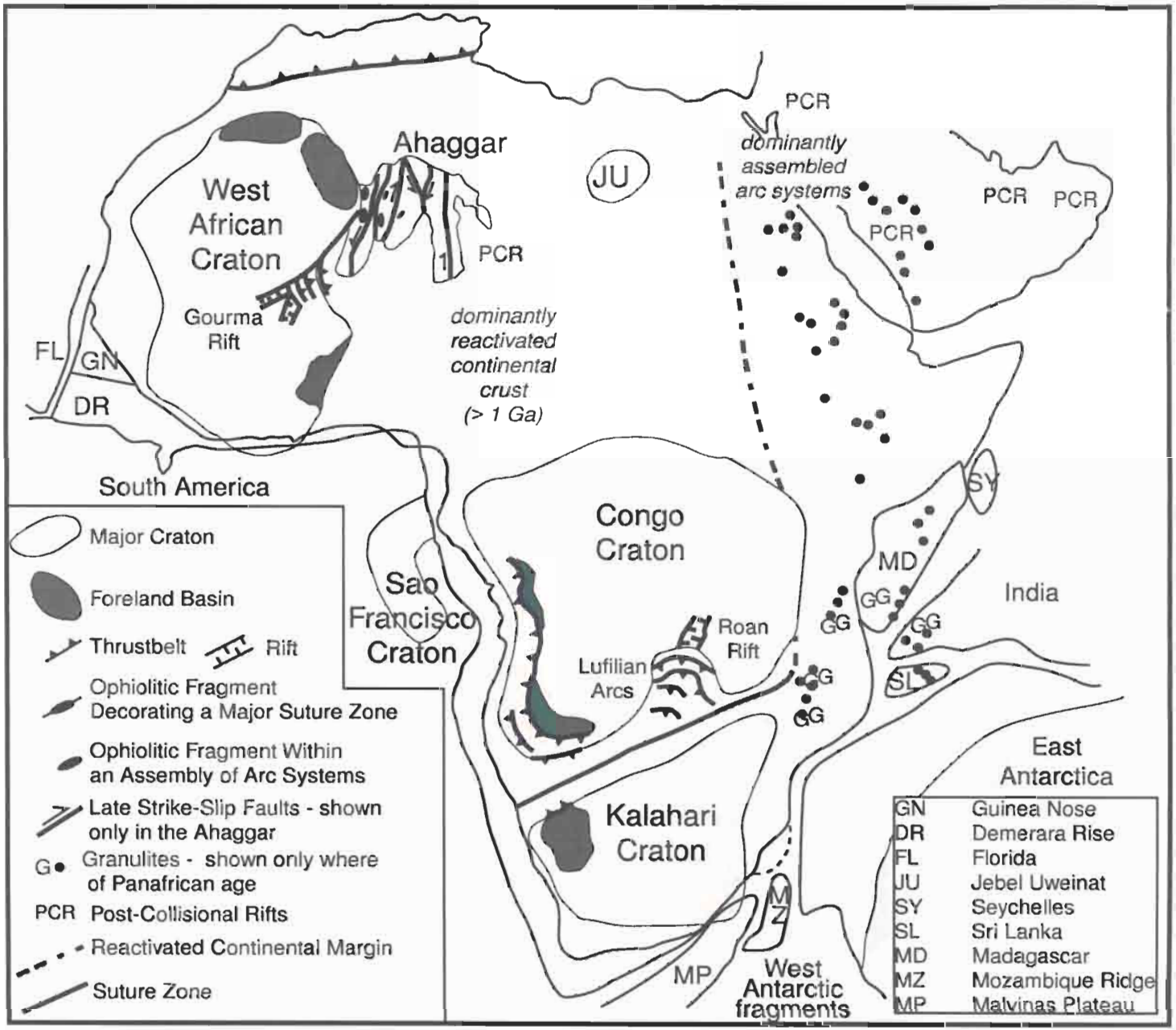
THE PANAFRICAN OROGENY

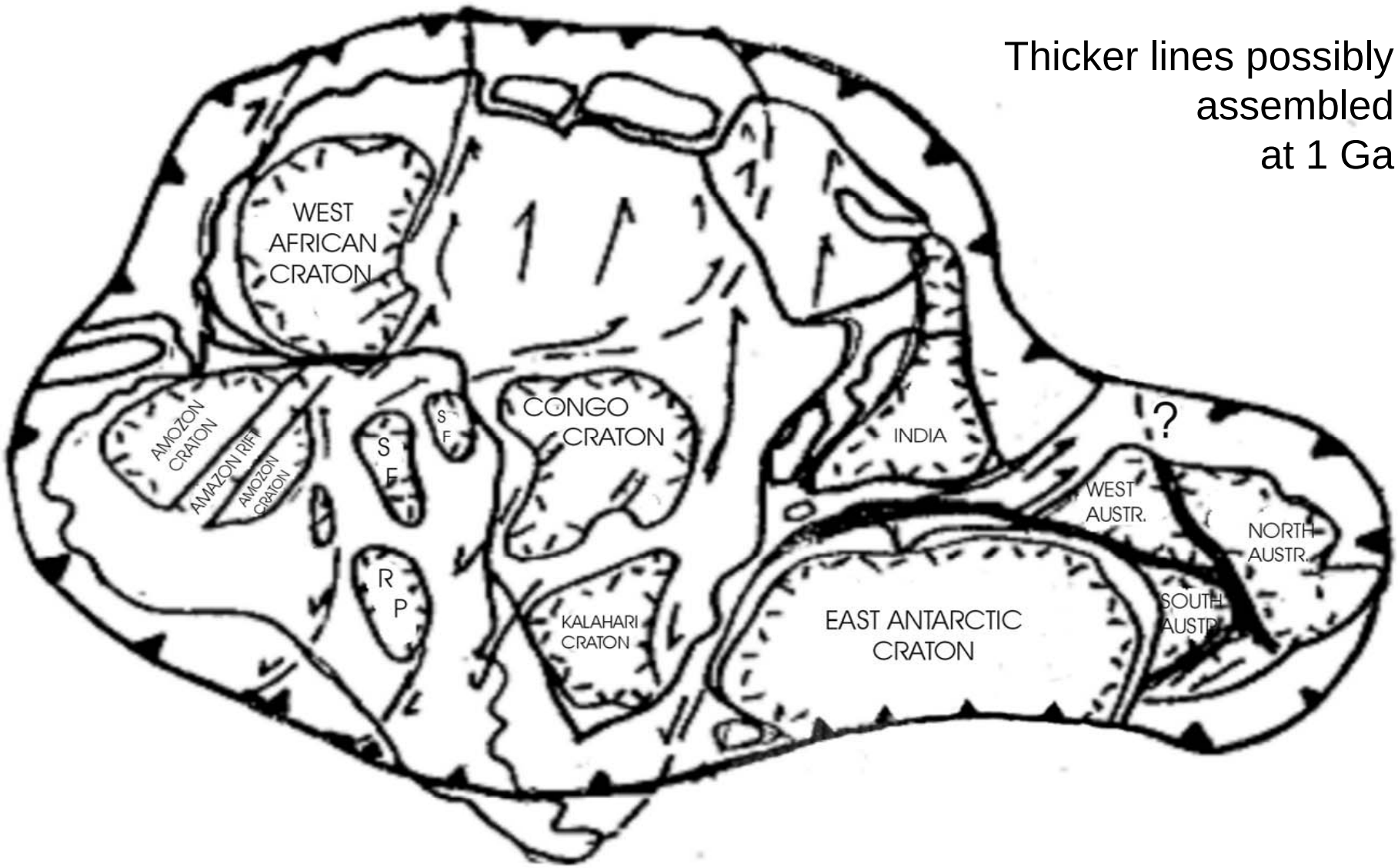
Panafrican Tectonic Elements



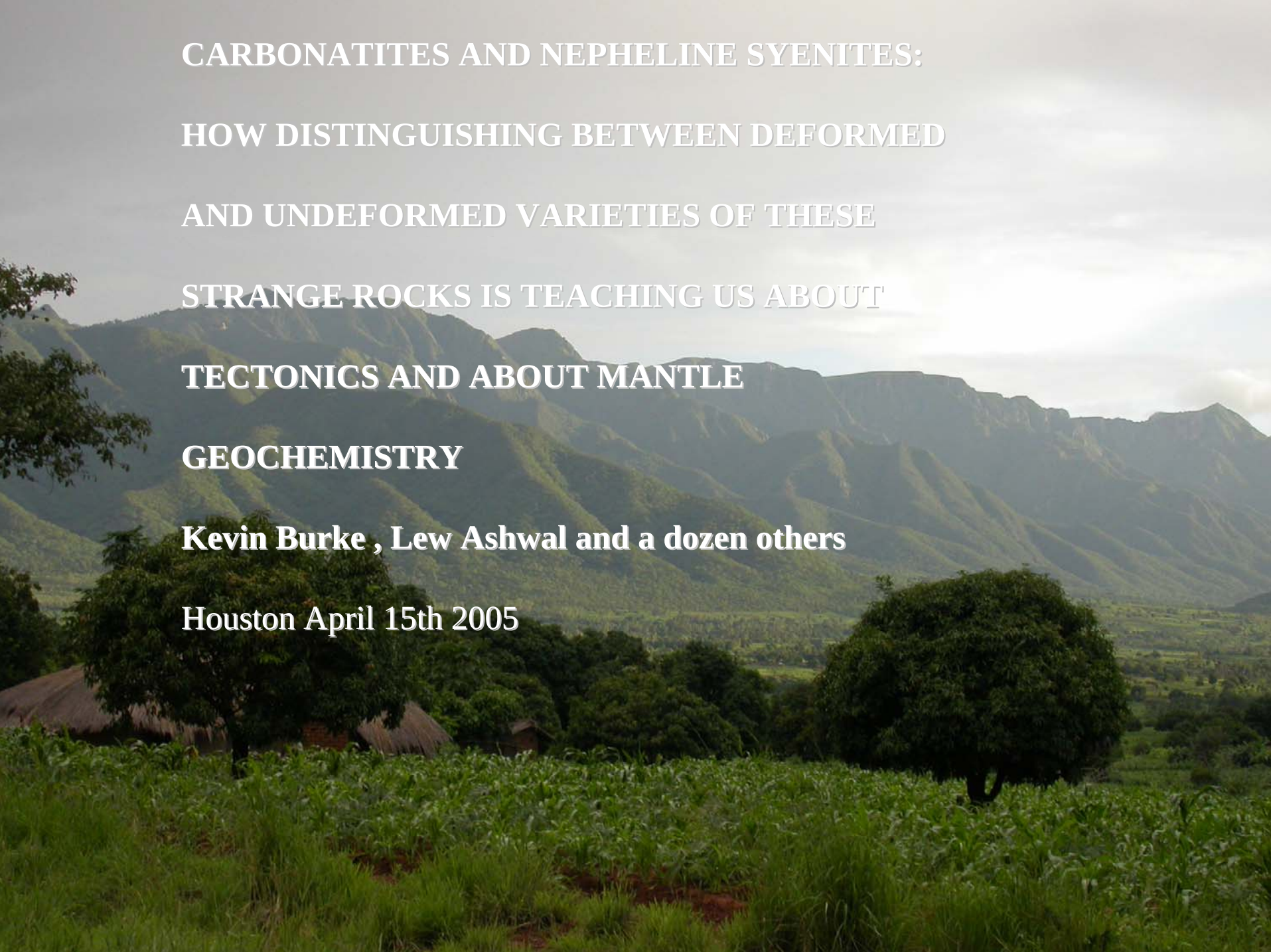
How Africa was assembled

DR - DEMERARA RISE
G - GRANULITE
GM - GOIAS MASSIF
GN - GUINEA NOSE
JU - JEBEL UWEINAT
M - MADAGASCAR
