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An exhumed mid-crustal attachment zone: Results of AMS fabric analysis of the Orlica-Snieznik massif, Poland & Czech Republic

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Models for exhumation of deep crustal rocks rely heavily on documentation of rocks structures (e.g. stretching lineations) which may not be visibly obvious in the field. In an attempt to better document exhumation features of the Orlica-Snieznik Dome (OSD), within the northeastern Bohemian massif, anisotropy of magnetic susceptibility (AMS) analysis was conducted on amphibolite-facies gneisses and migmatites, which envelope eclogite assemblages formed during Variscan convergence. The AMS technique can detect anisotropies of less than 1% and allows for the evaluation of non-visible petrofabrics within rocks, such as migmatites. Oriented AMS samples, typically eight to twelve samples per site, were collected from sixty-four sites distributed throughout the 400 km^2 of the OSD, within the Sudete Mountains of Poland and the Czech Republic. Metamorphic Th-Pb monazite ages and $^{40}Ar/^{39}Ar$ white mica and biotite data from migmatites within the OSD illustrate metamorphism and rapid cooling during mid-crustal ascent/extrusion from 345-335 Ma (Glascock et al., 2003; Gordon et al., 2003). In excess of 450 specimens were analyzed on a static KLY-4 Magnetic Susceptibility/Anisotropy System at the University of New Mexico Rock Magnetism Laboratory in order to characterize the magnetic fabric and phases within the rock. Preliminary rock magnetic data indicate that the dominate magnetic phase in most specimens analyzed is paramagnetic (hornblende, biotite, feldspar, etc.) as demonstrated by an average bulk susceptibility of 1.70x10^{-4} SI; few samples indicate that magnetite is the dominant magnetic phase with an average bulk susceptibility of

$1.79x10^{-2}$. Further rock magnetic experiments are being conducted to identify other magnetic phases. The AMS fabric data are fairly consistent with the macroscopic structural data, which was only visible at approximately half of the sites visited. In general, this combined structural data reveal a gentle to moderate west-dipping foliation in the Orlica Mountains of the western OSD. Within the central region of the dome, an area of ultrahigh grade assemblages including eclogites, lithologies yield a gentle to moderate east-dipping fabric from Miedzygorze north to Zloty Stok, and a near vertical N-S foliation in the south to Potczek. Fabric of the eastern Snieznik Mountains and adjacent N-S striking Stare Mesto shear zone is moderately to steeply dipping west. Remarkably, average lineations from all of our sites throughout the entire OSD plunge 11º toward 192º, an orientation that parallels the Stare Mesto zone. We propose that our petrofabric data, coupled with the presence of ultrahigh grade rocks, may display characteristics of a thick mid-crustal attachment zone (Teyssier et al., 2002). Oblique convergence in this region is well documented during Variscan orogenesis (Cymerman, 1997) as the Rheic ocean closed. We speculate the gently dipping/plunging fabrics of the OSD formed in the weak mid-crust below more rigid upper crustal blocks; sub-vertical fabrics in and near the Stare Mesto belt represent deeper structural levels formed under wrench dominated transpression. Our study shows that AMS petrofabric analysis is a simple yet powerful tool for obtaining high-quality orientation data from higher-grade, deeply exhumed rocks where visible rock structures may be tenuous.

References

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