

Re-awakening of the onshore Kwanza Basin: Geology and prospectivity



Introduction

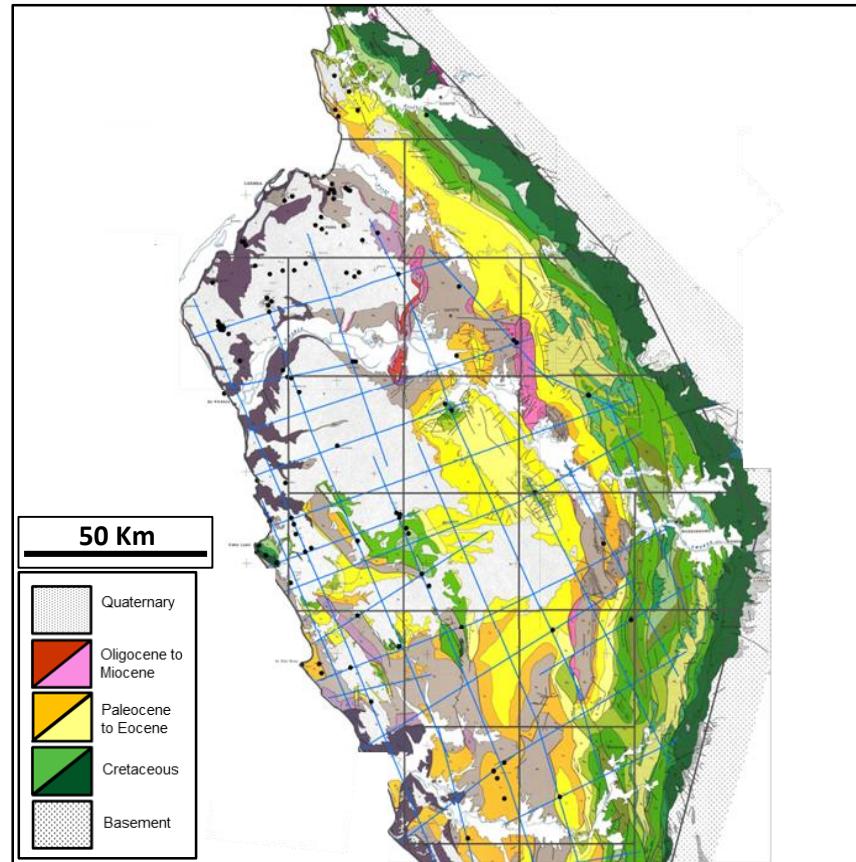
- Exploration history
- Tectonic reconstruction
- Geological history

Prospectivity highlights

- Tertiary system
- Cretaceous system
- Pre-Salt

Conclusions

Licensing round update



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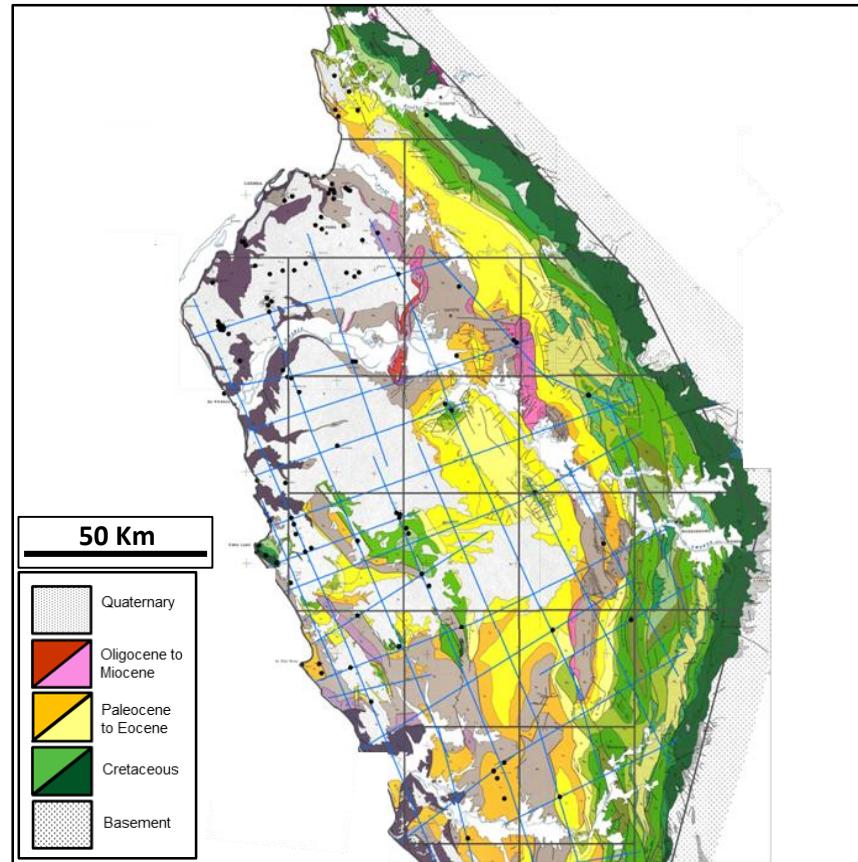
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Exploration history

