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Karoo-related basin-forming fault systems of northern Namibia

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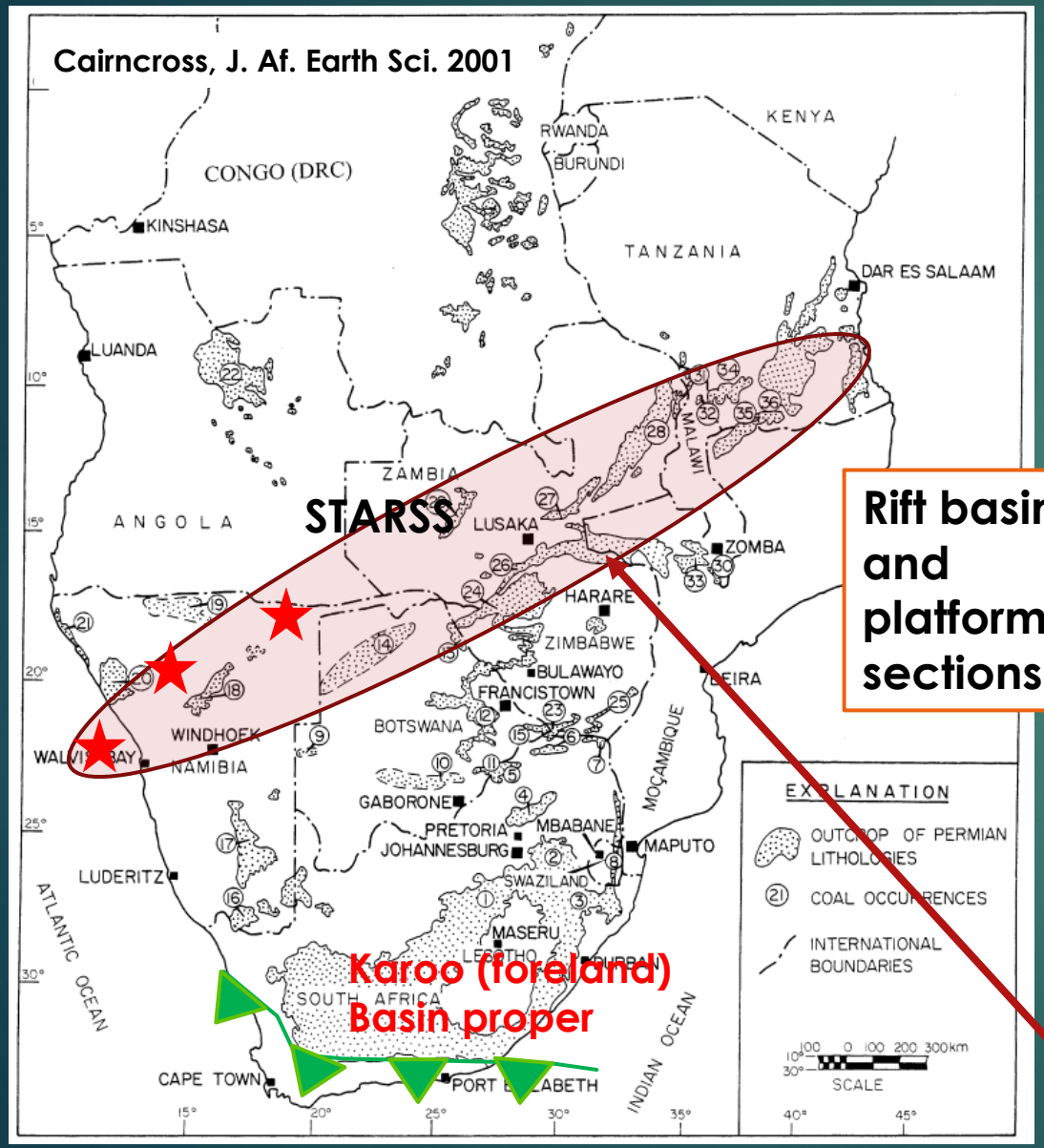
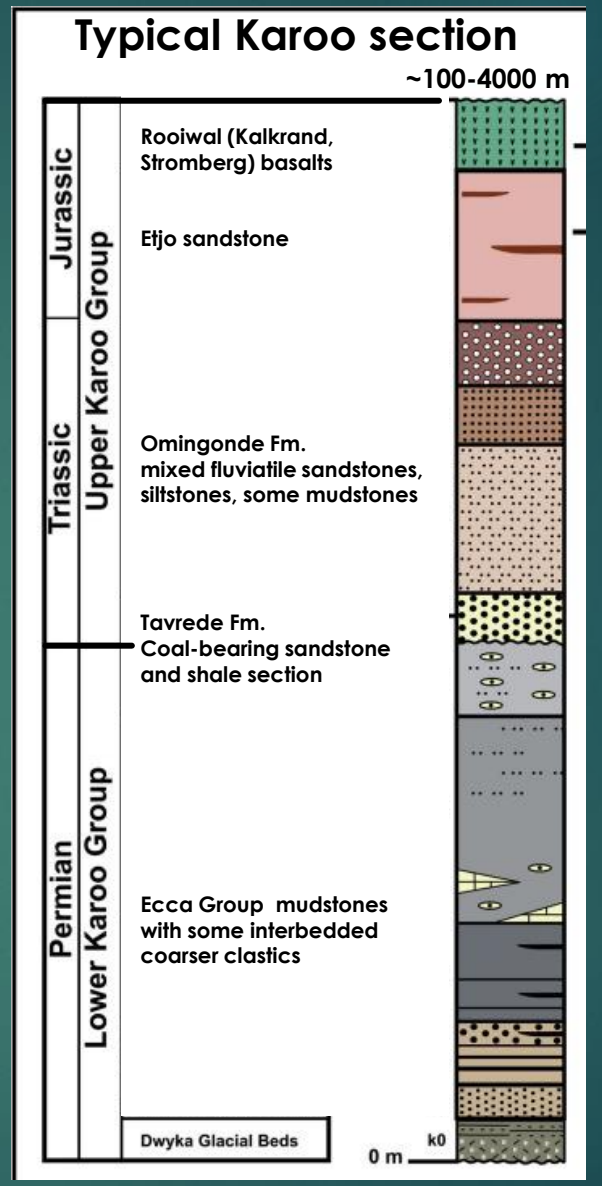
OUTLINE

- What and where is *Karoo*?
- Southern Trans-African rift and shear system: STARSS
- How STARSS relates to older and younger geology
- Elements within STARSS, especially in Namibia
- Kinematics of the system, emphasizing Namibia
- Observations on inversion of selected elements
- Petroleum implications

What and where is *Karoo*?



