Agenda

• Location & Recent Activity

• Regional Tectonic Elements

• Influence on Petroleum System Elements

• Summary
Recent Activity – East Africa

- Multiple 2D and 3D Seismic surveys acquired since 2005
- Drilling campaigns conducted in Tanzania (Ophir/BG) and Mozambique (Anadarko et al.) in 2010/2011
- Seven gas discoveries
- Various farmin/farm outs in Tanzania and Kenya
- Licence signatures in Kenya
Recent Discoveries – Tanzania

- Strong relationship between seismic amplitude anomalies and gas-bearing reservoirs.

- Nearby targets with similar seismic characteristics now substantially de-risked.

- Further 3D seismic surveys have been acquired and are currently being processed.
Regional Tectonics

- **Karoo continental rifting**
  - Late Carboniferous to Early Jurassic

- **Gondwanaland break-up**
  - Initial opening ~180Ma (NW-SE)
  - N-S opening from 160Ma to 120 Ma

- Development of “passive margin” successor basins

- East African Tertiary Doming
• Significant change in gravity signature across the Davie Fracture Zone (DFZ), separating continental and oceanic crust.

• Continental crust dominated by N-S trending anomalies that appear to step across NE-SW trending lineaments.

• NE-SW lineaments interpreted to represent Early Jurassic rift faults.

• N-S anomalies possibly represent Cretaceous structures generated during Jurassic to Aptian, coincident with movement along the DFZ.

• N-S structures reactivated during Oligocene to Recent.
Seagap Fault Zone

- Triassic/Jurassic Rift Faulting
- Generation of N-S Seagap Fault Zone during Jurassic to Aptian? Reactivation of rift faults?
- Oligocene onset of reactivation (transtensional in above example)
- Pliocene reactivation (generates transpressional anticline in above example)
Seagap Fault Zone

Transtension

Transpression
Seagap Fault Zone

Modified from Mikenorton, Wikipedia, 2009
Tanzania - Onshore

From Nicholas et al., (2007)
Structural Control on Reservoir Input

East Pande
• Fault-controlled sediment input

• Long-lived sediment input from quartz-rich provenance
Madagascar - Gravity

- NE-SW rift faults
- NW-SE transfer zones
- Deep structural control on sediment input and fault linkage
An East African Deepwater Cretaceous Source Rock?

- DSDP 330+511 – Barremian-Aptian organic rich shales up to 35m thick – TOCs 3 to 16%
- Aptian source rocks in Outeniqua Basin, South Africa.
- DSDP 249 – Thin Aptian shales with TOCs up to 9%
- DSDP 693 – Aptian organic rich sediments 68m thick – TOCs up to 4%

Duvalia Formation (Berriasian to Aptian shallow to deep marine facies) in Southern Morandava Basin – potential for an Excellent quality Lower Cret. source rock – TOCs average 3.74%, max 26.3%, HI Ave 167, Max 403.

Alb-Cen-Tur in Northern Morandava Basin – potential for oil and gas source rock. TOC 0.8 to 3.4%, HI max 240.

Serinam-1 North Morondava Basin– Light oil/wet gas source rock pot. in 15m Lwr Cret (Haut-Barrem). TOC 1.7 to 9.3%, HI max 248.
Lower Cretaceous is considered to have gas-prone potential near-shore, but could the deepwater be oil-prone?

Marginal ridges along the continental side of the (shear) margin perhaps provides local restricted circulation & anoxic conditions.
Recent discoveries to the west of the DFZ herald the start of an exciting period of hydrocarbon exploration offshore East Africa.

Tanzanian acreage appears have been significantly influenced by strike slip tectonics associated with the DFZ and Tertiary reactivation.

Deepwater Cretaceous source rock in East Africa?

2nd phase of 3D seismic acquired offshore Tanzania (Blocks 1, 3 and 4) in Q1 2011, with a further 3D survey planned for East Pande in Q4 2011.

Drilling planned to recommence offshore Tanzania during late 2011 / early 2012.