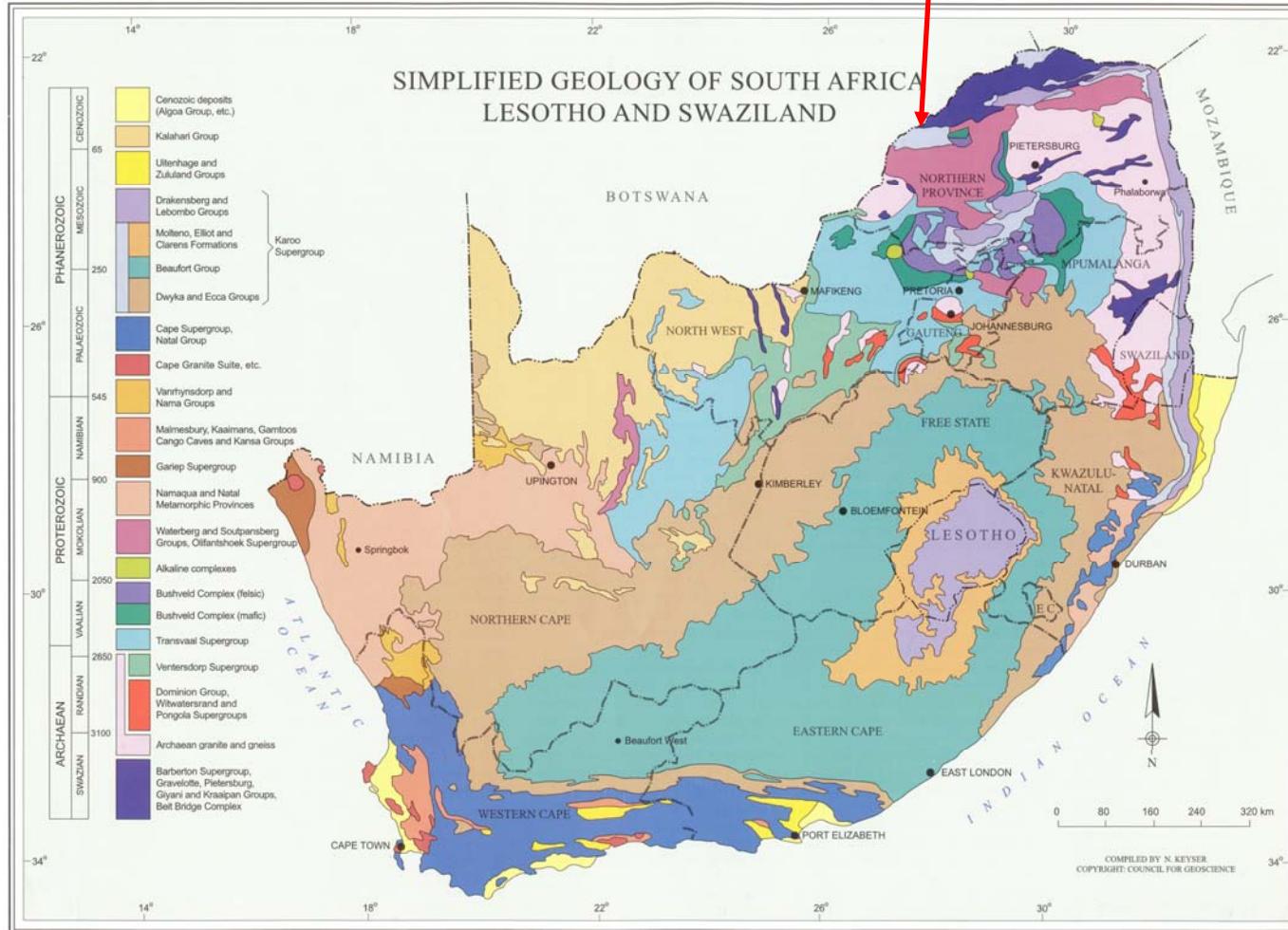


The structure of the Karoo-age Ellisras Basin in Limpopo Province, South Africa in the light of new airborne geophysical data

Dr. Stoffel Fourie, Dr. George Henry and Ms. Leonie Marè

Location

Waterberg Coalfield



Map courtesy Council for Geoscience



Importance of Waterberg Coalfield

- Future of SA coal resources
- Exxaro –
- Grootegeluk Mine:
- Resources 5 559 Million tonnes (Mt)
- Reserves 3 308 Mt (included in resources)
- Other resources – 6 662 Mt

From: Exxaro Annual Report 2008

Witbank : 10 140 Mt reserve

Highveld : 10 000 Mt

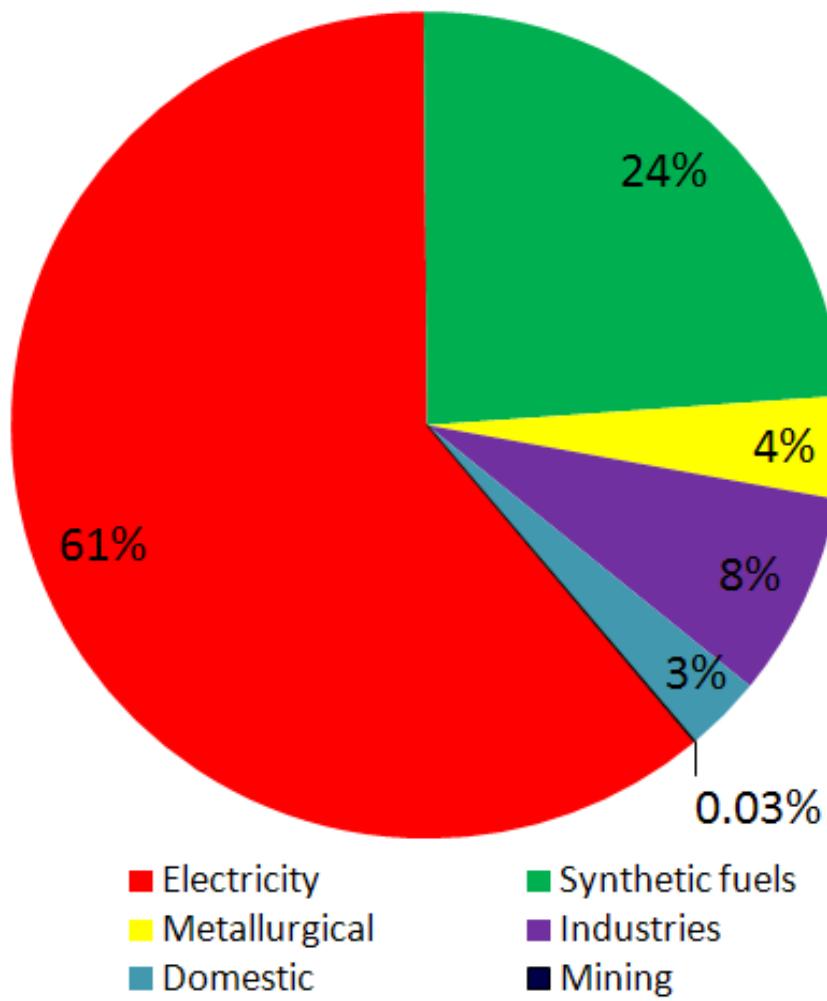
Ermelo : 4 600 Mt

From : Jeffrey 2005, all figures for 2000

SA Production ~250 Mt (2007)

