during relatively short time intervals (ca. 10 Myr), and some fragments of the subduction channel were exhumed shortly after formation while others lasted several tens of Myr to arrive to the near-surface forearc/accretionary environment. A rather variable thermal state and dynamic history of the subduction environment(s) in space and time suggests that along strike (local/occasional) geodynamic complexities (e.g., age of lithosphere, angle of subduction, convergence rate,... more than one subduction zone) characterized the plate margin and controlled its evolution.