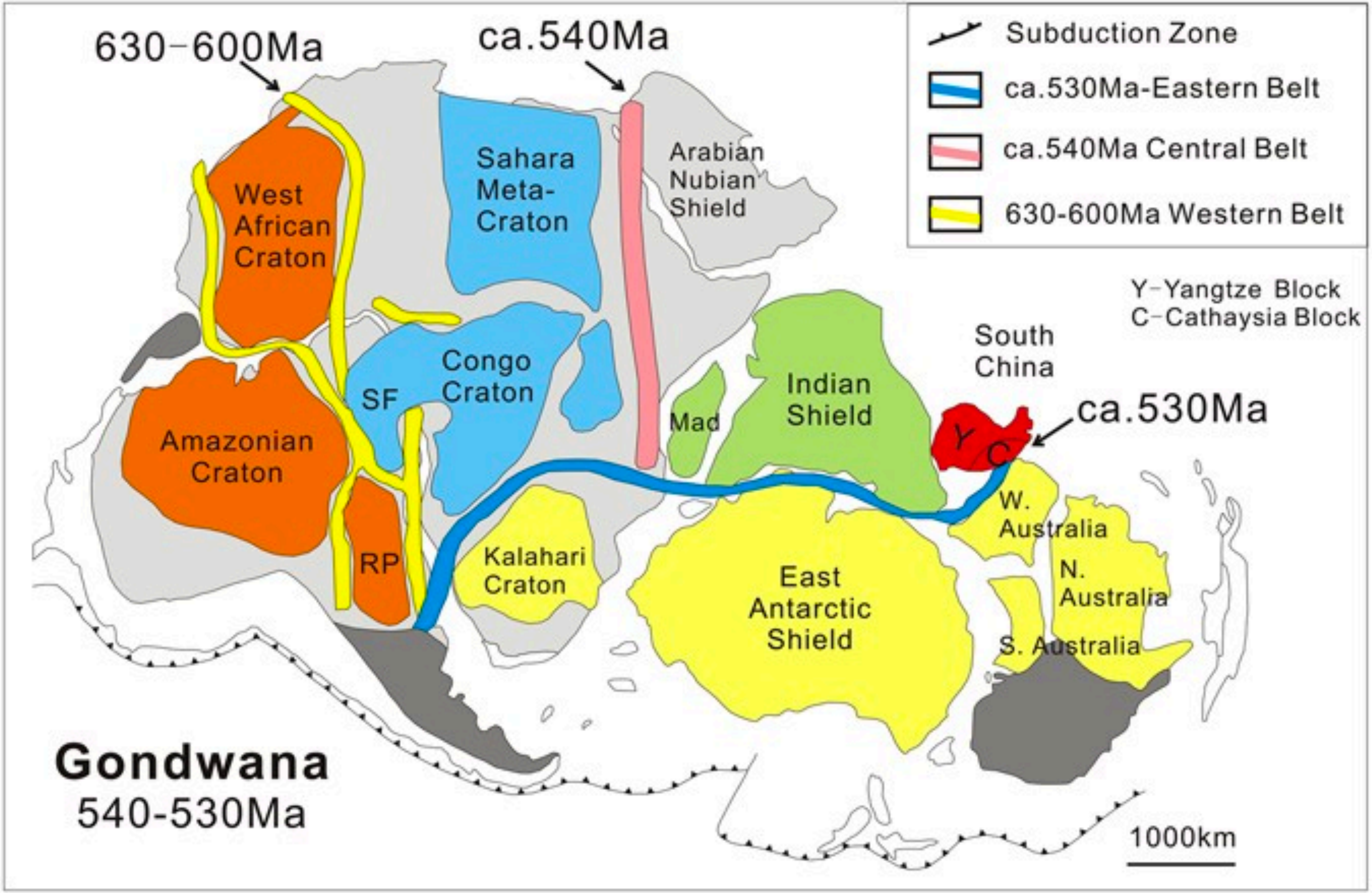
Brazilian Cratonic units in Precambrian continents

Ricardo Trindade,
Manoel S. D'Agrella-Filho, Paul Antonio, Wilson Teixeira, Franklin Bispo-Santos


630–600Ma
ca.540Ma
Subduction Zone
ca.530Ma-Eastern Belt
ca.540Ma Central Belt
630-600Ma Western Belt
West African Craton
Sahara Meta-Craton
Arabian Nubian Shield
Y–Yangtze Block
C–Cathaysia Block
South China
ca.530Ma
Y
C
SF
Congo Craton
Mad
Indian Shield
Amazonian Craton
RP
Kalahari Craton
East Antarctic Shield
W. Australia
N. Australia
S. Australia
Gondwana
540-530Ma
1000km

Several times in earth history the continents have joined to form one body, which later broke apart. The process seems to be cyclic; it may shape geology and climate and thereby influence biological evolution

Nance et al. 1988. The Supercontinent Cycle

Tópicos a serem abordados:

1. Origem e evolução da crosta continental

2. Continentes, Supercontinentes e Supercratons

3. O ciclo de Supercontinentes

4. Seriam os supercontinentes introvertidos ou extrovertidos ?

5. Velocidade de Placas no Arqueano, Pangea A e B, Columbia

6. Síntese

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Focus paper

Strange attractors, spiritual interlopers and lonely wanderers: The search for pre-Pangean supercontinents

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A R T I C L E I N F O

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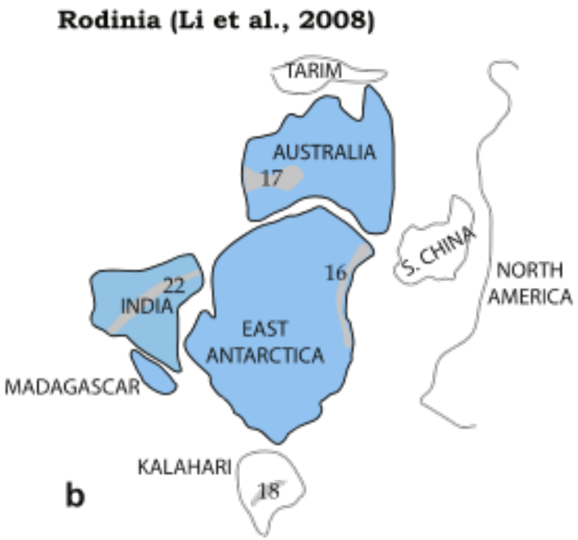
Supercontinent
Tectonics

A B S T R A C T

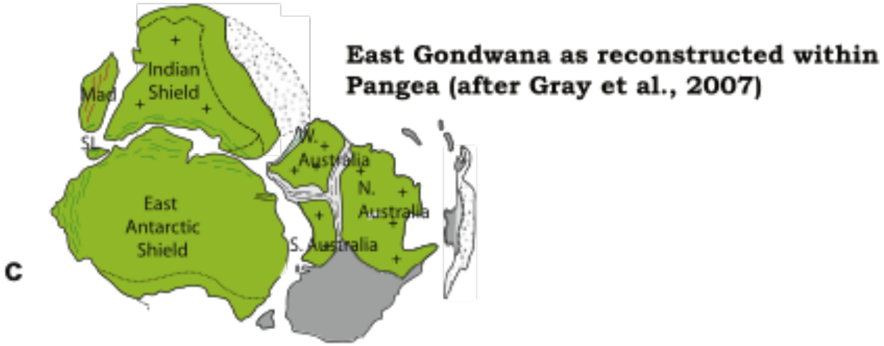
The observation is made that there are very strong similarities between the supercontinents Columbia, Rodinia and Pangea. If plate tectonics was operating over the past 2.5 billion years of Earth history, and dominated by extroversion and introversion of ocean basins, it would be unusual for three supercontinents to resemble one another so closely. The term 'strange attractor' is applied to landmasses that form a coherent geometry in all three supercontinents. Baltica, Laurentia and Siberia form a group of 'strange attractors' as do the elements of East Gondwana (India, Australia, Antarctica, Madagascar). The elements of "West Gondwana" are positioned as a slightly looser amalgam of cratonic blocks in all three supercontinents and are referred to as 'spiritual interlopers'. Relatively few landmasses (the South China, North China, Kalahari and perhaps Tarim cratons) are positioned in distinct locations within each of the three supercontinents and these are referred to as 'lonely wanderers'.

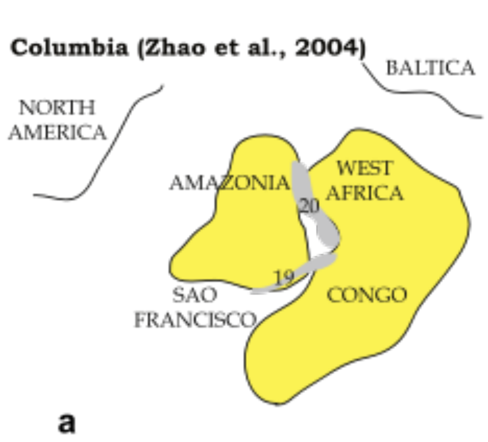
There may be several explanations for why these supercontinents show such remarkable similarities. One possibility is that modern-style plate tectonics did not begin until the late Neoproterozoic and horizontal motions were restricted and a vertical style of 'lid tectonics' dominated. If motions were limited for most of the Proterozoic, it would explain the remarkable similarities seen in the Columbia and Rodinia supercontinents, but would still require the strange attractors to rift, drift and return to approximately the same geometry within Pangea.

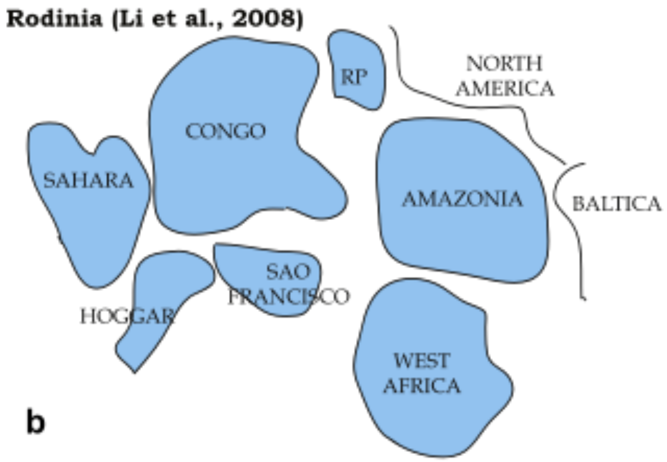
A second possibility is that our views of older supercontinents are shaped by well-known connections documented for the most recent supercontinent, Pangea. It is intriguing that three of the four 'lonely wanderers' (Tarim, North China, South China) did not unite until just before, or slightly after the breakup of Pangea. The fourth 'lonely wanderer', the Kalahari (and core Kaapvaal) craton has a somewhat unique Archean-age geology compared to its nearest neighbors in Gondwana, but very similar to that in western Australia.



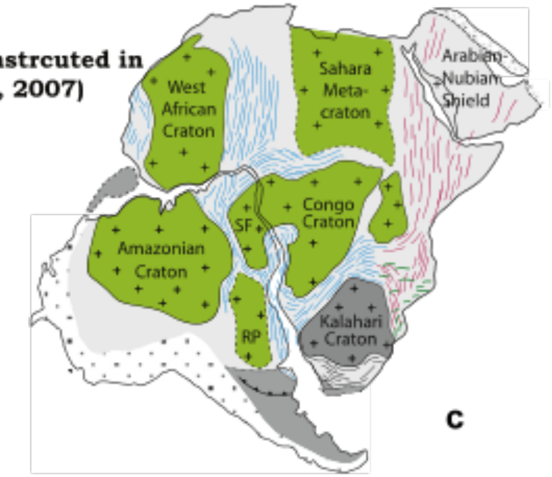
Strange attractors



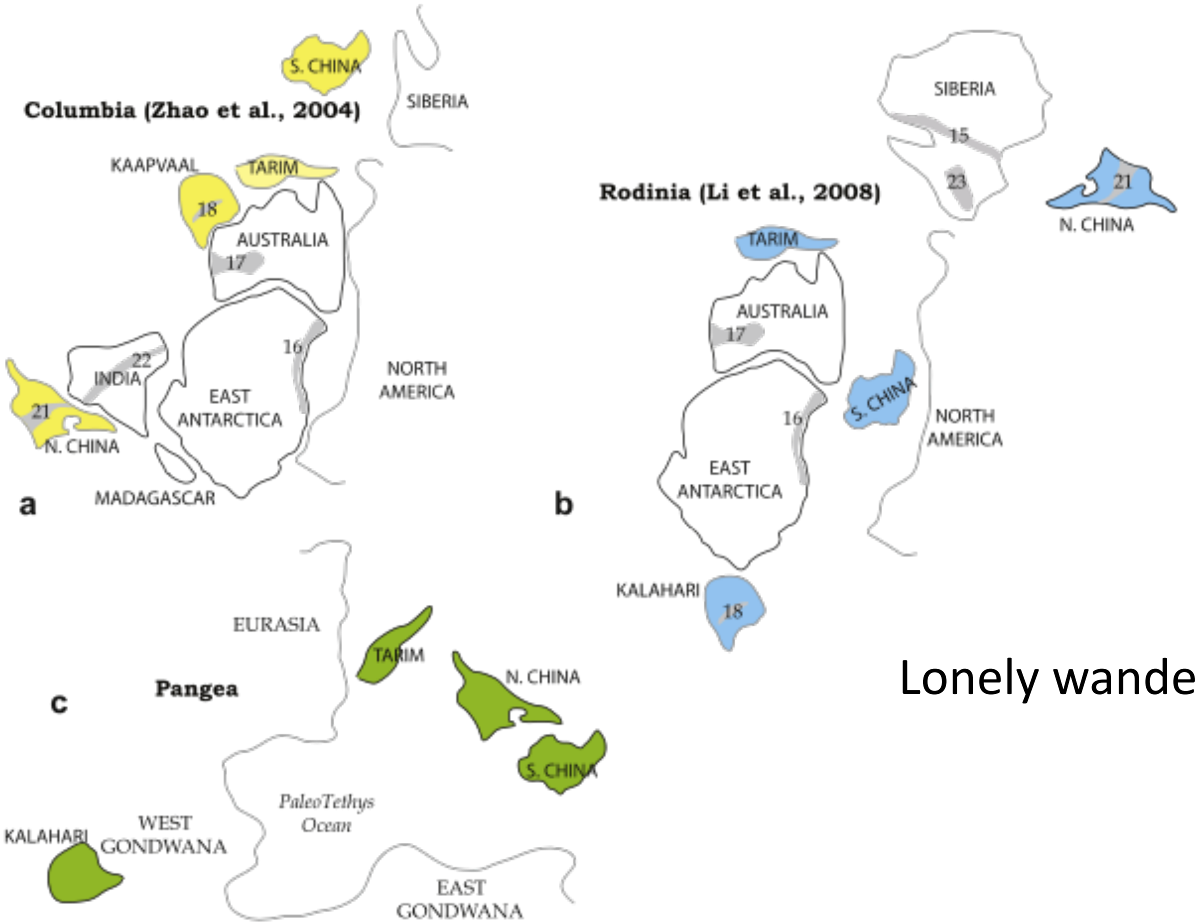




West Gondwana as reconstrcuted in Pangea (after Gray et al., 2007)



Spiritual interloopers



Lonely wanderers

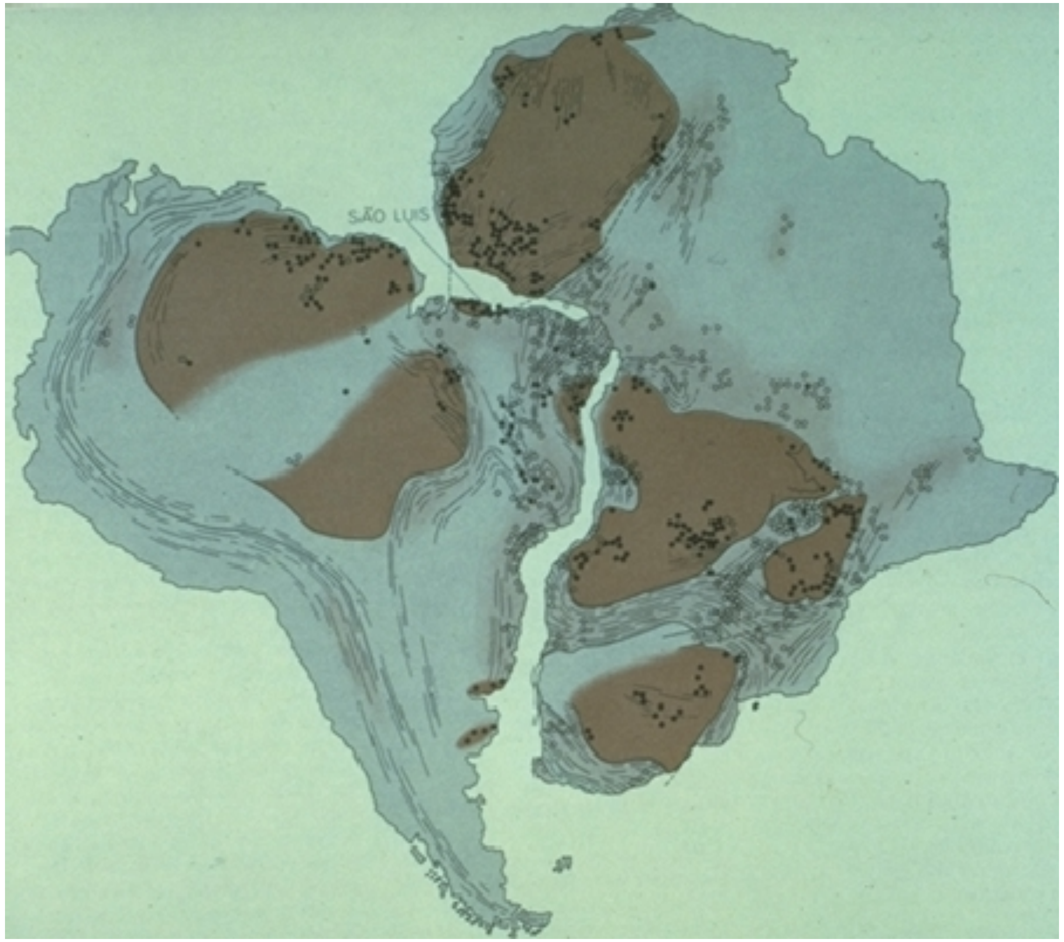
Supercontinentes: reunião de diversos blocos de litosfera continental compreendendo pelo menos 70% da superfície total dos continentes (Meert, 2012) – Colúmbia, Rodinia, Pangea.

Supercrátons: reunião de diversos blocos de litosfera continental que corresponde a menos de 70% da superfície total dos continentes

Pangea
(Wegener, 1913, Du Toit, 1923; *Irving, 1953*)

Rodinia
(Hoffman, 1991, Dalziel, 1991; *D'Agrella-Filho et al. 1998, Weil et al., 1998*)

Columbia
(Zhao et al., 2002, 2004; Meert, 2003, Bispo-Santos et al., 2008, Evans & Mitchell, 2011)



Supercontinent reconstruction criteria

Classical methods (Wegener, Du Toit):

1) Coastlines fit
2) Fossils
3) Paleoclimatic indicators (glacials, carbonate e evaporite)
4) Continuity of geological provinces

'Modern' methods (Precambrian continentes)

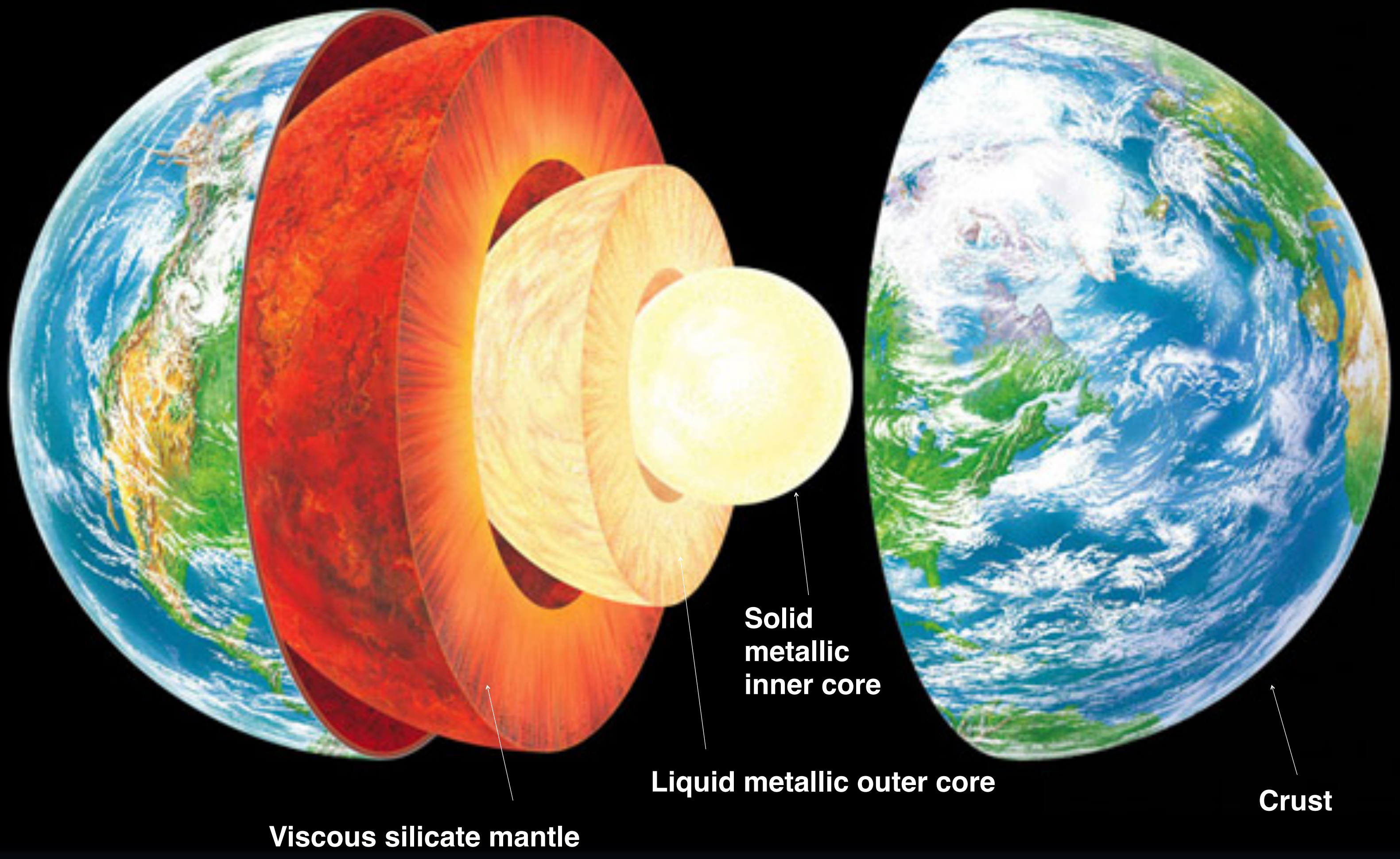
1) Transform faults
2) Seafloor magnetic anomalies
3) Continuity of isotopic provinces
4) Provenance studies (Pb-Hf in zircon, Ar-Ar in micas)
5) Age and continuity of dyke swarms and LIPs (barcode)
6) Paleomagnetism **(only quantitative way to test paleogeographic configurations)**

Two main assumptions of Paleomagnetism

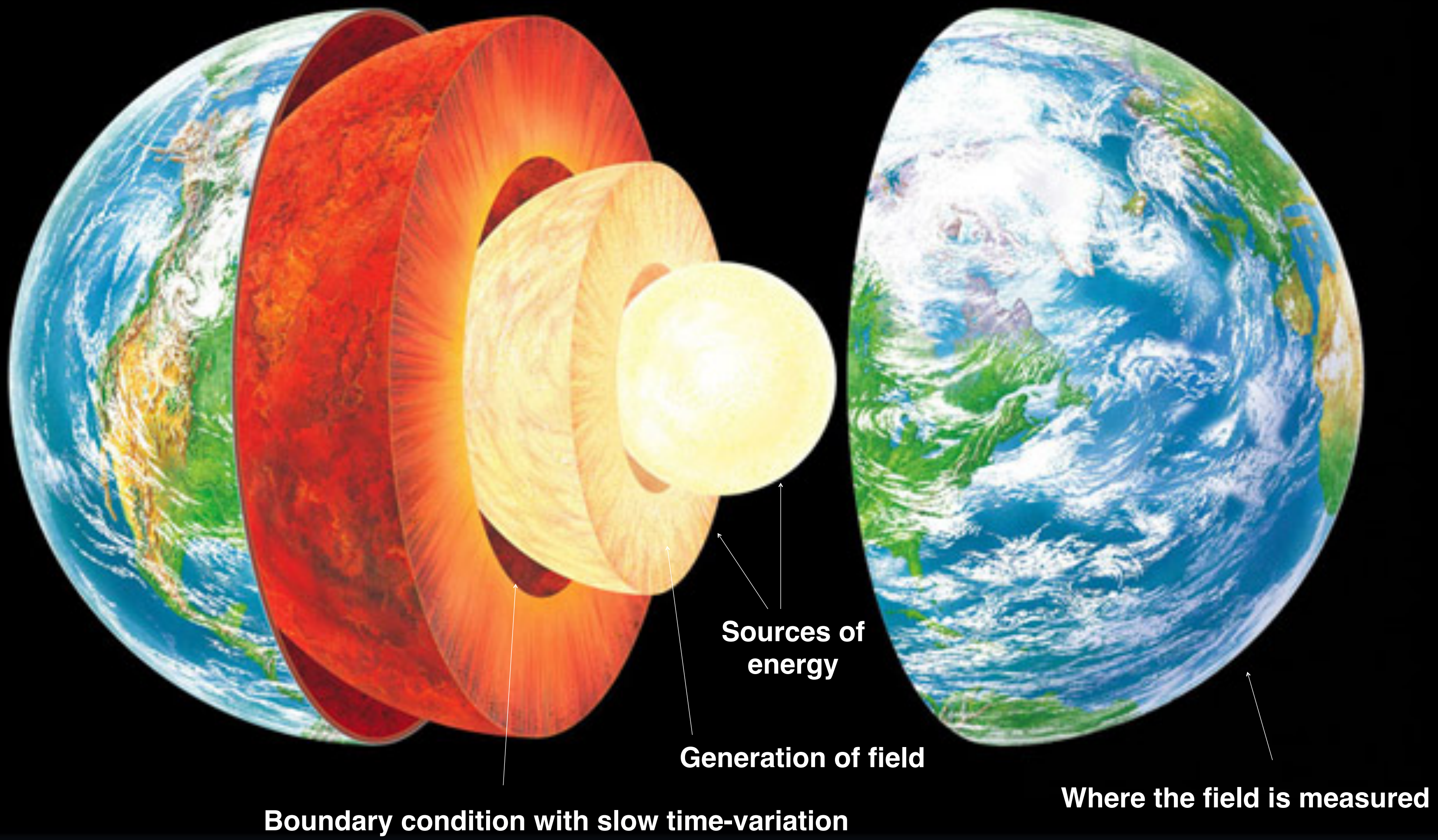
GAD: *For long time intervals (>10 Ka) the Earth's magnetic field behaves as a dipole centered in the planet and aligned with its spinning axis.*

Rocks get (and stay) magnetized in the geological time scale: *when rocks are formed they acquire a remanent magnetization parallel to the ambient magnetic field. This magnetization decays slowly (multi-million to billions of years time scale).*