Rift basins and platformal sections

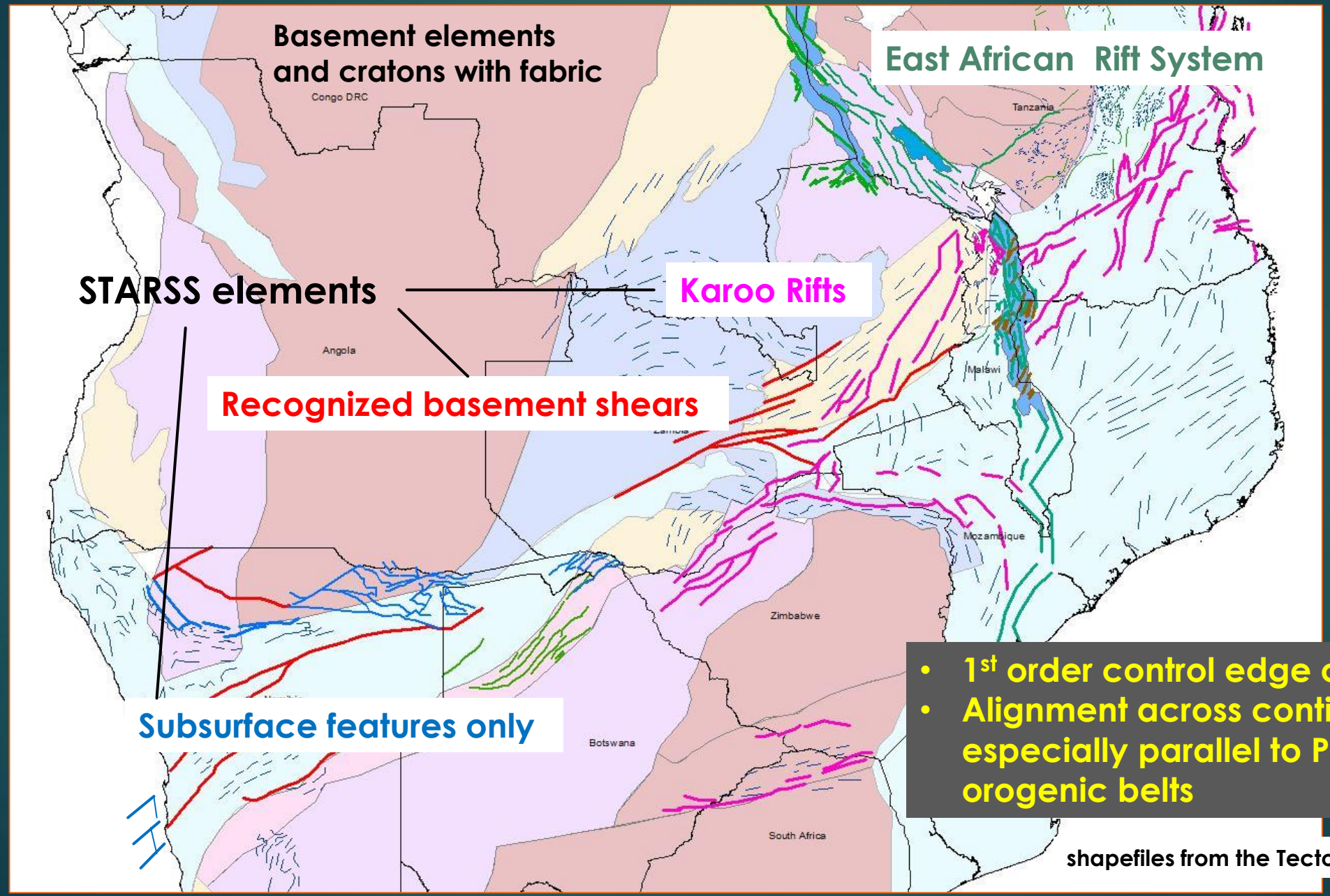


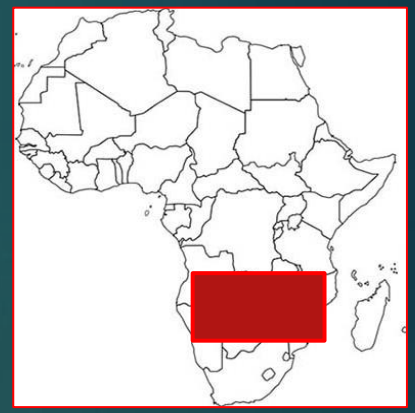
Supergroup with coarsening upward section; tectonically expanded periods of lacustrine and/or marine section

Glacial section

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

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

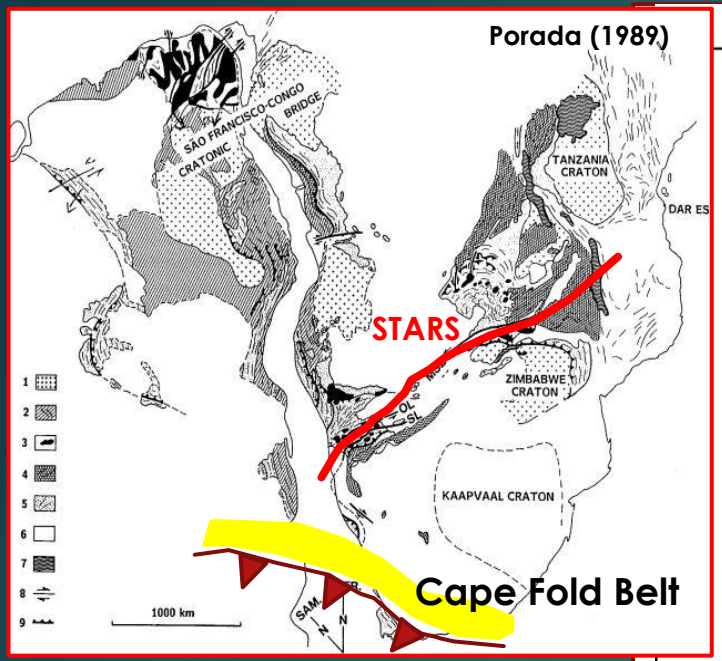


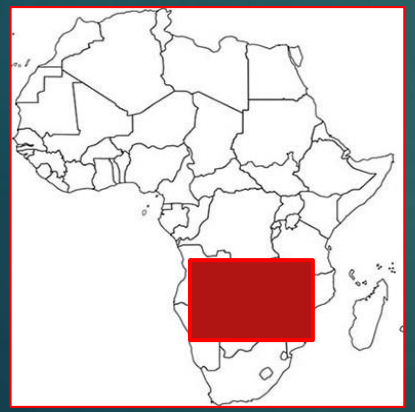


- 1st order control edge of cratons
- Alignment across continent evident, especially parallel to Pan-African orogenic belts