Hydrocarbon indicators from seeps and asphalt deposits for 200 years

Drilling phases in early, middle and late 1900s

1952-1978 11,500 line km shot and 133 wells drilled

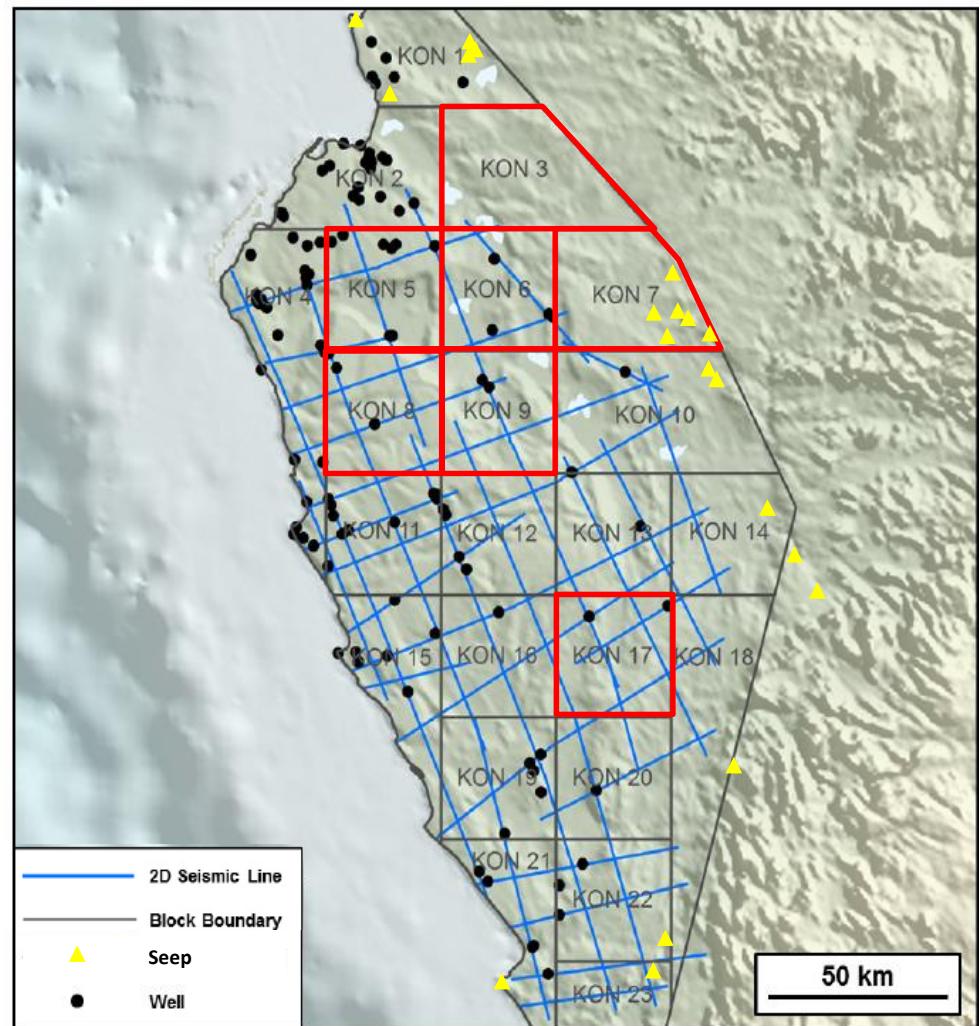
13 discoveries by 1998

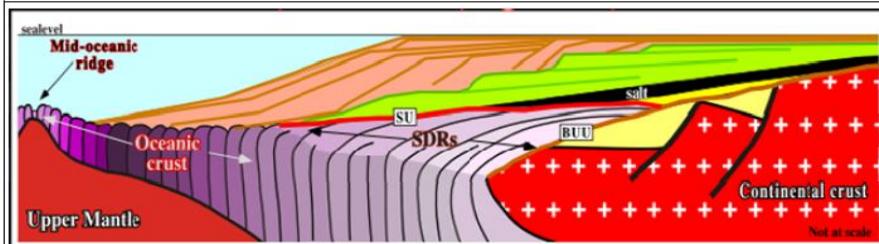
STOIIP 400 MMBOE

2010 new 2D data shot and processed

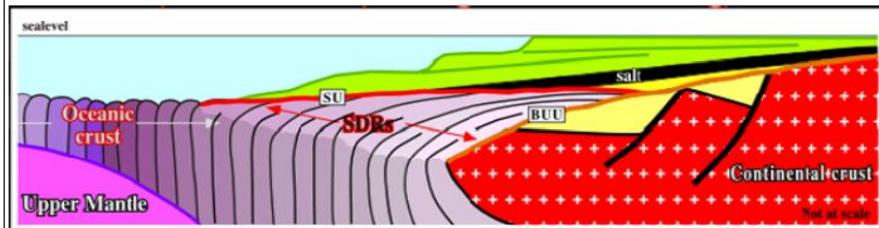
2014 new licensing round

2014 Pre-Qualification now open

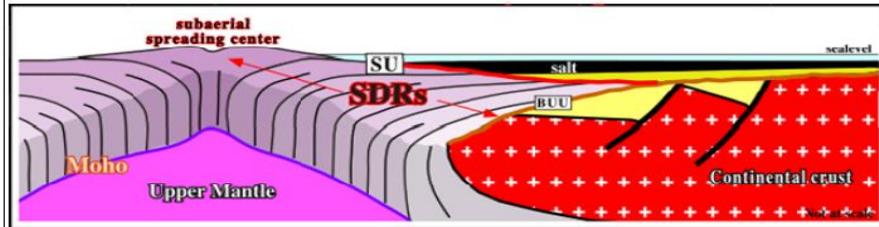




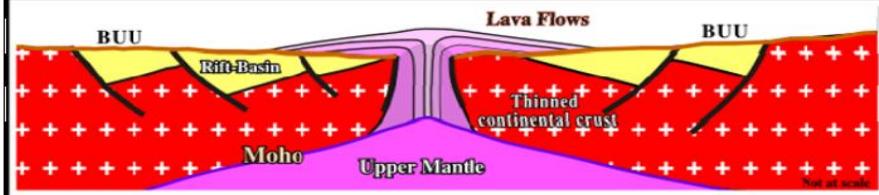
**5) Drift: U. Cretaceous and Cenozoic regressive megasequence
(91.5 -0 Ma)**



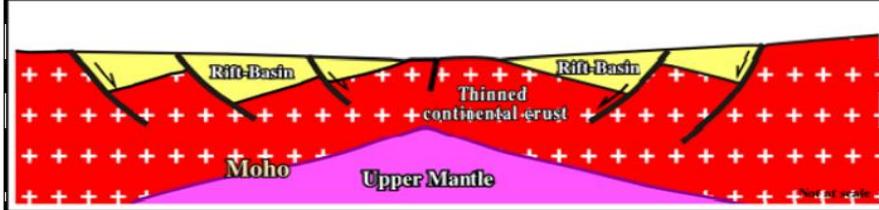
**4) Drift: Upper Cretaceous
(110-91.5 Ma)**



