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Determination and modelling of superposed AMS and feldspar fabrics in the syenite magma deformed in crustal wedge

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Recent studies from the eastern margin of the Bohemian Massif proposed two distinct evolutionary stages responsible for complex structural pattern of Variscan crustal wedge. First stage (360-340 Ma) is responsible for steep N-S trending fabrics associated with exhumation of the lower crust within the orogenic root domain (Moldanubian unit). The indentation of Brunia orthogonal to earlier fabrics results in horizontal flow of hot root material over the indenter (335-320). Mg-rich syenite body was emplaced into this polyphase deformed lower crust allowing systematic study of magma fabric in deep crustal wedges Two major structures were identified in host rock granulites and migmatites: 1) The older, dominantly subvertical and N-S trending composite S1-2 fabric register peak metamorphic conditions represented by metamorphic association of Kf-Ky-Grt-Plg-Rut in granulites (18 – 10 kbar, 800°C) and Kf-Plg-Bt±Grt (10kbar, 750°C) in orthogneisses. Towards the north the orientation of S1-2 progresively change to E-W direction forming crustal-scale fold like structure. These fabric are strongly overprinted by younger S3 migmatitic fabric (6 – 4kbar, 700°C) which is dominantly subhorizontal in the studied area.
The reflexion feldspar goniometry and AMS fabrics of the triangular syenite pluton reveal complex internal pattern resulting from long-lived (10 – 15 My) polyphase magmatic evolution and subsequent sub-solidus deformation. Two principal structural domains were defined based on detailed processing of composite AMS and K-feldspar data. The southern domain edge is characterised by relatively low degree of bulk magnetic susceptibility and prolate to plane strain shape of AMS ellipsoid. Here, the magnetic foliation bearing sub-horizontal N-S trending magnetic lineation coincide with steep feldspar fabric and S2 fabric in host rock. Locally the magnetic foliation is sub-horizontal and parallel to S3 fabrics in host rocks. The northern domain is characterised by oblate symmetry of AMS ellipsoid with subhorizontal or gently SE dipping magnetic foliation bearing NW-SE trending magnetic lineation. These fabrics are consistent with S3 fabrics in host rocks although the continuity is obliterated along north and partly eastern margin where both magnetic and feldspar fabrics are steep and parallel to intrusion margin. The similarity between internal pattern of the syenite and structural record of the host rock reflect emplacement of syenite magma during south-westward underhrusting of the Brunia indenter underneath lower crustal rocks and syenite magma. The onset of this deformation is marked by N-S shortening and dilatation of pre-existing N-S trending S2 anisotropy and emplacement of syenite into these voids. Continuous weakening of N-S trending vertical fabric, leads to development of magma-host rock multilayer system which becomes affected by large scale buckling process leading to development of steep E-W trending ramps, Finally, the folded syenite-host rock layers are reworked by northward horizontal flow of migmatite-syenite mass over underlying Brunia indenter. It is during the northward flow when the vertical E-W and N-S fabrics in magma become massively overprinted resulting in contrasting AMS patterns recorded in southern and northern regions within the main plutonic body.
Numerical AMS fabric modelling (of paramagnetic minerals) simulates fabric variations in the two respective domains by superposition of horizontal combined simple shear and axial shortening over magmatic fold limb and hinge fabrics marked by orthogonal orientations and variable intensity. The comparison of AMS and feldspar fabrics allow precise determination of D3 deformation tensor, character and intensity of original magmatic fabric of syenite.