Namibia: Chasing Giant Cretaceous Oil Prospects in the South Atlantic

NAPE Expo, Houston, Texas
Serica Energy plc, February 2014
Why Namibia?

- Highly under-explored but prospective continental margin
- Several proven hydrocarbon systems including recent oil discovery
- Close to large South African markets
- Stable democracy
- Very favourable fiscal terms
- Business language is English
- Serica has very large 17,384 km$^2$ acreage holding within the central Luderitz Basin
- Equates to approximately one third of the size of the UK Central Graben
Serica Namibia Introduction

- Serica 85% (operator) NAMCOR (10%) & IEPL (5%)
- Water depth 500 – 2000 m
- 4,176 km² 3D seismic data acquired in 2012
- Multiple Lower Cretaceous structural prospects with billion-barrel oil potential
- Further prospects at shallower levels, within canyon-channel turbidite systems and along the shelf edge
- Prospect B mapped on 3D seismic and high-graded for drilling
- Substantial equity available
Namibia Recent Exploration History

- Recent drilling has proven all elements of at least one active hydrocarbon system

**Kunene Gas Discovery**
Lower Cretaceous

- Tapir 1811/5-1
  - P&A dry, well encountered high-quality Cretaceous sands; also Lower Cretaceous carbonate

- Welwitschia
due to spud early 2014

- Murombe 2212/7-2
  - Secondary target water wet turbidite channel sands; primary Barremian target was volcanic

**Serica Acreage**

**Serica 3D Seismic**

**Kudu Gas Field**
Barremian aeolian-shallow marine sands; Under development by Tullow

**Walvis Basin**

- Wingat Oil Discovery 2212/7-1
  - 38-42° API oil recovered from thin Aptian turbidites, two thick, rich mature source rocks proven within Aptian

- Prospect B

**Luderitz Basin**

- Kabeljou 2714/6-1
  - P&A shows

- Moosehead 2713/16-1
  - P&A dry, encountered Aptian & Cenomanian source rocks; TD in / below Barremian carbonate with increasing wet gas levels

**Orange Basin**
Namibia Geological Setting

- Blocks located between inner and outer regional gravity highs
- Critical for exploring in outer syn-rift and sag basins
- These potentially contain mature lacustrine to restricted marine oil-prone source rocks
WSW-ENE Seismic Section
(flattened on 0.25 * seabed)

Prospect B

- Aptian shelf edge
- Upper Cretaceous fluvio-deltaics
- Base Tertiary 65 Ma
- Top Albian 101 Ma
- Mid Aptian 122 Ma
- Mid Barremian 128 Ma
- Top Hauterivian 130 Ma
- Prograding wedge

SDRs caldera Etendeka Volcanics Syn-rift inversion anticline Sag basin Igneous intrusion Syn-rift

Line Location (on 128 Ma Depth Map)

10 km
Regional Geoseismic Section

Prospect B

Provenance and depositional sequences:
- Post-rift / drift fill
- Clastic reservoir
- Carbonate reservoir
- Source rock
- Hydrothermal vent
- Igneous sills

Age (Ma):
- Cenomanian – Turonian marine source
- Aptian – Barremian marine source
- Barremian syn-rift source

Calibrations:
- 10 km
- 1 s TWT

Location:
- WSW
- ENE

Events:
- Channel Lead A 109-104 Ma
- Prospect B 086 Ma
- Prospect B 120 Ma
- Prospect B 128 Ma
- Shelf Leads 122-125 Ma

Additional notes:
- Etendeka Volcanics?
- Barremian Supergroup?
- Caldera
- Karoo Supergroup?
- Batholith
- Wingat-1

After HRT:
- Carbonate shelf, no effective porosity
- TD 5,000 m
- Depleted well to 500 m

Supergroup:
- Damara Supergroup / Cratonic Basement?
Prospect B, Barremian 128 Ma
(3D Depth Perspective)

• Giant Lower Cretaceous structural prospect
• 700 km² areal closure and 300 m relief
• Morphological similarities to known carbonate reservoirs worldwide

Potential Analogue: Jintan Field, Miocene, Luconia, Malaysia (Vahrenkamp et al, 2004)
Prospect B Seismic Inline 4300
(Seismic Coloured Inversion, flattened on 0.25 * seabed)

- Distinctive back-stepping, internal clinoforms, mounding & layering
- Potential reservoir analogues with Lower Cretaceous “microbialite” discoveries offshore Brazil and Angola

Inset: comparative seismic geometries from Jintan and Bu Hasa carbonate fields (Malaysia & Abu Dhabi)

WSW

Hydrothermal vent?

