THE OCEAN-CONTINENT-TRANSITION IN THE LOWER ENGADINE:

Petrologic, geochemical and geochronological insights constraining paleogeographic geometry and evolution (Tasna-Nauders area, CH-A)

Anne-Cécile Hauser

2011

Abstract

The Engadine Window in Eastern Switzerland/Western Austria exposes the Lower-Middle Penninic Tasna nappe, which was recognized to preserve a pre-alpine Ocean-Continent-Transition (OCT) by Florineth (1994) and Florineth & Froitzheim (1994) in the Piz Minschun area.

The present study confirms the observed OCT geometry in a more eastern part of the Tasna nappe at the border between Switzerland and Austria: Mapping of the area SW of Nauders reveals the contact between serpentinized spinel-lherzolites and NE-ward outwedging upper-continental crust which is seal by a continuous layer of sediments. Compilation of geological maps of the South-Western part of the Window allows lateral connection of the newly mapped Nauders-OCT with the Tasna-OCT of Florineth (1994) around the border of the Window. The obtained overall geometry shows an about 8km long extensional allochthonous block comprising pre-, syn- and post rift sediments in normal position whose northern-, eastern- and southern border

can be delimited. The lateral width of this block is undefined because it plunges below the Austroalpine Window border in the West.

Petrologic and geochemical investigations on serpentinites and (fromer-) garnetpyroxenites confirm the subcontinental origin of the Tasna mantle and allow constraining its

evolution. Pyroxenites formed at depths of at least 45km as indicated by the presence of garnet. They are Al-augite types which are known to represent the last magmatic event before mantle emplacement in crustal levels. Garnet subsequently almost completely decomposed to spl-opx-cpx symplectites by reaction with olivine in the spinel stability field at temperatures of initially ~830-950°C and lower depth of 30-45km (constraint by absence of plagioclase in serpentinite and garnet destabilisation in pyroxenites). This corresponds to an uplift of the mantle rocks below a thinned continental curst and can be linked with the late Carboniferous-Permian extension event. Almost complete decomposition of garnet associated with recrystallization and beginning equilibration of primary pyroxenes indicates relatively long residence at this sub-crustal depth during which the rocks cooled. The latest event registered in the mantle before exhumation is percolation of a K-rich Ca-poor alkaline fluid leading to formation of phlogopite and zircon in small, local veins. This event represents

the ascension of the (first?) rift-related magmatic liquids. Age determination on such a vein yields U-Pb ICP-MS crystallisation age of 167.3 }2.7Ma for zircon and a somewhat lower Ar- Ar cooling age of ~161Ma for phlogopite. They confirm the Ar-Ar phlogopite cooling age of 170.5 }0.4Ma and 169.1 }0.4Ma obtained for the Tasna mantle of the Minschun area 20km to the west of the field of this study (Manatschal et al. 2006). These ages indicate Middle-Jurassic mantle exhumation and are consistent with ages known for the South Penninic Piemont-Ligurian Ocean. They speak against a lower Cretaceous rifting of the Valais Ocean and confirm the strong evolutionary link between the North- and South Penninc domain already proposed by Manatschal et al. (2006).