

# **Tectonic and metamorphic evolution of Simano nappe at alpe Larecc (Ticino, CH)**

Original title: "Evolution tectonique et métamorphique de la nappe de Simano à l'alpe Larecc"

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This diploma thesis focused on tectonic and metamorphism of the Alpe Larecc (Valle Maggia, North of Ticino, Switzerland), on and around the great Lareccio anticline (= Verzasca anticline), at the limit between the pre-Mesozoic metasediments of the Campo Tencia unit and Verzasca gneiss complex, on the Simano nappe.

The tectonic evolution of the area is divided into 4 successive phases of deformation. The first two observed phases D2 and D3 form isoclinal folds and are related to overthrusting movements towards the NW as part of the emplacement of the Simano nappe. The D3 phase is divided into two episodes: D3a, responsible for the main schistosity and North-South main lineation in all lithologies, and D3b, which causes the opening of tension gashes and the crystallization of the Knauern, related to top-North shearing. This last phase is contemporary of the Tertiary barrovien peak of metamorphism in amphibolites facies which is marked by the assemblage kyanite, garnet and staurolite in metapelites and hornblende and plagioclase in amphibolites. The D3 phase is followed by a D4 phase of transverse folding of Western vergence, which causes the dominant fold structures in the area of study, including the great Lareccio anticline. This fourth phase is at the origin of a new coarse S4 schistosity which develops in the hinges of the great fold structures. This D4 phase is always placed in an amphibolite facies and show a deflection of the major unities of lower Pennique towards the West during a part of the tectonic exhumation phase. The last D5 phase causes a coarse vertical crenulation that display a vertical shortening at the time of the last stage of the ductile deformation.

A conventional thermobarometric study by multiple equilibrium allowed a quantification of the pressure and and temperature conditions of 620 - 650 °C and 8 to 10 kbar. These temperatures were confirmed by thermometry on titanium contents of amphiboles (600 - 630 °C). The thermobarometric study was done on the comparison of two programs, THERMOCALC and TWQ.

An important part of this study focused on the kinematic and metamorphic significance of the aluminosilicates veins present in the metasediments (Knauern) within the framework of the alpine evolution. Thermometry by the isotopes of oxygen on the couples quartz-kyanite in Knauern and the surrounding metapelites revealed concordant temperatures with those obtained by conventional thermobarometry (620 to 720°C). This confirms that the Knauern were formed during the peak of the metamorphism, underlined by the structural study. The textures' analysis in the Knauern showed that andalusite represente a retromorphosis of kyanite. The quartz-andalusite couples in the Knauern yielded temperatures comparable (640 to 760 °C) with those given by the pairs quartz-kyanite in the same samples. Andalusite not being stable at these temperatures for the conditions of pressure of the peak of the metamorphism, the isotopic composition of andalusite was inherited from kyanite at the time of the polymorphic transformation. The analyses highlighted that the isotopic compositions of quartz and kyanite in the Knauern are comparable with those of the surrounding metapelites. They confirm that crystallization in these gashes results from a local re-mobilisation of the material, shown by the mineralogical correlation between the Knauern and their surrounding rock.

The geochemistry of Alpe Larecc amphibolites denotes an E-MORB or OIB signature. Their close association with a quartzo-feldspathic series and the gradual transition from levels more or less rich in amphiboles led us to interpret them as a volcanogenic series, emplaced in a context of rifting, at the foot of the margin. The Caledonien age of the underlying granites (450 My, Köppel et al. 1980) suggests that these amphibolites are related to the rifting of the Paleotethys. Geochemistry on the augen gneiss showed a Rb enrichment that could betray its peraluminous character.

A detail cartographic study has allowed us to highlight a discordant contact between the Campo Tencia mass metasediments and the subjacent amphibolites, just above the augen gneisses from Verzasca's complex. This could either represent a tectonic, or a sedimentary contact with perhaps a time-gap. The latter interpretation is compatible with an episode of rifting and sedimentation in a system of tilted blocks.

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