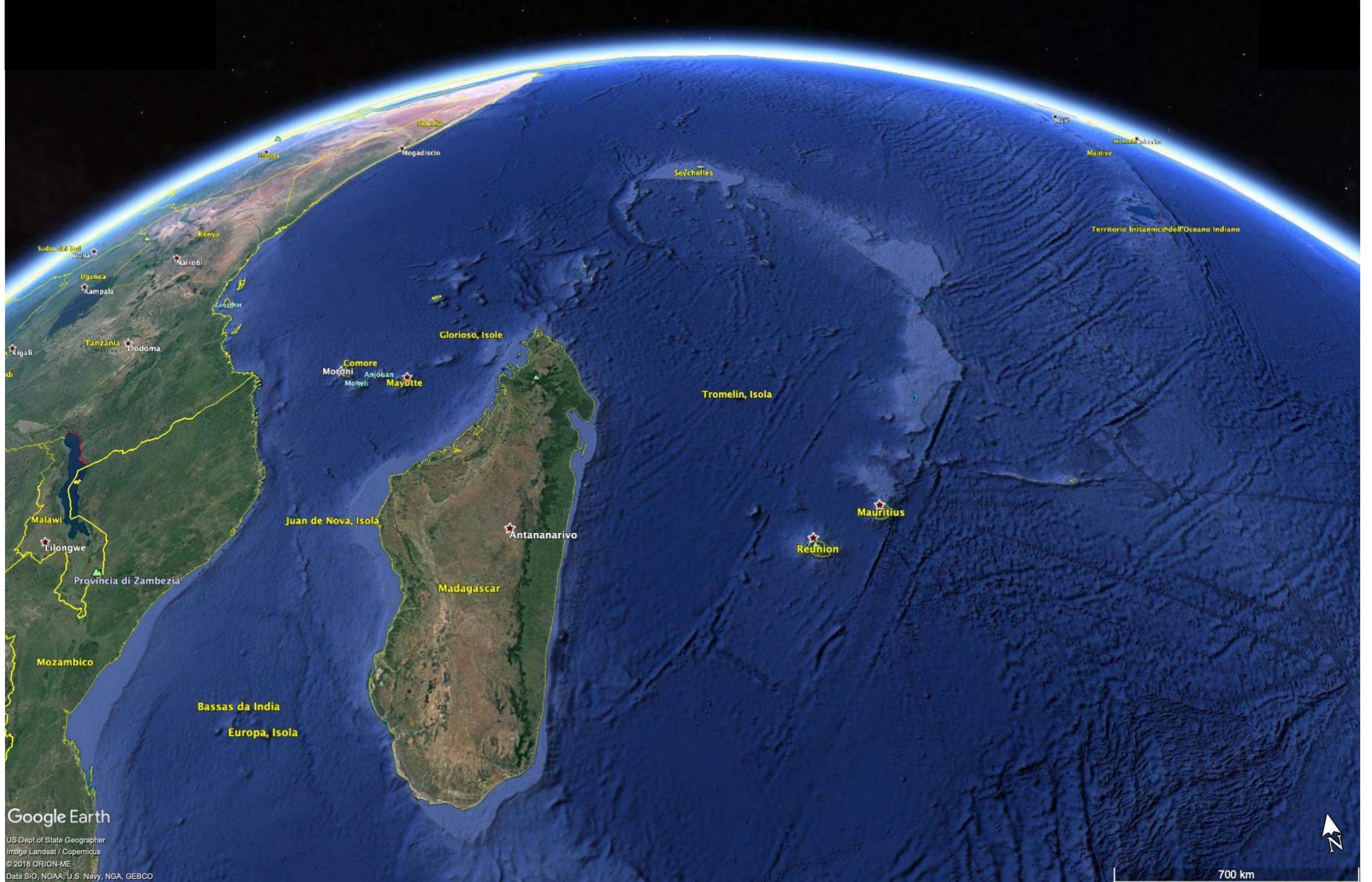


Madagascar

l'isola con un «volto»
da continente

Una storia di oltre 3 miliardi di anni



Google Earth

US Dept of State Geographer
Image Landsat / Copernicus
© 2018 ORION-ME
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

700 km



EONE ADEANO

EONE ARCHEANO

Accrezione della Terra

4 400 Ma

Granuli minerali più antichi

4 000 Ma

Rocce continentali più antiche



Assemblaggio di un primo supercontinente

Ur

Si formano i primi cratoni

3500

Kenorland

3000

Assemblaggio di *Columbia*

2500

2000

EONE PROTEROZOICO

Assemblaggio di *Rodinia*

1500

Pannotia

700

1000

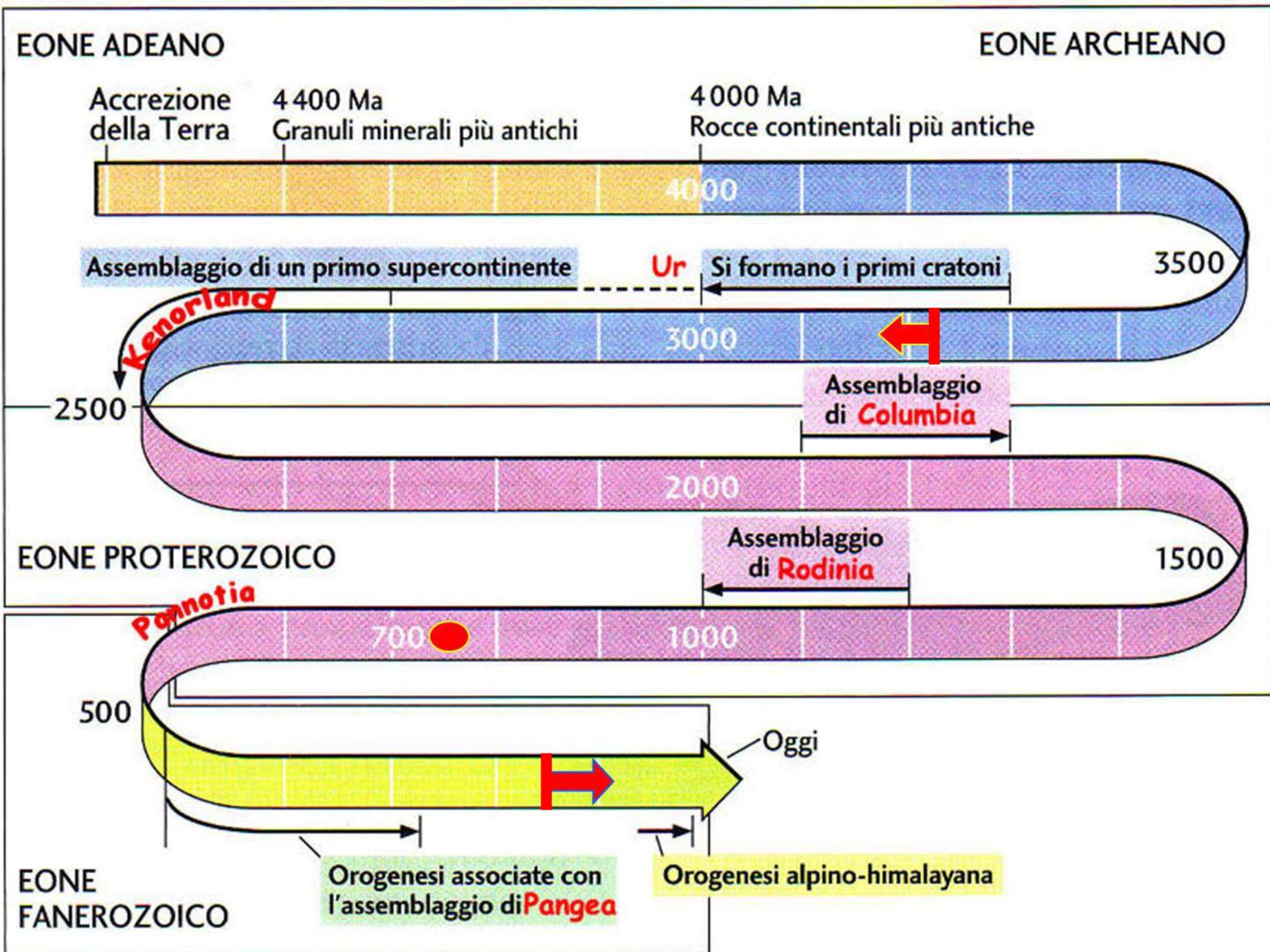
500

Oggi

EONE FANEROZOICO

Orogenesi associate con l'assemblaggio di *Pangea*

Orogenesi alpino-himalayana



M a d a g a s c a r

*Canale di
Mozambico*

Oceano Indiano

Tavolato

*Sedimenti non
deformati*

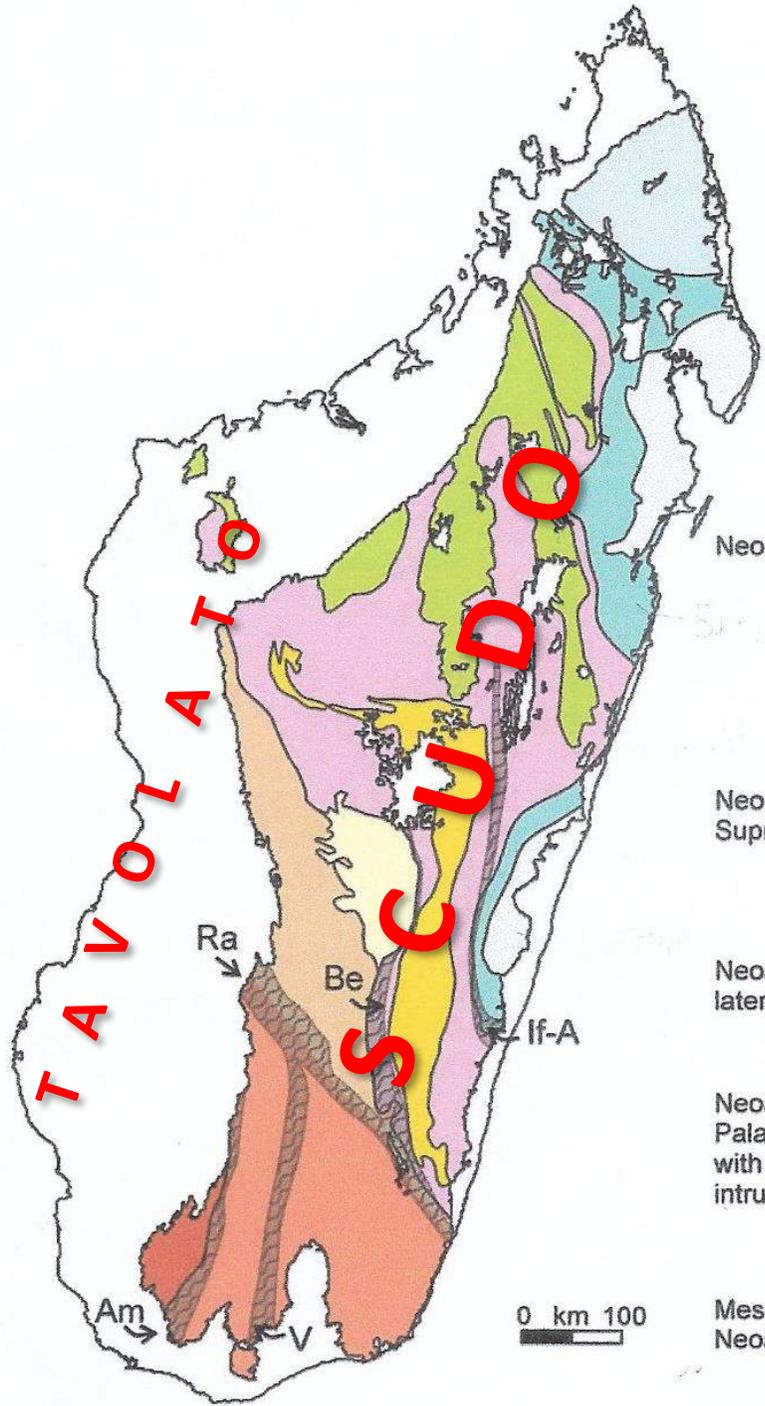
Scudo

*pre-Cambriano
(più di 500 Ma)*



C R A T O N E

Canale di Mozambico (Africa)