From: SAMI, 2008

Coal consumption in South Africa



From: ESI-Africa



Courtesy Exxaro

Grooteegeluk Coal Mine

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Courtesy Exxaro

Grootegegeluk Coal Mine – mining operations

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Courtesy Exxaro

Grootegeeluk Coal Mine – Processing Plant



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Geological Setting



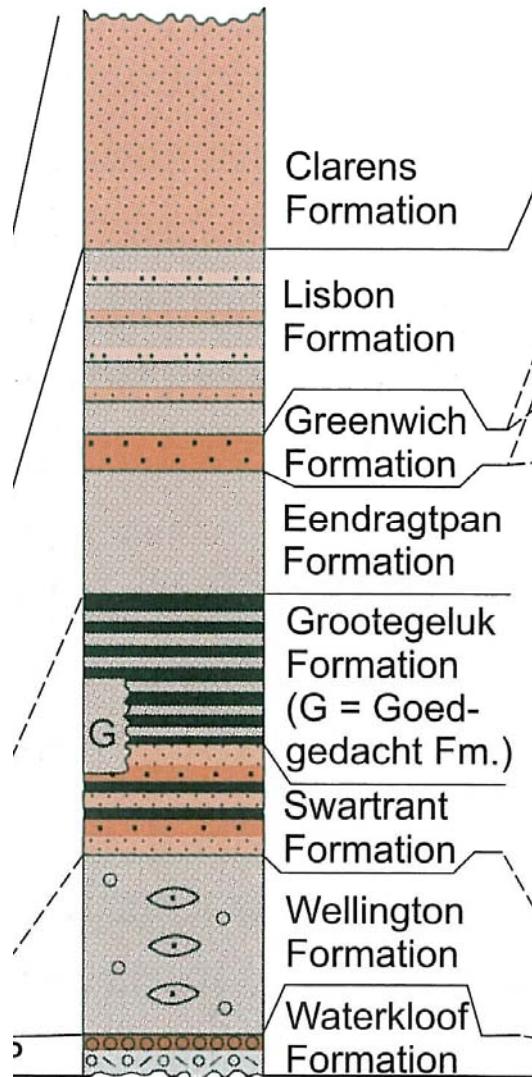
Courtesy: Council for Geoscience

The logo of the Council of Scientific and Industrial Research (CSIR) of India, featuring the letters 'csir' in a stylized blue font.

Karoo Supergroup



ELLISRAS BASIN



	Basaltic lava
	Mudrock
	Rhythmite
	Siltstone
	Very fine–medium sandstone
	Coarse sandstone–granulestone
	Conglomerate
	Diamictite
	Coal
	Concretions

