Paper Number: 3202

Stress field in the African Plate

Delvaux, D. [1], Andreoli, M.A.G.[2] and Meghraoui, M.[3]

[1] Royal Museum for Central Africa, Tervuren, Belgium, damien.delvaux@africamuseum.be
[2] School of Geosciences, University of the Witwatersrand, South Africa, marco.andreoli@necsa.co.za
[3] EOST-Institut de Physique du Globe (UMR 7516), Université de Strasbourg, France, m.meghraoui@unistra.fr

---

The current stress field for the African plate is still incompletely known due to the relatively small number of earthquake focal mechanisms and in-situ stress measurements available. In the last decade, there has been a strong efforts to revise the existing focal mechanisms and to determine new ones using systematic approaches. These data have been used for investigating the crustal structure of Africa, but they have not yet been used with the view to improve the African stress map. In 2010, Delvaux and Barth [1] compiled 332 focal mechanisms for Central, Eastern and Southern Africa. In the frame of IGCP-601 project *Seismotectonics and Seimic Hazards in Africa*, we compiled 690 mechanisms for the entire African plate. The significant increase in number is not only due to the integration of the North and Western African region but also, and in a large part, to the determination of new mechanisms from old seismological data and from the new events occurring during the last years. Similarly, New stress data from borehole in-situ measurements are becoming available for a series of basins in NW Africa and along the western and southern coast of South Africa.

The distribution of the mechanisms on the African plate is heterogeneous, but larger regions are now well covered. These allows to better image the first- and second-order stress fields across the continent, and provide locally third-order details. The focal mechanism data have been inverted to obtain stress tensors for a series of zones characterized by relatively homogeneous deformation.

The intraplate stress outside the East African rift system is largely compressional and the maximum horizontal principal stress directions (SHmax) correlate well with the minimum ones (Shmin) from the closest portion of the mid-oceanic ridge (data from the World Stress Map). This is particularly well expressed on the western side of Central Africa and in the Congo basin. The stress field in the regions of high elevation in East and Southern Africa are often associated to extensional stresses, with the Shmin directions radiating away from the topographic highs. In South-Africa, the stress field is governed by the co-called Wegener anomaly (NNW-SSE oriented SHmax) which prevails across most of central, southern and western South Africa, Namibia. The western flank of the Kivu rift segment in the DRC is a nice example of the transition between E-W extension in the western rift of the East African rift, to E-W compression in the Congo Basin, with progressive change in stress regime and horizontal stress directions. Other regions of the East African Rift present second to third-order stress anomalies which are not fully understood, but partly related to the rift architecture.

[1] Delvaux, D., and Barth, A. (2010) Tectonophysics, 482(1): 105-128.