CEGA International Division
October 21, 2026

Review of Walvis Basin Prospectivity; Similarities and Differences with the Orange Basin, Offshore Namibia

Dean Clemenson & Ansgar Wanke, Stamper Oil & Gas

AGENDA

- Offshore West Africa
- Namibia Basins Overview and Comparisons
- Orange Basin
  - Gravity System Dominated
  - Depositional Centers, Provenance, Reservoir Quality, Source Rocks
  - Play Types
- Walvis Basin
  - Tecto-Stratigraphic Dominated
  - Depositional Centers, Provenance, Reservoir Quality, Source rocks
  - Play Types
- Summary and Exploration Implications

Introduction: Offshore West Africa – Production and Margin Overview

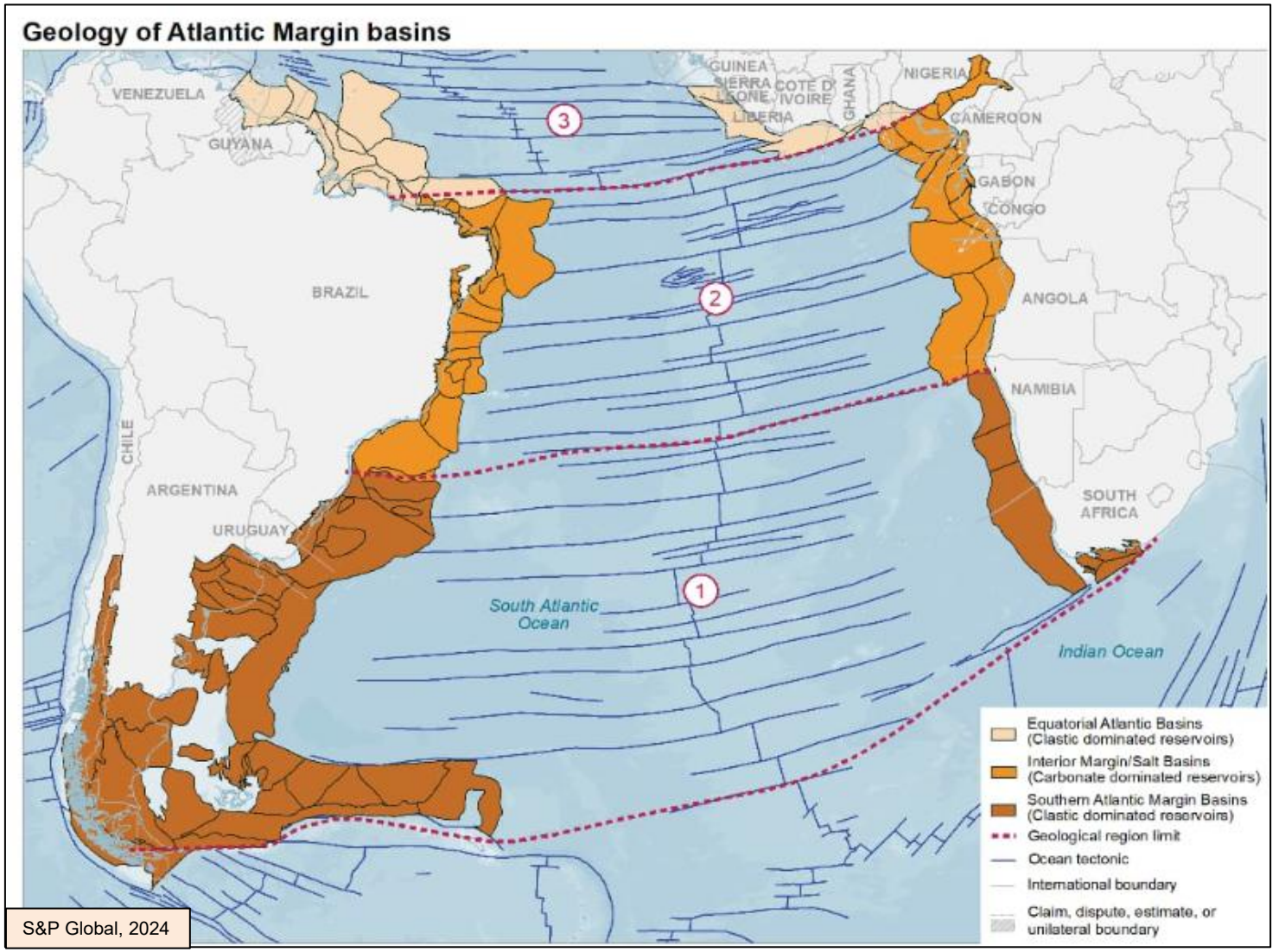


NVentures, 2026

West Africa Offshore Production (~)

Angola: 1,100,000 bbl/d
Nigeria: 800,000 bbl/d offshore (~1.75 million bbl/d total)
Congo: 270,000 bbl/d
Equatorial Guinea: 250,000 bbl/d
Gabon: 210,000 bbl/d
Ghana: 100,000 bbl/d
Senegal: 100,000 bbl/d
Cote d'Ivoire: 60,000 bbl/d

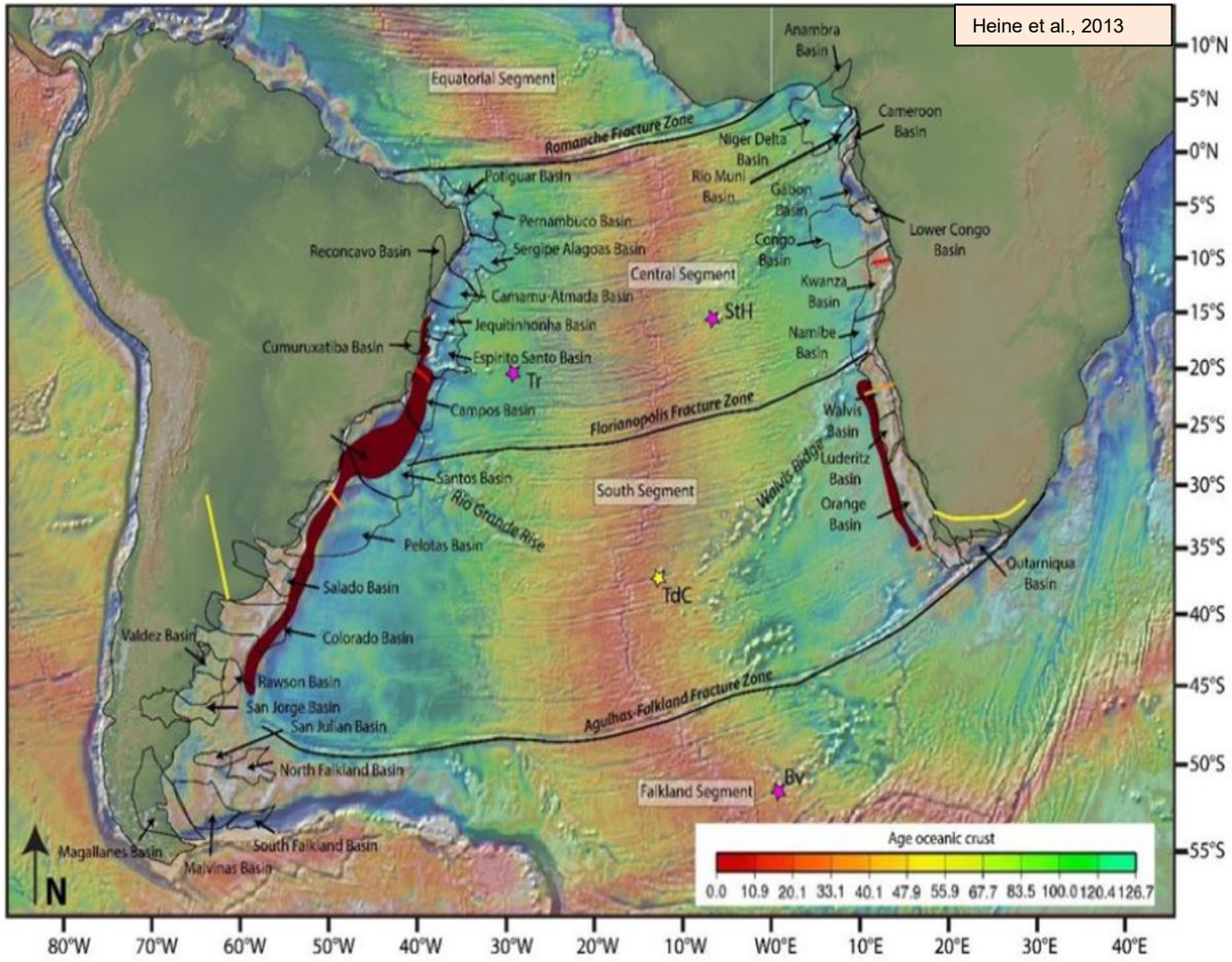
AFREC, 2026



S&P Global, 2024

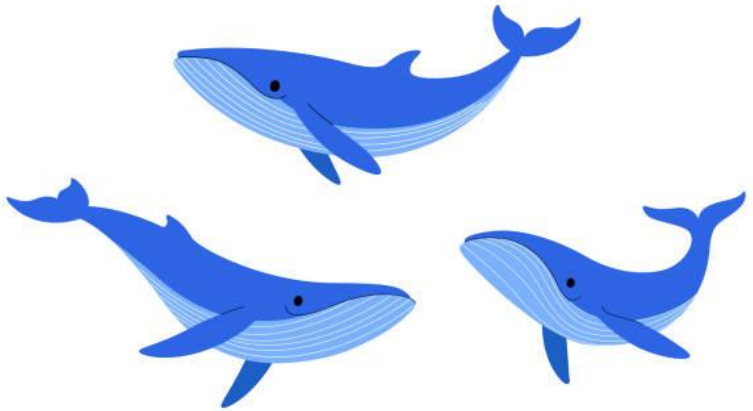
South Atlantic Margin Conjugate Basins

Attribute	Namibia Margin	Brazil/Uruguay Margin
Basins	Orange, Luderitz, Walvis, Namibe	Salado, Pelotas, Santos, Campos,
Margin Type	Volcanic rifted margin	Volcanic rifted margin
Break-up Architecture	Segmented, volcanic highs	Broad, smoother volcanic platform
SDR Geometry	Thick, stacked, asymmetric	Thick, more continuous
Aptian Sag	Narrow, localized	Wide, thick
Source Rock Setting	Broad Barremian - Aptian SR	Broad Barremian - Aptian SR
Sediment Routing	Point-source Orange River + multiple in Walvis	Widely distributed drainage, major rivers
Deepwater Systems	Continuous fans; contourite influence	Continuous fans; thick drift
Trap Styles	Stratigraphic + structural	Stratigraphic + structural



Offshore Namibia Basins Overview





Regional: Offshore Namibia Sedimentary Basins

Namibia's offshore margin is a classic volcanic rifted margin with SDRs, syn-rift fault blocks, post-rift sag, and deepwater turbidite/contourite systems. with potential for oil-prone source rocks and structural/stratigraphic traps

Basin Summary

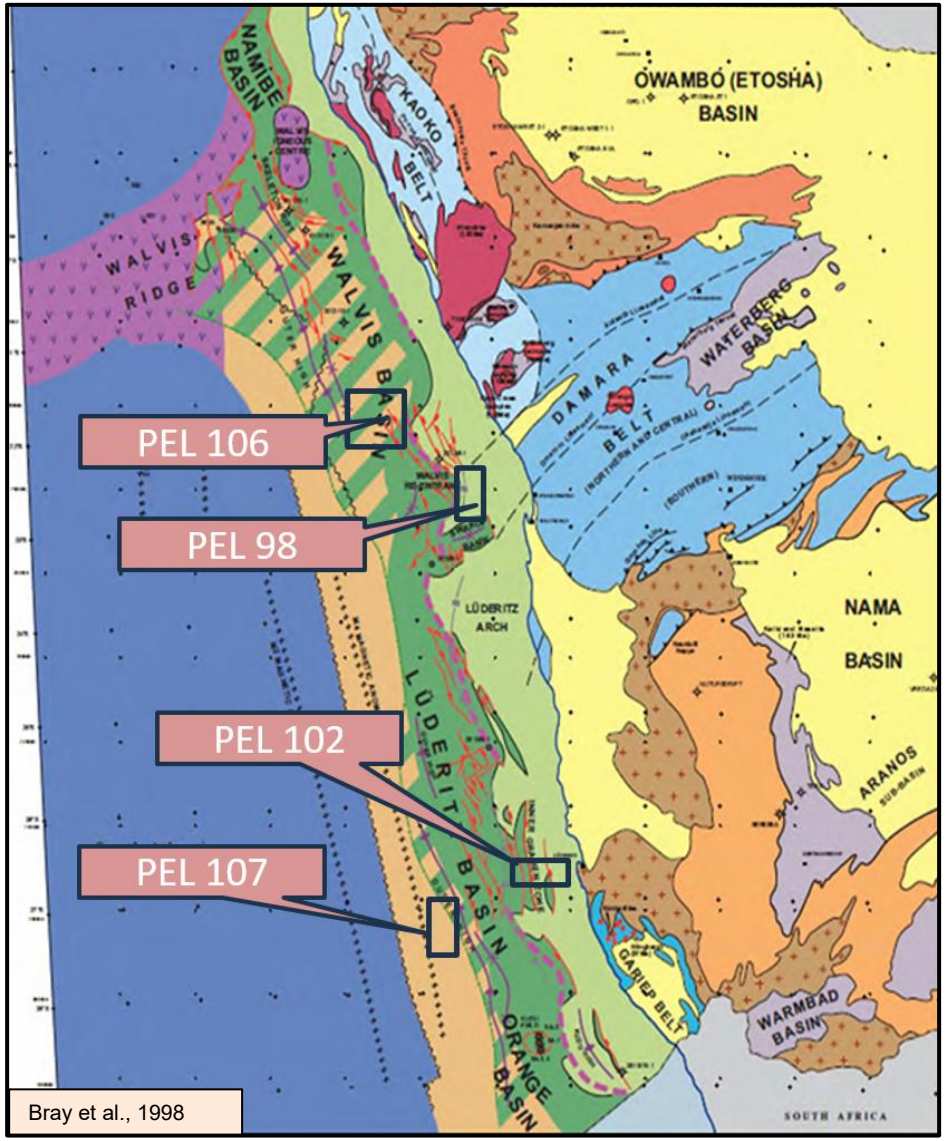
- There are four offshore basins in Namibia, from south to north: the Orange Basin, the Lüderitz Basin, the Walvis Basin, and the Namibe Basin
- They are separated by major transfer fault zones, volcanic-rift segmentation and volcanic highs, rift-segment offsets, and shifts in sediment routing creating distinct depocenters

Tectonic and Stratigraphic Framework

- Offshore Namibia has a rift-drift tectonic evolution, transitioning from syn-rift faulted blocks to post-rift thermal subsidence
- The stratigraphy includes:
  - Syn-rift sequences: Continental to shallow marine clastics
  - Post-rift sequences: Marine shales, turbidites, and carbonates
  - Potential source rocks: Organic-rich marine shales, particularly from the Barremian to Turonian intervals

Hydrocarbon Prospectivity

- Stratigraphic traps in deepwater turbidite systems
- Structural traps associated with mass transport and fault blocks
- Combination traps involving pinch-outs and onlap features



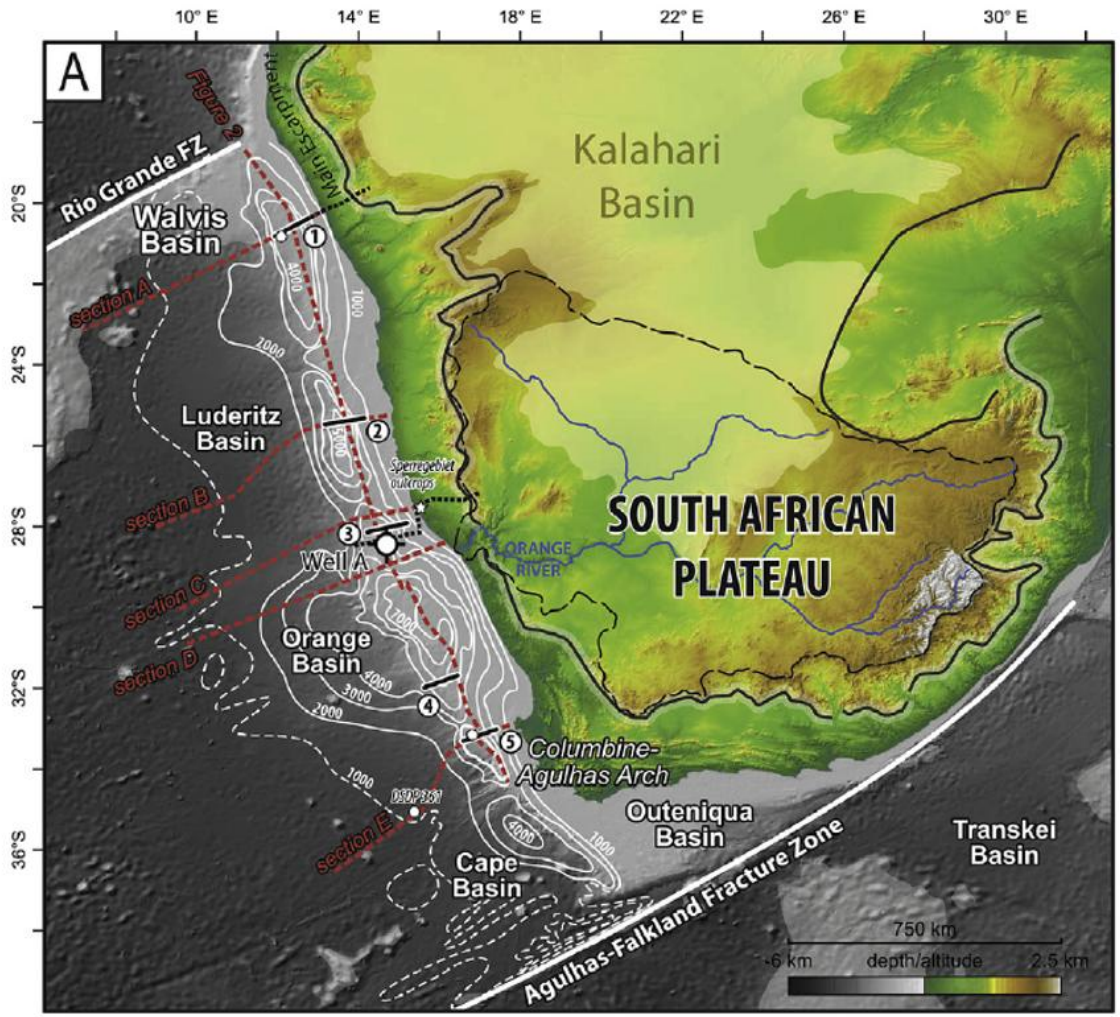
Offshore Namibia Basin Comparison Evaluation

