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Exhumation of HP rocks in a fossil subduction channel: petrologic and geochronologic evidences

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Recent numerical models (e.g. Gerya et al., 2002; Stöckhert and Gerya 2005) predict a mixing zone to develop between the subducting and the overriding plates in a convergent margin. The growth of this "subduction channel" is controlled by the progressive hydration (and thus serpentinization) of the mantle wedge; widening of the subduction channel results in the onset of forced return flow. A tectonic intermingling of fragments of the previously subducted crust, hydrated upper mantle slices and lower crustal rocks of the upper plate is therefore envisaged. The size of these fragments is a function of the viscosity contrast between the coherent slices and the serpentinite matrix. The model predictions include an array of diverse P-T paths for subduction-related metamorphic complexes.

In the High-Pressure (HP) metaophiolitic Voltri Massif (Western Ligurian Alps) a tectonic mélange is hosted in the country serpentinites. The mélange encloses blocks of various types of metabasites and metasediments unfound in the surrounding rock units of the Voltri Massif. The mélange matrix is a chlorite-actinolite schist, produced by blackwall reactions between serpentinites and enclosed blocks. The blocks equilibrated over a wide range of peak metamorphic conditions and record different segments of a typical subduction P-T path. Peak assemblages range from eclogite- to blueschist-facies, some blocks record the prograde transition from lawsonite-bearing assemblages to garnet blueschists. Omphacite-garnet foliations in the eclogites are overprinted by the multiple growth of syn-tectonic garnet- and epidote-blueschist assemblages. The blueschist blocks display peak syn-tectonic garnet-blueschist assemblages overgrown by epidote-blueschist ones. The different PT-paths apparentlly con-

verge in the blueschist facies. The matrix is widely retrogressed in greenschist facies, but it contains rare relics of Na-amphibole. Moreover, the oldest deformation event recognizable both in the matrix and in the metasedimentary blocks occurred in the blueschist-facies field. Structural and petrological investigations thus suggest that the mélange zone developed at least in blueschist-facies conditions.

We have dated the eclogite and the blueschist peaks in different blocks by means of step-heating 39Ar/40Ar technique on phengite. The three representative samples are an eclogitic metasediments (C46), and two mafic blueschists (VR81 and CP2).

Sample C46 shows a well defined metamorphic layering, with a synkinematic assemblage of glaucophane + garnet + phengite + quartz + apatite in the Na-amphibole-rich layers, and aegirinaugite + garnet + phengite + quartz $\pm$ glaucophane in the Na-clinopyroxene-rich layers. HP phengites are characterized by Si4+ content of 3.65-3.78 p.f.u. This sample records eclogitic equilibration at 43.2 $\pm$ 0,5 Ma.

Samples VR81 and CP2 are characterized by a pervasive schistosity with Na-amphibole 2 (Fe-glaucophane) + epidote + phengite (Si4+ = 3.37-3.58 p.f.u.) + sphene. Coarse -grained porphyroclasts of Na - amphibole 1, of Fe-rich garnet and of rutile are present. Sample VR81 records blueschist equilibration at 39.95 $\pm$ 0.37 Ma (Federico et al., 2005) and sample CP2 at 43.4 $\pm$ 0.5 Ma.

Two important points emerge from these results: first, two virtually undistinguishable samples underwent diachronic blueschist peak at c.a. 43 and 40 Ma respectively; second, the eclogitic equilibration of sample C46 is contemporaneous with the blueschist stage of sample CP2. A diachronic metamorphic evolution of the different mélange blocks can therefore be envisaged.

These geochronological data together with petrographic and structural constraints fit quite well the predictions of numerical models, therefore we suggest that the studied mélange originated in the subduction channel during forced return flow of the deeply subducted fragments inside a serpentinite-rick matrix.

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