- Shear zone systems
- Neoproterozoic
- Bemarivo Belt
- Betsimisaraka Unit
- Vohibory Unit
- Neoproterozoic Supra-crustals
- Androyen Unit
- Molo Unit
- Neoarchean with later intrusions
- Tsaratanana Sheet
- Itremo Group
- Undated Metasediments
- Dominantly orthogneiss
- Neoarchean to Palaeoproterozoic with later intrusions
- Meso - Neoarchean
- Antongil Block

Oceano Indiano

Antananarivo Block

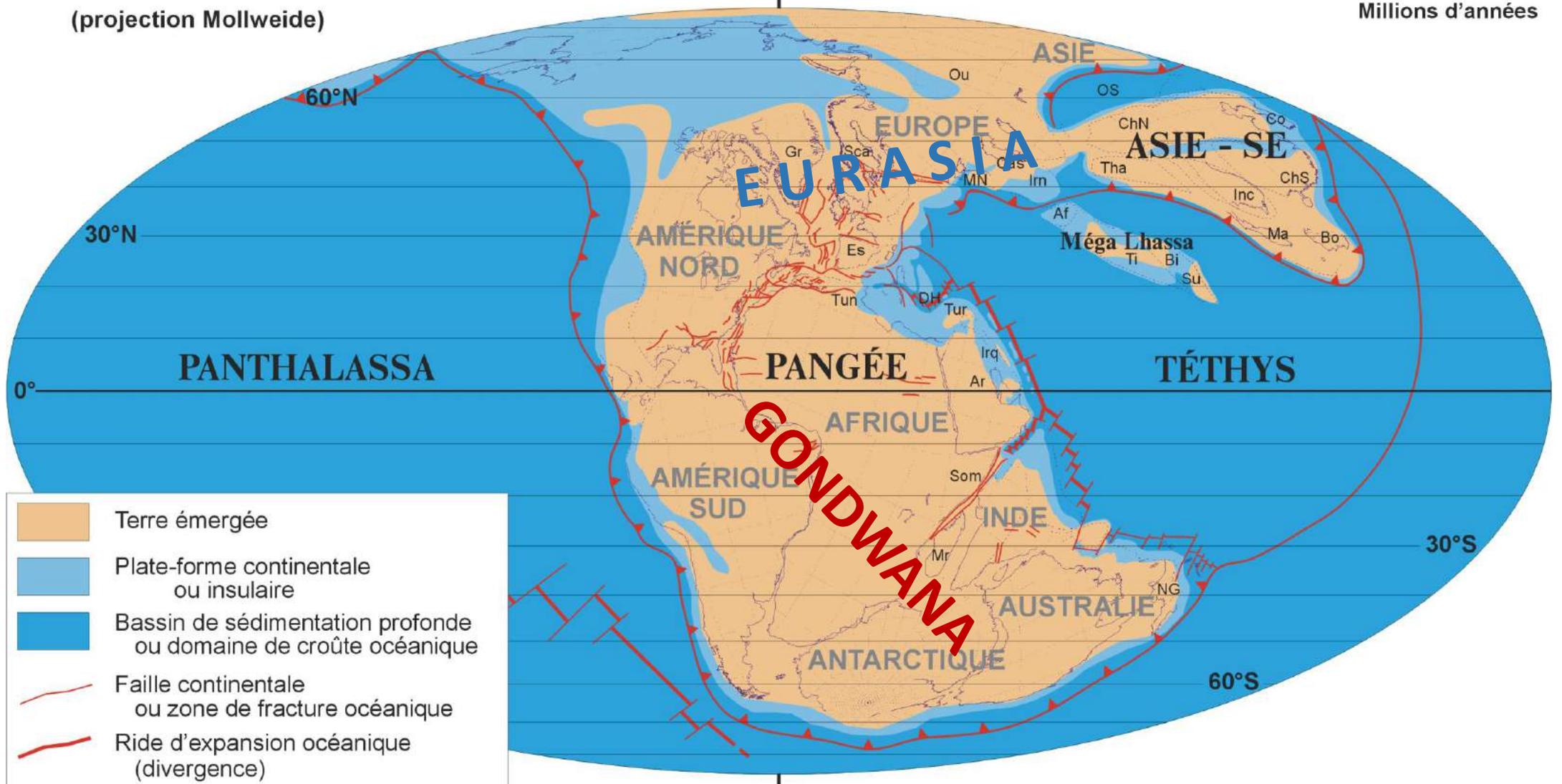
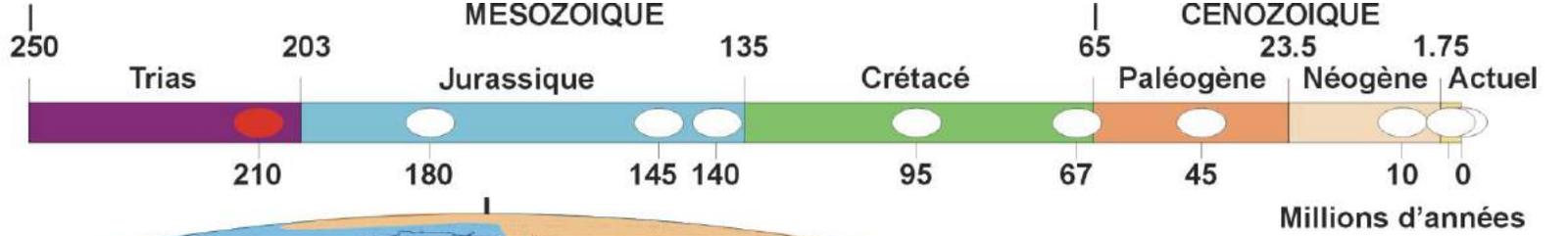
Dal cuore del megacontinente
Gondwana
alla placca indo-malgascia

Gli ultimi 200 milioni di anni
(«storia» del tavolato)

NORIEN (220-210 Ma)

Position à 210 Ma

(projection Mollweide)



- Terre émergée
- Plate-forme continentale ou insulaire
- Bassin de sédimentation profonde ou domaine de croûte océanique
- Faïlle continentale ou zone de fracture océanique
- Ride d'expansion océanique (divergence)
- Zone de subduction (convergence)
- Zone de chevauchement ou collision

Bruno Vrielynck (2001)

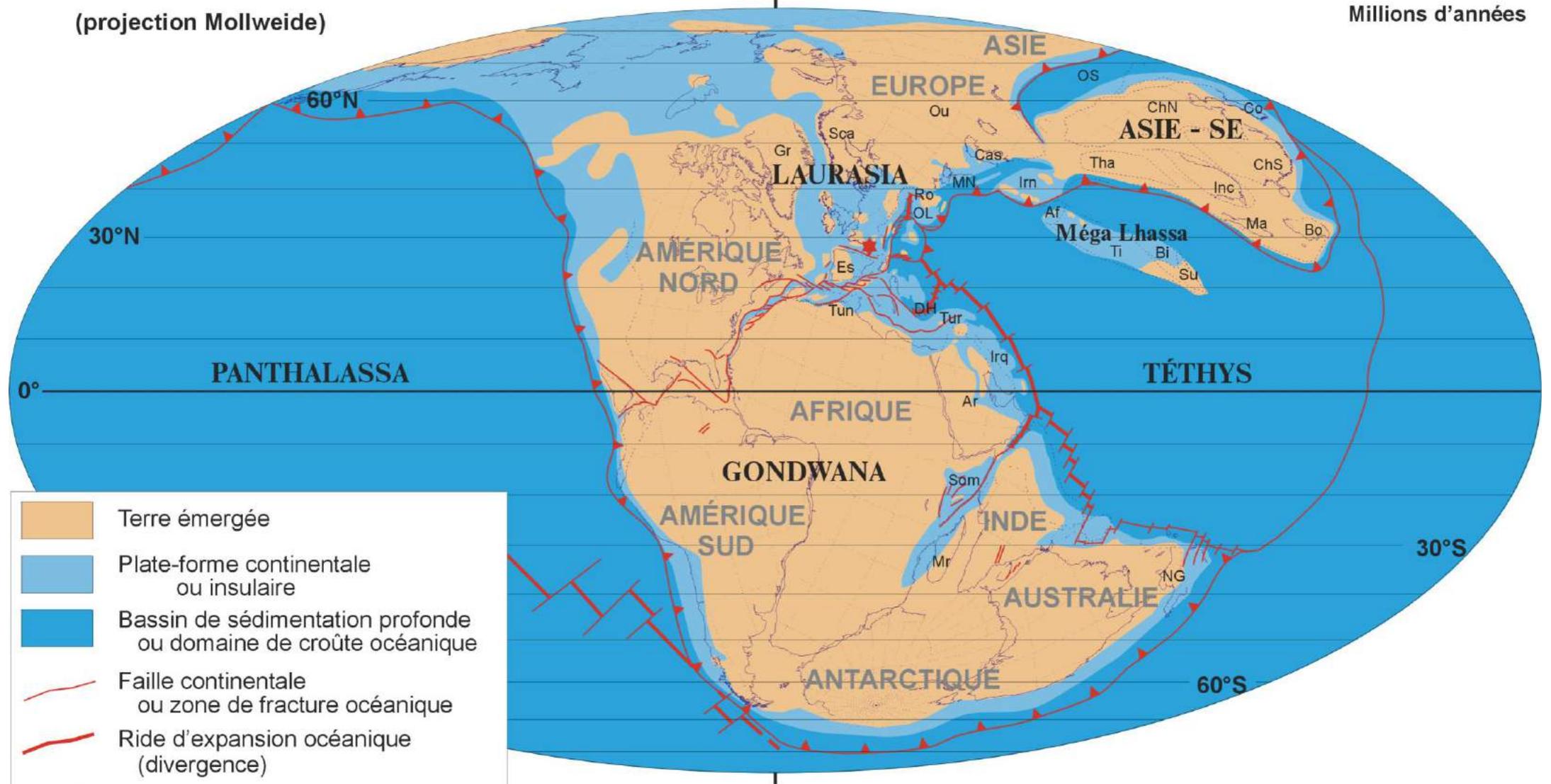
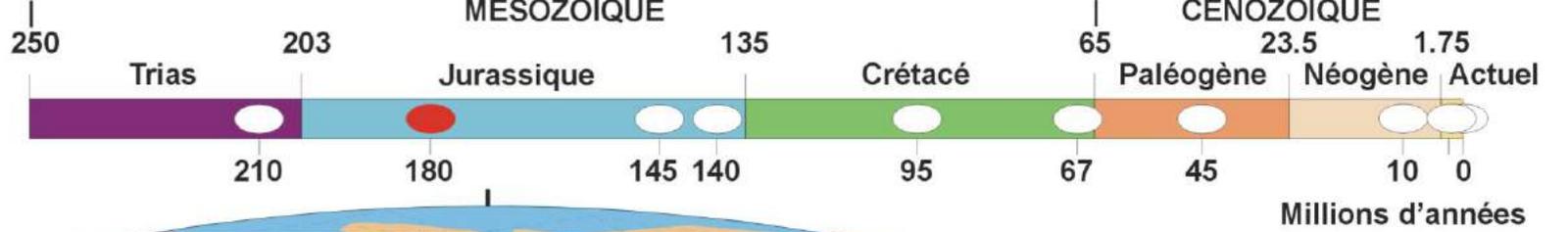
Planche 1