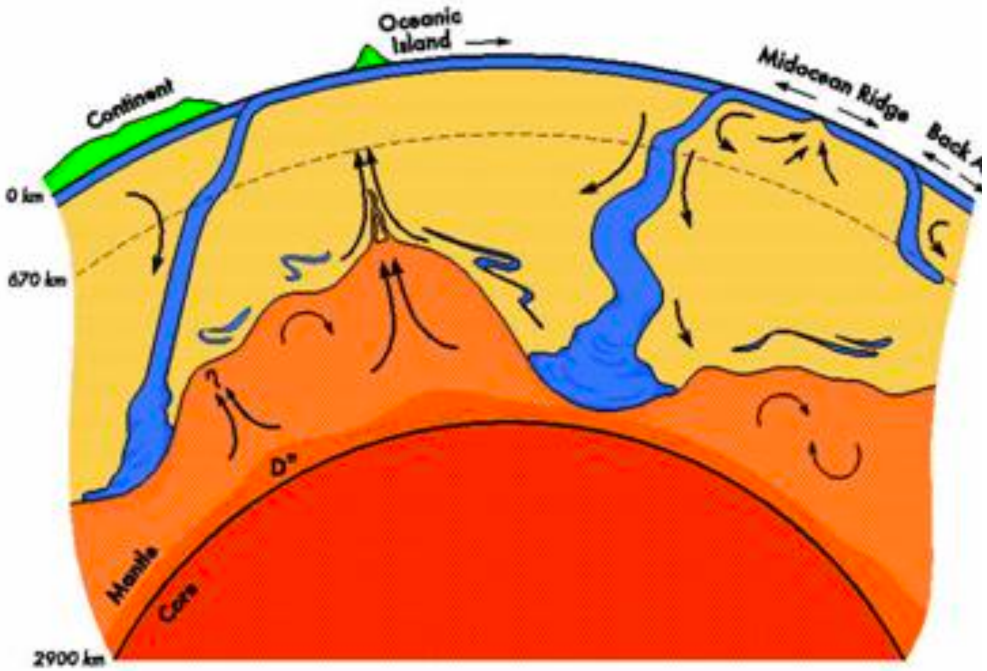
Earth's internal structure

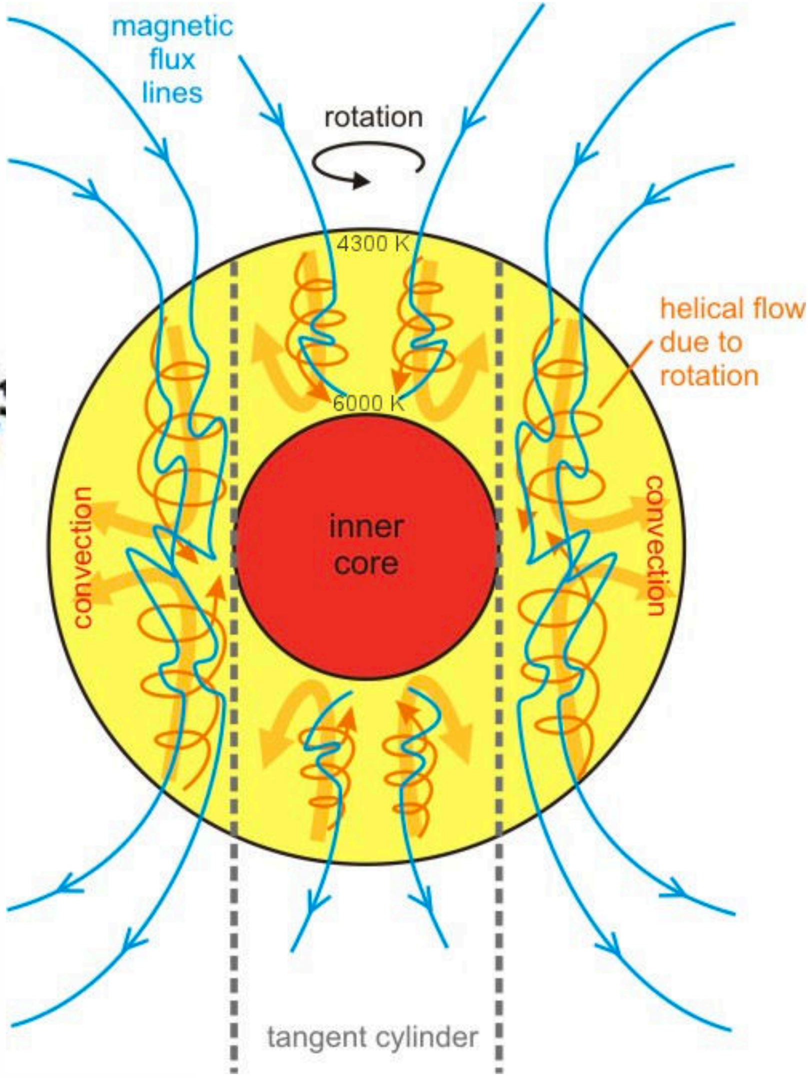


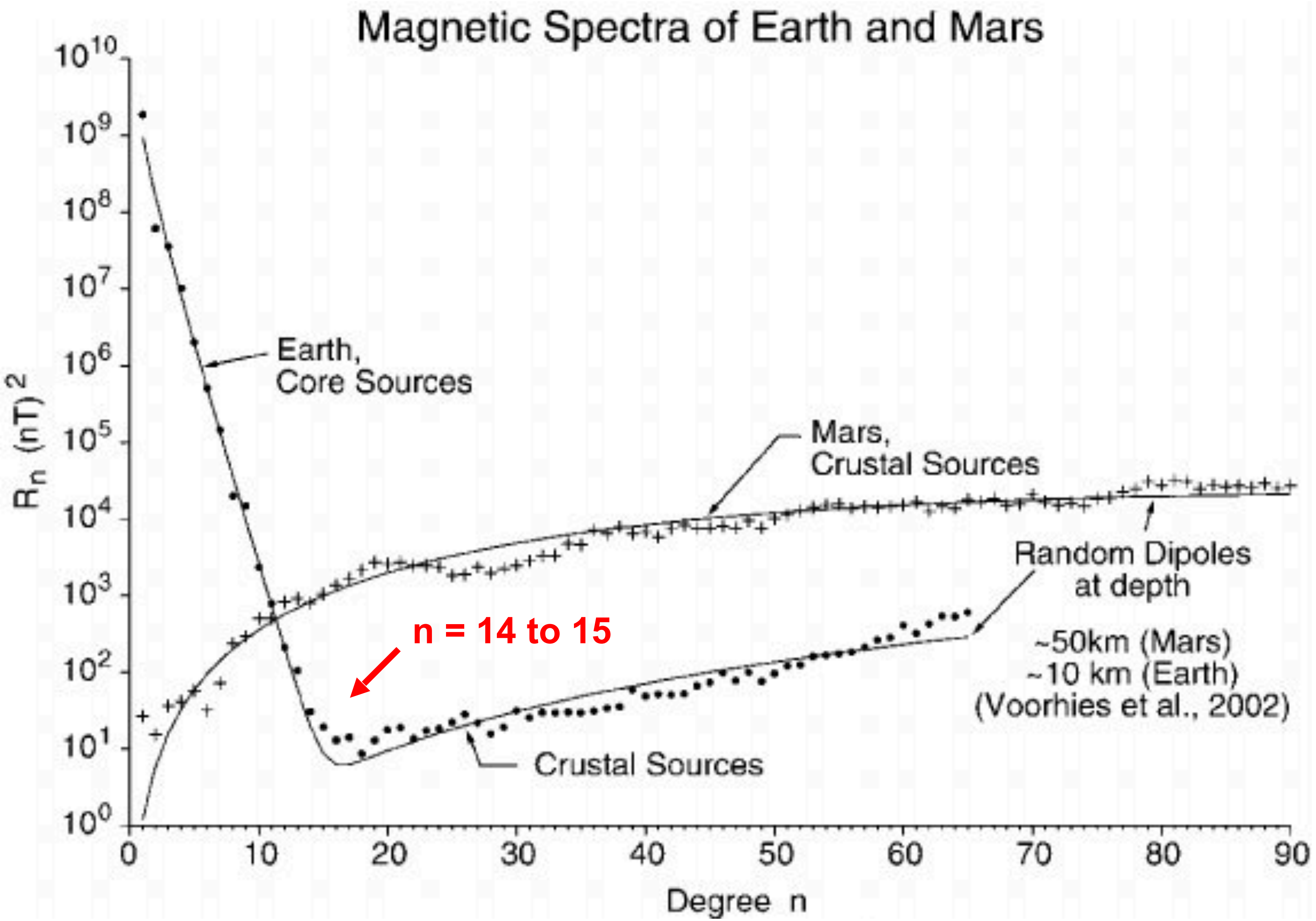
Origin of the Earth’s Magnetic Field



Convecção no núcleo + giro diferencial
geram o campo magnético terrestre



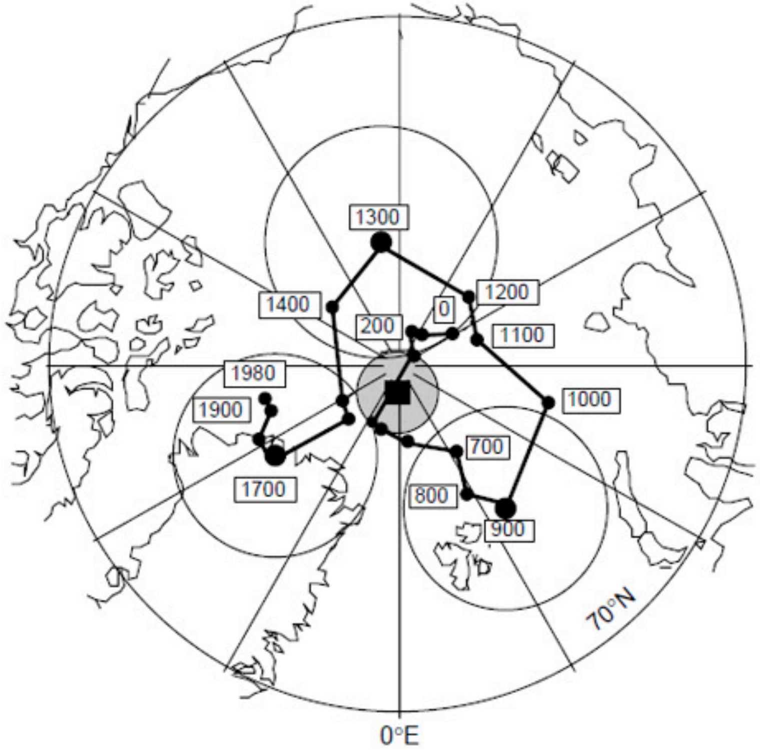




Magnetic Spectra of Earth and Mars
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}
R_n (nT) ^{2}
Earth,
Core Sources
Mars,
Crustal Sources
Random Dipoles
at depth
~50km (Mars)
~10 km (Earth)
(Voorhies et al., 2002)
n = 14 to 15
Crustal Sources
0
10
20
30
40
50
60
70
80
90
Degree n

"It is not very well known exactly how much time is required to average out secular variation; the consensus is that it is more than 400 years but less than 5 million. Most text books claim that 10^4 –10^5 years is sufficient. The minimum number of sampling sites required for a "good" average is also poorly constrained. Conventional wisdom suggests at least ten, while (Tauxe et al., 2003) suggest that approximately 100 sites are required to fully sample secular variation."

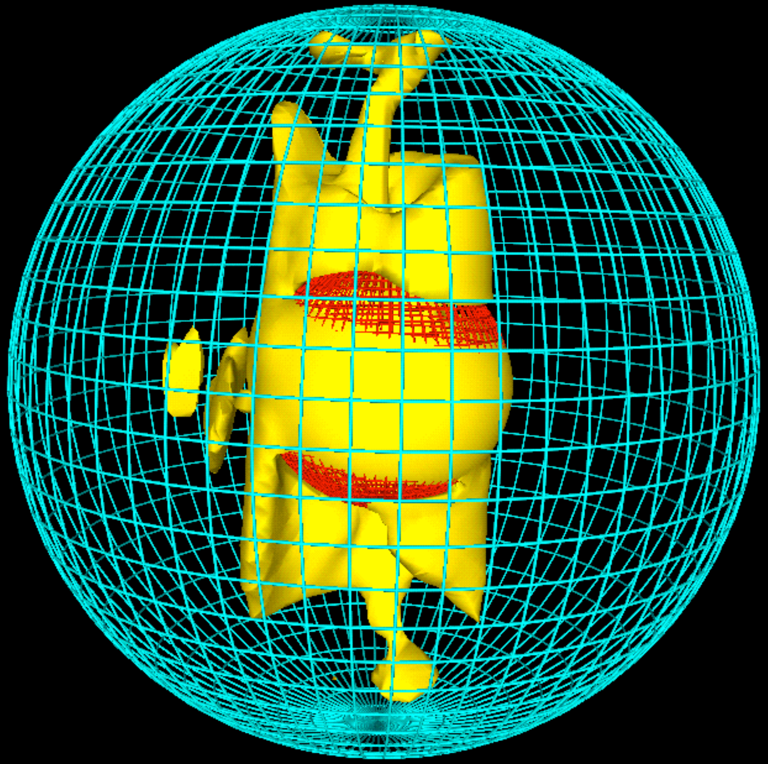
Tauxe (2015)



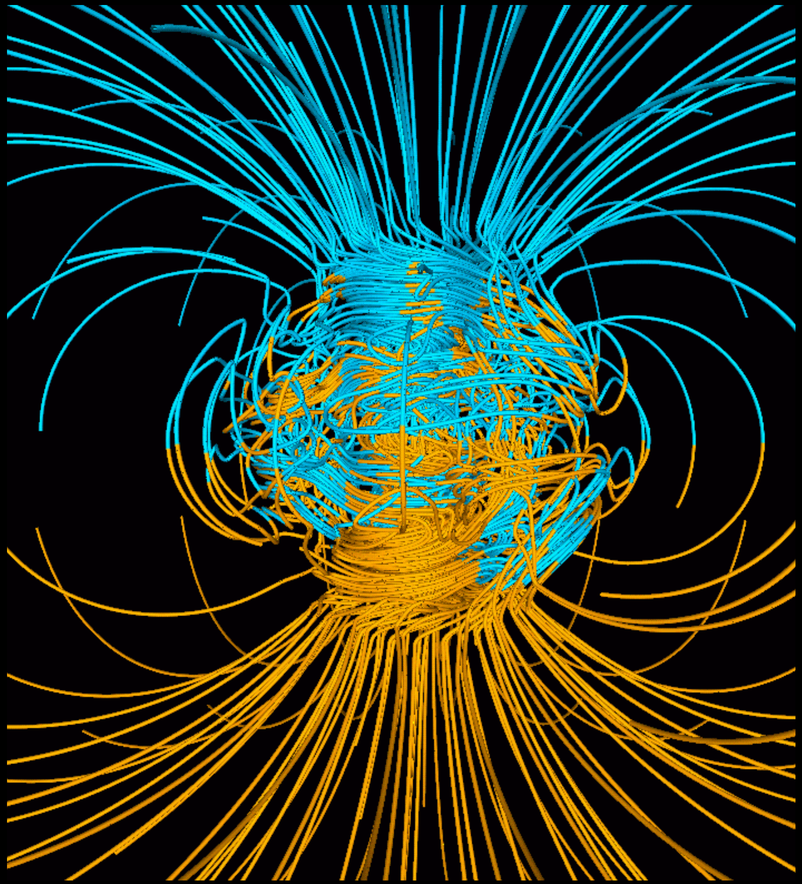
Global average paleomagnetic poles each 100 yrs for the past two millenia

Merrill and MacElhinny (1983) *in* Butler (1992)

The ‘normal’ GAD field



Glatzmaier and Roberts, 1995, Nature, vol. 377, p. 203-209.



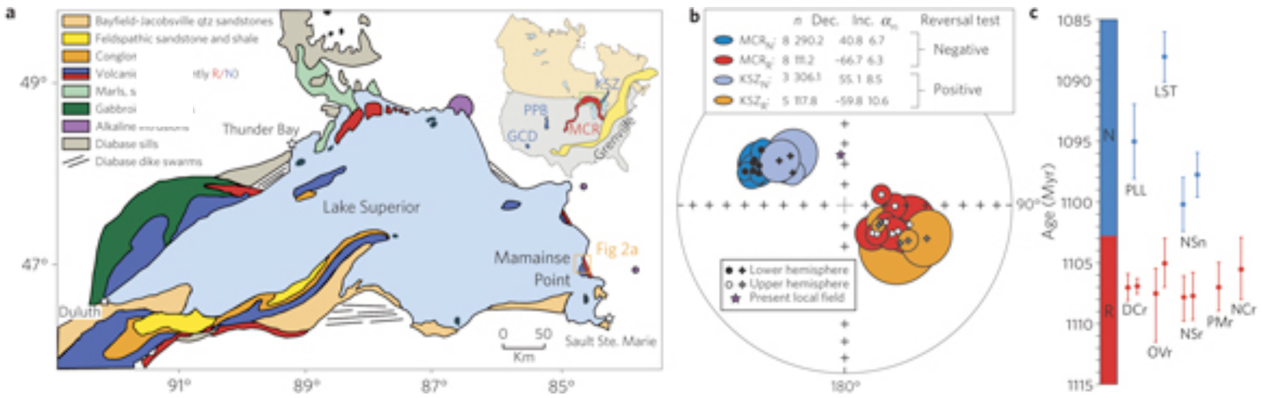
http://es.ucsc.edu/~glatz/geodynamo.html

PALAEOMAGNETISM

In GAD we trust

Palaeomagnetists' basic assumption that Earth's magnetic field is a GAD, that is, a geocentric axial dipole, has been challenged by anomalous magnetic data from ancient Canadian basalts. At a closer look, fast continental drift could explain this anomaly.

Joseph G. Meert



The dipolar record of Kewenawan lavas (1.1 Ga)

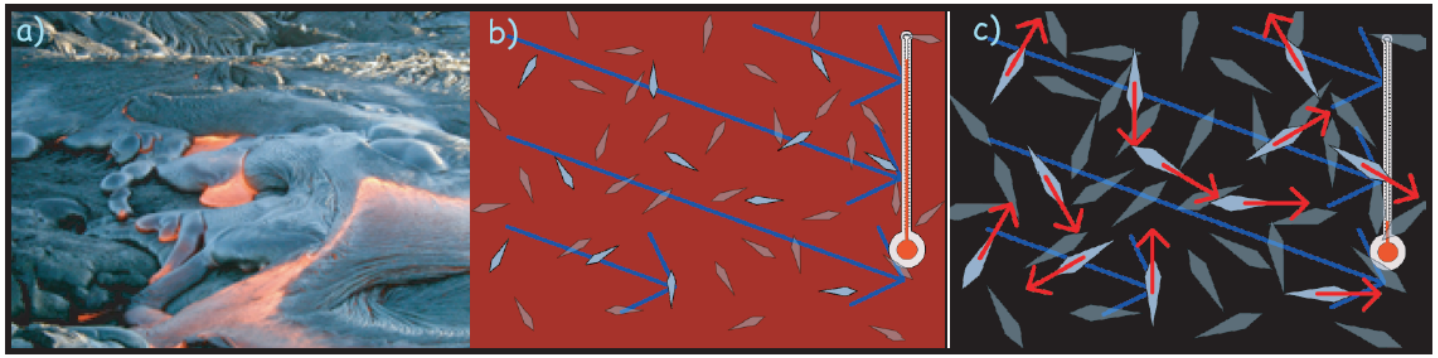
Swanson-Hyssel et al. (2010)

$$P(E) \propto \exp\left(-E_m/kT\right) \quad \longrightarrow \quad M(t) = M_o \exp\left(\frac{-t}{\tau}\right)$$

Onde:

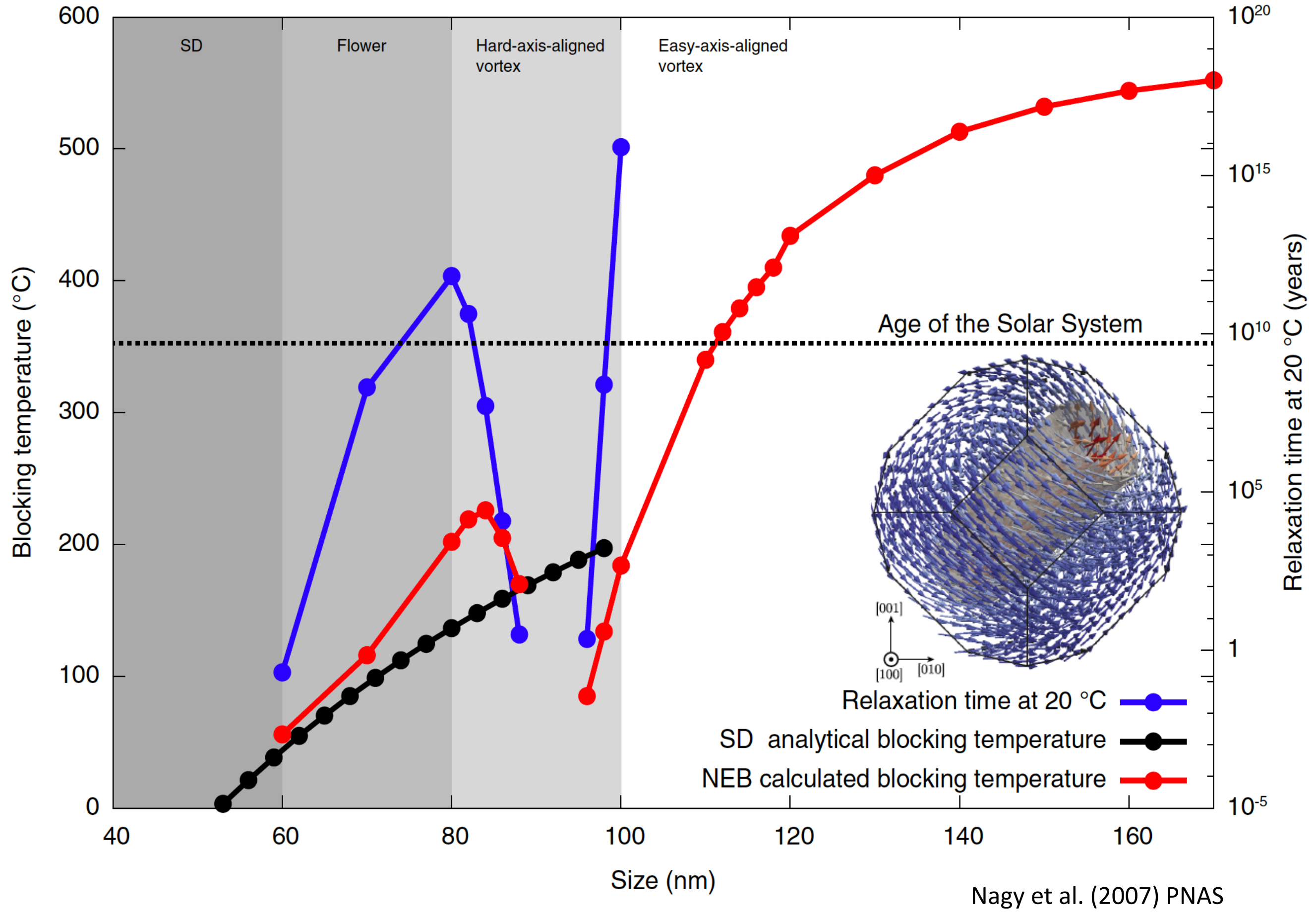
$$\tau = \frac{1}{C} \exp \frac{[\text{anisotropy} \quad \text{energy}]}{[\text{thermal} \quad \text{energy}]} = \frac{1}{C} \exp \frac{[Kv]}{[kT]}$$

$T > T_{blocking}$ $\qquad$ $T < T_{blocking}$



random magnetic moments $\qquad$ *magnetic moments aligned with the ambiente magnetic field*

Domain structure and magnetic stability in magnetite



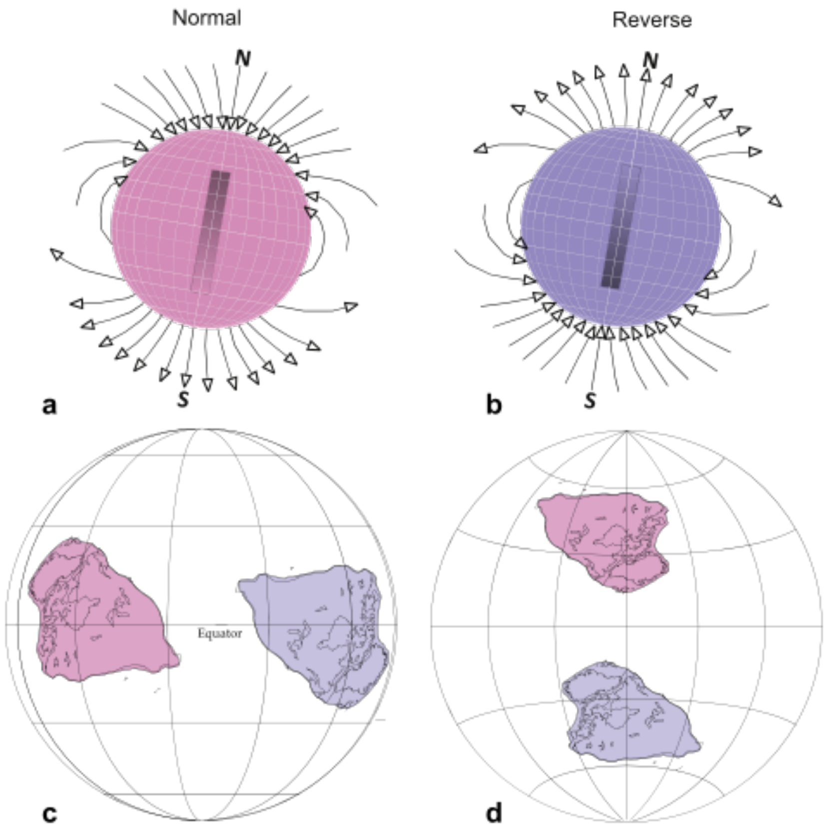
Nagy et al. (2007) PNAS

We also usually assume that:

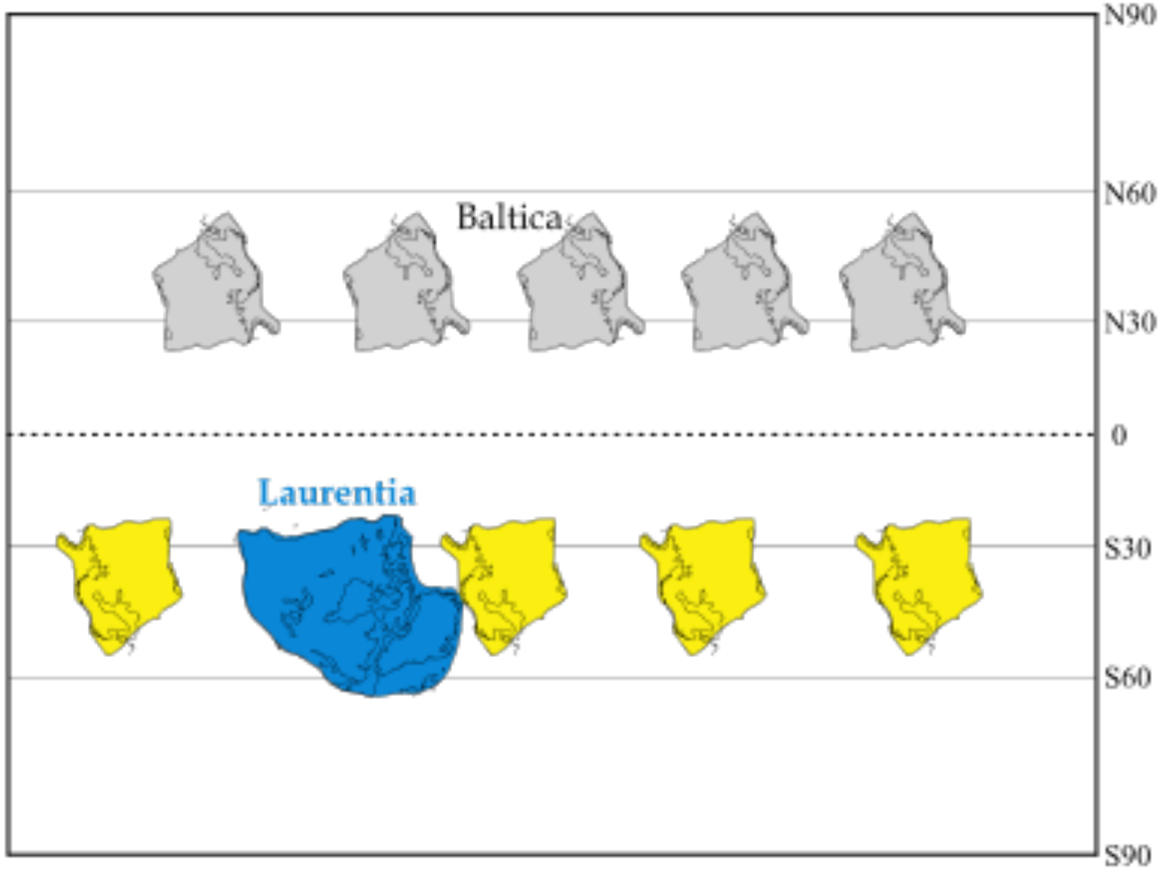
Plate velocities were similar to present-day (or Phanerozoic) in the distant past*: estimates from paleomagnetism of Phanerozoic units sets a speed limit of ~2^{o}/Myr (Tarduno et al., 1990, Meert et al., 1993).*