Johnson et al., 2006

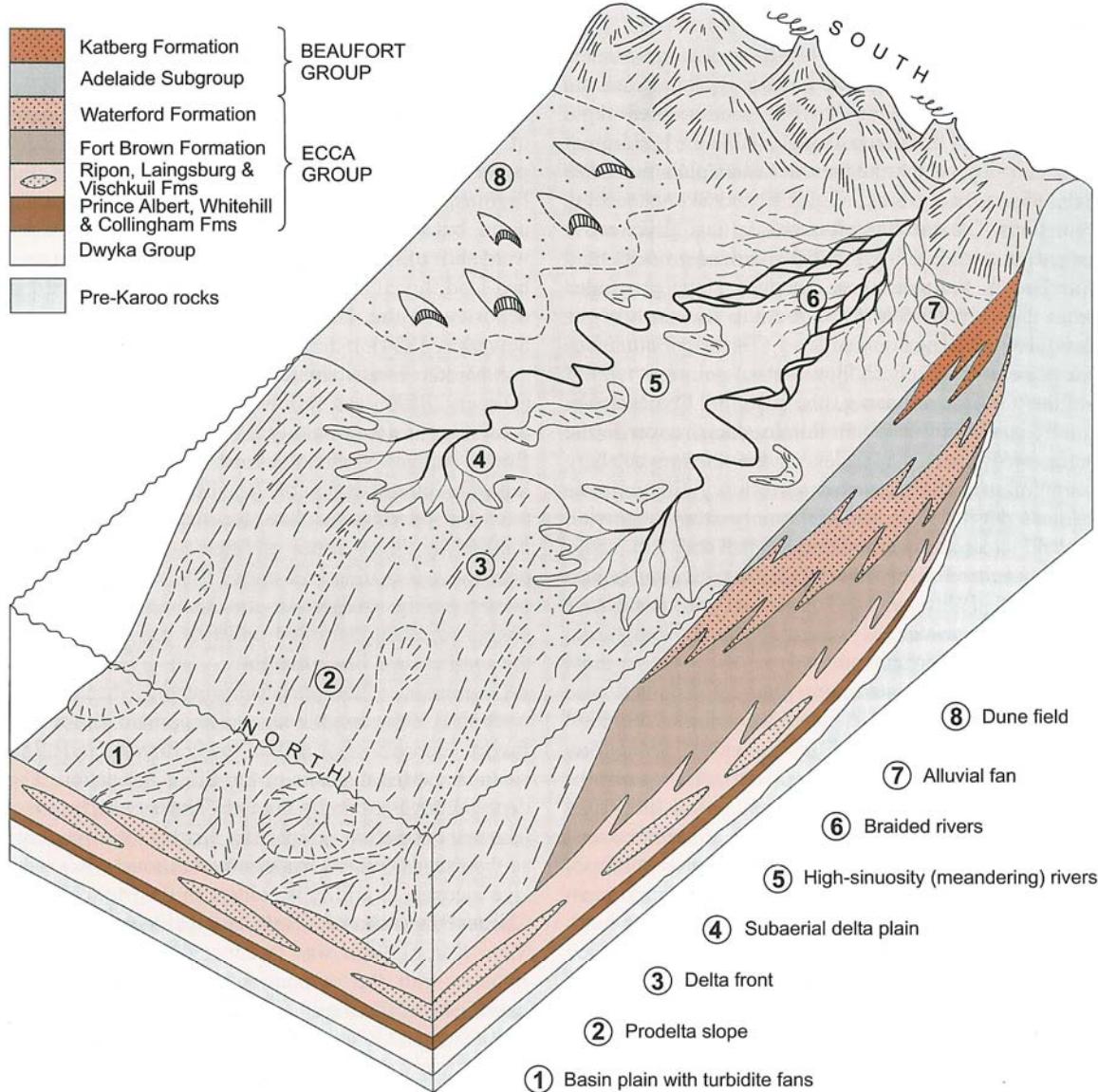


Courtesy Exxaro

Grootegegeluk Coal Mine – coal seams

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Depositional environments



Johnson et al., 2006

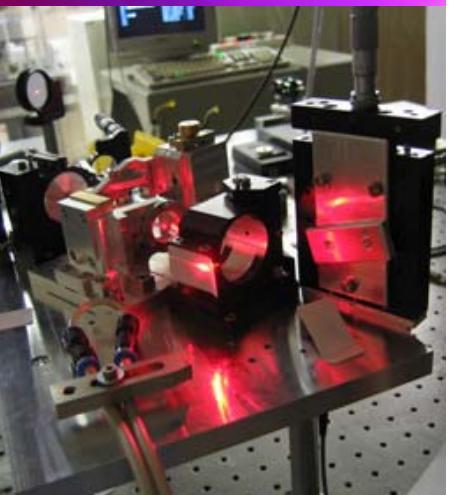
© CSIR 2009

www.csir.co.za

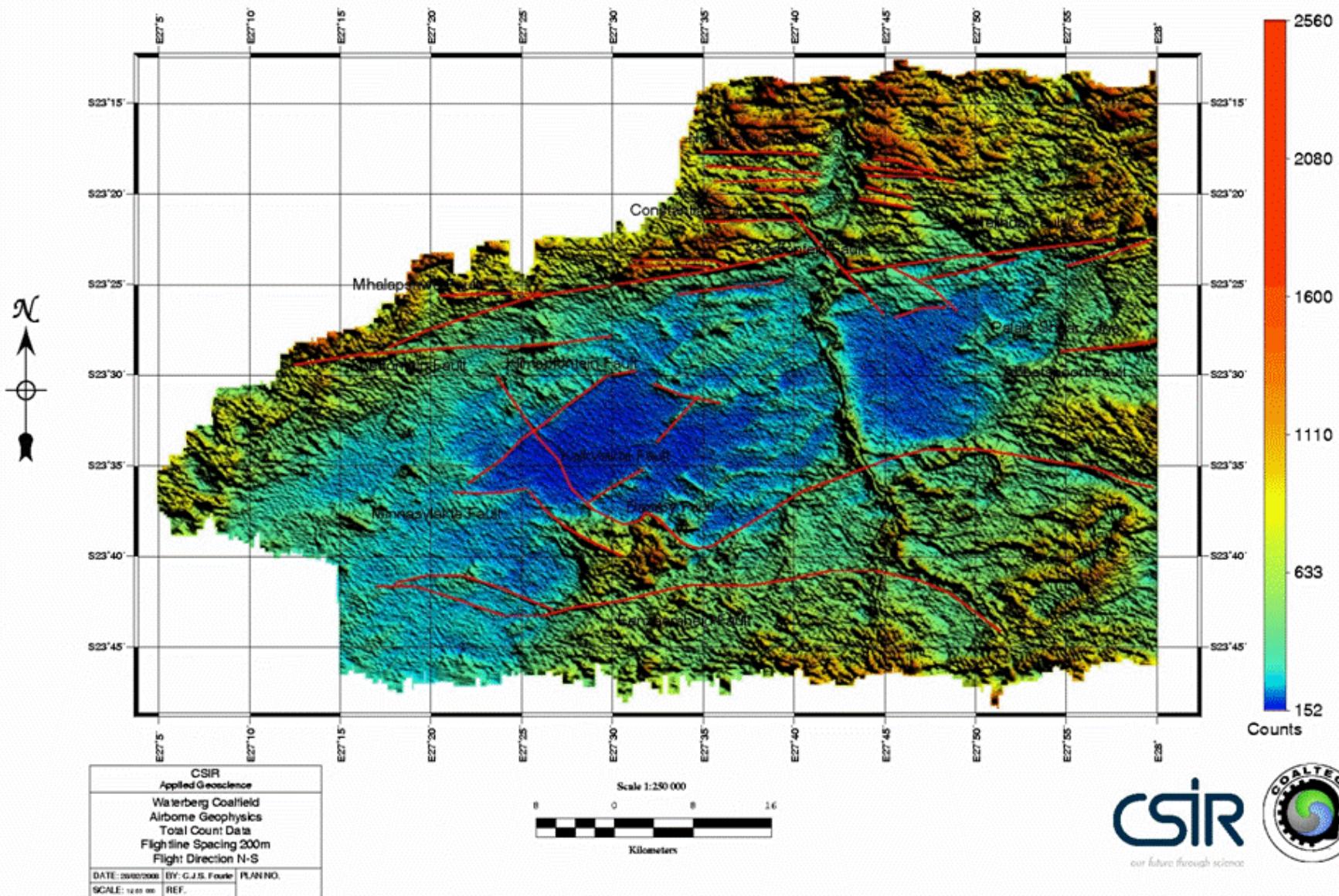


Airborne Geophysics

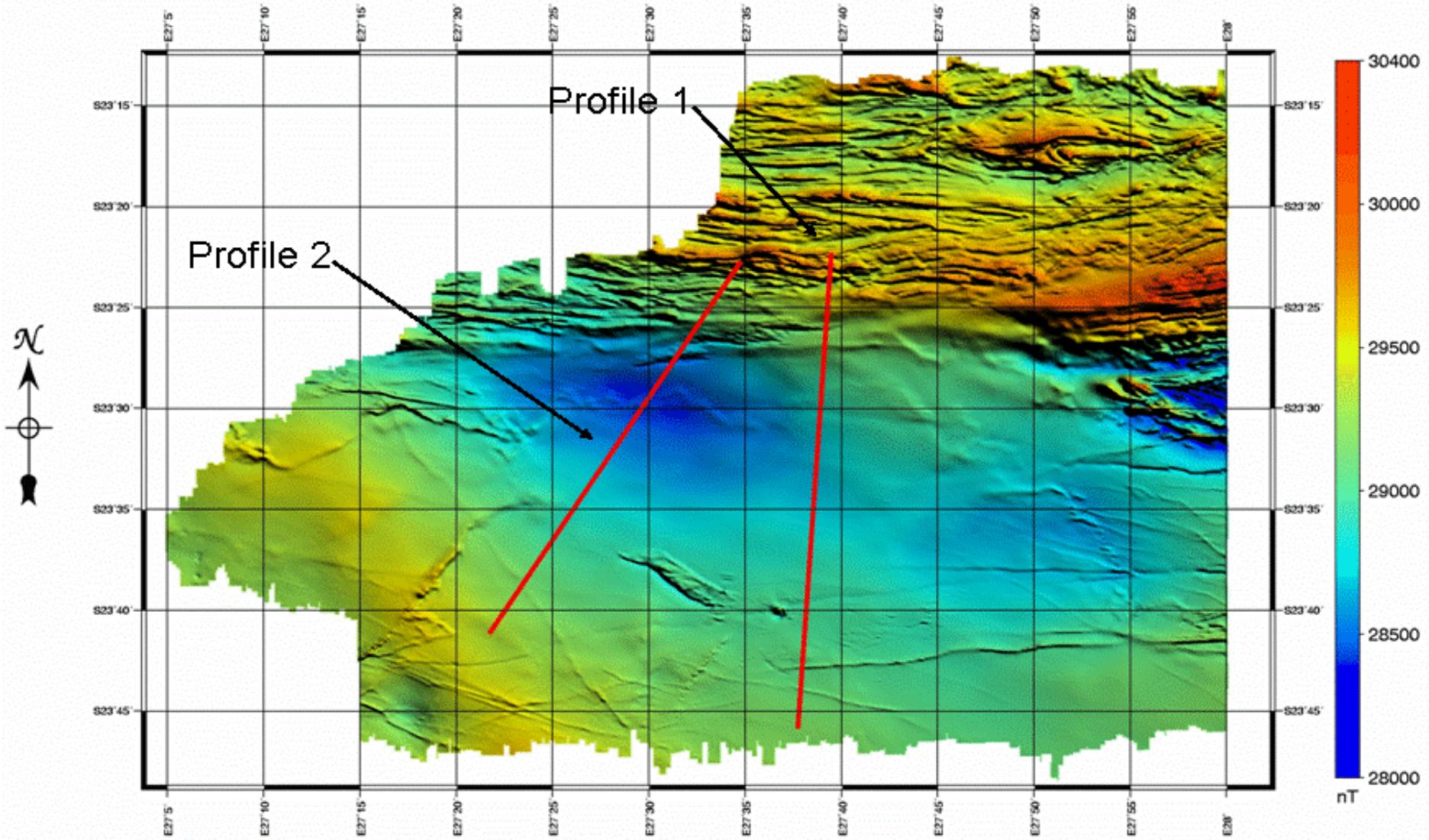
- 
- Stoffel Fourie's presentation
 - Radiometrics
 - Magnetics



