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Magnetic Fabric in Ductile Shear Zones: Analogue Modelling

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A b s t r a c t

The measurement of anisotropy of magnetic susceptibility (AMS) becomes one of the most popular structural techniques for precise and quick determination of anisotropic fabric in rocks with lack of macroscopically visible structures. Sometimes, the lack of comprehensive information about the governing processes of AMS in rock can make interpretation difficult. Although it is well-established method and the strain-AMS relationship has been long time under investigation, recent publications have brought more attention to this subject. There is considerable discussion concerning origin of the magnetic fabric, its correlation with the bulk deformation and rock strain memory. The aim of our work is to bring new insights into the time and space relationships between finite strain microstructure and AMS fabric by providing new comparative data from analogue shear zones. Relationship of AMS with increasing strain was experimentally studied in deformed sandstones, plasticine, magnetite bearing sand bonded with cement (Borradaile and Alford 1987, Jackson *et al.* 1993), during preparation and compaction of calcite and muscovite aggregate (Schmidt *et al.* 2008a, b) and simple shear experiments on mixture of silicone and wax (Arbaret *et al.* 2013).

The experiment set-up for analogue modelling is designed as a large shear-box enabling strain rate variability. Also shear zones of variable width can be produced. The experiments are carried out with the coloured plaster of Paris with 1wt % of powder retarding the solidification reaction. The used material displays a strain-rate dependent (thixotropic) rheology and is capable to well-reproduce the strain localization and very well corresponds to natural rocks. Experimentally produced shear fabric in plaster is analyzed in terms of AMS due to homogeneously admixed fine-grained magnetite. By varying experimental strain rate we are able to simulate ductile to brittle behavior of the shear zones and document AMS evolution by the strain localization.

Keywords: AMS, magnetic fabric, deformation, strain, shear zone.

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