Most of the record represents the dipole field, not transient field*: statistically, given the rapid nature of the reversal (total duration ~10^{3} yrs) most of the rock record of the ancient field corresponds to one of the two polarities.*

Polarity ambiguity

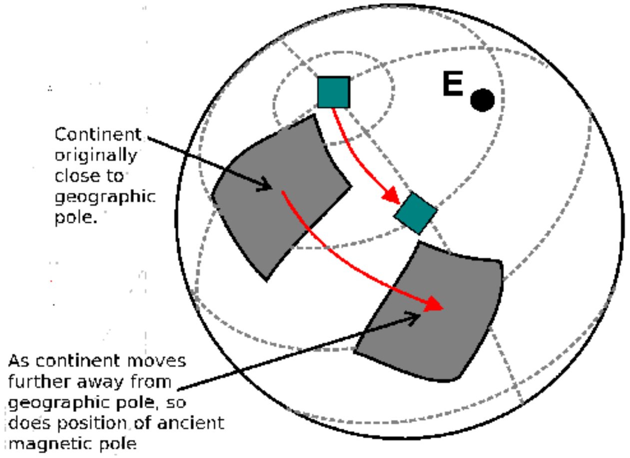


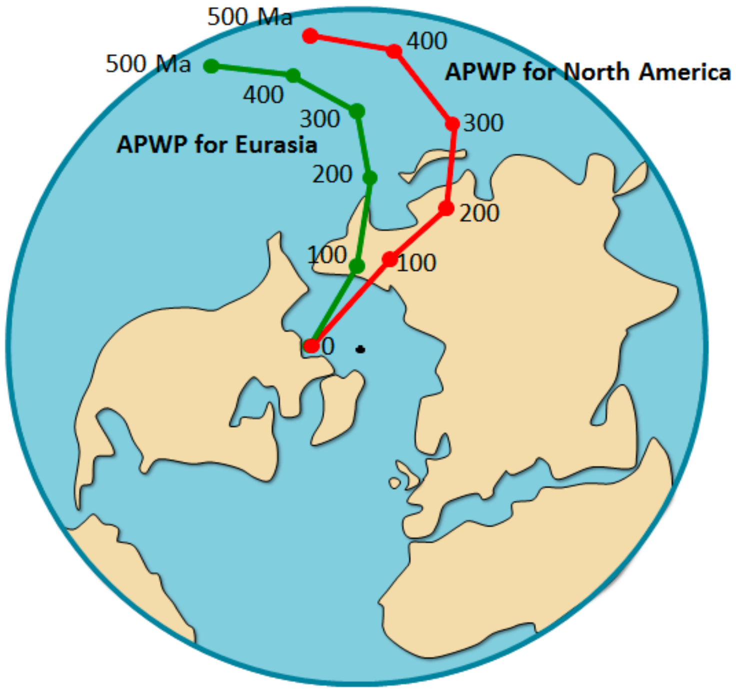
Longitude ambiguity

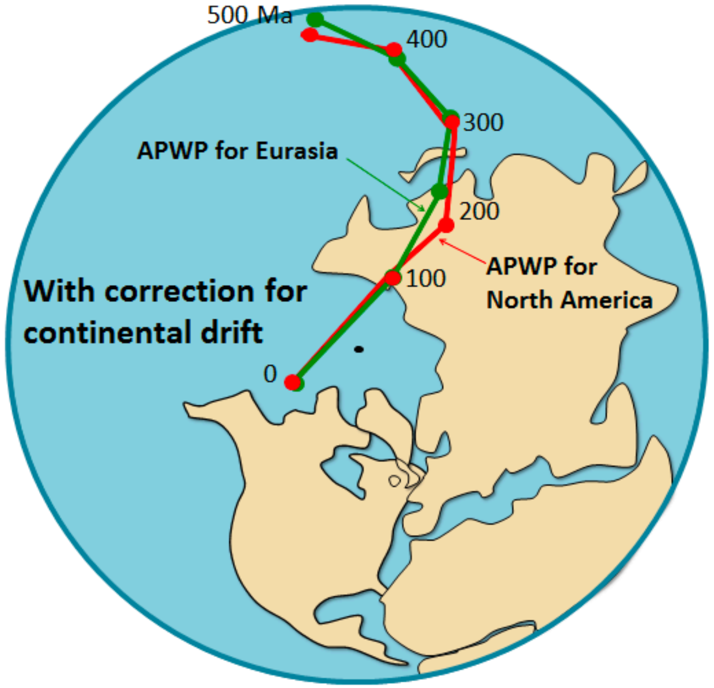


Apparent polar wander path

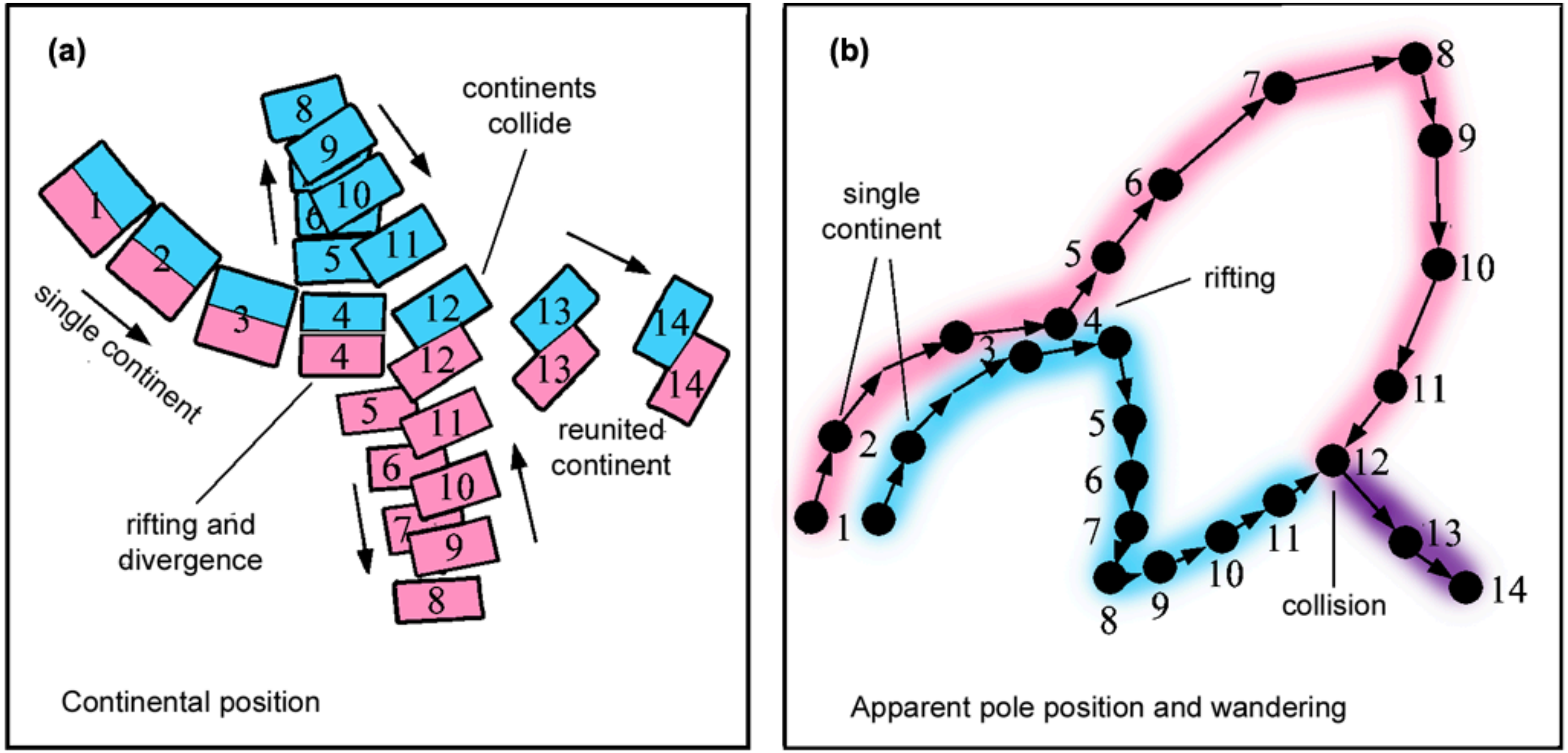
Ken Creer (1925-2020)



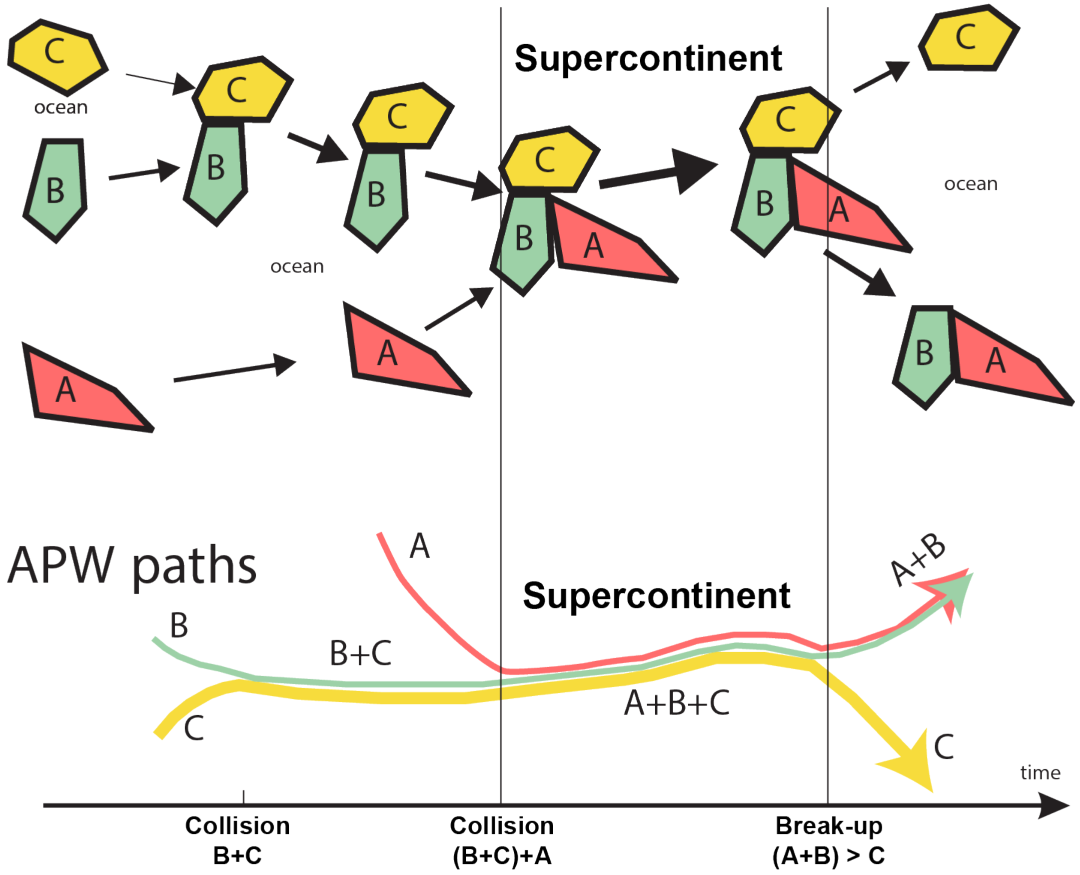




Supercontinent assembly from paleomagnetism

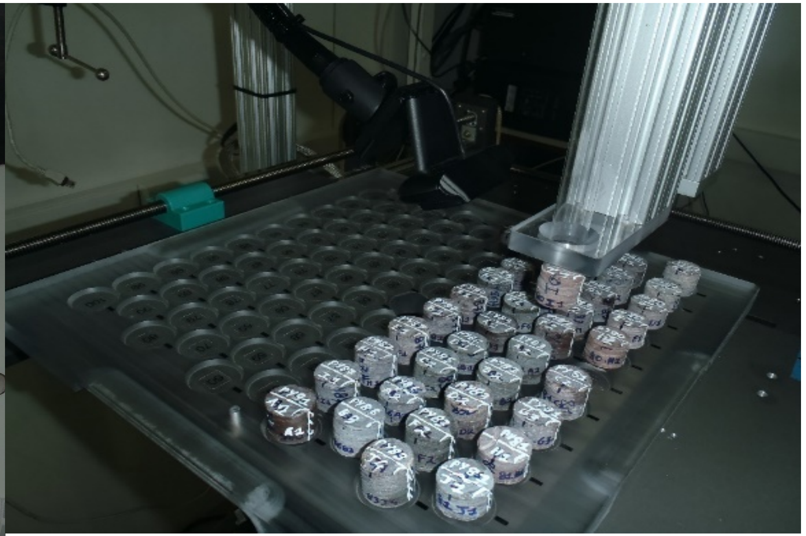


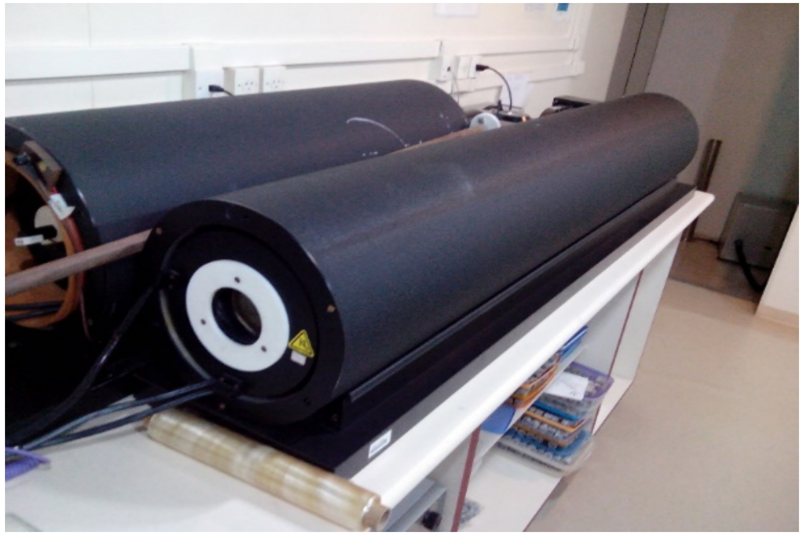
Supercontinent assembly from paleomagnetism

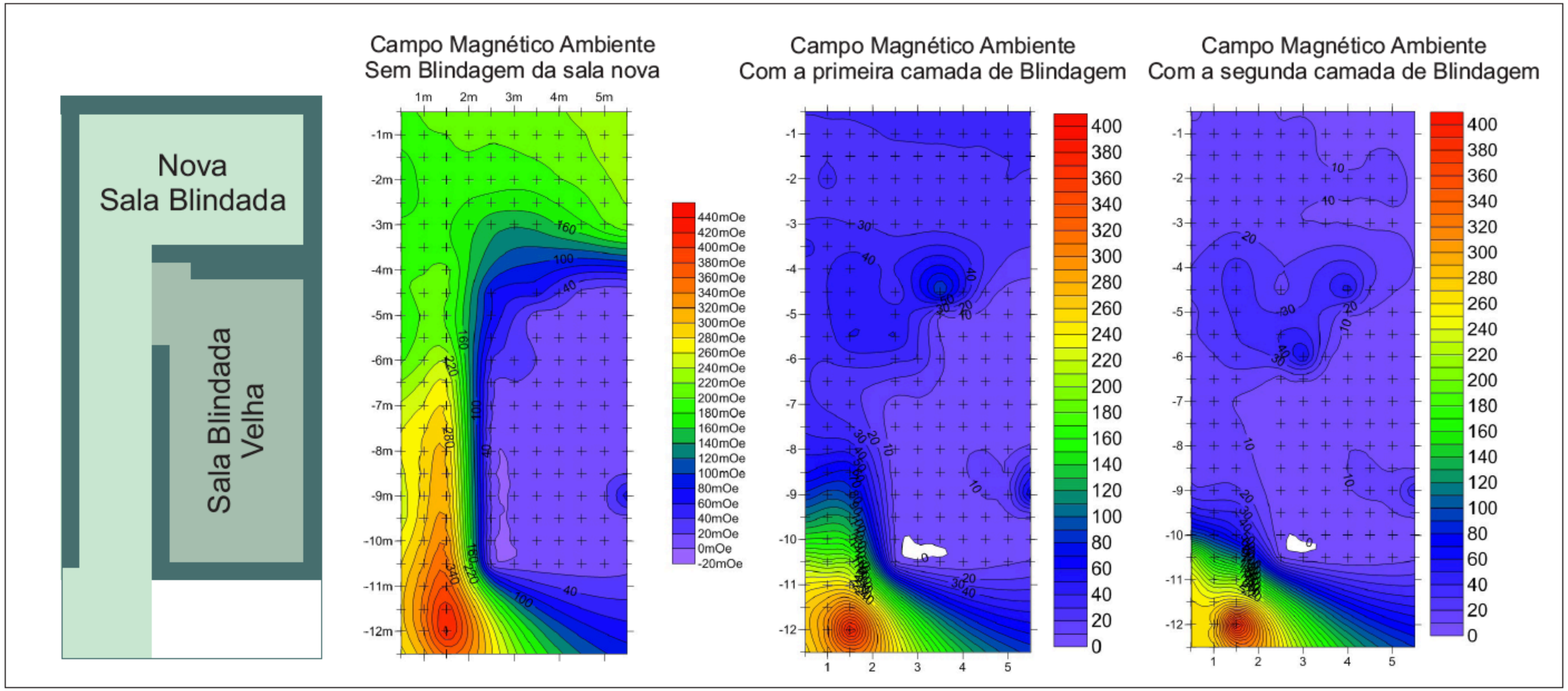


Fundamentals of Paleomagnetism

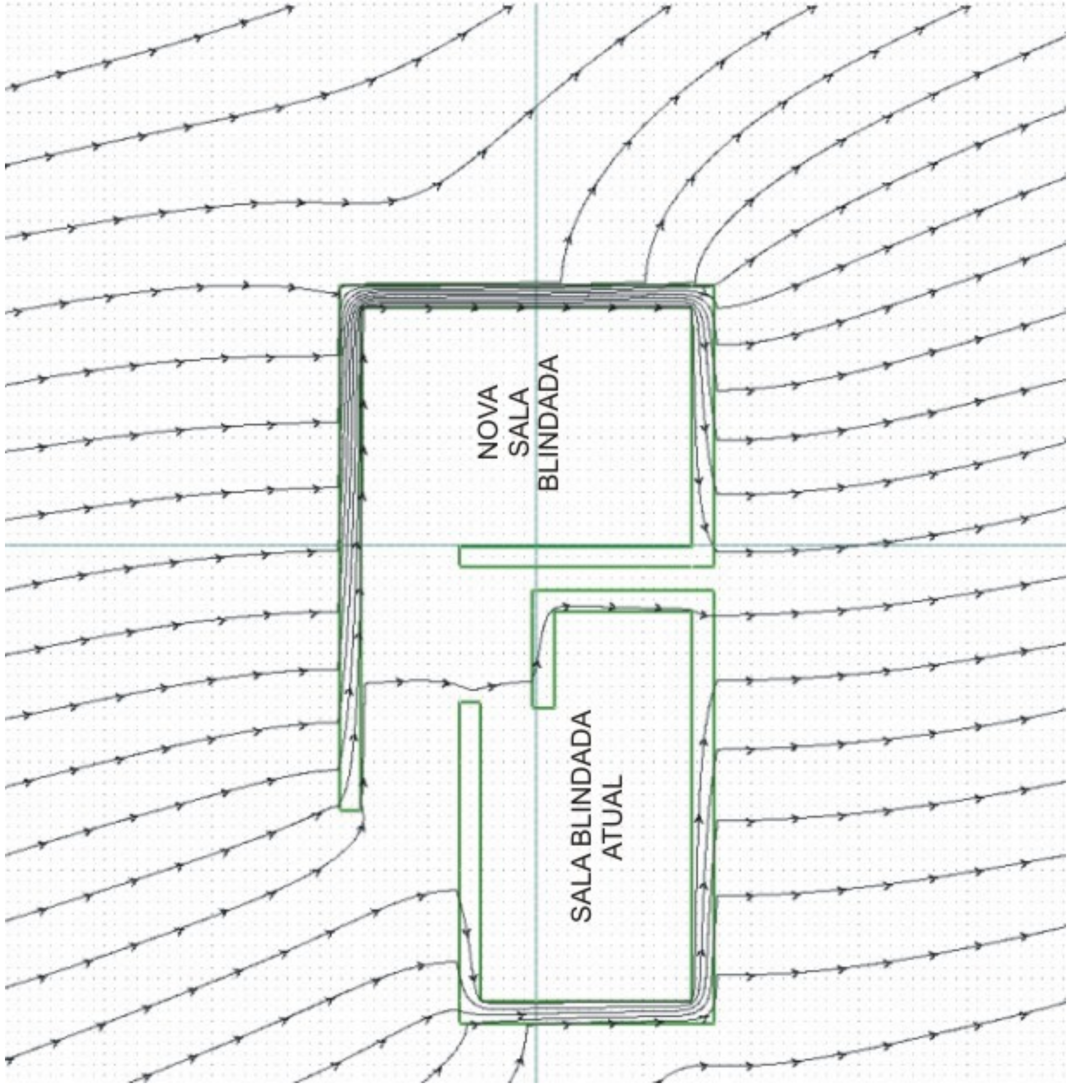
Fundamentals of Paleomagnetism



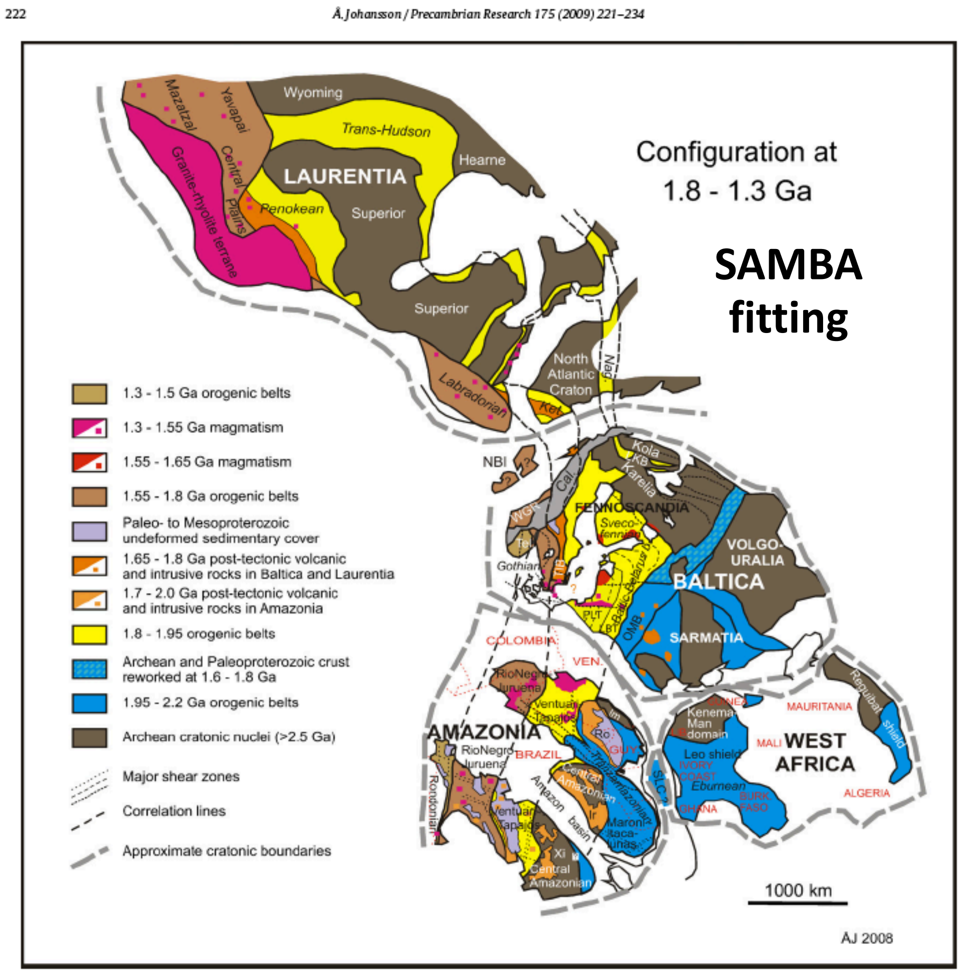


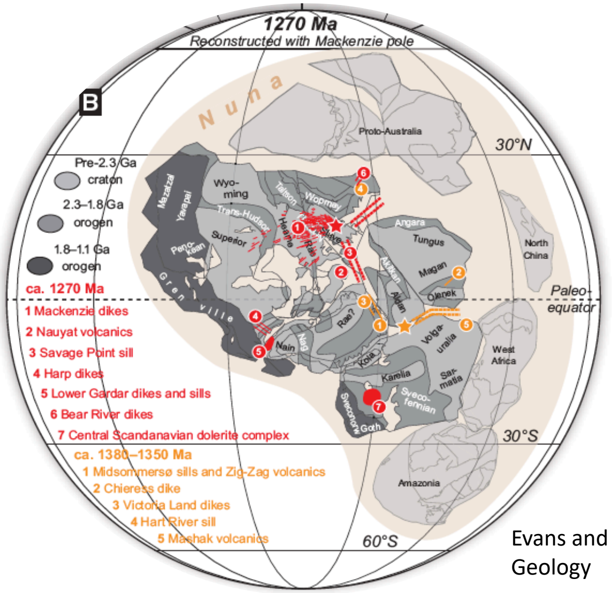


Nova
Sala Blindada
Sala Blindada
Velha
Campo Magnético Ambiente
Sem Blindagem da sala nova
Campo Magnético Ambiente
Com a primeira camada de Blindagem
Campo Magnético Ambiente
Com a segunda camada de Blindagem


NOVA
SALA
BLINDADA
SALA BLINDADA
ATUAL

Paleomagnetism:
A quantitative test for paleogeographic reconstructions.

