Abstract

Through this study, the author has endeavoured to 1) understand fabric development and emplacement mechanism of the Koppal Pluton (KP) and, 2) evaluate the state of stress during final phase of pluton emplacement using pegmatite dykes intruding KP. The fabric, as well as paleostress information, is integrated to develop a model that explains emplacement and kinematics of the KP. Anisotropy of Magnetic Susceptibility (AMS) data is presented from the KP (Dharwar Craton, India) that has U-Pb zircon age of 2528±9 Ma. Magnetic fabric of the KP is compared with the structural elements in the country rocks, and variation in the intensity of fabric within the KP is mapped. Emplacement mechanism of the KP is discussed, and it is inferred that it emplaced syntectonically with regional D_3 deformation. These results are compared with the time-relationship between emplacement/fabric development and regional deformation reported from the Mulgund Granite (2555±6 Ma; U-Pb zircon), which is also located in the Dharwar Craton and is equivalent to the KP in age. This granite is known to have emplaced syntectonically with regional D_1/D_2 deformation, and is thus not related to the same deformation event as the KP, despite their similar absolute ages. It is inferred that in the study area, D_3 is ≤2537 Ma, while D_1/D_2 is ≥2549 Ma in age. Orientations of pegmatite dykes intruding the ~2.5 Ga KP (Dharwar Craton, South India) are used to evaluate the state of stress prevalent during dyke emplacement. The dykes emplaced synchronously during late-D_3 regional deformation that was controlled by NW-SE directed shortening. Dykes within the KP have a restricted range of orientations, which is indicative of fluid pressure (P_f) < σ_2 (intermediate principal stress). Paleostress analysis using dykes yields orientation of σ_2 to be steep, while σ_1 is shallow, thus implying oblique-slip during dyke emplacement, but with a strong strike-slip component. Since cratonization of Dharwar Craton is known to have occurred at ca 2.5 Ga, the analysis provides information about paleostress prevalent during this process. Maximum orientation of dykes intruding KP is NNW-SSE, which is oblique to the NNE-SSW oriented fabric that is known to have developed in the KP during earlier stages of D_3. A kinematic model involving deformation partitioning during late-D_3 along this earlier fabric is envisaged to have resulted in the emplacement of dykes in NNW-SSE direction.

Keywords: Anisotropy of Magnetic Susceptibility; fabric; granitoid; pegmatite dykes; paleostress; Dharwar Craton; India