Karoo tectonics of Northern Namibia

James W. ("Jim") Granath
Consulting structural geologist
Denver area, Colorado
representing
Reconnaissance Energy Africa, Ltd.

ReconAFRICA

JWG

Aspects of Karoo geology

Dispersed outcrops of Karoo

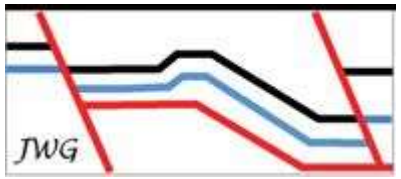
Organized system across Africa (“STARSS”)

- Offshore Namib Basin (not the Namibe)
- Kavango Basin
- Waterberg Basin and its inversion

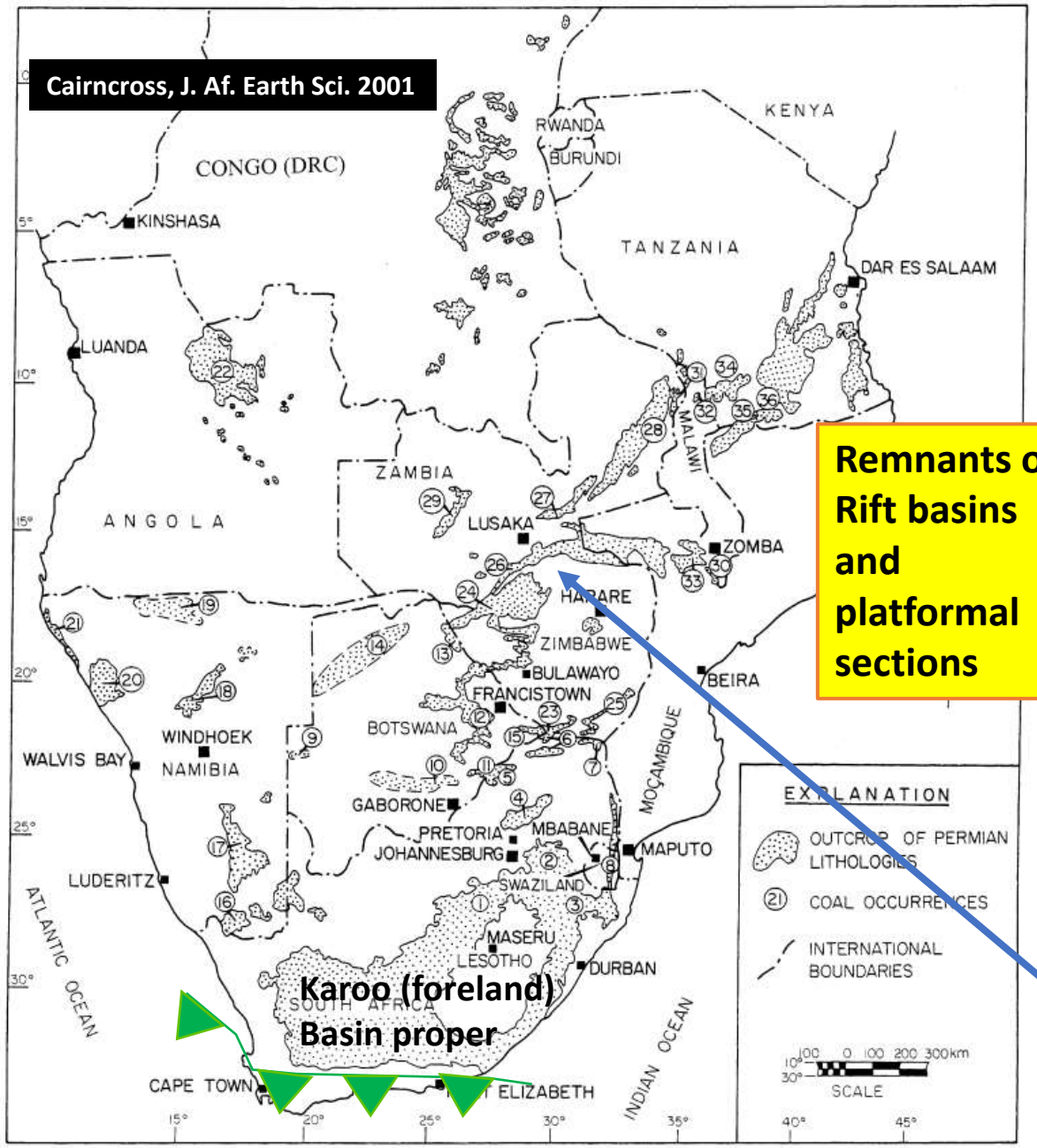
Block tectonics and regional uplift

Synthesize into working hypothesis on tectonics

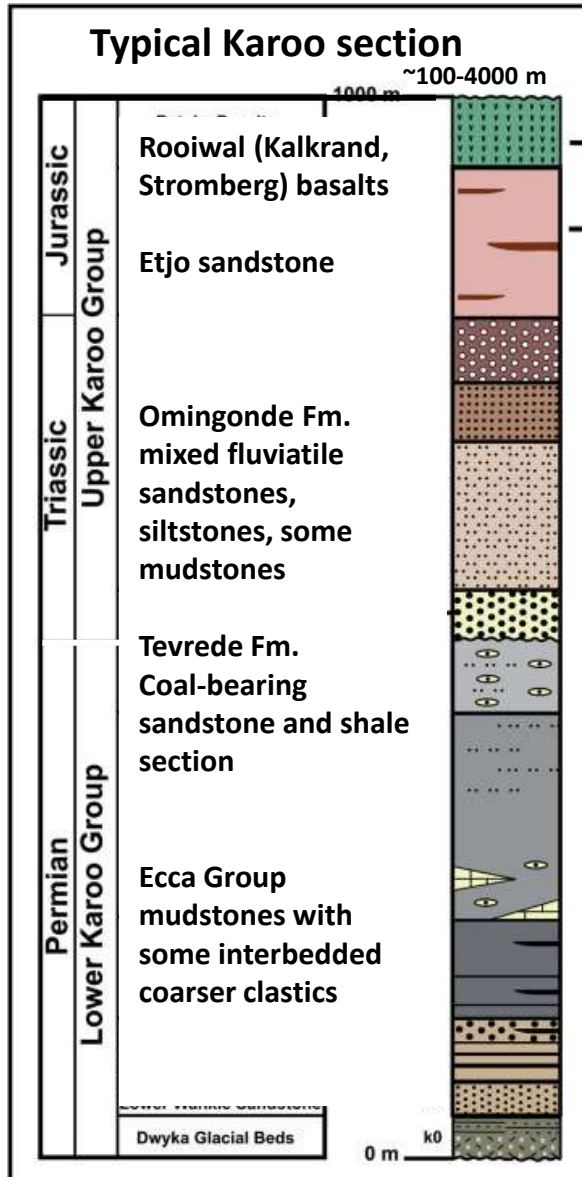
Petroleum prospectivity



Karoo outcrop and 'STARSS'



Remnants of Rift basins and platformal sections



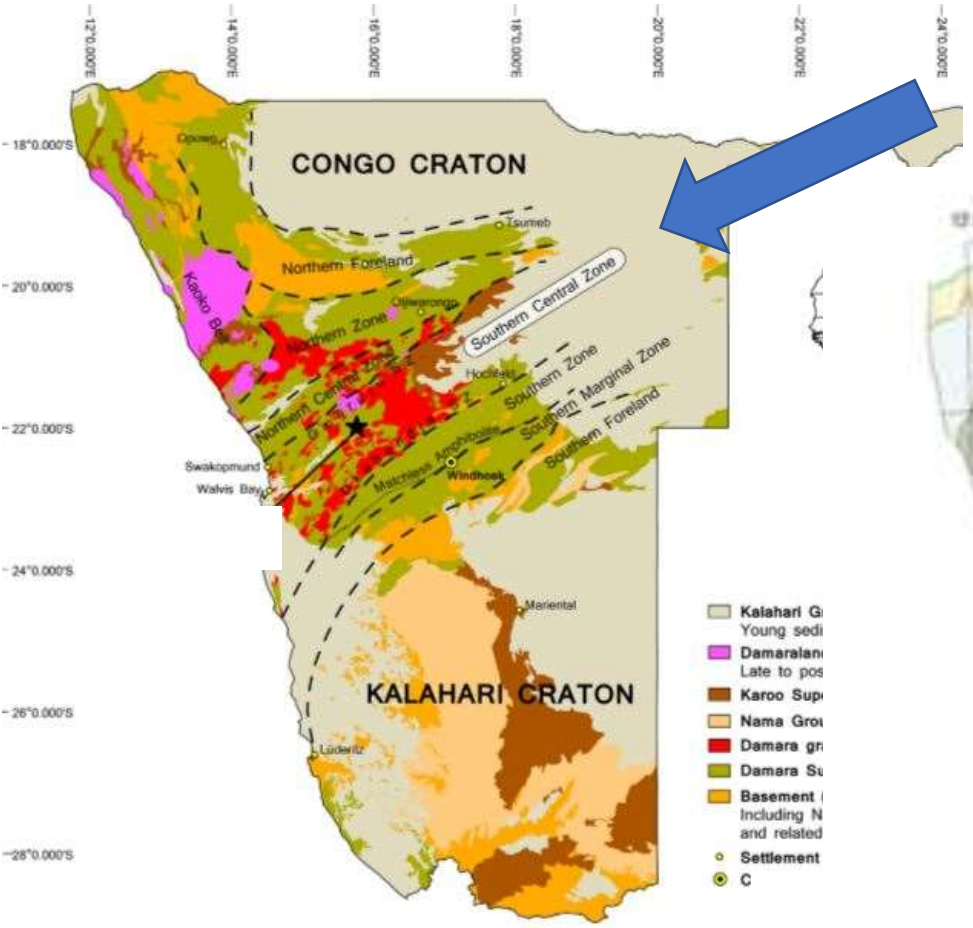
Supergroup with coarsening upward section; tectonically expanded periods of lacustrine and/or marine section

