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Neotectonic setting of the Kivu rift segment within its intraplate Central African context

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The Kivu rift region forms a particular rift segment in the western branch of the East African rift system, between the northern termination of the Tanganyika rift and the southern extension of the Edward-George rift. It is however not isolated in the center of the African plate, but part of the intraplate deformation and influenced by its intraplate setting. A compilation of existing data on earthquake epicenters, focal depth, focal mechanisms, thermal springs and neotectonic faults has been performed. SRTM topographic data at 90 and 30 m resolution, river network extracted from the SRTM 90 m and bathymetric data have been used to better constrain the geographic locations, and also as a new topographic reference for analyzing the morpho-structural elements.

At the scale of the African plate, the western shoulder of the Kivu rift marks the transition between the Congo Basin, characterized by E-W horizontal compression, and the Kivu rift basin, characterized by E-W horizontal extension. This is expressed by a progressive rotation of the stress directions, together with a progressive change in stress regime. The basement structural fabric plays an important role in controlling the development of neotectonic structures. The depth-distribution of earthquakes suggests asymmetric crustal structures, with deeper events (25-40 km, with a few up to 65 km) on the western rift shoulder and shallower events (5-30 km, peaking at 10-25 km) below the rift valley and the eastern shoulder, where seismicity is also slightly more abundant. The general rift structure is marked by the interaction of two grabens systems that join in the Rusizi accommodation zone. A first system, formed by the NNE-SSW alignment of the Edward-George basin, the Virunga volcanoes and the Kivu basin, seems to continue south-westward into a tectonic depression that forms the upper part of the Elila river catchment. This rift valley alignment is bordered on its western side by the Lubero, Mitumba-North and Kahuzi-Biega chain of rift shoulder mountains. The Elila basin and south Kivu basins are flanked on their eastern side by the South-Mitumba Mountains in DRC and the Nyungwe massif in SE Rwanda. This eastern flank is dissected by the Rusizi basin which forms the northern termination of the N-trending Tanganyika rift basin. This complex architecture is controlled by basement structures and influence also the tectonic stress field. The distribution of seismicity and thermal springs shows that tectonic deformation is not limited to the central part of the rift valley but also affect its flanks. It is particularly well expressed for the western flank, which is affected up to 200 km away, i.e. up to the margin of the Congo basin. The eastern flank is also affected by neotectonic activity, in Burundi, Rwanda and NW Uganda. This area was strongly uplifted and tilted in response of rifting activity, as shown by the presence of river flow reversals and captures, inundation lakes, swamps and recent lacustrine deposits, as well as by seism epicenters and rare thermal springs.