shapefiles from the Tectonic Fabric of Africa

STARSS feature synthesis for 2020





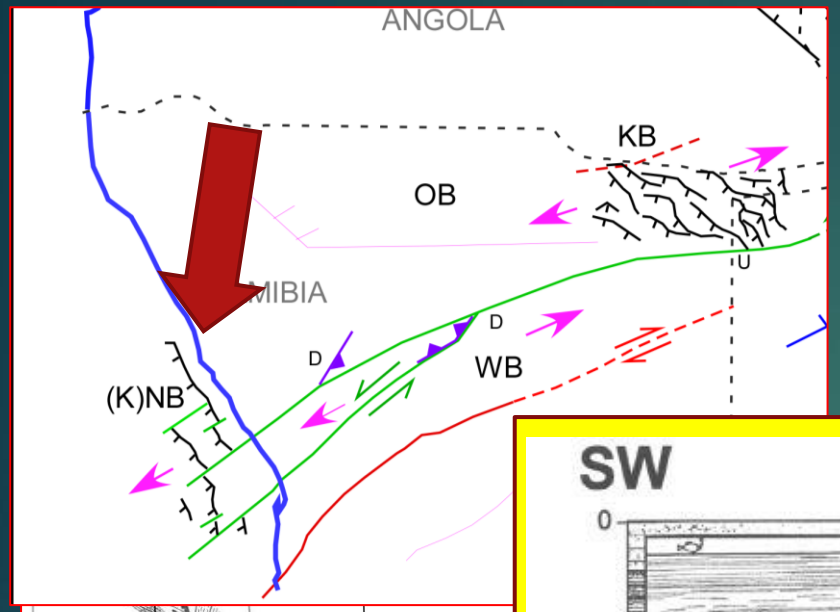
BB Barotse Basin
CB Caprivi Basin
KB Kavango Basin
(K)NB (Karoo) Namib Basin
LB Luangwa Basin
LM Lake Malawi
MB Mariamba Basin
OB Owambo Basin
OR Okavango Rift
RG Ruhuhu Graben
WG Waterberg Rift
ZG Zambezi Graben

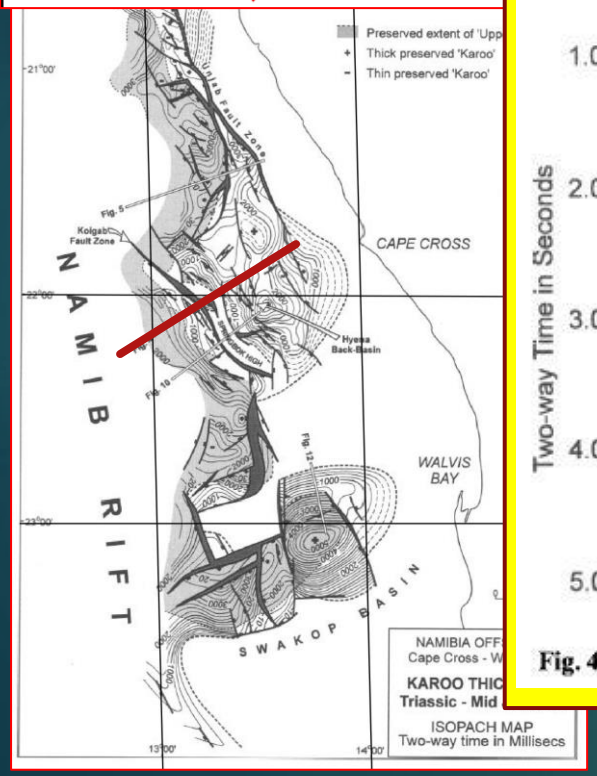
Atlantic Ocean
DRC
TANZANIA
ZAMBIA
MALAWI
MOZAM
ANGOLA
NAMIBIA
ZIMBABWE
BOTSWANA
RSA
RG
LM
MB
LB
ZG
BB
KB
OB
OR
CB
WB
(K)NB
D
U
Malawi reconstruction
g

Left-lateral interpretation in green
Right-lateral interpretation in red
Extensional features in black
Thrust features in purple
East African-age rifting in blue