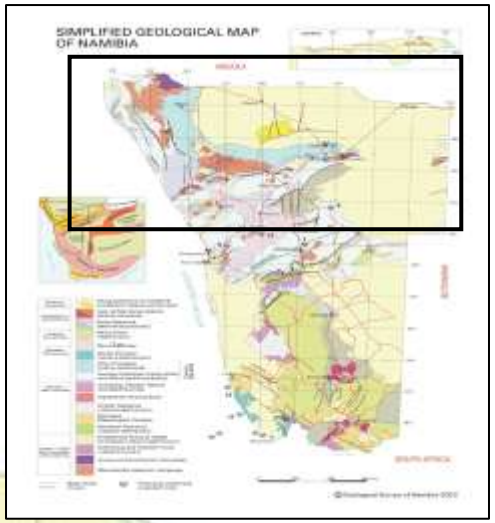
Glacial section

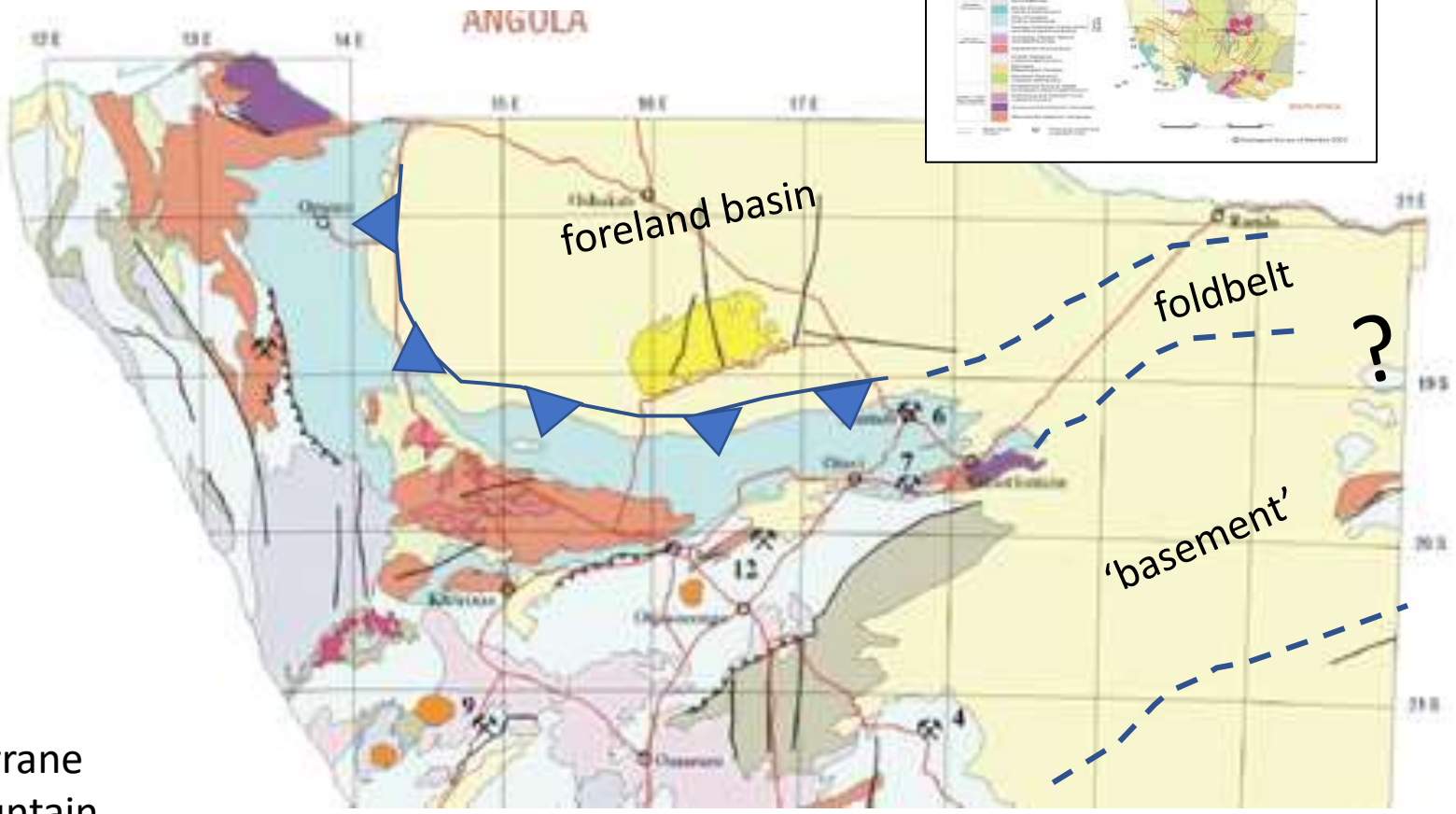
Lithologies shown for Zambezi graben, from Viglietti et al., J. Af. Earth Sci. 2018

Namibian Tectonics/Geology

'Zones' in Damara separated by lineaments that mark the boundaries of different elements in the orogenic belt



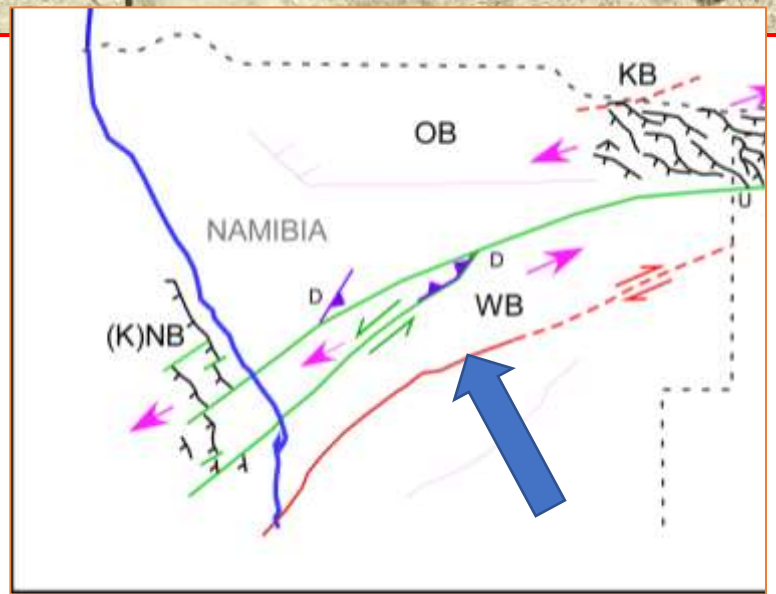




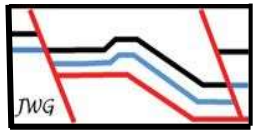
Lineaments as 'zone' or terrane boundaries within the mountain belt become the controlling factor in later development

Damara 'provinces/belts' continue under the Kalahari cover

Prominence of Lineaments



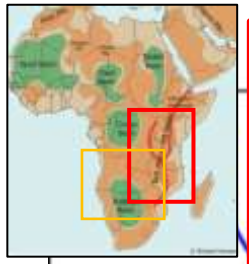
Okahandja lineament
Horizontal slickenlines > strike slip motion developed in PC granites