**3) Transition
(115-100 Ma)**



**2) Rift
(115-110 Ma)**



**1) Pre-rift
(135-115 Ma)**

Tertiary

Key source rocks

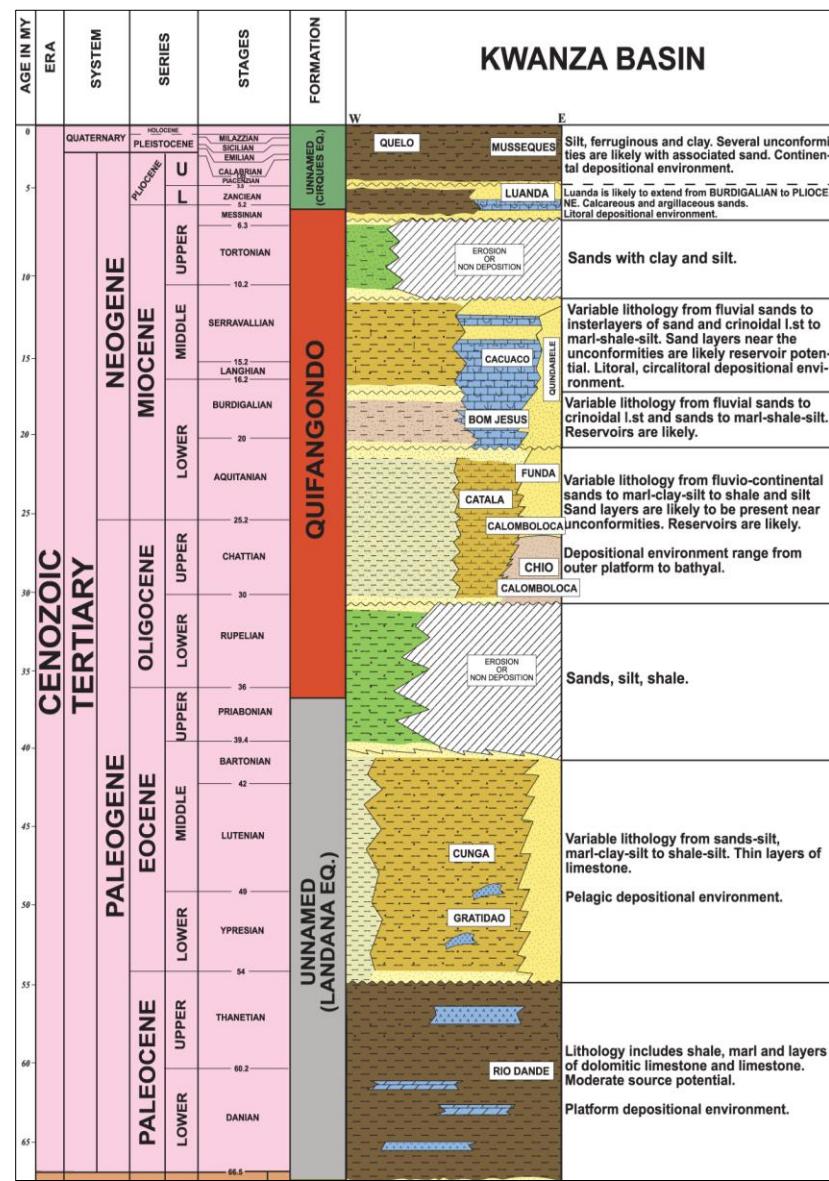
- **Cunga Mb Marine shales**

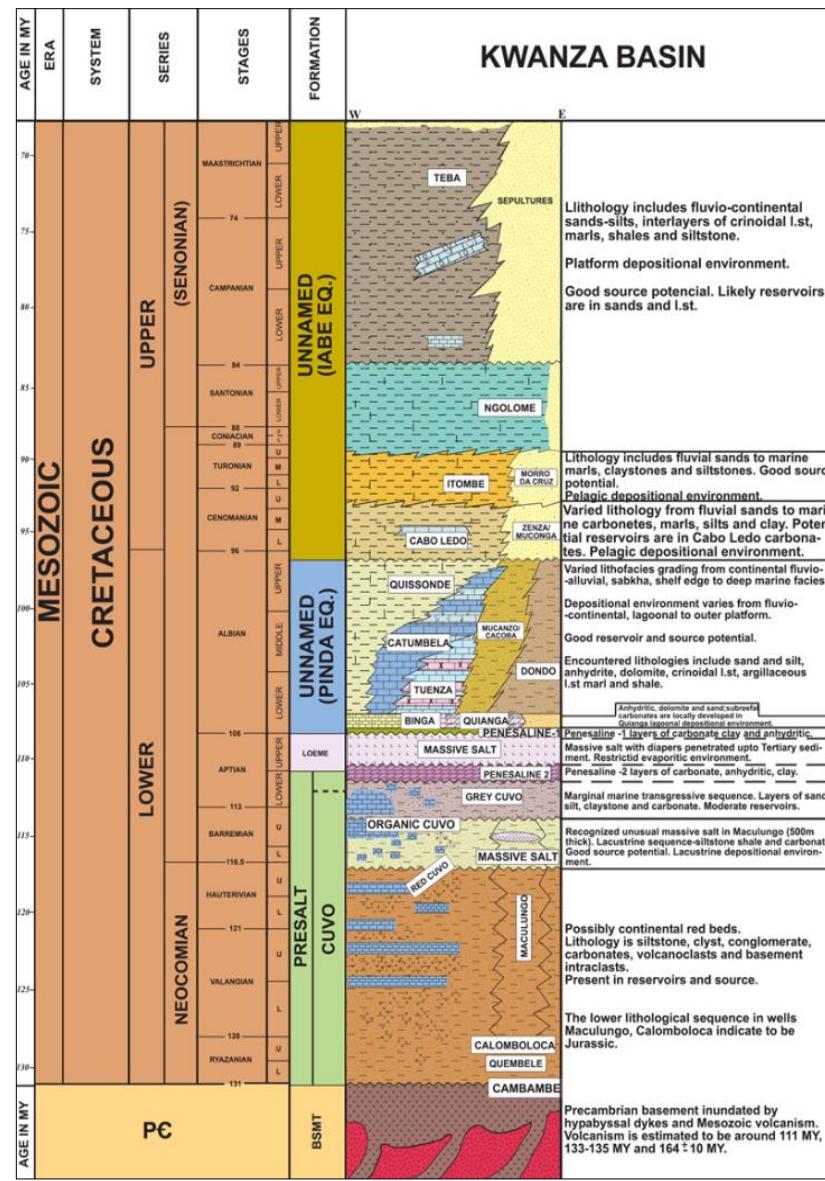
Key reservoir intervals

- **Quifangondo Fm Shallow marine sandstone**

Key seal intervals

- **Intraformational shale basinal / shallow marine shales**





Cretaceous

Key source rocks

- Cuvo Fm Lacustrine – Type I&II**
- Binga Fm Basinal shales**
- Cabo Ledo Fm Basinal shales**

} Syn-rift
} Post-rift

Key reservoir intervals

- Volvanic Tuffs Ash and pumices**
- Red Cuvo Mb Terrestrial sands**
- Toca Fm equivalent Lacustrine carbonate banks**
- Grey Cuvo Mb Marginal marine sandstone**
- Binga Mb Shallow marine limestone**
- Tuenza Mb Dolomite**
- Cacoba Mb Shallow marine sandstone**
- Catumbela / Quissonde Mb Shallow marine limestone**
- Cabo Ledo Fm Shallow marine sandstone**
- Itombe Mb Marine sandstone**

