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The Lake Albert Rift (Uganda, East African Rift System): Deformation, basin and relief evolution since 17 Ma

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This study is based on a coupled basin infilling study and a landforms analysis of the Lake Albert Rift located at the northern part of the western branch of the East African Rift.

The basin infilling study is based on both subsurface data and outcrops analysis. The objective was to (1) obtain an age model based on onshore mammals biozones, (2) to reconstruct the 3D architecture of the rift using sequence stratigraphy correlations and seismic data interpretation, (3) to characterize the deformation and its changes through times and (4) to quantify the accommodation for several time intervals. The infilling essentially consists of isopach fault-bounded units composed of lacustrine deposits wherein were characterized two major unconformities dated at 6.2 Ma (Uppermost Miocene) and 2.7 Ma (Pliocene-Pleistocene boundary), coeval with major subsidence and climatic changes.

The landforms analysis is based on the characterization and relative dating of Ugandan landforms which consist of stepped planation surfaces (etchplains and pediplains) and incised valleys.

We here proposed a seven-steps reconstruction of the deformation-erosion-sedimentation relationships of the Lake Albert Basin and its catchments:

- 55-45 Ma: formation of laterites corresponding to the African Surface during the very humid period of the Lower-Middle Eocene;
- 45-22 Ma: stripping of the African Surface in response of the beginning of the East-African Dome uplift and formation of a pediplain which associated base level is the Atlantic Ocean;
- 17-2.5 Ma: Initiation of the Lake Albert Basin around 17 Ma and creation of local base levels (Lake Albert, Edward and George) on which three pediplains tend to adapt;
- 18-16 Ma to 6.2 Ma: "Flexural" stage (subsidence rate: 150-200 m/Ma; sedimentation rate 1.3 km3/Ma between 17 and 12 Ma and 0.6 km3/Ma from 12 to 6 Ma) – depocenters location (southern part of Lake Albert Basin) poorly controlled by fault;
- 6.2 Ma to 2.5 Ma: Rift stage 1 (subsidence rate: > 500m/Ma up to 600-800 m/Ma; sedimentation rate: 2.4 km3/Ma) – Rifting climax;
- 2.5-0.4 Ma: uplift of the Ruwenzori Mountains and shifting from an alluvial system to a network of bedrock river incision – Rift Stage 2 (subsidence rate: 450 to 250 m/Ma; sedimentation rate: 1.5 km3/Ma);
- 0.4-0 Ma: long wavelength downwarping of the Tanzanian Craton, initiation of the Lake Victoria trough, drainage network inversion and uplift of the present-day Ugandan escarpment (normal

faulting motion of the border faults) with formation of perched valleys associated to the Lower Pleistocene (2.5-0.4 Ma) rivers network.

At larger scale, comparison of the Lake Albert Rift evolution with the data available in the basins of both eastern and western branches of the East African Rift System shows that most of the sedimentary basins experienced the same geometrical evolution from large basins with limited fault controls during Late Miocene to narrow true rift in Late Pleistocene (e.g. Northern and Central Kenyan Basins), in agreement with the volcanism distribution, large (width >100 km) during the Miocene times, narrower (width x10 km) from Late Pliocene to Pleistocene times and today limited to narrow rifts.