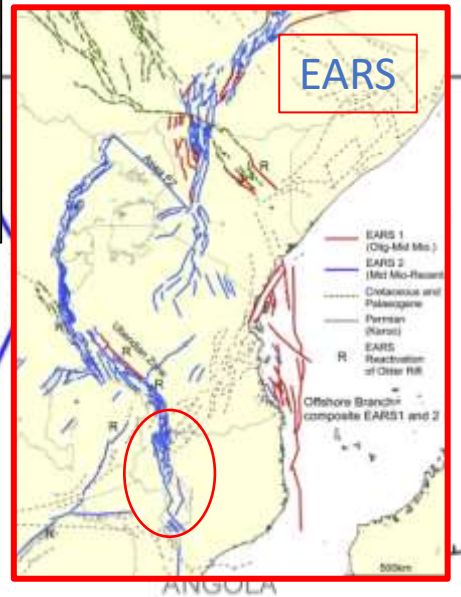


STARSS tracks a reactivation of grain in Damara Belt

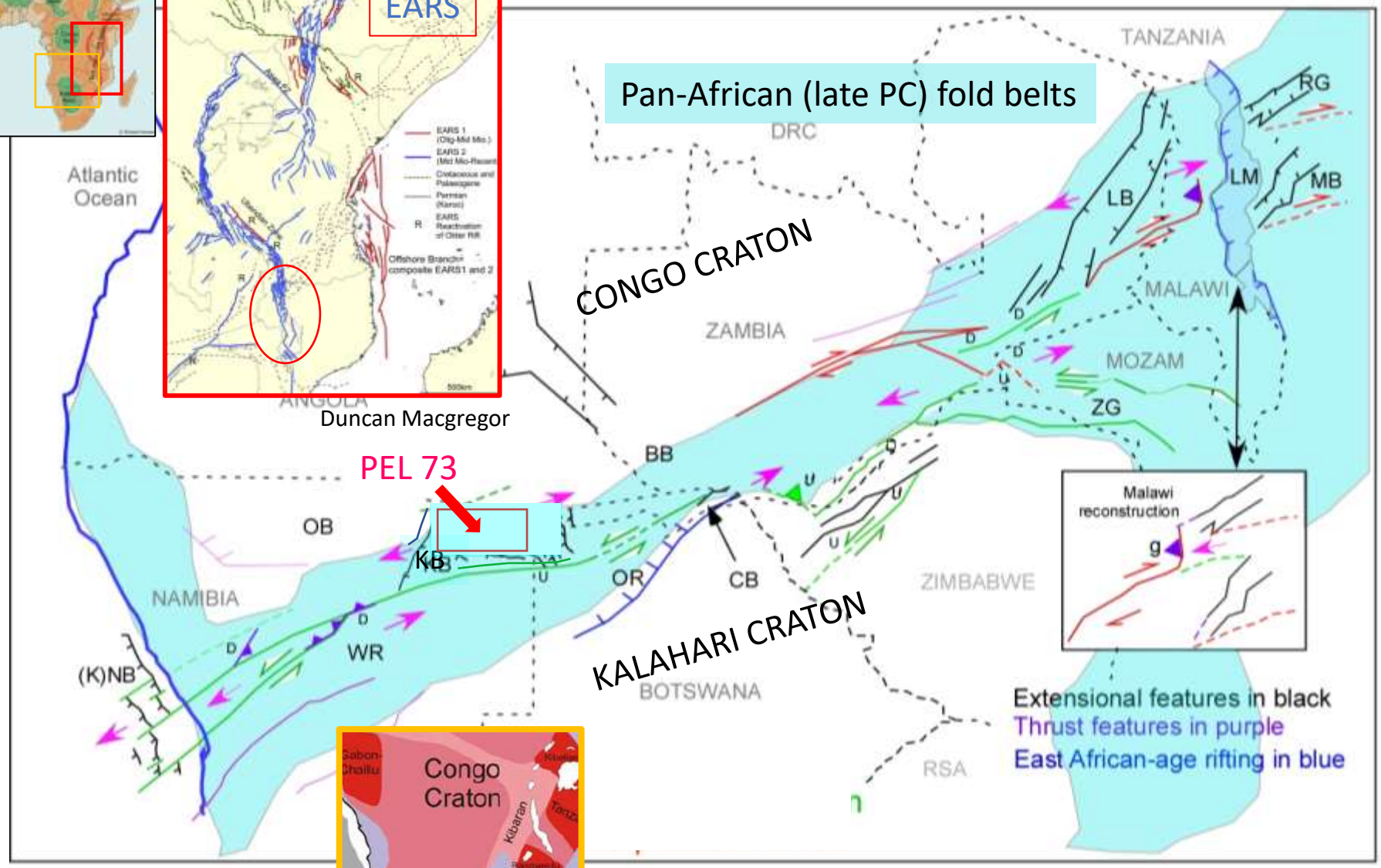
Yemane et al., 2002, SEPM

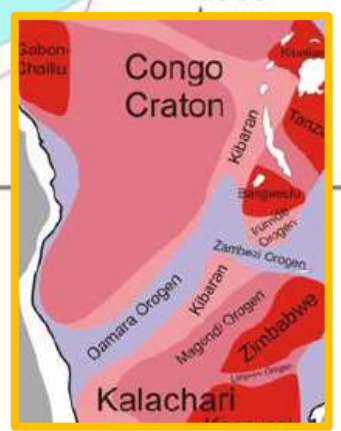
Karoo basins in East Africa postulated to continue under Kalahari cover in central Africa to connect to basins in western Africa >>
Nicknamed 'Southern Trans-Africa Rift and Shear System' (STARSS)





Duncan Macgregor



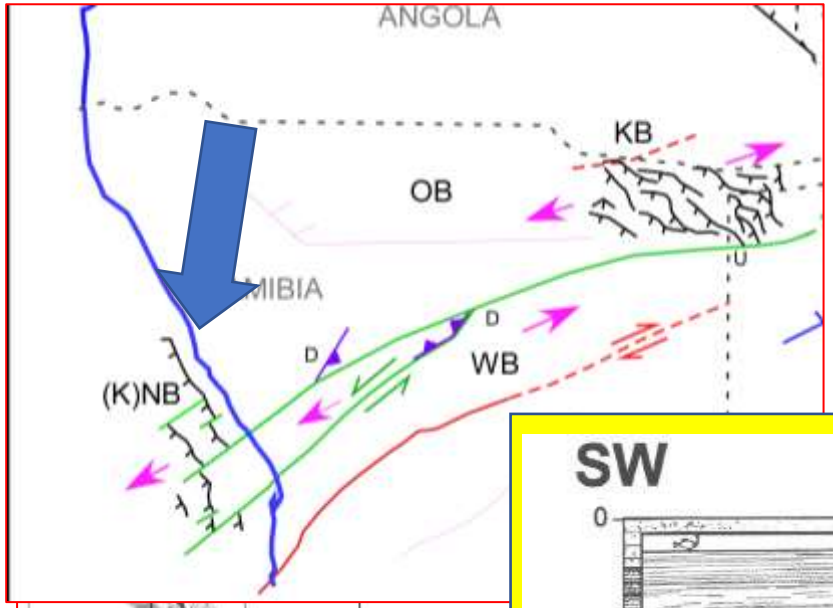


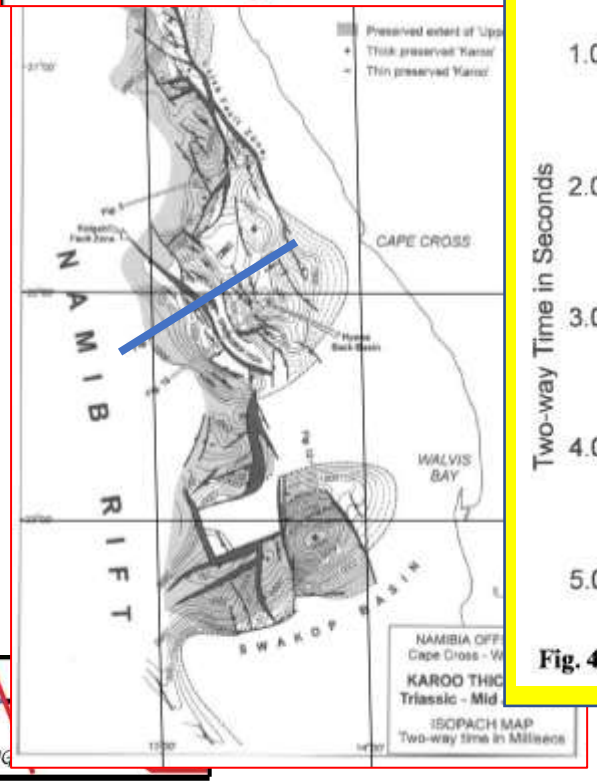
Granath & Dickson, 2015-17, various S&D papers
"Tectonic Fabric of Africa"
GIS supplement to
"Purdy Project"

