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Strike-slip brittle shear zone from coastal Deccan in and around Mumbai, India: Evidence for N-S extension

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An E-W extension separated India from the Seychelles micro-continent at $\sim$ 62 Ma. This post-dated the Deccan volcanic eruptions. However, the structures attributed to this extension lack geometrical quantification, especially in the western Indian coast. The Narmada-Tapi region, $\sim$ 400 Km north of Mumbai, experienced a $\sim$ N-S extension prior to and/or concurrent with the volcanism. Normal faults dip towards W. Sub-horizontal lava flows, slickensides, N-S shear zones etc. have been reported from the western part of the Deccan Large Igneous Province (DLIP). This work, for the first time, identifies and investigates a $\sim$ 20°N strike-slip brittle shear zone, traced for $\sim$ 100 Km along the west coast of India from Mumbai to Murud by fieldworks. The W-block moved north through a dextral-slip. Deformation is more enhanced in the south (near Murud). Field observations reveal Y-planes ($\sim$ N20°E; abundant), Riedels ($\sim$ 0-N30°E; abundant), anti-Riedels ($\sim$ N30-50°W; less abundant), asymmetric elevations ($\sim$ N15°E; locally abundant), extension and en-echelon fractures (2 sets: $\sim$N-S and $\sim$E-W) with a single miniature pull-apart basin ($\sim$ N-S extension). The E-W fractures reactivated locally and around Murud slipped/faulted $\sim$ N-S dykes. Average directions of paleostress tensors were computed for the regime yielding $\sigma 1$ (trend = 99°; plunge = 0°), $\sigma 2$ (trend = 196°; plunge = 90°) and $\sigma 3$ (trend = 10°; plunge = 0°). Associated strain results convincingly display a dominant N-S extension. It was not possible to establish which set of extensions (i.e. between N-S and E-W) occurred earlier. Alongside E-W extension, structurally weak shear zones might have channelized late-stage intrusions of $\sim$ N-S dykes. The DLIP was not subject to any post-rifting deformations regionally, except isostatic adjustments. Hence, based on available data, we postulate that these two extensions were coevally operating in the late phases of the Deccan eruptions. As the Indian plate drifted NE, the strike-slip brittle shear zone might have been a structural adjustment in response to the E-W extension.