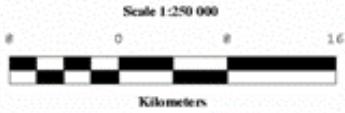
Waterberg Total Count Data



Waterberg Magnetic Data



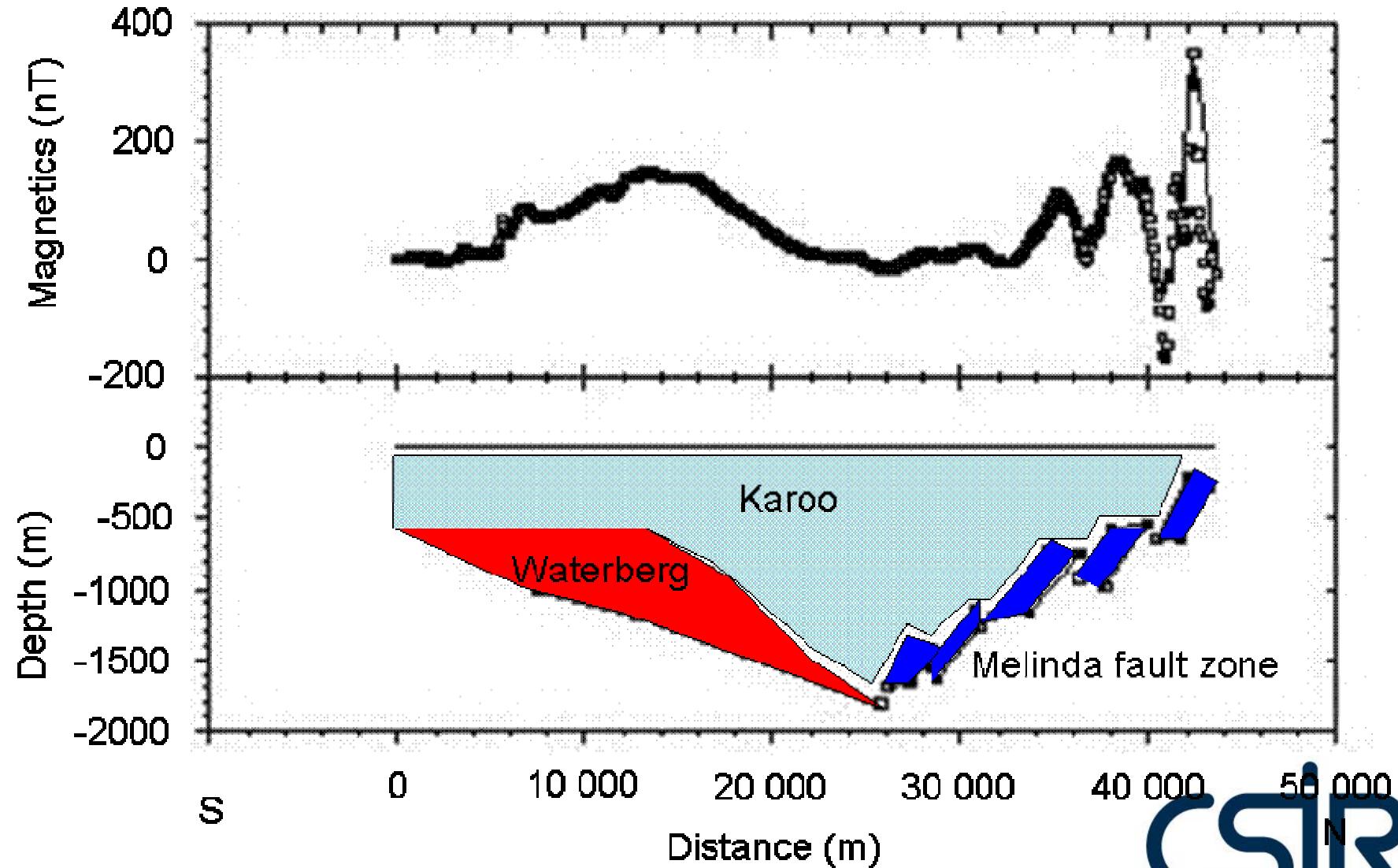
CSIR Applied Geoscience
Waterberg Coalfield
Airborne Geophysics
Magnetic Data
Flightline Spacing 200m
Flight Direction N-S
DATE: 28/02/2008
By: C.J.S. Fourie
PLAN NO:
SCALE: 1:250 000
REF:



