

Monday, April 19, 2010

Westchase Hilton • 9999 Westheimer  
Social Hour 5:30–6:30 p.m.  
Dinner 6:30–7:30 p.m.

Cost: \$28 Preregistered members; \$35 non-members & walk-ups

To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card.

Pre-registration without payment will not be accepted.

You may still walk up and pay at the door, if extra seats are available.

## HGS International Dinner Meeting

*Ian Hutchinson, RPS Energy,  
Steve Lawrence, Darnoc Ltd and  
Alastair Beach, Independent Consultant*

# Interfering Cretaceous and Tertiary Rift Systems of the Turkana Depression (Sudan-Ethiopia-Kenya).

The Turkana Depression has for some time been the subject of speculation regarding the geometric relationship of an obvious Miocene rift system crossing between Kenya and

Ethiopia and an older sequence of rifts – oblique to the East African Rift System (EARS) – that is evident in the Mesozoic Anza Graben of Kenya and the Muglad and Melut systems of southern Sudan. Up to five phases of rifting potentially affected the area. The Early Cretaceous to Paleogene systems of the Anza, Muglad and Melut basins, (ca. 120 Ma, 70 Ma and 40 Ma) have been overprinted by the Miocene East African Rift system (ca. 20 Ma and 10 Ma). Crucially a lack of geological or geophysical data has hampered an understanding of this critical area of interfering rift systems.

