

The Freyenstein Shear Zone – Implications for exhumation of the South Bohemian Batholith (Moldanubian Superunit, Strudengau, Austria)

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The Moldanubian superunit is part of the internal zone of the Variscan Orogen in Europe and borders on the Saxothuringian and Sudetes zones in the north. In the south, it is blanketed by the Alpine foreland molasse. Tectonically it is subdivided into the Moldanubian Nappes (MN), the South Bohemian Batholith (SBB) and the Bavarian Nappes.

This work describes the ~ 500 m thick Freyenstein shear zone, which is located at the southern border of the Bohemian Massif north and south of the Danube near Freyenstein (Strudengau, Lower Austria). The area is built up by granites of Weinsberg-type, which are interlayered by numerous dikes and paragneisses of the Ostrong nappe system. These dikes include medium grained granites and finegrained granites (Mauthausen-type granites), which form huge intrusions. In addition, smaller intrusions of dark, finegrained diorites und aplitic dikes are observed. These rocks are affected by the Freyenstein shear zone und ductily deformed. Highly deformed pegmatoides containing white mica crystals up to one cm cut through the deformed rocks and form the last dike generation.

The Freyenstein shear zone is a NE-SW striking shear zone at the eastern edge of the SBB. The mylonitic foliation is dipping to the SE with angles around 60°. Shear-sense criteria like clast geometries, SC' structures as well as microstructures show normal faulting top to S/SW with steep (ca. 50°) angles. The Freyenstein shear zone records a polyphase history of deformation and crystallization: In a first phase, mylonitized mineral assemblages in deformed granitoides can be observed, which consist of pre- to syntectonic muscovite-porphyroclasts and biotite as well as dynamically recrystallized potassium feldspar, plagioclase and quartz. The muscovite porphyroclasts often form mica fishes and show top to S/SW directed shear-sense. The lack of syntectonic chlorite crystals points to metamorphic conditions of lower amphibolite-facies > than 450° C. In a later stage fluid infiltration under lower greenschist-facies conditions locally lead to sericitization of feldspar and development of pseudomorphs after it. In addition, syn-mylonitic biotite has been chloritized mimetically. Chlorite growth across the mylonitic foliation occurs rarely. Brittle faulting, overprinting the shear zone features, is documented by the occurrence of numerous harnish planes. They show normal faulting to the N with angles around 30° and locally sinistral shear-sense.

The Freyenstein shear zone belongs to a system of NE-SW striking shear zones and faults in the Moldanubian superunit and is located at the border between the SBB and MN ductily deforming both. Therefore, it plays an important role in exhumation processes of last stage SBB (synkinematic) intrusions during Late Variscan orogenic extension. According to cooling ages in other shear zones and (synkinematic) intrusions an age of ca. 320-290 Ma for the ductile deformation can be assumed.