Petroleum geology and potential of Karoo related rift basins, NE Namibia and NW Botswana

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EAGE Global Hotspots: Southern Africa
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Online

WWW.EAGE.ORG
Newly Discovered Kavango Basin in Namibia & Botswana

- 8.5 MM acres covers the entire basin
- Potentially one of the largest onshore undeveloped hydrocarbon basins in the world
- Stable governments
  - Licence Contracts
- Successful Technical Team
  - In depth knowledge of the basin
- Catalyst-rich near term
  - Drilling program underway to confirm active petroleum system
ReconAfrica Acreage location

ReconAfrica Petroleum Exploration Licences

YELLOW AREAS: Sedimentary Basins

PINK AND ORANGE AREAS: crystalline basement in outcrop

NAMIBIA  BOTSWANA
Permian-Triassic Karoo supergroup

What and where is Karoo?


Granath, Dickson, Wanke, and Odegarde, PESGB HGS Joint Africa Session 2020

Supergroup with coarsening upward section; tectonically expanded periods of lacustrine and/or marine section

Section shown for Zambezi graben, from Viglietti et al., J. Af. Earth Sci. 2018
Southern Africa Tectonic Elements

“Southern Trans-African Rift System” (STARSS) among other Sub-Saharan tectonic elements

- Basement elements and cratons with fabric
- East African Rift System
- STARSS elements
- Karoo Rifts
- Recognized basement shears
- Subsurface features only

- 1st order control edge of cratons
- Alignment across continent evident, especially parallel to Pan-African orogenic belts

Granath, Dickson, Wanke, and Odegarde, PESGB HGS Joint Africa Session 2020
Eastern Owambo and Kavango Basin Depth to Basement

Depth to Basement
250m Contour Interval

Total Magnetic Intensity (TMI)
Horizontal Derivative

Thinner Volcanics
Thicker Volcanics

Crystalline Basement
Crustal scale Profile NE Namibia NW Botswana
Paleogeographic Karoo (Ecca) setting

**KAVANGO BASIN**
ReconAfrica
Namibia Licence 73 and Botswana Licence 001/2020

**KAVANGO BASIN KAROO**
Interpreted to be the same depositional environment as Shell’s organic-rich Whitehill Permian formation

**South Africa Karoo**
Shell’s Whitehill Permian 370 TCF Recoverable (EIA Estimate)

- PEL 73
- PEL 001/2020
- Marine (shallow to deep)
- Paralic/deltaic/shoreface
- Deltaic/fluvial/lacustrine
- Fluvial-alluvial/peat swamp
- Continental depocentre
- Country Borders
- STARSS rift system
Average TOC at high conversion: **3.81%**

Utilizing a Hydrogen Index of 358 mg/g, Average restored TOC: **5.44%**

Difference in TOC is **1.63%** or converted to petroleum **460 boe/af**

At only **100 ft** of source rock thickness, this is **29.5 mmboe/section**
ST-1 Well, Owambo Basin, Onshore Namibia

All Restricted Marine or Lacustrine
**Source Rock Geochemistry**

**Estimated Petroleum Generation:**

<table>
<thead>
<tr>
<th>Conversion</th>
<th>Thickness in Feet</th>
<th>200 (mmbbl/section)</th>
<th>300 (mmbbl/section)</th>
<th>328* (mmbbl/section)</th>
<th>400 (mmbbl/section)</th>
<th>443** (mmbbl/section)</th>
<th>500 (mmbbl/section)</th>
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<tbody>
<tr>
<td>50% Kerogen Conversion</td>
<td></td>
<td>24</td>
<td>37</td>
<td>40</td>
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<td>55</td>
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<td>73</td>
<td>81</td>
<td>92</td>
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</tbody>
</table>

* net thickness from geological data
** net thickness from Shell's Permian source rock section, Karoo basin, South Africa

50% Kerogen Conversion = ~ 0.84 vitrinite reflectance
75% Kerogen Conversion = ~ 1.10 vitrinite reflectance

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<tr>
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<th>1641 sections* (billion boe)**</th>
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* 1641 sections represents 12% of ReconAfrica total holdings of 13,671 sections
** boe = barrels of oil equivalent

50% Kerogen Conversion = ~ 0.84 vitrinite reflectance
75% Kerogen Conversion = ~ 1.10 vitrinite reflectance

* Source – Daniel Jarvie, Worldwide Geochemistry LLC.
Play Maps Deep Kavango Basin

- INITIAL 3 WELL DRILLING PROGRAM
  - To Establish an Active Hydrocarbon System
  - Source Rock Basins and Conventional Traps
Conclusions

- Extensional basins developed across continent
- Could harbor extensive source, reservoir, and seal sections
- In west, only preserved offshore
- In east many Karoo basins exposed down to Karoo sections—potential for breaching
- In center (mid-Namibia & Angola to Zambia/Botswana/Zimbabwe) basins preserved under K and Cenozoic cover