(Karoo) Namib Basin

OFFSHORE

Extensional basin under drift sequence inboard and below Atlantic rift opening





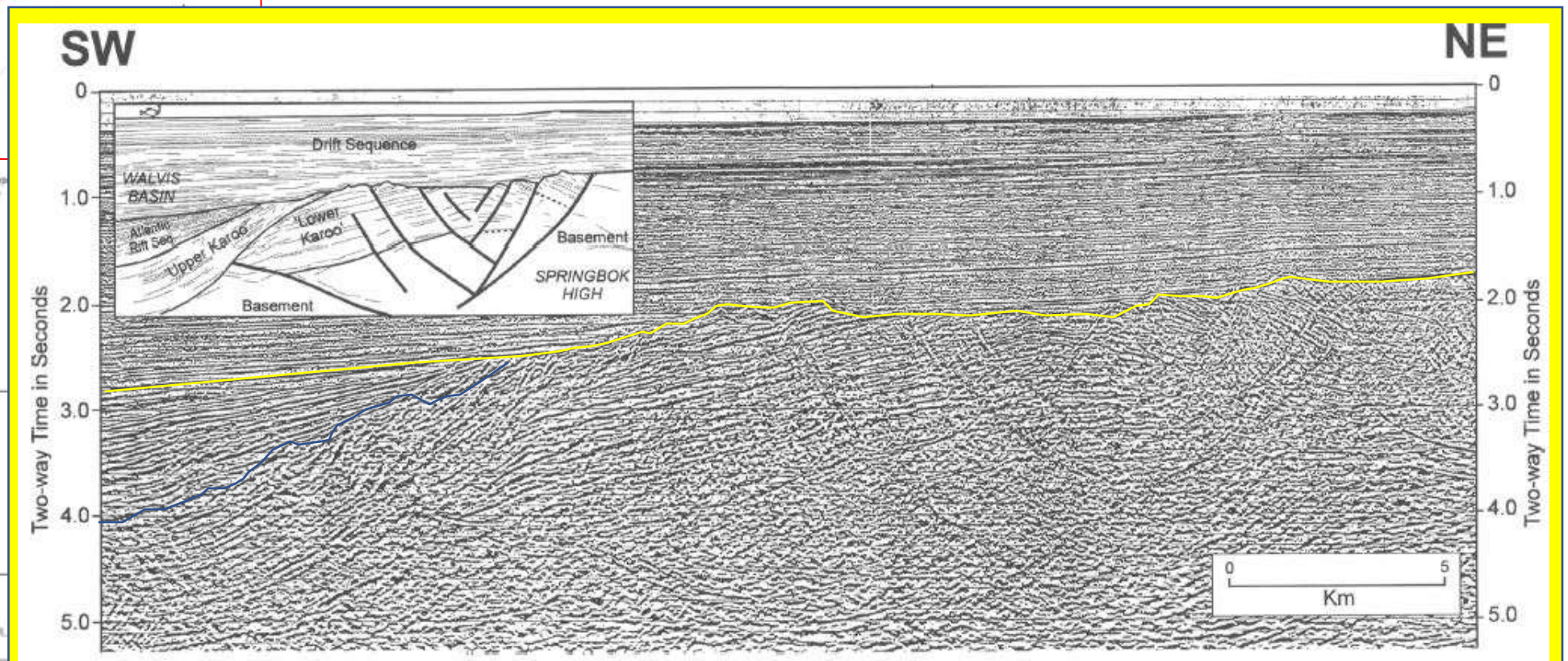
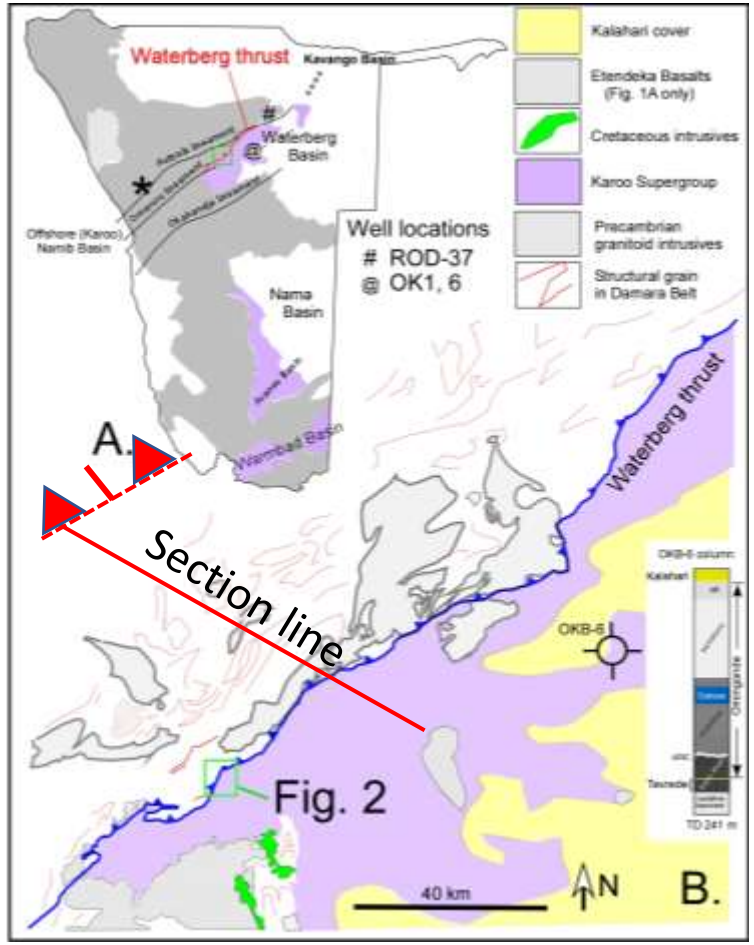


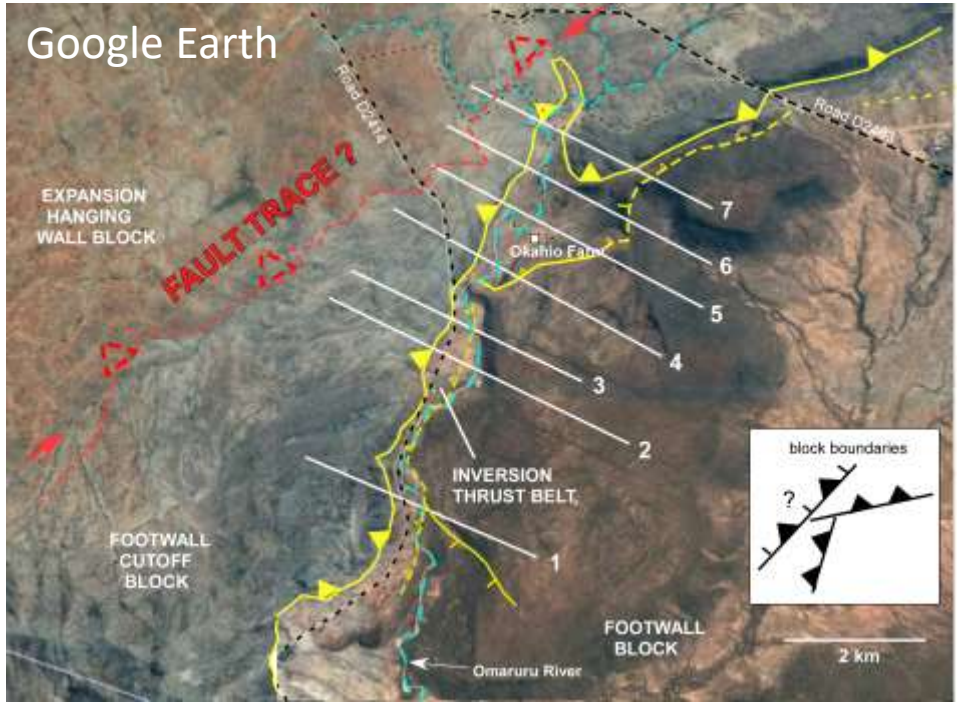
Fig. 4. Seismic line illustrating stratigraphic relationships of the 'Lower' and 'Upper Karoo' (see Fig. 8 for location).

