

STRUCTURE AND KINEMATICS OF THE SIVIEZ-MISCHABEL NAPPE IN THE MATTERTAL - (WESTERN ALPS OF SWITZERLAND)

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This study investigates the overturned limb of the Siviez-Mischabel nappe and underlying tectonic units (Upper Stalden zone and Houillère zone) in the Mattertal area. Detailed structural analysis in the Permian Randa granite (augen orthogneiss) allows a better understanding of the Alpine deformation effects on basement rocks. Detailed mapping of this orthogneiss and surrounding rocks, and the study of the lithostratigraphy in the related sedimentary horizons allow the proposition of a structural and kinematic model for the overturned limb of the Siviez-Mischabel and to better understand the relations with the underlying tectonic units.

The structural analysis of the Randa orthogneiss and surrounding rocks revealed the superposition of several phases of ductile deformation. This orthogneiss formed under greenschist facies metamorphic conditions displays a strong Alpine foliation with at least two stretching lineations. The first lineation, L1, is oriented NW-SE and is related to the nappe emplacement northward. The second one, L2, is related to the Simplon ductile shear zone.

Strain estimation using the Fry method has been performed on porphyritic facies of the Randa orthogneiss. The obtained ellipses have axial ratios varying between 1.9 and 5.3, in agreement with strain estimation obtained from other markers (stretched turmalines, fringes). The strain values are very similar if measured parallel to L1 or to L2.

A theoretical approach was necessary to verify the relevant application of the Fry method to augen orthogneiss. This method requires that the distribution of the used markers has to be homogeneous and isotropic. Statistical tests have been done and revealed that K-feldspar phenocrysts satisfy these conditions and can be used as strain markers with the Fry method. The obtained strain measurements revealed the importance of the Simplon ductile shear zone on the geometry of the nappe in the studied area.

Mapping has improved the lithostratigraphy at the base of the Siviez-Mischabel nappe. Three overturned formations can be observed below the gneisses forming the core of the nappe. These three formations form the St-Niklaus syncline, which connects the Siviez-Mischabel nappe to the underlying Upper Stalden zone. U-Pb dating of detrital and magmatic zircons by LA-ICP-MS allowed the age of the observed formations to be constrained (presumably Carboniferous to Early Triassic). This data has critical implications for nappe structure in the region, composed of few recumbent folds with well preserved normal and overturned limbs. The definition and dating of these formations, as well as their identification in the adjacent "Houillère Zone" improve the understanding of the geometry and tectonic relations of the Middle Penninic nappes in the Mattertal.