MOZ - MOZAMBIQUE RIDGE
MP - MALVINAS PLATEAU
PCR - POST COLLISIONAL RIFTS
RDP - RIO DE LA PLATA
S - SRI LANKA
SY - SEYCHELLES

Newly assembled Gondwana ca. 550 Ma



Thicker lines possibly assembled at 1 Ga



CARBONATITES AND NEPHELINE SYENITES:

HOW DISTINGUISHING BETWEEN DEFORMED AND UNDEFORMED VARIETIES OF THESE STRANGE ROCKS IS TEACHING US ABOUT TECTONICS AND ABOUT MANTLE GEOCHEMISTRY

Kevin Burke , Lew Ashwal and a dozen others

Houston April 15th 2005

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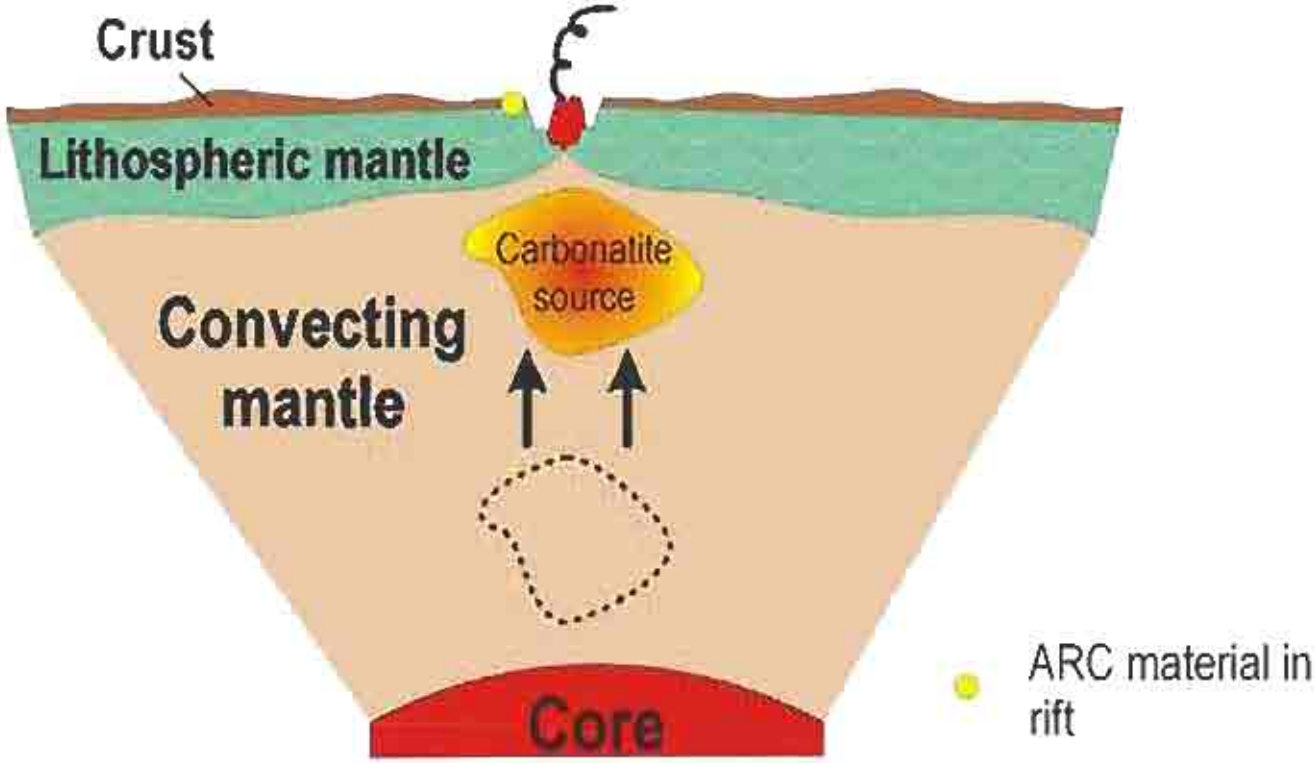
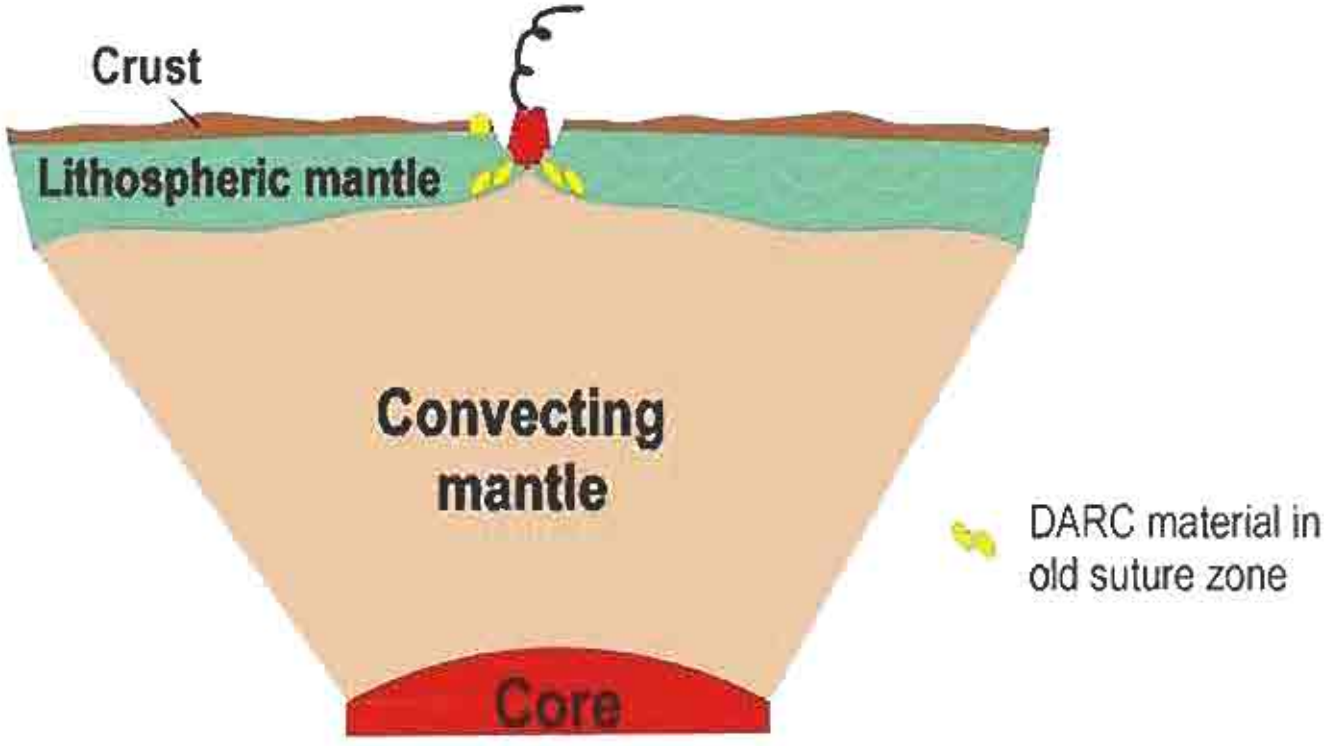
Carbonatite source is a deep mantle plume