Guiding Questions

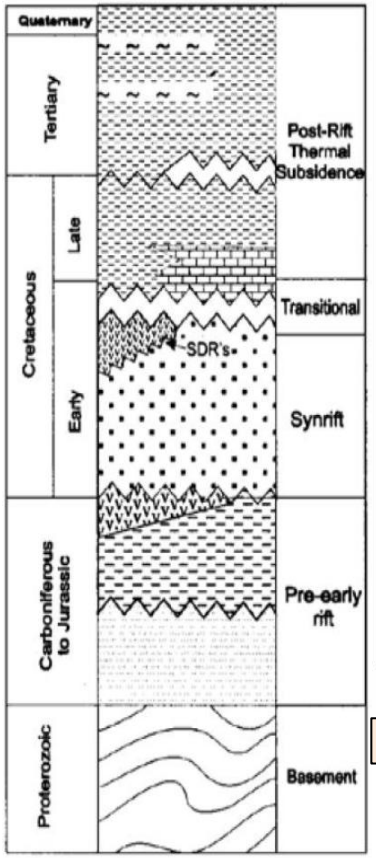
- Which plays work in the Orange Basin and why?
- Which conditions are similar between the Walvis and Orange Basin?
- Which conditions are markedly different between both basins?
- What are the critical unknowns?

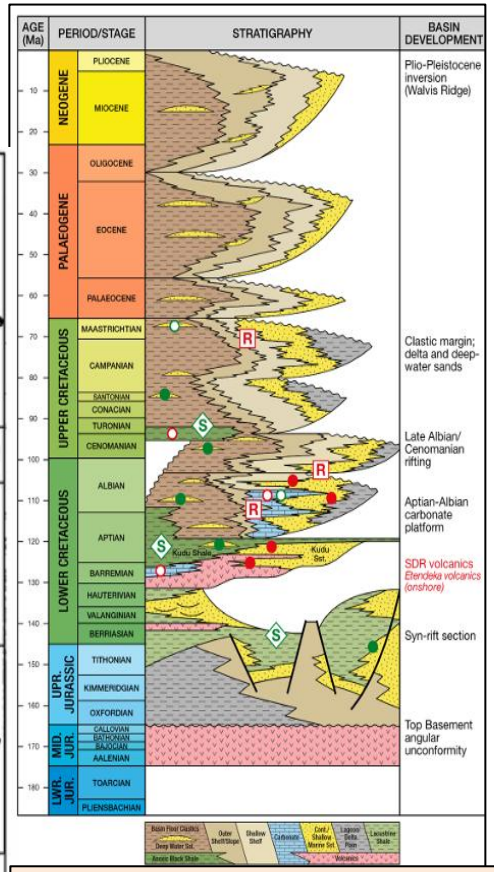
Key Elements

- Structural Framework and Sediment Distribution
- Sediment Provenance and Reservoir Quality
- Source Rock presence, quality, and maturity
- Charge access and trapping

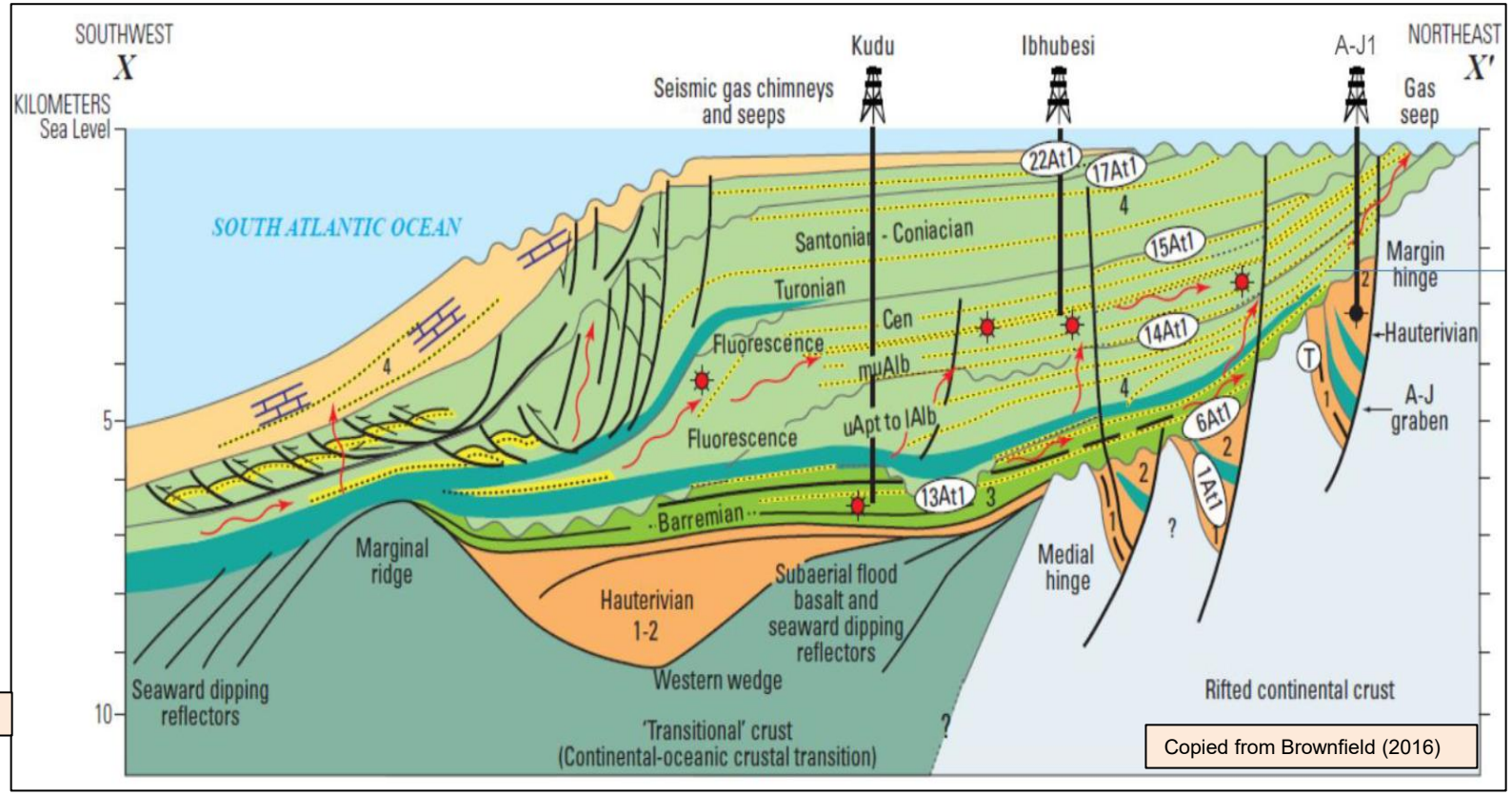


INTRODUCTION: OFFSHORE MARGIN STRATIGRAPHY





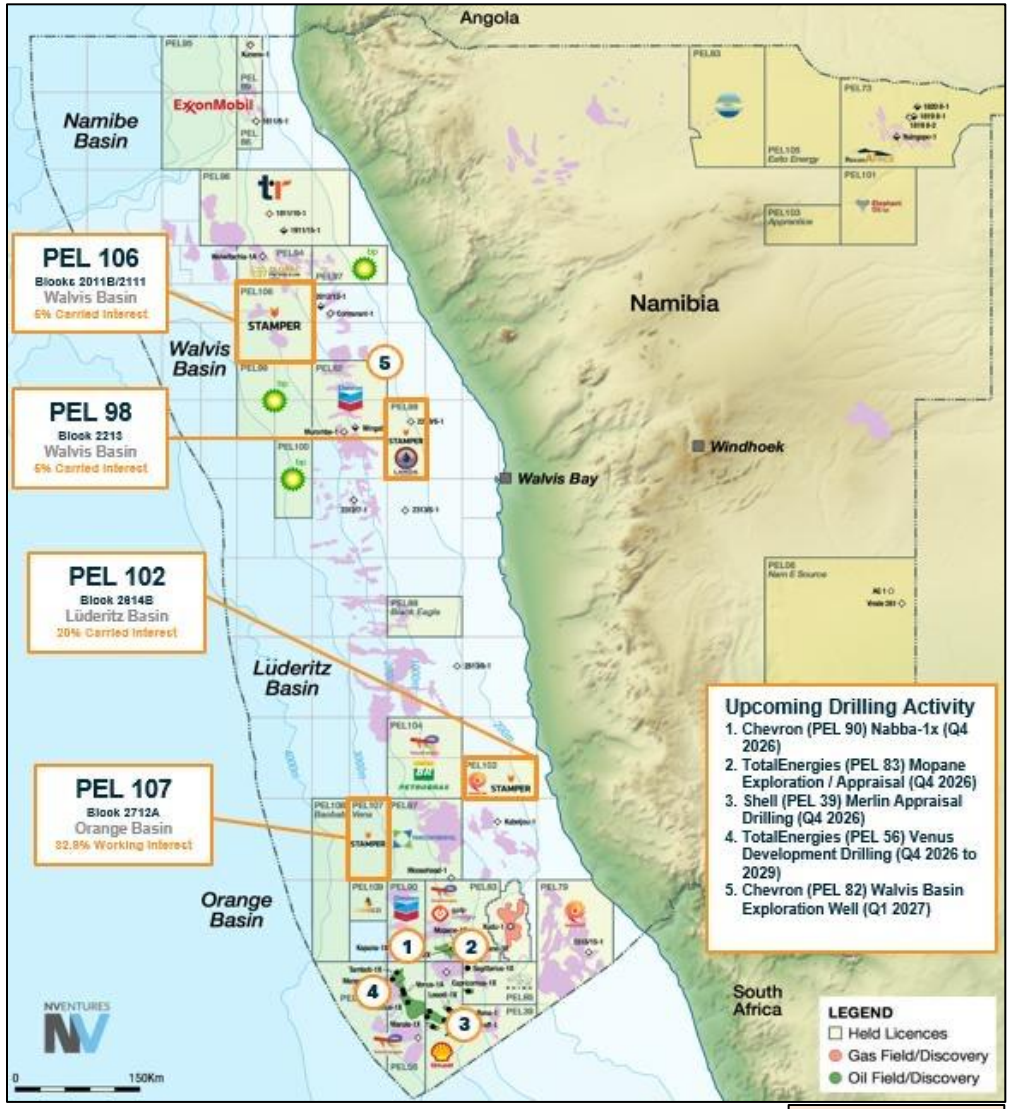
Modified after Sarkar, A. and Huuse, M., (2017)



Copied from Brownfield (2016)

General Namibian margin Tectonostratigraphy

Petroleum Exploration Licences (PELs) and Key Exploration Wells



Nventures (2026)

Orange
Luderitz
Walvis

Prospect/Field	Discovery Well	Operator at Discovery	Basin / PEL	Year	Target	Fluid Type	
Kudu	Kudu-1	Chevron & Soekor	Orange Basin PEL-3	1974	Barremian Aeolian Sands	Gas	
Kabeljou	Kabeljou-1	Petrobras & Chariot	Luderitz Basin PEL 72	2012	Aptian-Albian Fan System	Dry (Good Source Rock)	
Wingat	Wingat-1	HRT	Walvis Basin PEL 23 (82)	2013	Albian Carbonates and Turbidites	Oil Saturated	
Murombe	Murombe-1	HRT	Walvis Basin PEL 23 (82)	2013	Barremian & Cenomanian Turbidite/Channels	Water (Good Reservoir)	
Moosehead	Moosehead-1	HRT	Orange Basin PEL 87	2013	Barremian Carbonate	Dry (Good Source Rock)	
Welwitschia	Welwitschia-1A	Repsol & Tower	Walvis Basin PEL 94	2014	Albian Carbonate	TD Short of Target (Good Seal)	
Cormorant	Cormorant-1	Tullow	Walvis Basin PEL 37	2018	Albian Submarine Fan	Water (Marginal Reservoir)	
Chariot Prospect S	2312/7-1	Chariot	Walvis Basin PEL 71	2018	Cenomanian Turbidite	Water (Good Reservoir)	★
Graff	Graff-1	Shell	Orange Basin PEL 39	2022	Cenomanian Marine Sands	Oil	★
Venus	Venus-1	TotalEnergies	Orange Basin PEL 56	2022	Albian Turbidites - Basin Floor Fan	Oil	
Jonker	Jonker-1X	Shell	Orange Basin PEL 39	2023	Cenomanian Marine Sands	Oil	★
Nara	Nara-1X	TotalEnergies	Orange Basin PEL 56	2023	Albian Turbidites - Basin Floor Fan (West)	Dry, Oil Shows	
Mangetti	Mangetti-1X	TotalEnergies	Orange Basin PEL 56	2024	Albian Turbidites (North)	Oil	
Mopane	Mopane-1X	Galp Energia	Orange Basin PEL 83	2024	Cenomanian-Turonian Marine Sands	Oil	★
Capricornus	Capricornus-1/1A	Rhino Resources	Orange Basin PEL 85	2024/26	Lower Cretaceous Marine Sands	Oil	★
Volans	Volans-1X	Rhino Resources	Orange Basin PEL 85	2024	Cenomanian-Turonian Marine Sands	Gas-condensate	★
Kapana	Kapana-1X	Chevron	Orange Basin PEL 90	2025	Cretaceous Marine Sands	Dry	
Merlin	Merlin-1/1X	Shell	Orange Basin PEL 39	2026	Coniacian Marine Sands	Oil	★

★ Upper Cretaceous

Offshore Namibia Play Types

1) Outer high.

2) Mixed volcanics (flood basalts) and continental sediments (may also contain Lower Cretaceous source rock).

3) Hauterivian play: pinch out of the syn-rift lacustrine, fluvial and deltaic sandstones.

4) Kudu discovery: pinch out of Barremian fluvial facies.

5) Albian-Cenomanian prograding clastic wedge.

6) Albian shelf fluvial channel system.

7) Mopane discovery: stacked slope channel complex.

8) Oceanic MORB (mid ocean ridge basalts).

9) Aptian source rock.

10) Venus discovery: basin floor fan sits on Aptian source rock. Note counter-regional dip

11) Mangetti discovery.

12) Truncated SDR's first marine transgression erodes SDR's.

13) Graff discovery: channels truncated by gravity. Driven structure. Similar model for Jonker, Enigma, La Rhona, Leseidi.

14) Turonian source rock.

15) Extensional part of gravity driven fold and thrust belt (GDFTB).

16) Contractional part of GDFTB: toe trust.

17) Undrilled trap beyond first thrust of GDFTB.

18) Translated part of GDFTB.

19) MTD.

