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Pressure gradients across the Plattengneiss Shear Zone

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The Plattengneiss is one of the largest shear zones in the Eastern Alps. It is flat lying, about 500 m thick and crops out over almost 1000 kmˆ2. It is characterised by a strong mylonitic foliation, a strictly north - south striking lineation and an absence of obvious shear sense indicators. Thus, neither the amount of displacement, nor that of flattening across the shear zone are known. Nevertheless, because of its size, its deformation time during the eo-alpine orogenic event and its regional consistency with the Austroalpine nappe stacking history, many researchers have attempted to understand its regional importance. Here, we present estimates of the flattening component of strain during its evolution using geobarometry.

Samples from the surrounding area were collected in order to compare samples from the hanging wall of the Plattengneiss shear zone with samples from the foot wall. Based on published geometrical models of the shear zone we were able to determine the vertical distance of each sample from the shear zone margin with high accuracy. Formation pressure was then determined for each sample using THERMOCALC 3.30, paying careful attention to compare identical parageneses and end-member reactions in all samples. Moreover, samples were grouped into foot wall - hanging wall pairs and pressure differences were determined for selected pairs. For this, a new facility of THERMOCALC was employed. Pressure differences can be determined with much more precision than absolute pressures, as many of the errors cancel out.

Pressure differences throughout the whole outcrop area of the Plattengneiss show systematic trends. Typically, pressure differences between hanging wall - foot wall pairs are too high compared to the vertical distance between the two samples. For example, two samples with 2 km vertical separation record a pressure difference of 2 to 4 kbars.

Being aware of that, all samples were listed in an order corresponding to the vertical distance from the shear zone contacts. The so developed vertical pressure gradient features a more rapid increase of pressure with depth, than could be explained by a lithostatic gradient. We suggest that this may be interpreted in terms of a strong component of flattening and consequently by a dominating pure shear component. Moreover, it can be observed the formation pressures in the Plattengneiss are higher than pressures in both the hanging and the foot wall. We discuss interpretations of this observation in terms of (a) tectonic overpressure and (b) the shear zone recording a different stage of the metamorphic evolution.