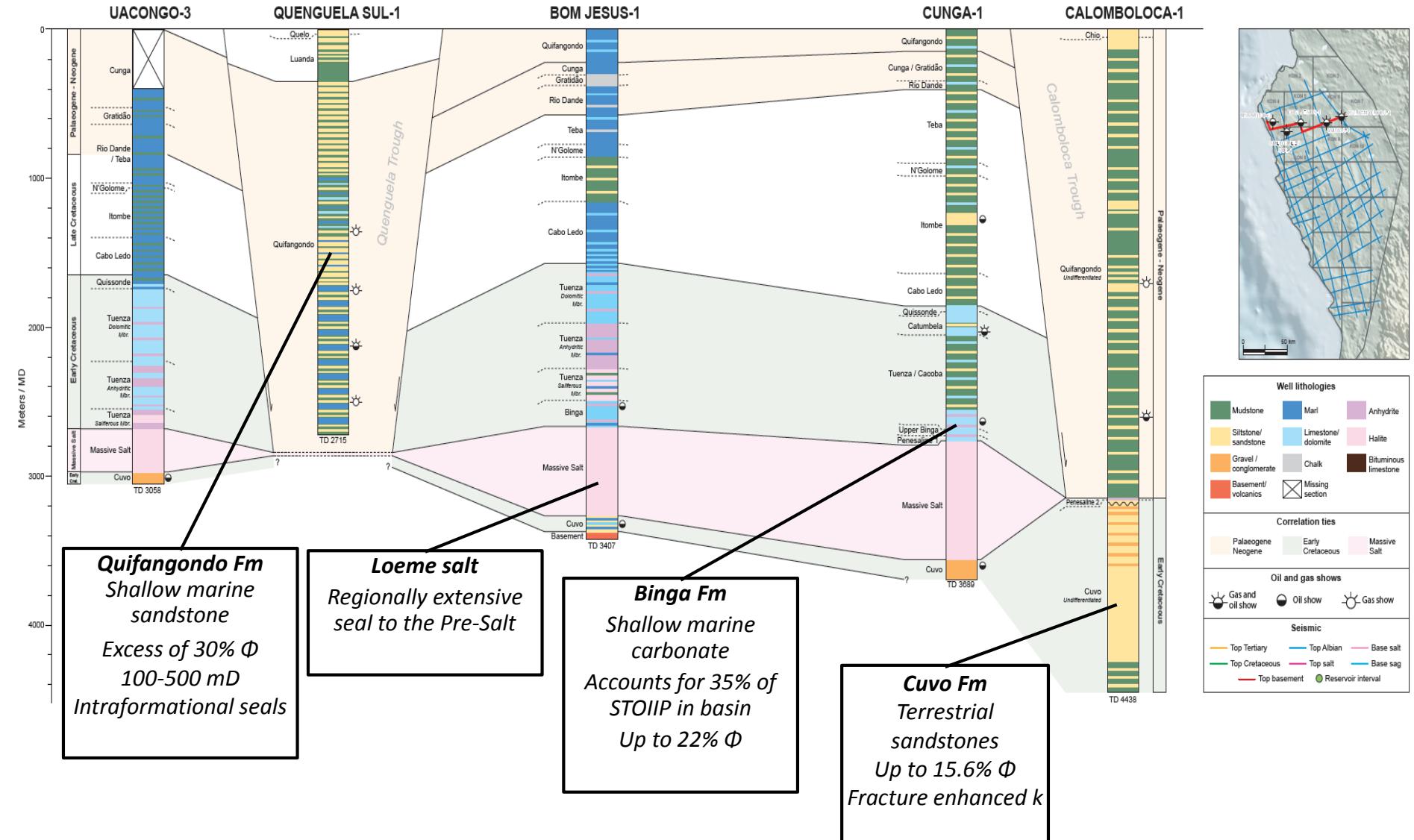
} Syn-rift
} Post-rift

Key seal intervals

- Intraformational seals basinal shales**
- Loeme Fm salt**

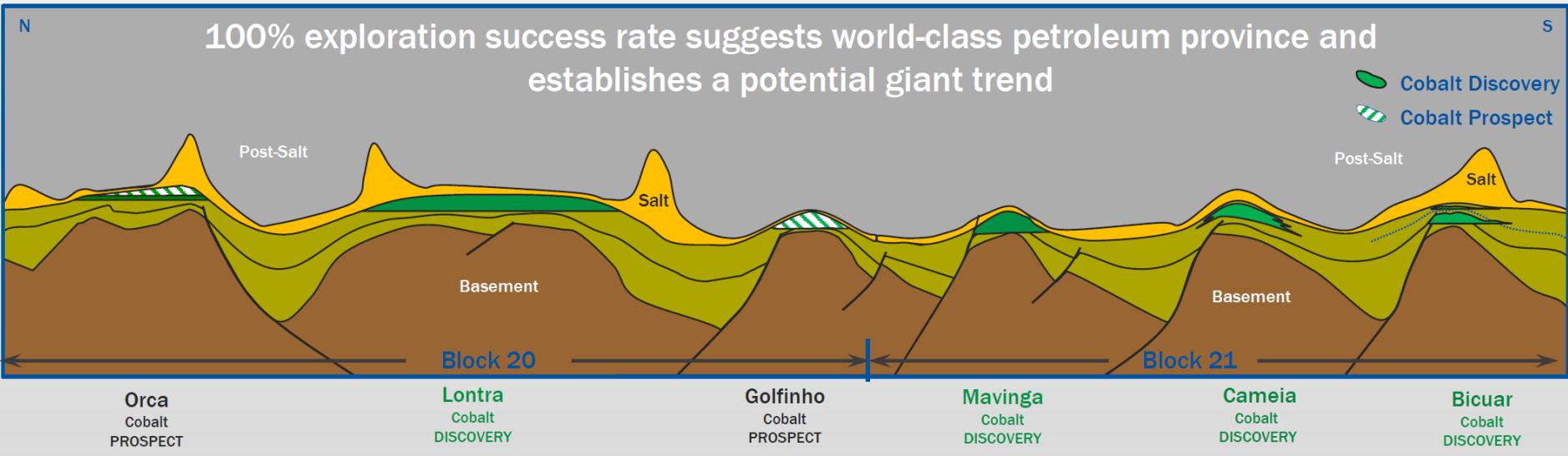
} Syn-rift
} Post-rift

Stratigraphic correlation



Offshore Kwanza Pre-Salt play

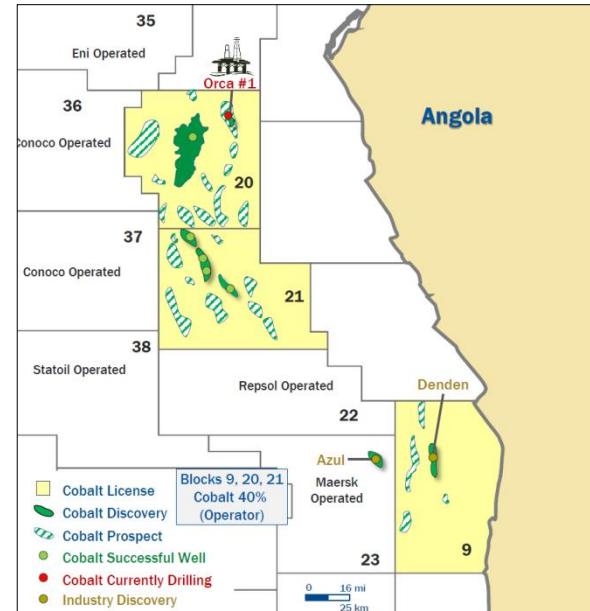
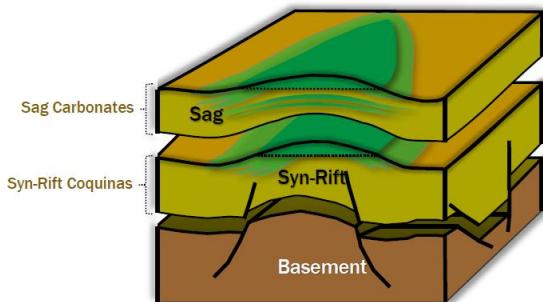
100% exploration success rate suggests world-class petroleum province and establishes a potential giant trend



Discovered 700-1300+ MMBO (gross)

- Lontra: 250-500 MMBO
- Cameia: 200-500 MMBO
- Mavinga: <100 MMBO
- Bicuar: 150-300+ MMBO

