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EMPLACEMENT TECTONICS OF THE RIESERFERNER PLUTON AND ITS COUNTRY ROCKS (EASTERN ALPS)

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Structural mapping of the Austroalpine basement south of the Tauern Window between the Pfunderer Valley in the W and the Lasörling group in the E revealed three major deformation phases. The first one (D1) was nearly completely overprinted by D2 and D3 under greenschist facies conditions. The occurrence of the latter two deformation phases in Mesozoic rocks of the Matreier Zone (MZ) proves their Alpine age. The main foliation S2 is oriented parallel to axial planes of F2 folds. S3 foliation occurs along Oligo-Miocene shear zones. In the western part of the area (Pfunderer Valley) the main foliation is a steeply dipping S3. Further to the E (Ahrn Valley and Lasörling Group) S2 seems to be the dominant foliation. In contrast to S3, S2 may also dip gently to subhorizontally in some areas.

The area is affected by several map-scale shear zones, all of which are approximately E-W trending and subvertically dipping. These shear zones have subhorizontal stretching lineations, but accommodated opposite senses of shear. The northern margin of the Austroalpine basement, just south of the western Tauern Window, is characterized by a dextral shear zone that was active under lower greenschist facies conditions. This shear zone is located mainly in the Cima Dura Series and is therefore named the Cima Dura Shear Zone (CDSZ). The occurrence in the CDSZ of both sinistral shear sense indicators in addition to the more common dextral ones is interpreted to result from transpressive deformation.

Further south the sinistral Speikboden mylonitic shear zone (KLEINSCHRODT, 1987) overprints the northern border of the 30 Ma old Rieserferner Pluton (BORSI et al. 1978b). Overprinting relationships indicate syn- to post-intrusive deformation, thus constraining mylonitization to have been syn- to post 30 Ma.

The southern border of the Rieserferner Pluton is bounded by another transpressive sinistral shear zone, the Defereggen-Antholz-Vals Line (DAV). The local occurrence of magmatic foliations and lineations oriented parallel to the mylonitic foliation and stretching lineation of the DAV suggests that this shear zone was also active during intrusion of the Rieserferner Pluton. The widespread solid-state overprint of the magmatic fabrics indicates that deformation continued after 30 Ma.

Our Rb-Sr dating of fine grained (< 0.2 μm - < 63 μm) white micas within dextral shear bands of the CDSZ revealed an age of 35,7±5,4 Ma (Rb-Sr on white mica). We interpret this age as the maximum age of dextral shearing. Sinistral shearing along the DAV was dated at 33-30 Ma (MÜLLER et al., 2000). It is therefore suggested that dextral and sinistral movements south of the Tauern window were coeval and effected the eastward extrusion of the Austroalpine basement.

Biotite cooling ages in the investigated area are progressively younger from E to W (BORSI et al. 1978a), reflecting a later or greater exhumation of the western part of the area. First results from Al in hornblende barometry (ALBERTZ 1999) on the tonalitic rocks of the Rieserferner Pluton seem to confirm this interpretation; the crystallization pressure increases from E to W. In addition, the progressive disappearence of F2 folds from E to W associated with the increasing occurrence of S3 foliations suggest that N-S shortening increases from E to W. Therefore, N-

S shortening appears to be accommodated by both vertical and eastward extrusion.

The varied orientation of the axial planes of F2 from subhorizontal (in the pluton roof) to subvertical (along the pluton sides) suggests that prior to intrusion the main foliation affected by these folds was heterogeneously oriented, probably due to prior folding. Therefore, folding of the Early Alpine foliation started before 30 Ma.

The geometry of the roof is characterised by two domal structures, separated by a syncline with a N-S striking axial plane. This orientation is perpendicular to the regional foliation. In other areas of the roof the foliation of the country rocks is folded, with axial planes dipping gently to the NW, parallel to the roof of the pluton. These orientations are not found away from the pluton and are therefore interpreted to result from emplacement-related deformation. Large parts of the roof of the pluton are discordant with respect to the enclosing rocks, and no significant strain increase is observed at the contact. Xenoliths of the country rocks are rare.

Large parts of the southern margin of the pluton dip steeply to the south and show fabrics oriented parallel to those of the DAV-Line. The floor of the pluton is exposed at its western end. Here, the country rocks dip with 20° to 40° to the E, beneath the tonalite. This allows one to estimate the thickness of the pluton at ca. 2 km.

Mapping in the SW part of the pluton (upper Val Fredda) reveals concentric magmatic foliation traces with steep lineations, both on the map- and the outcrop scales. We interpret these fabrics as feeders for the ascending melts.

Our observations lead us to the following emplacement history of the Rieserferner Pluton: the ascent of the tonalitic melts takes place along the mylonites of the DAV. At a depth of ca.12 km the melts intrude discordantly into the country rocks, just north of the DAV and form a subhorizontal, magmatic protrusion of ca. 2 km thickness. Gravitational instabilities of this protrusion lead to the domal stuctures of the pluton. Our interpretation of the Rieserferner Pluton as an elongate sheet-like body with an asymmetrical protrusion contrasts markedly with the interpretation of MAGER (1985) and STEENKEN et al. (2000) of the pluton as the magmatic filler of a purported releasing bend or pull-apart between the DAV and Speikboden mylonites. The lack of a field evidence for a continuous Speikboden mylonite zone precludes a pull-apart geometry, and suggests that deformation was widely distributed with conjugate domains of dextral and sinistral mylonitic shear.

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