TOARCIEEN

(184-175 Ma)

Position à 180 Ma

(projection Mollweide)



- Terre émergée
- Plate-forme continentale ou insulaire
- Bassin de sédimentation profonde ou domaine de croûte océanique
- Faïlle continentale ou zone de fracture océanique
- Ride d'expansion océanique (divergence)
- Zone de subduction (convergence)
- Zone de chevauchement ou collision

★ Cratère d'impact de la météorite de Rochechouart

Bruno Vrielynck (2001)

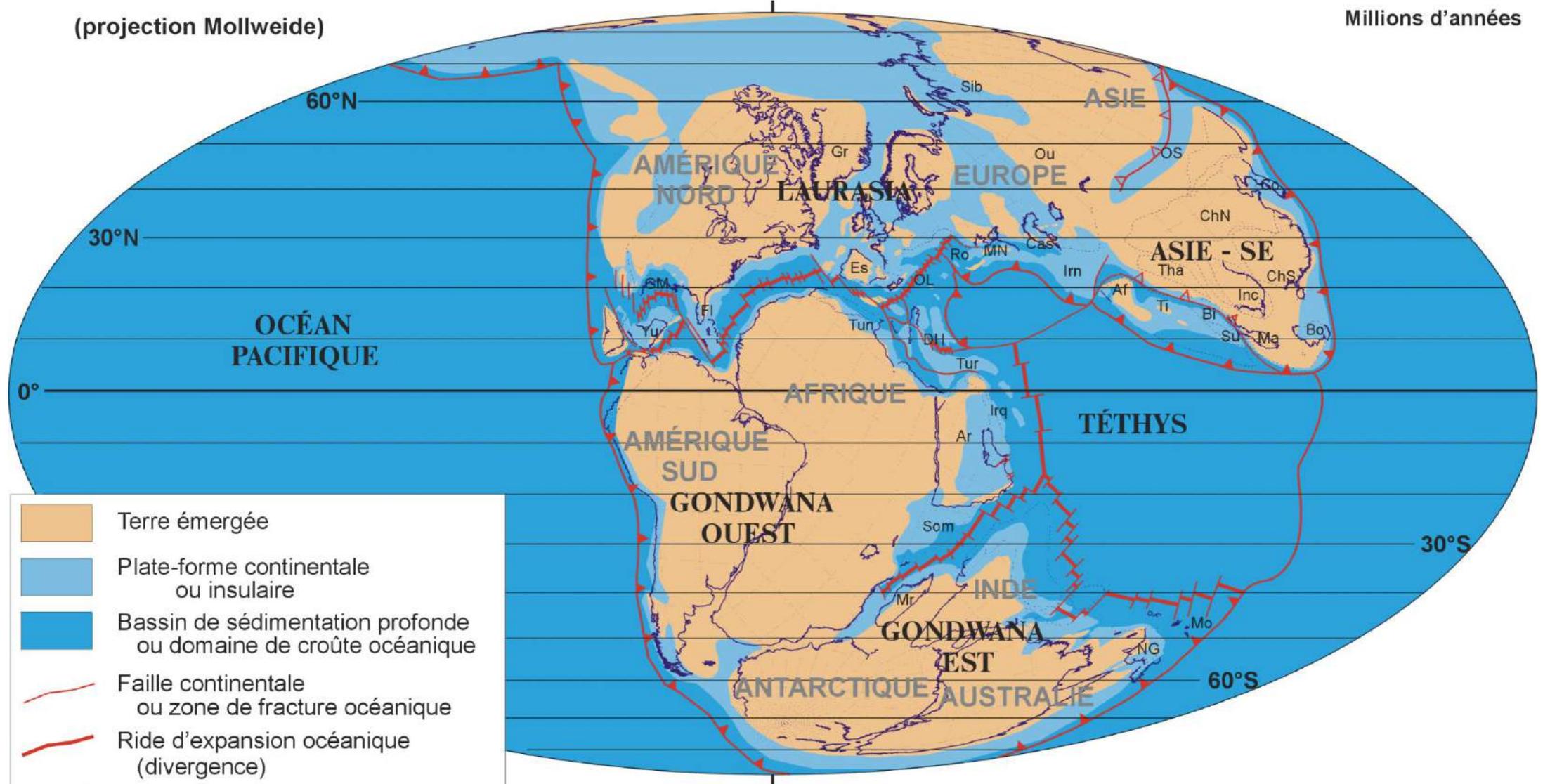
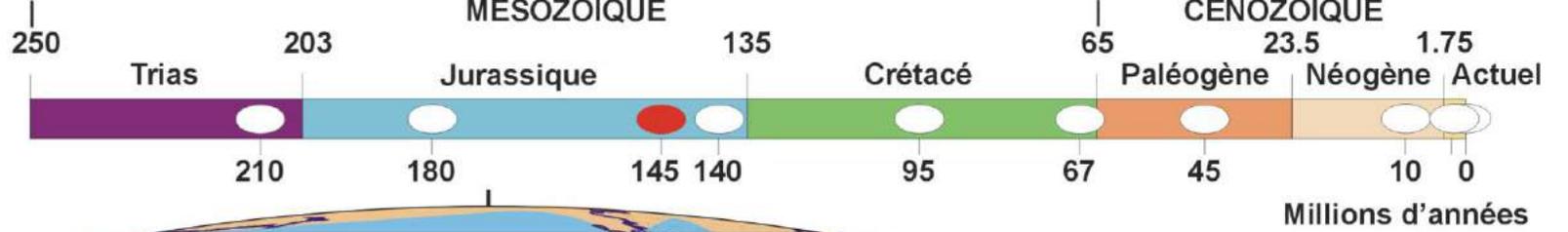


KIMMÉRIDIEN

(146-141 Ma)

Position à 145 Ma

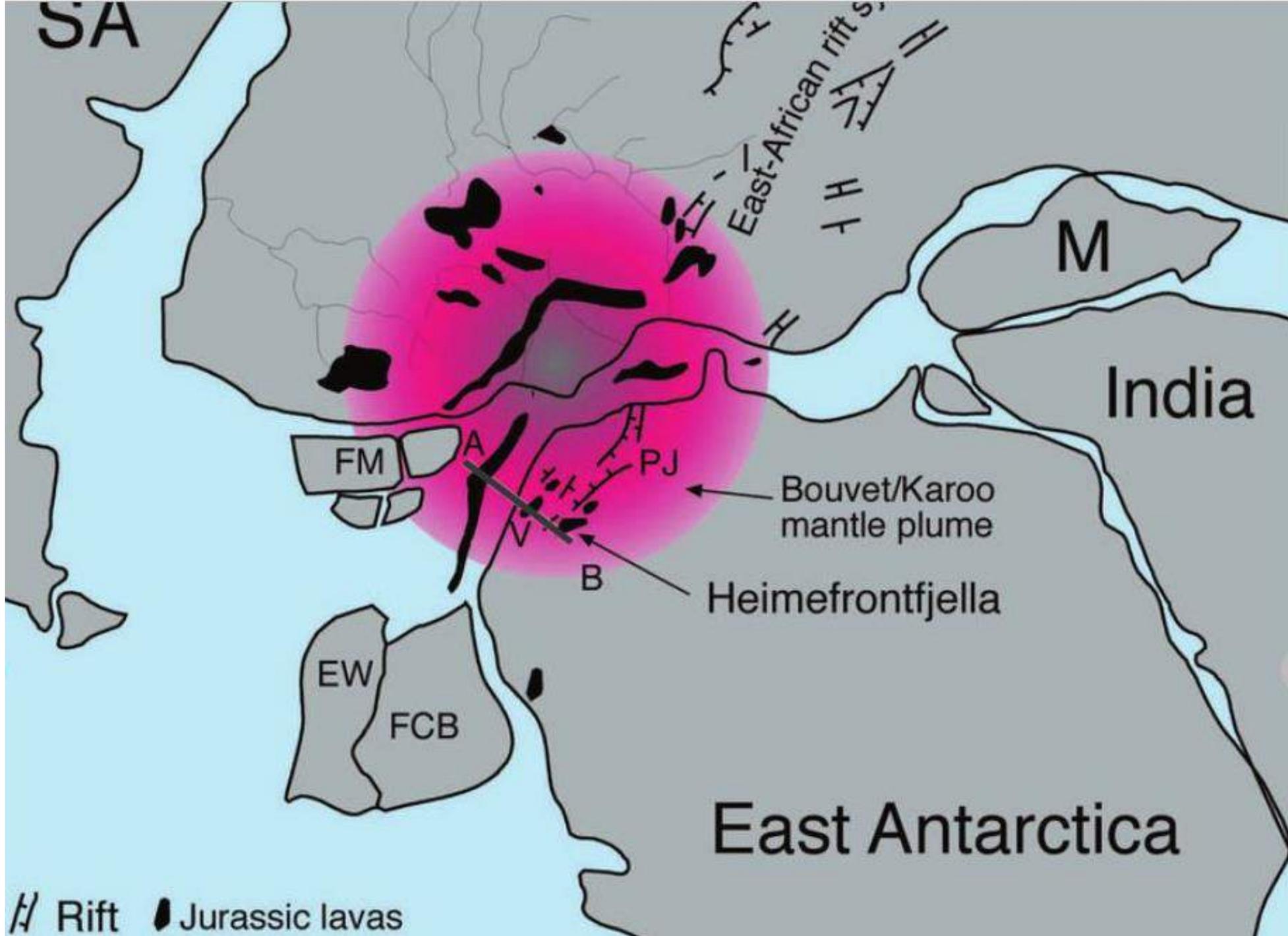
(projection Mollweide)



