Supplementary Information

Depth model Constraints

The depth model covers a 500 km2 area at a gridding resolution of 5 km for key sequence stratigraphic depth surfaces. Additional surfaces were interpolated between the key depth surfaces in order to capture the structure at a 2nd order sequence stratigraphic interval within the geological framework of the basin. The model inputs include structural depth maps from Anderson *et al.* (2013) and Isopach maps from Walford *et al.* (2005) that were used to calculate the depth surfaces over the Zambezi Delta Depression and Beira High. The onshore extent of the model was constrained using the surface geology map from Pekkala *et al.* (2008). Where strata of a certain age reach the surface the digital elevation model (DEM) is used to constrain the correct depth relative to sea level of surfaces in the model. Well data from the region (Kamen-Kaye, 1982; De Buyl and Flores, 1984; Salman and Abdula, 1995) were included in the model, however they are simplified wells sticks without wireline logs and so they are lower confidence data sources. The locations of the major regional faults were defined from (Flores, 1973; Kamen-Kaye 1982; Hiller, 1995; Mahanjane, 2012, Anderson et al., 2013) and their depths were included schematically using cross sections from Trueblood (2013) and Zacarias (2009) and a seismic section from Mahanjane (2012). This seismic section was converted with a basic time-depth calculation using the total depth of the Zambezi -3 well (Kamen-Kaye, 1982) and then extrapolated over the remaining extent of the section.

Source rockdefinitions

Although the source rock remains unpenetrated, a reasonable definition of properties for each source rock was achieved using the regional understanding of the key drivers and controls on the depositional environments to assign the following organofacies (ORGAS source rock schema, Pepper and Corvi,1995).

* Bajocian lacustrine and rift restricted shales: Organofacies C (~Type I).
* Kimmeridgian deep marine shales (known as the Lupata Equivalent): Organofacies B (~Type II).
* Early Aptian deep marine shales (known as the Lower Domo Shales): Organofacies B (~Type II).

Initial Total Organic Carbon (TOC) and Initial Hydrogen Index (HI) values were assigned to each source rock using global averages for the different kerogen type, because of the lack of sufficient measured data from analogues in East Africa for source rocks of this age.

Proprietary modelling software details

The modelling software that was used in this project is proprietary to Landmark, Halliburton. The 3D modelling software that was used to build the structural framework was DecisionSpace Geoscience™ version 5000.10.0.06. The petroleum systems modelling software used to build the basin model was PermediaTM version 5000.12.

The depth surfaces were created within the structural framework using the Dynamic Framework to Fill® tool. This modelling tool allows many depth surfaces to be built simultaneously as part of the same model and so it is possible to automatically update the entire model whenever there are changes to the input data. This tool also uses geological principles, such as conformance, to define the relationships between surfaces and so adds geological intelligence to the model. For example, a surface that is defined as an unconformity in the model will truncate other modelled surfaces.

Landmark’s petroleum system modelling software, PermediaTM was used for the basin modelling.

Neftex Exploration Insights Global Sequence Stratigraphic Model

Landmark’s proprietary global sequence stratigraphic model recognizes specific geological events related to eustatic changes in sea-level rather than using lithostratigraphic units to define strata. In this way the strata can be correlated globally.

Supplementary information references

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