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Fractured micro-granitoid enclaves: a stress marker

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Abstract:

Systematic, parallel, and steeply dipping tensile fractures within rounded to sub-rounded micro-granitoid enclaves are analyzed to decipher the stress condition at Chitradurga granite (Dharwar craton, south India). The study is performed in two steps: 1) Assessing the fracturing condition through thermo-mechanical model as fractures in granite may be related to thermal stresses during its cooling or to tectonics stresses. 2) Performing the plane strain mechanical solution for circular rigid inclusions to fractured enclaves, where rock mechanics concepts of fracturing are integrated with kinematic analysis. We interpret that the parallel, systematic fractures in the micro-granitoid enclaves developed due to the stress amplification inside enclaves when the host pluton was at shallow depth of ~2.4km. The derived paleostress orientation fits well with the orientation and sense of movement to the adjacent Chitradurga Shear Zone. The deduced paleostress conditions from fractured micro-granitoid enclaves are also in a good agreement with the previously revealed regional tectonics. We conclude that the fractured micro-granitoid enclaves are reliable stress indicator.

Keywords: Fractures; Micro-granitoid enclaves; Paleostress; Dharwar craton; India

1. Introduction

The study of fractures is central to evaluate rock strength and fluid flow in rocks. (Segall et al., 1990; National Academy of Sciences, 1996; Bergbauer and Martel, 1999; Aydin, 2000; Zhong et al., 2009; Sato et al., 2013; Mondal and Mamtani, 2013; Crider, 2015;