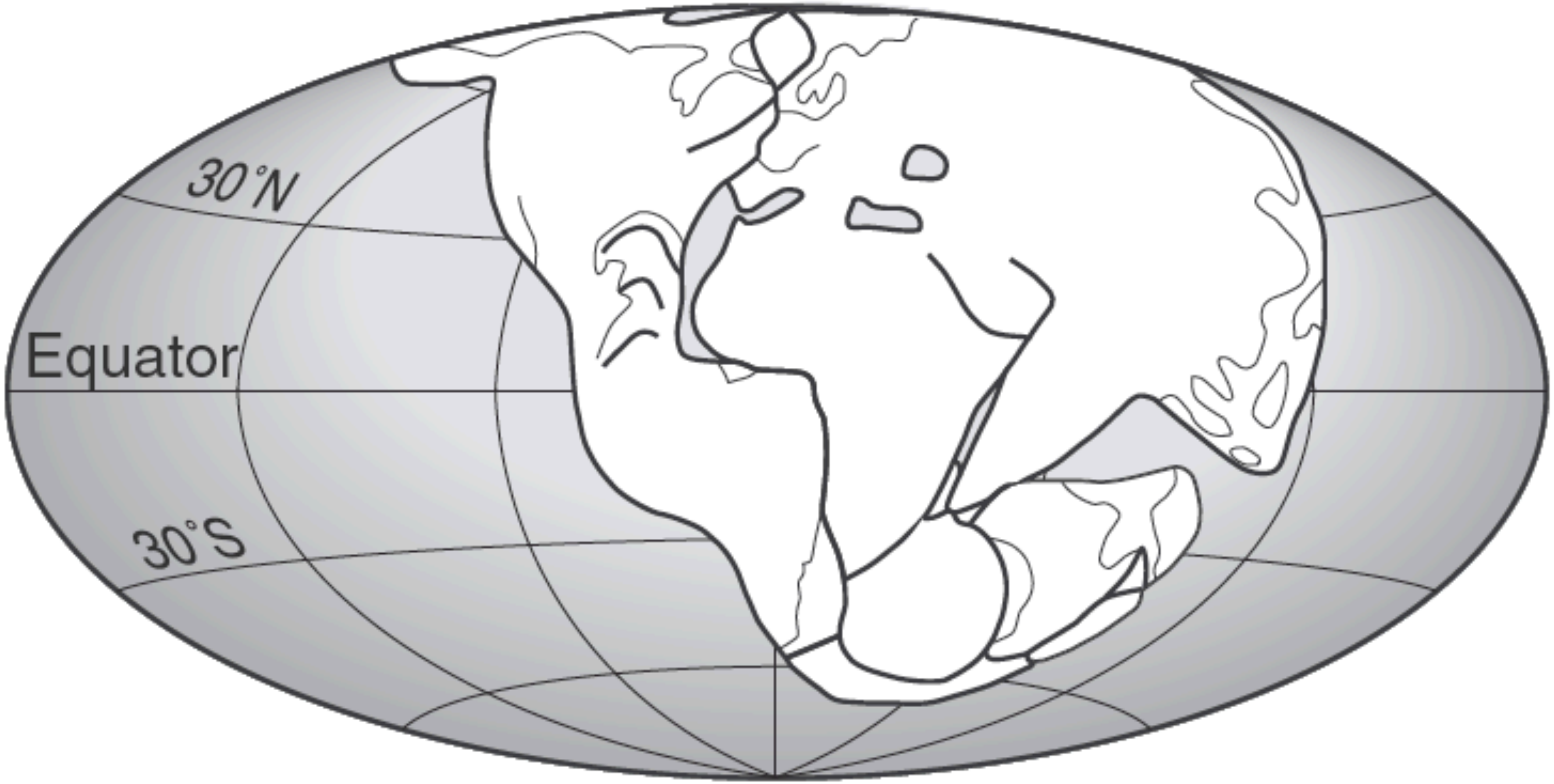




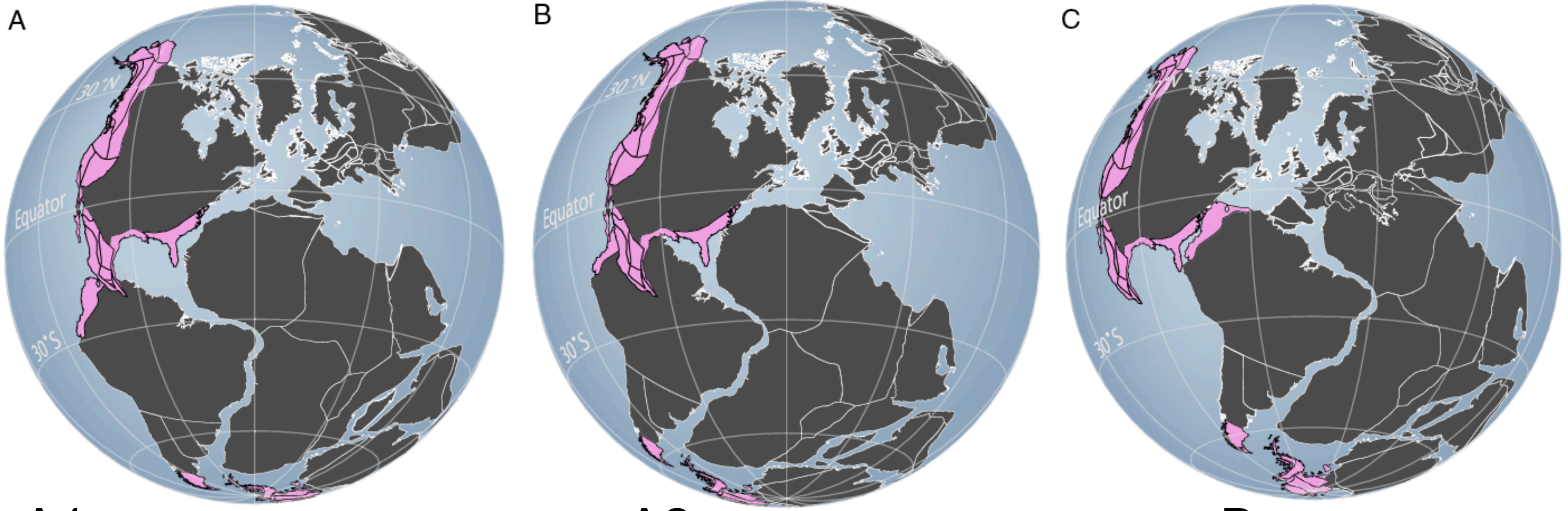
Evans and Mitchell 2011, Geology

Euler poles to Laurentia.
Siberia (78, 099, +147)
Greenland (67.5, 241.5, -13.8)
Baltica (47.5, 0001.5, +49)
Australian blocks (31.5, 098, +102.5)
North China (11, 196, -24)

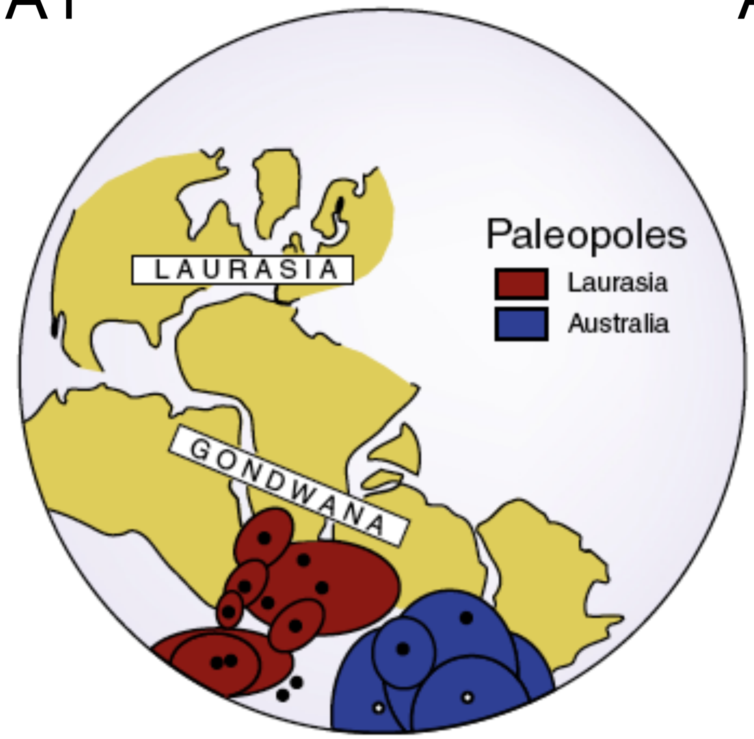
Euler poles to Baltica
West Africa to Baltica (06, 029, -93)
Amazonia to Baltica (43, 197, 84)



A Pangea (*Urkontinent*) de Wegener (1922)

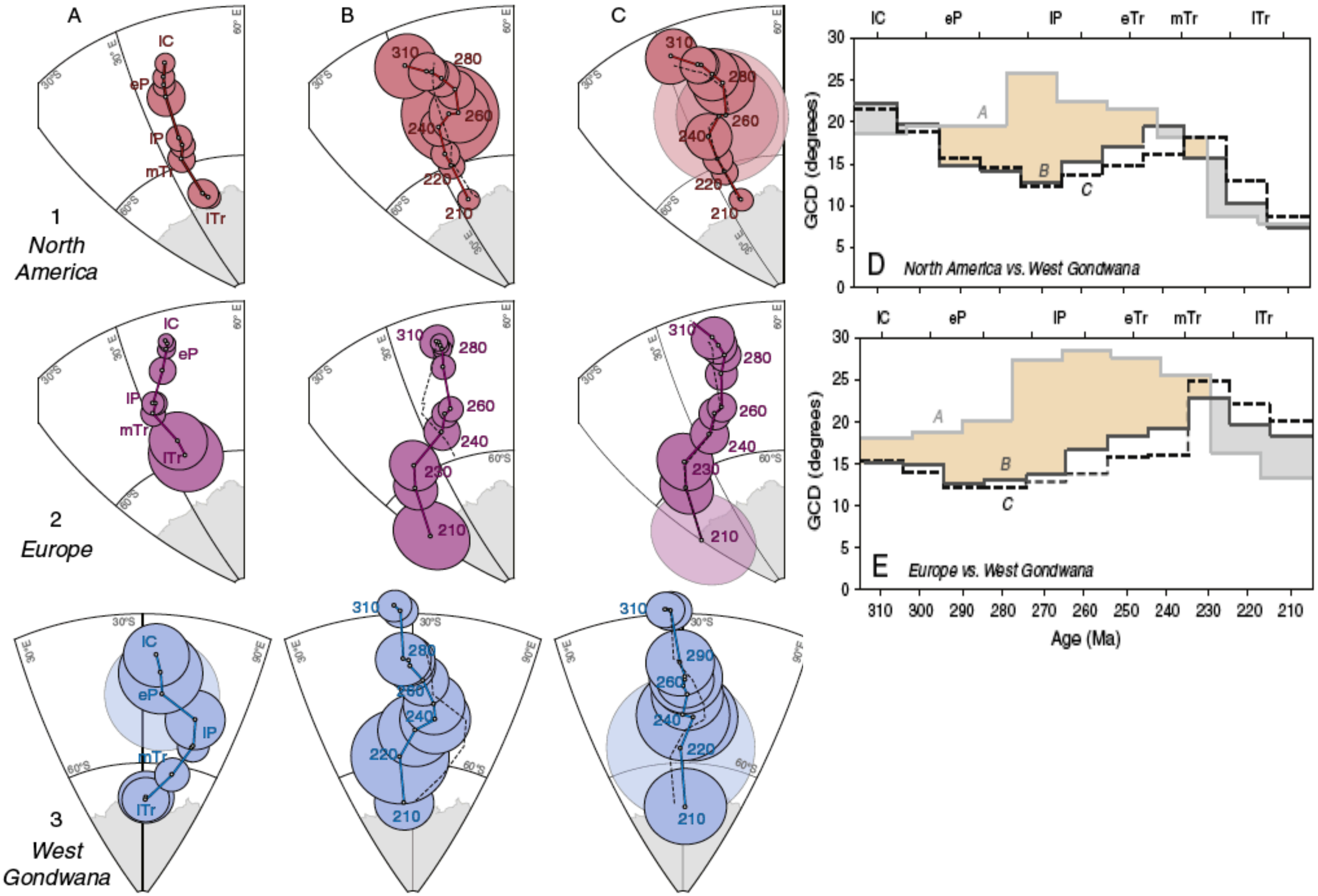


A1 A2 B

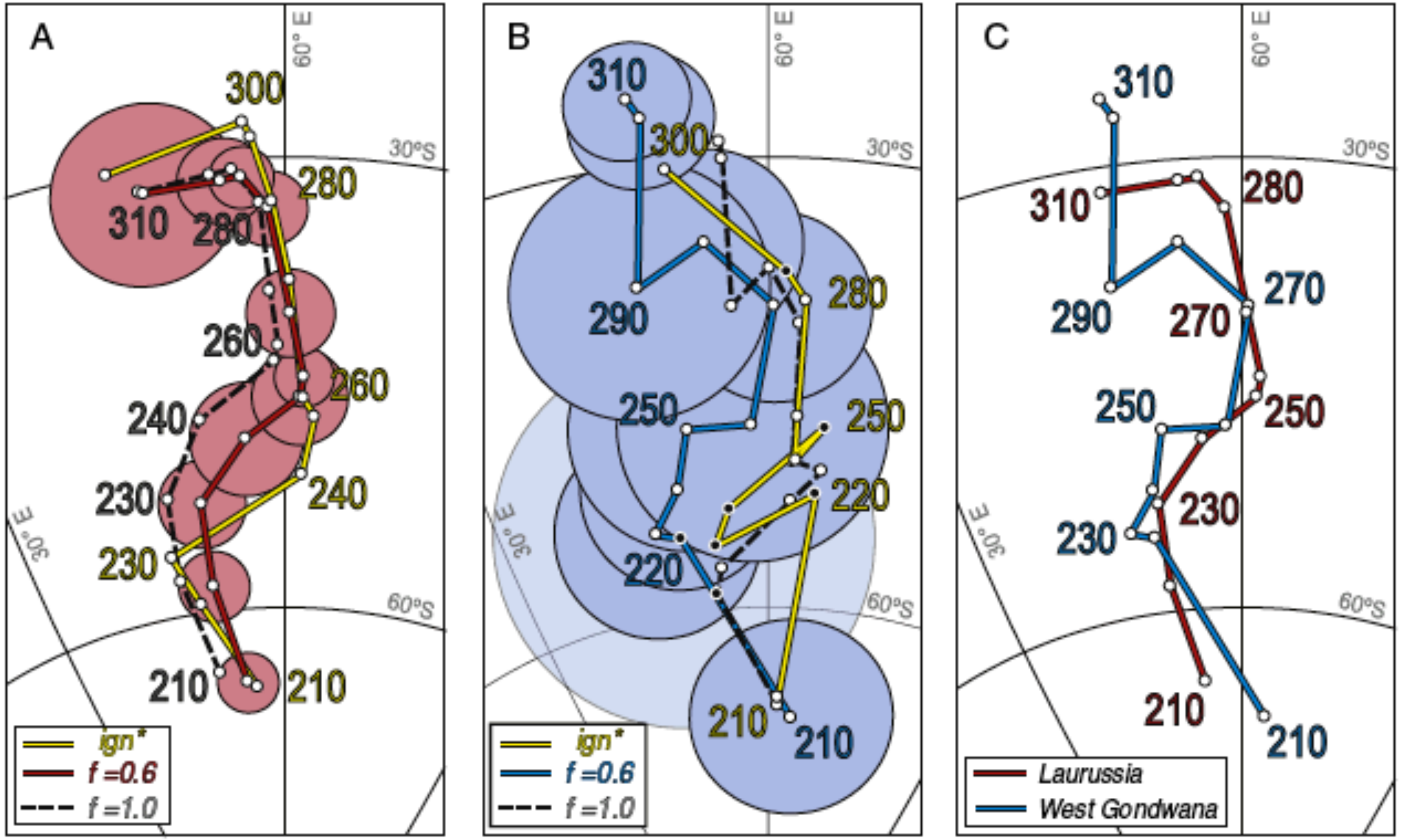


Pangea A1, A2, B...

Misfit of paleomagnetic poles



After a critical reaprisal...



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ABSTRACT

Brito Neves, B.B. de and Cordani, U.G., 1991. Tectonic evolution of South America during the Late Proterozoic. In: R.J. Stern and W.R. van Schmus (Editors), Crustal Evolution in the Late Proterozoic. Precambrian Res., 53: 23–40.

This paper discusses the evolution and the Late Proterozoic assembly of the South American continent (i.e. the West Gondwana) under the light of global tectonics. The northern portion of the continent—the Amazonian craton—is a "Pre-Brasiliano" domain; it may be a fragment derived from Laurentia. This domain behaved as a large continental plate which was accreted to the central and southeastern portions of the continent ("Brasiliano domain"). The Brasiliano domain had a more complex history and composition during the Brasiliano cycle (Middle Proterozoic to Early Paleozoic).

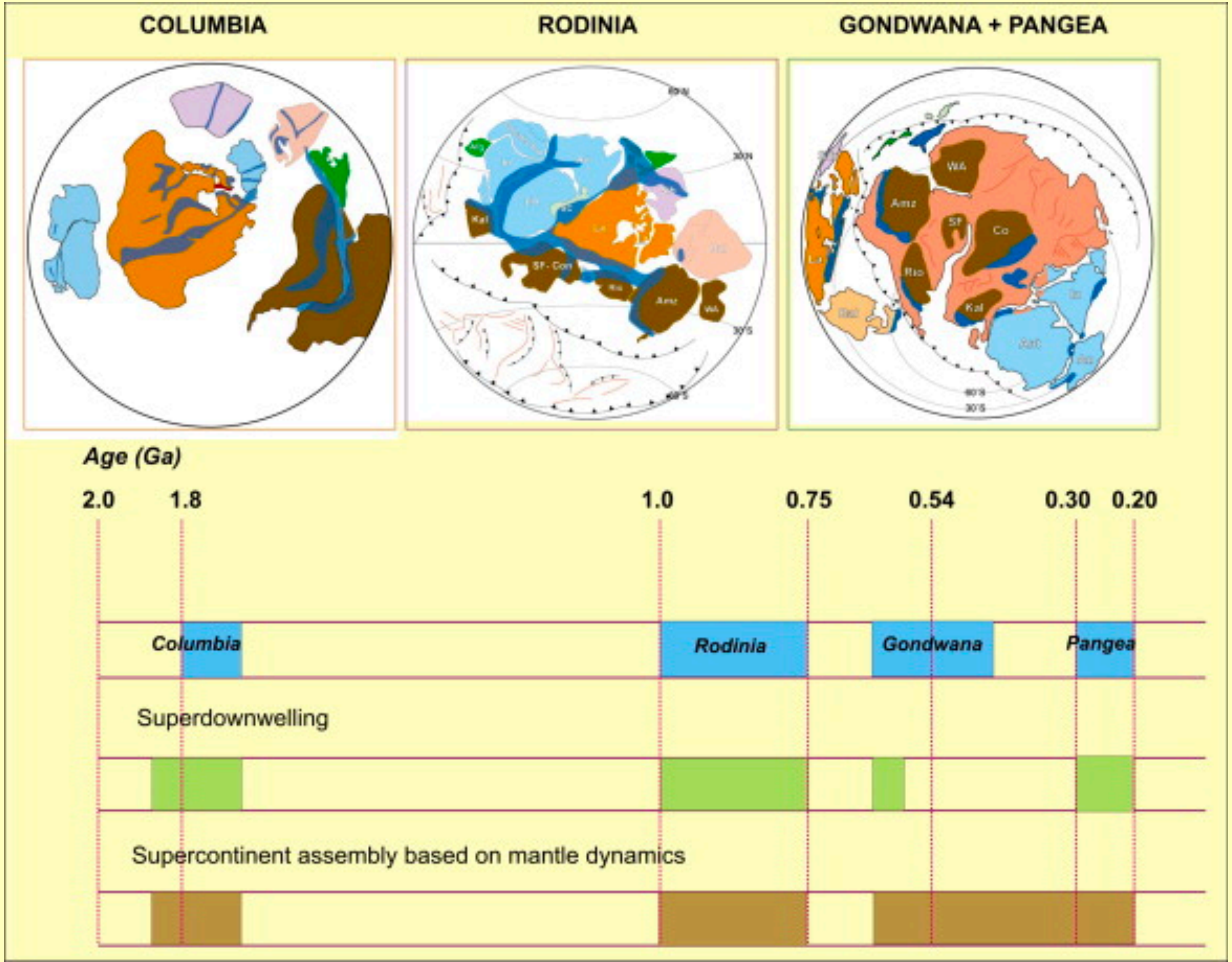
In the Brasiliano domain, several Late Proterozoic continental plates have been identified (São Luiz–West Africa, Congo-Kasai/São Francisco, Rio de La Plata, Arequipa–Antofalla) which acted as forelands to the Brasiliano orogenic belts that surround and amalgamate these plates. Smaller fragments of Pre-Brasiliano continental lithosphere are common in the interior of the Brasiliano orogenic belts and played diversified roles (microplates, microcontinents, "structural highs"). Some of them have acted as true backlands (hinterlands) flanked by arc magmatism.

Two principal types of Brasiliano orogenic belts are recognized between the continental plates: (a) marginal orogenies to the Late Proterozoic plates, with pelitic–carbonatic rocks and discrete volcanism, which were thrust by collision onto the margin of the plates, and which seem to represent final products of previous passive margin sequences; (b) distal orogenies (internal belts within the continental masses, sometimes a branching system of orogenies), that contain varied clastic and minor carbonate sedimentary rocks, accompanied by important bimodal volcanism and calc-alkaline plutonism. For these orogenies a greater variety of basinal scenarios and tectonic settings may be visualized.

Table 2. Generalized scheme of evolution and main events of the Amazonian (Pre-Brasiliano, north and northwes parts) and Brasiliano (central and eastern parts) domains of the basement of the South American platform. Base on Saes and Leite (1993), Geraldes *et al.* (2000), Ruiz *et al.* (2004), Tassinari and Macambira (2004), Bettencour *et al.* (2010), Rizzotto and Hartmann (2012), Rizzotto *et al.* (2013), Brito Neves and Fuck (2013), Brito Neves an Fuck (2014), among others.

AMAZONIAN DOMAIN (Pre-Brasiliano)	BRASILIANO DOMAIN	(Ga)
First cratonic sedimentary sequences of western Gondwana SILURIAN – EARLY DEVONIAN CAMBRO – ORDOVICIAN		0.40
Absence of orogenic events	Diversified late to post tectonic processes: Transition stage	0.50
	CAMBRIAN OROGENIC BELTS (0.55 – 0.52 Ga)	0.55
	MIDDLE EDIACARAN OROGENIES (0.59 – 0.56 Ga)	0.60
	LATE CRYOGEN – EARLY EDIACARAN OROGENIES(0.66 – 0.62 Ga)	0.65
	MAIN EVENTS OF TAPHROGENESES + LOCAL PRECURSOR OROGENIC EVENTS (0.85 – 0.75 Ga)	0.80
	TONIAN OROGENIES / TERRANES (1000 – 0.920 Ma)	1.00
SUNSÁS AGUAPEÍ/ HUANCHACA Orogenie and cover sequences (1200 – 1000 Ma) ANOROG. GRANITES	Vulcanic, plutonic (felsic and mafic) cratogenic processes + Cratonic sedimentary sequences	1.20
RONDONIAN – SAN IGNACIO Accretionary, collisional and cratogenic processes (1510 – 1320 Ma)		1.40
STA. HELENA OROGEN (1440±15Ma)		1.60
CACHOEIRINHA OROGEN (1590±1530Ma)		
RIO NEGRO – JURUENA ACCRET. PROCESSES (1.75 – 1.60 Ga)	STATHERIAN TAPHROGENIC PROCESSES	1.80
RORAIMA PLATEAU	OROSIRIAN OROGENIC CYCLES	
UATUMÃ (LIP)/ VOLCANISM/PLUTONISM	+ ANOREGENIC CRATONIC PLUTONISM	2.05
RHYACIAN – OROSIRIAN OROGENIES RHYACIAN OROGENIES		2.30
SIDERIAN OROGENIC PROCESSES AND PLUTONIC		2.50
IMPORTANT OCCURRENCES (GRÃO PARÁ,"JEQUIÉ" /"RIO DAS VELHAS" CYCLE)		2.86
SPARSE OCCURRENCES		3.20
FEW, SPARSE, SMALL NUCLEI		3.60
SOME ISOTOPIC INDICATIONS		4.00
FEW ISOTOPIC TRACES		

Supercontinentes



Elsevier book:
Ancient Supercontinents and the Paleogeography of the Earth
by Lauri Pesonen et al. (+50 authors).

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(i) present updated drift histories of Precambrian cratons using the best and most recent paleomagnetic data coupled with new precise radiometric age data,

(ii) test paleolatitude observations with available paleoclimate indicators of latitudes

(iii) highlight the evolutionary history of the cratons with geological and geophysical constraints.