(Karoo) Namib Basin

Extensional basin under drift sequence inboard and below Atlantic rift opening





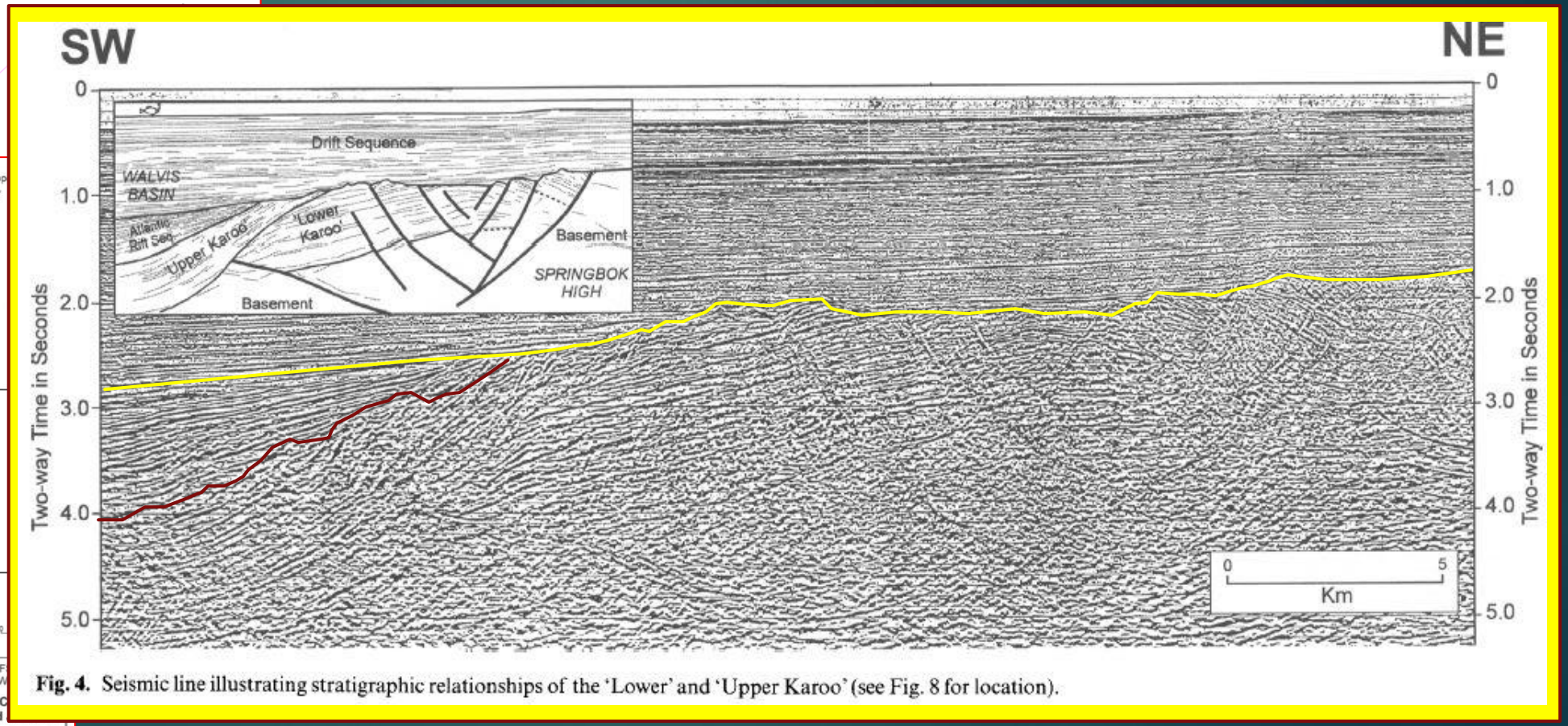
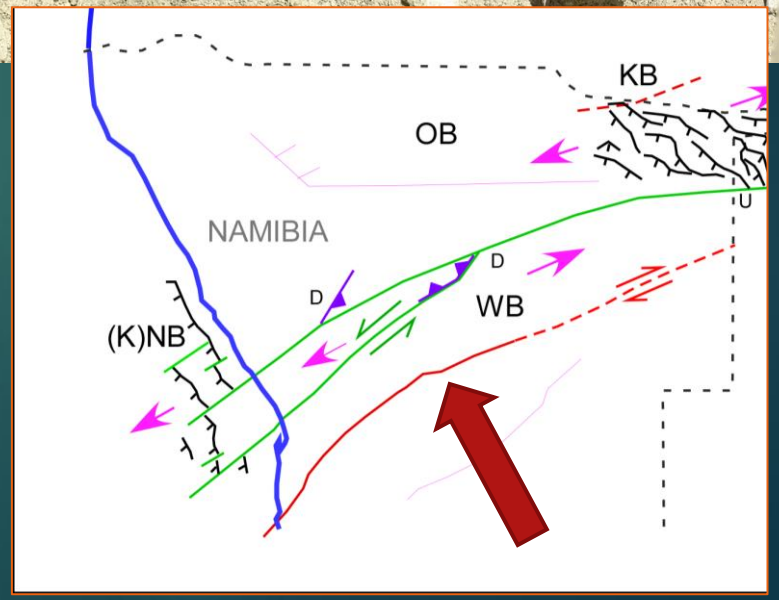


Fig. 4. Seismic line illustrating stratigraphic relationships of the 'Lower' and 'Upper Karoo' (see Fig. 8 for location).