- Terre émergée
- Plate-forme continentale ou insulaire
- Bassin de sédimentation profonde ou domaine de croûte océanique
- Faille continentale ou zone de fracture océanique
- Ride d'expansion océanique (divergence)
- Zone de subduction (convergence)
- Zone de chevauchement ou collision

Bruno Vrielynck (2001)

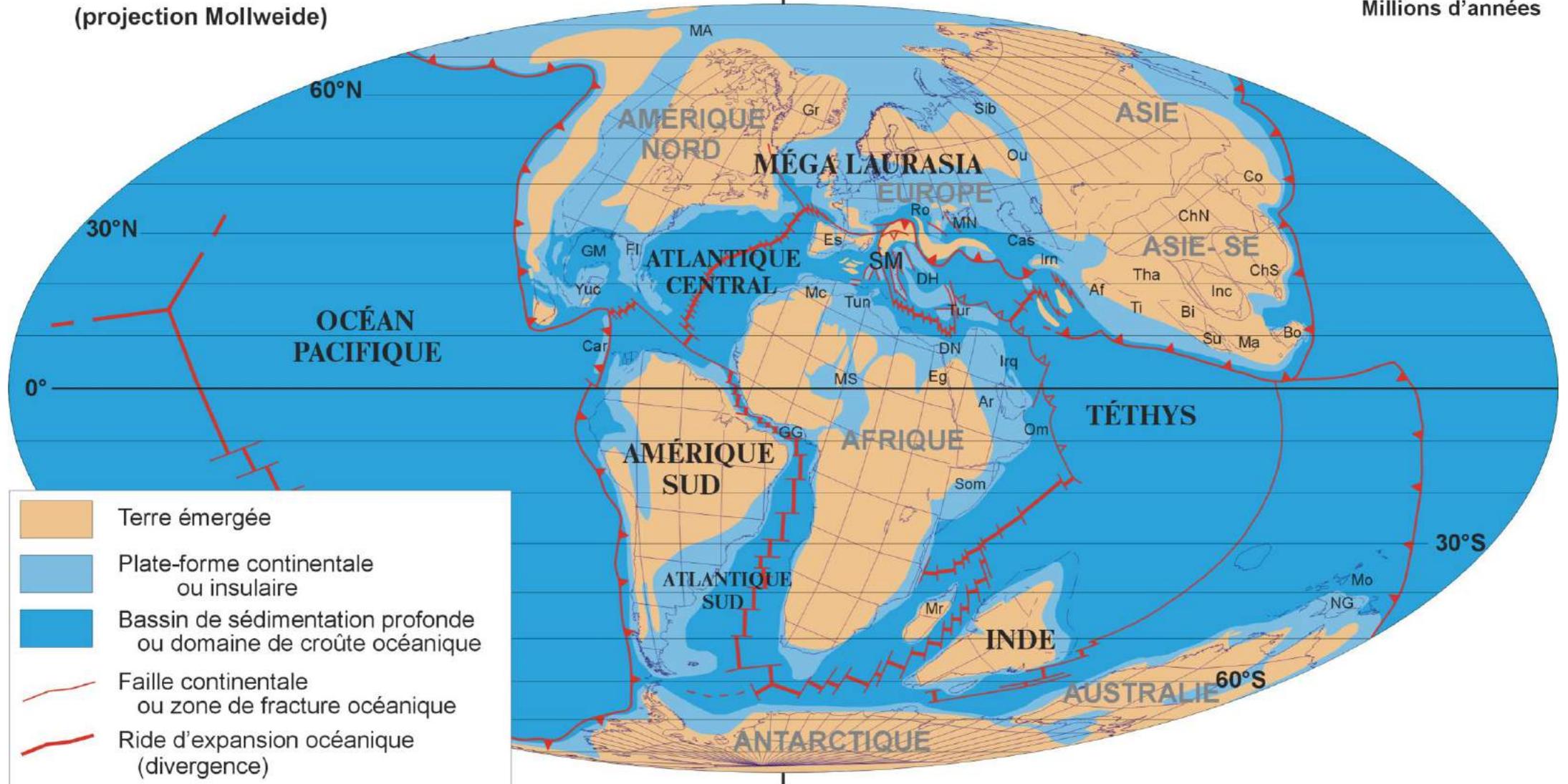
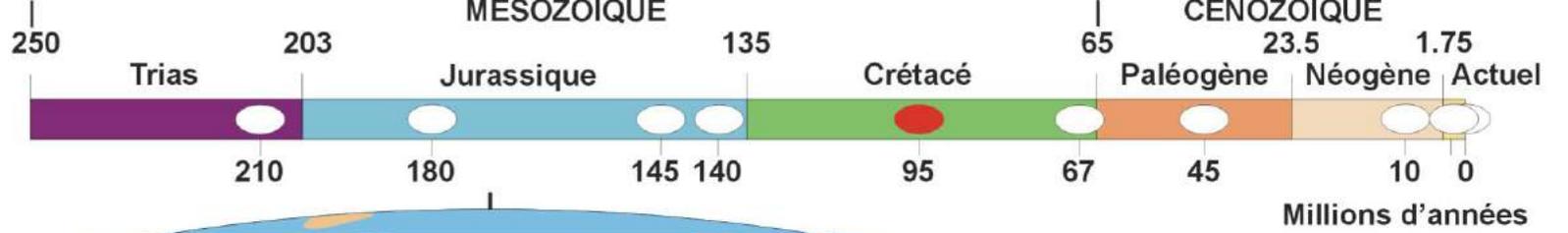




CÉNOMANIEN (96-92 Ma)

Position à 95 Ma

(projection Mollweide)



- Terre émergée
- Plate-forme continentale ou insulaire
- Bassin de sédimentation profonde ou domaine de croûte océanique
- Faïlle continentale ou zone de fracture océanique
- Ride d'expansion océanique (divergence)
- Zone de subduction (convergence)
- Zone de chevauchement ou collision

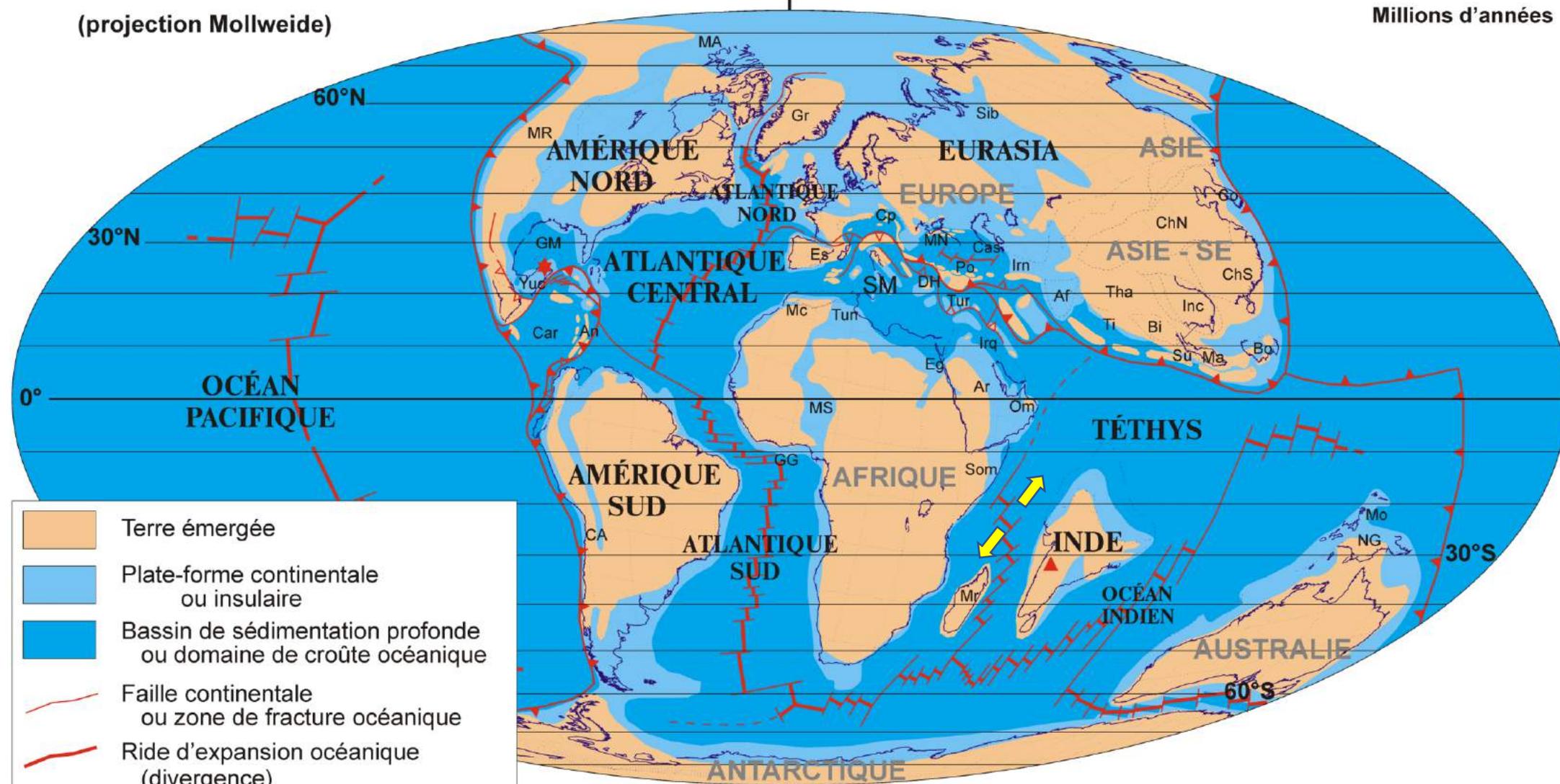
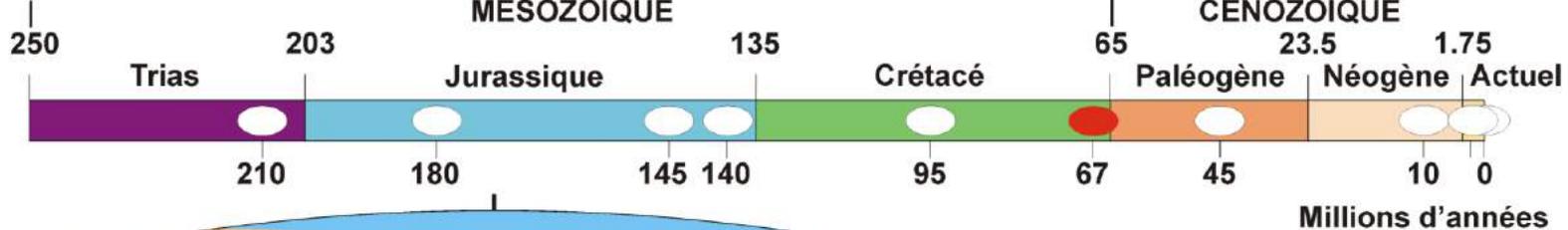
Bruno Vrielynck (2001)