Elsevier book:
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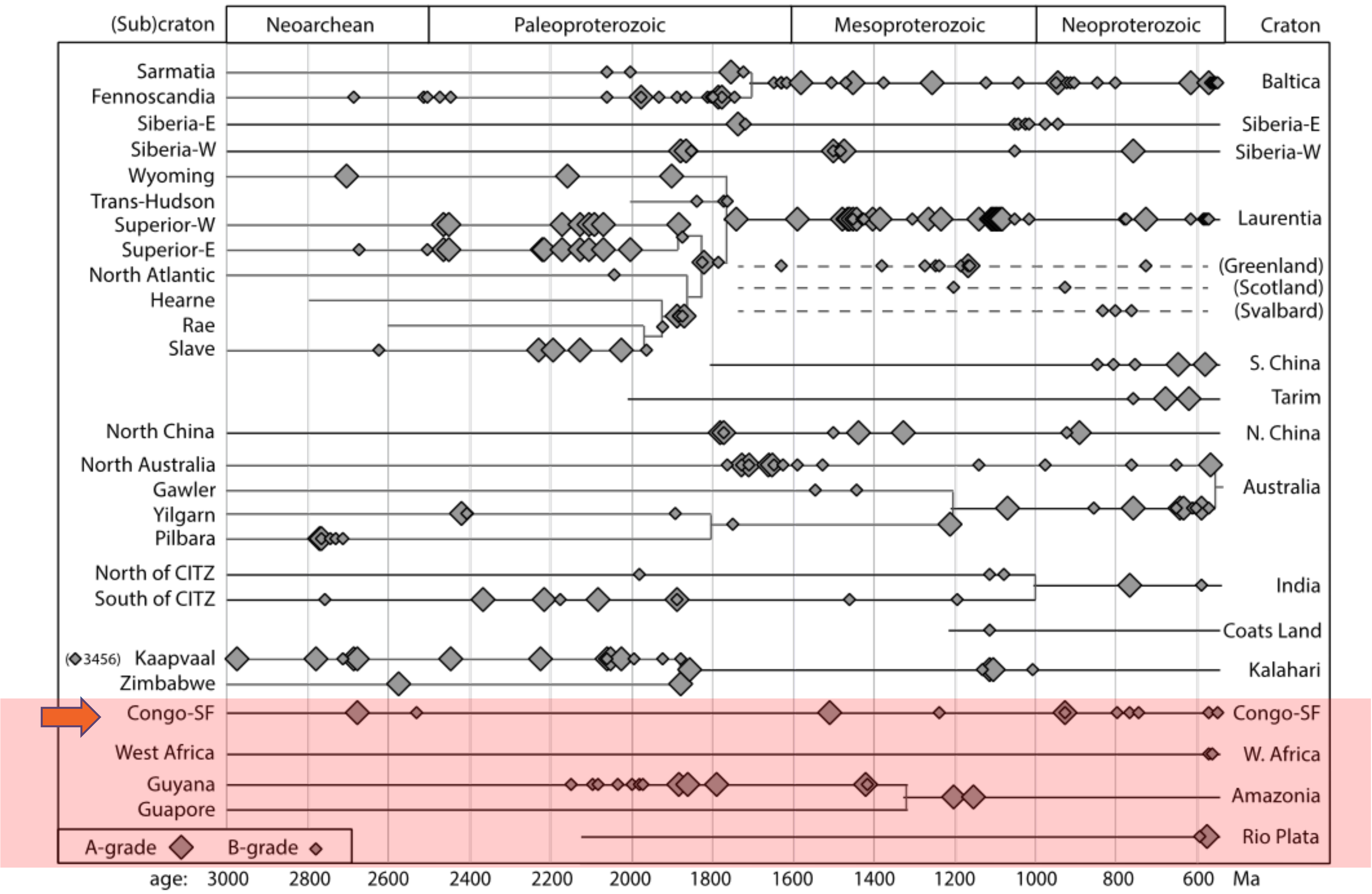
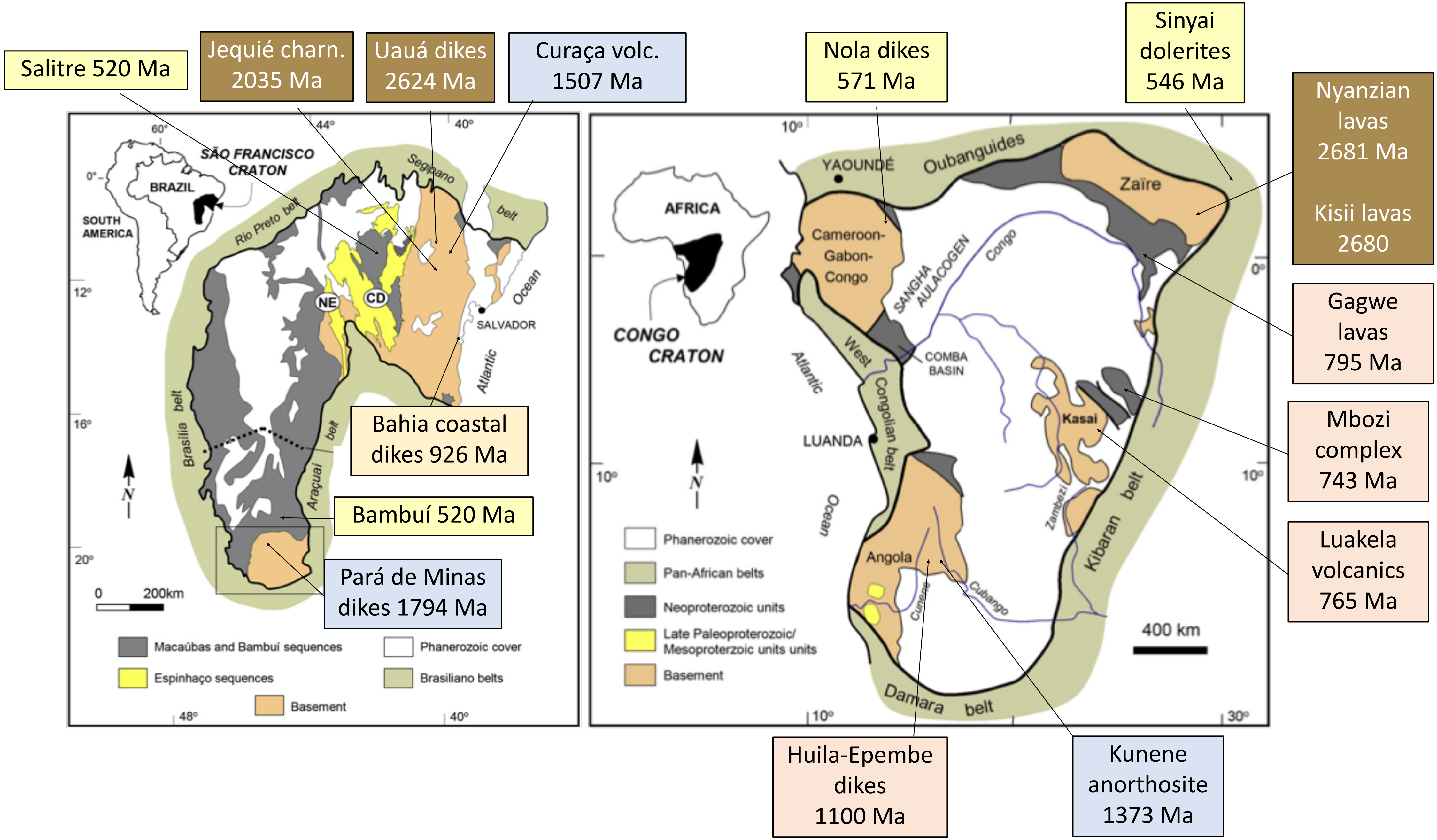
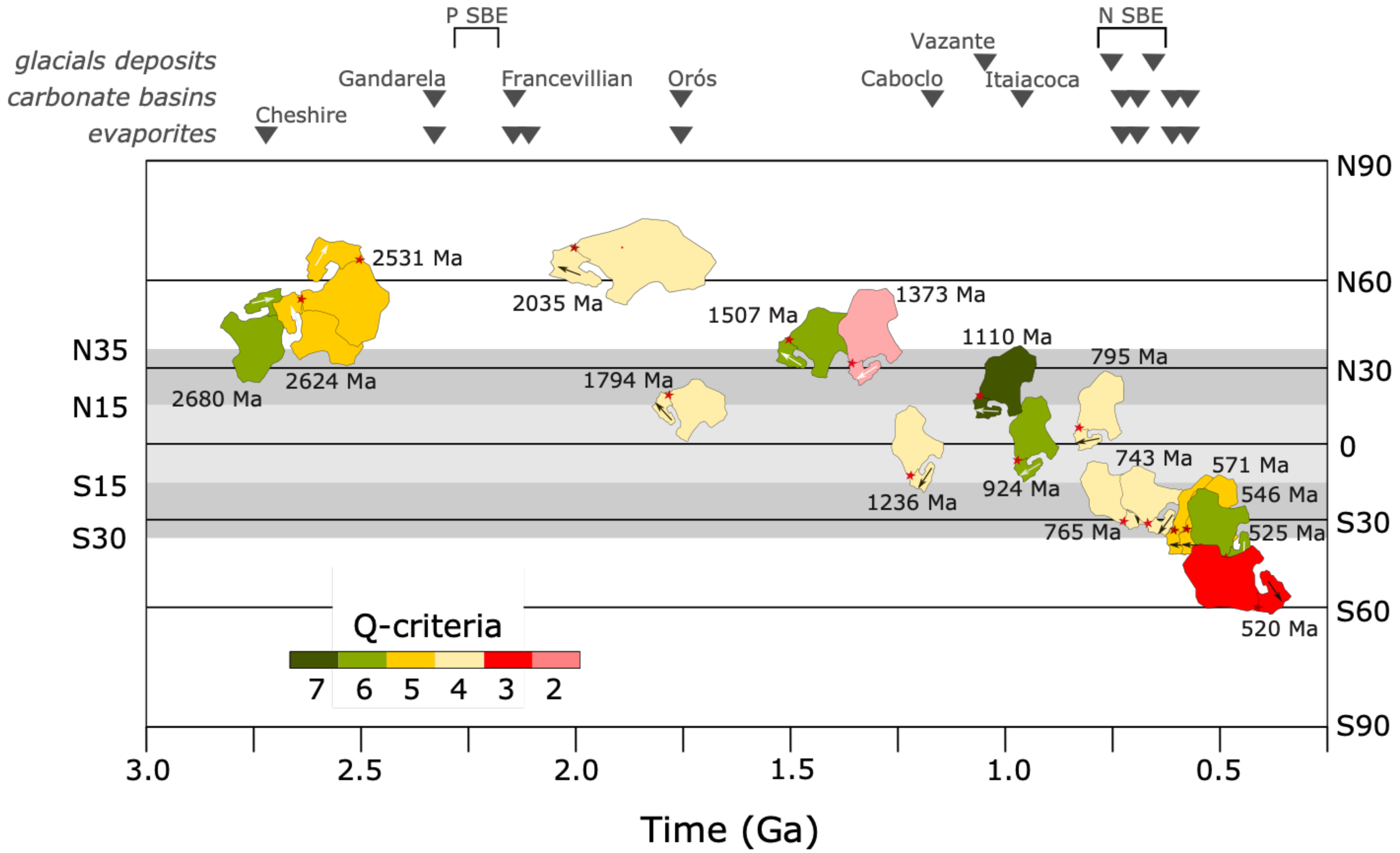


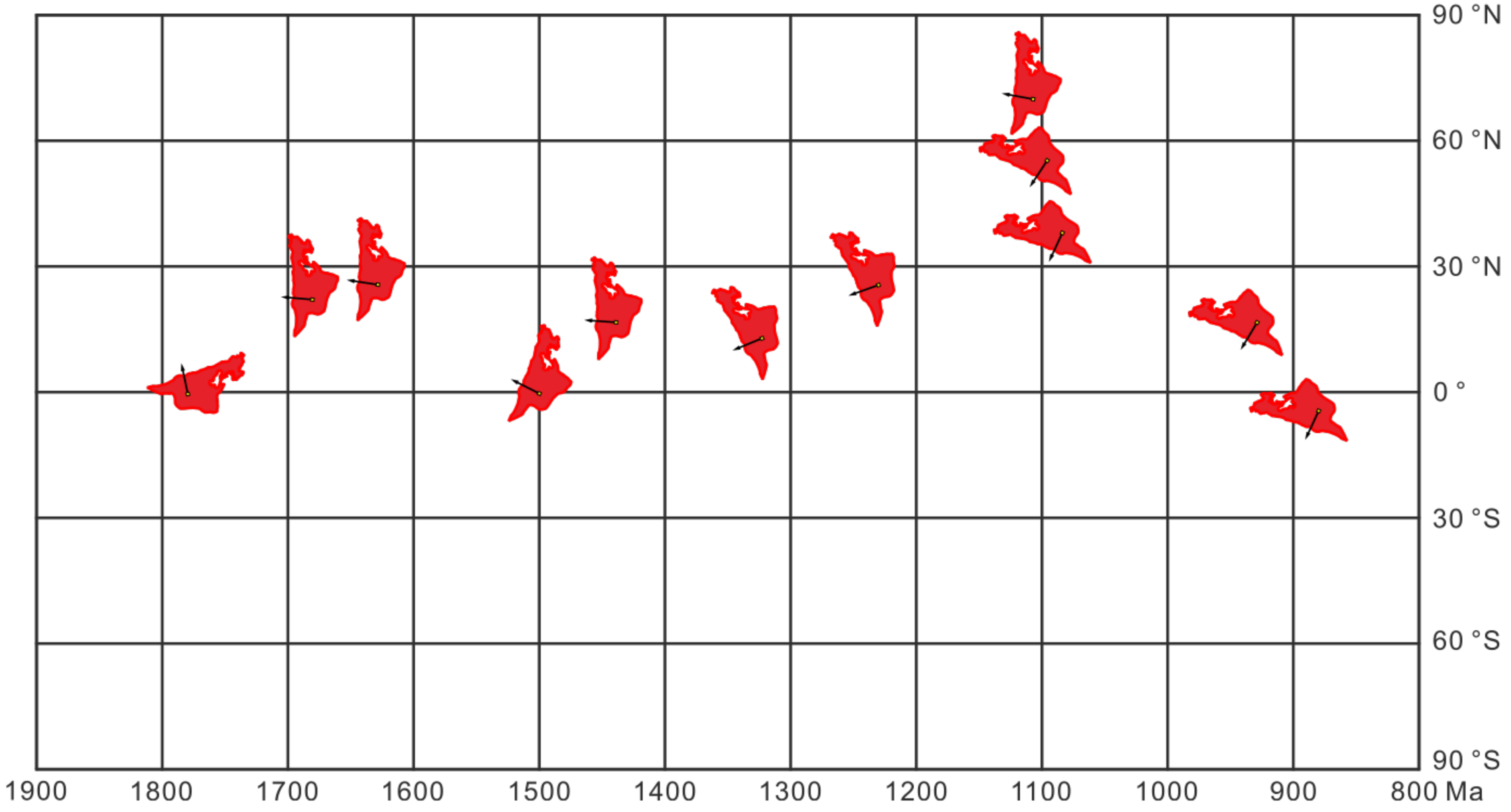
Evans et al., Figure 1


Salitre 520 Ma
Jequié charn. 2035 Ma
Uauá dikes 2624 Ma
Curaça volc. 1507 Ma
SÃO FRANCISCO CRATON
BRAZIL
SOUTH AMERICA
Rio Preto belt
Sergipano belt
Ocean
Atlantic
SALVADOR
NE
CD
Brasília belt
Araçuaí belt
Bahia coastal dikes 926 Ma
Bambuí 520 Ma
Pará de Minas dikes 1794 Ma
0 200km
Macaúbas and Bambuí sequences
Phanerozoic cover
Espinhaço sequences
Brasiliano belts
Basement
Nola dikes 571 Ma
Sinyai dolerites 546 Ma
Nyanzian lavas 2681 Ma
Kisii lavas 2680
Gagwe lavas 795 Ma
Mbozi complex 743 Ma
Luakela volcanics 765 Ma
Huila-Epembe dikes 1100 Ma
Kunene anorthosite 1373 Ma
AFRICA
CONGO CRATON
YAOUNDÉ
Oubanguides
Zaïre
Cameroon-Gabon-Congo
SANGHA AULACOGEN
Congo
COMBA BASIN
West Congolian belt
Atlantic Ocean
LUANDA
Kasai
Zambezi
Kibaran belt
Angola
Cunene
Cubango
Damara belt
400 km
Phanerozoic cover
Pan-African belts
Neoproterozoic units
Late Paleoproterozoic/ Mesoproterzoic units units
Basement

Congo – São Francisco Craton Latitudinal drift

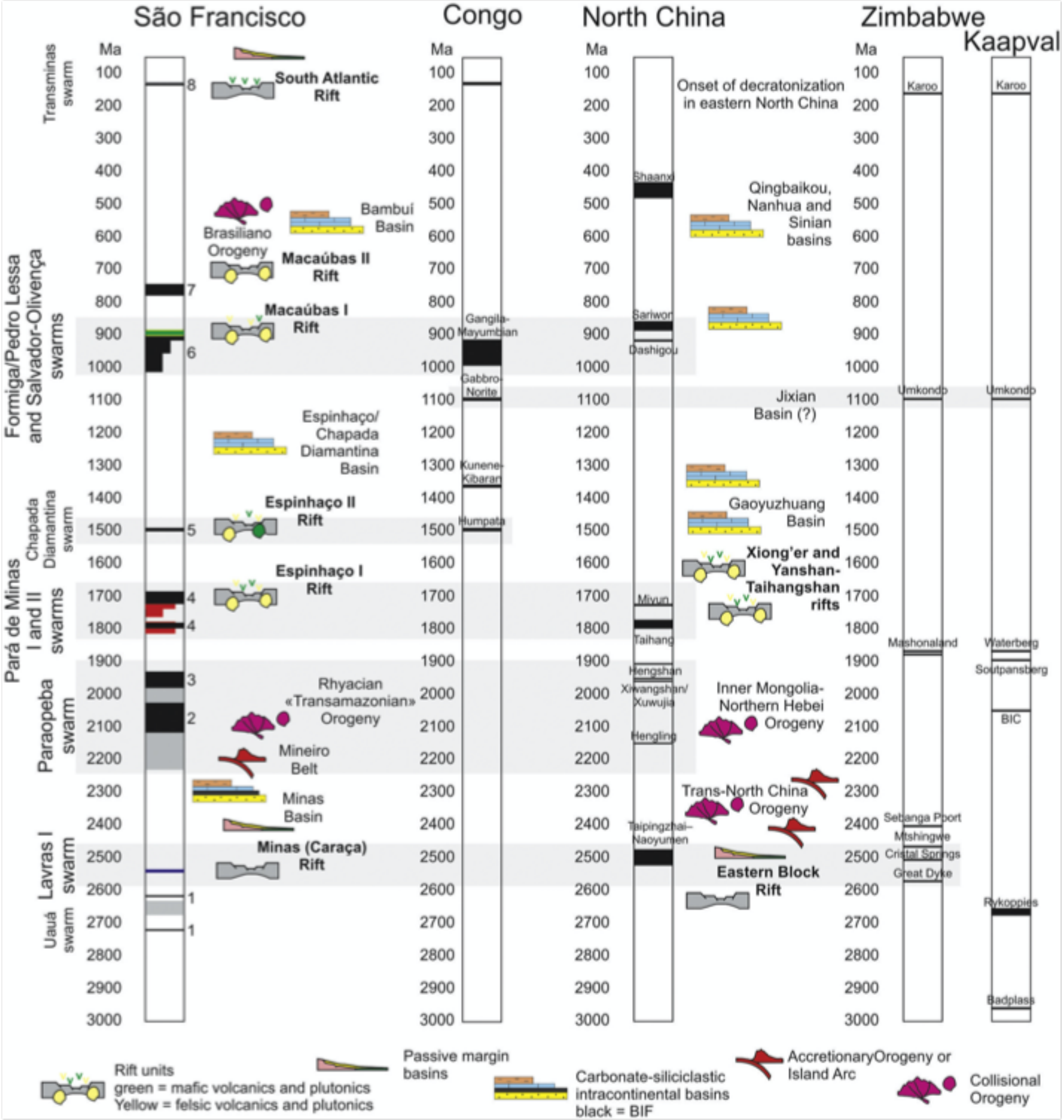


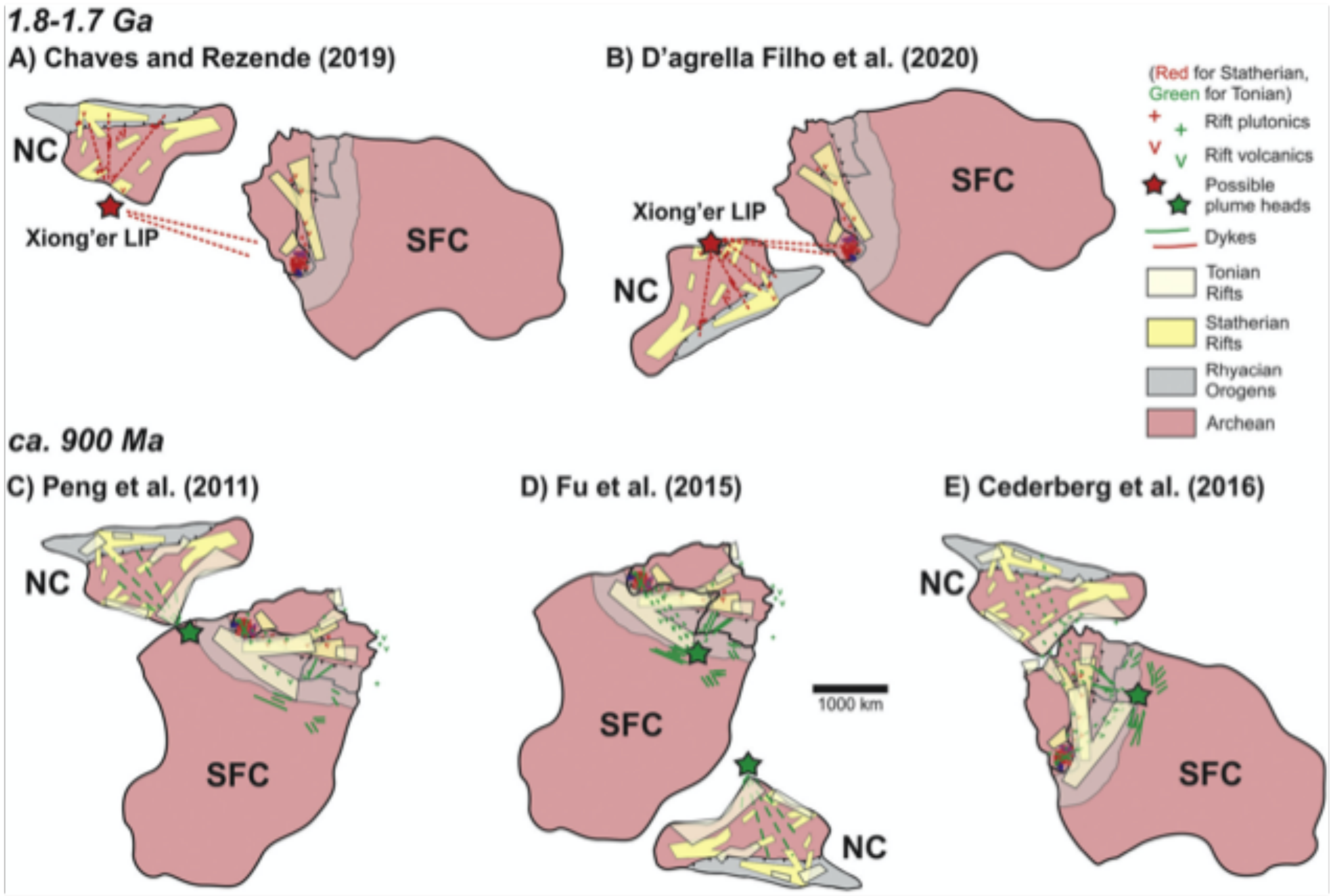
North China Craton Latitudinal drift

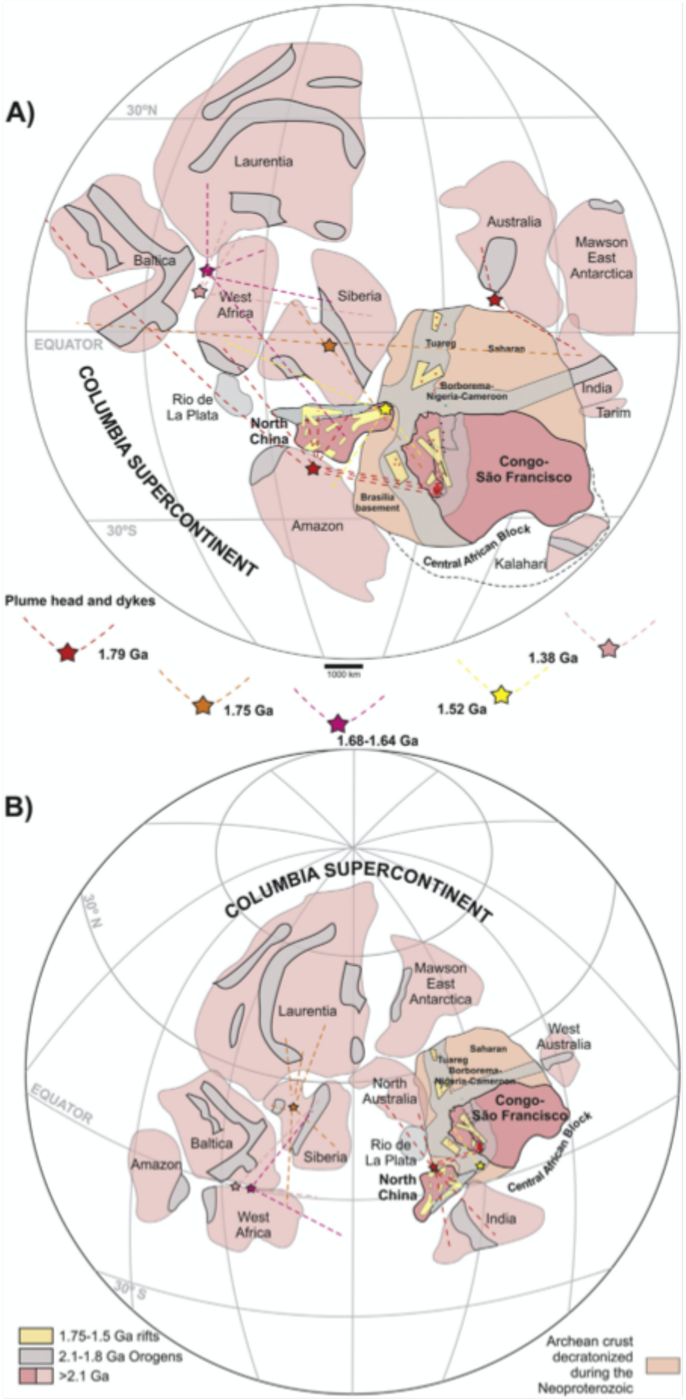


oldest Paleomagnetic pole for 1780 Ma

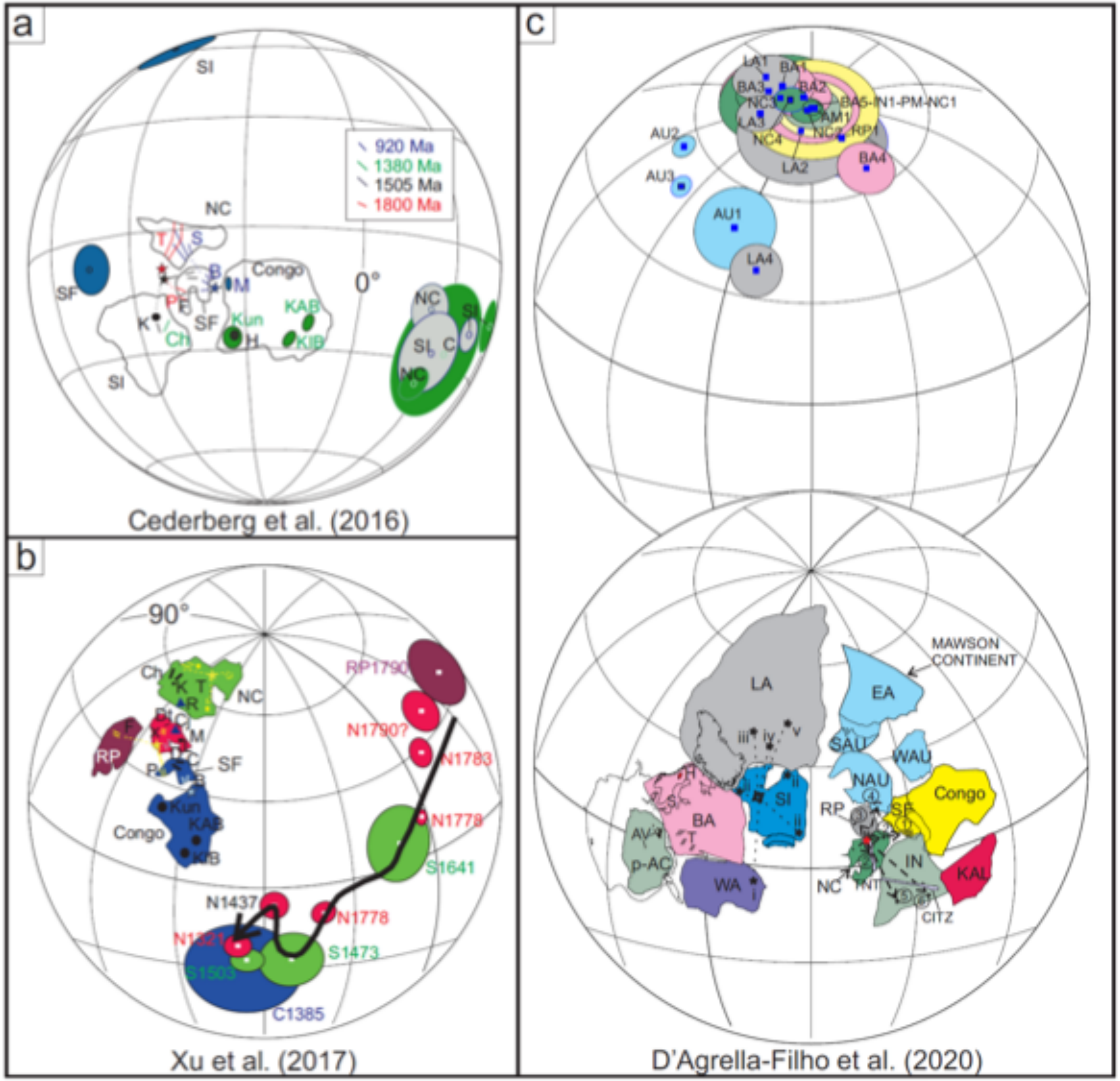
Zhang et al., 2021. Ancient superocontinents book, Elsevier