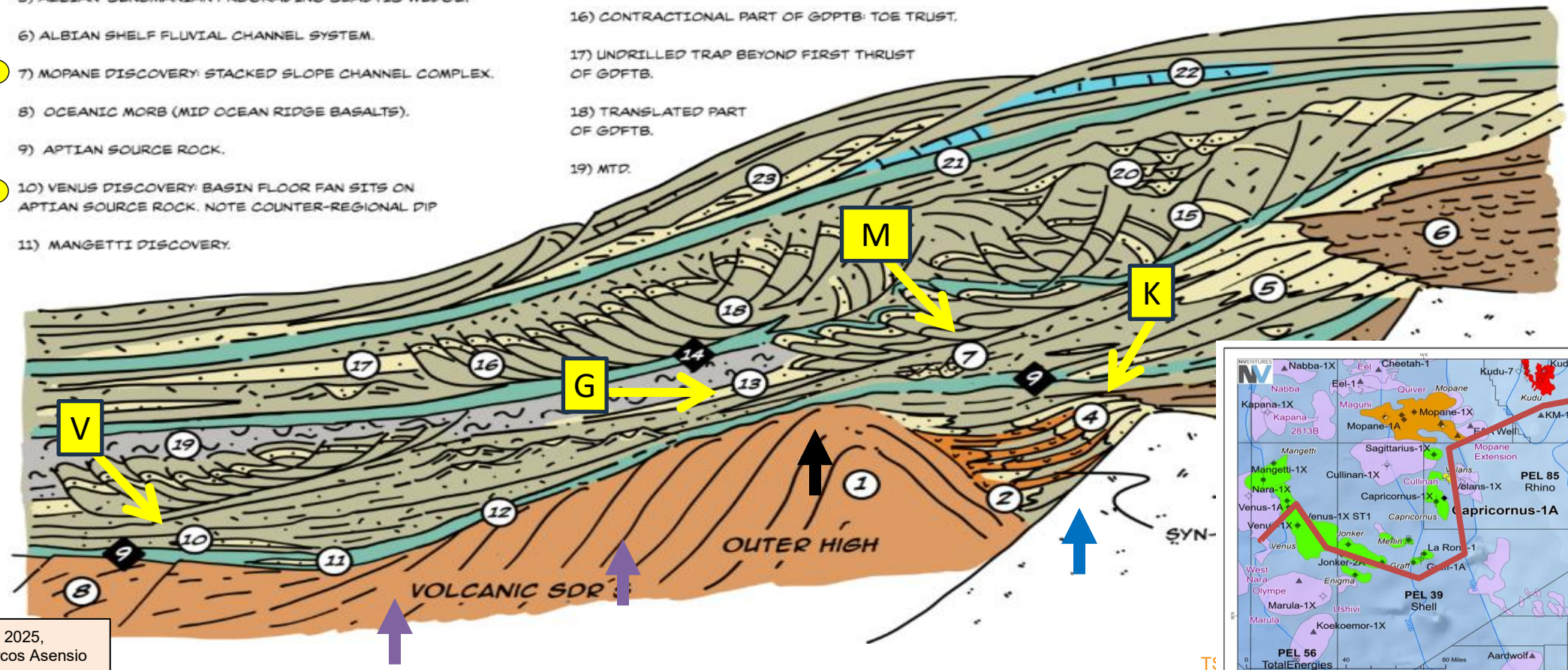
20) Santonian-Coniacian slope channel complex.

21) Maastrichtian transgressive surface.

22) Tertiary marlstone-carbonate.

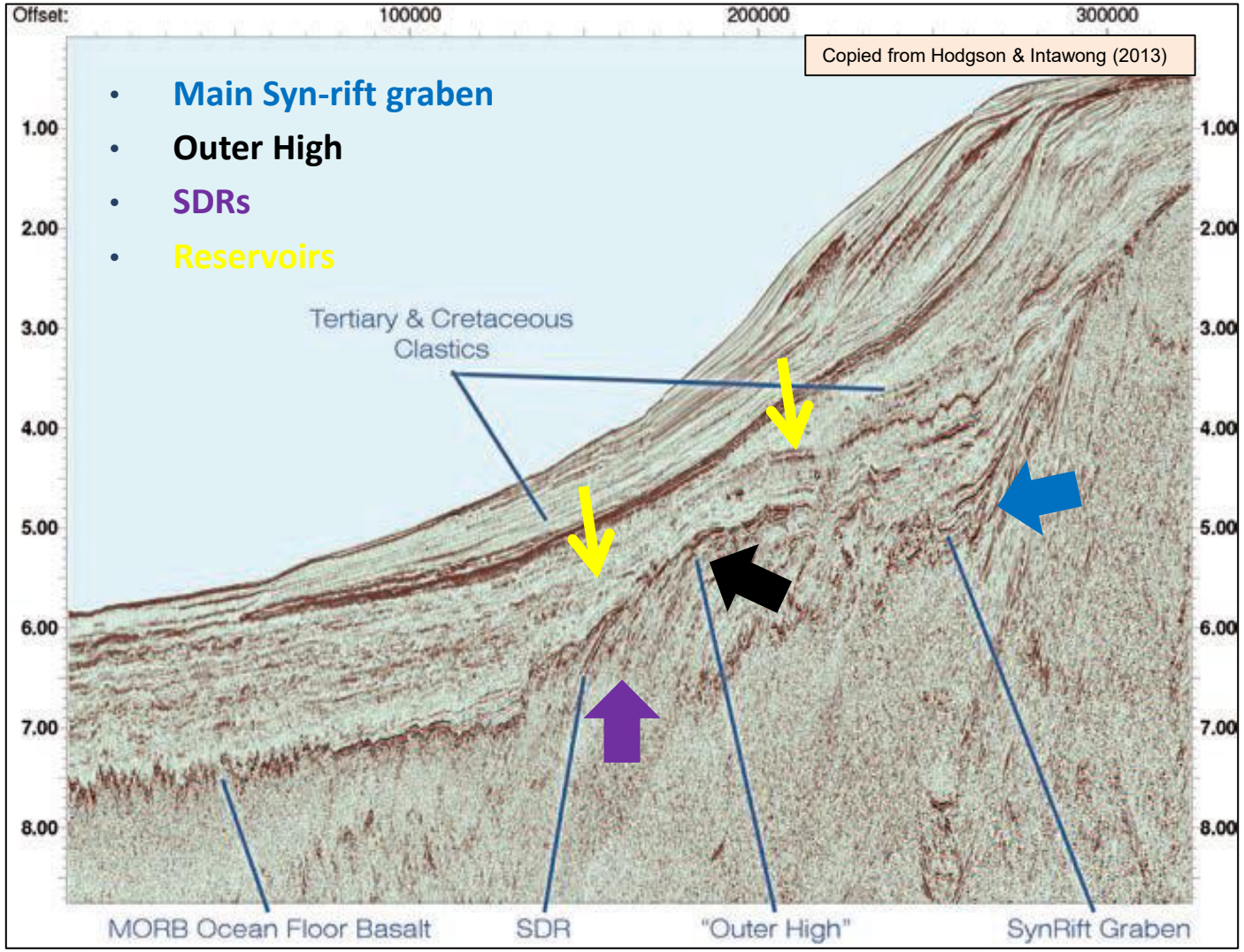
23) Countourite drift.

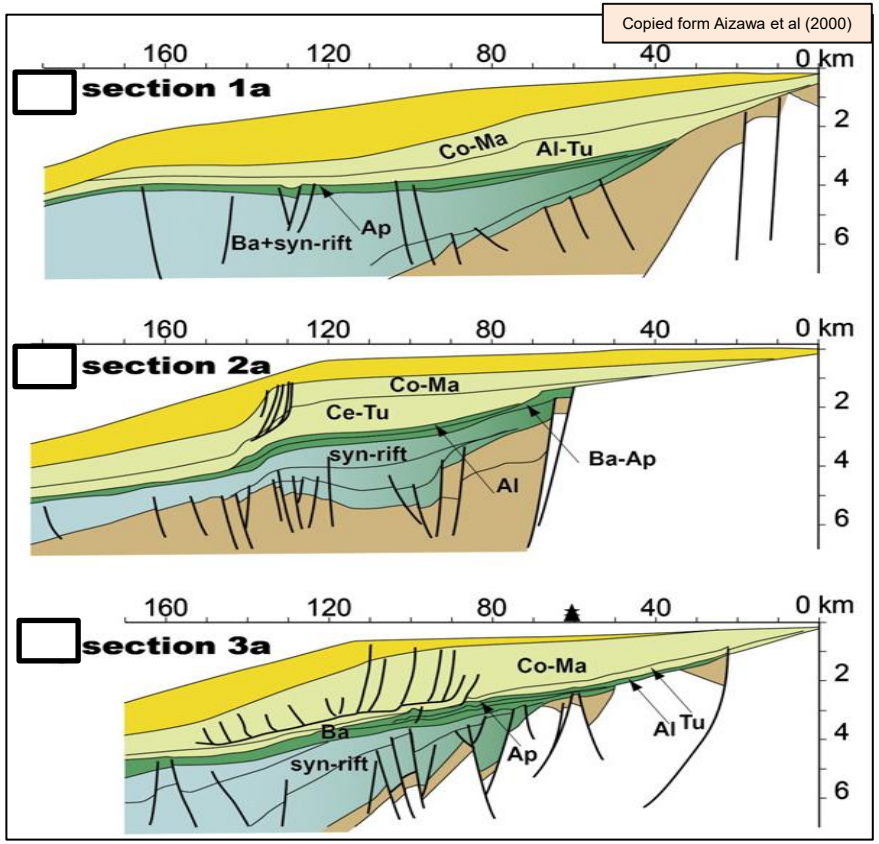
24) Rifted continental crust.



GeoExPro 03 Oct 2025,
Illustration by Marcos Asensio

General Structural Framework – Offshore Namibia

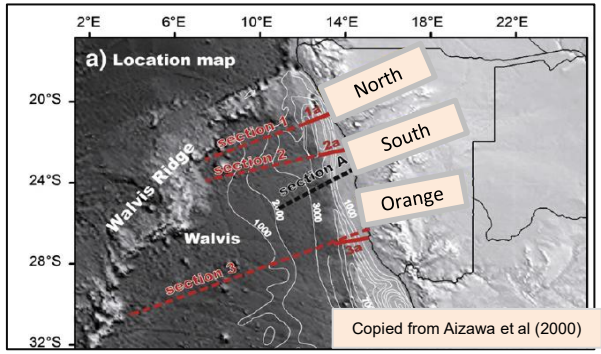


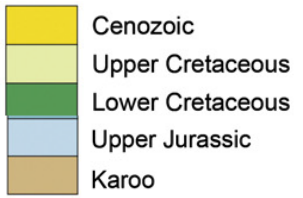


Northern Walvis Basin

Southern Walvis Basin

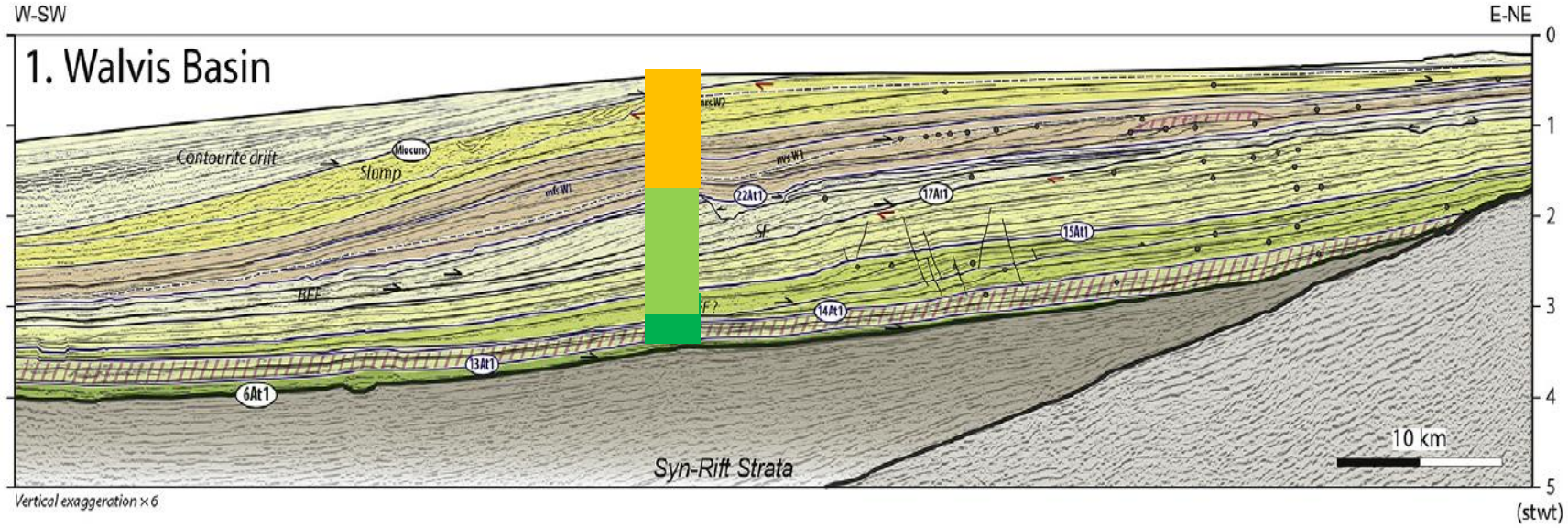
Northern Orange Basin

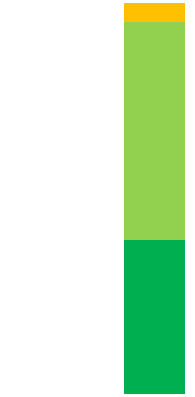


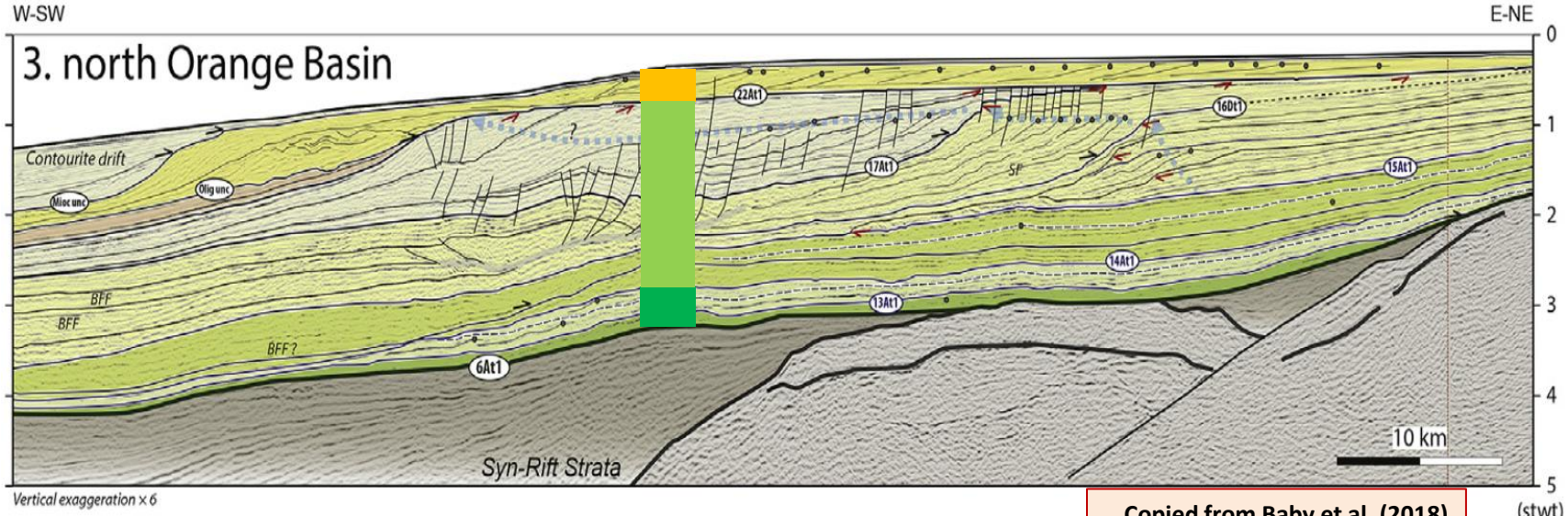


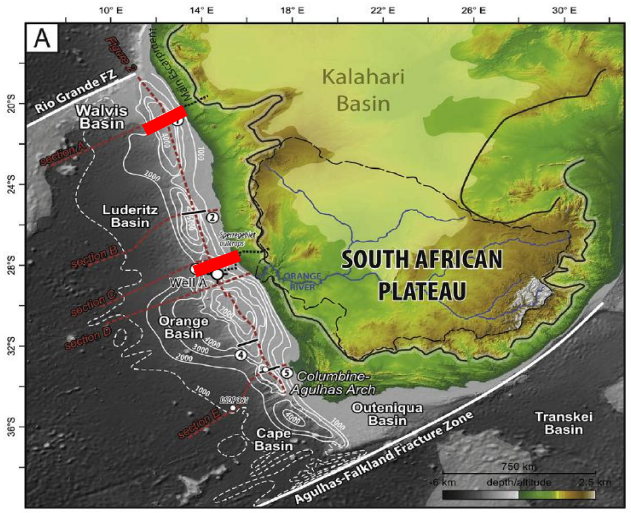
A typical WSE-ENE dip line showing the consistent structures on the Namibian margin. This line is 320 km long.