MAASTRICHTIEN

(72-65 Ma)

Position à 67 Ma

(projection Mollweide)



- Terre émergée
- Plate-forme continentale ou insulaire
- Bassin de sédimentation profonde ou domaine de croûte océanique
- Faïlle continentale ou zone de fracture océanique
- Ride d'expansion océanique (divergence)
- Zone de subduction (convergence)
- Zone de chevauchement ou collision

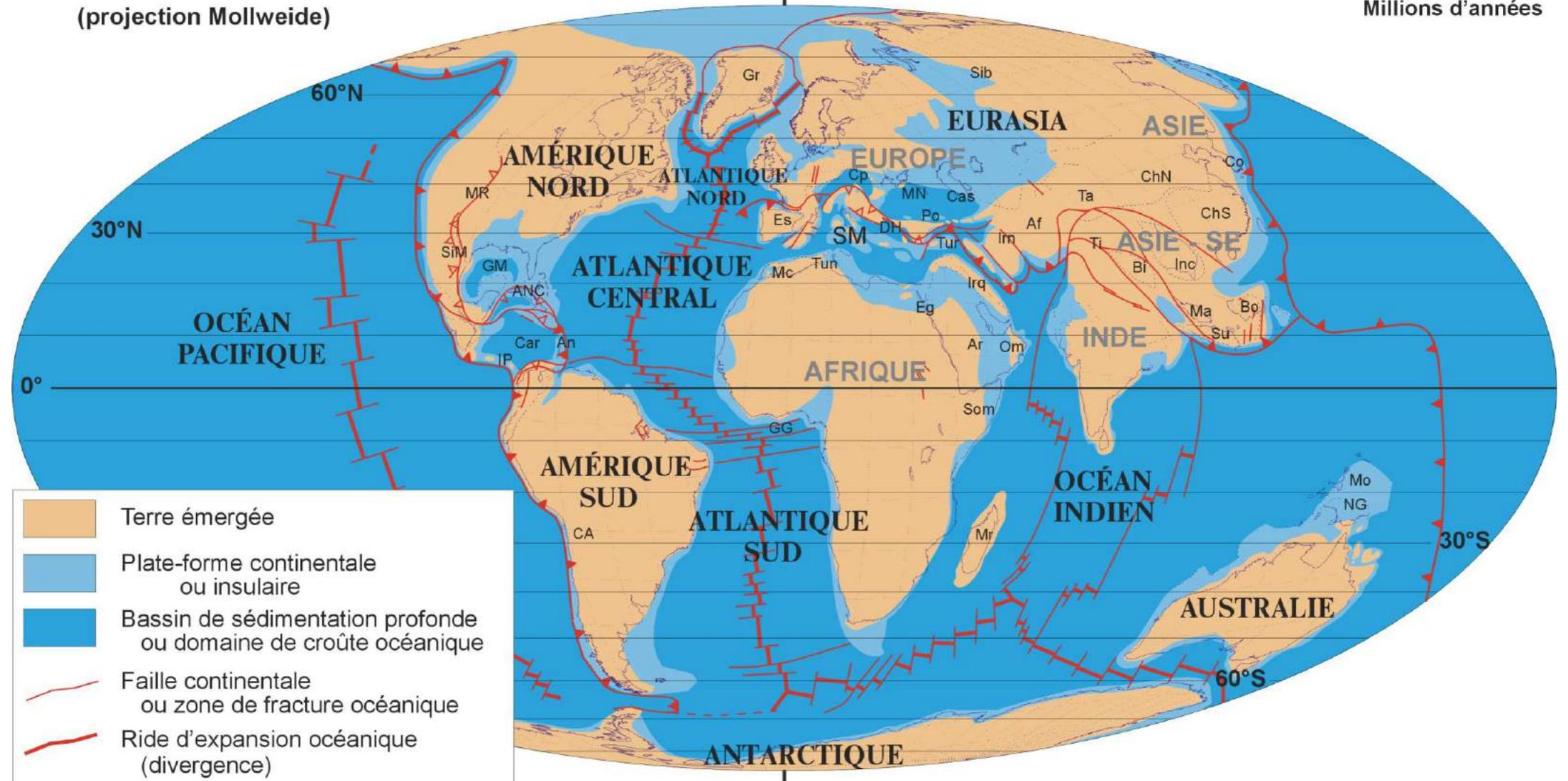
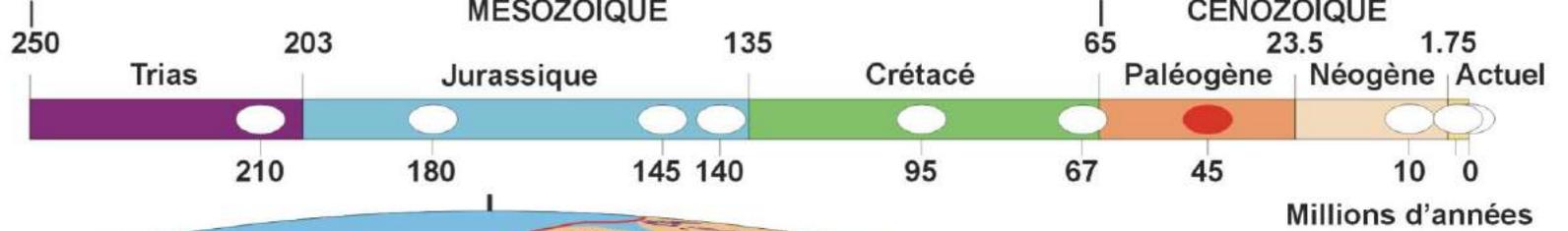
- ▲ Trapps du Deccan
- ★ Cratère d'impact de la météorite de Chicxulub

Bruno Vrielynck (2001)

LUTÉTIEN (46-40 Ma)

Position à 45 Ma

(projection Mollweide)