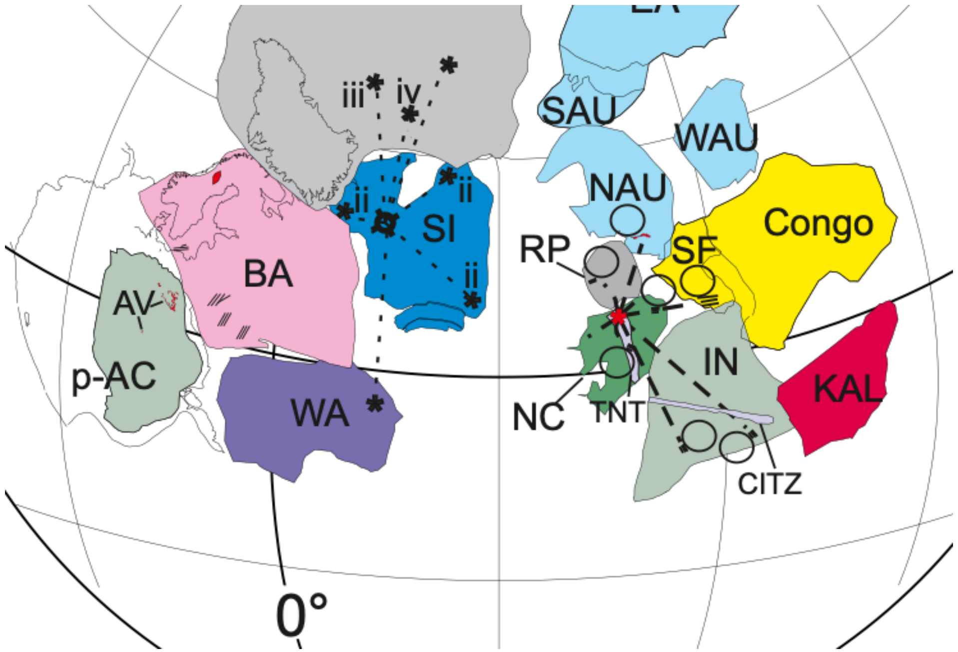

São Francisco
Congo
North China
Zimbabwe
Kaapval
Ma
Transminas swarm
Formiga/Pedro Lessa and Salvador-Olivença swarms
Chapada Diamantina swarm
Pará de Minas I and II swarms
Paraopeba swarm
Lavras I swarm
Uauá swarm
South Atlantic Rift
Brasiliano Orogeny
Bambuí Basin
Macaúbas II Rift
Macaúbas I Rift
Espinhaço/ Chapada Diamantina Basin
Espinhaço II Rift
Espinhaço I Rift
Rhyacian «Transamazonian» Orogeny
Mineiro Belt
Minas Basin
Minas (Caraça) Rift
Gangila-Mayumbian
Gabbro-Norite
Kunene-Kibaran
Humpata
Shaanxi
Sariwon
Dashigou
Miyun
Taihang
Hengshan
Xiwangshan/ Xuwujia
Hengling
Taipingzhai-Naoyumen
Onset of decratonization in eastern North China
Qingbaikou, Nanhua and Sinian basins
Jixian Basin (?)
Gaoyuzhuang Basin
Xiong'er and Yanshan-Taihangshan rifts
Inner Mongolia-Northern Hebei Orogeny
Trans-North China Orogeny
Eastern Block Rift
Karoo
Umkondo
Mashonaland
Sebanga Poort
Mtshingwe
Cristal Springs
Great Dyke
Waterberg
Soutpansberg
BIC
Rykoppies
Badplaas
Rift units
green = mafic volcanics and plutonics
Yellow = felsic volcanics and plutonics
Passive margin basins
Carbonate-siliciclastic intracontinental basins
black = BIF
AccretionaryOrogeny or Island Arc
Collisional Orogeny





Caxito et al. (2020) Lithos





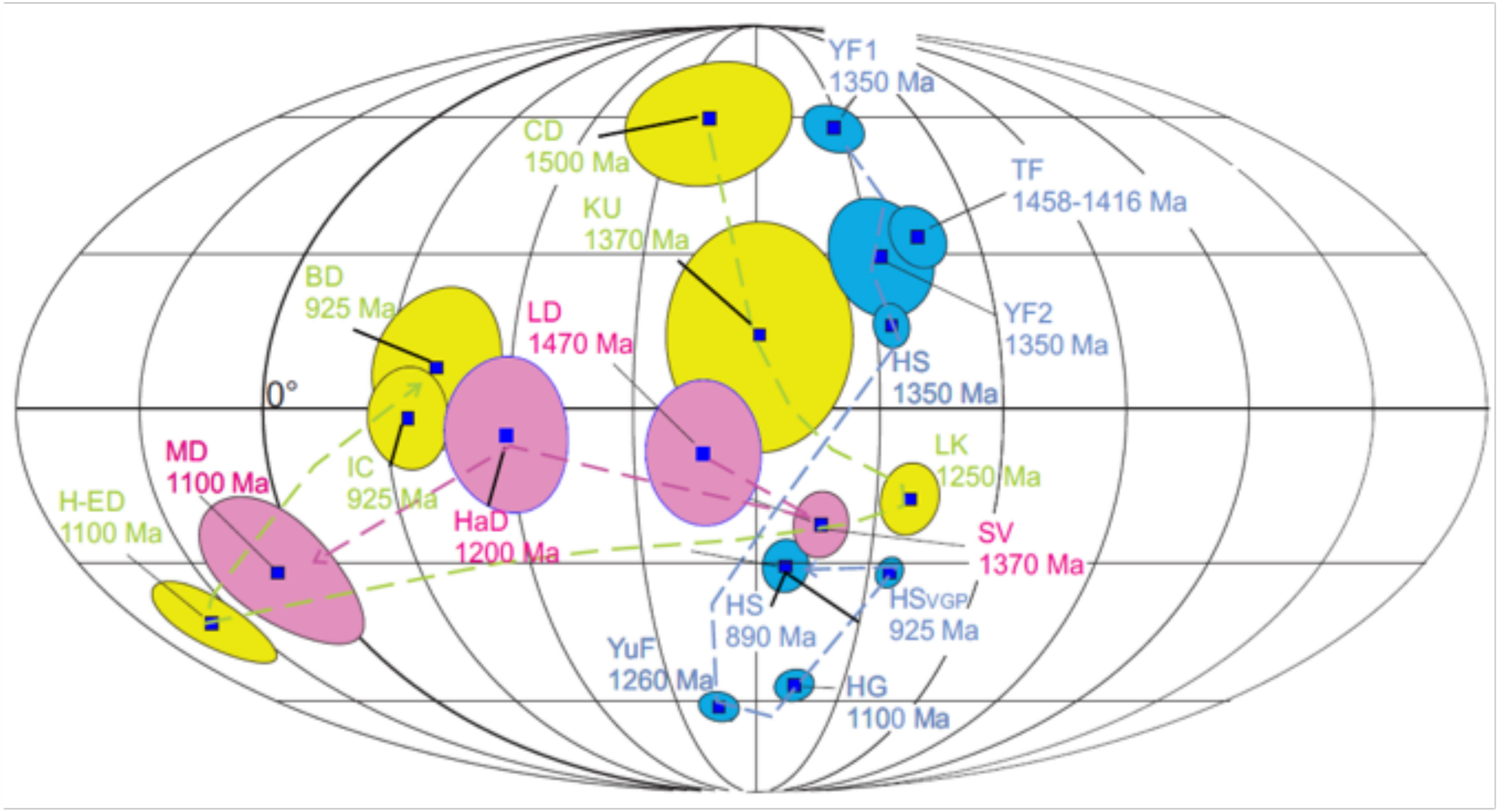
Trindade et al. (in press)

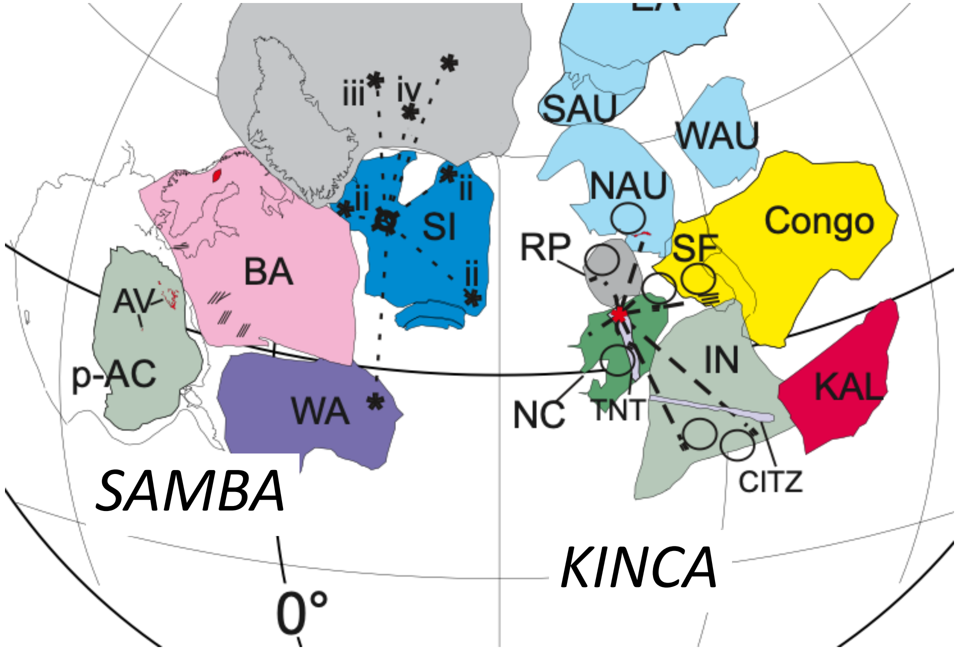
1- Pará de Minas swarm
2- Taihang-Yinshan swarm
3- Florida swarm
4- Hart dolerites
5- Pipilia swarm
6- Pebbair swarm.

star: Xiong’er plume center
(North China)

Congo-São Francisco Craton in Columbia

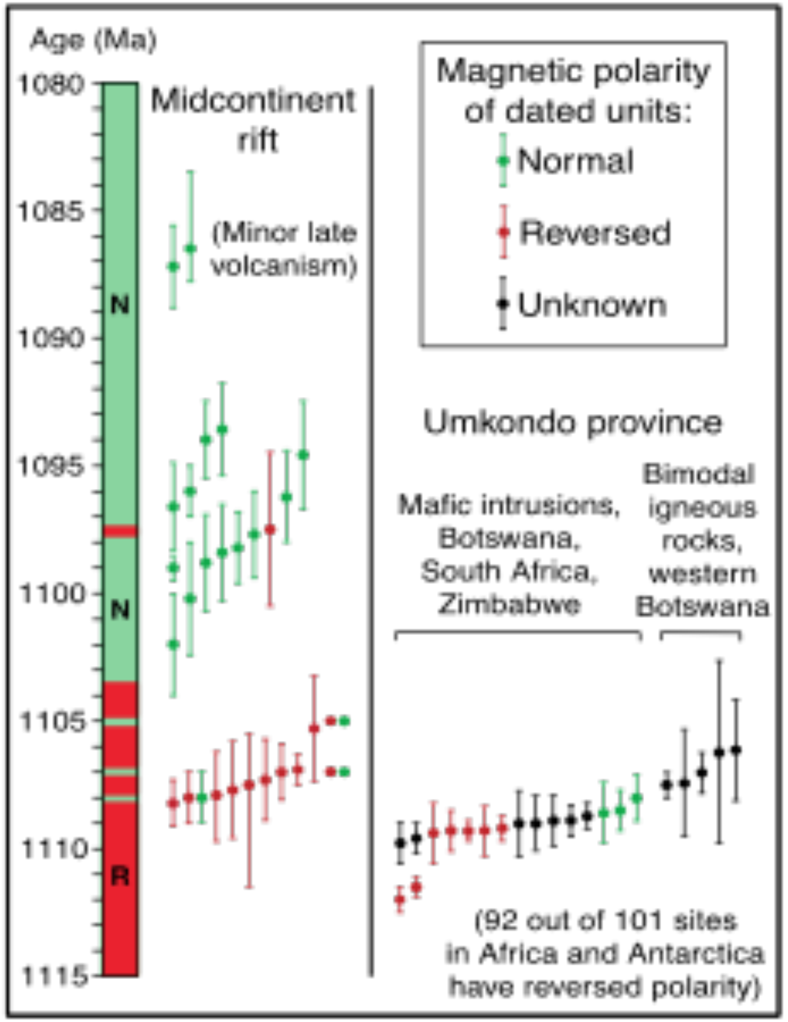
A short-lived KINCA?
Kalahari, India, North China, Congo-São Francisco, Australia

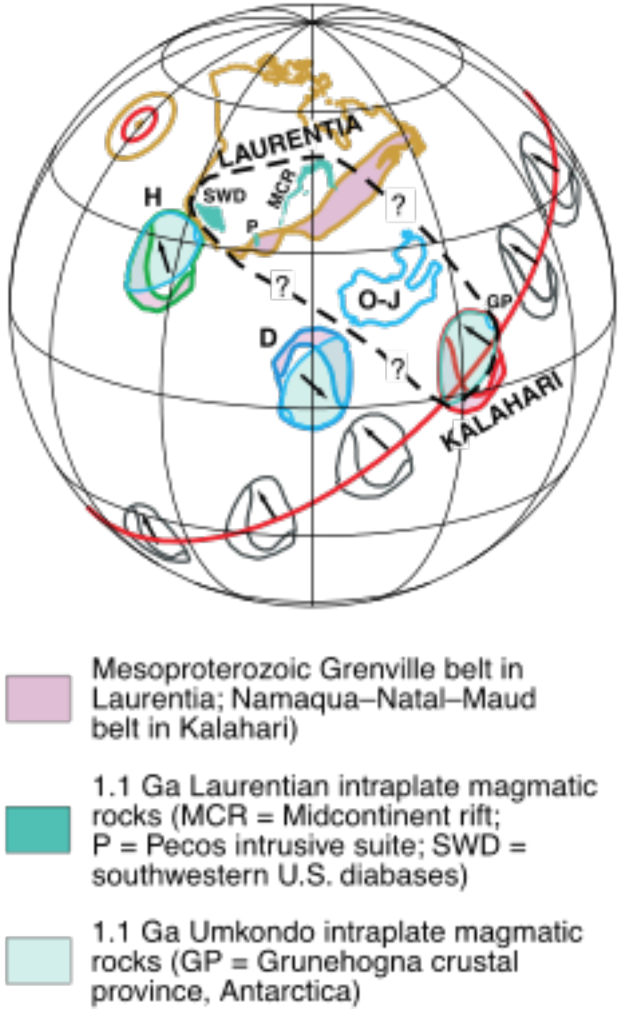




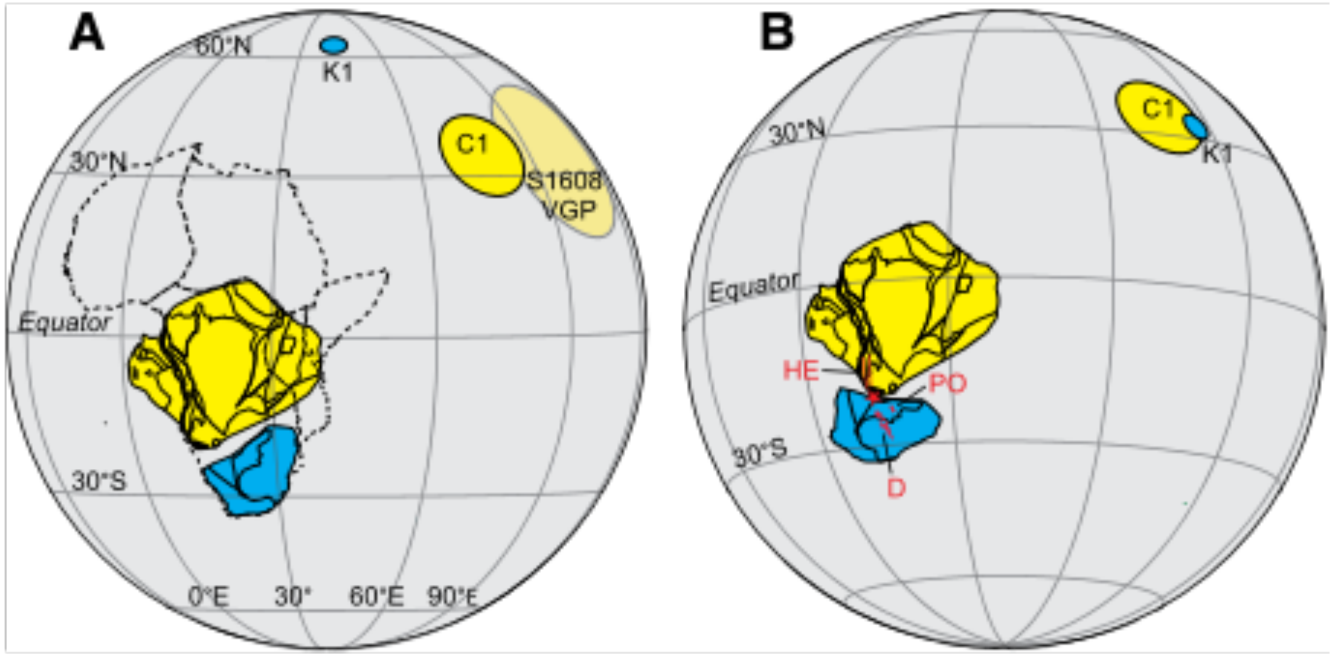
Trindade et al. 2021. Ancient supercontinents book

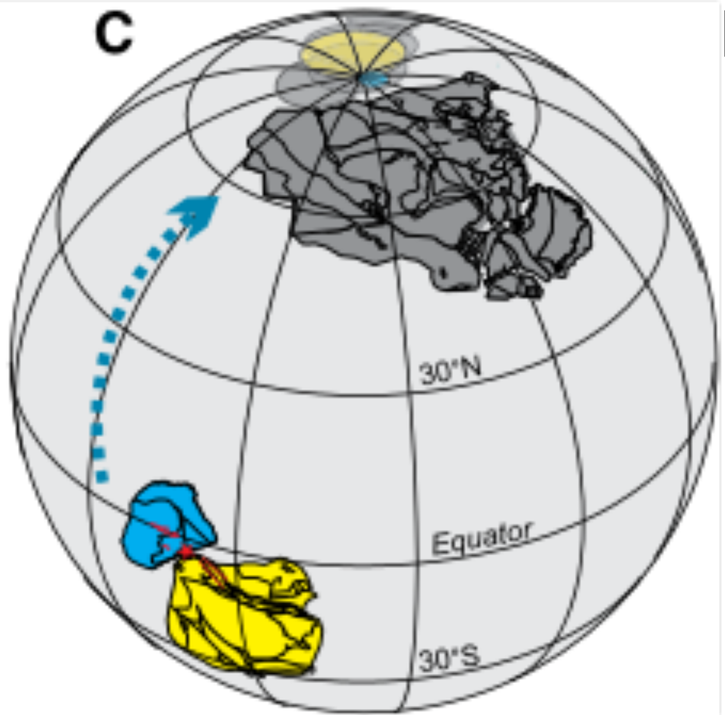
Bar code + reversals + paleomagnetism





Hanson et al. (2004) Science

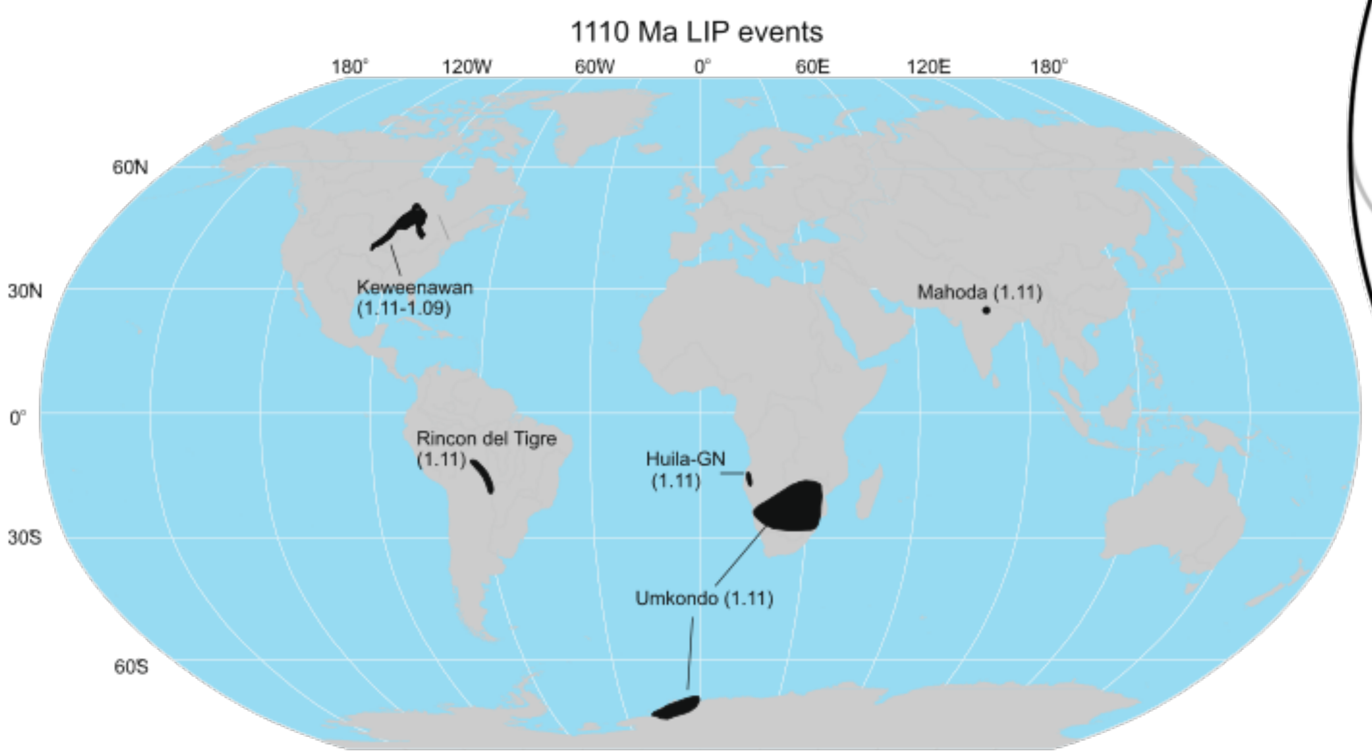


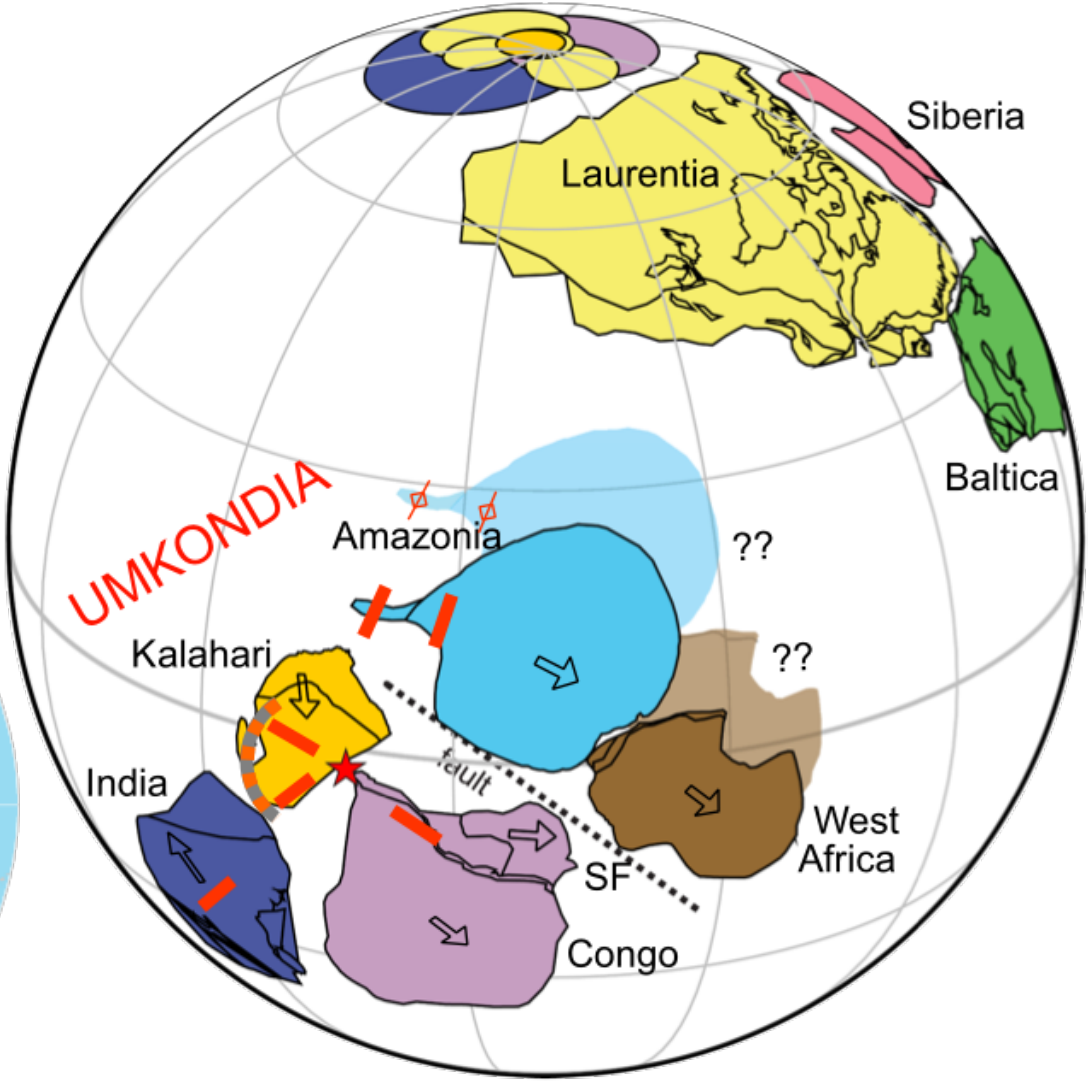


Huila-Epembe pole 1100 Ma

Salminen et al. (2018) Geology

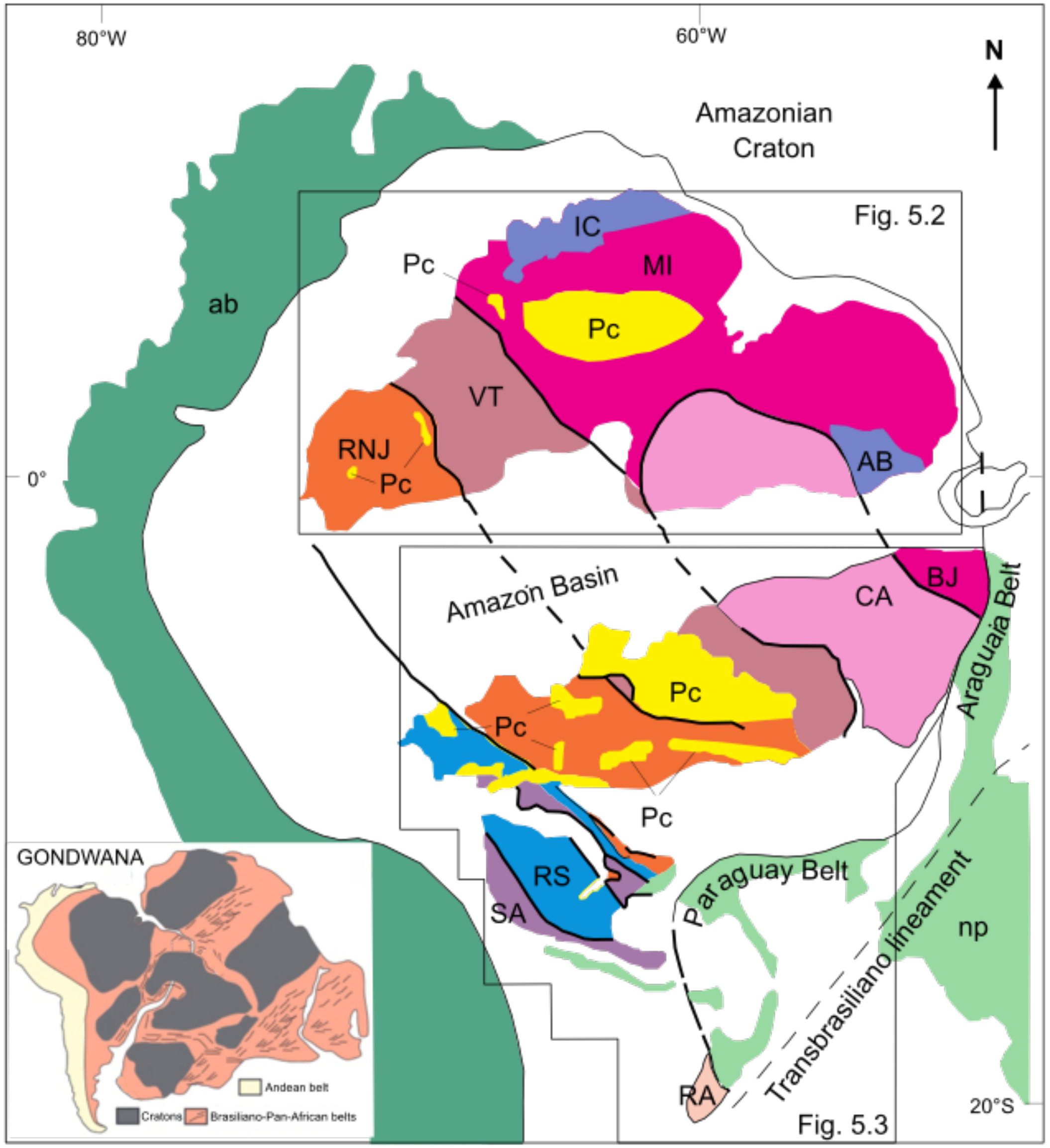
Bar code + paleomagnetism
Umkondia and Rodinia

