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Syn-collisional exhumation of the San Bernardino eclogites (Adula unit, central Alps)

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In the Central Alps, the Adula unit reveals (U)HP mafic and ultramafic rocks, offering insights into the subduction history of the distal European margin during the final phases of the Europe-Adria collision. The Adula unit, one of the highest basement units in the Lower Penninic nappe stack of the Lepontine Dome, is located between non-eclogitic Lower Penninic units, Simano and Lucomagno, derived from distal European margin below and non-eclogitic Middle Penninic units, Tambò and Suretta, above, composed of pre-Permian basement and Mesozoic covers of the Briançonnais terrane. The upper tectonic boundary of the Adula unit is a complex shear zone known as the Misox zone, which contains lenses of non-metamorphic sheared Mesozoic sediments and volcanics.

It is widely accepted that Suretta, Tambò and Adula units were thrust over each other during extensive mylonitic shearing directed northward. However, the current structural arrangement and the metamorphic discontinuity between the (U)HP Adula unit and the eclogite-free Tambò-Suretta complex suggest the presence of a normal-sense shear zone. This shear zone, at some point during the tectonic evolution of the central Alps, facilitated the exhumation of the Adula unit.

We have documented this shear zone between the top of the Adula unit and the base of the Misox zone in the San Bernardino pass area (Switzerland). The shear zone primarily developed within Adula orthogneisses, containing lenses of paragneisses and eclogites at the top. These eclogites consistently display a mylonitic texture, with the mylonitic foliation rotated at various angles relative to the shear zone-related foliation.

The P-T equilibrium conditions of the eclogites have been determined to be approximately 2.0-2.1 GPa and 520-645 °C, which are considered coeval with the development of the mylonitic texture based on microstructural evidence. The ⁴⁰Ar/³⁹Ar dating of phengite in eclogites yielded ages of 37-39 Ma. The ⁴⁰Ar/³⁹Ar age distribution across the mylonitic orthogneiss of the shear zone indicates a younging trend from the bottom to the top (eclogite-bearing zone) of the shear zone, from approximately 37 to 29 Ma. This is consistent with top-to-the-east normal shearing that started just after the HP metamorphism.