Neotectonic faults and stress field of the Late Cenozoic East African Rift System around the Tanzanian Craton

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In the last decade, significant advances have been made in the understanding of the structure and kinematics of the East African Rift System. An important increase in the number of earthquake focal mechanisms (Delvaux and Barth, 2010), together with the emergence of geodetic GPS measurements (Stamps et al., 2008; Fernandes et al., 2013; Saria et al., 2013; 2014) allow a better constraint on the kinematics of rift opening. In parallel, new chronological data on volcanic deposits, suggest the coeval rather than a diachronous late Cenozoic development of the two rift branches surrounding the Tanzanian craton (Roberts et al., 2012). Distribution of earthquake epicenters and thermal springs both show good correlation with the actively deforming zones. As a contribution to IGCP project 601 and towards preparation of the Seismotectonic Map of Africa, we made a new compilation of the neotectonic faults related to the East African Rift System around the Tanzanian craton. The initial aim was to identify and map the potentially active faults. Faults are usually defined as active when they show seismogenic displacement during the last 10,000 to 100,000 years, generally on the basis of paleoseismic investigation. In East Africa, however, very few faults have been studied by paleoseismic techniques and even fewer have known historical seismic activation. To address this issue, we mapped faults that show morphological indications of displacement. We used the SRTM DTM (90 and 30 m when available to us), with artificial shading as basis for identify neotectonic faults, in combination with existing data from geological maps, publications and reports, complemented by our own field observations. Thermal springs often occur along tectonically active faults. We use them to distinguish present-day faulting from other mapped faults as they are in most cases structurally controlled. In parallel, we used also the available focal mechanisms and geological fault-slip data to constrain the stress second-order stress field (at the scale of rift segments) and locally also the third-order stress field (at the local scale).

All these elements are combined and compared with existing kinematic models for the East African Rift based on earthquake slip vectors, GPS measurements and geologic indicators. The comparison evidences some local discrepancies in the direction of opening, probably due to the interactions between different rift segments, as in the Rukwa rift, Mbeya southern junction between the eastern and western rift branches, and in the Manyara-Natron area.

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