Sediment Thickness Comparison – Walvis vs Orange



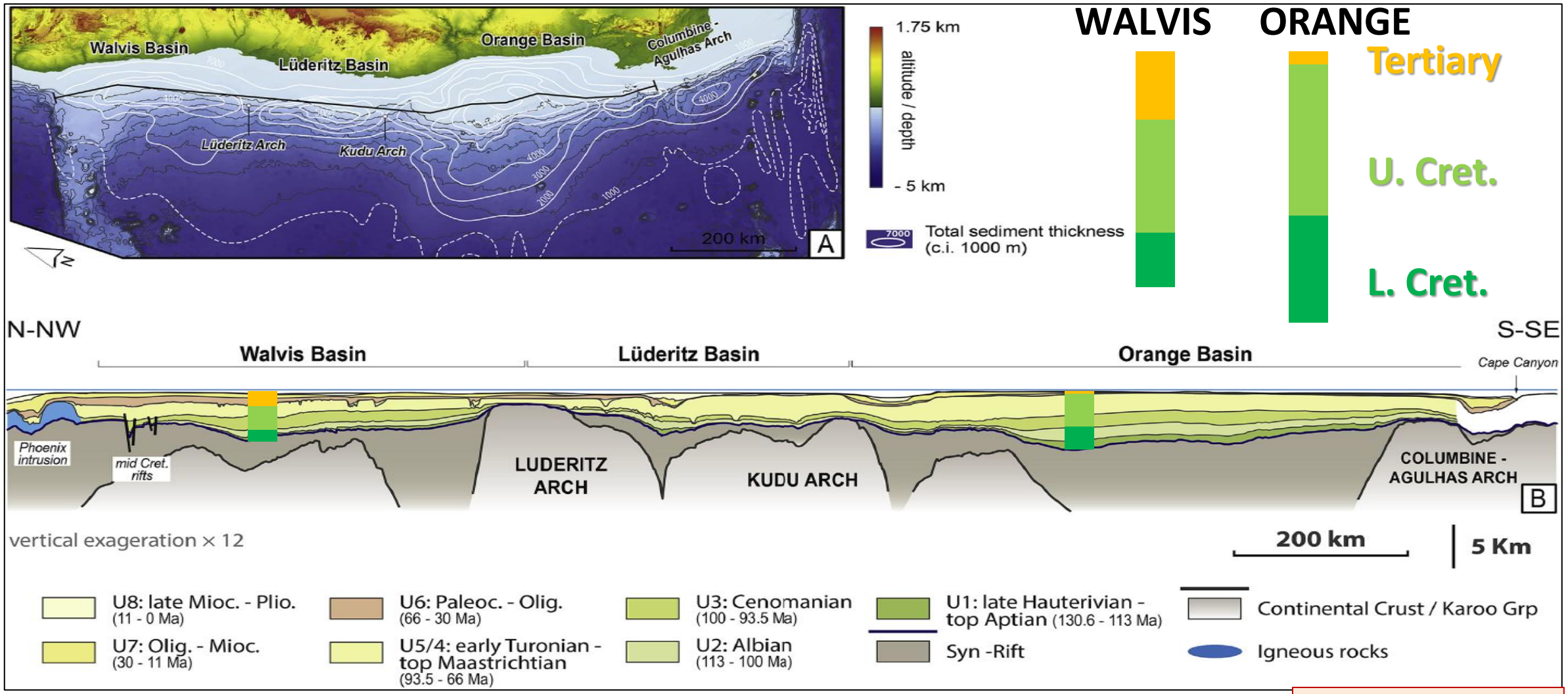






Copied from Baby et al. (2018)

Sediment Distribution Comparison – Walvis vs Orange



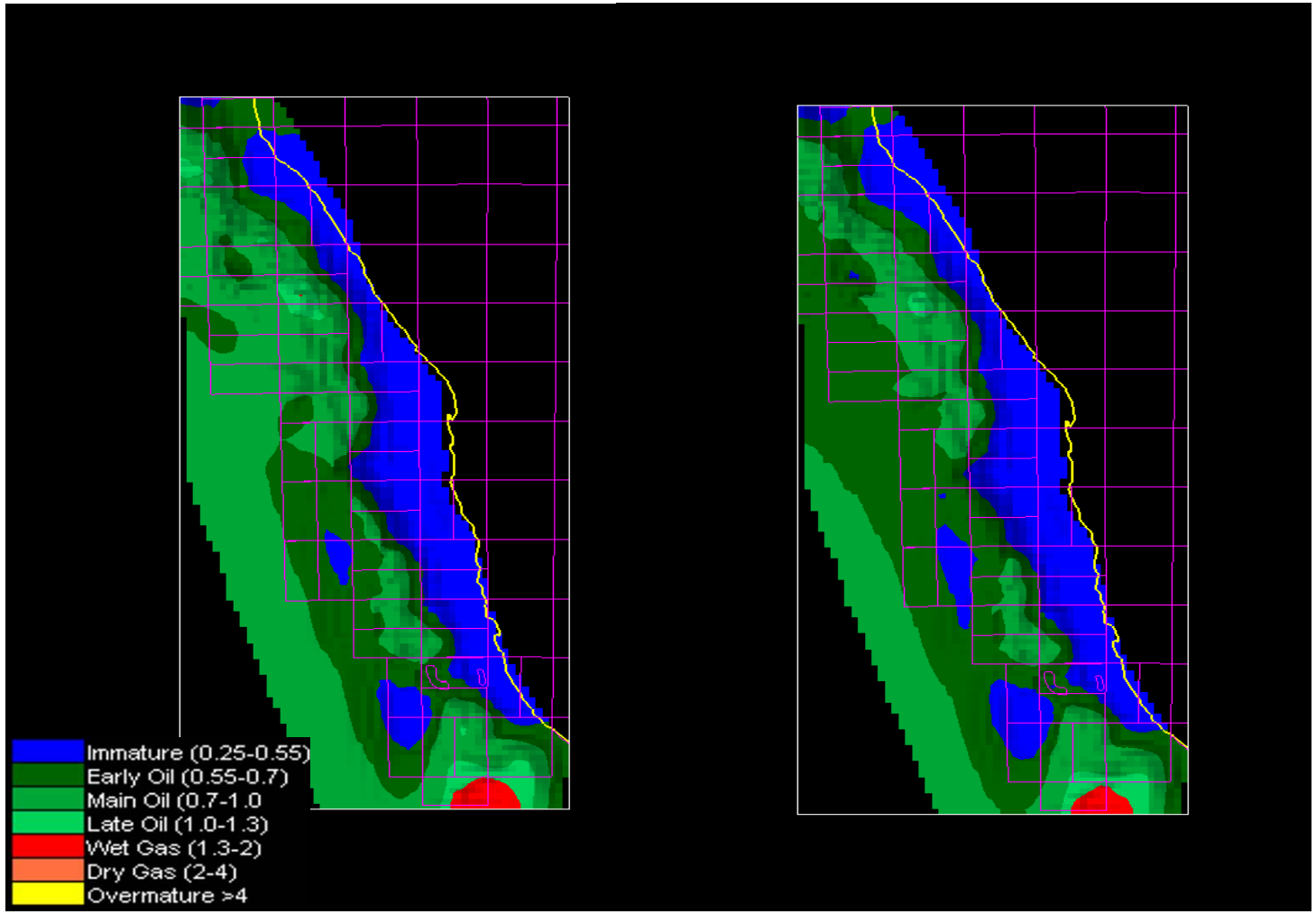
Copied from Baby et al. (2018)

Regional SR Maturity Comparison – Walvis vs Orange

General Trends

- Kudu shale and Albian SR main candidates of oil mature SRs - widespread
- Cenomanian-Turonian rarely reaching maturity (not shown here)
- Better oil-prone organofacies expected farther offshore (less dilution with clastic and lower vitrinite input)
- Venus prove that SR on oceanic crust can be mature (only approx. 2.5km overburden required)
- Orange Basin: high maturity – up into dry gas window (high sediment thickness, possible influence of Miocene Vema hot-spot)
- Walvis Basin: larger area of lower maturity, no or limited dry gas zones (attributed to lower sediment thickness)

Oil rather than gas potential in the Walvis

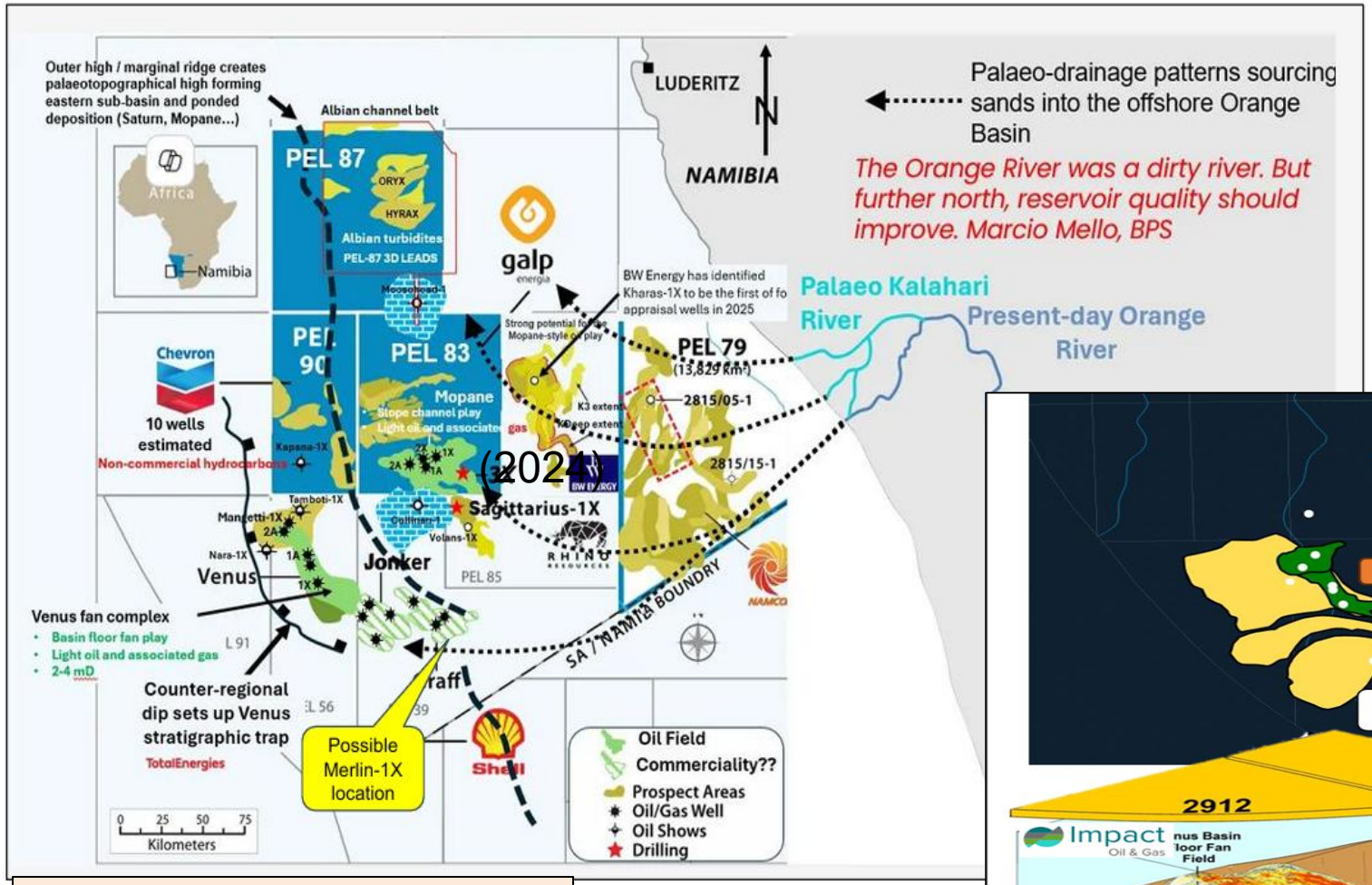


Super-regional model of simulated present-day maturity (%Ro) of two potential source rock intervals. Left: potential source rock interval of Aptian age (Kudu Shale); right: potential source rock interval of Albian age. Study by H.A. Kemna.

Orange Basin



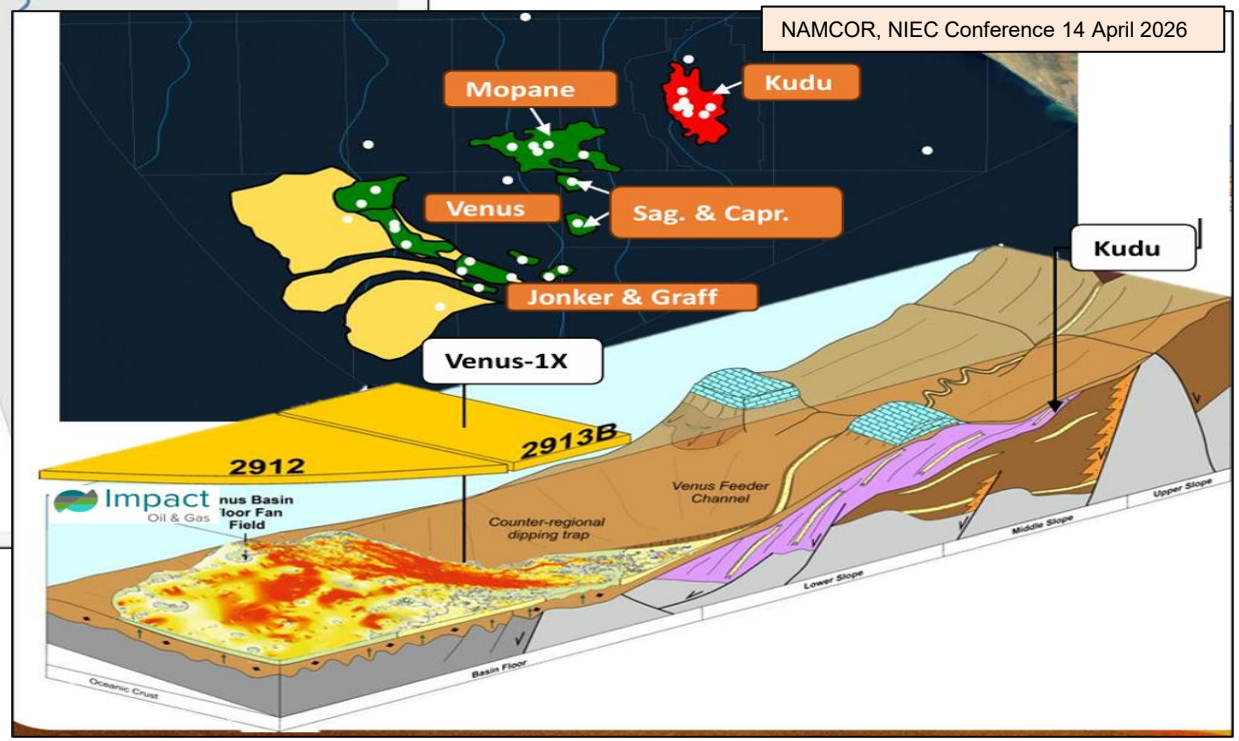
Orange Basin: Depositional Concepts



(2024)

Impact Oil & Gas – Orange Basin Exploration Update (2024)

NAMCOR, NIEC Conference 14 April 2026



Orange Basin Sediment Provenance and Reservoir Quality

Sediment Source

- Sediment supply from continental interior – large catchment area
- Mixed igneous and metamorphic basement rocks, various sedimentary rocks

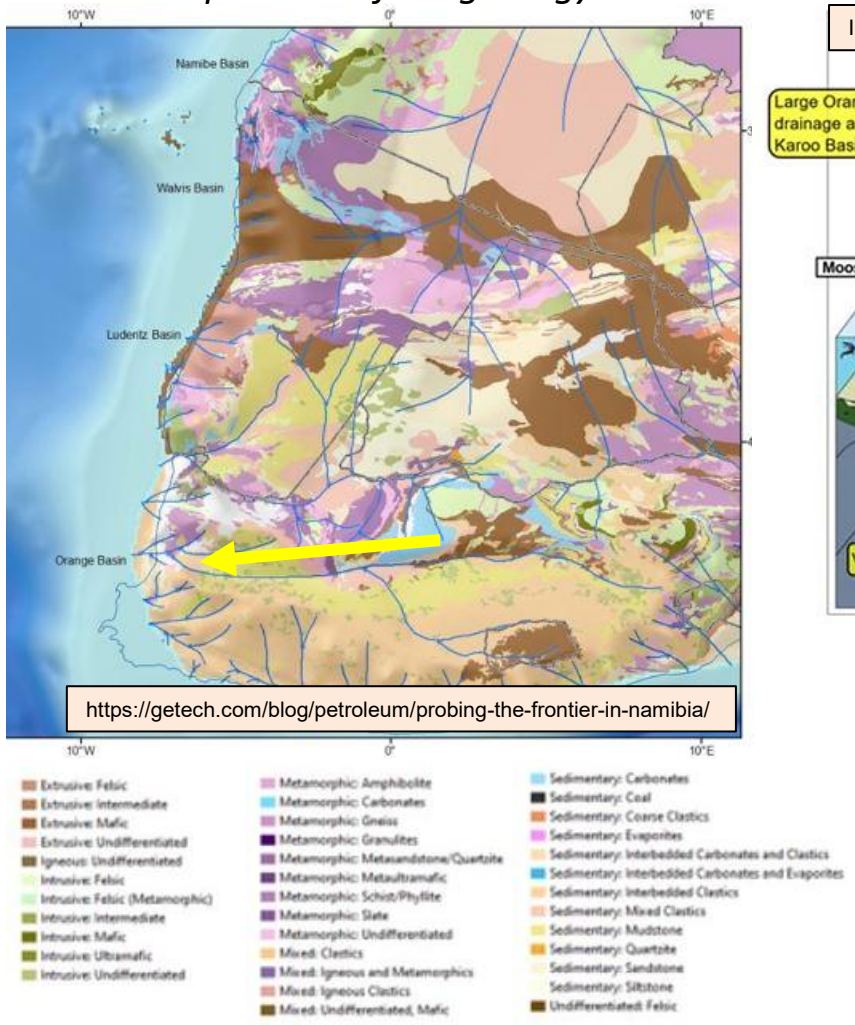
Basin Entry

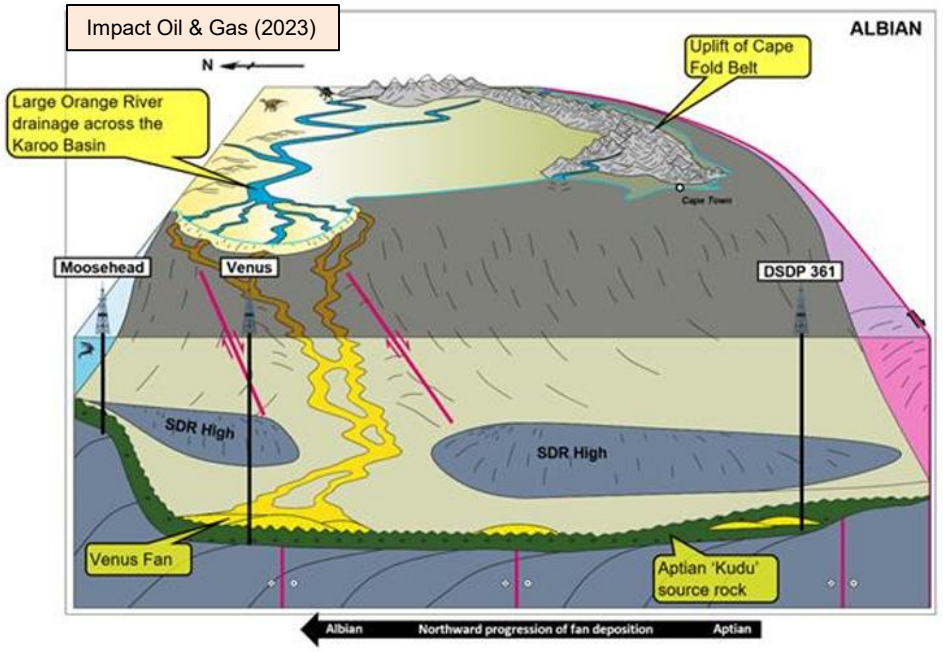
- Relatively stationary Orange and Olifants River

