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Coupling monazite and titanite dating to unravel the evolution of an amphibolite-facies shear zone (Ivrea-Verbano Zone; Italy)

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Dating the time of shear zone activity remains challenging. Here we present a study from a mid-crustal shear zone, the Forno-Rosarolo Shear Zone (FRSZ), exposed in the Ivrea-Verbano Zone [1]. Although the activity of this structure has been associated to the Mesozoic rifting [2]; the age of its activity is still unconstrained. We here report an attempt to date the amphibolite-facies deformation by integrating monazite and titanite U-(Th-)Pb data.

The FRSZ is a sub-vertical structure with a thickness of about 500m [3]. It is located at the amphibolite- to granulite-facies transition. Mylonites developed mainly at the expense of paragneisses, mafic rocks and minor calc-silicates. Paragneisses and calc-silicates were selected for *in-situ* U-(Th-)Pb monazite and titanite geochronology, respectively. Mylonitic paragneisses consist of garnet, sillimanite, feldspar and biotite with accessory zircon, monazite and rutile. Monazite occurs in different microstructural positions (included in porphyroclasts or along the mylonitic foliation) and commonly presents complex chemical zoning of Th and Y allowing to identify three different generations. Preliminary data suggest a late Triassic-Jurassic recrystallization event induced by deformation.

Mylonitic calc-silicates are made of calcite-rich and calcite-poor layers. The latter are richer of amphiboles, clinopyroxenes, feldspars and quartz (± garnet). Large titanite grains (up to 1mm) are common along the foliation. Two types of titanite were identified: i) strongly zoned grains with LREE depleted rims/tips and ii) homogeneous grains. Both types show evidence for intracrystalline deformation (e.g., deformation twins and systematic crystal lattice bending). U-Pb dating across titanite grains revealed a coupling between chemical domains and isotopic data. The rims/tips of zoned titanite provided an alignment of isotopic data with the youngest intercept age at the Triassic-Jurassic transition.

The application of two independent geochronometers allowed us to shed light on the age and duration of deformation from Triassic to Jurassic. Our approach is particularly appropriate when dealing with large-scale shear zones involving different types of rocks.

References:

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