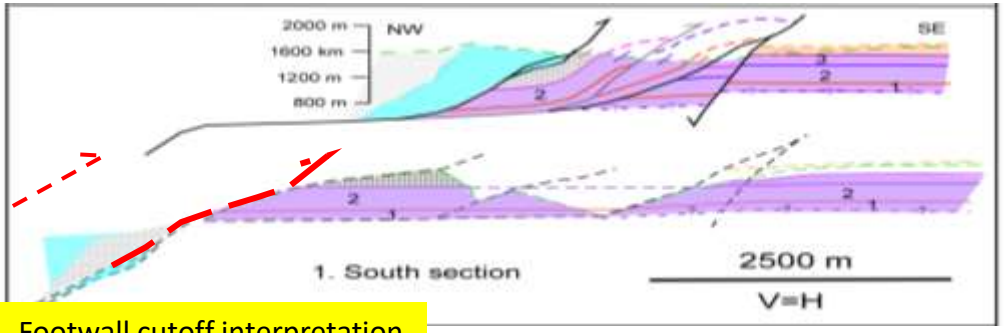
Clemson, Cartwright, & Swart 1999: Geol. Soc. London Spec Publ. 153

Waterberg Basin

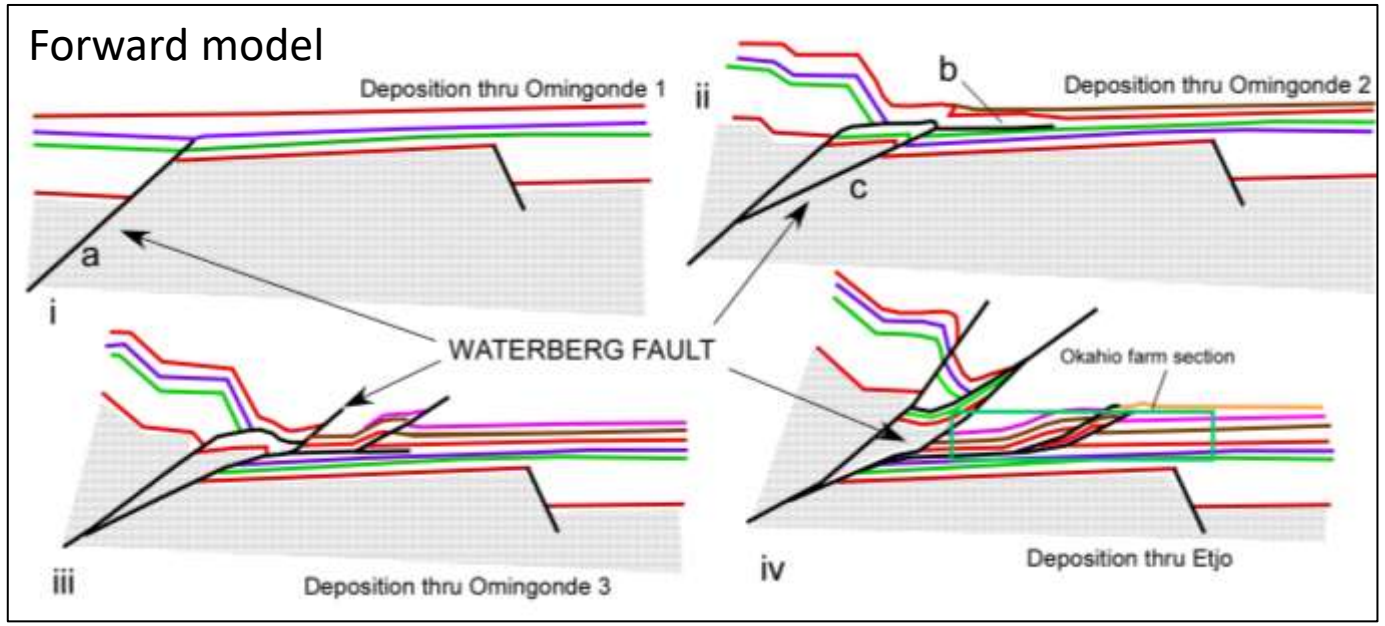
Karoo-aged normal fault reactivated as a thrust extensional fault







Footwall cutoff interpretation



Granath, Wanke, & Stollhofen, J.Struc.Geol. *in press*

Kavango Basin

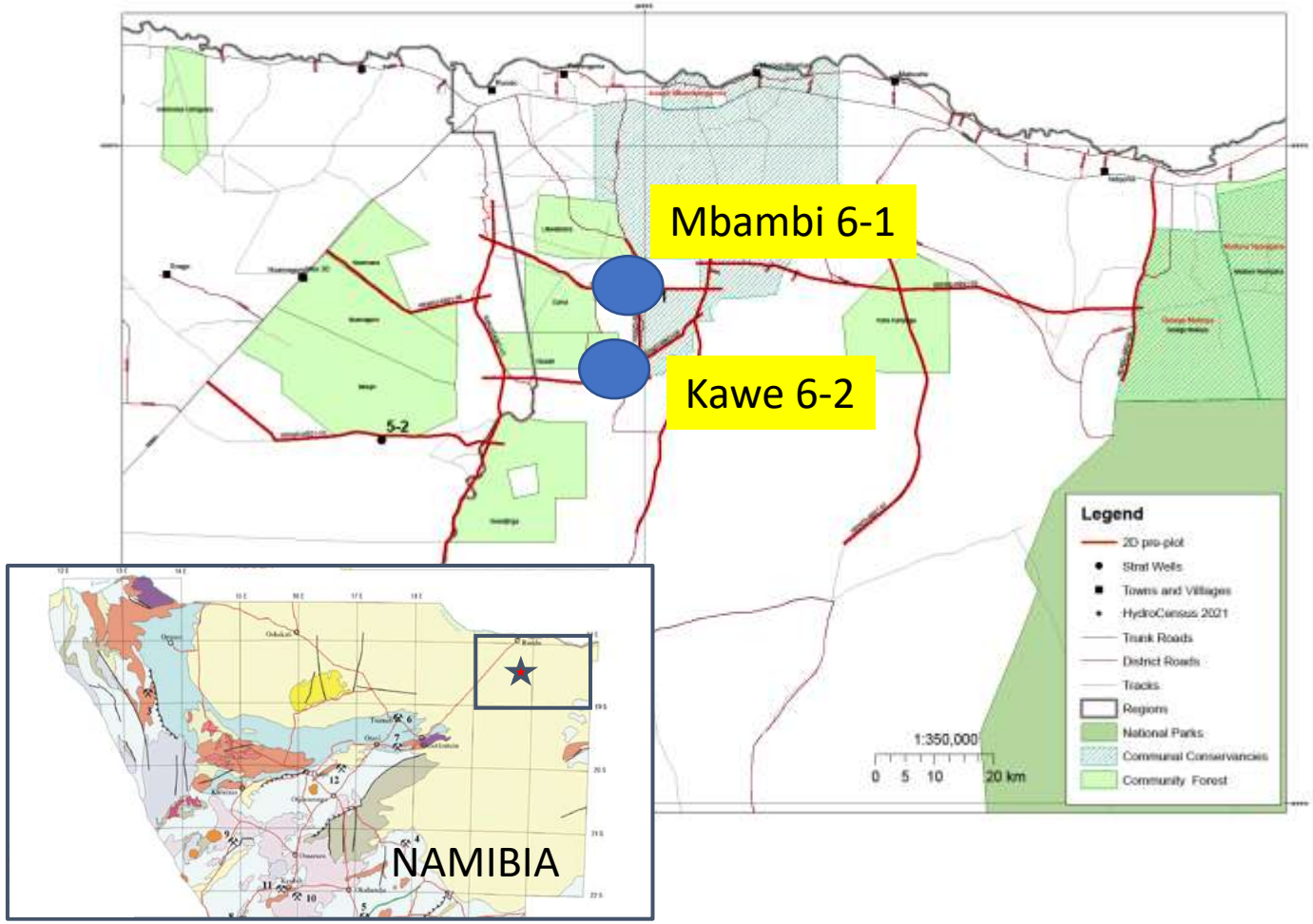
Reconnaissance Energy Africa Ltd.
2021 operations

Several community water wells
1st one > 7000 m^3/hr fresh water
from top of Karoo Supergroup (Etjo)

