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## The Stress Field of southern Africa

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The most reliable sources of contemporary tectonic stress data for southern Africa include a) borehole breakouts in oil exploration wells from the offshore Orange River and Outeniqua basins, and b) focal mechanism/fault plane solutions from seismic events recorded by multiple stations. Information is also provided by c) stress and strain release structures in operating mines and tunnels, but these data are less reliable because stress induced by nearby or adjacent excavations interfere with the natural stress field. A final source of recent to neotectonic data is provided by d) faults displacing Late Cenozoic sediments. These geological stress indicators are most problematic to interpret owing to the difficulty in finding dissected sediments of demonstrably contemporary, i.e. late Holocene age.

Our observations consistently indicate a NNW - N orientation of the maximum horizontal compressive stress ( $\sigma_H$ ) that prevails across most of central, southern and western South Africa, and in Namibia up to the Angola border. However, in the Congo basin, a few earthquake focal mechanisms indicate rotation of the regional  $\sigma_H$  to an E-W orientation. Geological units affected by this stress field belong to all ages, from Archaean cratons (Angola-Kasai, Kaapvaal) and Proterozoic Mobile belts (Namaqualand metamorphic complex) to the offshore Mesozoic to Cenozoic Outeniqua and Orange Basins and the Cretaceous oceanic lithosphere (Walvis Ridge). Azimuths of  $\sigma_H$  in the NE-SW quadrants seem prevalent in E Mpumalanga, N Natal, and northern Limpopo.

The southerly propagation of the E African Rift System is probably the main driver of stress both in the fractured crust of the northern (Limpopo belt) and northeastern regions (N Natal), and in the less fractured crust that extends from the Kaapvaal craton to the Outeniqua basin. However, the strike slip to transpressional character of the NNW-SSE oriented  $\sigma_H$ /signal (Wegener Stress Anomaly or WSA) over much of western southern Africa remains unexplained.

The WSA is puzzling, especially because its intensity/strain rate has waxed and waned over time spans of decades (cf. the recent Au-grabies seismic "swarm") to tens of millions of years. At least 7 successive very different tectonic regimes have affected Namaqualand and W Namibia in the past 130 Ma; and in the Kaapvaal craton, thrust faults consistent with the same WSA displace likely late Cenozoic sediments at Bultfontein and near Douglas. At this latter locality, at least one overturned fold of Dwyka diamictite and several reverse faults with a NE dip were also recognized, but their age/structural relations with the reverse faults dipping to the NW have not been resolved.

**Key words:** southern Africa, focal mechanism solutions, neotectonic stress, Wegener Stress Anomaly

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## Malagasy Seismic Network Extension and Focal Mechanism of Itasy

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