Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15361

# Ophiolitic Relicts in the Central Alps: Timing the Transition from High-Pressure Melting to Amphibolite Facies Conditions

**KIM LEMKE**[1,2], PROF. DANIELA RUBATTO[1,3] AND JÖRG HERMANN[2]

[1]University of Lausanne

[2]Institute of Geological Sciences, University of Bern

[3]University of Bern

Presenting Author: kim.lemke@unil.ch

Remnants of subducted and altered oceanic lithosphere occur as isolated mafic-ultramafic lenses within the migmatites of the Central Alps (Adula Nappe and Cima-Lunga Unit). These relicts provide crucial insights into the dynamics of subduction zones and exhumation processes in collisional orogens. They preserve information about the crustal protoliths, record high-pressure and high-temperature metamorphism and fluid-rock interaction during the Alpine subduction.

This study presents a detailed investigation of the mafic-ultramafic suits, consisting of metarodingites, (retro-)eclogites and metasediments associated with chlorite-harzburgites that are embedded in gneissic basement rocks. Different stages of the complex evolution of these mafic-ultramafic lenses could be determined by a combination of U-Pb dating of zircon and rutile, petrological considerations, and field observations.

The metarodingite-ultramafic-metasediment association and the low δ18O signatures of zircon ($\delta^{18}O$ 3.0-3.8‰), inherited from seafloor metasomatism of the protoliths, indicate that these rocks have originated from oceanic crust. They underwent HP metamorphism at eclogite-facies conditions with estimated pressures of 2.5-3.0 GPa and heating to ˜800°C. Polyphase inclusions in garnet from eclogites record fluid-assisted melting under high-pressure conditions. U-Pb dating and trace element analyses of zircon constrain the age of high-pressure metamorphism to 32-31 Ma and the subsequent amphibolite-facies metamorphism to ~29 Ma. The fast transition between these two stages indicates rapid exhumation with rates of 3-6 cm/yr and fast cooling to amphibolite-facies conditions of ˜650°C. Rutile yields significantly younger ages, suggesting that the rocks remained at temperatures > 550°C for about 10 Myr.

Heating and partial melting of the subducting oceanic lithosphere and fast exhumation tectonics can be explained by a slab break-off geodynamic setting: the hot asthenospheric material infiltrated into the slab window produced by the removal of the slab and provided heat for the dehydration of the ultramafic rocks, which were situated at the subducted ocean-continent transition. The released fluids from the ultramafic rocks triggered partial melting of the adjacent eclogites. The release of slab-pull forces resulted in a rapid uplift and slight cooling of the rocks to amphibolite-facies conditions.