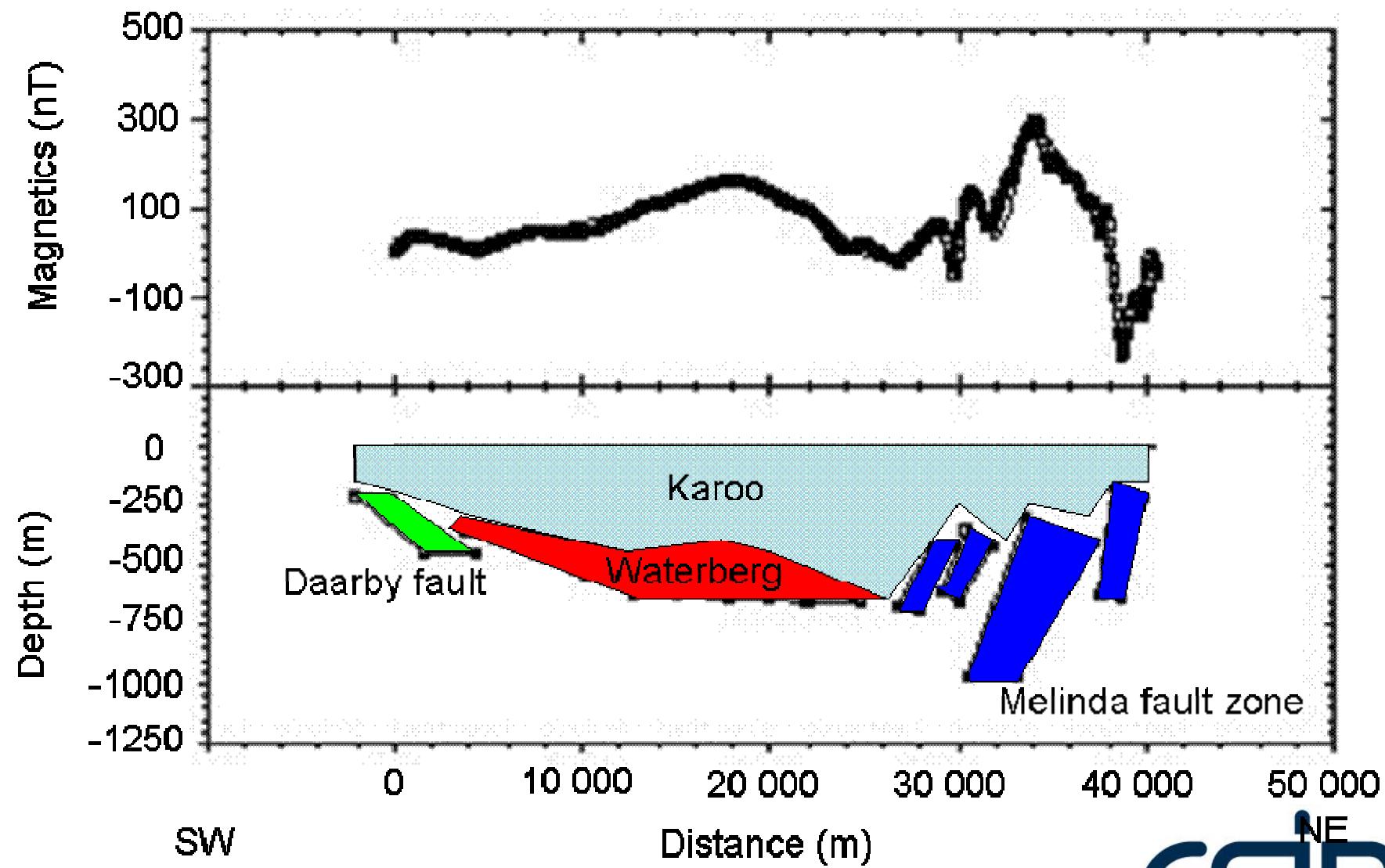
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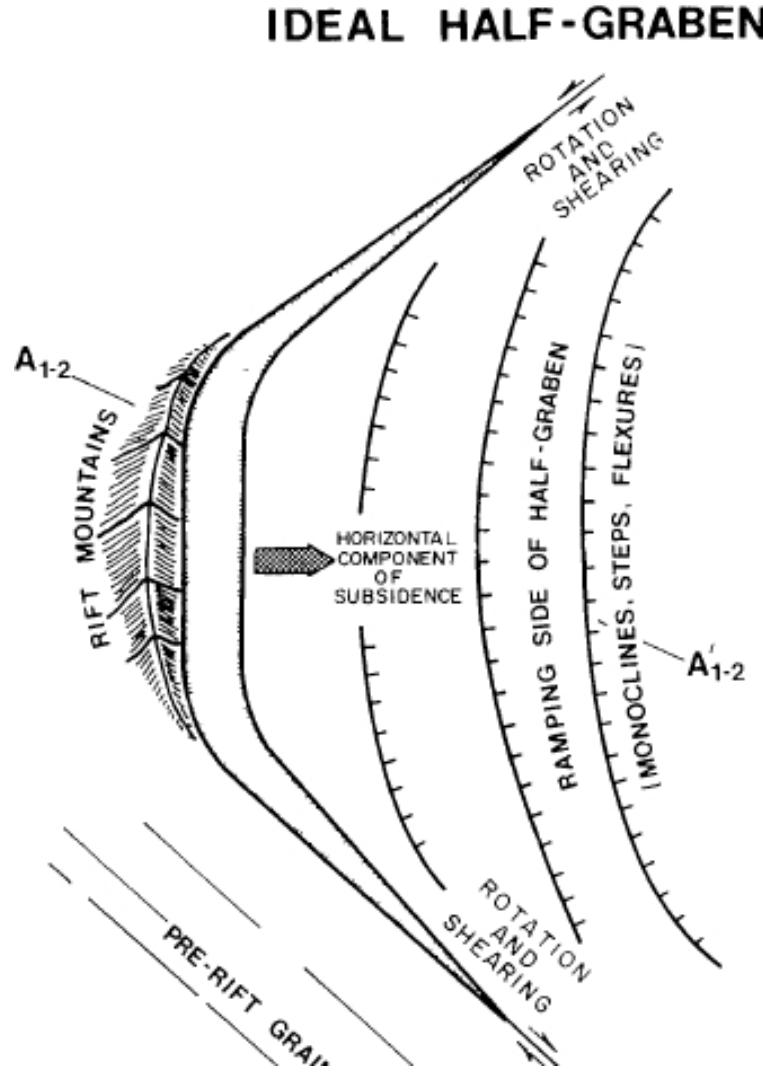
Profile 1



Profile 2



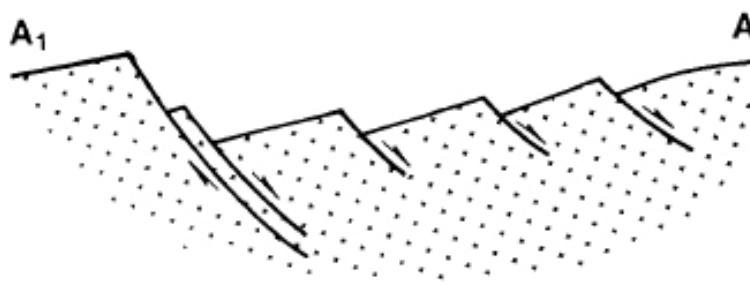
Analogue with East African Rift



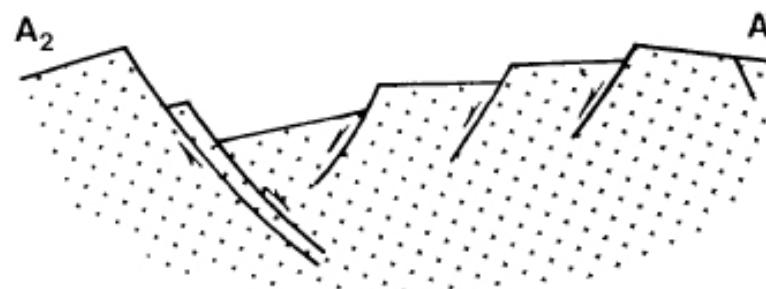
From: Rosendahl, 1987

Analogue with East African Rift

TYPICAL CROSS-SECTIONS



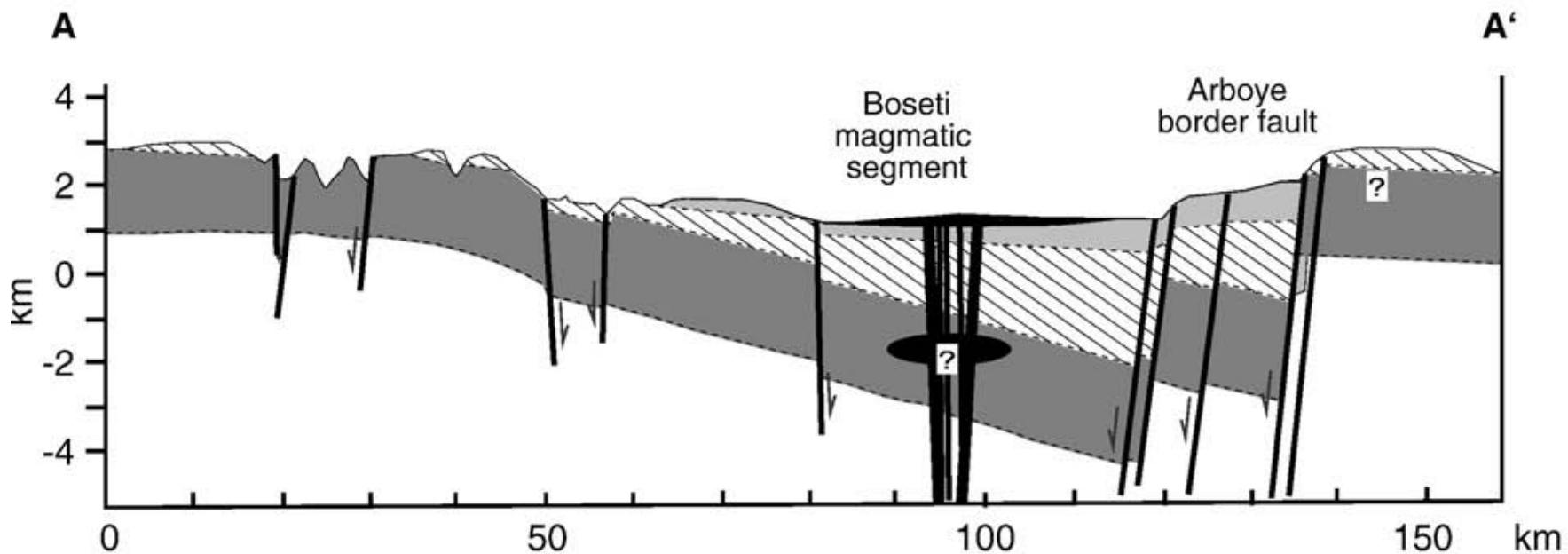
NOTE PLAN VIEW SHOWS INFRA-STRUCTURE
OF CROSS - SECTION A₁ - A'₁



From: Rosendahl, 1987

Main Ethiopian Rift (MER)