Clemson, Cartwright, & Swart 1999: Geol. Soc. London Spec Publ. 153

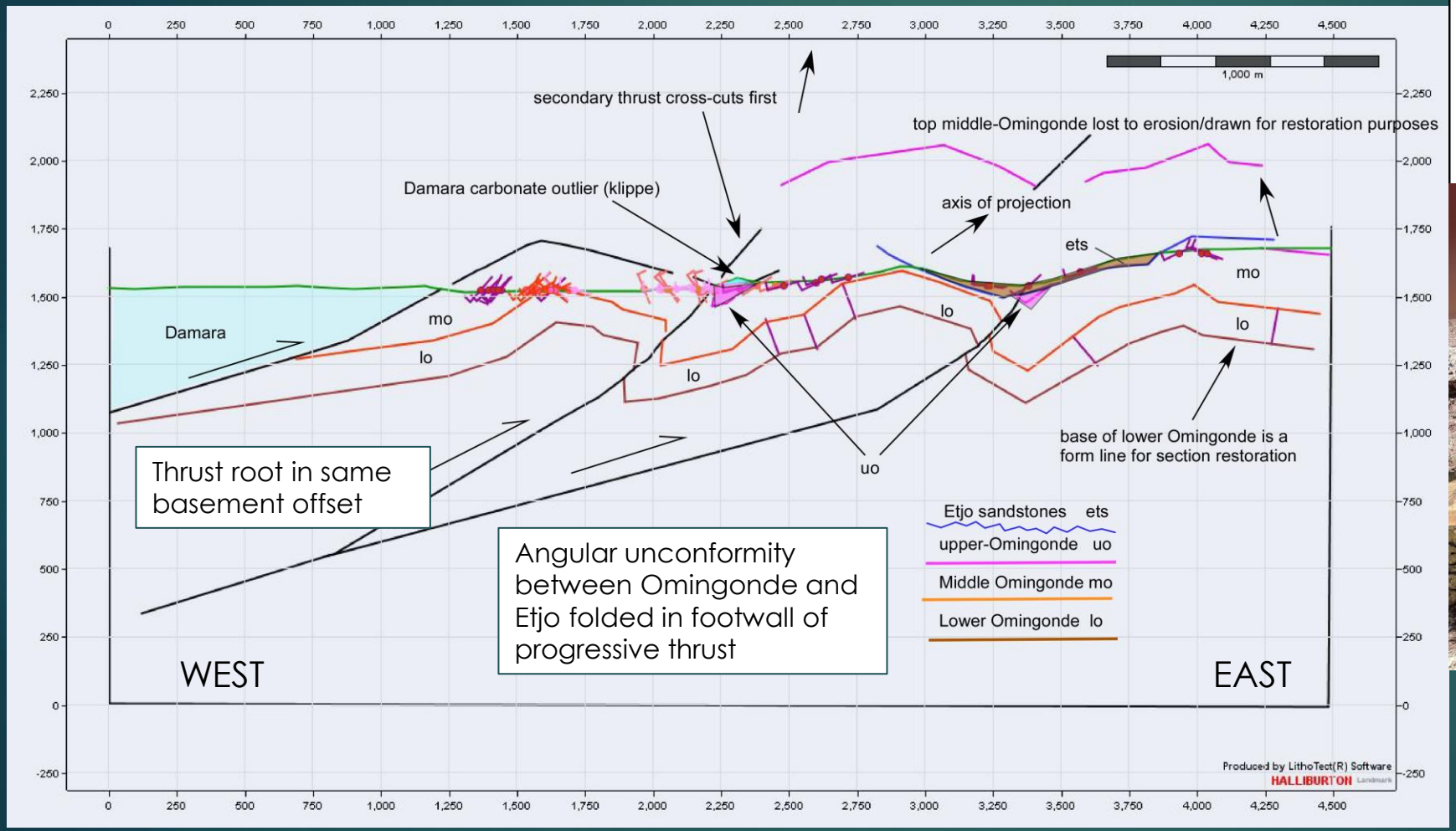
Okahandja lineament

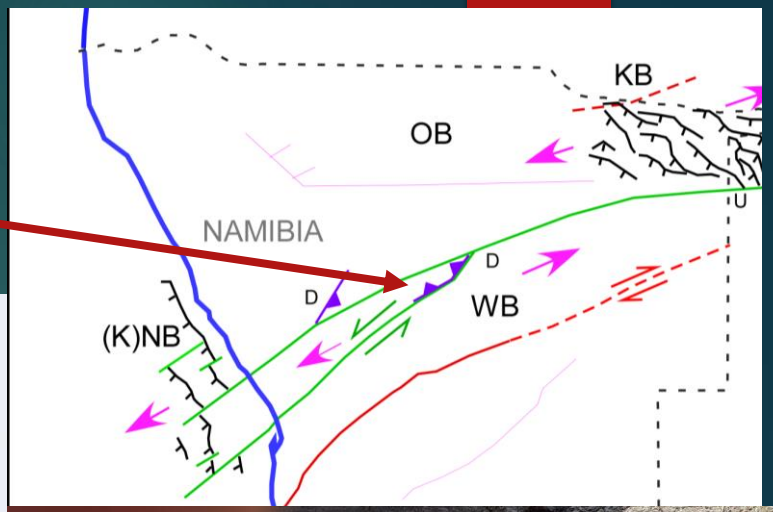
Horizontal slickenlines > strike slip motion



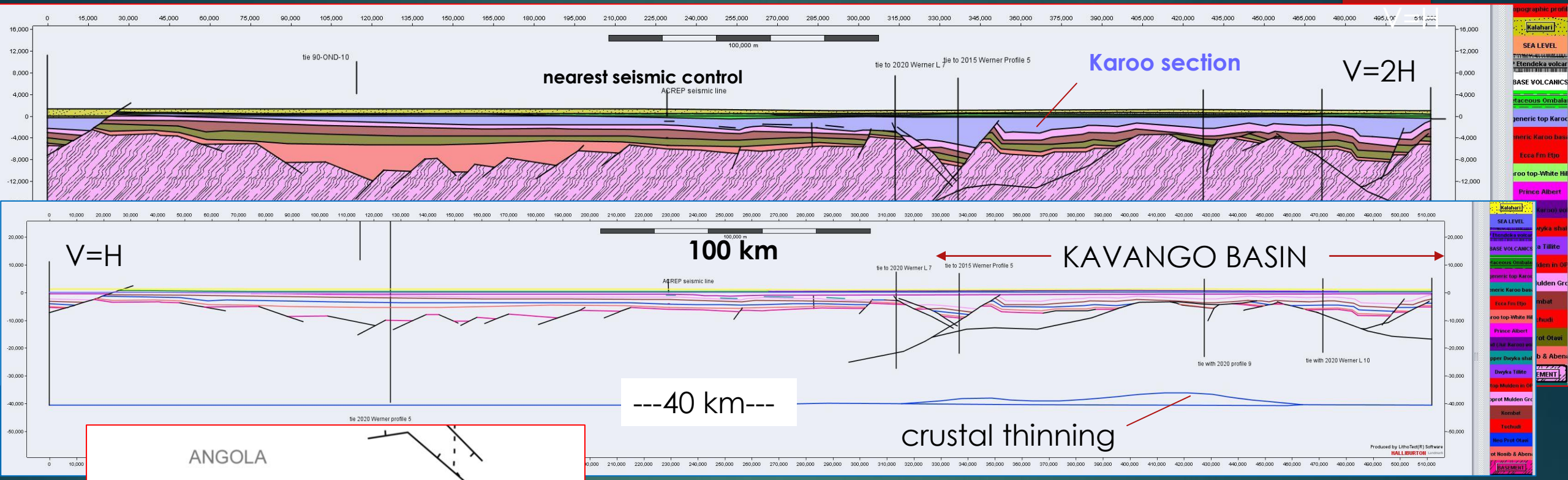
Waterberg Basin, Waterberg thrust

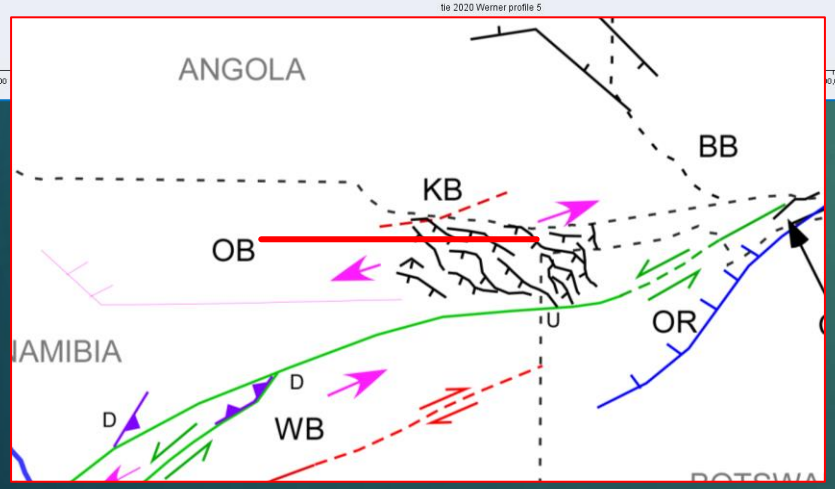
Syn- and late/post Karoo inversion of extensional fault

