Post-Gondwana stress distribution in South Africa
Helping to understand seismic hazards in the subcontinent

M A G ANDREOLI[1,2], Z Ben-Avraham[3,4], D Delvaux De Fenffe[2,5], R Durrheim[6,2], A Fagereng[7], A O Heidbach[8], M Hodge[7], A Le Roux[7], A Logue[1,7],H Malephane[2],N v d Merwe[2], J Muoka[2], K Saalmann[2] and I Saunders[9]

1. South African Nuclear Energy Corporation, South Africa, marco@necsa.co.za
2. University of the Witwatersrand, South Africa
3. Tel Aviv University, Israel, zviba@tau.ac.il
4. University of Haifa, Israel
5. Royal Museum for Central Africa, Belgium, damien.delvaux@africamuseum.be
6. CSIR, South Africa, RDurrhei@csir.co.za
7. University of Cape Town, South Africa, Ake.Fagereng@uct.ac.za
8. GFZ Potsdam, Germany, heidbach@gfz-potsdam.de
9. Council for Geoscience, South Africa, ians@geoscience.org.za

A persistent weakness in assessing the seismic hazards in South Africa originates from the under-representation of much of the subcontinent in the World Stress Map database. As a consequence, it is generally difficult to determine the reactivation potential of known faults, permissible only if they line up close to the direction of *maximum horizontal compressive stress* (σ_H). To obtain this datum, or even better the orientation of the principal compressive stresses ($\sigma_1>\sigma_2>\sigma_3$), we installed 3 compact Trillium stations across the Grootvloer seismic cluster (Bushmanland, Northern Cape) whose data will be integrated with those from the national network to obtain focal mechanism solutions. These neotectonic stress tensors are then combined with σ_H parameters obtained from caliper logs of off-shore wells and from the geometry of joints, faults and sheared fractures in palaeosols (Bushmanland), soils and calcrete (NW Free State) and aeolianites (southern Cape). We also include underground rock engineering phenomenological observations and measurements (Witbank coal field), and data in the public domain. Our data consistently indicate a NNW-SSE oriented σ_H (Wegener Stress Anomaly or WSA) prevailing across most of central, southern and western South Africa/Namibia not further than southern Angola. We also found that the WSA is the last of at least 7 successive tectonic regimes to leave their brittle imprints along the SE Atlantic seaboard since the break-up of W Gondwana. In conclusion, the state of stress in South Africa holds many uncertainties, including the strike-slip to transpressional character of the WSA, its rapidly changing strength and stain rate and the influence of the E African Rift System.