Illustrative Geologic Model



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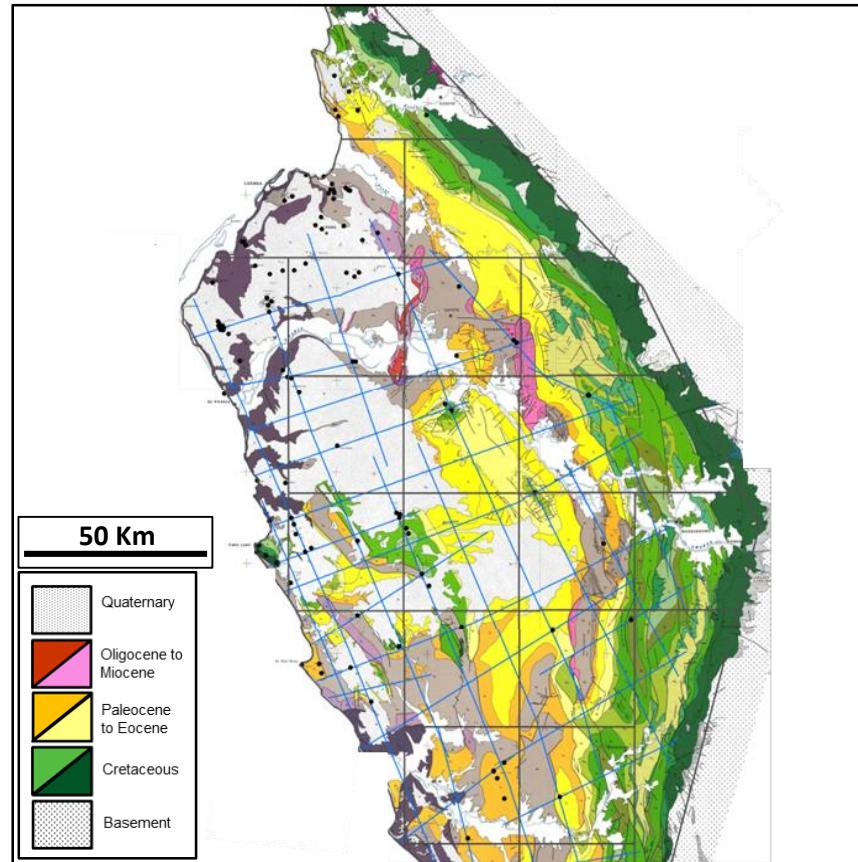
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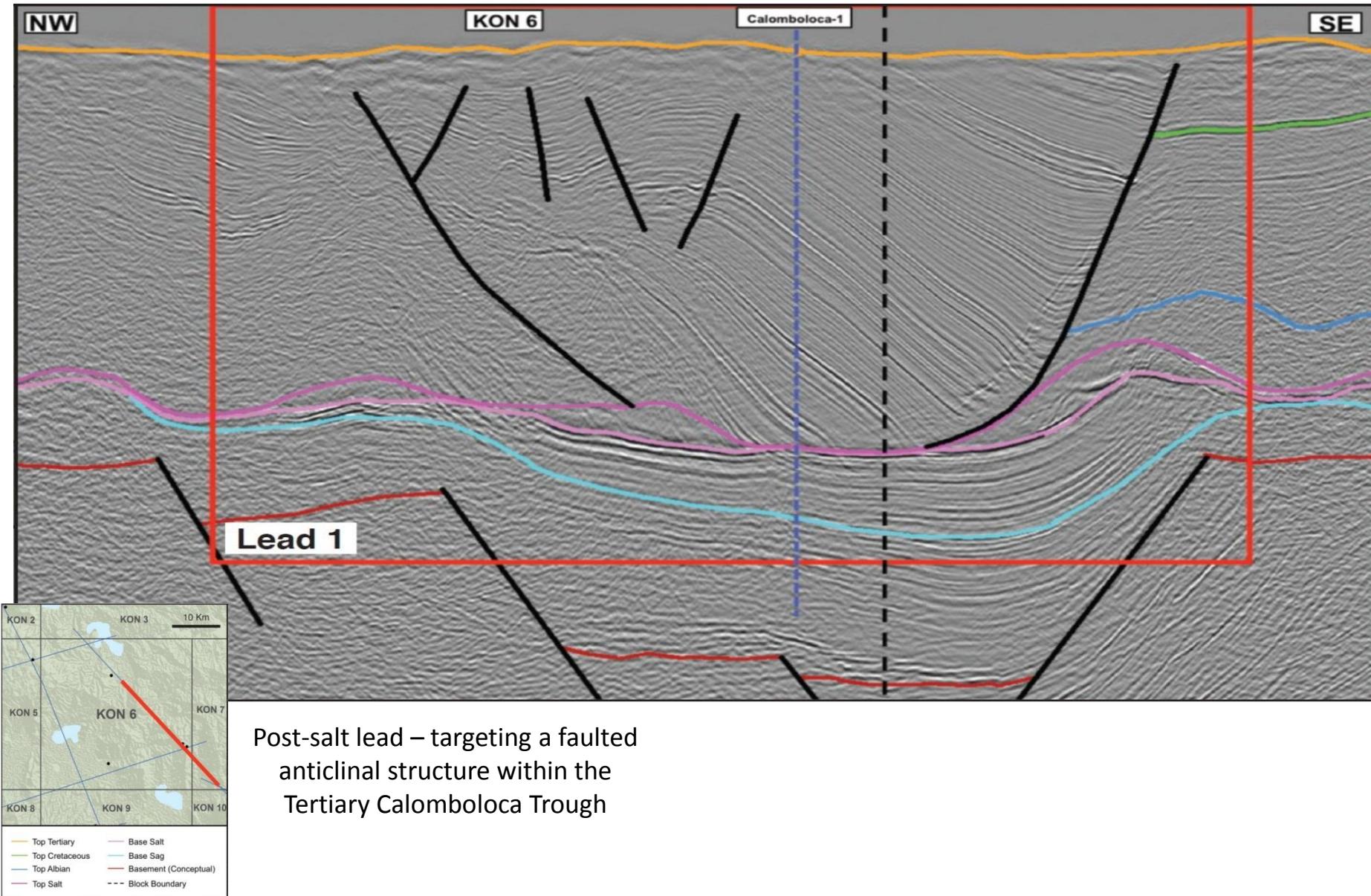
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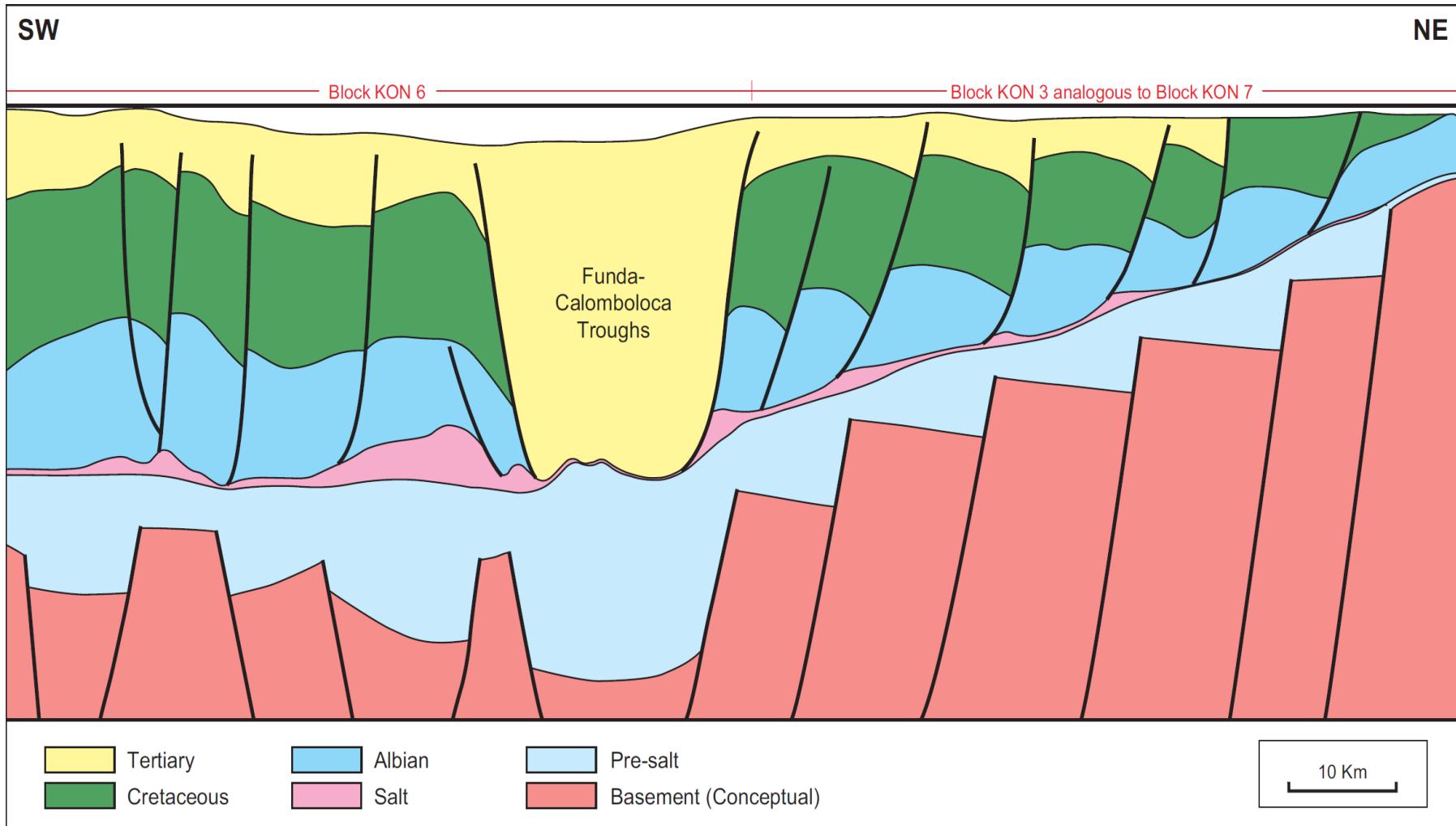