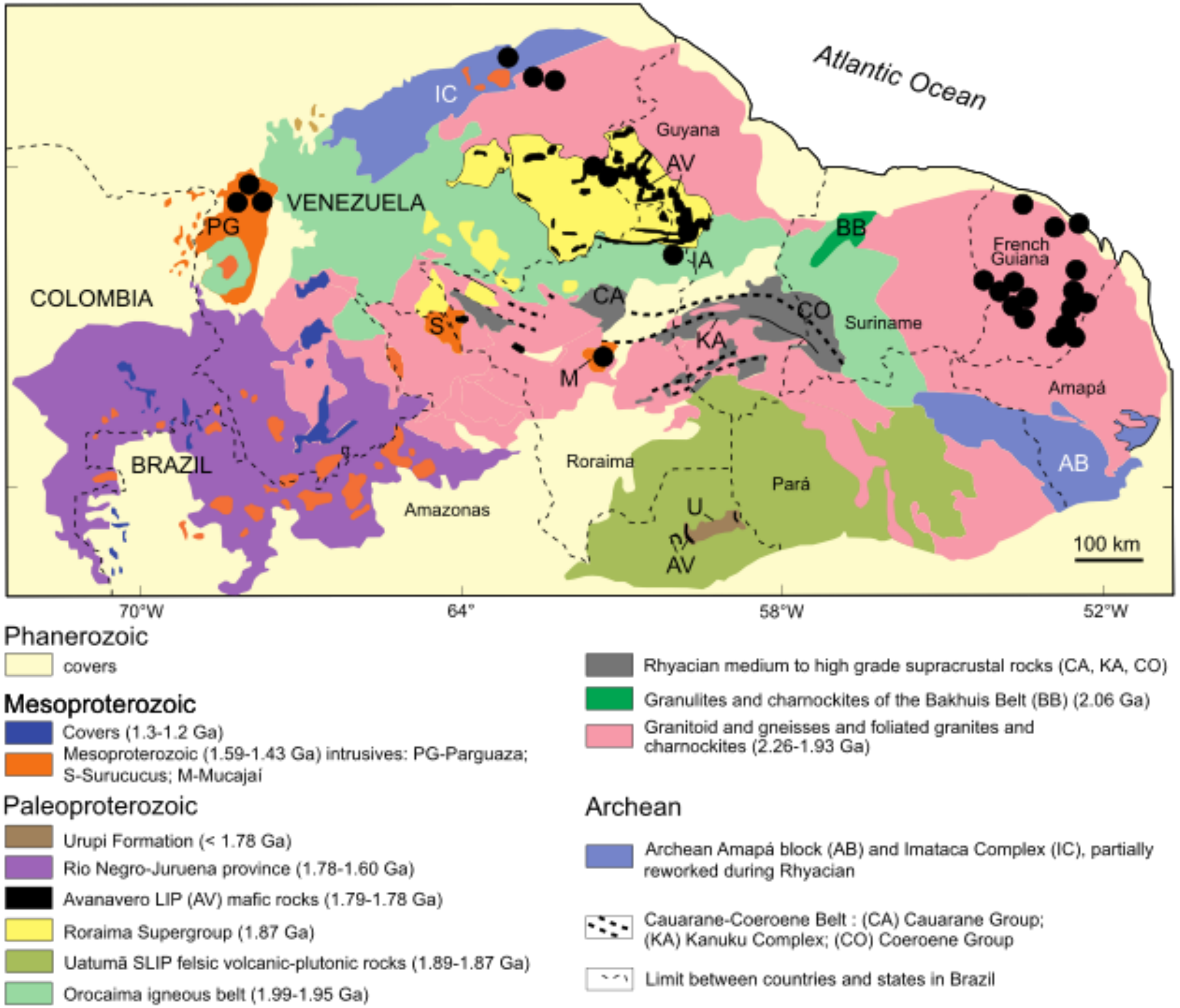




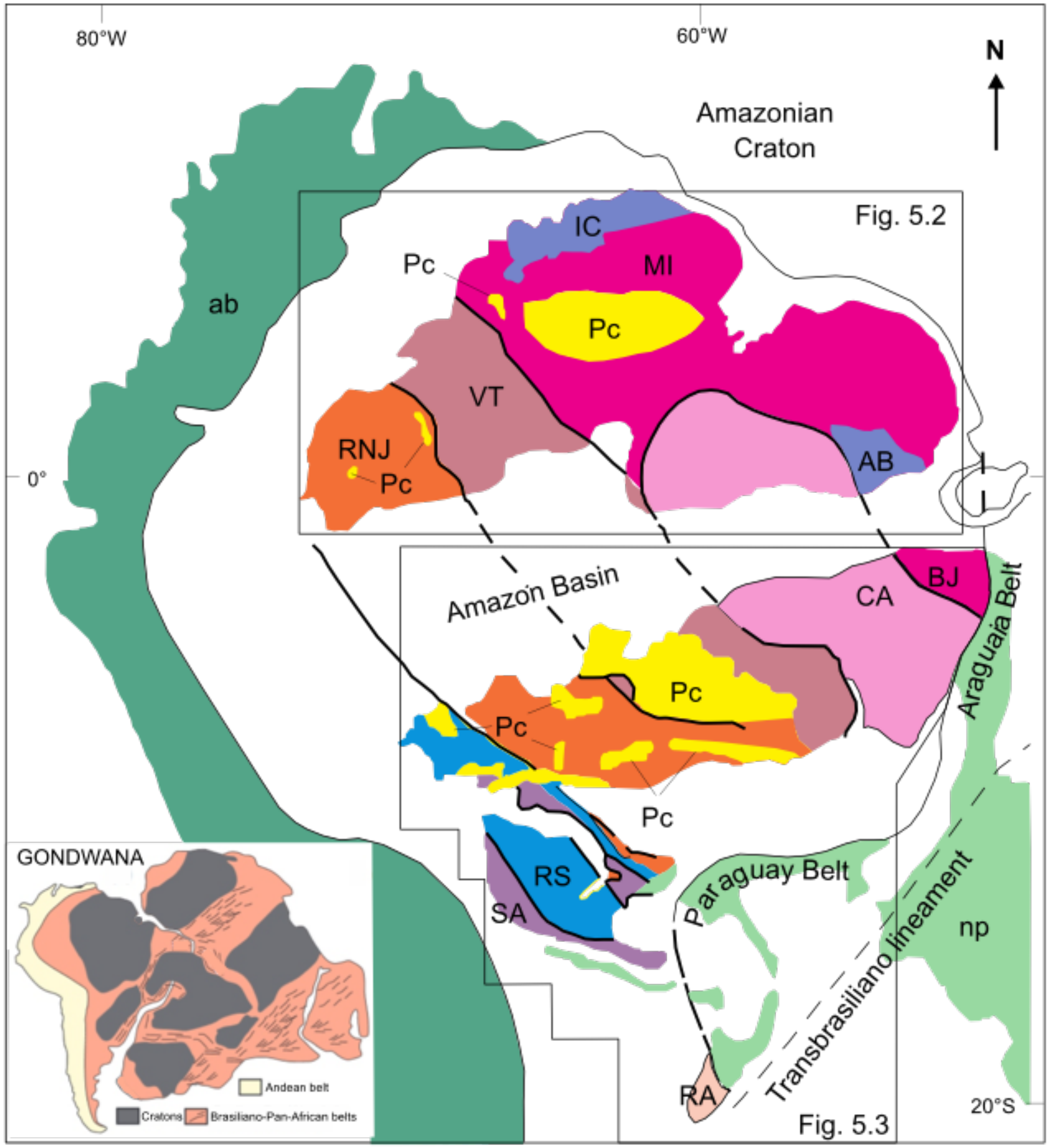
Choudhary et al. (2019) Prec. Res.