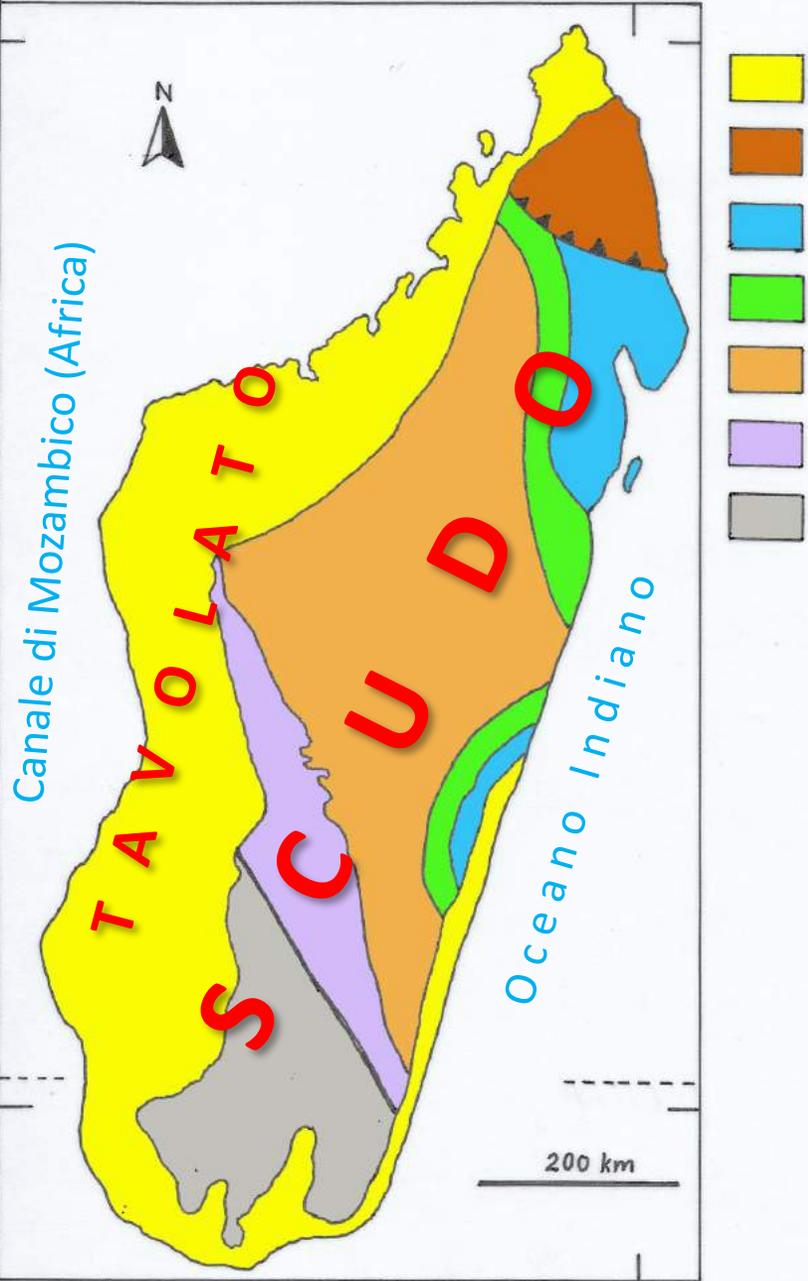


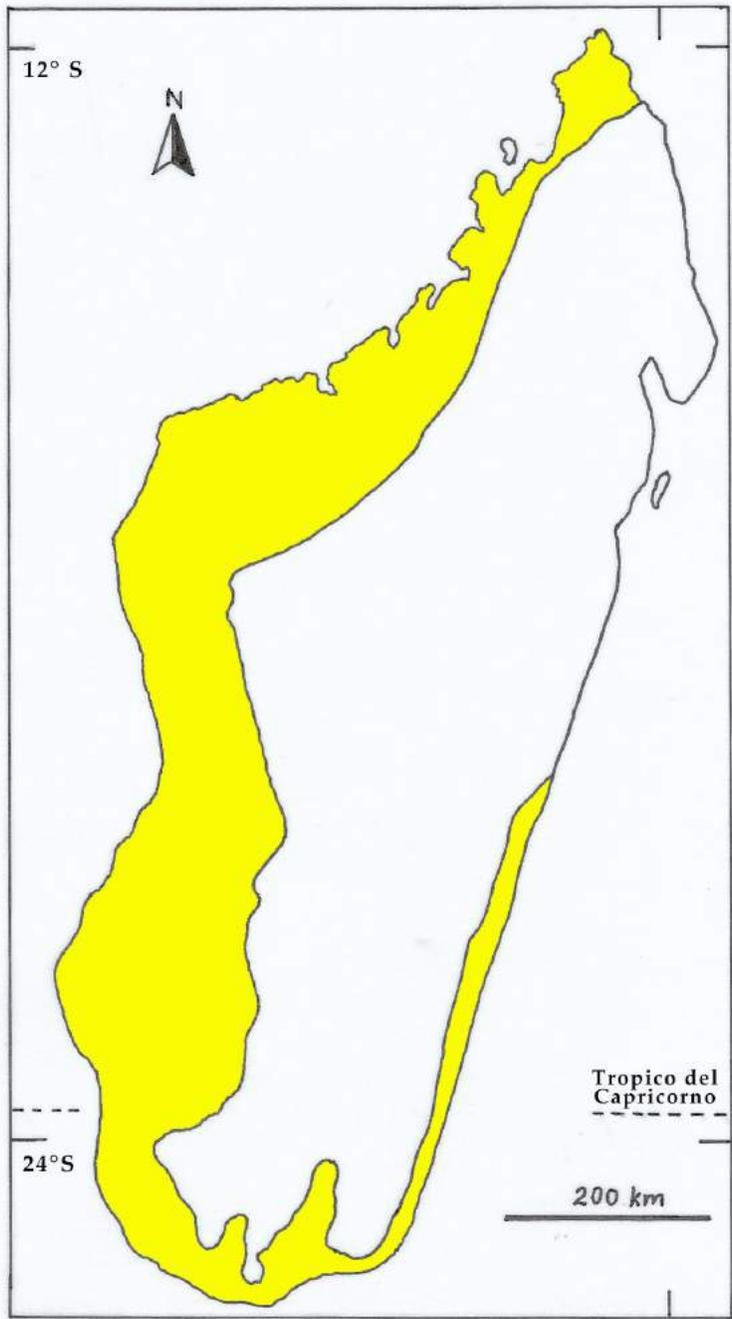
- Terre émergée
- Plate-forme continentale ou insulaire
- Bassin de sédimentation profonde ou domaine de croûte océanique
- Faille continentale ou zone de fracture océanique
- Ride d'expansion océanique (divergence)
- Zone de subduction (convergence)
- Zone de chevauchement ou collision

Bruno Vrielynck (2001)

La storia più antica:
nel cuore del megacontinente Gondwana

La struttura dello scudo malgascio





Tavorato
Copertura fanerozoica





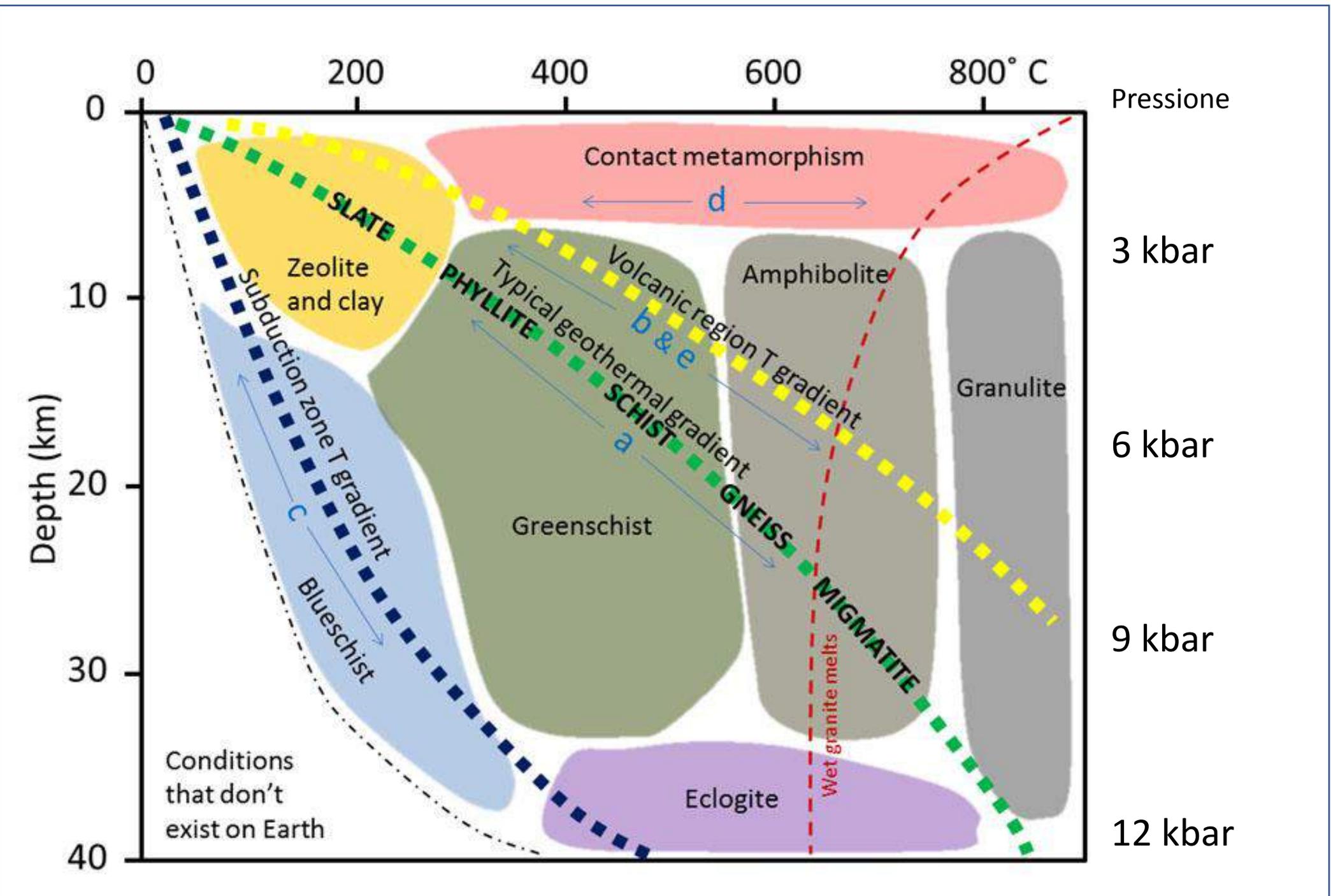


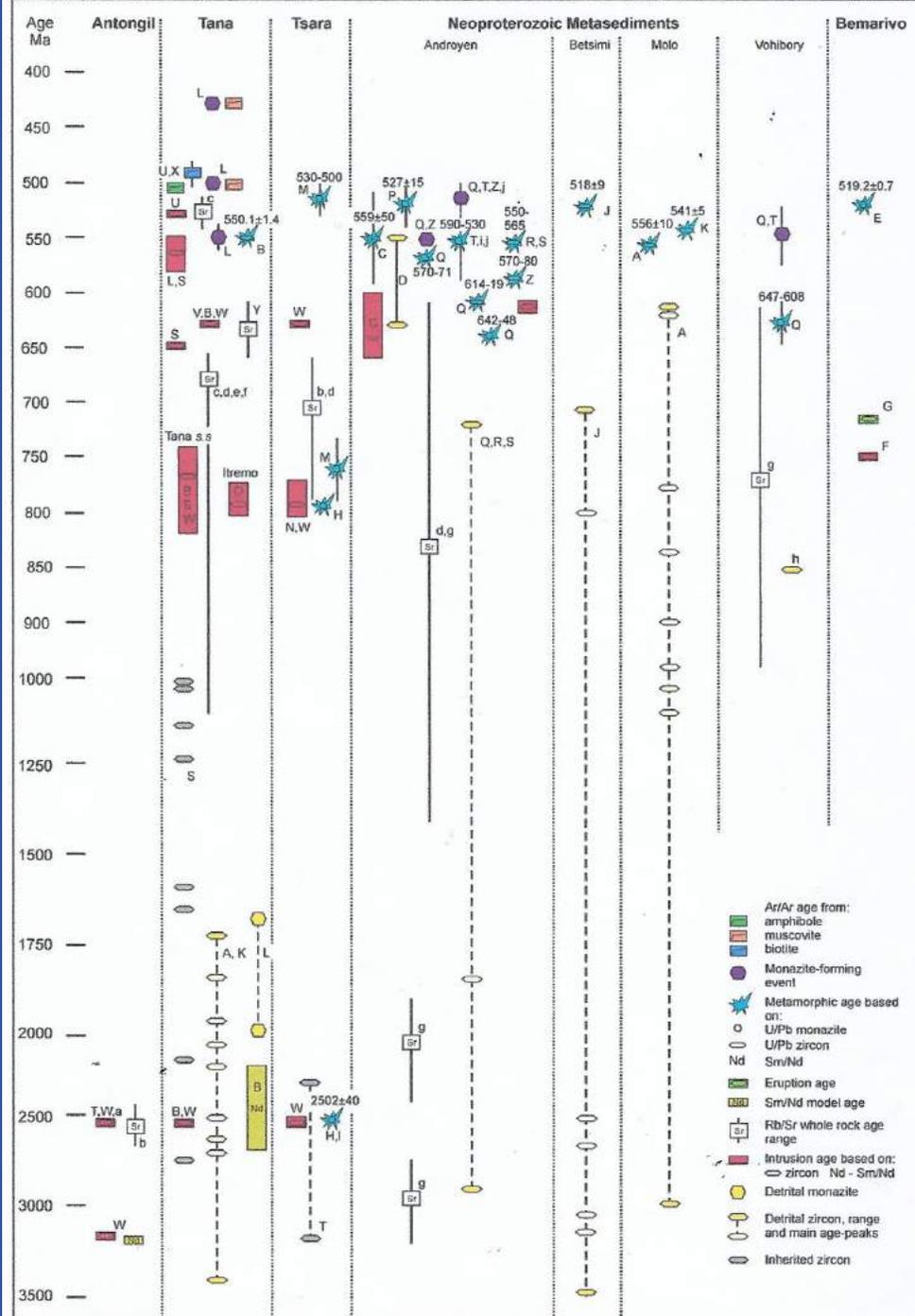




Sull'altopiano, le tracce di storie diverse, tutte antichissime

Rocce metamorfiche di alto grado, rocce intrusive:
soprattutto resti di crosta continentale privata della copertura