Onshore Kwanza surface geology

Tertiary system

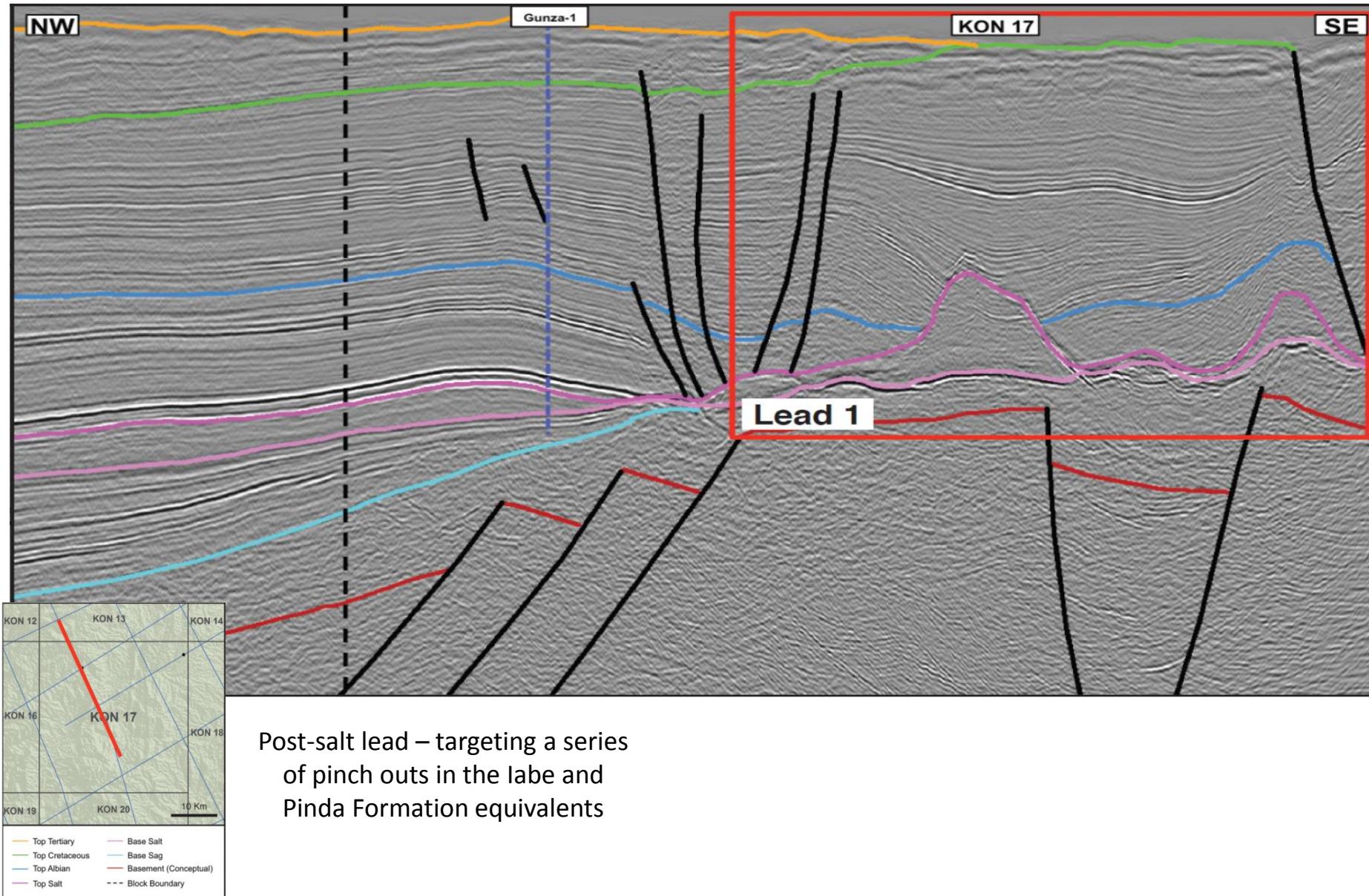


Tertiary system

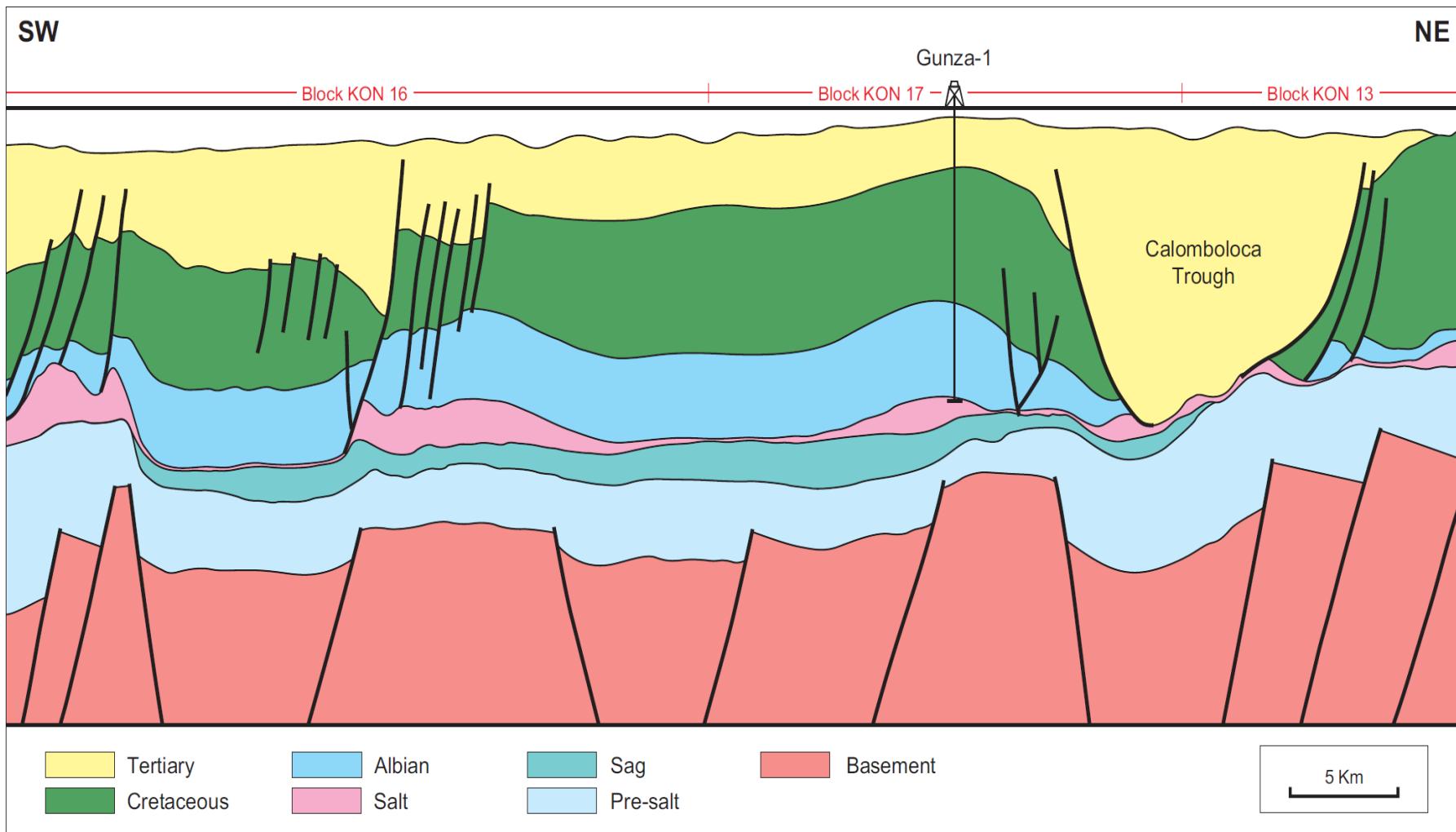


SW-NE oriented cross-section showing Tertiary Calomboloca Trough and Cretaceous rafts