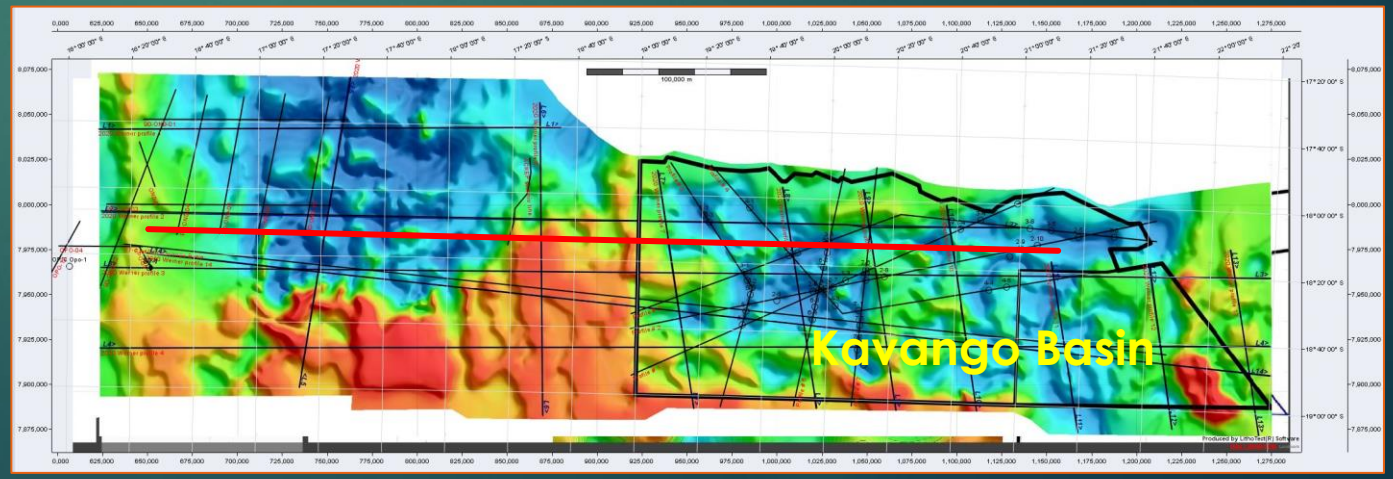




Kavango to Owambo Basin crustal scale profile



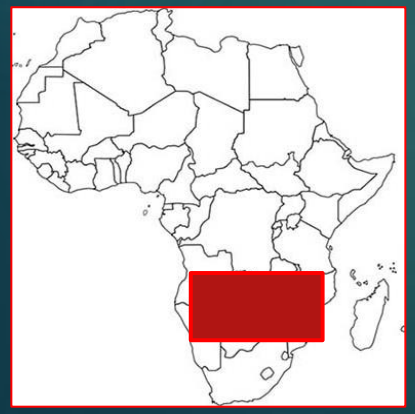


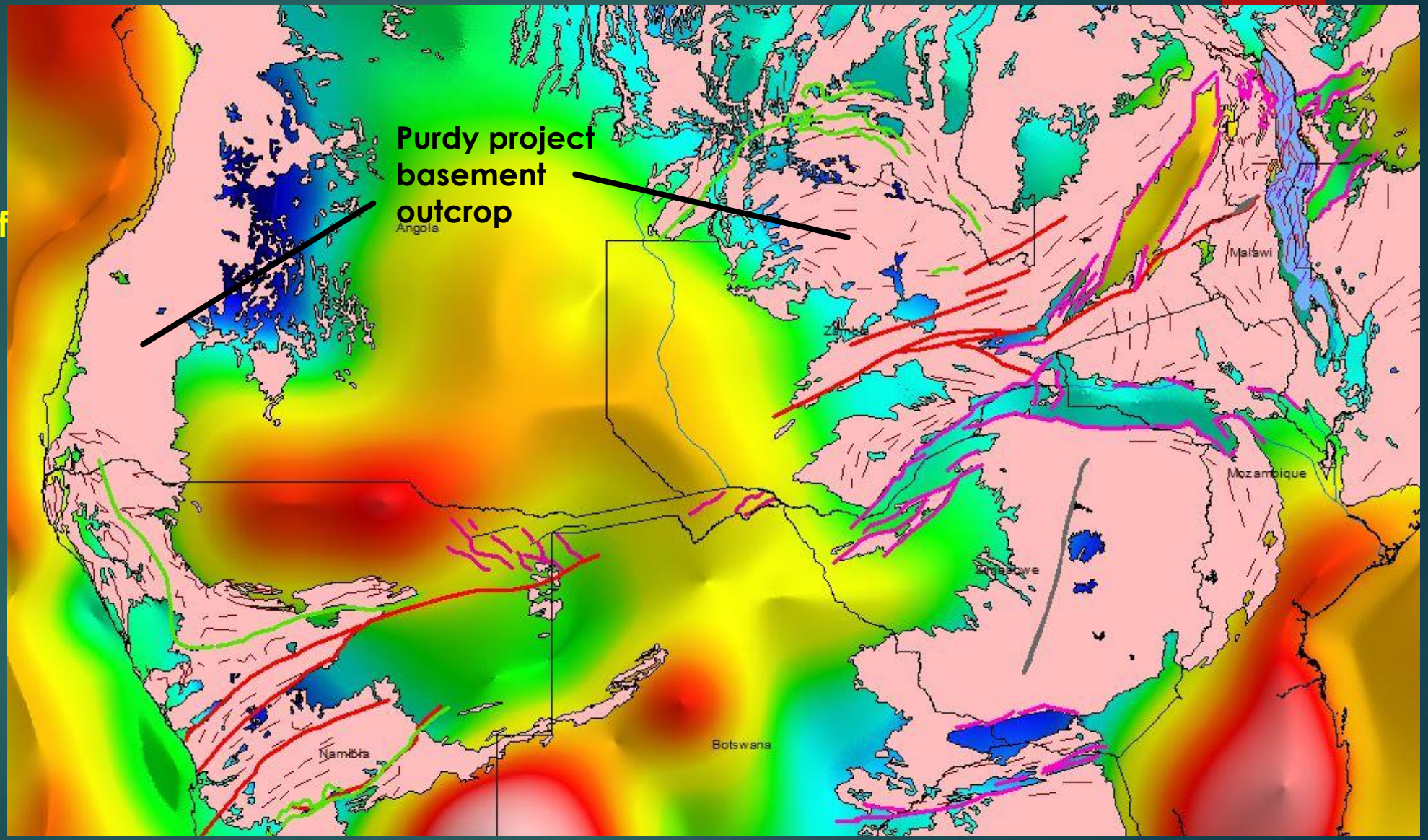


Courtesy Reconnaissance Energy Africa RECO

Central STARSS with hydrocarbon potential

- 2016-18 view of outcropping elements
- 'Rimming' uplifts of Africa
- Central African cover of older basins