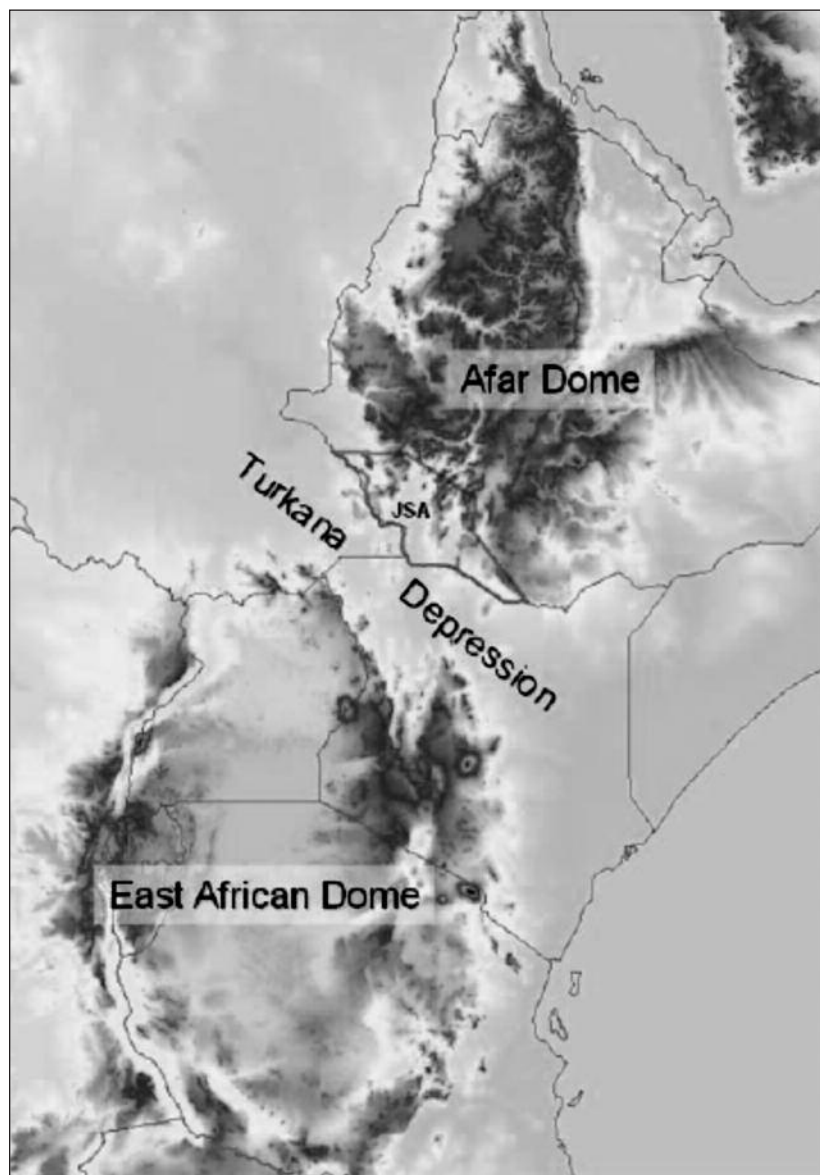


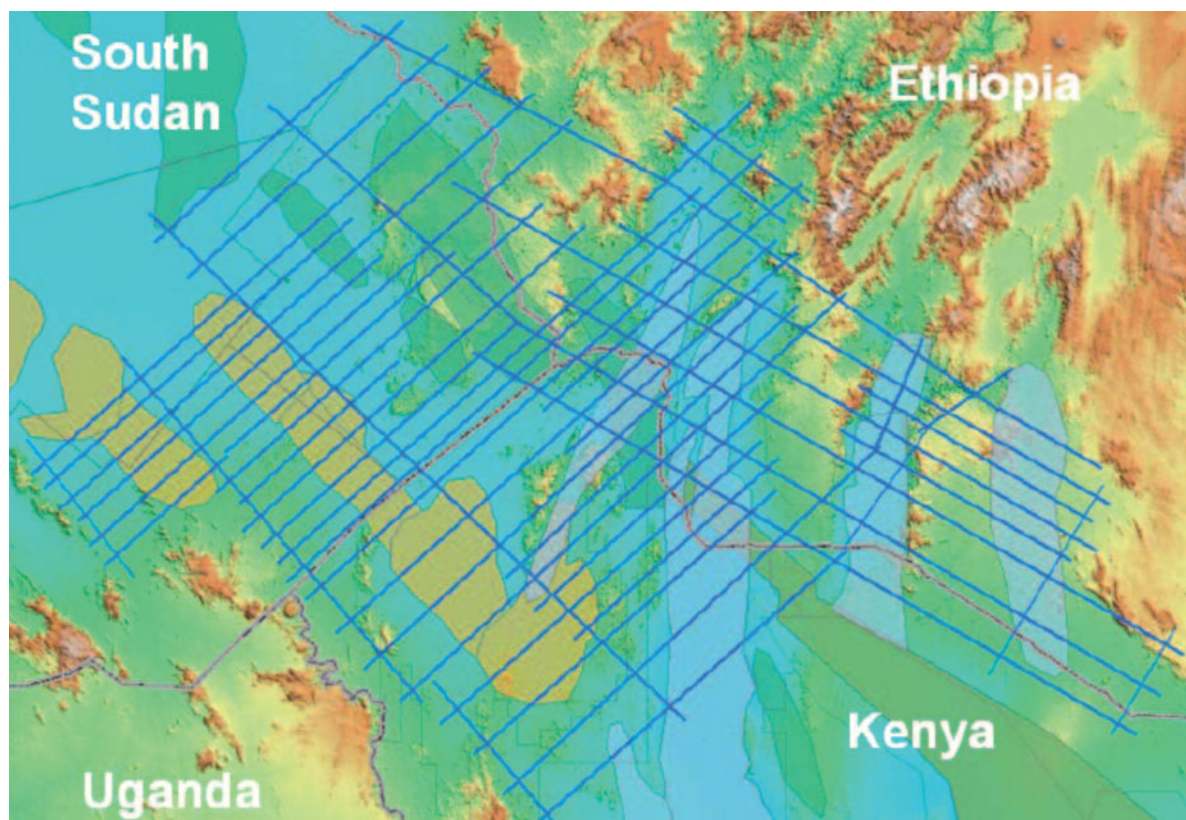
Figure 1: East African topography showing the Afar and East African Domes separated by the Turkana Depression

The East African Rift System of Tertiary age is predominantly located in zones of Precambrian orogenic belts, avoiding stable Archaean cratonic areas. The geometry of the rift system is largely controlled by the Precambrian mobile belt architecture; however, later extensional events of Permo-Triassic (Karoo), Jurassic, Cretaceous, and Palaeogene ages have also affected the location and orientation of the Tertiary rift systems to a greater or lesser degree. A major challenge in the area is that outcrops comprise either volcanic rocks or metamorphic basements with few sedimentary sequences that might give indications of East African or earlier rift systems.

Seismic control was restricted to mid-1980's vintage data shot over the Lotikipi and Gatome basins of northwest Kenya by Amoco, plus ship-borne Project PROBE data acquired over the Lake Turkana rift. There was also sparse gravity data over a large part of the depression, outside of Kenya.

A pioneering, tri-nation airborne gravity and magnetic survey that was flown offered a new insight into the complex rift geometry of the

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*Figure 2: Airborne survey flight lines over pre-survey outlines of potential rifts*

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Turkana Depression. The survey revealed an interfering older rift system running from the Anza into the Muglad-Melut systems. Cretaceous rifting extends from the Anza Graben through the Turkana region and links with the Sudanese rifting of the Muglad and Melut basins. Maastrichtian rifting appears to extend northwestwards from the Anza Graben, and may be present within basins of SW Ethiopia and northern Kenya. Similar rifting occurred in the Eocene, and Oligocene-Miocene rifting is evident in the western Turkana basins. Middle to Late Miocene East African rifting cross-cuts all of these earlier rift geometries.

Source rocks are known in the Miocene of Ethiopia and Kenya and in the Oligocene (?Eocene) of the Loperot-1 well, and they are predicted to occur in the earlier rift phases. In southwest Ethiopia, north of the Turkana Depression, Middle Miocene oil-shales and coals have been shown to have excellent source rock properties, and equivalents may be preserved within the EARS. The presence of marine Cretaceous sequences is supportive evidence of earlier source rocks. Suitable reservoirs are developed in all tectono-stratigraphic phases of rifting. The interfering rifts of the Turkana Depression provide several new exciting

## *The interfering rifts of the Turkana Depression provide several new exciting exploration plays*

exploration plays and the probability of numerous trapping scenarios. Undoubted challenges are presented by the complex thermal history and the presence of volcanics and volcanic activity. ■

### **Biographical Sketch**

IAN HUTCHISON is a geologist with over 25 years experience in Africa, Australia, and North America. He started out his career in the hard-rock side of the industry – firstly mining and subsequently exploring for various sediment-hosted gold systems starting with the famous Witwatersrand deposits. The strong hydrocarbon affiliation and genetic connection between oil and gold mineralization led Ian gradually into the oil patch where he brings his field exploration skills – including the use of potential field data to the fore. Ian has subsequently worked on oil and gas field projects in East Africa, Mali and Mozambique. Corresponding author: [hutchinsoni@rpsgroup.com](mailto:hutchinsoni@rpsgroup.com). RPS Energy, 309 Reading Road, Henley-on-Thames, RG9 1EL, UK

