Tectonic development of the Rungwe volcanic province and Upemba graben in perspective of geothermal exploration.

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Structural investigations in the Rungwe Volcanic Province at the intersection between the E and W branches of the East African rift system in the SW highlands of Tanzania have reinforced the importance of the recent tectonic architecture in controlling the location of quaternary volcanic eruptive centers. According to the two-phase Late Cenozoic rifting history, mainly constrained by dated volcanics from the Rungwe massif, the present-day tectonic regime in the area started to become active 1.5 - 1 Ma ago, so defining the Neotectonic period.

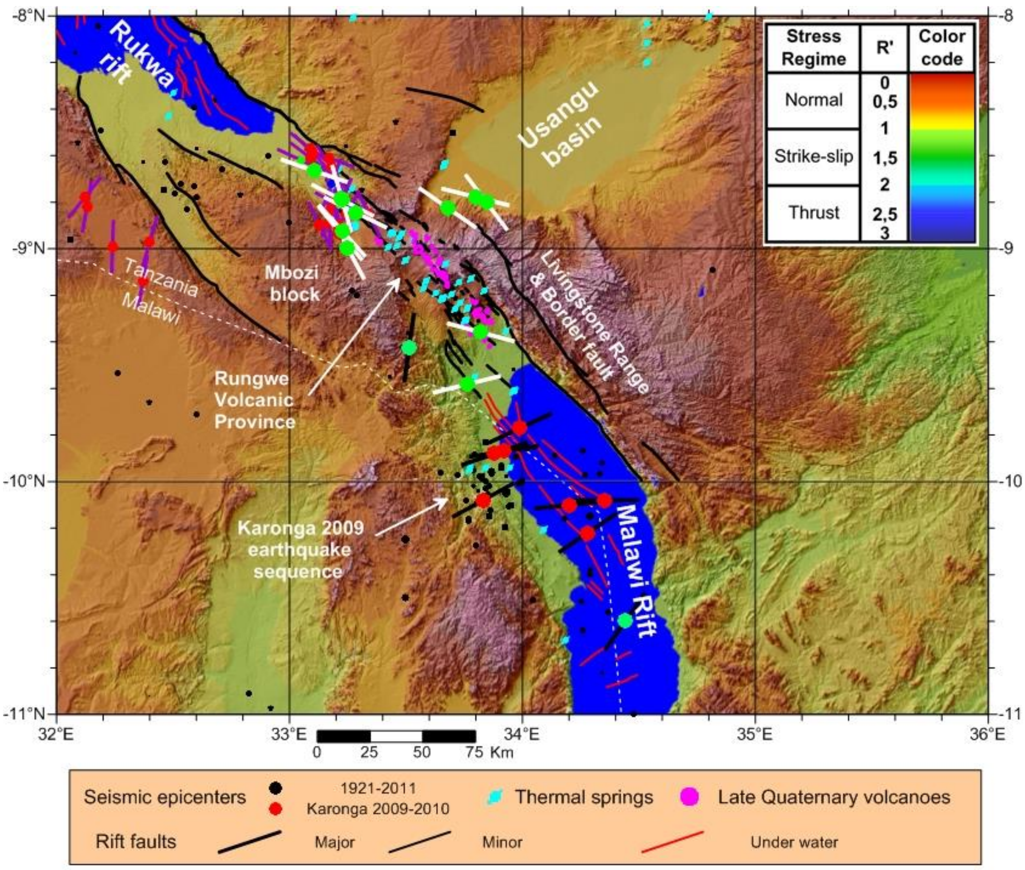

Figure 1: Tectonic setting of the Mbeya triple rift junction with the major, NW-trending faults, thermal springs, seismic epicentres and tectonic stress indicators. Tectonic stress are represented by filled circles with color in function of the stress regime index R' and a thick bar for the direction of horizontal principal extension (black: form focal mechanisms of teleseismic earthquakes, purple: from focal mechanisms of the 1992 seismic Mbeya seismic network, white, from the inversion of fault-slip data).

This neotectonic period is characterized by a tectonic stress regime of strike-slip type with both horizontal ENE-WSW maximum compression and NNW-SSE minimum compression (extension) axes (Fig. 1). Deformation localises mainly along high-angle faults that cross-cut the whole volcanic massif and along which significant strike-slip movements occur (Fig. 2). These faults often reactivate older basement structures and/or normal fault systems within the rift sediments and volcanics related to the first phase of late Cenozoic rifting. They also seem to control discharge of many hydrothermal springs (hot springs and CO2 gas vents, depending of the hydrothermal system).