Two Stratigraphic test wells
Innovative water-based mud system

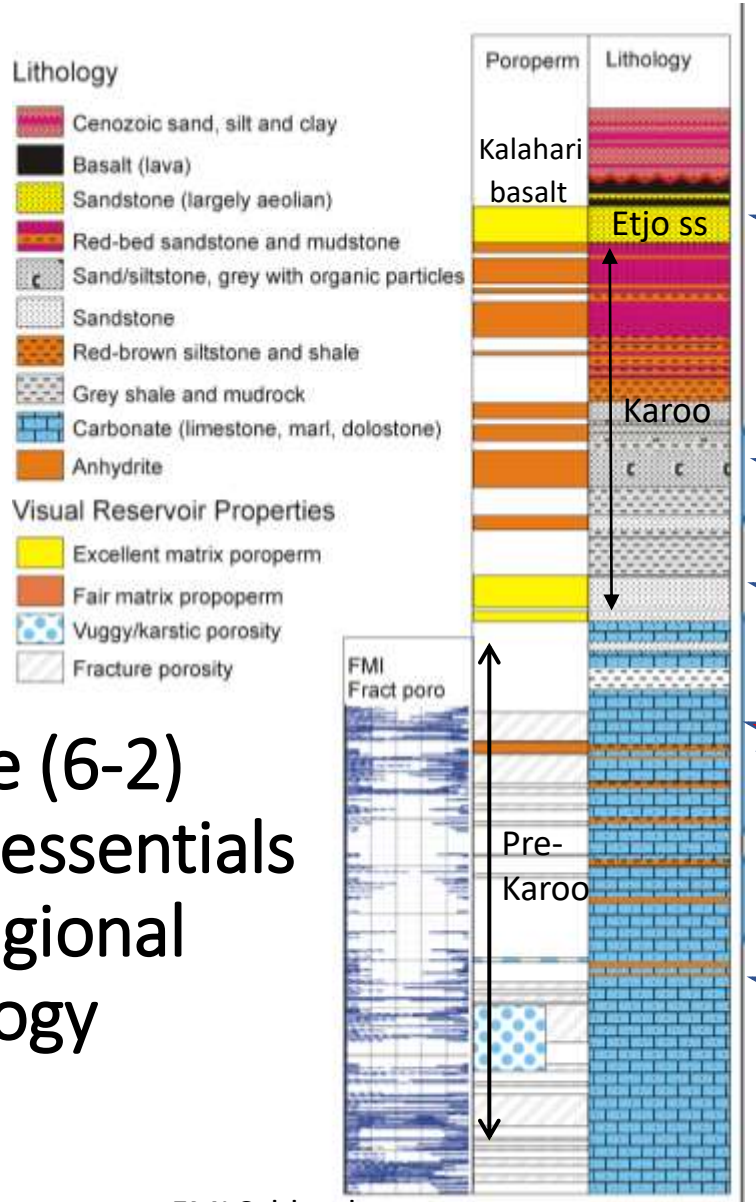
450 km 2D seismic acquisition
weight drop system

2022 operations doubling of seismic
data set, resumed drilling

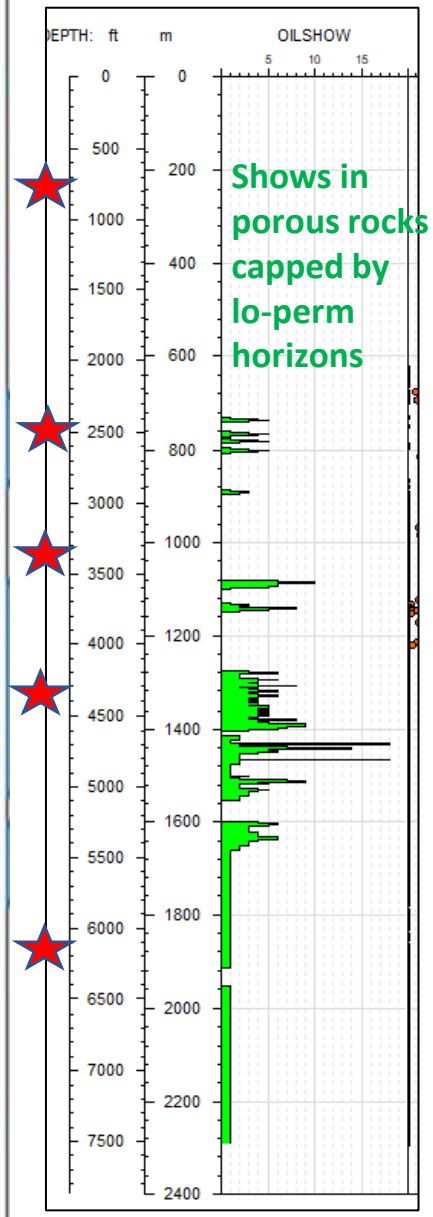


Organizations involved: NAMCOR, the scientific personnel in Pioneer in Windhoek, and all the supporting scientists in Chronosurveys, Core Labs, Horizon, Schlumberger, Polaris, Halliburton, and NSAI who have worked and are working on this project.

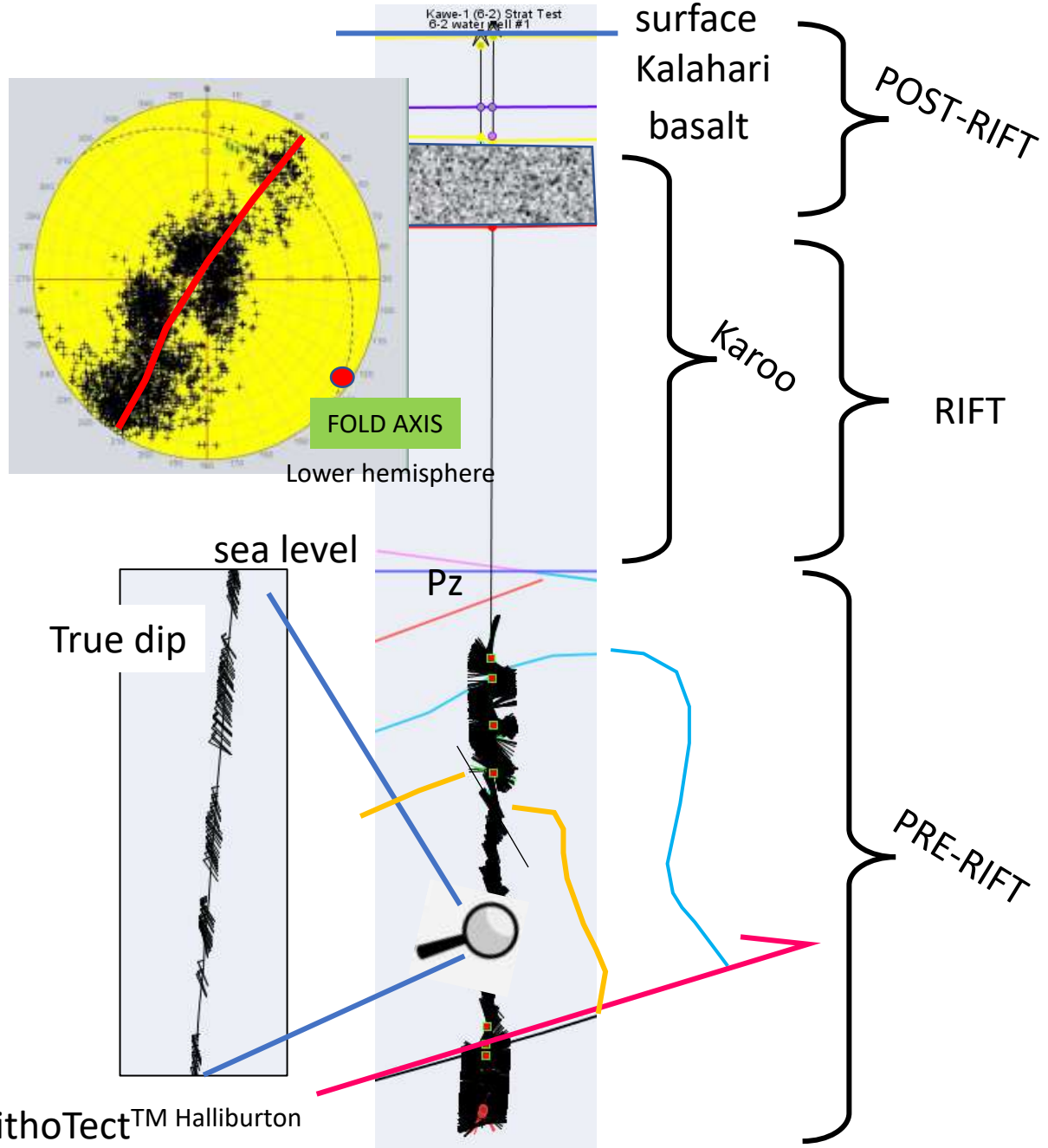
Kawe (6-2) well essentials re regional geology