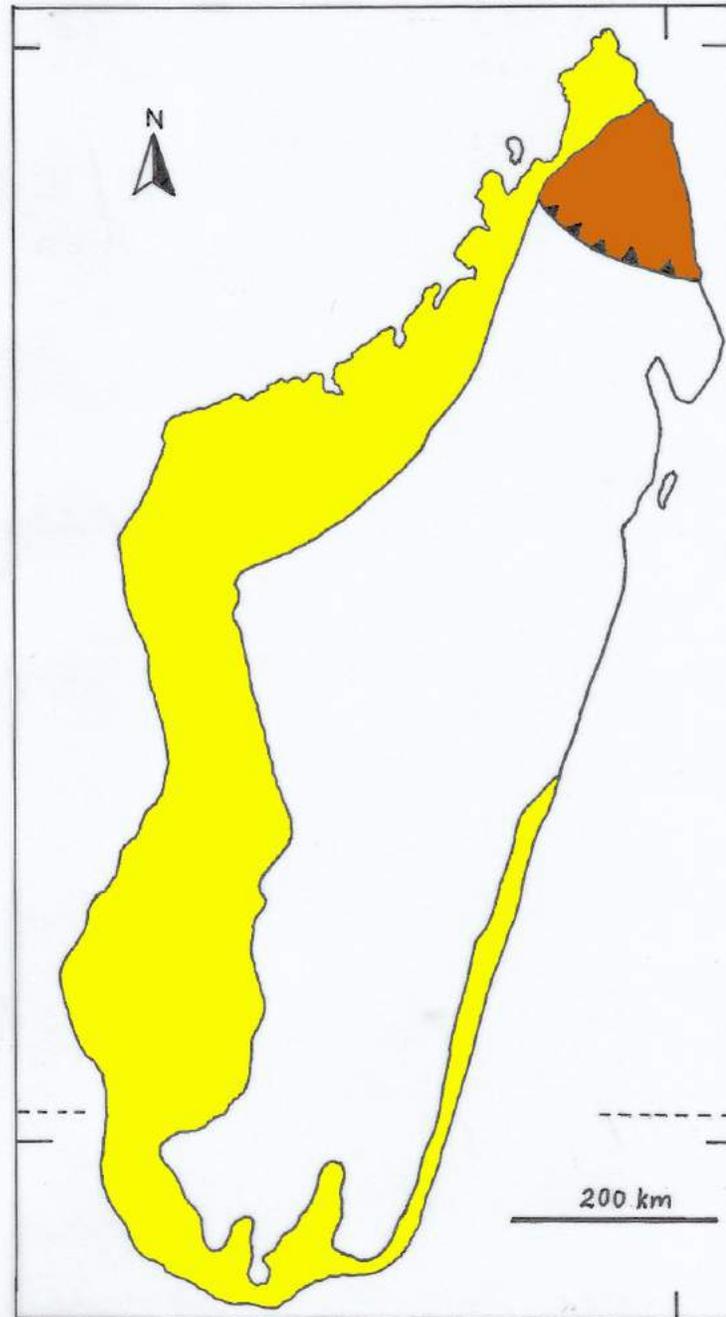




Catena di Bemarivo

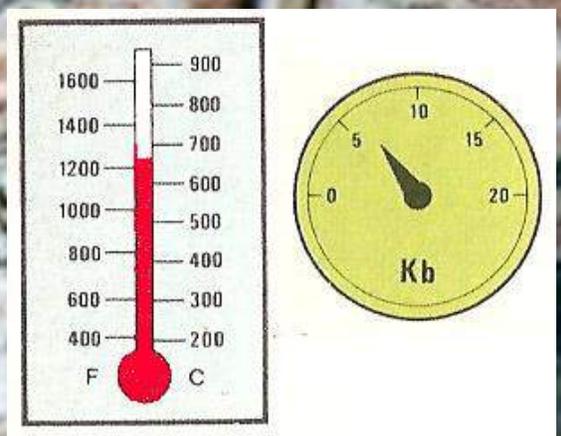
Neo-Proterozoico

750 Milioni di anni



Migmatiti, ortogneiss;
intrusioni di graniti, 750 Ma fa
Neo-Proterozoico

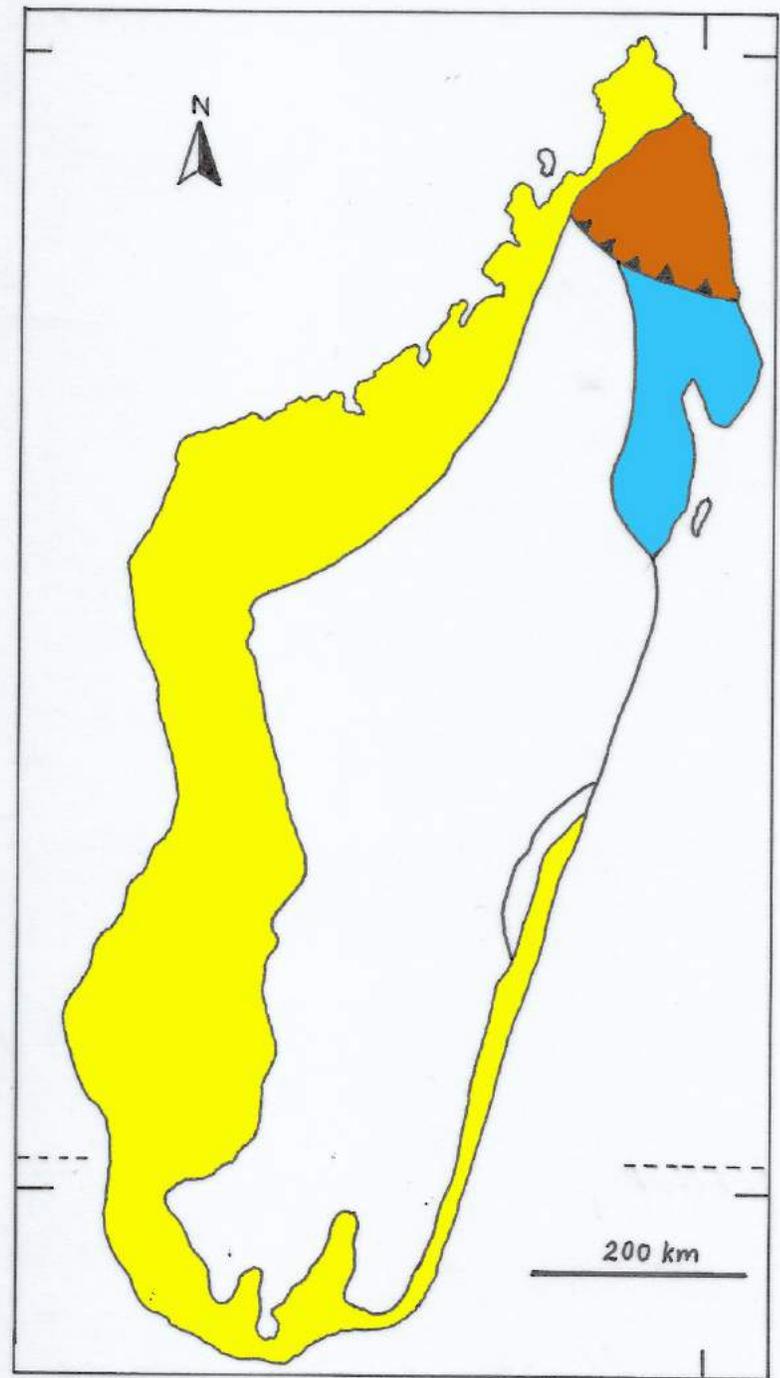
Collegabili a Seychelles e India



Il blocco di *Antongil*

Meso-Neo-Archeano

3100 – 2500 Milioni di anni



Blocco di Antongil

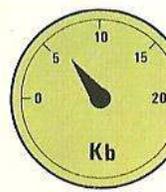
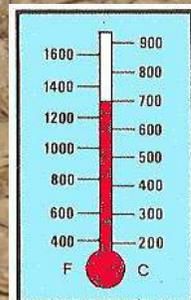
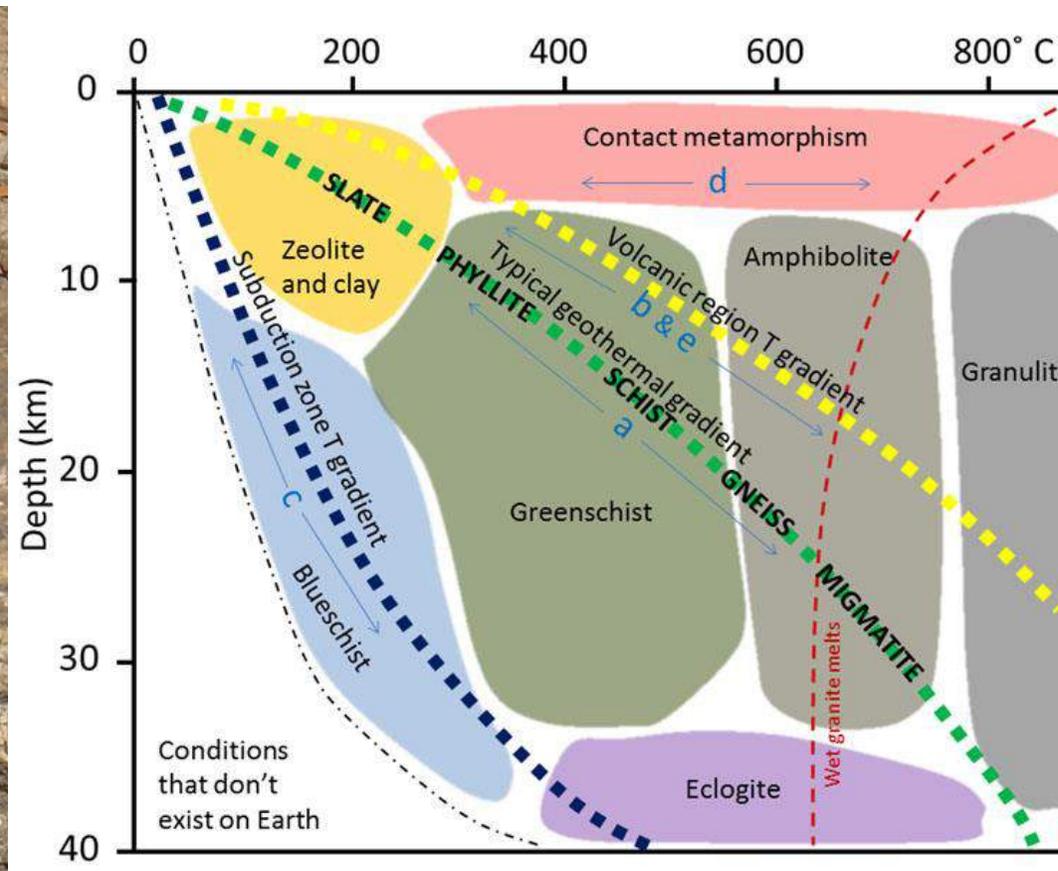
Nuclei di orto- e para-gneiss

