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Seismotectonics of the 2017 Botswana earthquake (Mw 6.5): An active branch of the East African Rift

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The 3 April 2017 Botswana earthquake occurred along a moderately seismic active zone in central southern Africa, west of the 2006 Machaze earthquake (Mw 7.0). Although located in the continental interior of the African plate, the seismogenic area previously considered as a stable region reveals a background seismicity associated with long-term deformation and faulting. We study this intraplate seismic activity and mainshock area using the seismotectonic data of the recent published map of Africa * and the Archean Limpopo–Shashe Tectonic Belt (ALSTB), the geodetic (InSAR) analysis and seismological (aftershock data) determined from a post-earthquake local seismic array. The mainshock location (25.18E, 22.6S) and depth (25 $\pm$3 km) provided by the Council for Geoscience (CGS, Pretoria), Euro-Mediterranean Seismological Center (EMSC) and United States Geological Survey (USGS) was followed by the largest aftershock with Mw 4.5 on the 5 April 2017.
The seismotectonic setting of the ALSTB shows a significant recent background seismicity reaching Ml 4.5 in 2009 along ENE-WSW trending shear zones associated with NW-SE striking dip-slip fault system. Our analysis of Sentinel-1 interferogram (images from ascending orbit) shows 4 to 6 cm coseismic slip on a NW-SE elongated and 30-km-long surface deformation consistent with the mainshock location, normal faulting mechanism and source time function (http://geoscope.ipgp.fr/index.php/en/catalog/). We also investigate the earthquake rupture dimension at depth from the inversion of surface deformation and obtain slip distribution on a fault plane striking 315°, dipping 45° and -80° rake and with Mo 7.12 e18 N.m. The earthquake rupture geometry is in agreement with the $\sim$500 aftershock locations at surface and depth and confirms the $\sim$28 km seismogenic layer thickness.
The earthquake sequence affected the ALTSB that limits the Zimbabwe Craton to the north with the Kaapvaal Craton to the south and defines the central Limpopo belt. The ALTSB appears as an analog of the NE-SW trending Okavango active zone that experienced the Ml 6.7 seismic event on 11 October 1952. Although the seismic strain rate is of low level, the 2017 earthquake rupture characteristics and related seismotectonic framework classify the intraplate region as an active plate interior.

* Meghraoui, M., P. Amponsah, A. Ayadi, A. Ayele, B. Ateba, A. Bensuleman, D. Delvaux; M. El Gabry, R.-M. Fernandes, V. Midzi, M. Roos, Y. Timoulali, 2016, The Seismotectonic Map of Africa, Episodes Vol. 39, no. 1, DOI:10.18814/epiiugs/2016/v39i1/89232