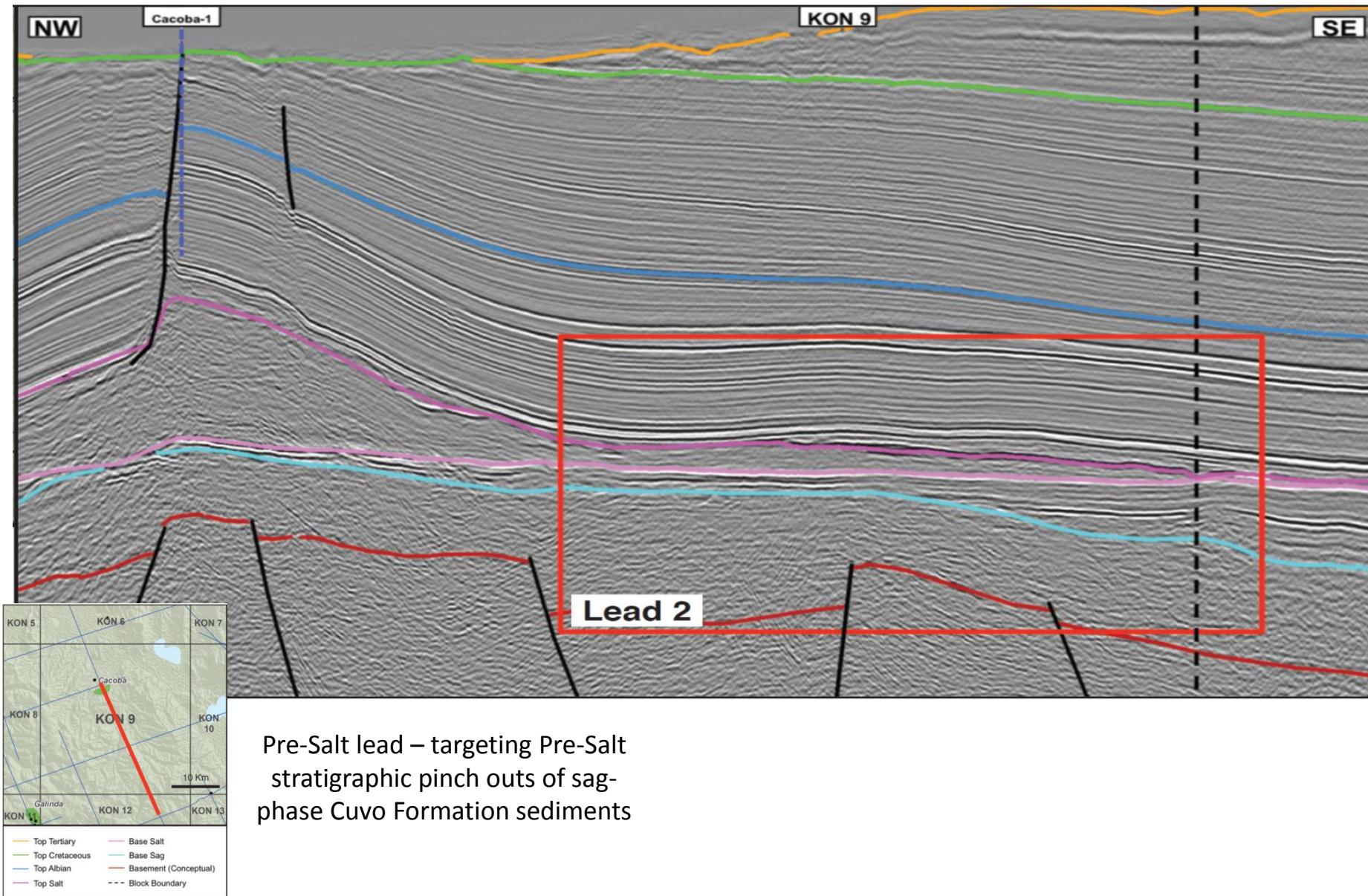
Cretaceous system



Cretaceous system

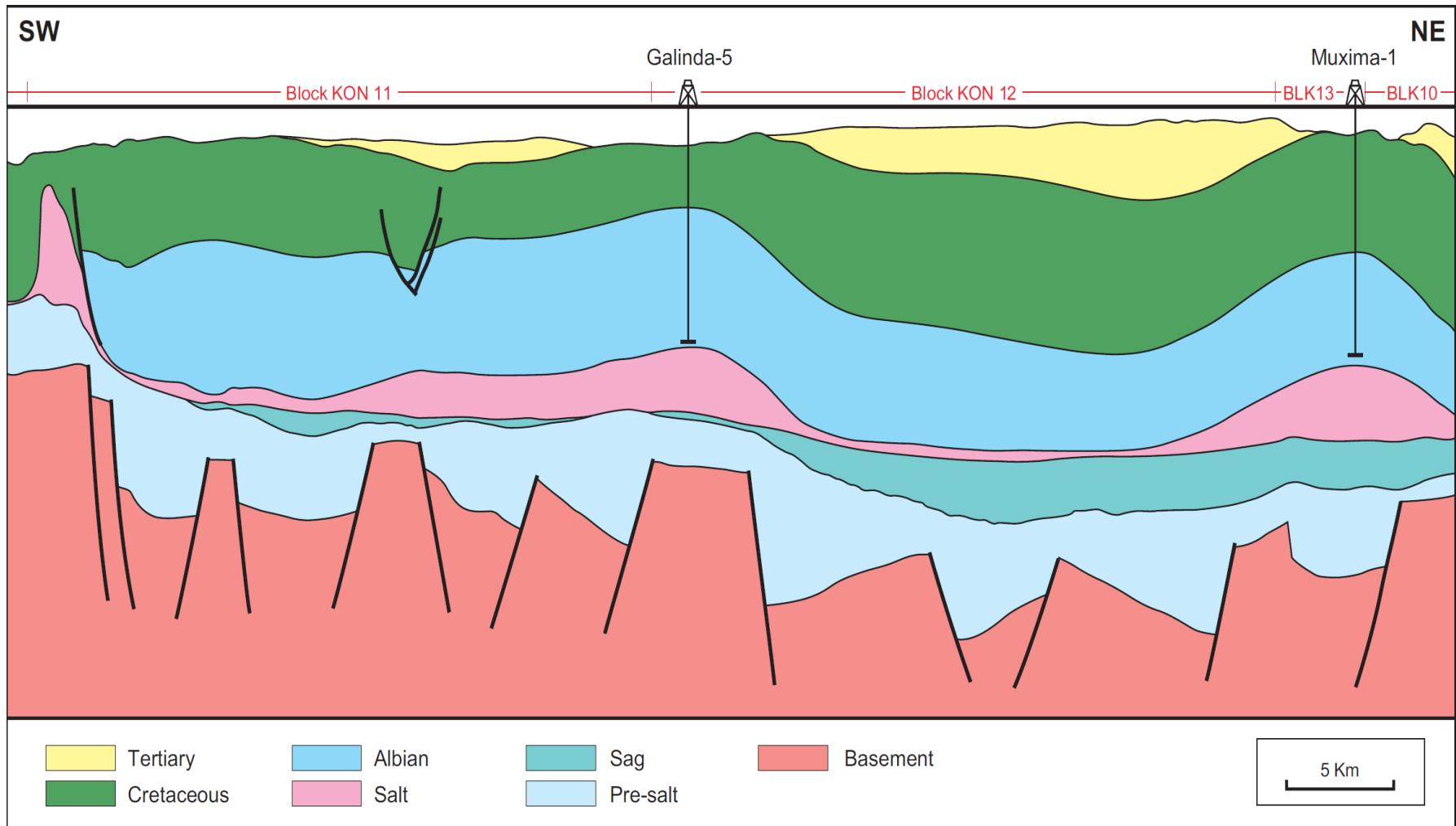


SW-NE oriented cross-section showing major Cretaceous rafts





Pre-Salt system



SW-NE oriented cross-section highlighting the Pre-Salt sag basin thickening towards the centre of the onshore Kwanza Basin

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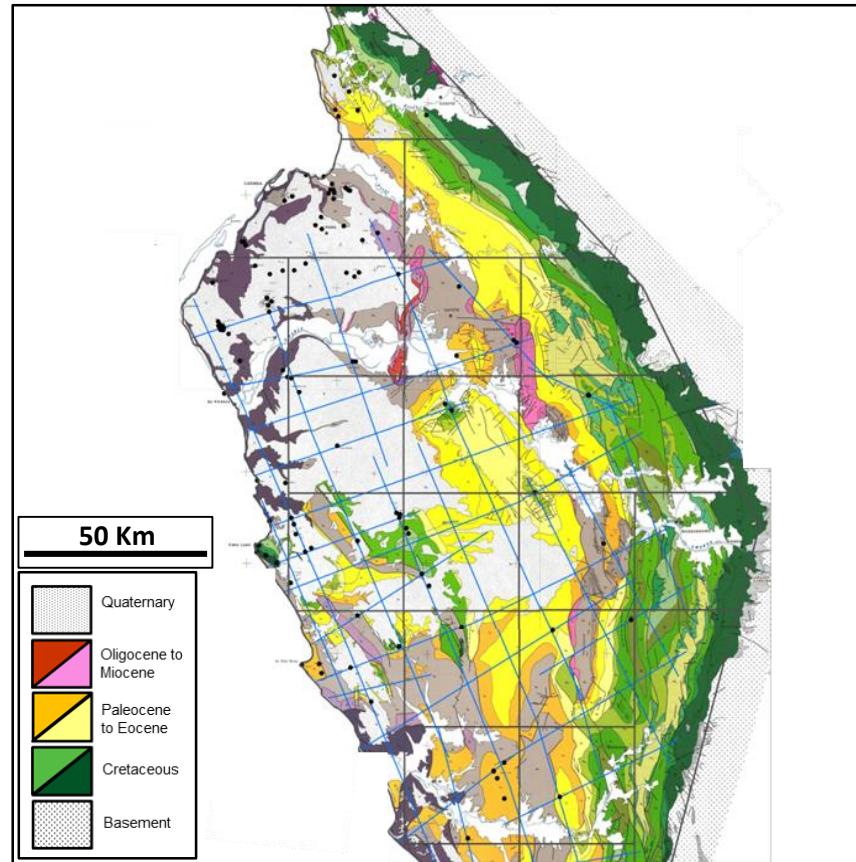
