

Frontier Exploration in East Africa: Combining Unconventional Techniques and Traditional Exploration

Monstad, Staale ¹; Syrdalen, Erik ¹; Pfaffhuber, Andreas A. ²; Greb, Matthias D. ³; Thompson, Vaughn G. ³ (1) Head Office, DNO International ASA, Oslo, Norway. (2) Geophysics, NGI, Oslo, Norway. (3) Energy & Geoscience Institute, The University of Utah, Salt Lake City, UT.

The onshore Inhaminga exploration license is located in central Mozambique and covers 10,000 km² of the Mesozoic Urema Graben. Owing to later tectonic overprint, the present day Urema Graben represents the southernmost extension of the East African Rift System.

Despite some early exploration in the 1930's the area remained essentially unexplored. The large size of the Inhaminga block, in combination with a tight exploration schedule, necessitated a timely and cost effective way to explore this frontier acreage. Thus, unconventional techniques were combined with traditional exploration methods to assess its hydrocarbon potential.

A four-step campaign consisting of (1) GoreTM sorber and bacterial analysis surveys, (2) a pilot seismic survey, (3) a PetroMod petroleum systems model, and (4) an airborne electromagnetic survey (AEM) was designed. Each step was closely monitored by management, as positive indicators were required in order to continue with subsequent activities.

Widely spaced sample points maximized the area, and sorber and soil samples for bacterial analysis were taken for parallel testing. Both methods indicated the presence of vaporous and liquid hydrocarbons. These results guided the design of a 200 line km seismic survey across the graben. The seismic data provided vital insights about the sedimentary geometries and tectonic history of the graben.

A petroleum systems model was elaborated from the seismic lines to assess the systems maturity and hydrocarbon generation and migration timing. The findings supported the sorber and bacterial analysis results.

The campaign concluded with the first hydrocarbon oriented AEM survey ever conducted in Africa. The survey focused on identifying hydrocarbon seepage zones and improved the spatial mapping of faults and geologic units. The AEM results correlated well with the petroleum systems modeling and seismic interpretation thus proving its capabilities for frontier exploration.

The results were significantly encouraging that the operator entered into a final exploration period with commitments to further seismic acquisition and drilling.