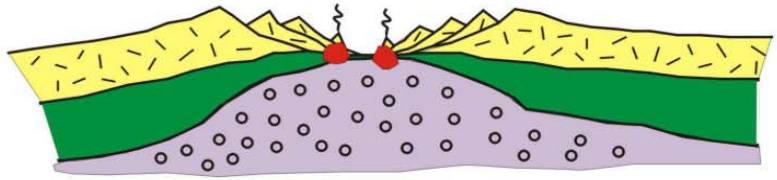
Plume model

Alkaline Rock and Carbonatites (ARCs)
source is Deformed Alkaline Rocks and Carbonatites (DARC)
and Depleted mantle (DM) in the mantle lithosphere

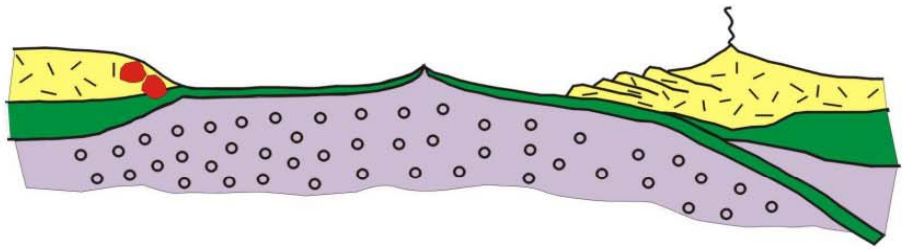


DARC model

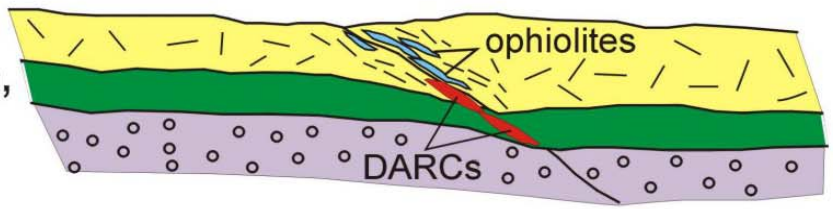
A. 1000? Ma
First alkaline rocks formed,
Continental rupture



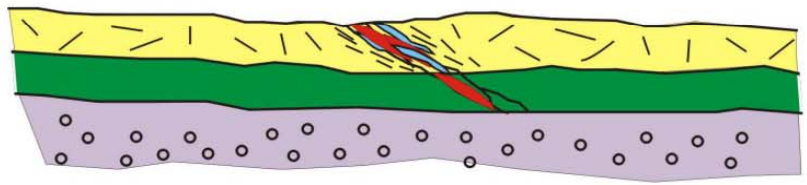
B. 700? Ma
Ocean open,
Alkaline rocks not active