Low angle sigmoidal clinoforms & mounding

Strongly layered internal platform

Clinoforms

ENE

Clinoforms / prograding edge

Velocity push-down or collapse

10 kms

Top Hauterivian 130 Ma
Mid Aptian 122 Ma
Mid Barremian 128 Ma
Top Albion 101 Ma

Yose et al (2006)
Shallower Canyon & Shelf Plays
(3D TWT Perspective, 120 to 101 Ma mid point Amplitude)

Major canyon incision; Cenomanian-Turonian

Aptian shelf edge Carbonate Plays

Aptian turbidite channels

Possible onlap over edge of underlying carbonate platform

Channel Lead A (Albian)

Drape over underlying Prospect B carbonate platform

Albian volcanics
Regional Hydrocarbon System
Lower Cretaceous

Kudu gas field
1.3 tcf gas + minor condensate; over-mature oil-prone lacustrine & restricted marine source, Barremian-Aptian age (Mello et al., 2012)

Serica

Restricted basin, 120 Ma, Aptian

Wingat Oil Discovery
38-42 °API oil, two proven Aptian marine source rocks

Kudu gas field
1.3 tcf gas + minor condensate; over-mature oil-prone lacustrine & restricted marine source, Barremian-Aptian age (Mello et al., 2012)

AJ-1 Oil Discovery
Barremian-Hauterivian proven syn-rift lacustrine oil source

Ibhubesi gas Field
Aptian-Albian highly mature fluvio-deltaic terrestrial source

Falklands 14/10-1 Sealion Discovery
Barremian reservoir and mixed lacustrine-volcanogenic oil source?

DSDP 361
Rich Aptian source rocks

Lacustrine Source
Marine Source
Terrestrial source

Wingat-1 oil sample
Kudu-4 condensate

Restricted marine source rock

1911/15-1 Reported oil shows

Reported oil shows DSDP 361 Rich Aptian source rocks
Source Rocks modelled at Barremian & Hauterivian levels

Corrected geothermal gradient of ±30 °C/km

Early oil generation starting at between ~120 Ma and 80 Ma, influenced by early high heat flow caused by rifting

Positive implications for early preservation of reservoir quality
Evidence of Working Petroleum System
Fugro-NPA 2013 Data Acquisition

New cluster of slicks identified along WSW-ENE structural trend

Slicks are aligned with WSW-ENE trending, deep-seated structural lineament
Namibia Prospect B Conclusions

- Multiple Lower Cretaceous structural prospects with billion-barrel oil potential
- Prospect B: giant structure mapped on high-quality 3D seismic
- 700 km² areal closure and 300 m relief
- Seismic character consistent with a carbonate platform
- Further prospects at shallower levels, within canyon-channel turbidite systems and along the shelf edge
- Substantial equity available

Prospect B Depth Perspective
Top Barremian 128 Ma

Prospect B

Prospect B Resources *

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<thead>
<tr>
<th>NSAI, Sept. 2013</th>
<th>P₉₀ (low)</th>
<th>P₅₀ (best)</th>
<th>P₁₀ (high)</th>
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<tr>
<td></td>
<td>138</td>
<td>622</td>
<td>2810</td>
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* Resource estimate based on NSAI September 2013 interpretation of 3D seismic data. There is no certainty that any portion of the resources will be discovered. If discovered, there is no certainty that it will be commercially viable to produce any portion of the resources. NI 51-101 compliant.