

## ABSTRACT

**Title: Impact of Depositional Architecture on Petroleum Reservoir Quality of the Southern Lake Albert Basin, Western Uganda**

**Supervisors:** *Dr. Betty Nagudi*, Department of Geology and Petroleum Studies, Makerere University, Kampala; *Dr. Kevin Aanyu*, Department of Geology and Petroleum Studies, Makerere University, Kampala; *Professor William Helland-Hansen*; Department of Earth Sciences, University of Bergen, Norway.

**Abstract:** Depositional environments and architectures' interpretations and analyses were carried out in the South Lake Albert Basin to map depositional environments and their associated architectures with the main objective of establishing the impact of depositional architecture on the petroleum reservoir quality within the stratigraphic section, Late Miocene to Late Pliocene stratigraphic interval (11.6 ma to 5.3 ma). Structural modelling was conducted to generate depth structural maps to guide the development of zoned models. In addition, facies and reservoir property modelling, geological sampling and stratigraphic logging were undertaken to evaluate reservoir properties and depositional environments with their associated depositional architectures. Thin section analysis was conducted on cored samples and field sample to investigate spatial and stratigraphic distribution of porosity and permeability.

The results indicate that South Lake Albert Basin is comprised of structural compartments, pinchouts, flower structures, a fault that makes a terrace in the basin, and a basin bounding fault in the Kaiso-Tonya area, normal faults with limited displacements and a basin bounding fault in the Kingfisher area. Sediments were also found to be highly intercalated. Alluvial fans, fluvial, deltaic and lacustrine depositional environments with associated depositional architectures are common. Petroleum reservoir quality in both Kaiso-Tonya and Kingfisher areas was found to be very low to high. Sections that are close to the basin bounding fault for both Kaiso-Tonya and Kingfisher areas consist of alluvial fan and fluvial depositional environments and have low to moderate petroleum reservoir quality. The section that is close to the lake and under the lake consists of deltaic and lacustrine depositional environments and has moderate to high petroleum reservoir quality.

The results further showed that compartmentalization, pinchouts and intercalations of sediments and all the other identified architectural elements influence the petroleum reservoir quality. They found that these identified architectural elements have a high effect on the connectivity, fluid saturation and flow, and delineation of the reservoir continuity. Structural compartments stacked or intercalated sediments, pinchouts lead to reduced connectivity within sediments. They further contribute to the uncertainty in reservoir continuity, stacked petroleum reservoirs with undefined lateral extent and the low to moderate petroleum reservoir quality. The study further developed a petroleum reservoir quality predictive model that will guide future petroleum exploitation programs within the study area and basins with similar sedimentological and structural settings.