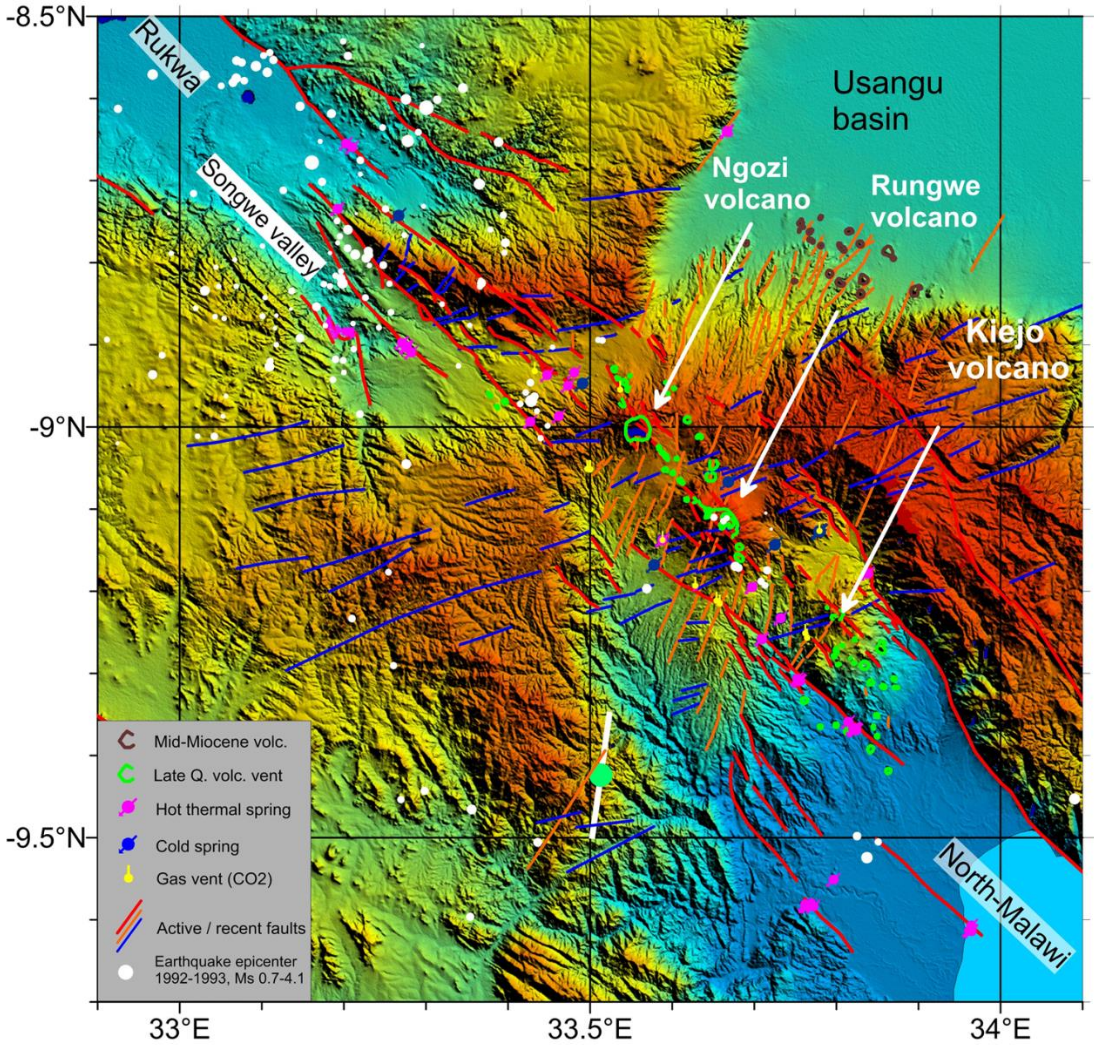

Fig. 2. Detailed structural map with the major and older NW-trending rift faults (red), and a conjugated system of NE-SW and ENE-WSW recent faults formed in late quaternary strike-slip setting.

According to the watershed location, location of major Quaternary volcanoes and tectonic architecture, at least two major geothermal systems can be identified. Both present mantle isotopic signatures in the analysed gas.

Along the Southwestern branch of the East African Rift, the Upemba graben hosts a series of fault-controlled warm thermal springs, of which the Kiabukwa spring has been developed to produce about 250 Kw electricity for local mining use (Rollet, 1950; Robert, 1956). In the Cameron Bay of the Zambian side of Lake Tanganyika, the Kapisha spring was also developed and a power plant installed, but it was never connected to the grid and abandoned.

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