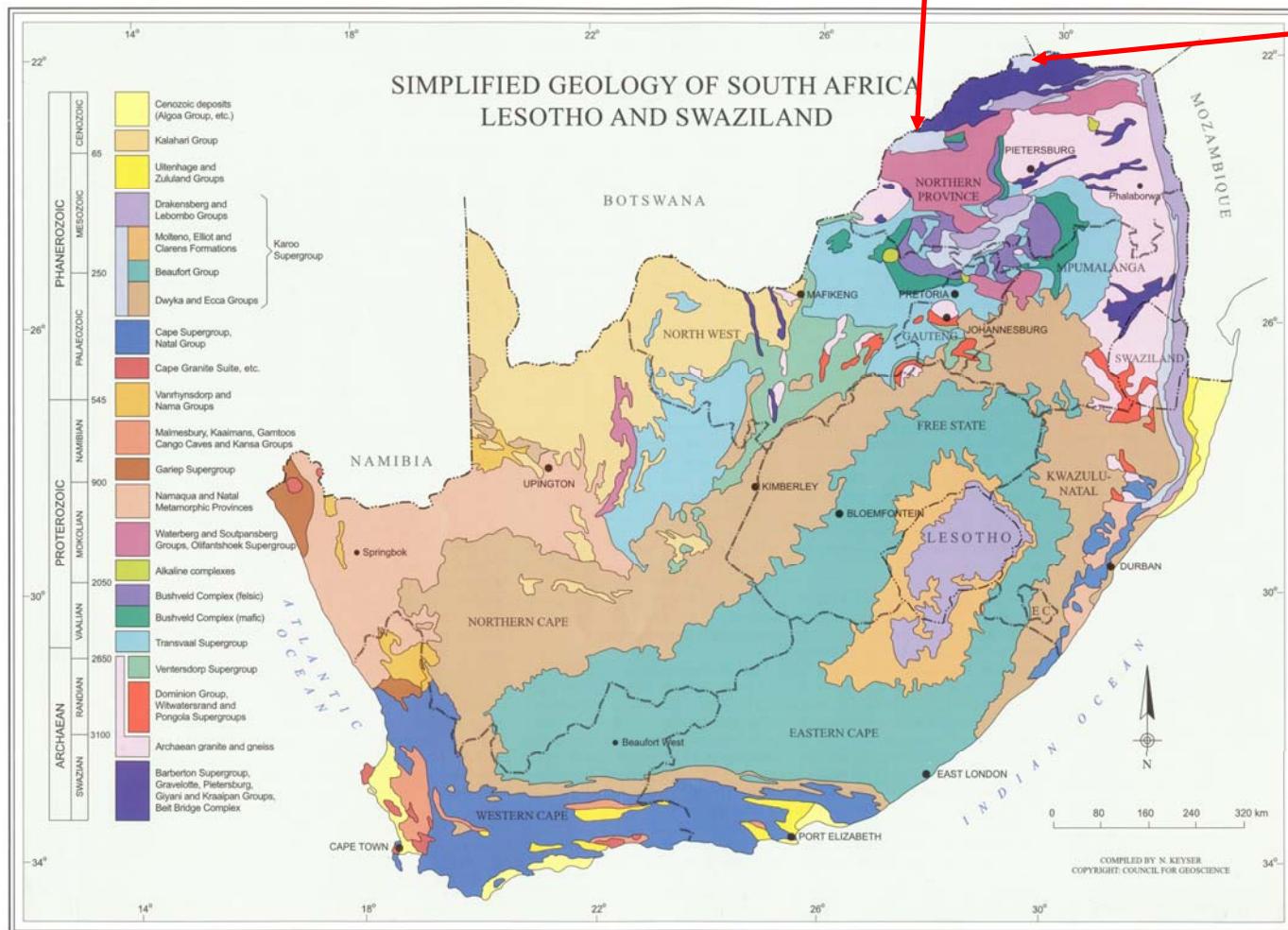
Northern MER



From: Corti, 2009

Bordy and Catuneanu, 2001

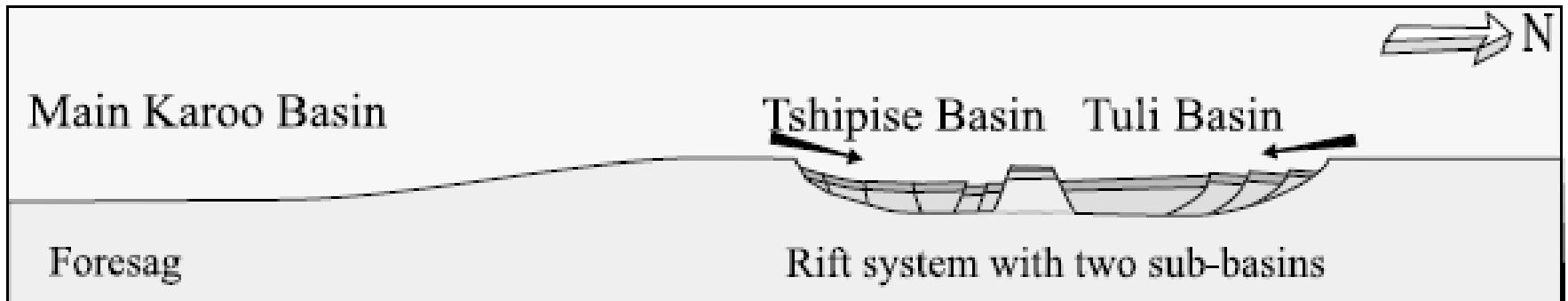
Waterberg Coalfield



Tuli Coalfield

Map courtesy Council for Geoscience

Cross-section Tuli



Asymmetric basins

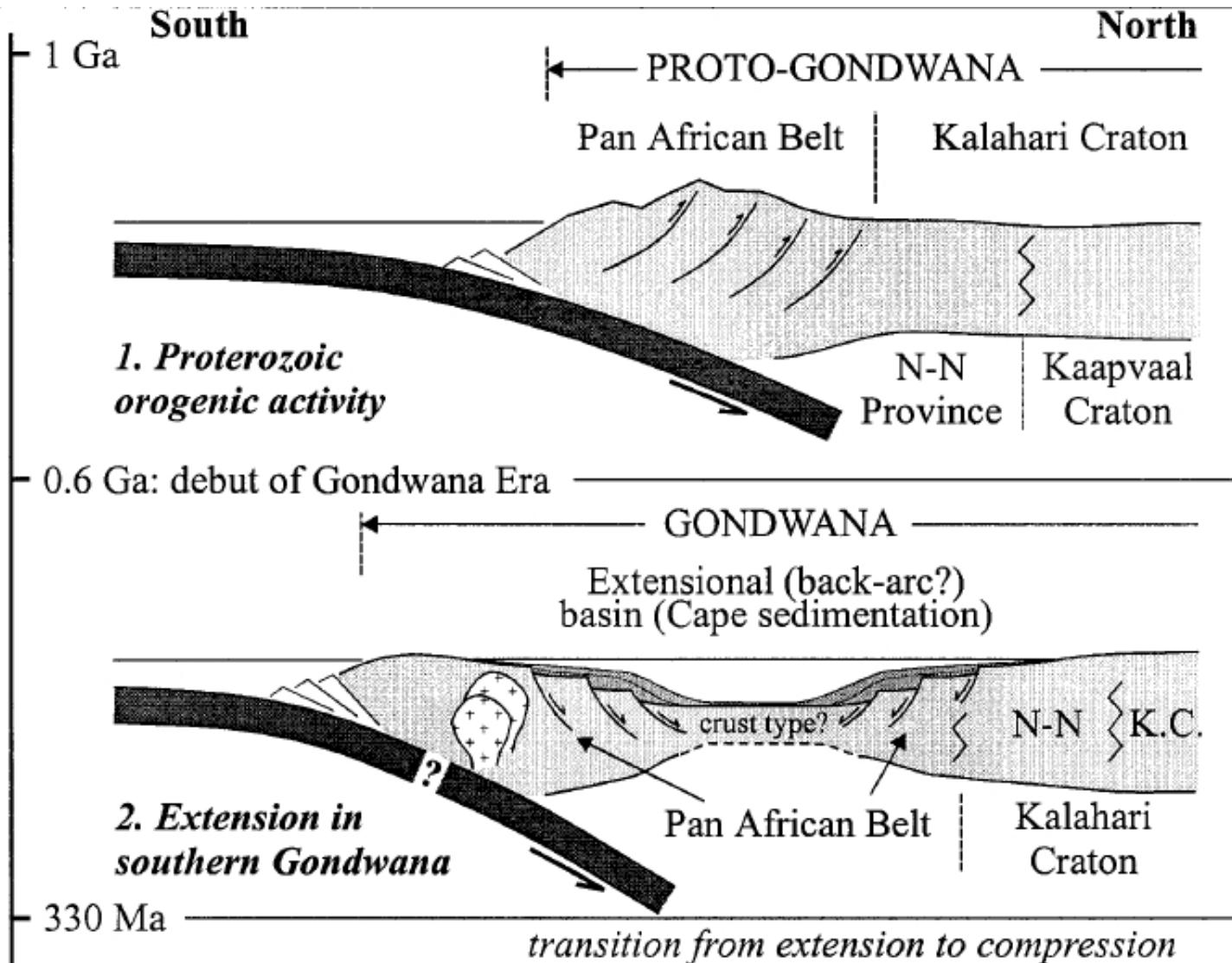
Bordy and Catuneanu, 2001