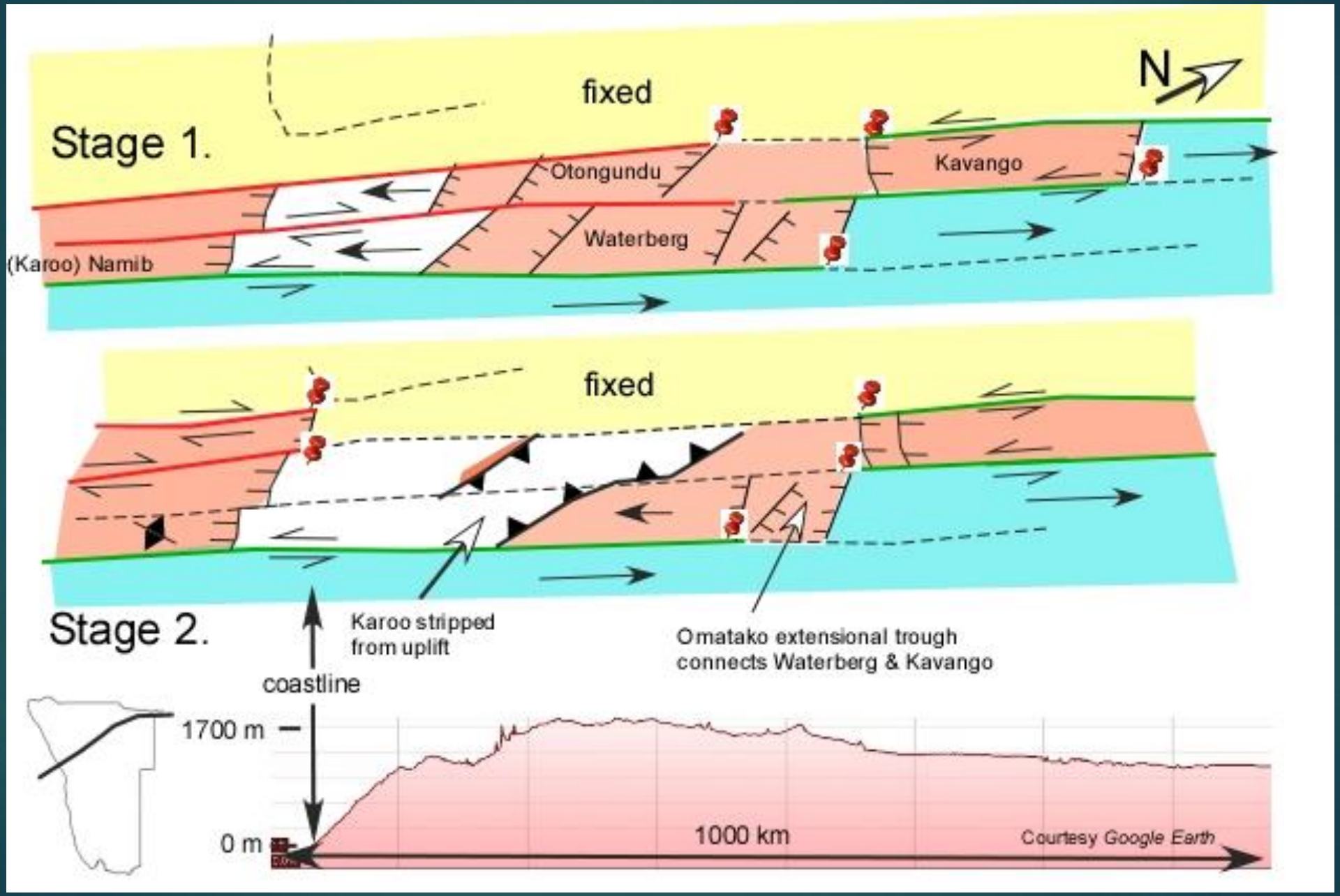




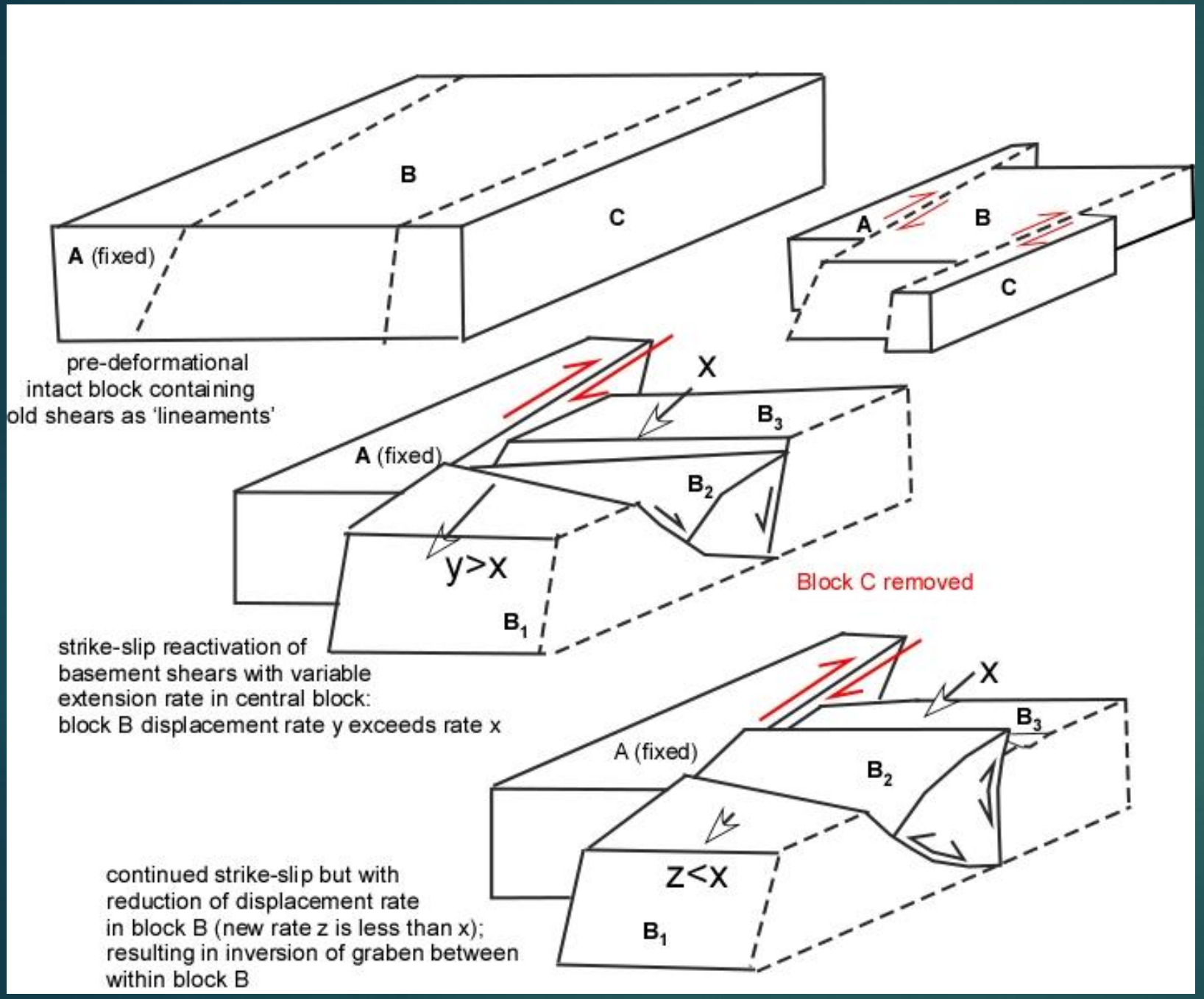
Marimba sediment thickness Inversion

Grizzly Geosciences

Evolution of system: extensional basin opening thru senesence and inversion



Synkinematic inversion



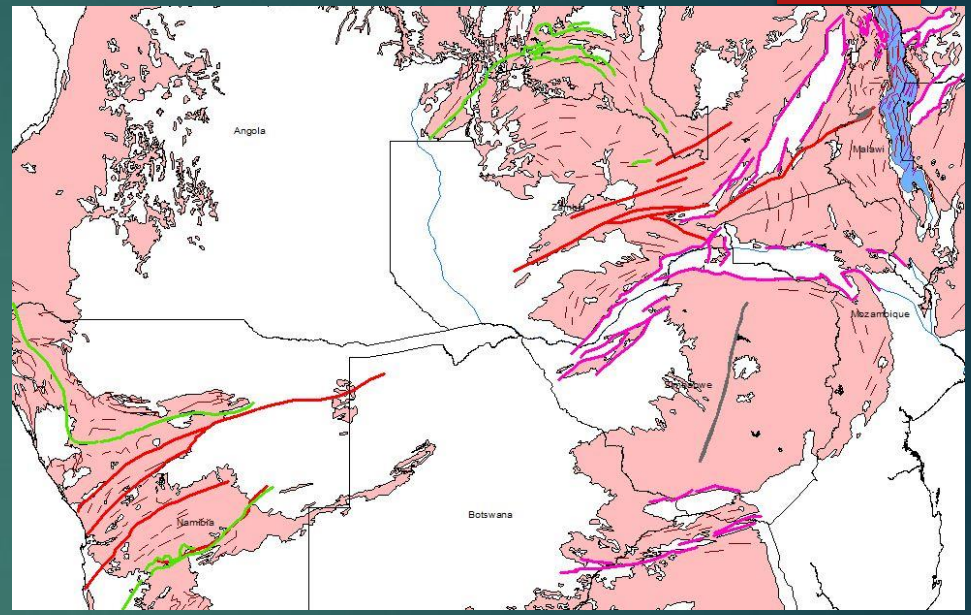
Senescence and changes in differential motion between blocks can lead to