Reservoir Quality

- Excellent to poor, depending on amount of unstable minerals and diagenetic modifications
  - Kudu sands with excellent RQ: well sorted sands, textural and mineralogical mature
  - Graff RQ: Poro-Perm influenced by chlorite (probably deriving from alteration of unstable minerals)
- Contourite drift could help improving RQ northwards – contourite features seen from late Lower Cretaceous

Albian palaeosurface geology



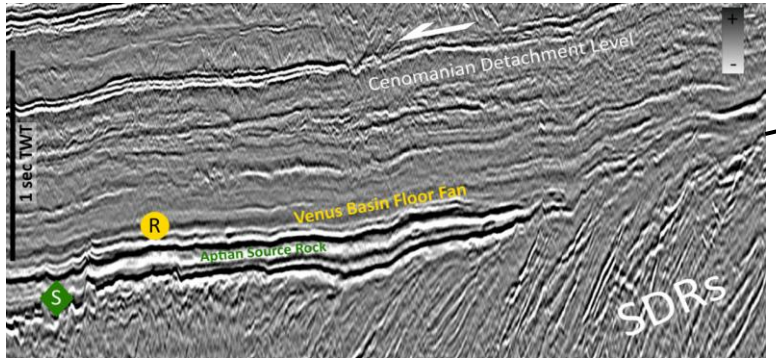


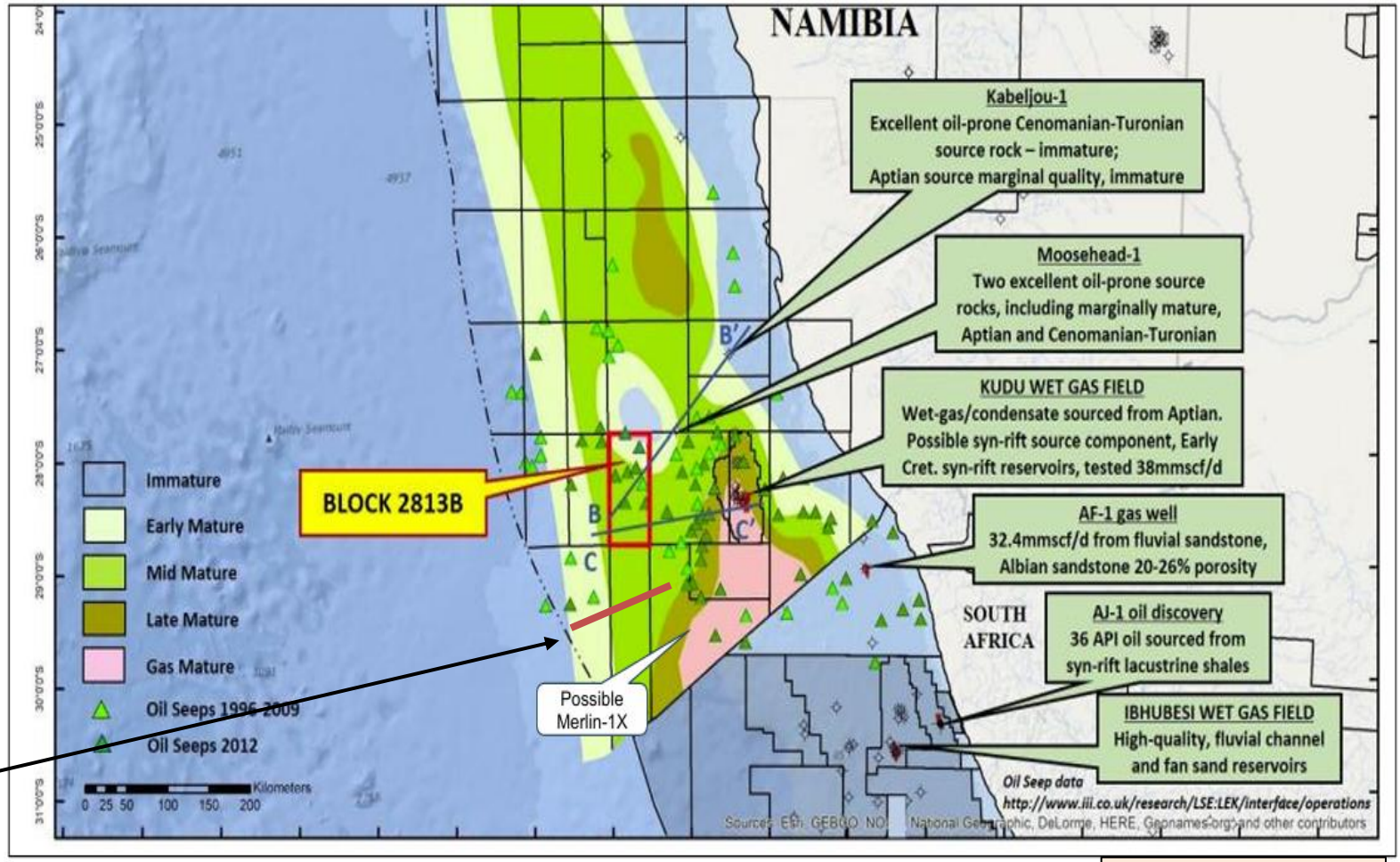
Deposition of the Albian-aged Venus Fan in the outer Orange Basin directly on to the Aptian aged "Kudu Shale" source rock. Sediment drainage from across the Karoo basin.

Orange Basin Source Rock Presence and Maturity

- Aptian - Albian marine source rocks are thick and regionally extensive, with strong Type II/II-D kerogens
- High maturity driven by deep burial and elevated heat flow with large areas firmly in the oil → wet-gas → dry-gas windows, supporting multi-phase charge
- Geochemical calibration (biomarkers, trace-element redox indicators) confirms anoxic marine conditions and efficient hydrocarbon generation.
- Broad, laterally continuous charge kitchens positioned to feed Upper Cretaceous turbidite systems and gravity-driven structural traps.

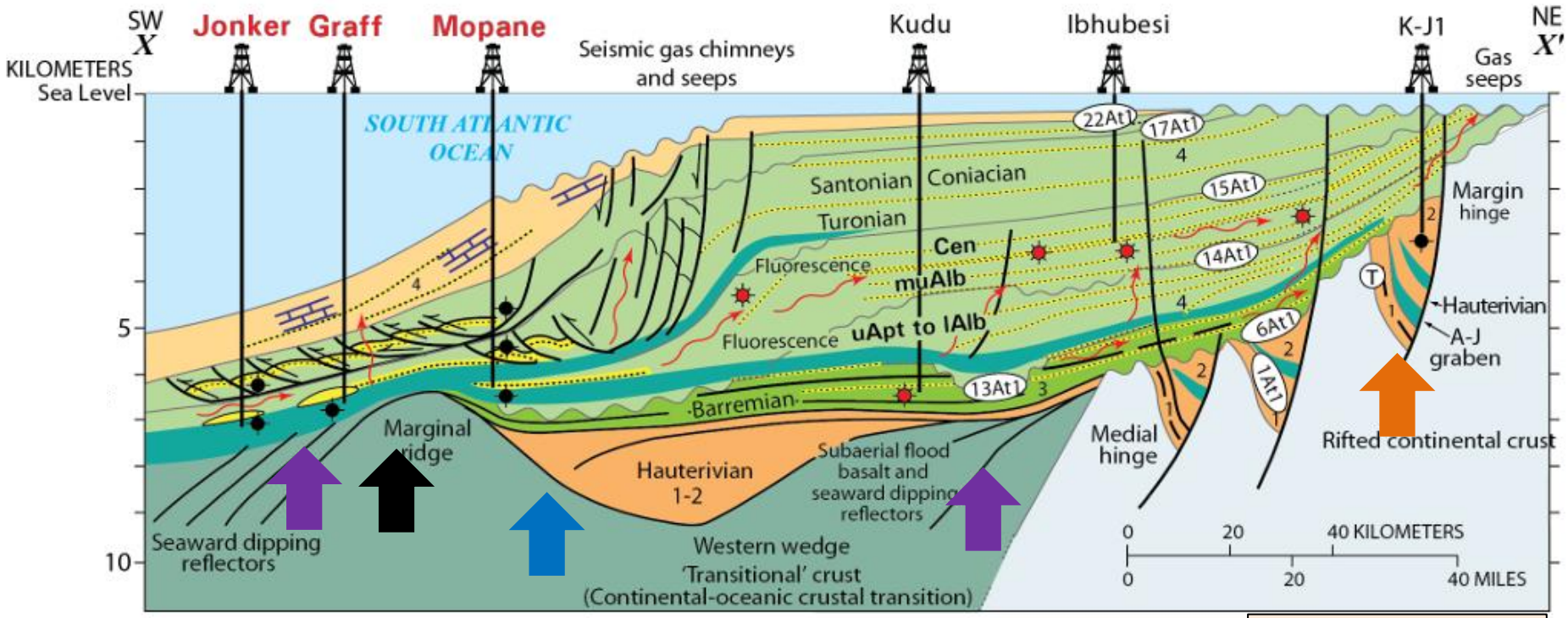
The Orange Basin has a high confidence deeply mature regionally extensive source system.

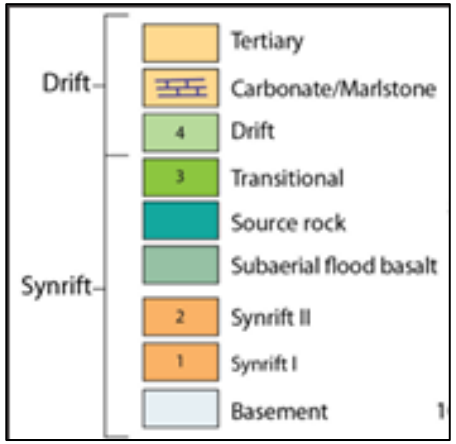




Impact Oil & Gas. (2013)

Schematic Geological Dip Section For The Orange Basin





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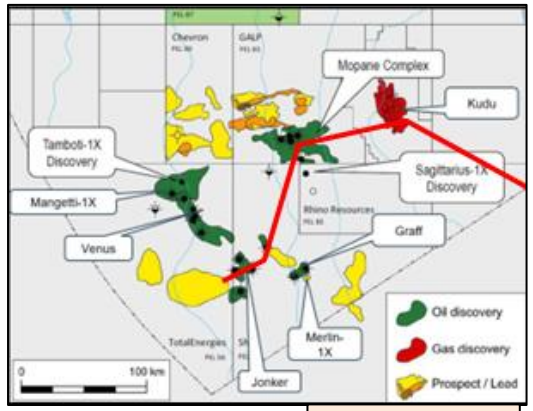
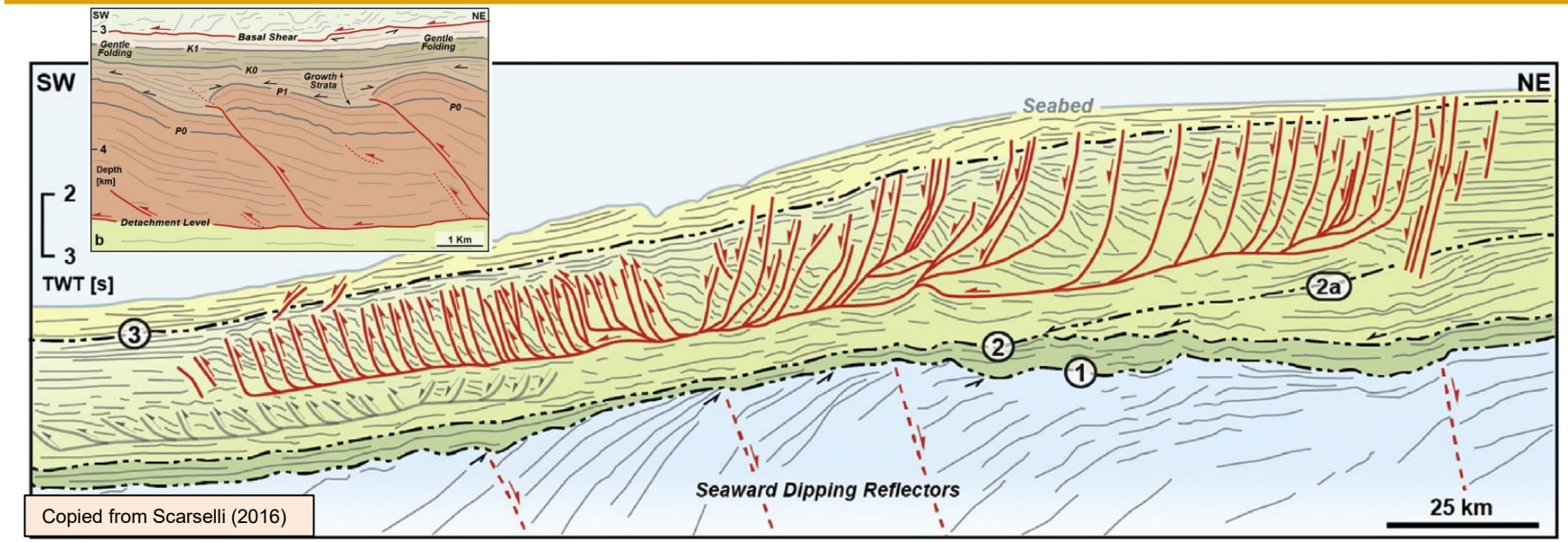


NVentures (2026)

- **Passive volcanic margin hosting classic rift-drift sequence**
  - Hauterivian - Barremian Syn-rift: volcanic, mixed volcanic and lacustrine clastic
  - Early Cret. (Late Barremian - Aptian) transitional sequence: argillaceous and arenaceous clastics, carbonates
  - Late Early Cretaceous - Cenozoic Post-rift / drift sequence: shales, turbidites, contourites
- **Inboard shelfal grabens** (local, e.g., A-J1 in Orange Basin)
- **Main Syn-rift graben(s)** flanked by Outer High and "Medial Hinge line" (Hauterivian-Barremian fill)
- **Outer High** / Marginal Ridge (established since the Aptian)
- **SDRs** (Mostly Barremian)

