Geophysical Research Abstracts, Vol. 9, 06403, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06403

Possible coupling between climatically induced lake level change, volcanic eruptions and seismotectonic activation in the Rukwa-Rungwe-Nyasa rift, SW Tanzania

D. Delvaux (1), A.S. Macheyeki (2), F. Kervyn (1), K. Fontijn (2), G. Ernst (2), E.B. Temu E.B. (3)

(1) Royal Museum for Central Africa, Belgium, (2) University of Gent, Geology and Soil Science, Belgium, (3) Geological Survey of Tanzania

(damien.delvaux@africamuseum.be)

The Rukwa rift basin is presently a closed hydrogeological depression containing a shallow lake (max 20 me deep) with its surface at an altitude around 810 m above sea level. Lacustrine terraces and paleo-shorelines are known up to 980 m above sea level, an altitude at which it reach the overflow sill towards Lake Tanganyika. Both Lakes Tanganyika and Nyasa (Malawi) are presently overflowing, but as their lake level fluctuates, they have been disconnected from their outlet in the recent past. High resolution seismic profiling in both Lakes Rukwa and Malawi has show the presence of active fault systems underneath the lake floor. Some of these fault systems appear to have had a cyclic activity, with alternating periods of high tectonic activity/sedimentation and periods of tectonic quiescence. The accommodation zone between Lake Rukwa and Nyasa is occupied by the Rungwe volcanic Province, with the Ngozi, Rungwe and Kiejo volcanoes presenting signs of recent volcanic activity. The Rungwe Province is cross-cut by several directions of faults, which clearly control the location of the volcanic vents.

In our work, we reviewed the available data on recent (Late Pleistocene – Holocene) volcanic eruptions, in the Rungwe area itself, in the drill cores from the surrounding lakes and from aerial observations up to 300 km away from the Rungwe Province. We performed morphotectonic and paleoseismic investigations of the Kanda fault,

a major normal fault between lakes Rukwa and Tanganyika. We investigated lacustrine deposits of the Rukwa basin corresponding to the two last cycles of high lake level. The chronological framework was established using 30 new radiocarbon dating and the most prominent volcanic tephra layers were used as a reference in the correlations. The results are still preliminary, but a good correlation already appear between climatically induced lake level change (in Lake Rukwa), seismo-tectonic activation of the regional fault network (underneath Lake Rukwa and the Kanda fault between Lakes Rukwa and Tanganyika) and the timing of the recent strong volcanic eruptions in the Rungwe Volcanic Province since the last 40.000 years. This relation is explained taking into account that Lake Rukwa is very sensitive to climate change as it occupies a flat depression and its overflow outlet is 180 m above its present-day level. Its lake level rises rapidly when the climate becomes more humid as it was the case during the Last Glacial Maximum and during the Younger Dryas event. Increase in lake level means increasing of the load in the basin and perturbation of the ambient tectonic stresses. In most of the Rukwa rift, the tectonic stress is of extensional (normal faulting) regime, with the maximum principal stress axis (sigma 1) subvertical. In these conditions, increasing the vertical load will increase the shear stress on the existing normal faults, triggering (seismogenic) normal faulting deformation. As the architecture of the active volcanoes in the Rungwe Province is tectonically controlled, activation of the faults, together with a greater pressure of water in the tectonic discontinuities are likely to trigger large volcanic eruptions, strongly explosive.