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Seismotectonic Analysis of the 2017 Moiyabana Earthquake (MW 6.5; Botswana), Insights from field investigations, aftershock and InSAR studies

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The 3 April 2017 M_W 6.5, Moiyabana (Botswana) earthquake occurred in the continental interior of the African plate and in a seismogenic region previously considered as stable. We analyse the mainshock and aftershock sequence based on a local seismic network and local seismotectonic characteristics. The earthquake rupture geometry is constrained with more than 1,000 aftershocks recorded over a period of three months and from the InSAR analysis of Sentinel-1 images (ascending orbit). The mainshock (25.134 E, 22.565 S; depth 22 ± 3 km) was followed by more than 500 events of magnitude M ≥ 0.8 recorded in April 2017 including the largest aftershock (M_W 4.6 on the 5 April 2017). Focal mechanism solutions of the mainshock and aftershocks display predominance of NW-SE trending and NE dipping normal faulting. Stress inversion of focal mechanisms obtained from the mainshock and aftershock database are compatible with a NE-SW extension under normal faulting regime. The InSAR study shows fringes with two lobes with 4 to 6 cm coseismic slip on a NW-SE elongated and 30-km-long surface deformation consistent with the mainshock location and normal faulting mechanism. The modelling of surface deformation provides the earthquake rupture dimension at depth with ~ 1 m maximum slip on a fault plane striking 315°, dipping 45°, -80° rake and with M_o 7.12 10^{18} Nm Although the seismic strain rate is of low level, the occurrence of the 2017 Moiyabana earthquake, followed by an aftershock sequence in the central Limpopo belt classifies the intraplate region as an active plate interior.