Distinct Orange Basin Feature: Upper Cretaceous Gravity Systems



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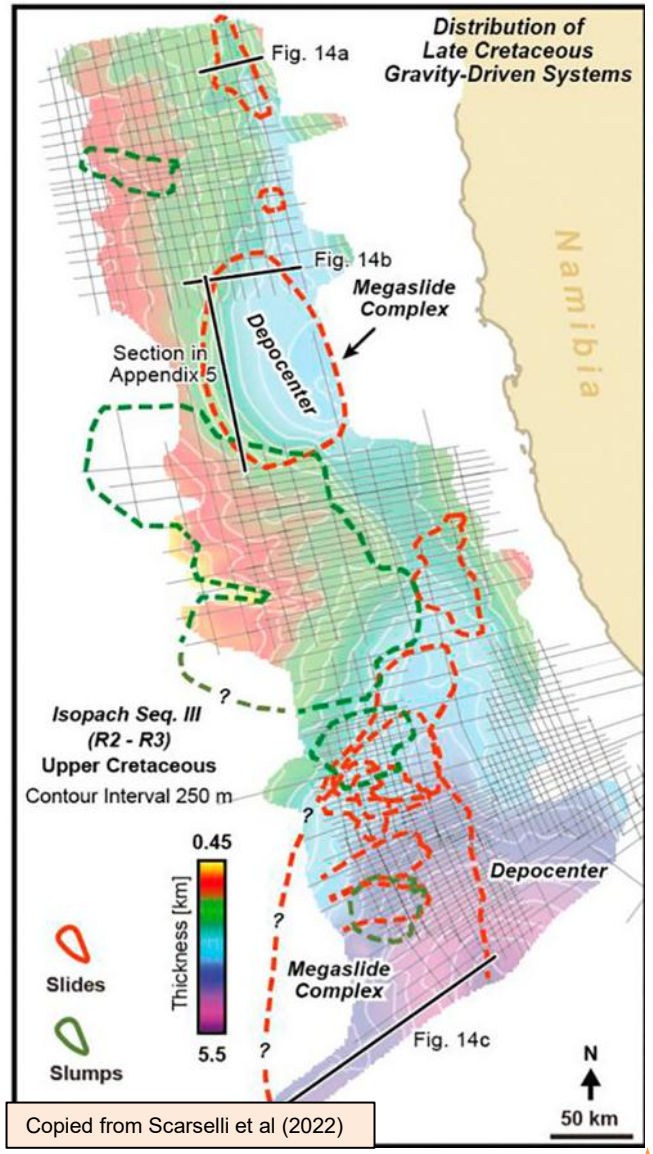
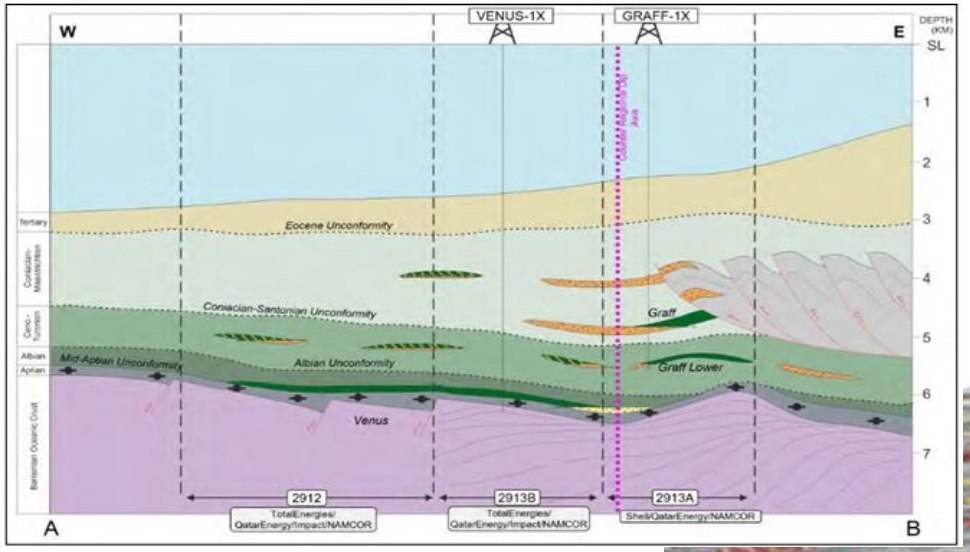


Copied from Scarselli et al (2022)

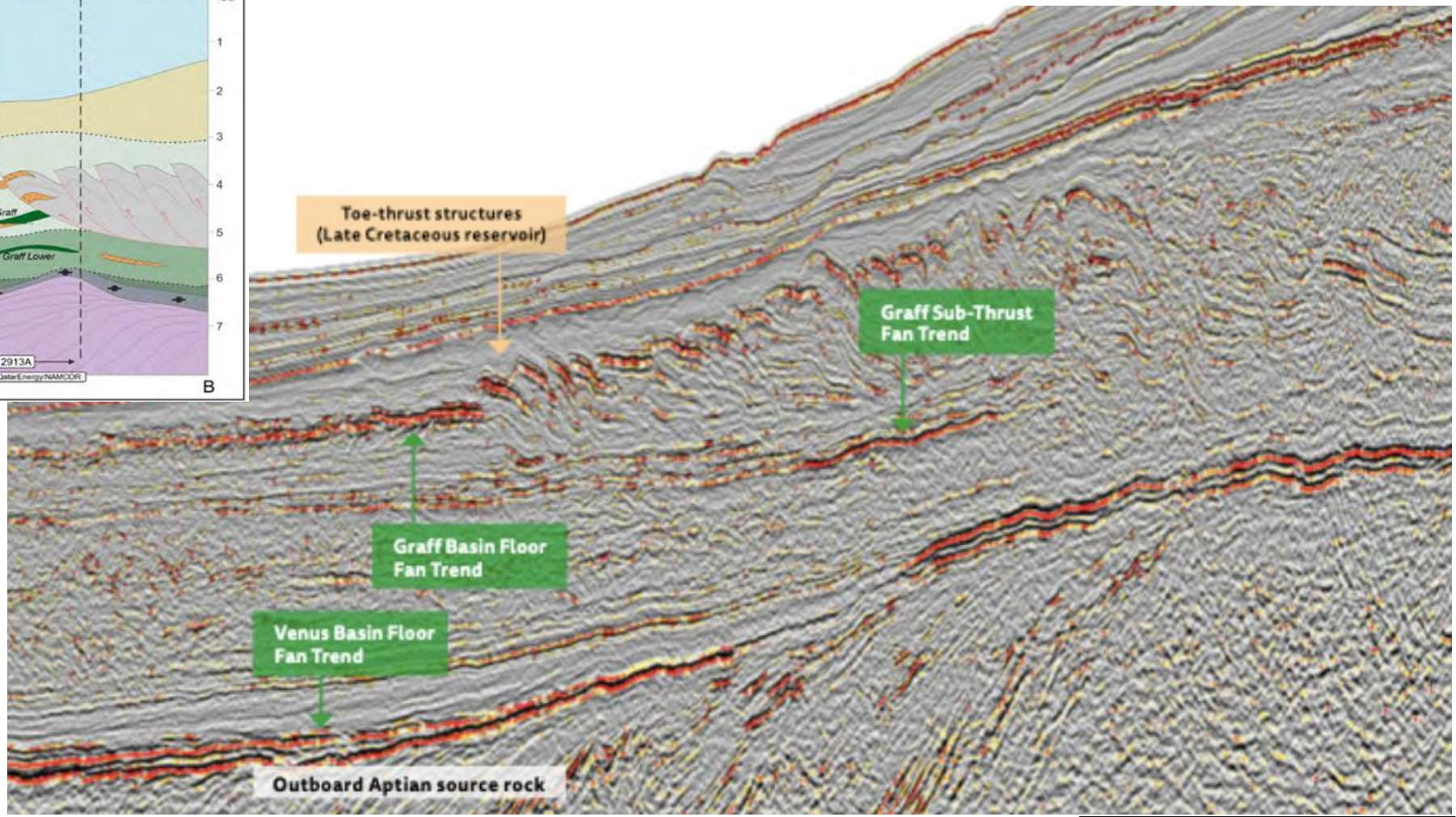
Prominent Gravity Driven Systems

- Slides / Mega-Slides, Slumps
- Updip extensional Slope Domain
- Downdip Fold and Thrust Belt
- Regional detachment mostly in Turonian shales
- Drape and growth geometries over rotated blocks

Orange Basin: Depositional Features

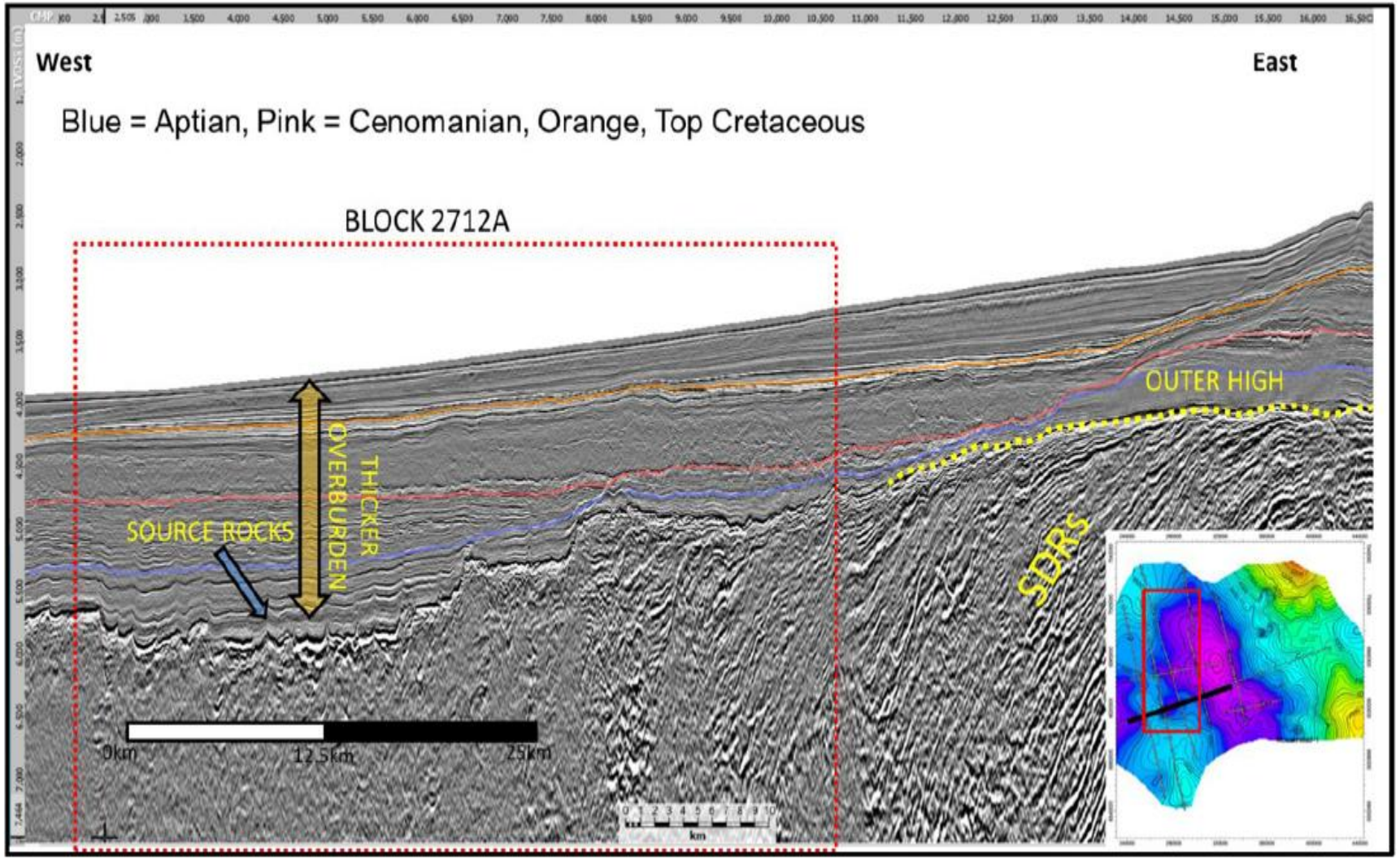




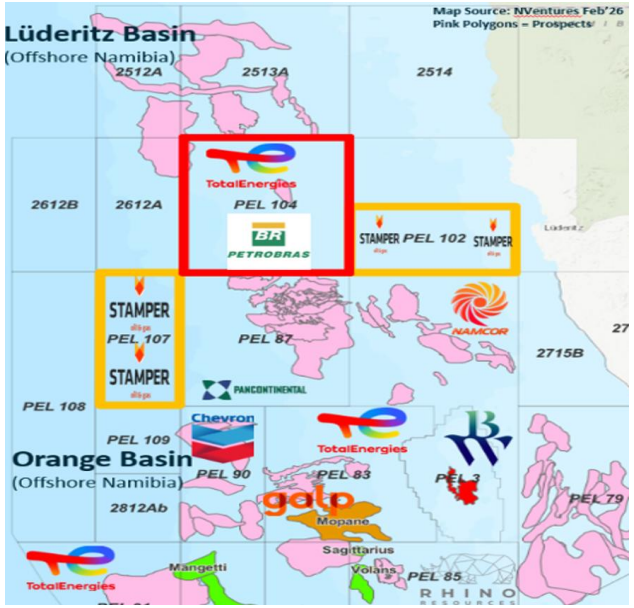


TotalEnergies & Impact Oil & Gas. (2023)

Orange Basin Plays – PEL 107

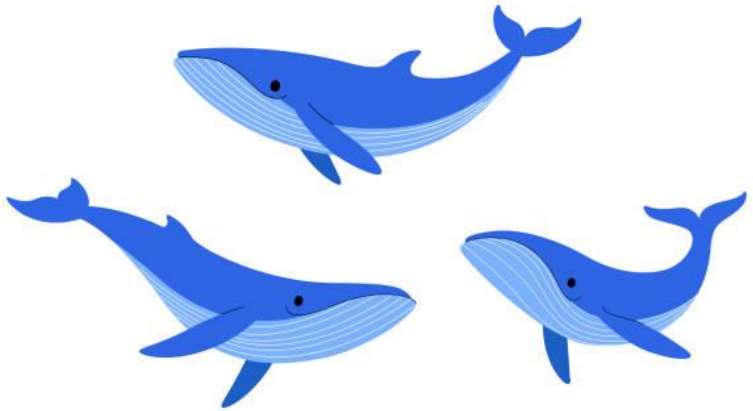


More Venus lookalikes along strike northwards?

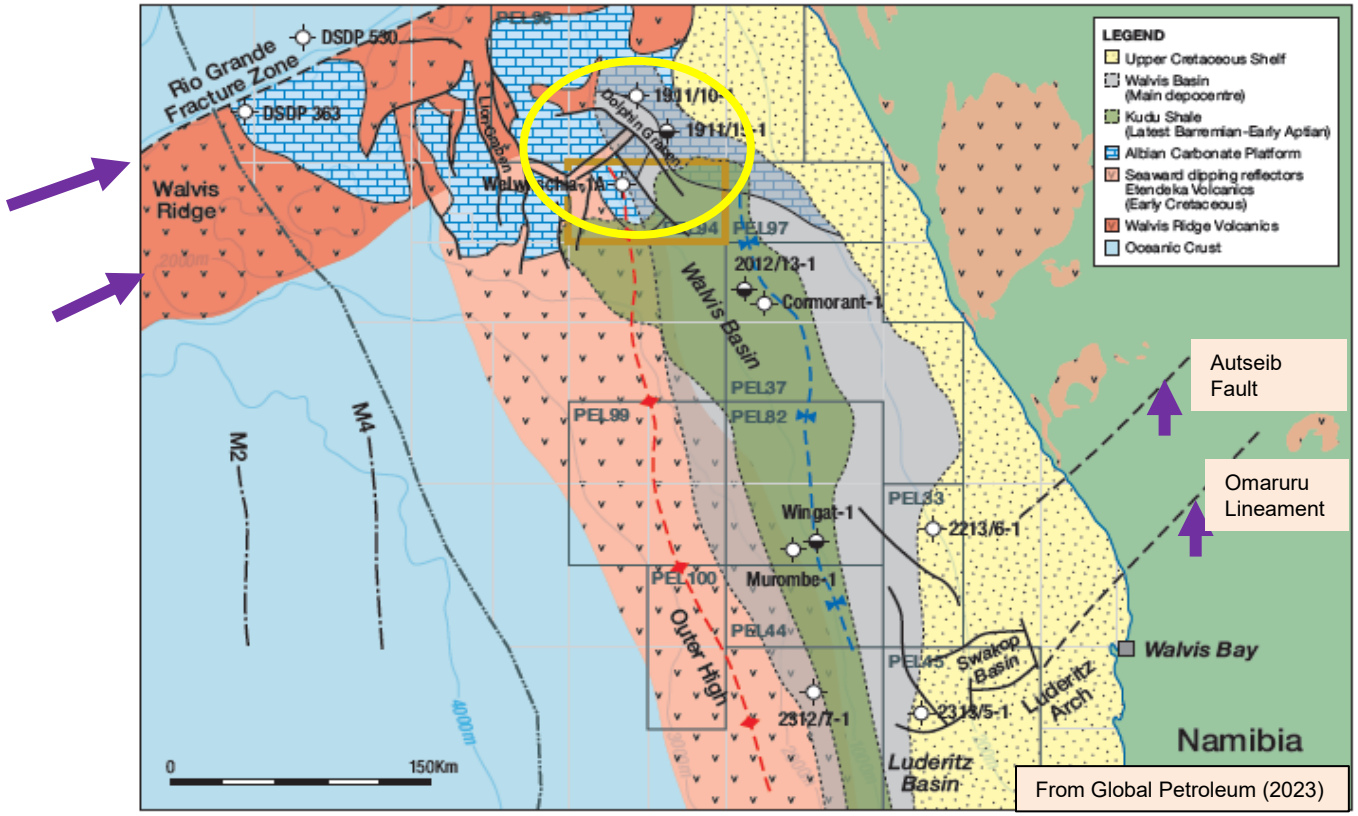


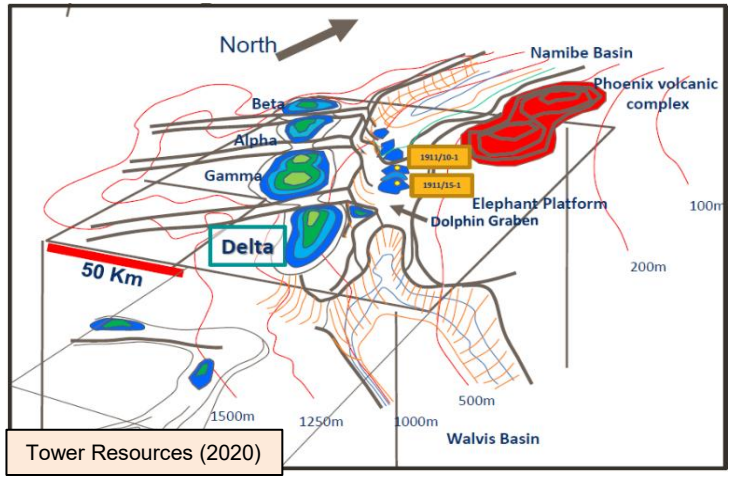
Stamper 2026

WALVIS BASIN

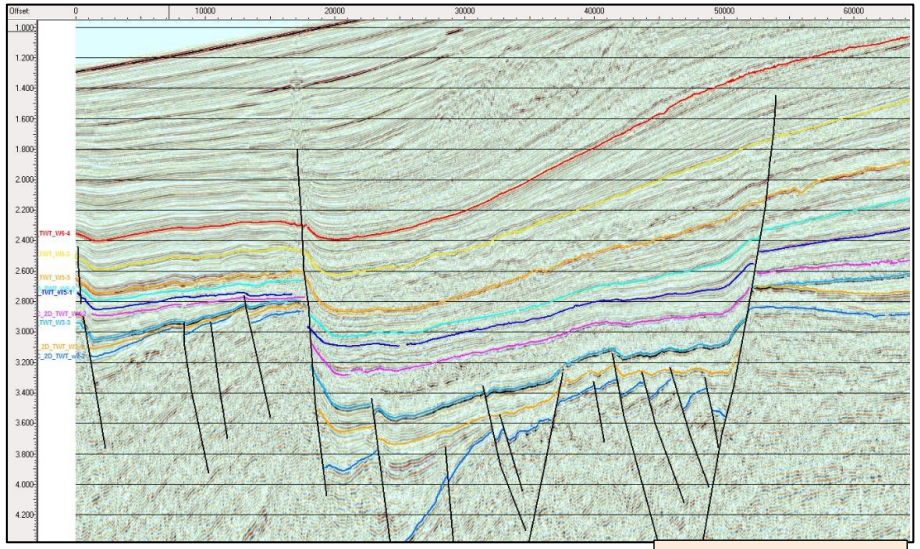


Walvis Depositional Concepts: Dolphin Graben, SW-NE Structural Elements





Tower Resources (2020)


