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Ascent and emplacement of pegmatite dykes in Koppal Pluton, Dharwar Craton (India)

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Fluid flow in the lithosphere is a consequence of interplay between rheology, fluid pressure/magma pressure, and stress conditions. Dykes/veins are the surface manifestation of fluid flow and can be utilized to comment on the state of stress, host rock strength and the tectonic setup at the time of their emplacement. Whether the fluid/melt will exploit the pre-existing fractures or develop new fractures will depend upon the tensile strength of rock, magnitude of the fluid pressure and stress. Apart from this, configuration of the fabric anisotropy vis-à-vis regional stress and strength of the host-rock are very crucial to dictate vein/dyke emplacement. In the present study, we investigate visually isotropic Koppal Pluton (KP) in East Dharwar Craton, which is replete with the pegmatite dykes/veins. The anisotropy of magnetic susceptibility (AMS) analysis on the samples of the KP reveals NNE-SSW oriented magnetic fabric attributed to the regional D3 deformational event (NW-SE compression). The mean orientation of pegmatite dykes/veins is NNW-SSE, which is oblique to anisotropies viz. magnetic fabric and the rarely visible field fabric. Several pegmatite dykes/veins have quartz/feldspar crystals growing perpendicular to the contact with the host rock (syenite). Moreover, at few places displaced mafic enclaves/bands are observed across the pegmatite veins. These field evidences imply that the pegmatite emplaced syntectonically as either Mode-I crack or by combination of Mode-I and II fracturing during the late regional D3 deformation event (pure shear dominated transpression). The present study provides a unique insight to explore the influence and interaction of principal stress and fabric anisotropy on visually isotropic KP to assess the ascent and emplacement of pegmatite dykes.
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