

The Bundelkhand ‘giant quartz reef’ system: A possible ancient granitoid-hosted geothermal system

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The key information on fluid characteristics in the Bundelkhand granitoids (2.58- 2.50Ga) was missing so far to examine the possible link with the ‘giant quartz reef’ (GQR) system’ in the Bundelkhand craton [1]. The gross fluid characteristics in the GQR was established from fluid inclusion studies [2]. The fluid characteristics revealed from study of the dominant aqueous inclusions in quartz from the matrix and quartz veins in the granitoid, have striking resemblance to the fluid in the GQR in terms of temperature and salinity ranges. The inclusion types (aqueous biphasic, pure carbonic and aqueous carbonic types along with polyphase inclusions with various types of daughter/captive phase that do not dissolve on heating) are same with a greater abundance of CO₂-bearing inclusions in the granitoid domain. The salinity ranges of aqueous fluid (~0 to about 30 wt % NaCl equivalent) is the same in both domains and so is the range of T_h and density (73.2- 399.8°C; ρ =0.5- 1.77g/cc respectively). The carbonic component in the fluid in granitoid domain is identical in nature but furnishes higher range and limit of pressure (2600 bars) as compared to GQR (1820 bars). The scenario of T_h – salinity path of fluid evolution is virtually indistinguishable in the two and almost rules out a deeper metamorphogenic source of fluid for the GQR and indicates involvement of meteoric fluid in their origin. We thus visualize that the GQR in the Bundelkhand craton possibly represents an ancient ‘geothermal system’ in a granitic terrane. The twenty ‘giant quartz reefs’ each running for a few tens of kilometers in strike length in the Bundelkhand craton (dominated by the granitoid complex) represent upper-crustal fracture zones. The process is likely to have operated in a crustal-scale extensional regime with advective fluid flow from the surrounding in response to drop in pressure, convective channelization of fluid and mixing with meteoric fluid in the fracture zone and deposition of quartz that gave rise to the Bundelkhand GQR.

[1]Pati (2020) Episodes J. of International Geoscience, 43(1),69-87. [2]Rout et al. (2017) AGU Fall Meeting Abstract No. V43B-054.