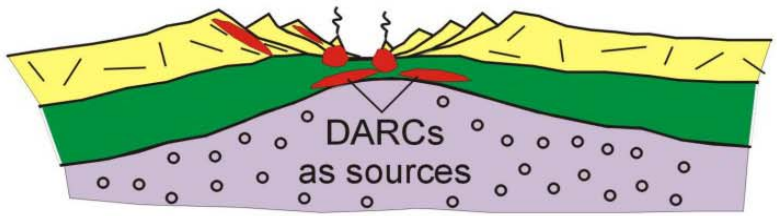
C. 550Ma
Pan-African collision,
Deformation of alkaline rocks



D. 450 - 140 Ma
Lithospheric stability,
DARCs in crust & mantle lithosphere



E. 140 Ma
Cretaceous rifting,
Renewed alkaline igneous activity



After Burke *et al*. (2003)

Burke *et al*. (2003)

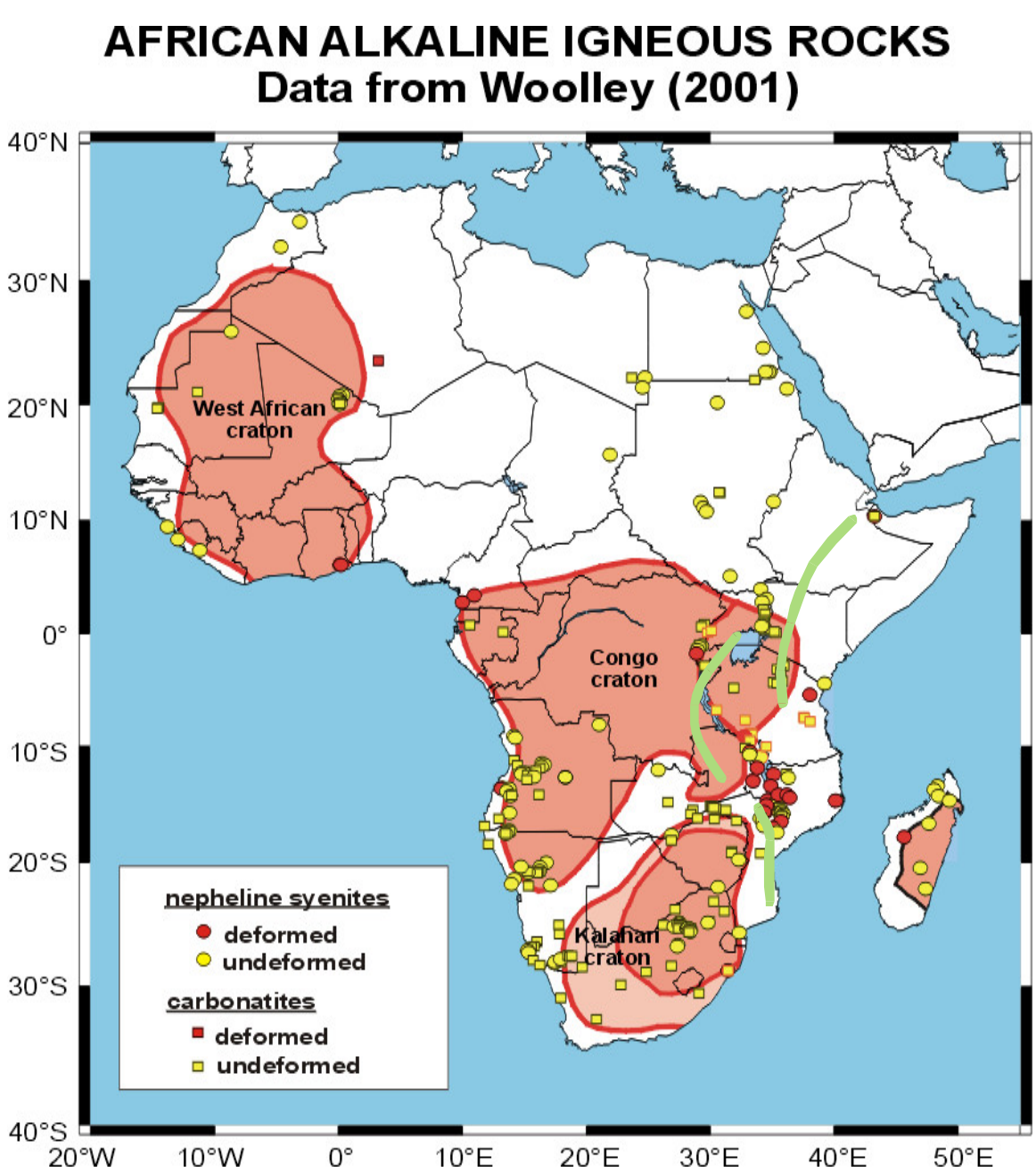
ARCs = Alkaline Rocks & Carbonatites

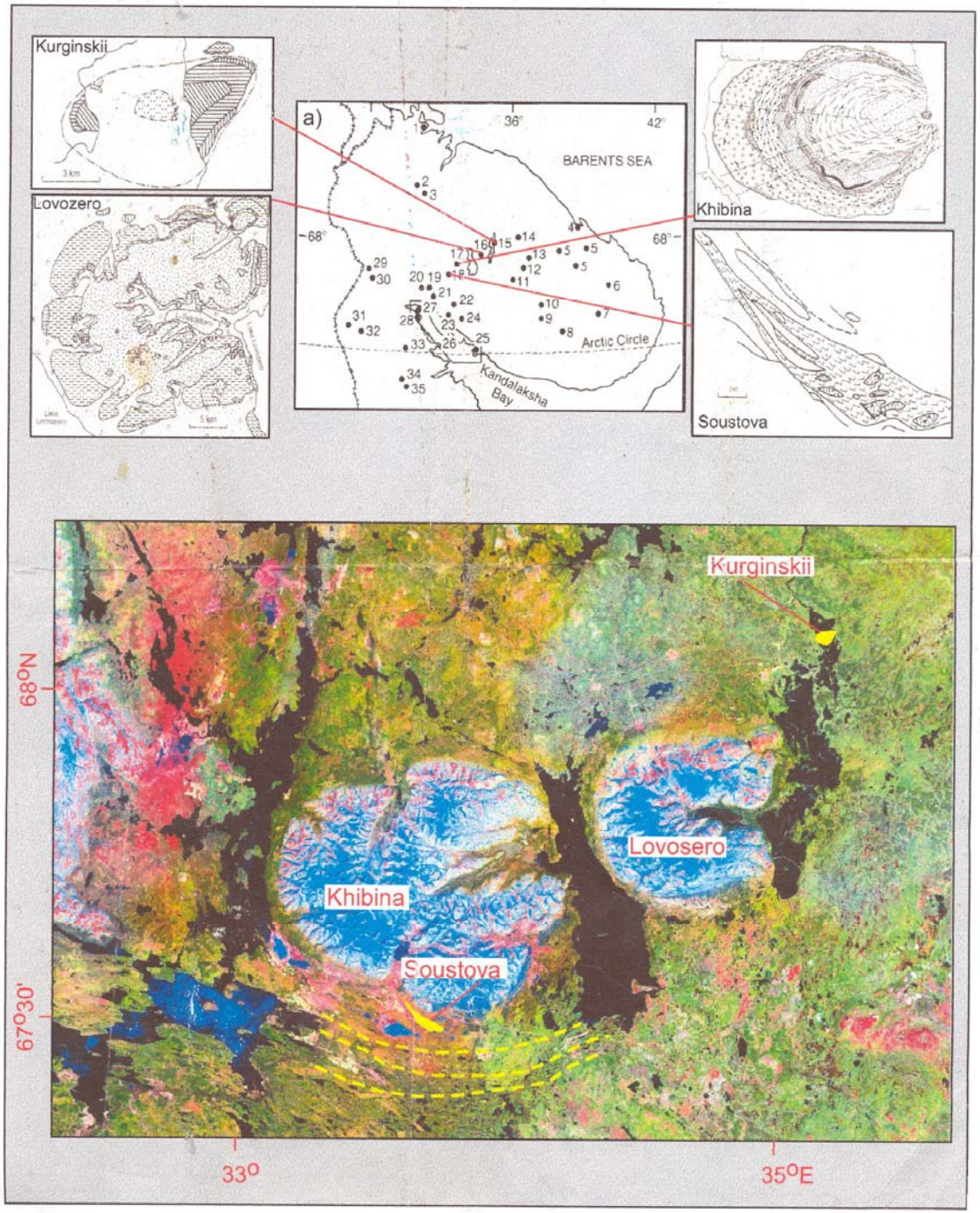
DARCs = Deformed Alkaline Rocks and & Carbonatites

- **All igneous ARCs and DARCs have mantle isotopic signatures**

- **Many alkaline rocks and carbonatites (ARCs) are strongly associated with rifts**

(Figure after Burke *et al.*, 2003)





Kola Peninsula

ARCs are about 400 Ma emplaced during continental collision in Norwegian Caledonides ~300 km away

DARCs (yellow) have yielded 2.4 Ga and 2.0 Ga ages

Kogarko et al. (1995)

This association raises the question: “Could there be DARKs and later kimberlites?”

- **DARCs (Deformed Alkaline Rocks and Carbonatites) are associated with known/ inferred suture zones**

- **Rifts/suture zones show recurrent nepheline syenite and carbonatite activity**

