



Active tectonic deformation in Central Tanzania: the Manyara-Dodoma rift segment

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In November 4, 2002, an earthquake of $M_b = 5.5$ struck Dodoma, the capital city of Tanzania, in Central Tanzania, in a portion of the Eastern East African Rift System with a weak topographic expression. Analysis of modern digital relief, seismological and geological data reveals that ongoing tectonic deformation is presently affecting a broad N-S trending belt, extending southward from the North Tanzanian Divergence to at least the region of Dodoma, forming the “Manyara-Dodoma rift segment”. The latter forms the southwards continuation of the Eastern Branch of the East African Rift System.

The two-stage rifting model proposed for Kenya and North Tanzania also applies to the Manyara-Dodoma rift segment. In a first stage, large, well-expressed topographic and volcanogenic structures were initiated in the Natron, Eyasi and Manyara grabens during the Late Miocene to Pliocene. From the Middle Pleistocene onwards, deformations related to the second rifting stage propagated southwards to the Dodoma region. These young structures have still limited morphological expressions compared to the structures formed during the first stage. However, they appear to be tectonically active as shown by the high concentration of moderate earthquakes into earthquake swarms, the distribution of He-bearing thermal springs, the freshness of the fault scarps visible in the morphology, and the presence of open surface fractures. Fault kinematic and paleostress analysis of geological fault data in basement rocks along the active fault lines show that recent faults often reactivate older fault systems. The present-day stress inverted from earthquake focal mechanisms shows that the Manyara-Dodoma

rift segment is presently subjected to an extensional stress field with a N080°E direction of horizontal principal extension. Under this stress field, the rift develops by (1) reactivation of the pre-existing tectonic planes of weakness, and (2) progressive development of a new fault system in a more N-S trend by the linkage of existing rift faults. This process started about 1.2 Ma ago and is still ongoing.