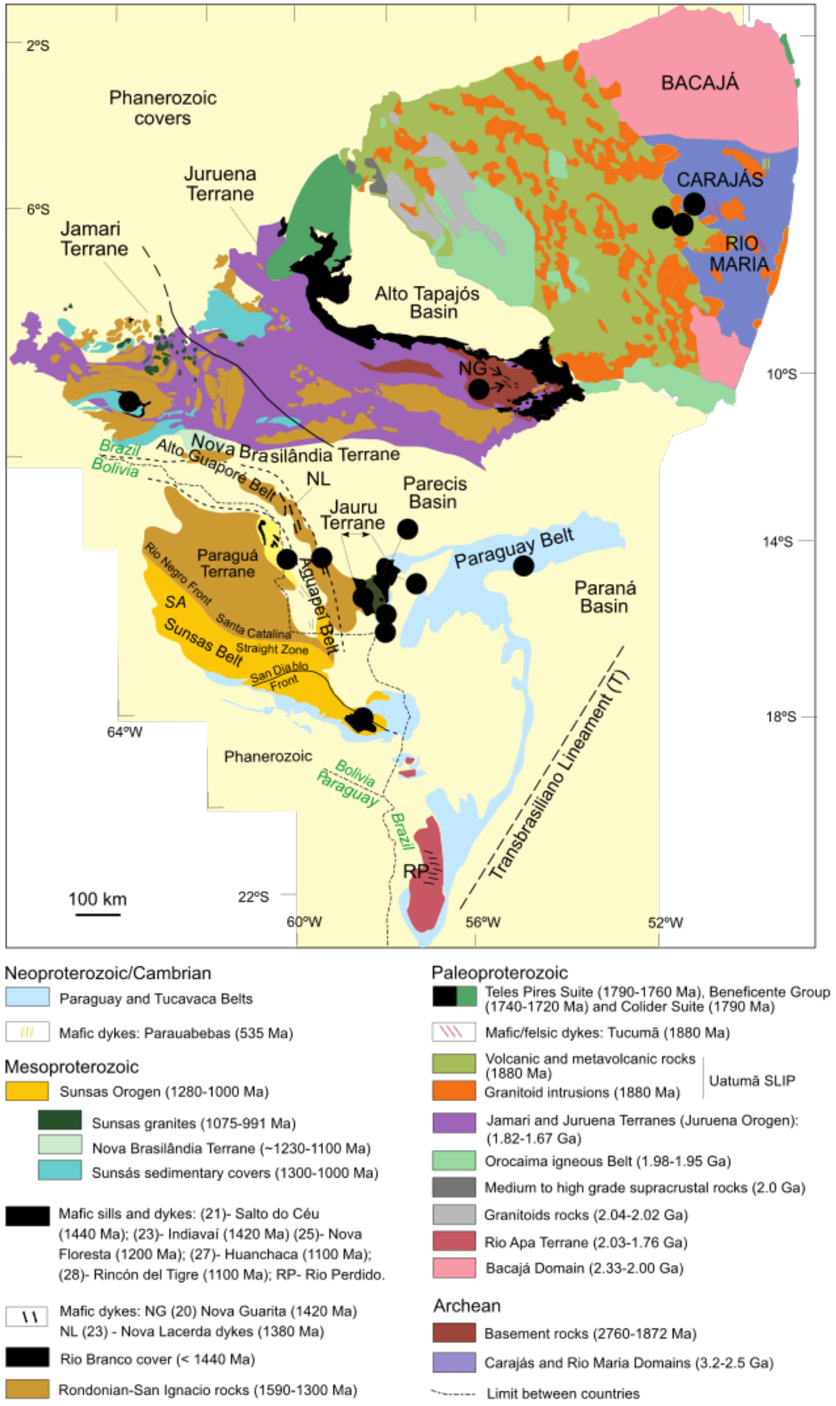
Amazonian Craton

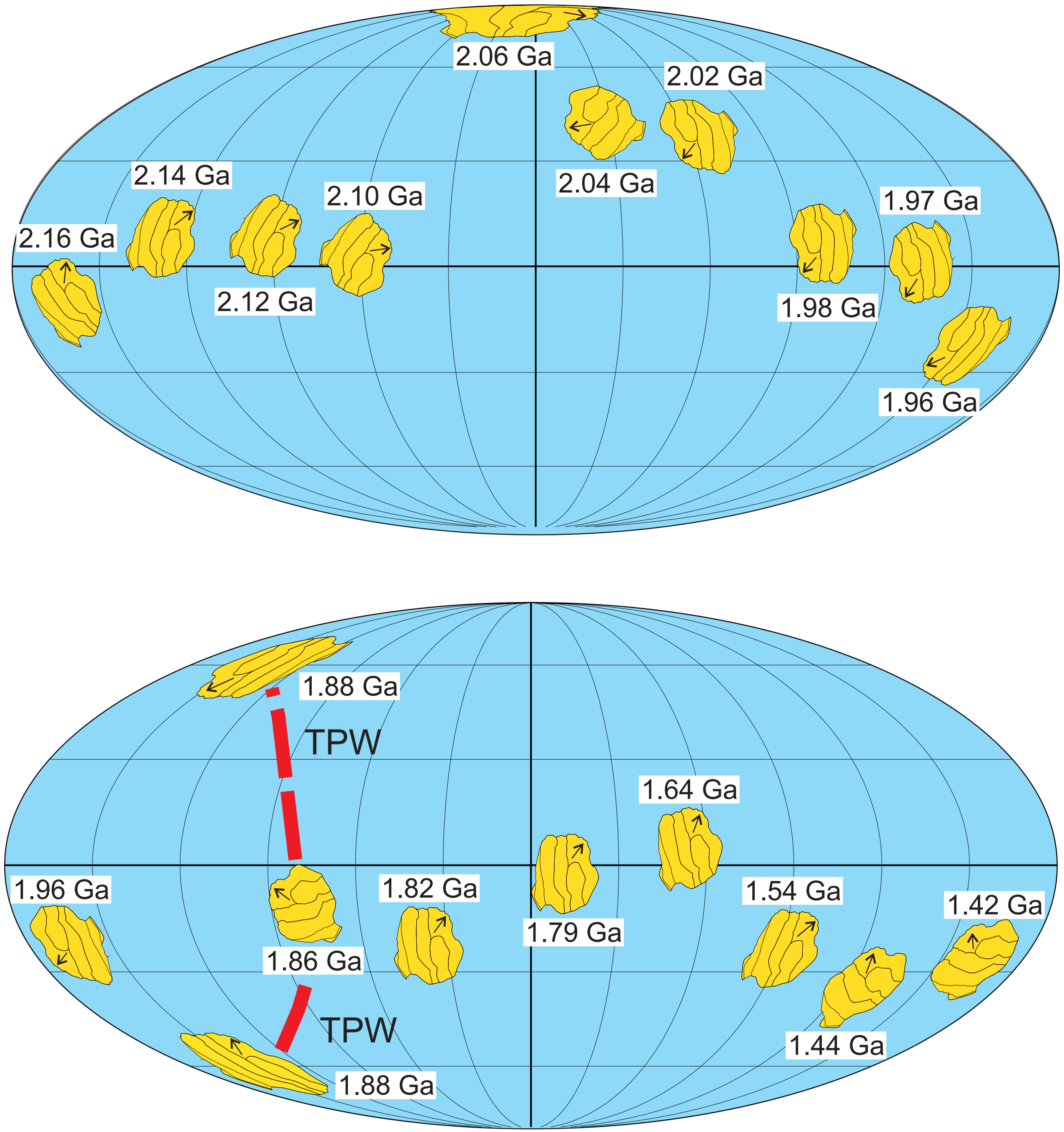




Amazonian Craton



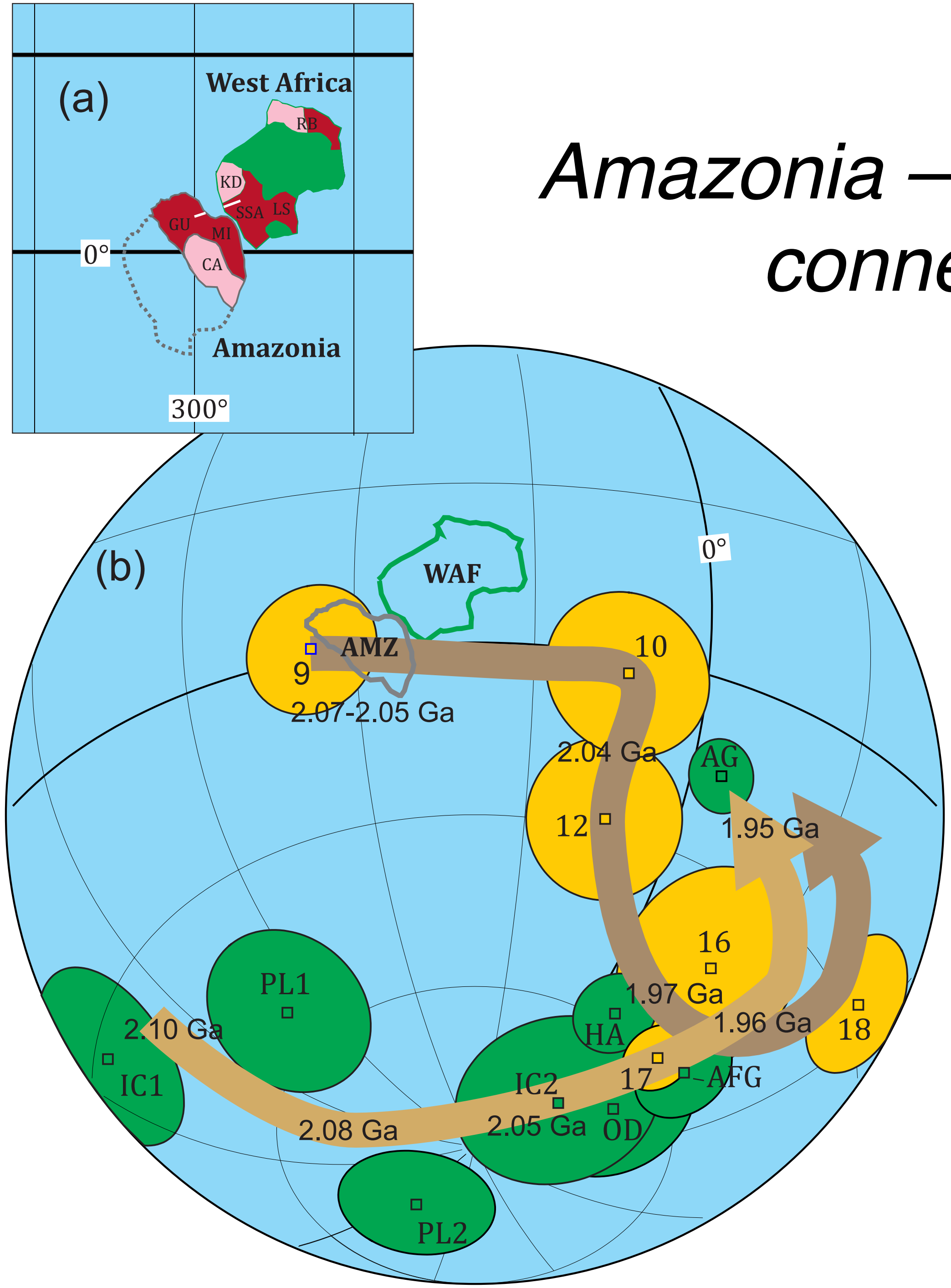




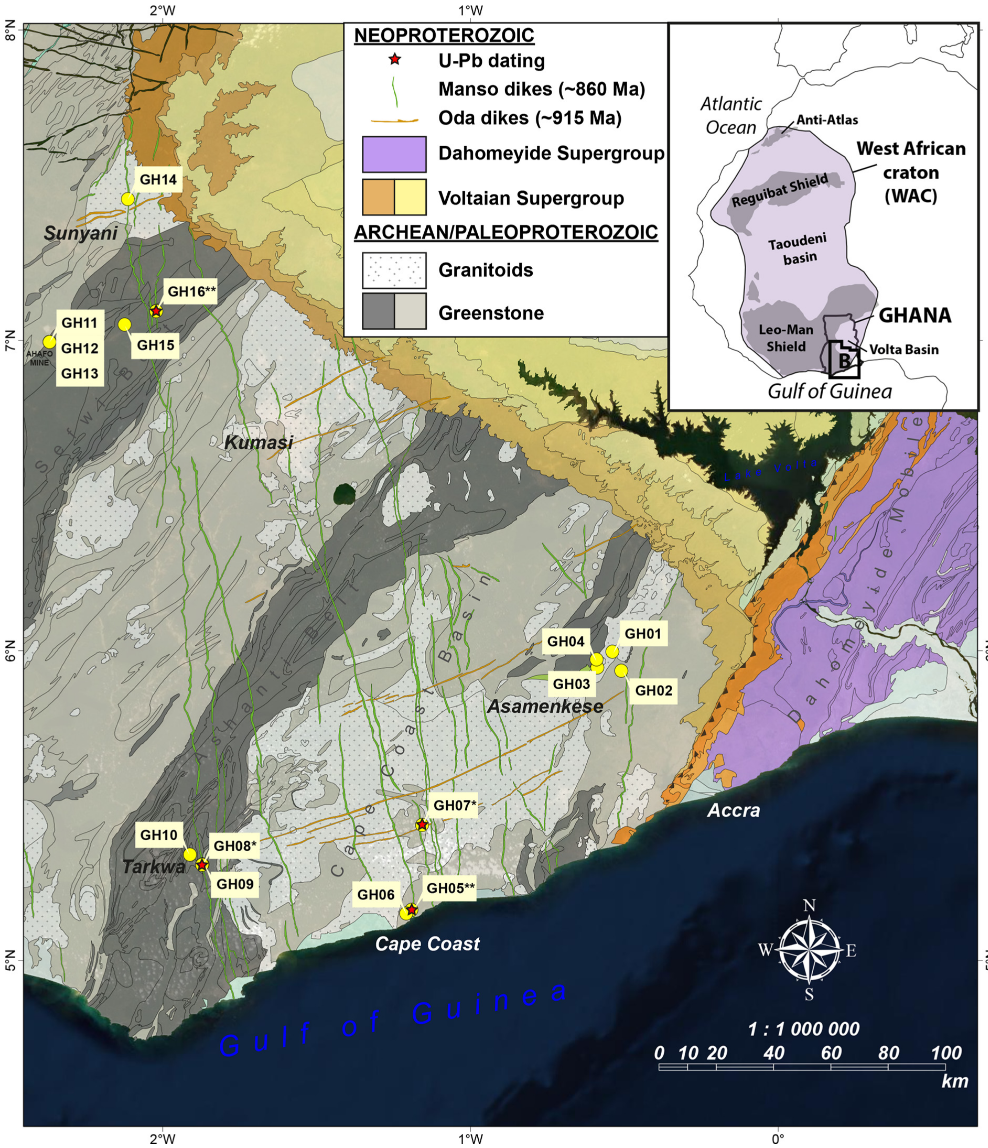
Amazonian Craton

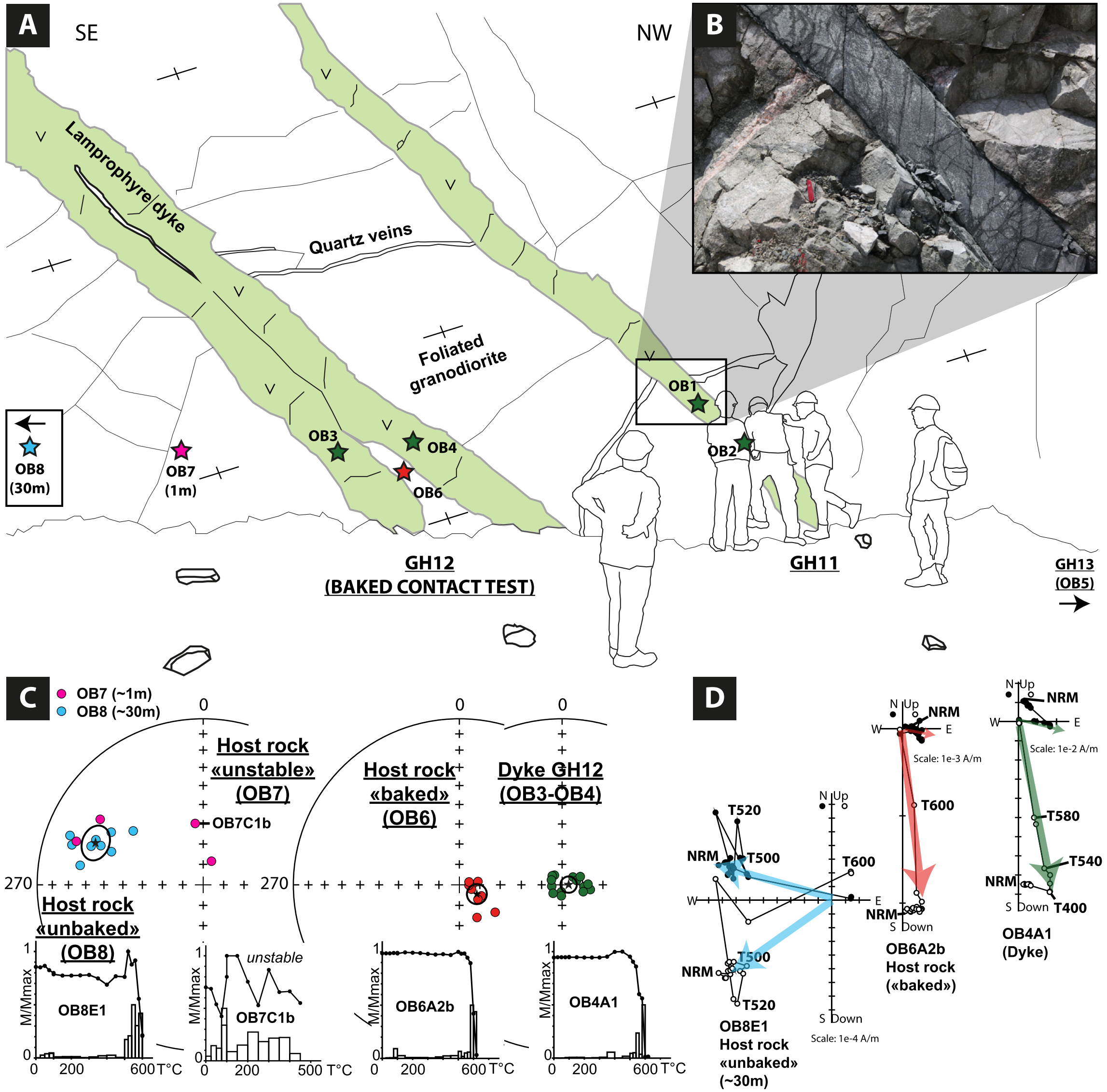
Latitudinal drift

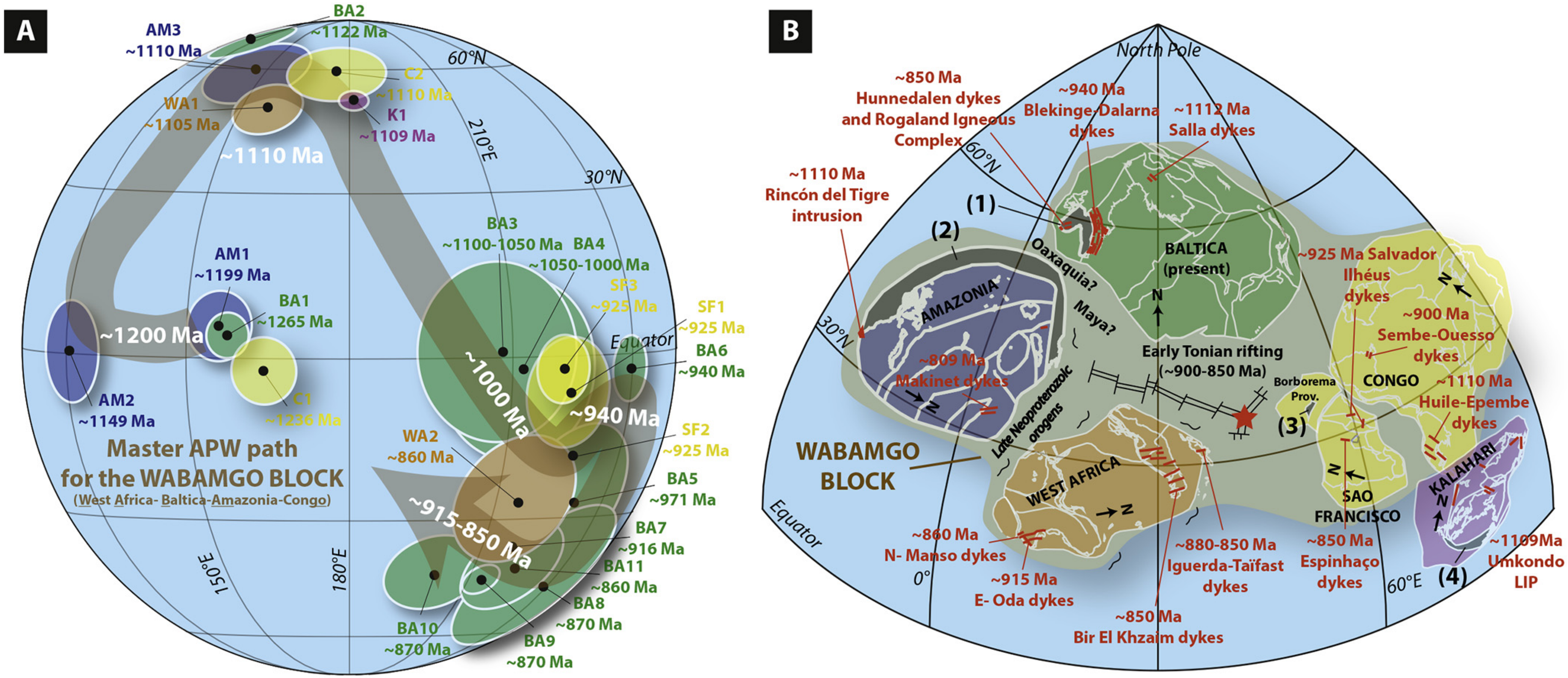
Amazonia – West Africa connection

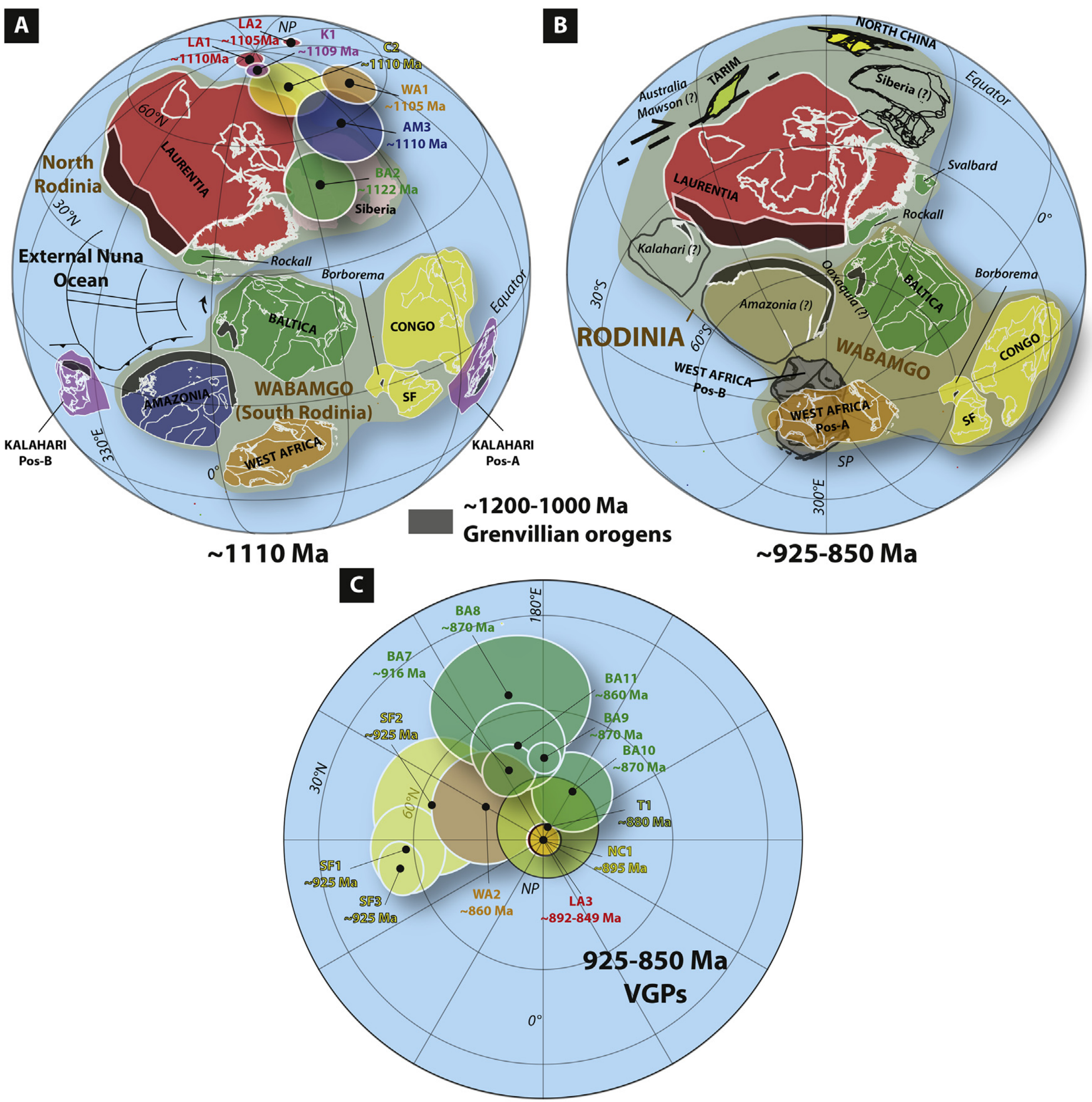


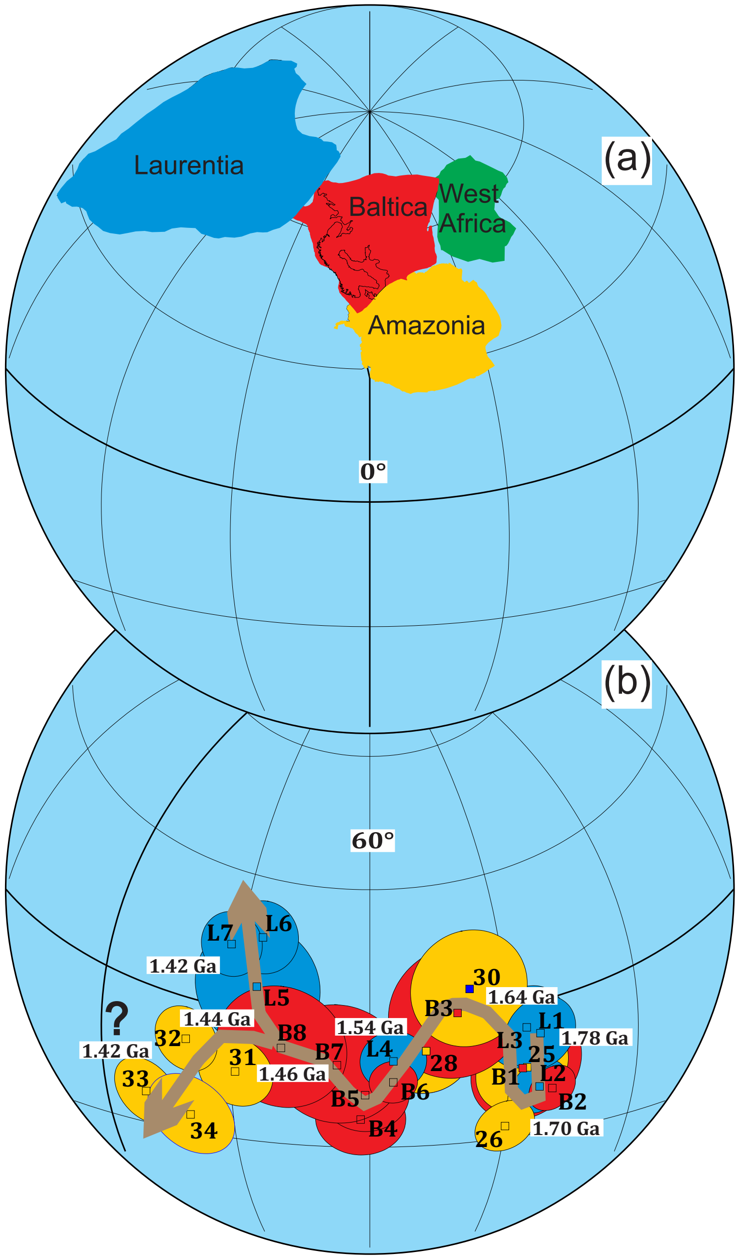
Amazonia – West Africa connection

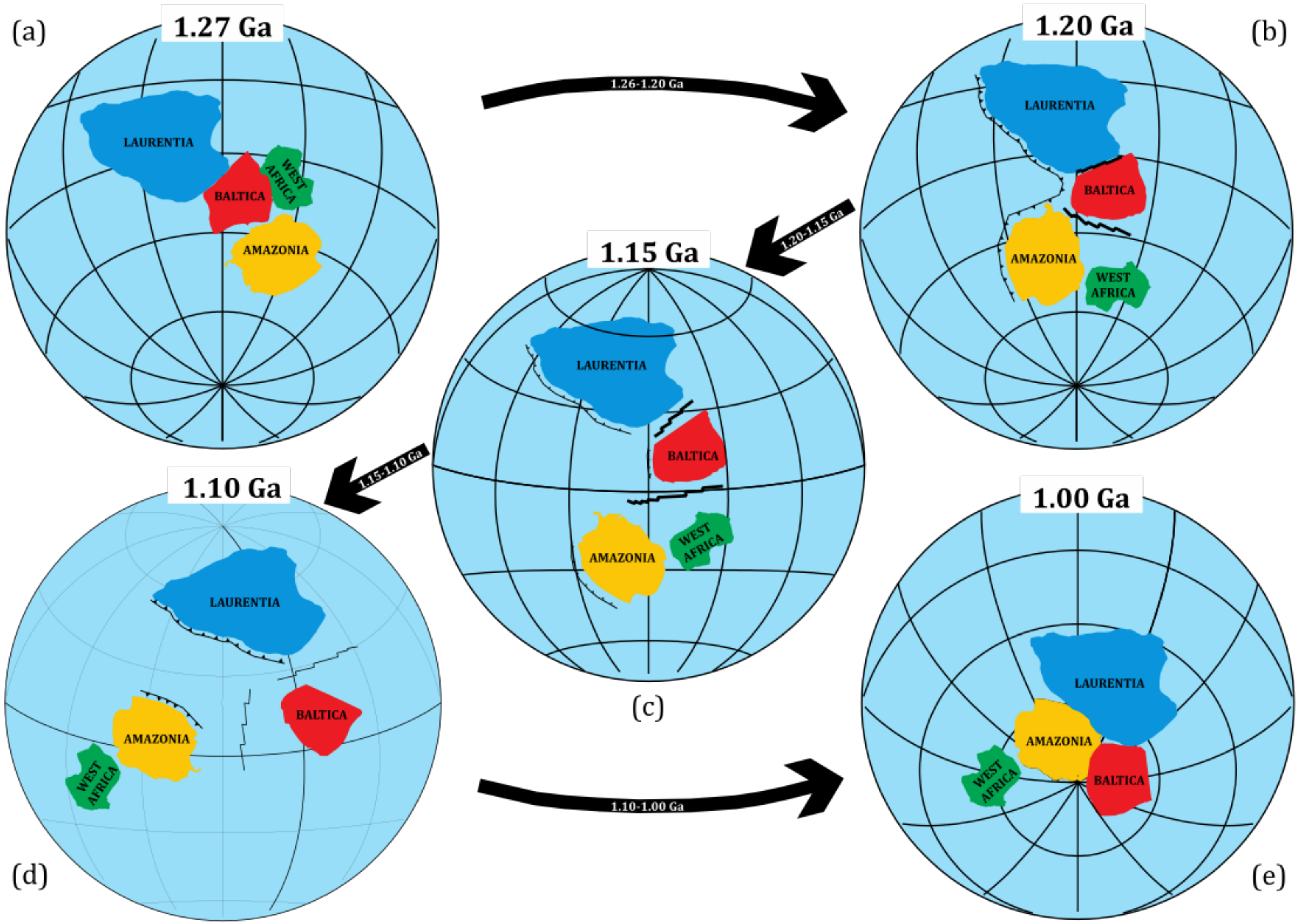


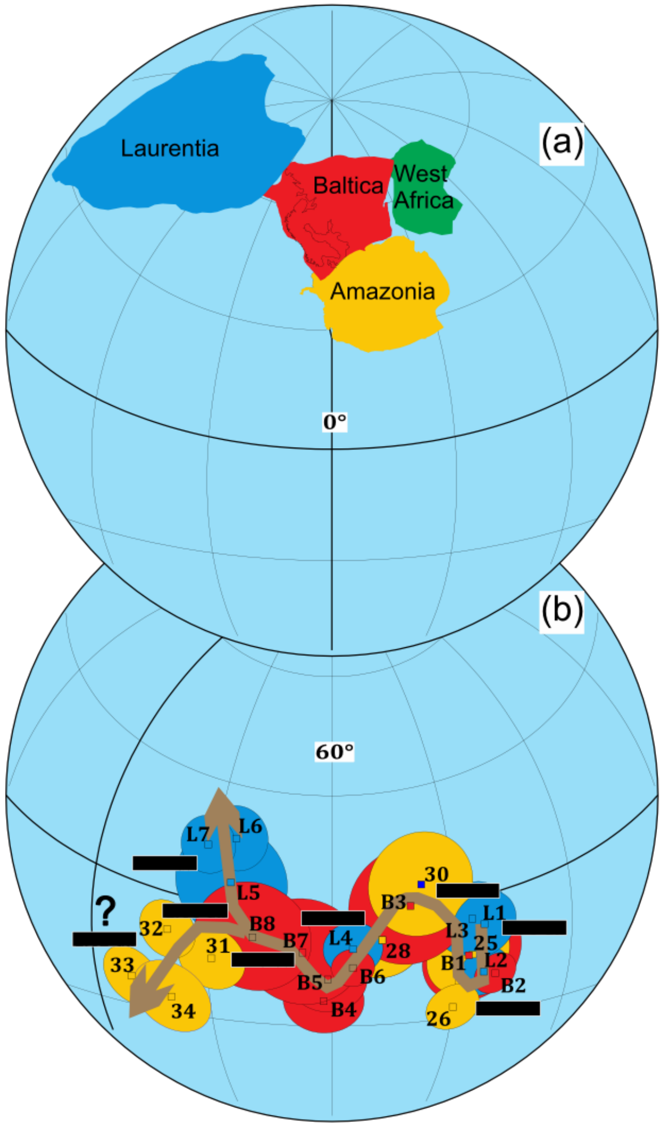



A
AM3
~1110 Ma
BA2
~1122 Ma
60°N
C2
~1110 Ma
WA1
~1105 Ma
K1
~1109 Ma
~1110 Ma
210°E
30°N
BA3
~1100-1050 Ma
BA4
~1050-1000 Ma
AM1
~1199 Ma
BA1
~1265 Ma
SF3
~925 Ma
SF1
~925 Ma
~1200 Ma
Equator
BA6
~940 Ma
~1000 Ma
AM2
~1149 Ma
C1
~1236 Ma
~940 Ma
Master APW path
for the WABAMGO BLOCK
(West Africa- Baltica-Amazonia-Congo)
WA2
~860 Ma
SF2
~925 Ma
BA5
~971 Ma
~915-850 Ma
BA7
~916 Ma
BA11
~860 Ma
150°E
180°E
BA8
~870 Ma
BA10
~870 Ma
BA9
~870 Ma
B
North Pole
~850 Ma
Hunnedalen dykes
and Rogaland Igneous
Complex
~940 Ma
Blekinge-Dalarna
dykes
~1112 Ma
Salla dykes
60°N
~1110 Ma
Rincón del Tigre
intrusion
(1)
(2)
Oaxaquia?
Maya?
BALTICA
(present)
AMAZONIA
30°N
~925 Ma Salvador
Ilhéus
dykes
~900 Ma
Sembe-Ouesso
dykes
Early Tonian rifting
(~900-850 Ma)
~809 Ma
Makinet dykes
Late Neoproterozoic
orogens
Borborema
Prov.
(3)
CONGO
~1110 Ma
Huile-Epembe
dykes
WABAMGO
BLOCK
WEST AFRICA
KALAHARI
SAO
FRANCISCO
Equator
~860 Ma
N- Manso dykes
~915 Ma
E- Oda dykes
~880-850 Ma
Iguerda-Taïfast
dykes
~850 Ma
Espinhaço
dykes
~1109Ma
Umkondo
LIP
0°
60°E
(4)
~850 Ma
Bir El Khzaim dykes

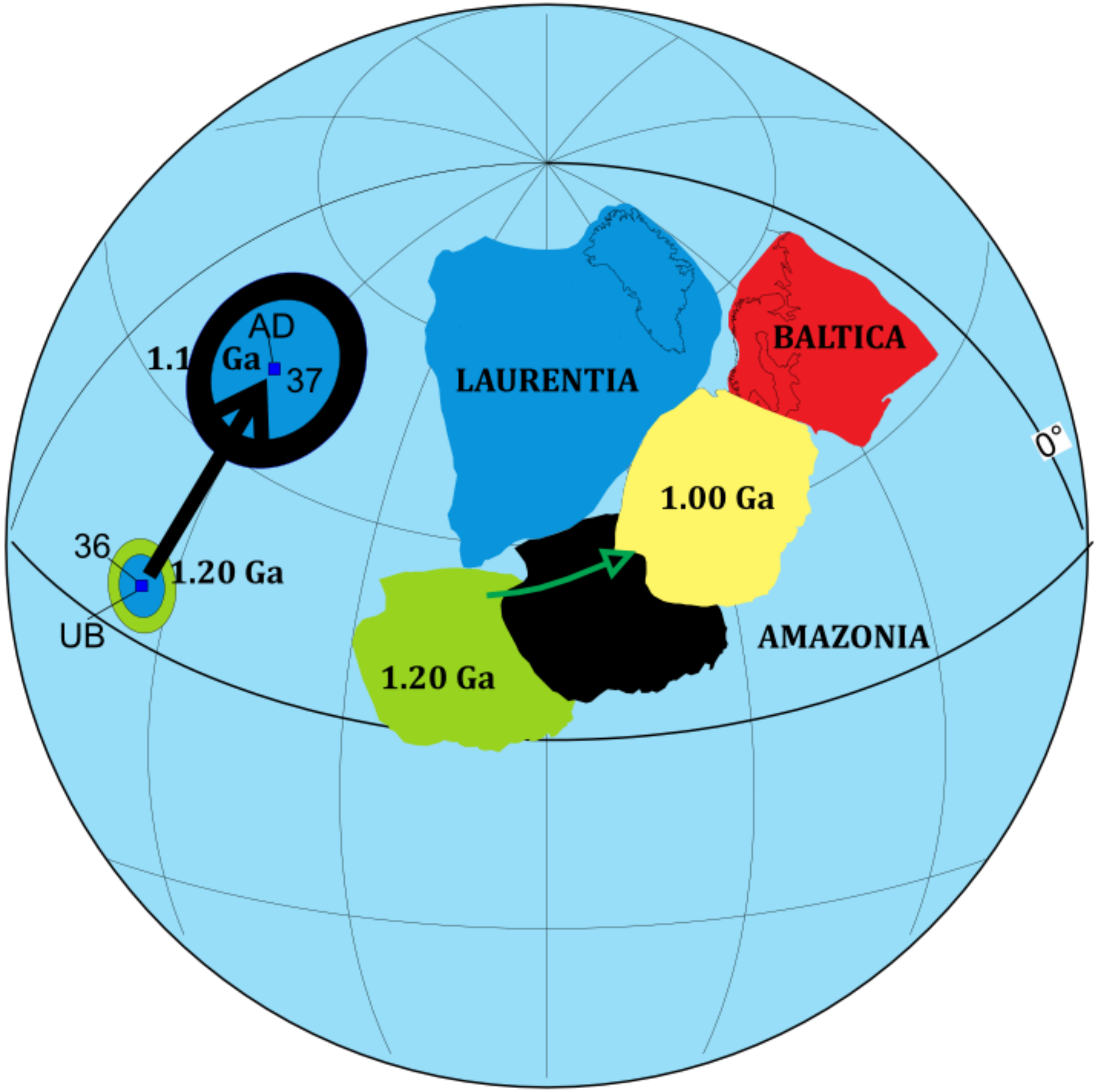

A
NP
LA2
~1105Ma
LA1
~1110Ma
K1
~1109 Ma
C2
~1110 Ma
WA1
~1105 Ma
AM3
~1110 Ma
BA2
~1122 Ma
Siberia
60°N
LAURENTIA
North
Rodinia
30°N
Rockall
External Nuna
Ocean
Borborema
BALTICA
CONGO
Equator
AMAZONIA
WABAMGO
(South Rodinia)
SF
KALAHARI
Pos-B
KALAHARI
Pos-A
330°E
0°
WEST AFRICA
~1110 Ma
~1200-1000 Ma
Grenvillian orogens
B
NORTH CHINA
TARIM
Australia
Mawson (?)
Siberia (?)
Equator
Svalbard
LAURENTIA
Rockall
0°
Kalahari (?)
Oaxaquia (?)
BALTICA
Borborema
30°S
Amazonia (?)
RODINIA
60°S
WABAMGO
CONGO
WEST AFRICA
Pos-B
WEST AFRICA
Pos-A
SF
SP
300°E
~925-850 Ma
C
180°E
BA8
~870 Ma
BA7
~916 Ma
BA11
~860 Ma
SF2
~925 Ma
BA9
~870 Ma
BA10
~870 Ma
30°N
60°N
T1
~880 Ma
NC1
~895 Ma
SF1
~925 Ma
SF3
~925 Ma
WA2
~860 Ma
NP
LA3
~892-849 Ma
925-850 Ma
VGPs
0°


(a)
Laurentia
Baltica
West Africa
Amazonia
0°
(b)
60°
L7
L6
1.42 Ga
L5
?
1.44 Ga
1.42 Ga
32
B8
31
B7
33
1.46 Ga
1.54 Ga
L4
B5
B6
34
B4
30
1.64 Ga
B3
28
L3
L1
1.78 Ga
25
B1
L2
B2
26
1.70 Ga

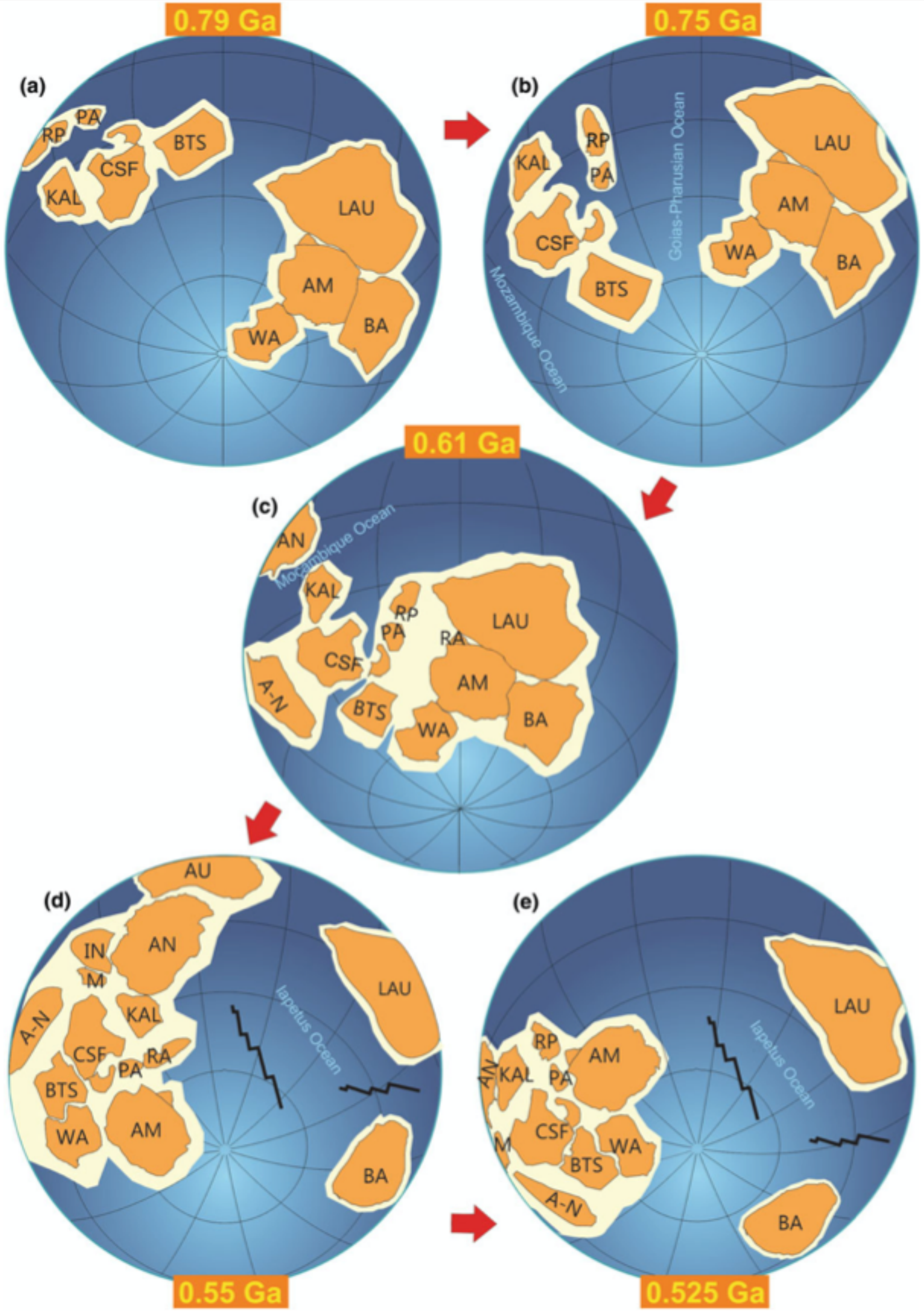

(a)
1.27 Ga
LAURENTIA
BALTICA
WEST AFRICA
AMAZONIA
1.26-1.20 Ga
(b)
1.20 Ga
LAURENTIA
BALTICA
AMAZONIA
WEST AFRICA
1.20-1.15 Ga
1.15 Ga
LAURENTIA
BALTICA
AMAZONIA
WEST AFRICA
(c)
1.15-1.10 Ga
1.10 Ga
LAURENTIA
BALTICA
AMAZONIA
WEST AFRICA
(d)
1.10-1.00 Ga
1.00 Ga
LAURENTIA
AMAZONIA
BALTICA
WEST AFRICA
(e)



Laurentia
Baltica
West Africa
Amazonia
(a)
0°
(b)
60°
L7
L6
L5
?
32
B8
31
33
34
B7
L4
B5
B4
B6
28
30
B3
L1
L3
25
B1
L2
B2
26



AD
1.1
Ga
37
36
1.20 Ga
UB
LAURENTIA
BALTICA
1.00 Ga
AMAZONIA
1.20 Ga
0°



From Rodinia to Gondwana

Trindade et al. (2006) EPSL
Tohver et al. (2006) Precambrian Res.
D'Agrella-Filho and Cordani (2018)
São Francisco Craton, Eastern Brazil

Summary:

Amazon and São Francisco cratons were likely part of all three supercontinents since the Paleoproterozoic. Few constraints exist on the Rio de la Plata Craton.

Columbia (1800-1340): Amazonia was part of a group including Baltica, Laurentia and West Africa; CSF was possibly connected to North China and India, and made part of the Columbia supercontinent

Rodinia (1000-630 Ma): Amazonia, always in connection with Laurentia, with two different models for interaction; São Francisco position is not clear;

Gondwana (630-130 Ma): One of the worst periods for the paleomagnetic record; several anomalous conditions suggest this was the onset of the inner core. In spite of that the available data is compatible with an assembly not later than 570 Ma, with poles from West Africa, Congo-São Francisco and Rio de la Plata coinciding at this time.

Patagonia behaved as a para-autochton terrane, with limited opening in its NE border.