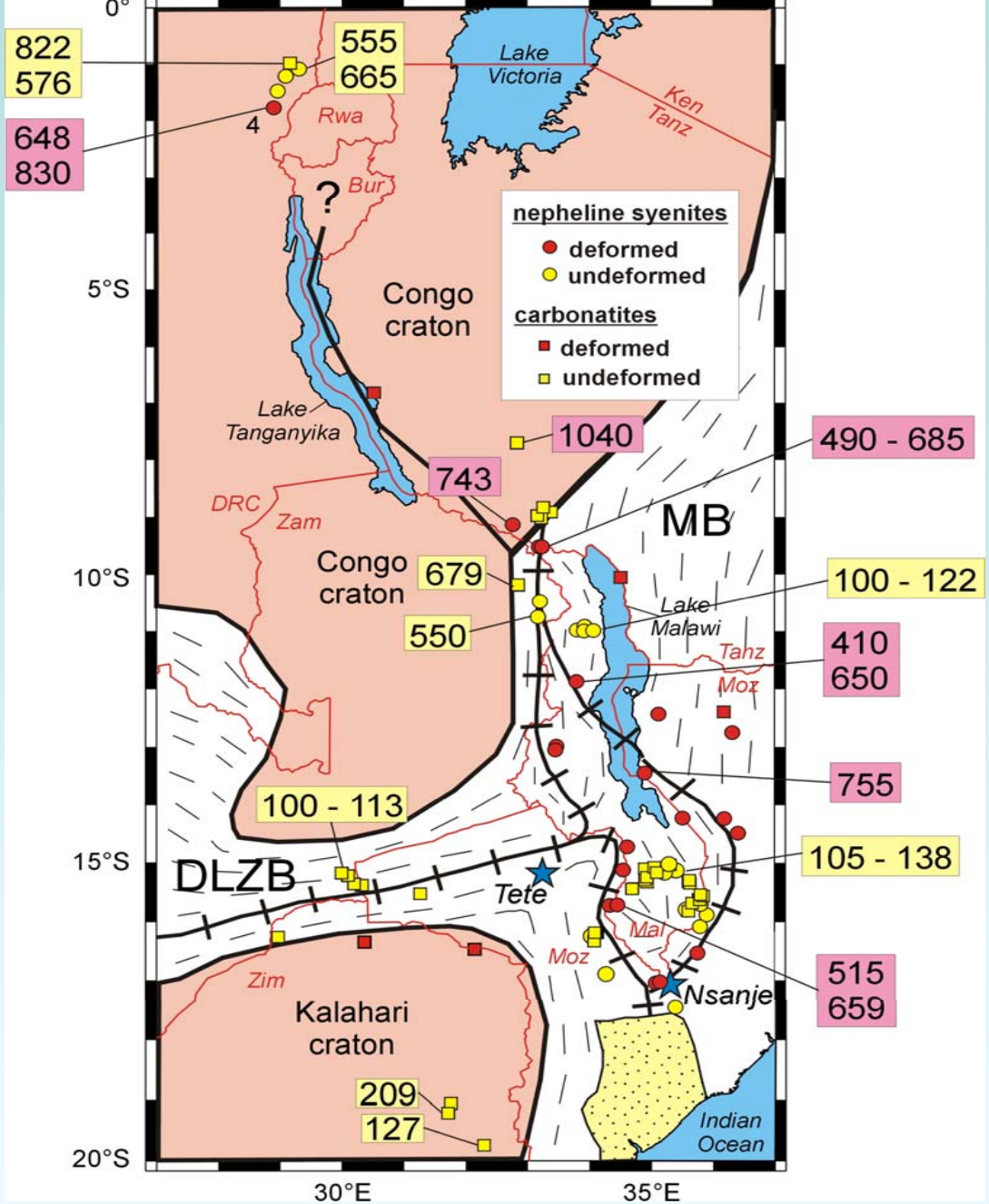
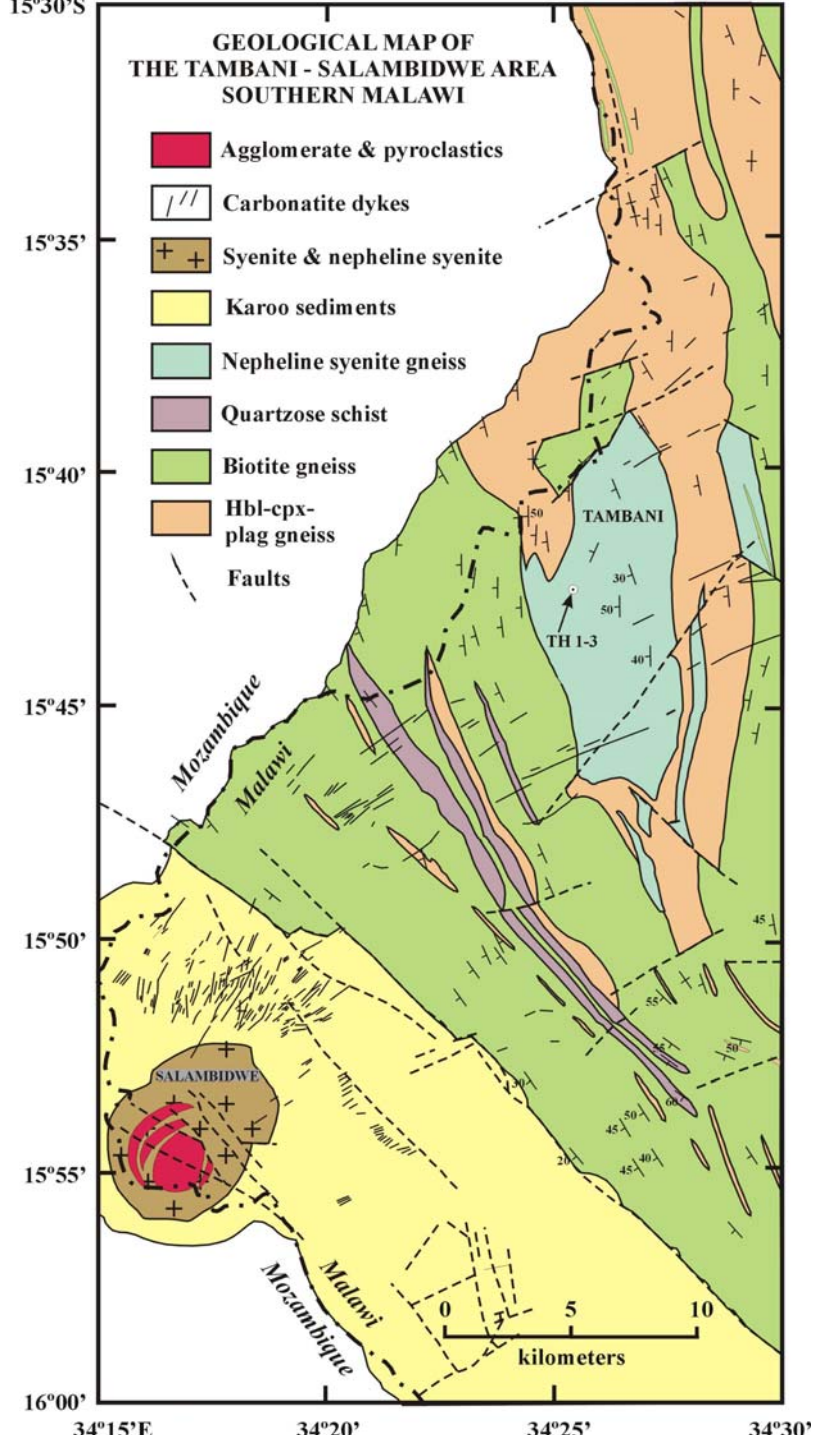