Tower Resources (2020)

Distinct structural elements

- Dolphin Graben: possible mature syn-rift SR, as well as Aptian SR
- Rio-Grande Fracture Zone and Walvis Ridge delineating basin geometry
- SW-NE transfer faults extending deep onshore (e.g. Omaruru lineament, Autseib Fault), forming shelfal sub-basins

Walvis Basin Sediment Provenance and Reservoir Quality

Sediment Source

- Sediment supply from rather short trunk rivers (precursors of Swakop, Ugab, Huab)
- Mixed metamorphic basement rocks, Karoo shales and sandstone, volcanics

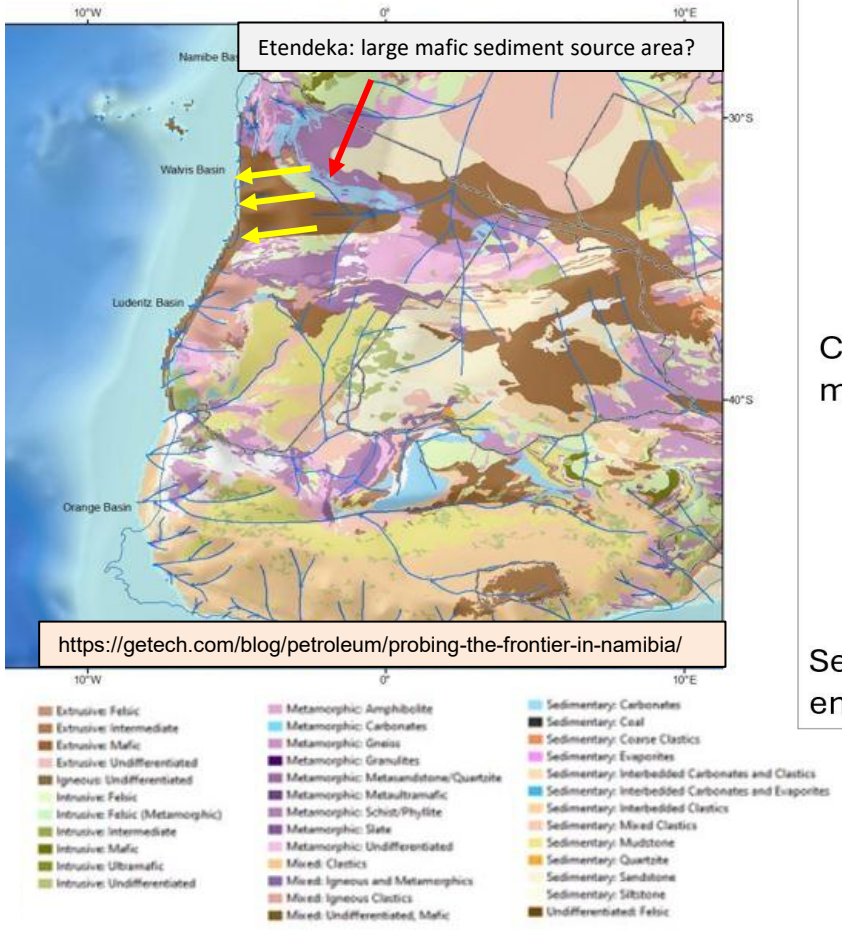
Basin Entry

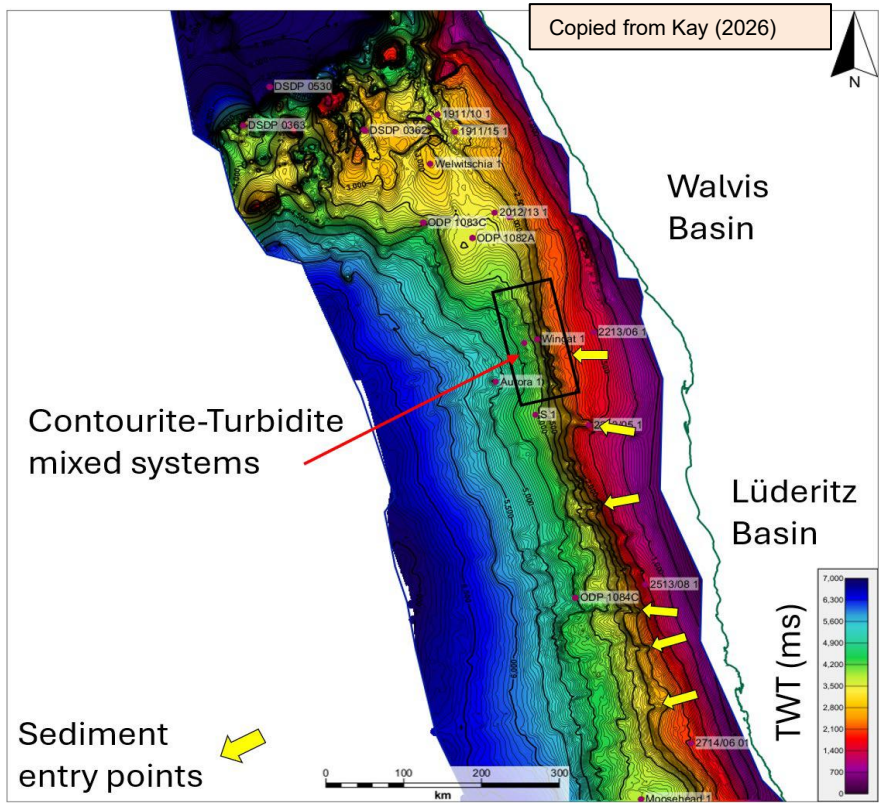
- Multiple entry point, possibly stationary because they are fault controlled

Reservoir Quality

- Excellent to limited
  - Chariot Prospect S – Upper Cretaceous excellent, deeper sands lower RQ; only limited impact of unstable minerals on RQ (Fox & Wallace 2025)
- Contourite drift may help improve RQ (active from Albian)
- Remark: little volcanic detritus in modern river bed sediments

Albian palaeosurface geology



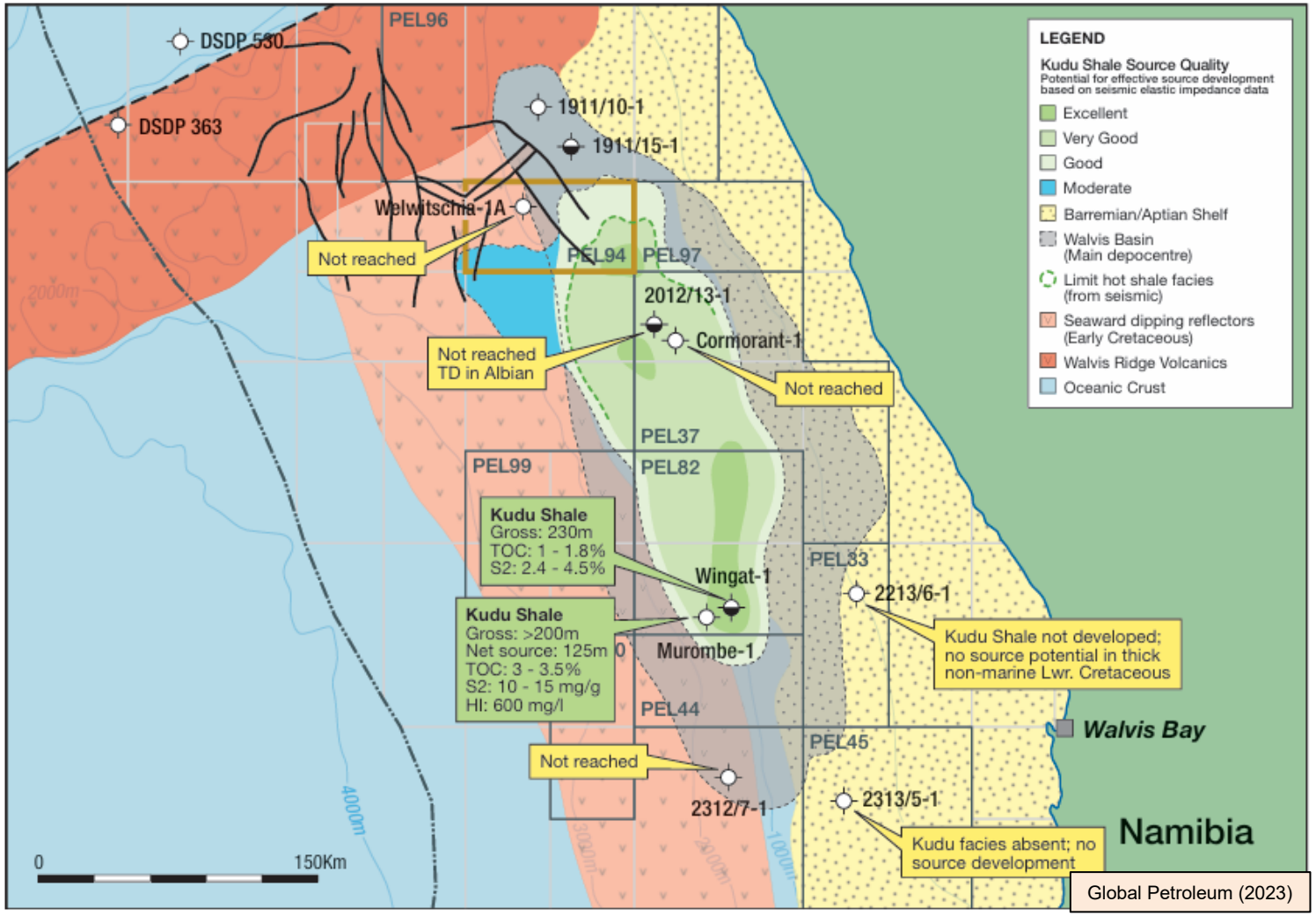


Top Cenomanian TWT map showing sediment entry points on the shelf and highlighting the presence of a mixed contourite-turbidite system along-strike of the Wingat-1 well

Walvis Basin Source Rock Presence and Maturity

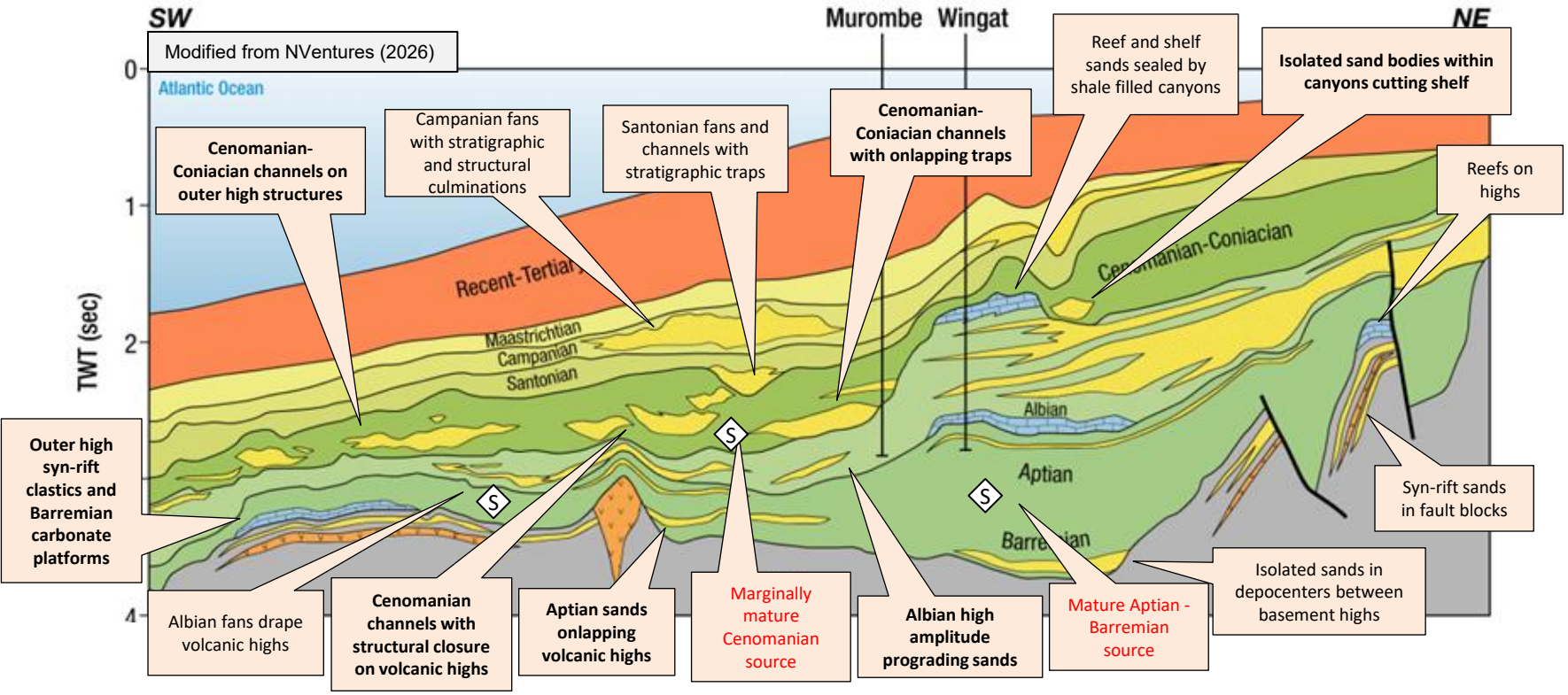
- Aptian Shale consistently developed across the Walvis depocenter, with >200 m gross and up to 125 m net marine source intervals in calibrated wells (Murombe-1, Wingat-1)
- High-quality Type II kerogen confirmed in Murombe-1 (TOC 3–3.5%) with strong oil-prone potential
- Seismic impedance mapping delineates broad source fairways aligned with Lower Cretaceous structural lows and Barremian - Aptian shelf architecture
- Thermal maturity trends improve seaward, with deeper Walvis kitchens positioned to charge both Cretaceous structural closures with potential to charge younger stratigraphic traps

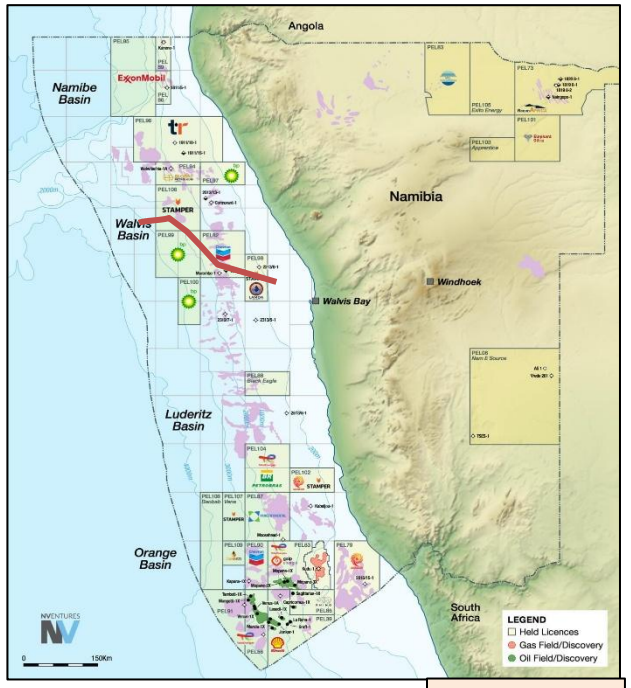
The Walvis Basin has a well-calibrated marine source system, with charge confidence strongest across the central depocenter and adjacent PELs



