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THE METAMORPHIC EVOLUTION OF THE ORTLER CRYSTALLINE

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The Ortler crystalline represents a polymetamorphic Austroalpine crystalline basement which occurs southwest of the Ötztal crystalline between the Vinschgau- and the Ulten Valley. During the Eo-Alpine orogeny, the Ötztal Crystalline was juxtaposed onto the northern part of the Ortler Crystalline and its sedimentary cover [6].

Tectonostratigraphy

Tectonically, the Ortler crystalline represents a stack of three distinct units which can be distinguished by their polymetamorphic P-T evolution:
A): The Laaser Series: It is the lowermost unit and is characterized by intensely deformed, mylonitic amphibolites, micaschists, paragneisses and almost pure marbles (Laas Marble).
B): The Martell Micaschists: It is on top of the Laas Series and is comprised of a more or less homogeneous stack of micaschists (Grt-Sta-Bt-bearing schists) with intercalations of amphibolites, orthogneisses and rarely marbles.
C): The Zebru Schuppenzone: This unit consists mainly of quartzphyllites with small intercalations of greenschists, quartzites and impure marbles. This unit is tectonically emplaced onto the Martell Micaschists and occurs at the base of the overlying sedimentary cover (Ortler Trias).

Deformation history

The Variscan orogeny led to the formation of large-scale (km) folds, directed E-W and a penetrative foliation. Crosscutting relations between the foliation and the pegmatite dike swarms of the permian Martell Granite [2] clearly indicate a Variscan age of the deformation. During the Eo-Alpine orogeny, the Variscan fold system was re-deformed which led to the formation of mylonites with WNW oriented stretching lineations and ± N-directed fold axes in the crystalline basement and the sedimentary cover. A second Eo-Alpine deformation phase caused the formation of a new fold system with fold axes directed towards WSW and NNW-directed thrusts. This deformation phase re-activated the early Eo-Alpine W-directed thrust systems such as the Zebru Line an the Zumpanell Line and led to the formation of a second penetrative foliation striking 60°- 80° and falling 30°- 40° south.

Metamorphic evolution

The Laas series and the Martell Micaschists clearly show a polymetamorphic evolution with an earlier Variscan and a later Eo-Alpine metamorphic overprint. In contrast to the Martell Micaschists, the Laas Series shows a stronger Eo-Alpine re-equilibration, thus erasing almost all of the Variscan metamorphic history. The Variscan mineral assemblage is in both units comprised of garnet + staurolite + biotite + plagioclase + quartz, the Eo-Alpine mineral assemblage contains garnet + plagioclase + biotite + muscovite ± chloritoid + paragonite ± margarite. While the P-T conditions of the Variscan event have not been constrained yet, the Eo-Alpine metamorphic conditions in both units range from 6.7–8.5 kbar and 480–500°C constrained from paragneisses and quartzphyllites. These data are in accordance with geochronological investigations which clearly indicate an Eo-Alpine metamorphic evolution. Previous investigations by [1], [3] and [4] reported also in [6] suggested that the deformation and metamorphic evolution of the Ortler Crystalline was mainly Variscan of age with a slight Eo-Alpine overprint, while our results clearly show that the Eo-Alpine metamorphic overprint was very strong and pervasive and thus led in the Laas Unit to a complete recrystallization during the Alpine orogeny. The metamorphic overprint decreases towards the W, indicated by the diminuishing overprint of the Martell micaschists that in their westernmost part (Upper Peder and Sulden Valley) have almost preserved their variscan mineral assemblage.

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