FMI Schlumberger



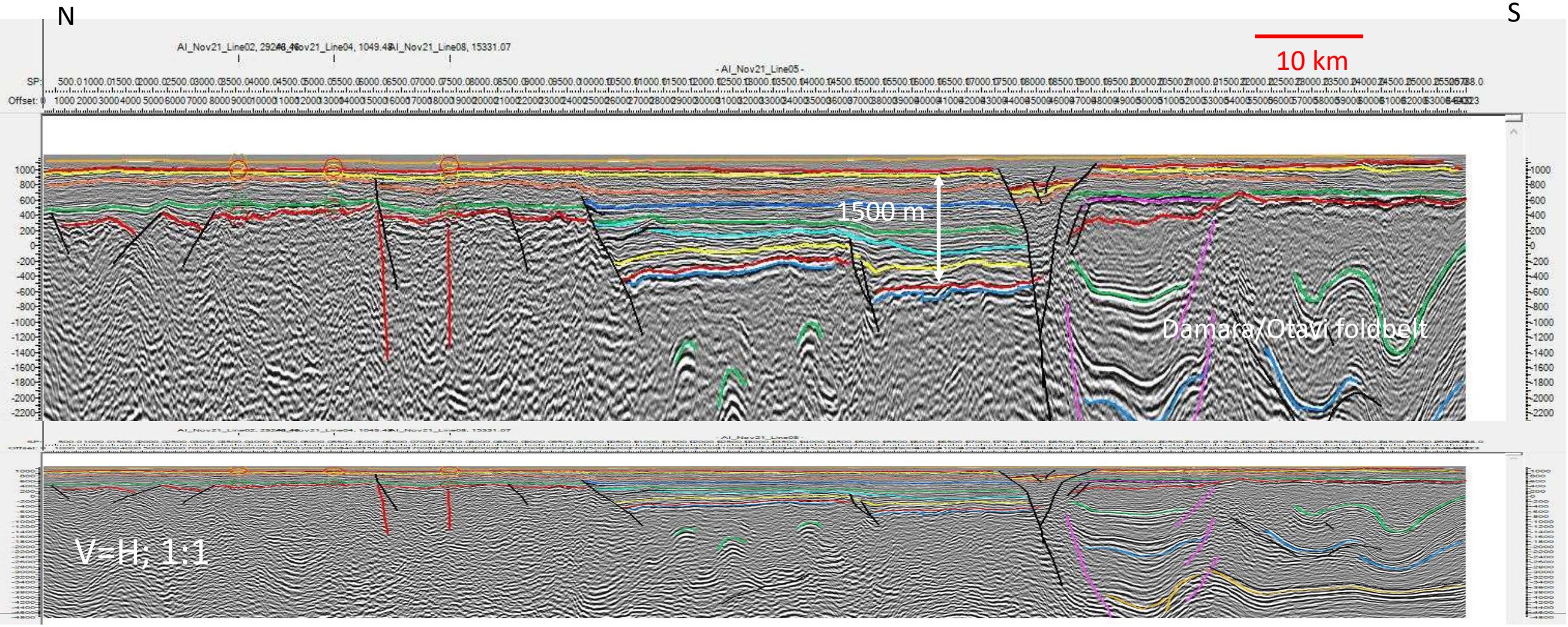
Kawe (6-2) well

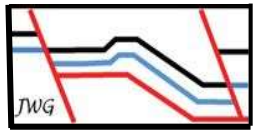


LithoTect™ Halliburton

From various company releases and PESGB-HGS talks in 2021

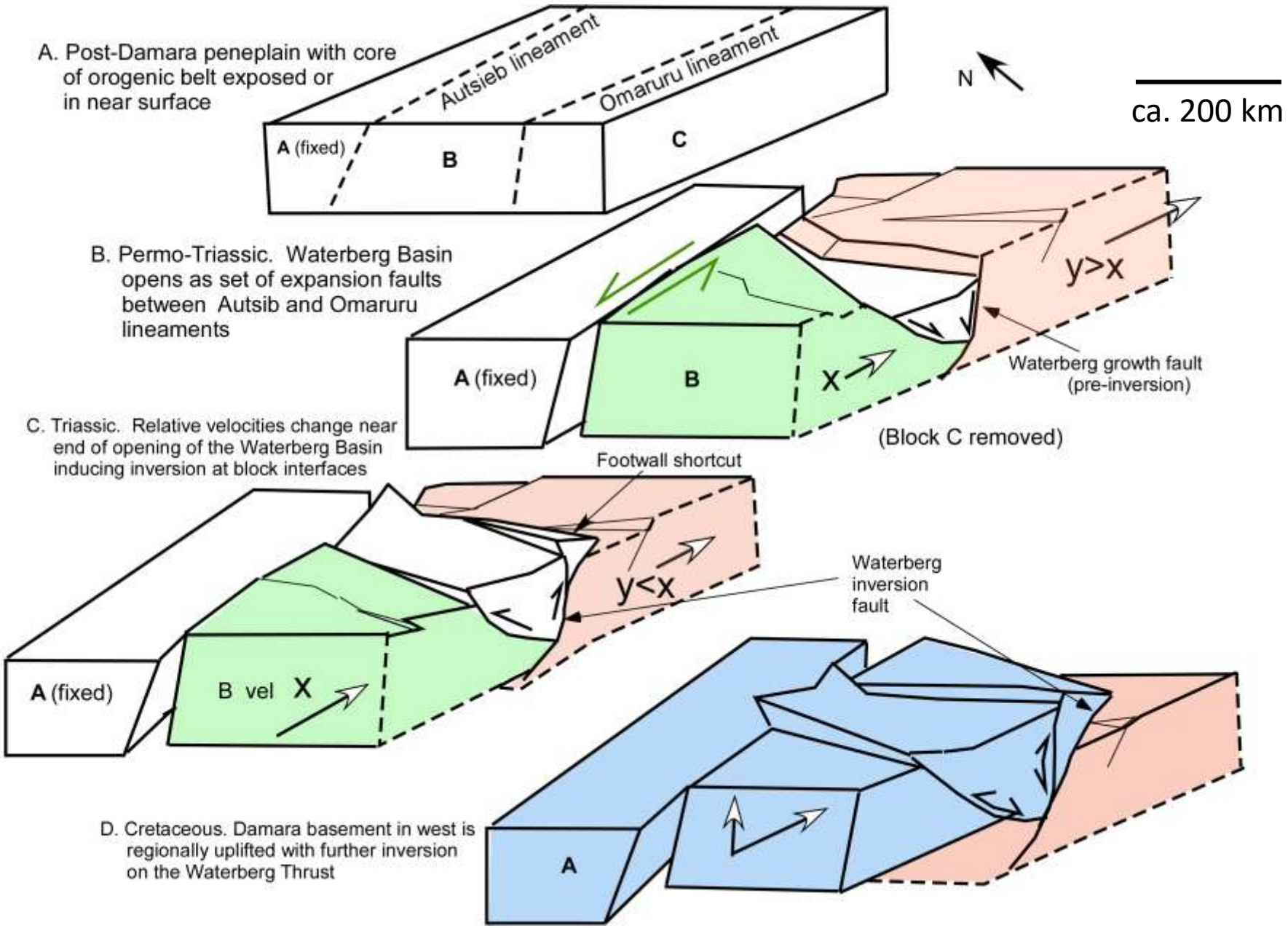
North-south 2021 line across Kavango Basin

