ABSTRACT

The present study involves the analysis of the deformation fabric and its control on vein emplacement in the rocks of Gadag region (western Dharwar craton, southern India). The study involves an integration of field, anisotropy of magnetic susceptibility (AMS), and microstructural studies. Since these rocks do not show well developed mesoscopic planar and linear structural elements (fabric), the internal fabric is recorded from AMS. The magnetic foliation is dominantly NW-SE oriented, which is parallel to regional trend of the schist belt. The magnetic lineations are doubly plunging - due NW and SE in both the lithologies (metavolcanic rocks and granite).The metasedimentary rocks of Gadag are known to have undergone three phases of deformation - D1/D2 folds (due to NE-SW compression) are coaxial (NW striking axial planes). D3 (NW-SE compression) produced regional warping with NE-SW axial plane that resulted in formation of dome-basin geometry. Accordingly, it is concluded that the magnetic foliation in the rocks of Gadag region developed during D1/D2, and the doubly plunging attitude of the magnetic lineation indicates superimposition of D3 deformation. The metavolcanic rocks are replete with quartz veins and fractures having various orientations. However, NW-SE striking quartz veins and fractures are dominant. 3-D Mohr circle prepared from vein orientation data indicate that: (a) the veins emplaced due to dilation of NW-SE oriented fabric elements during D3 deformation under NW-SE directed far-field stress (SH_{max}), and (b) repeated vein emplacement and gold mineralization took place on account of fluid pressure fluctuation under constant SH_{max}. Petrographic studies of the granite reveal presence of solid-state deformation fabrics developed at high and low temperature indicating that the granite underwent ductile deformation during emplacement. However, right-lateral and left-lateral oblique-slip normal faults in various orientations are recorded in the granite indicating brittle deformation. Paleostress analysis of these faults yields ENE-WSW compression direction (paleostress) for the development of oblique-slip normal faults in the granite. It is inferred that these faults can be considered to be a part of Riedel shear that has developed as a consequence of deformation partitioning along the NNW-SSE oriented granite-metavolcanic, and NW-SE oriented granite-TTG contact during D3 deformation under NW-SE directed SH_{max}. Thus, the emplacements of veins in the metavolcanic and metasedimentary rocks, as well as the formation of oblique-slip normal faults in the granite are interpreted to be synchronous during late stages of regional D3 deformation.

Key words: Fabric analysis, Anisotropy of Magnetic Susceptibility, Paleostress analysis, 3-D Mohr circle, Vein emplacement, Dharwar craton