ABSTRACT

In this study, two different methods for estimating absolute differential stress using vein or dikes are proposed. Further, the methods are applied to the hydrothermal gold bearing vein mesh of Gadag region (Southern India) and active volcanic system of Santorini (Greece). First method incorporates fluid pressure from fluid inclusion data of quartz vein and rock mass failure criterion (Hoek Brown rupture criterion). Second method is based on the idea of using aspect ratio of vein/dyke and calculation of fluid/ magma over pressure. Vein orientations from Gadag shows evidence of fluid pressure fluctuation. Due to fluctuation of fluid pressure, variation in driving pressure ratio ($\Delta R'$) is higher in mineralized domain compare to non-mineralized domain. Statistical vein thickness distribution reveals that mineralized zone has lower Weibull modulus (α), fractal dimension (D_c) and higher mean thickness (T_{mean}), vein intensity (Vi) compare to non-mineralized zone. It is interpreted that, the strength of the rock was weak which triggered high fluid influx in the mineralized domain resulting higher mean thickness (T_{mean}), vein intensity (Vi). Using the first method for estimating differential stress, change of effective normal stress prevailed during gold deposition in the Gadag region is estimated to be 10.5 MPa. Second method is applied on the dikes of Santorini for estimating absolute differential stress acting on the shallow magma chamber. In addition, a model is proposed considering differential stress (σ_d), driving magma pressure ratio (R') and tensile strength (T) of a rock mass for a volcanic system. Considering the proposed model, minimum volume of magma (Vr) required for diking and volcanic eruption for Santorini volcanic system are calculated. Finally, the proposed new methods of estimating differential stress are validated with the obtained results from well established method of Calcite twinning.