

Geological and mineralogical study of the High Val Formazza - Binntal area (Central Alps): new stratigraphic, geochemical and structural constraints

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The Penninic domain represents a complex suture zone between the European foreland and the overriding Austro- and South- alpine realm. This domain is made of pre-Triassic basements, of Mesozoic to Tertiary cover series (often detached from their basement), and of ophiolites, in which polyphase penetrative deformations and an intense metamorphism erase the primary structural and sedimentological relations. This PhD work reports results (stratigraphic, tectonics, geochemical and metamorphic) obtained from during the investigations of parts of the lower Penninic units outcropping in the Lepontine Alps.

An area covering principally the High Val Formazza in Italy and the upper part of the Binntal in Switzerland has been mapped in detail. These valleys show natural cross sections, differently oriented, of six nappes belonging to the lower Penninic: the Camosci (newly defined here), Antigorio, Lebendun, Monte Leone, and Pizzo del Vallone (newly defined here) nappes and the Rosswald series. The stratigraphy, tectonic history and metamorphic grade of the various nappes were investigated in details

The stratigraphic study of the Mesozoic cover series shows strong analogies as well as obvious differences. However the stratigraphic section put in a paleogeographic order show the image of a structured passive margin, now severely deformed. The T-MORB like signature of the basalts present in the Pizzo del Vallone nappe reinforces this conclusion.

The Pizzo del Vallone, Monte Leone and Lebendun nappes show obvious similarities with the prépiémontais and ultrabriançonnais series, favouring a paleogeographic position on the northern margin of the Alpine Tethys. The Antigorio nappe was the shoulder, and the Camosci nappe, situated north of the shoulder, marked the beginning of the southern part of the Helvetic s.l. basin.

The superposed folds and the different schistosités highlight seven successive deformations. The deduced regional structural model shows that the deformation D3 (dominant schistosity) and the deformation D4 (crenulative schistosity) are the dominant structures. They follow the initial thrusting of the various nappes and mark the end of the procharriage. The backfolding D5, characterised by open folds, precedes a dextral shear movement D6. The latter obliterates most of the structural relations with the Eastern Alps because it strongly reorients the structures between the Morasco and Busin lakes. Finally the D7 folds, characterised by horizontal axial surfaces, are probably coeval to the late vertical strain related to the late exhumation of the Lepontine Alps.

The culmination of the amphibolitic Lepontine metamorphism was reach at the end of the procharriage (D4). The metamorphic conditions were first identified by studying

the mineralogical assemblages and were then estimated using the software THERMOCALC (~580°C, ~9.6 kbar). An approximation of the metamorphic history is based upon the zoned garnets.