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Proven hydrocarbon system

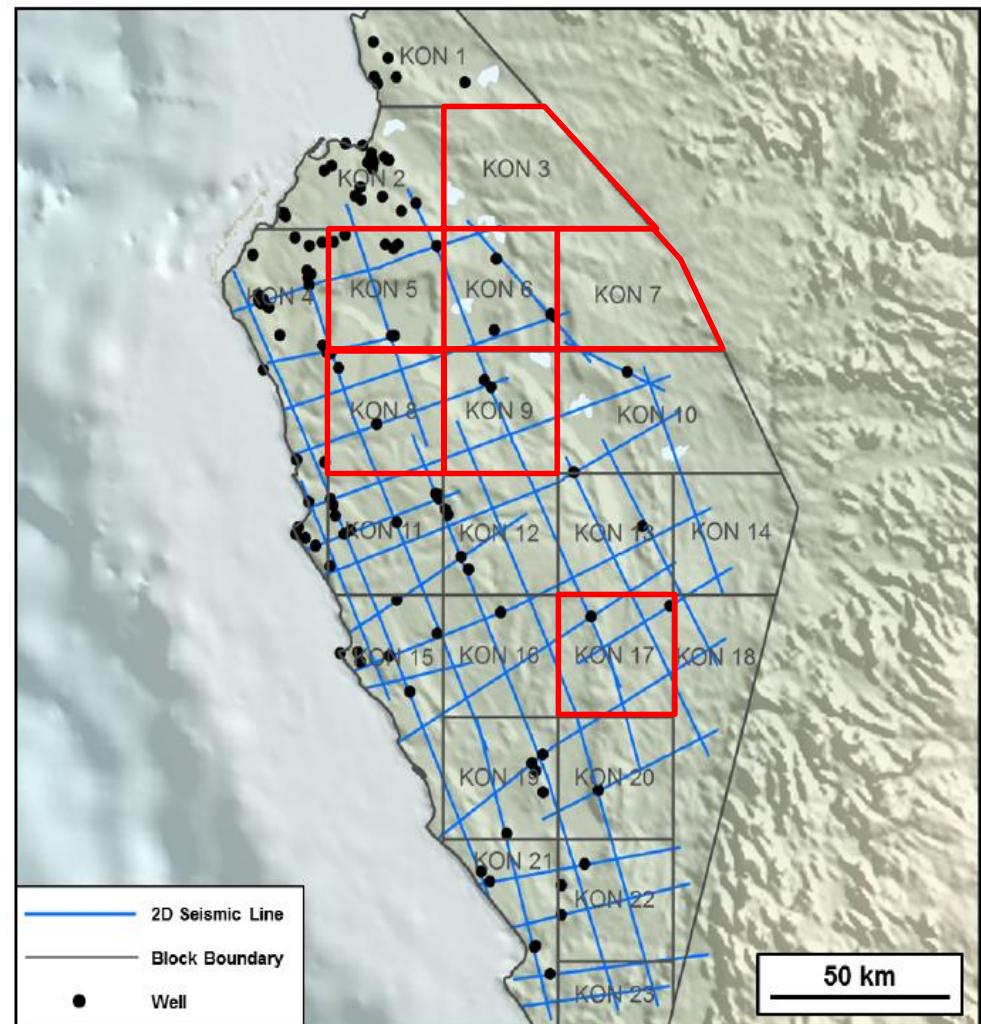
Multiple source, reservoir and seals

Kwanza offshore **Pre-Salt analogue**

New high quality 2D seismic survey

2014 Licensing Round

Pre-Qualification open



Pre-Qualification open

10 blocks onshore **Lower Congo and Kwanza** available

Interested participants must submit documentation by April 30th 2014

Data shows at **Petroleum Geo-Services** London and Luanda offices