- **Changes in relative motion on s/s faults**
- **Inversion of older extensional elements**

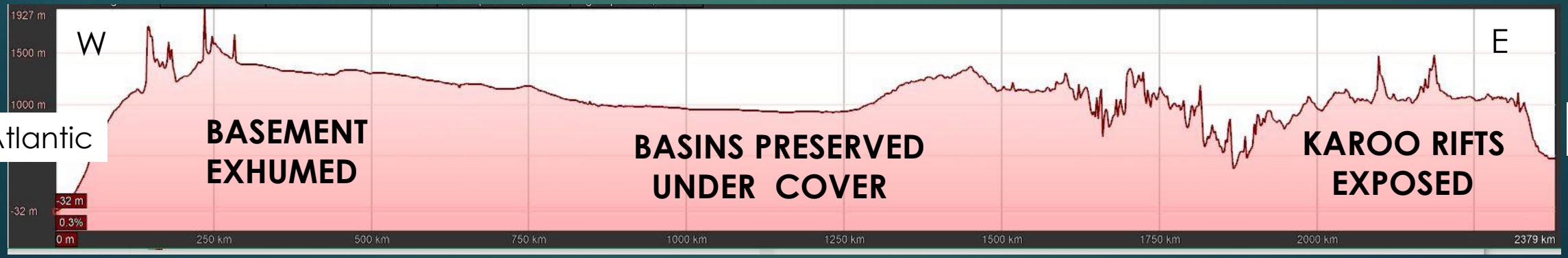
CONCLUSIONS

Petroleum implications for Karoo basins

- 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



Purdy project basement outcrop



2000 m

Atlantic

Indian

Sea level

Trans-African topographic profile—Google Earth