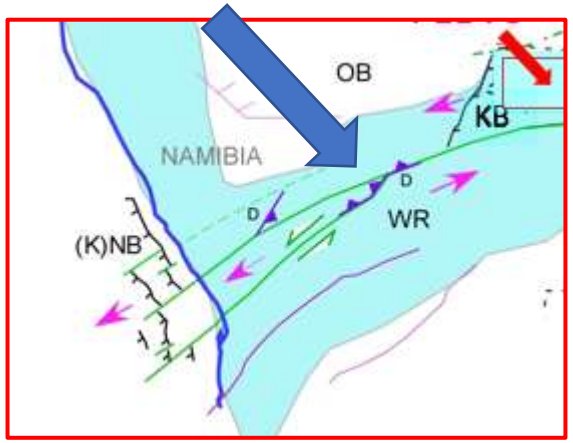




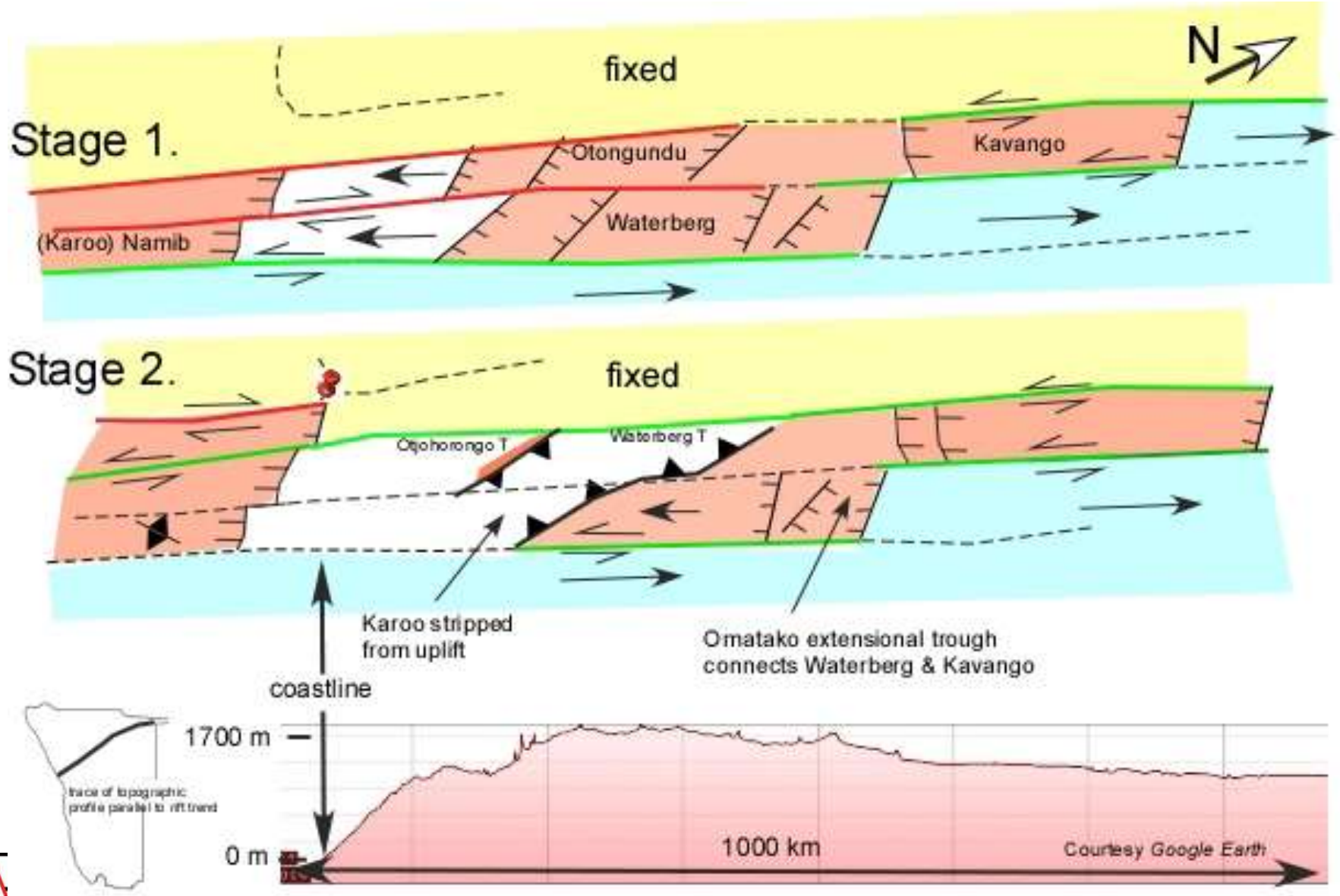
Kavango Basin is a Karoo prism of rocks occupying several graben and intervening platforms in NE Namibia, primarily developed above the eastward extension of the Damara belt, its foreland fold and thrust belt, and Is marginal to and younger than the Owambo foreland basin.

Schematic development of a STARSS Basin / basement block view



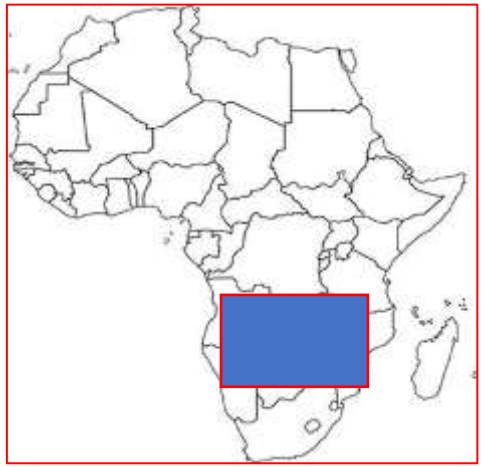


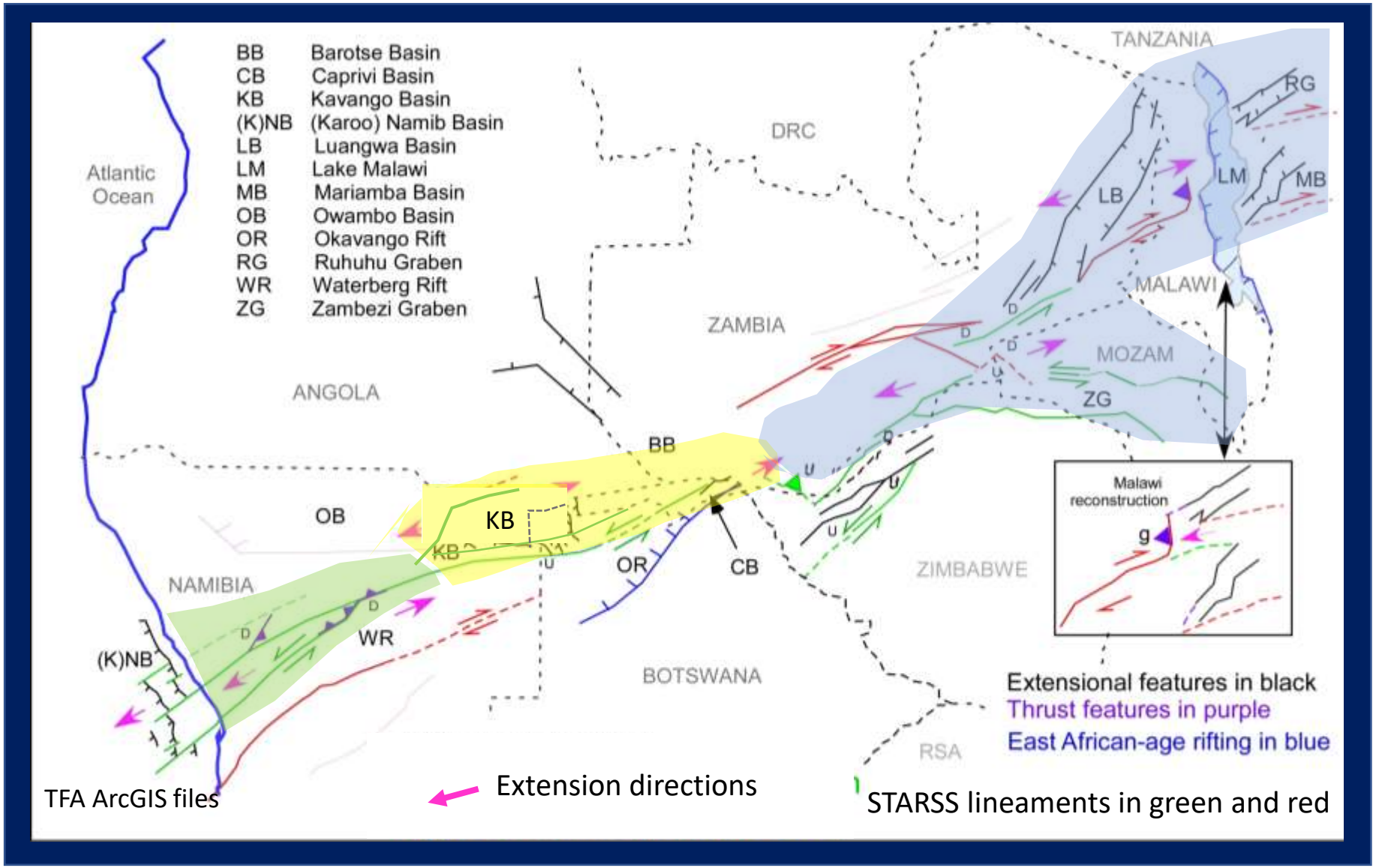
Evolution of North Namibian STARSS system



Hydrocarbon Prospectivity

STARSS (Karoo) features differently exposed





Shading represents level of exposure: yellow covered, blue basement in shoulders exposed, green unroofed

CONCLUSIONS and TAKE-AWAYS

- Karoo is a widespread fault-related sedimentary sequence in northern Namibia
- It is related to a continent-wide system stretching from Tanzania to offshore Namibia, dubbed ‘STARSS’
- That trend tracks with Pan-African and other late Proterozoic fold belts using in many cases structural trends and lineaments in those systems as transfer faults between rift segments
- Regional uplift has stripped much of the Karoo along the Damara Belt, exposing the underpinnings of the basins
- The STARSS Basins in northern Namibia afford a habitat for petroleum systems when sufficiently preserved through the post-Karoo uplift