Global Petroleum (2023)

Schematic Geological Dip Section For The Walvis Basin

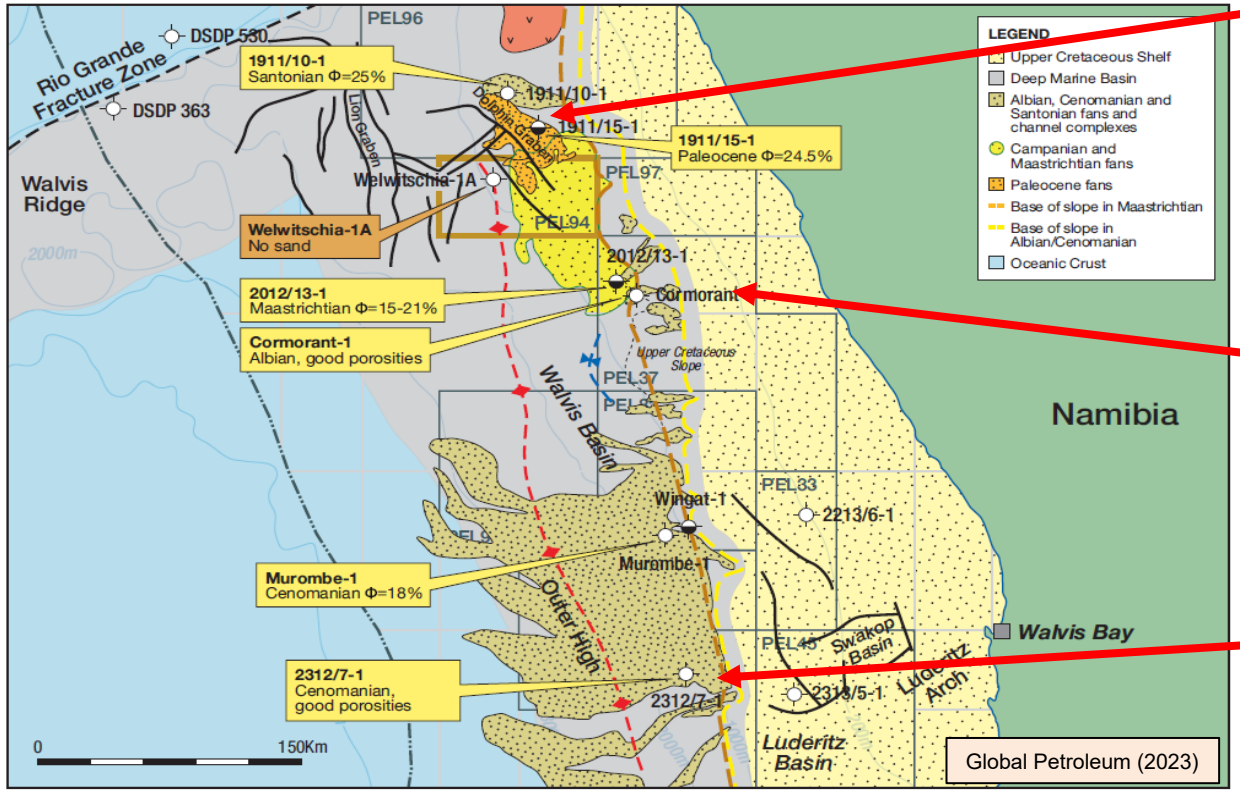




Stamper (2026)

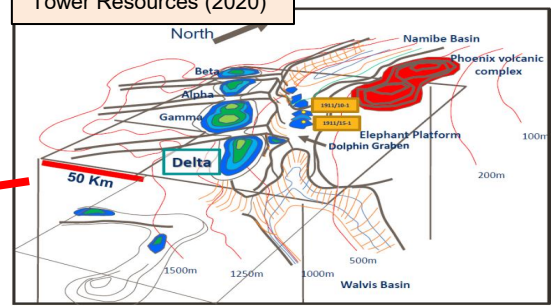
- Barremian (Syn-rift): Fault-bounded lacustrine, fluvial, and alluvial fan deposition within active grabens; localized volcaniclastic input
- Aptian (Transitional): Early marine flooding producing shallow-marine mixed clastics and carbonates; interval includes marine source rock
- Albian (Early Drift): Establishment of a shelf–slope system with turbidite channels and carbonate - turbidite hybrids (Wingat/Murombe targets)
- Cenomanian - Coniacian: Fully marine deepwater turbidite systems (channels, lobes, basin-floor fans) fed by continental drainage
- Santonian to Tertiary (Drift Stage): Transition from hemipelagic slope muds to contourite drifts and reworked deepwater mudstones, reflecting reduced clastic supply and strong bottom current influence

Walvis Basin Plays

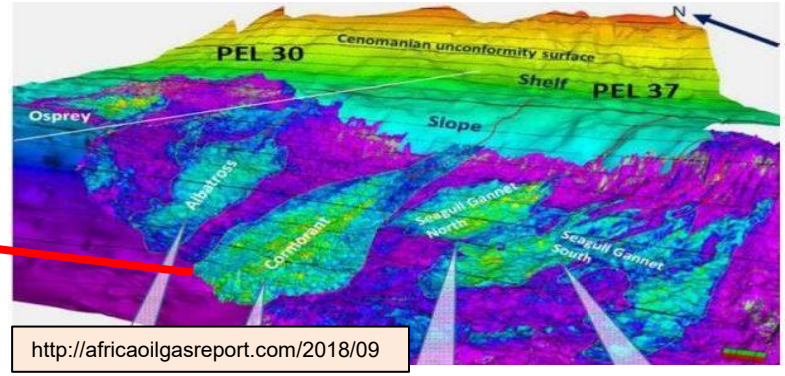


Walvis Basin Cretaceous / Paleocene Facies and Reservoirs

Tower Resources (2020)

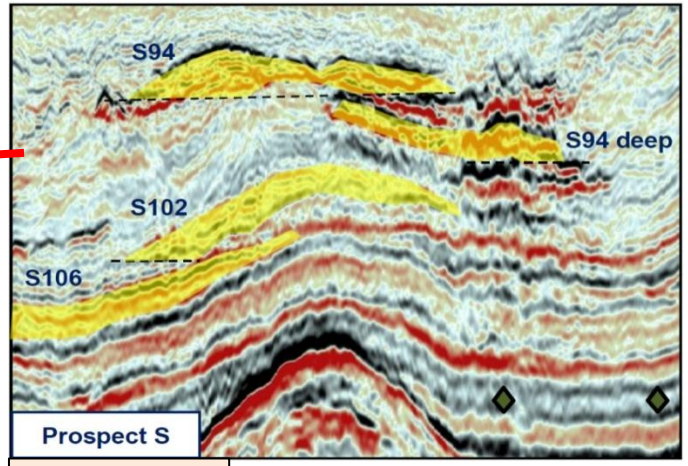


Dolphin Graben architecture with leads



http://africaoilgasreport.com/2018/09

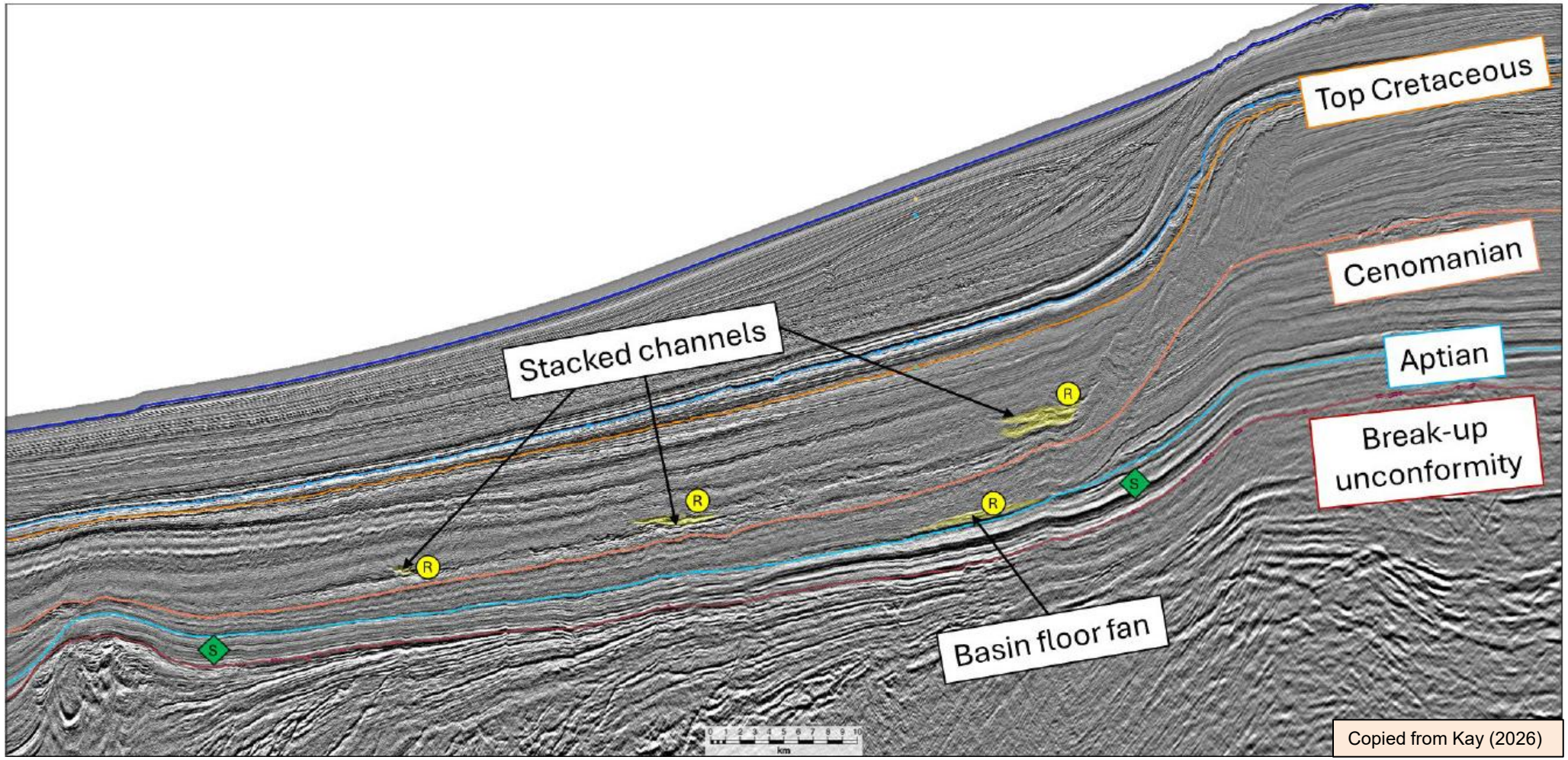
Lower Slope Cretaceous Turbidite plays



Chariot Oil & Gas

Deep water Cretaceous Turbidite play over volcanic intrusion

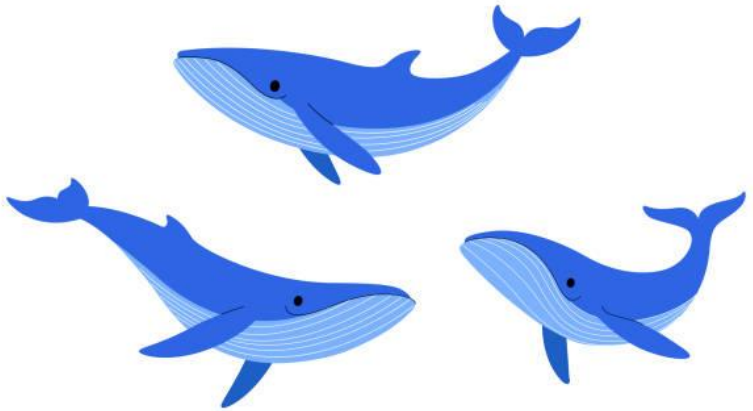
Walvis Basin Plays



Dip example in TWT across the Walvis Basin showing play elements and potential stratigraphic traps in the Albian and Upper Cretaceous

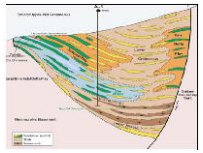
Offshore Namibia Basins Comparisons



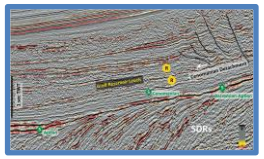


Orange Basin vs Walvis Basin – Direct Comparison

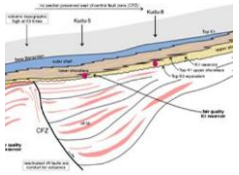
Orange Basin



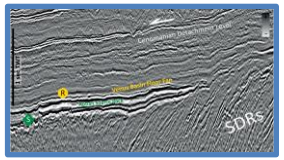
Inboard Grabens – AJ-1
- Established in S-Africa



East of Outer High - Graff, Mopane, etc.
- Stacked slope-channel complexes
- Ponding against Outer High
- Fold and Thrust structures augment trapping configuration
- Charge access to deeper SR

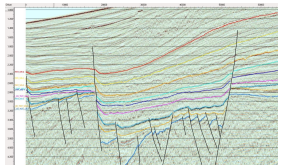


Intra-volcanic - Kudu
- Excellent reservoir - mature sands
- Paleo-morphologic feature - Kudu High



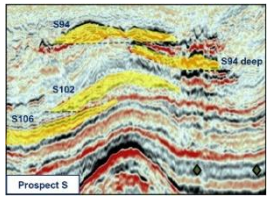
West of Outer High - Venus
- SR on oceanic crust, good heatflow
- (Influence of Vema hotspot?)
- Counter-regional dip and onlap against Outer High
- Short migration path (Reservoir directly on SR)
- Long sediment transport, contourite drift improving RQ

Walvis Basin



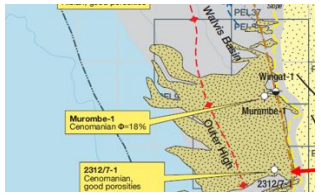
Inboard Grabens
- 2213/6-1 Dry
- Dolphin Graben further downdip, 1911 wells dry
  - Multiple opportunities remaining

East of Outer High
- Excellent RQ in stacked channels, indication of turbidite-contourite systems
- Drape over volcanic features (e.g. Wingat)
- Limited Cretaceous MTCs
- ? Charge access to deeper SR



Intra-volcanic
- Unknown – possible within syn-rift graben (likely lower maturity source)

West of Outer High
- ? Warm transitional-oceanic crust as in Orange
- ? Counter-regional dip
- Reservoir likely present, fans extending west of Outer High mapped, indication of turbidite-contourite systems
- ? RQ of Albian sands



Summary – First Principles; Implications for Exploration

Exp. Risk	Orange Basin (Data Driven)	Walvis Basin (Model Driven)	Walvis Critical Unknowns	Implications for Exploration
Source	• Thick Aptian - Albian SRs • Deep; oil and gas window • Charge proven across multiple depocenters	• Thick Aptian - Albian SRs • Favourable oil-window burial suggests more liquids rich • Potential in Late Cretaceous	• The extent, thickness, and continuity of Aptian - Albian SRs • Maturity variations across volcanic/transitional crust	• **Walvis offers a more liquids weighted charge system** • There may be more uncertainty in SR distribution and maturity
Reservoir	• High-quality turbidites sourced from a major river system • Predictable sand delivery into large depocenters	• Cleaner focused sands from contourite - turbidite interaction • Drift bodies typically extensive • Canyon fed systems common	• Distribution and thickness of drift enhanced sands • Connectivity of canyon systems • Imaging issues with volcanics	• **Reservoirs likely high quality where present** • Exploration is fairway led and depocenter specific
Charge	• Strong system with deep burial and high maturity • Results in potential for mixed oil and gas outcomes	• Oil weighted charge from moderate burial • Potential for localized transitional crust heat flow	• Depth of SR burial in key depocenters • Heat flow variability • Migration pathways	• Walvis charge is more oil prone • **High potential commerciality if SR aligns with trap geometry**
Trap	• Large high relief structural traps • Gravity driven fold and thrusts • Additional stratigraphic traps along slope and basin floor	• Scalable stratigraphic and structural traps tied to drifts, volcanic highs, and canyons • Subtle stratigraphic closures	• Seal capacity over volcanic highs • Continuity of contourite enhanced sand bodies • Effectiveness of subtle closures	• Walvis traps include both structural and stratigraphic • **Subtle closures on regionally extensive stratigraphic plays**

- **The Orange Basin works because of thickness, maturity, and gravity driven trap formation**
- **The Walvis Basin is expected to work where SR maturity, reservoir quality, and localized trap geometries coincide**
- **Walvis shares key elements with the Orange Basin, but its potential will be defined by targeted exploration**

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