Karoo tectonic setting

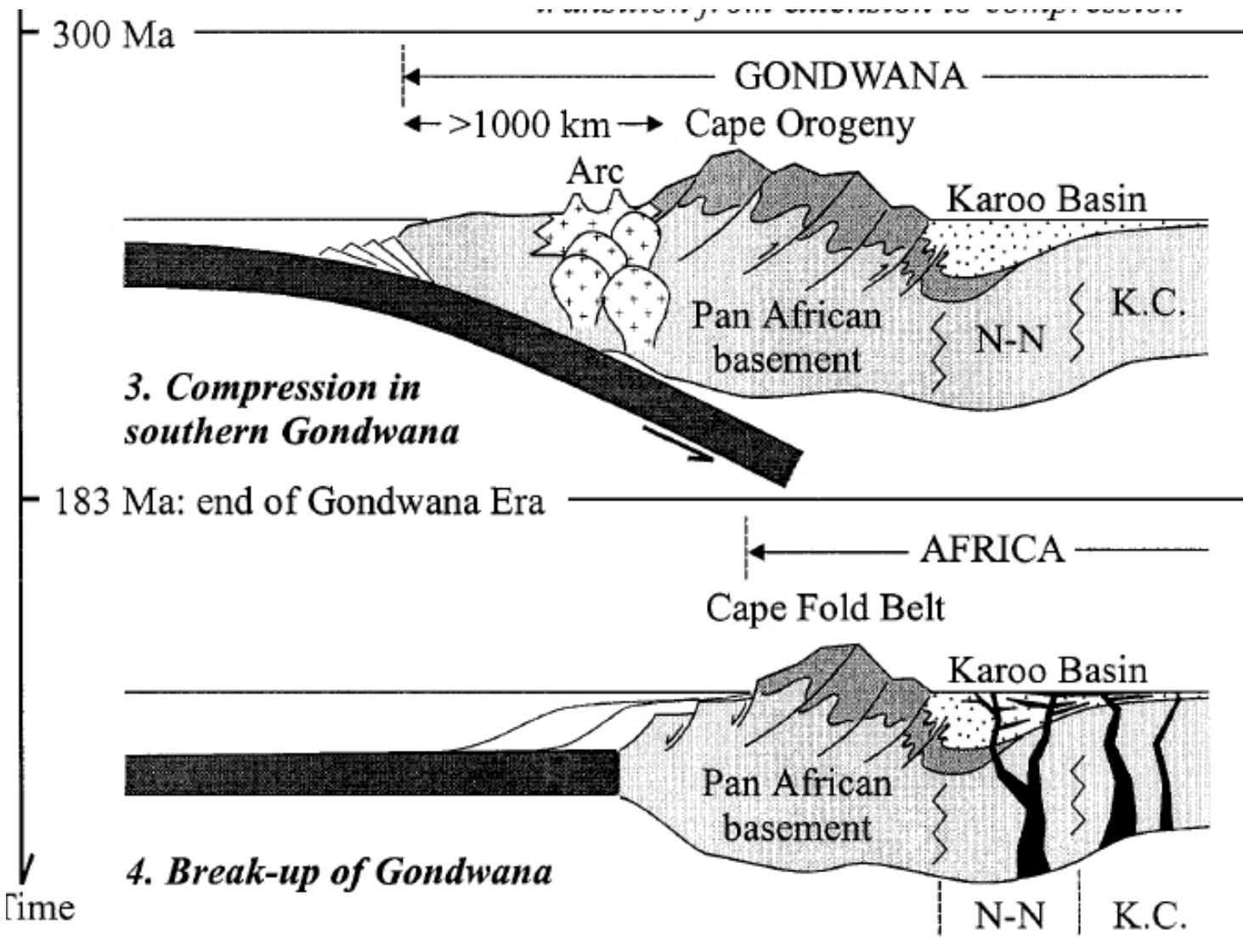
- 
- Catuneanu et al. 1998 – retro-arc foreland basin
 - Tankard et al. 2009 – lithospheric deflection due to subduction-driven mantle flow
 - Both models – have rifting late in basin development
 - Here we support early rifting in the smaller basins