Image courtesy of The Geological Society of America.

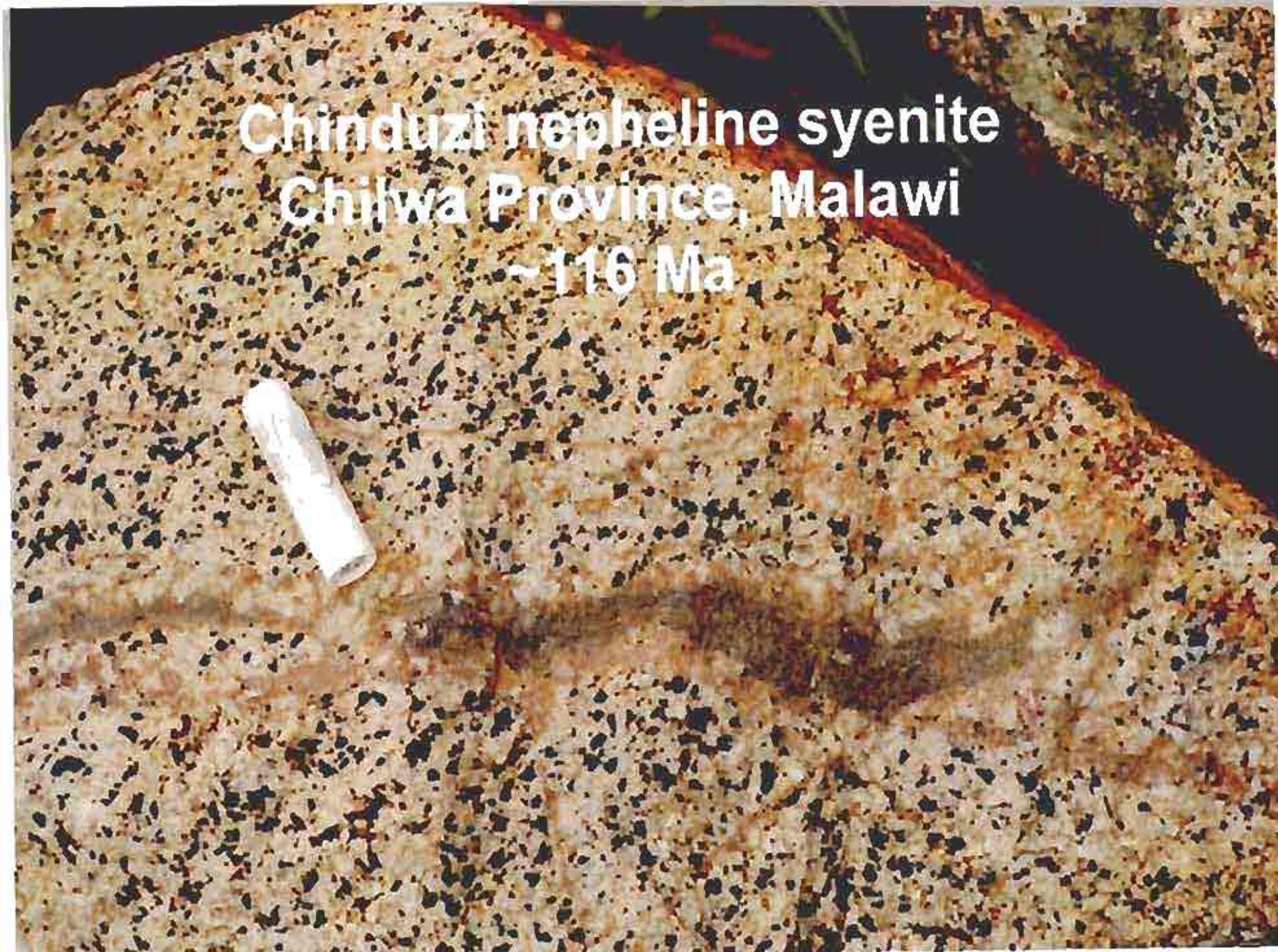
- **ARCs and DARCs of different ages occur within small distances from each other e.g. Thambani & Salambidwe, southern Malawi**



Data set

AIM: TO DETERMINE A GENETIC LINK BETWEEN OLDER DARCs AND YOUNGER UNDEFORMED ARCs

- **Rb-Sr**
- **Sm-Nd**
- **Lu-Hf**


Chinduzi nepheline syenite
Chilwa Province, Malawi
~116 Ma


Chinduzi porphyritic foyaite
Chilwa Province, Malawi
~116 Ma


Nepheline syenite gneiss
Thambani, southern Malawi
>659 Ma