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Strain analysis in quartzites with negative magnetic susceptibility using AMS and EBSD data

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This study is being done with the objective of trying to understand whether the anisotropy of magnetic susceptibility (AMS) data can provide information about strain in quartzites with negative magnetic susceptibility. For this, nine quartzite samples have been collected from Rengali Province (located in the eastern part of India) with bulk magnetic susceptibility between -13.6 x 10^{-6} SI units and -3.06 x 10^{-6} SI units. Since these rocks did not show any visible foliation or lineation, AMS analysis was performed using KLY-4S Kappabridge and the orientation of three principal axes of the AMS ellipsoid ($K_1 > K_2 > K_3$) were determined. Thin sections were prepared parallel to the K_1K_3 plane of the AMS ellipsoid (plane parallel to lineation and perpendicular to foliation), which is equivalent to the XZ plane of the strain ellipsoid. SEM based electron backscatter diffraction (EBSD) analysis, shape preferred orientation (SPO) analysis and strain analysis were carried out in these sections.

Recently, Renjith et al. (2016) used the same samples to establish that the AMS in quartzites gives information about the SPO and not the CPO. To further evaluate the robustness of AMS in strain analysis, the authors have integrated the degree of magnetic anisotropy (P_j - a measure of the eccentricity of AMS ellipsoid; Tarling and Hrouda, 1993) with the intensity of SPO (κ; Piazolo and Passchier, 2002), and the strain (E - calculated using AMOCADO; Gerik and Kruhl, 2009) from the same samples from Rengali. EBSD data were used as the basis for the above calculations. Whilst the orientation of long axis of quartz grains from EBSD statistical data was used to calculate κ, the grain boundary map generated from EBSD analysis was used as the basis to determine strain (E). It is found that the sample with minimum P_j also has a minimum κ and E, and vice-versa. Hence it is concluded that one-to-one correlation exists between the degree of magnetic anisotropy, strain and intensity of SPO in deformed quartzites that have a negative magnetic susceptibility. Since the application of AMS as a strain-intensity gauge in quartzites with mean susceptibility below 50 x 10^{-6} SI units has been questioned in the past (Hrouda, 1986), the present findings open up a further avenue of research that can be addressed using AMS.

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