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En-echelon quartz vein arrays in a progressive dextral transpressional system, Storms River, Eastern Cape, South Africa

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En-echelon sigmoidal quartz vein arrays transect a folded package of Table Mountain Group quartzites of the Cape Supergroup, west of Storms River mouth. The quartzite package is overlain by an argillite-siltstone unit, a thinner quartzite unit, and a thick argillite-siltstone package. Individual veins within the conjugate arrays, are sub-vertical and commonly lie at a high angle to bedding. The small competency contrast between veins and host rock, suggests that deformation of veins occurred by passive rotation. Of the two arrays developed, one array is dominant, indicative of rotational finite strain [1]. In sub-vertical profile sections exposed in the quartzite package, veins are also *en-echelon*, with geometries suggestive of apparent normal movement in this plane.

Veins deflect across contacts from quartzite into argillite-siltstone units where they transition into *en-echelon* arrays with array boundaries at lower angles to contacts (Fig. 1) compared within quartzites. This is both a consequence of rheology, as principal axes of finite strain change direction where they are followed across contacts from competent to incompetent units [1], and it is also indicative that the incompetent units hosting them has undergone progressive dextral simple shear. Veins within argillite-siltstone generally lie within one of two arrays: sinistral arrays typically orientated NE-SW (but also E-W where the argillite-siltstone thins and pinches out), and dextral arrays, orientated NE-SW. Individual veins in the sinistral arrays are either folded or sheared, depending on their initial angle and relative timing of propagation. During non-coaxial deformation, where veins within zones of initial extension subsequently entered zones of contraction, veins were buckled, accounting for folded veins. Veins in orientations of initial extension which stayed within zones of extension, have become lengthened, rotated and sheared, such that they have taken on a strong sigmoidal curvature. In general, folded veins appear to have formed earlier than sheared veins, as the principal compressive stress rotated with respect to contacts, while the zones were deforming. In some cases small dextral shear zones cross-cut the sinistral arrays, resulting in localized box folding of veins. The dextral *en-echelon* arrays are usually developed in kink bands in dilational spaces parallel to the dominant anisotropy i.e. cleavage. These veins are interpreted to have formed at the fringe of a single parent vein, where fragmentation of the propagating edge has occurred [2].

The geometry of vein arrays within competent and incompetent units is consistent with an overall progressive dextral regime formed by NNW-SSE to NNE-SSW compression, which has resulted in incompetent zones having undergone localized dextral inclined transpression.

References:

[1] Ramsay, J.G., Huber, M.I., 1987. The techniques of modern structural geology. In: Folds and Fractures, vol. 2. Academic Press, London.
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