Cape Supergroup

From :Catuneanu et al. 1998

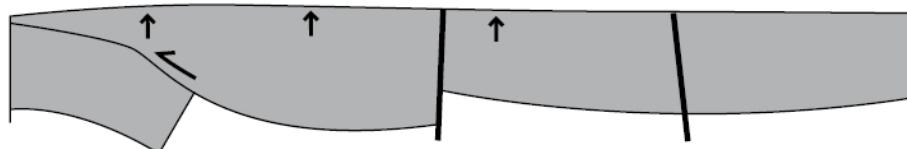


Karoo Supergroup

From: Catuneanu et al., 1998

E Late Carboniferous Shortening and Uplift

330-305 Ma

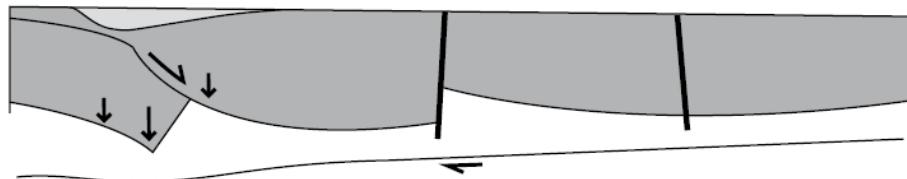


Youngest

Cape Supergroup

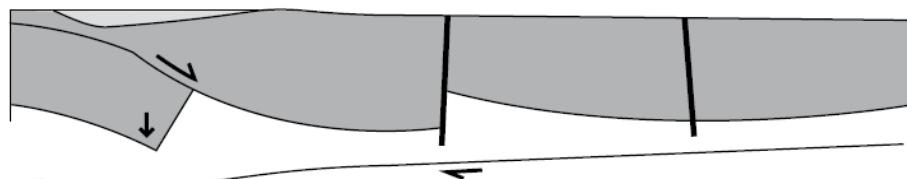
D Bokkeveld-Witteberg Subsidence by Mantle Flow

405-330 Ma



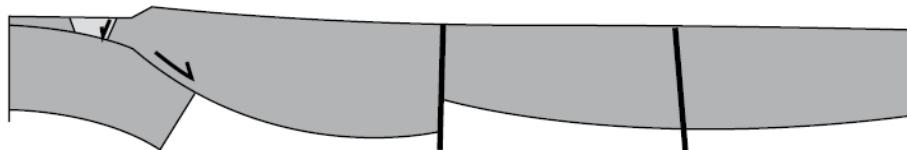
C Table Mountain Subsidence by Mantle Flow

470-405 Ma



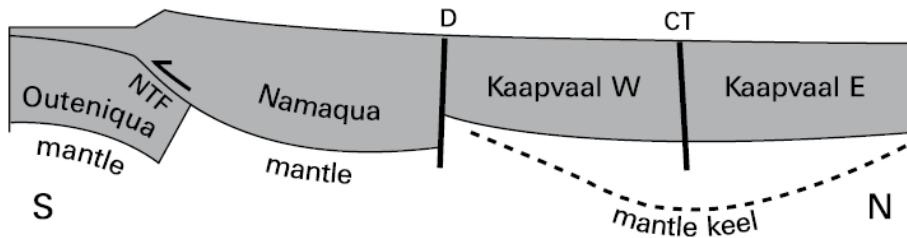
B Piekeniers Rifting by Upper Crustal Extension

490-470 Ma



A Saldanian Orogeny

650-500 Ma



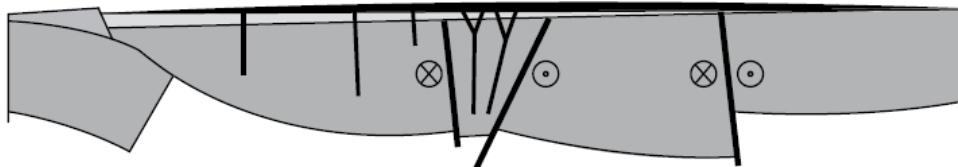
Oldest

Tankard et al., 2009

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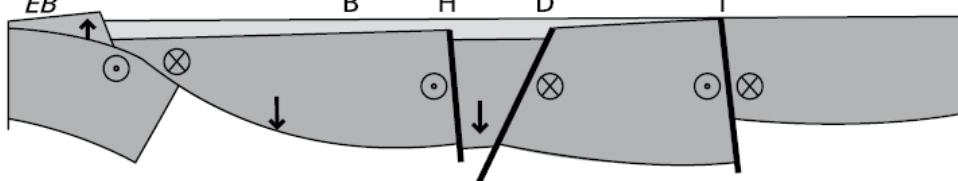
Karoo Supergroup

H Tectonic Resetting and Drakensberg Flood Basalts 200-180 Ma

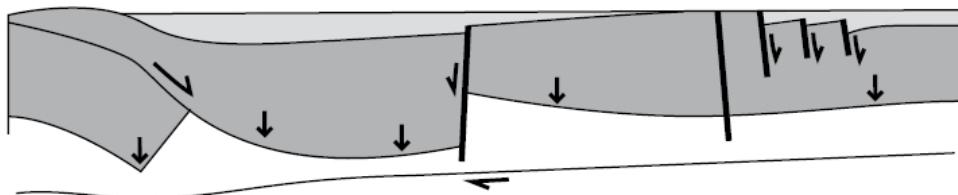


Youngest

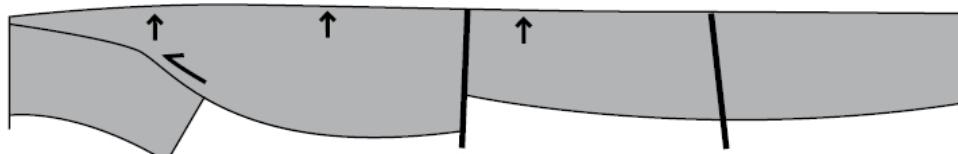
G Cape Orogeny and Transtensional Foreland Basin 250-200 Ma



F Early Karoo Dynamic Subsidence by Mantle Flow 290-260 Ma

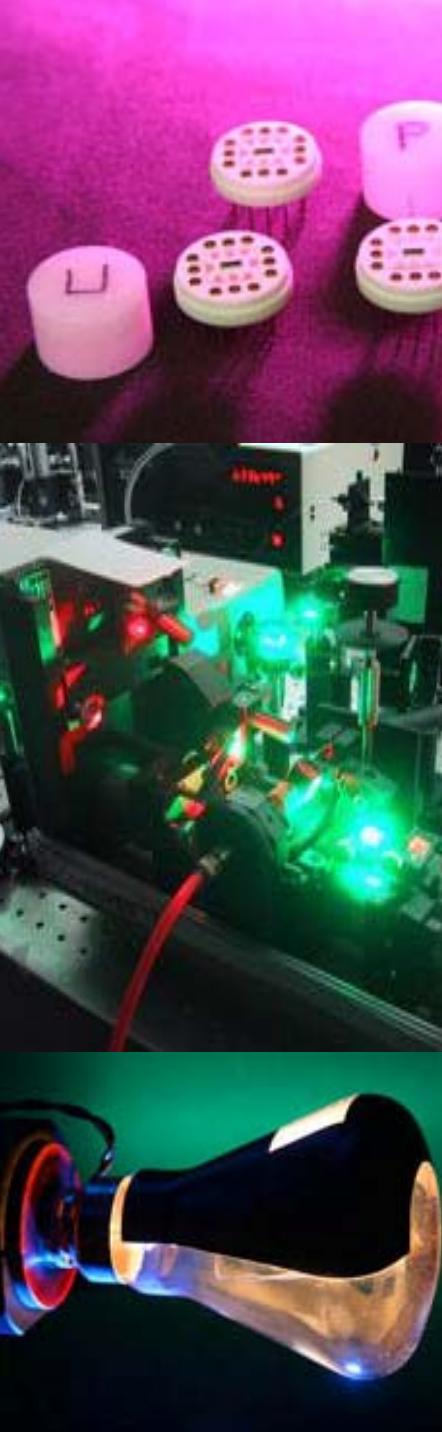


E Late Carboniferous Shortening and Uplift 330-305 Ma



Oldest

Tankard et al., 2009



Future work

- Geophysical
- Gravity
- EM
- Seismics – problem with farmers !
- More sedimentology

Questions ?



Courtesy Exxaro



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Thank you

Acknowledgments : Coaltech, CGS, CSIR



Catuneanu et al. 1998