Età: 3127 Ma

Intrusione di graniti

Età: 2520 Ma

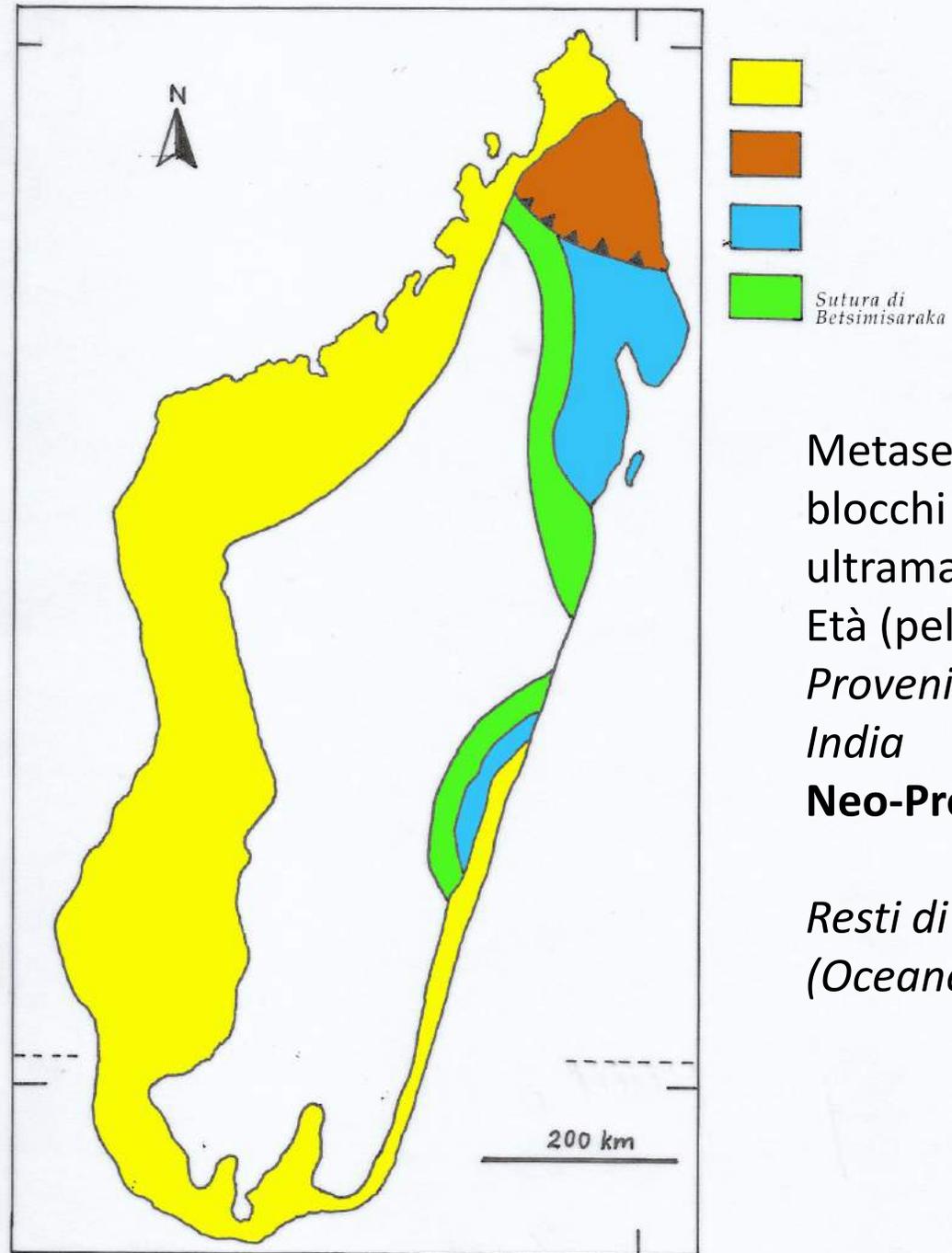
Meso-Neo-Archeano



Catena di Betsimisaraka

Neo-Proterozoico

800 – 550 Milioni di anni



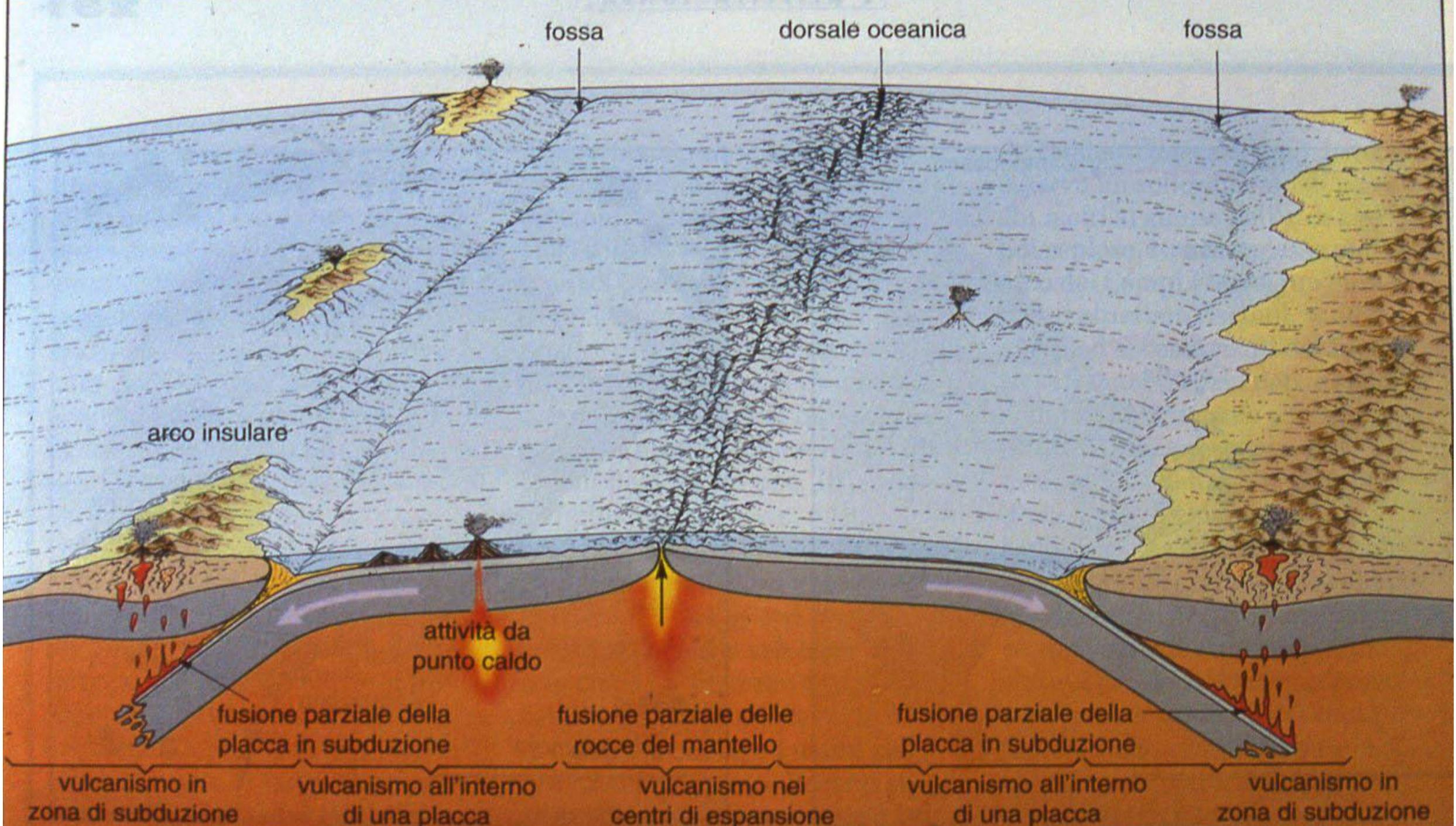
Metasedimenti (da *peliti*) con
blocchi di rocce mafiche e
ultramafiche

Età (*peliti*): 800-550 Ma

Provenienza: *cratone Darwar,*
India

Neo-Proterozoico

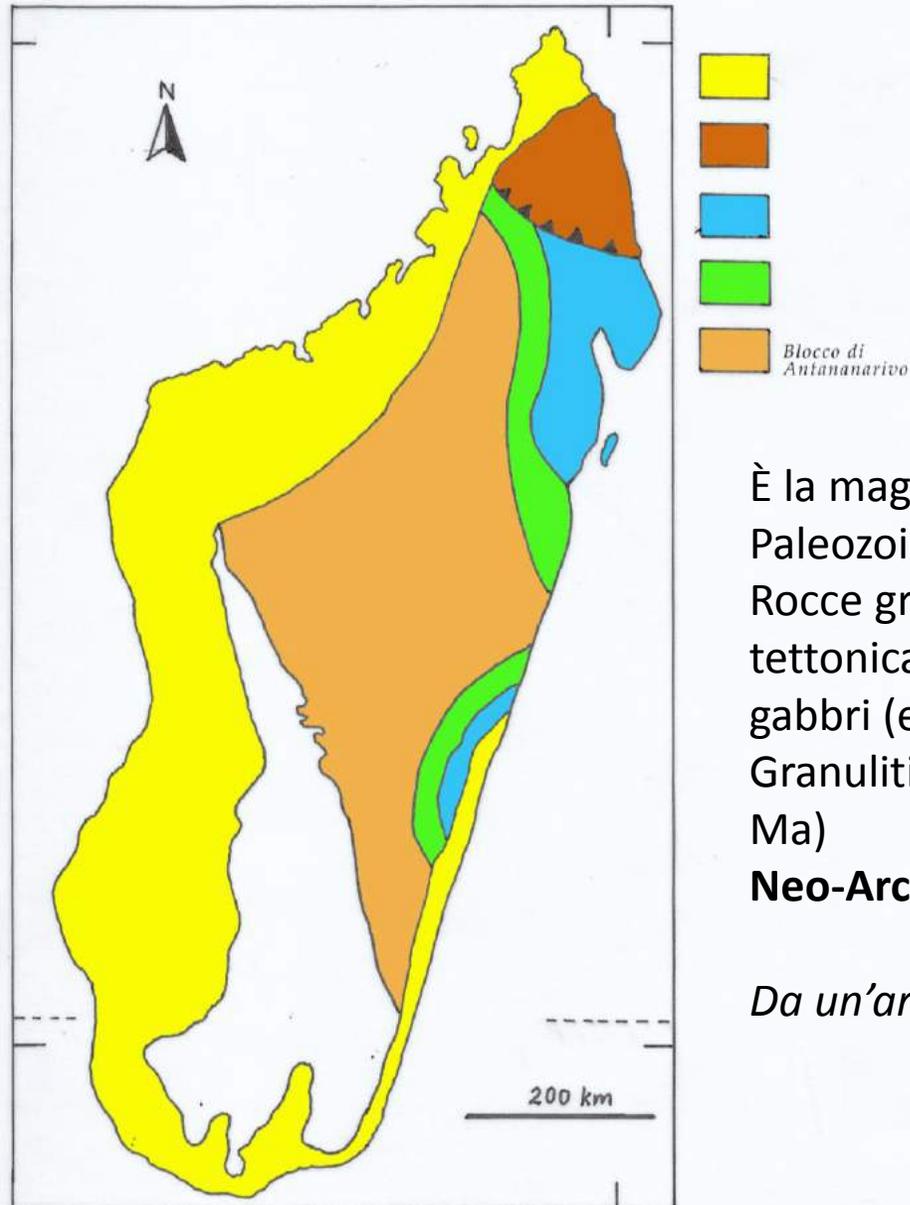
Resti di una sutura oceanica
(Oceano Mozambico)



Il blocco di *Antananarivo*

Dal Neo-Archeano al Paleo-Proterozoico

2500 – 750 Milioni di anni

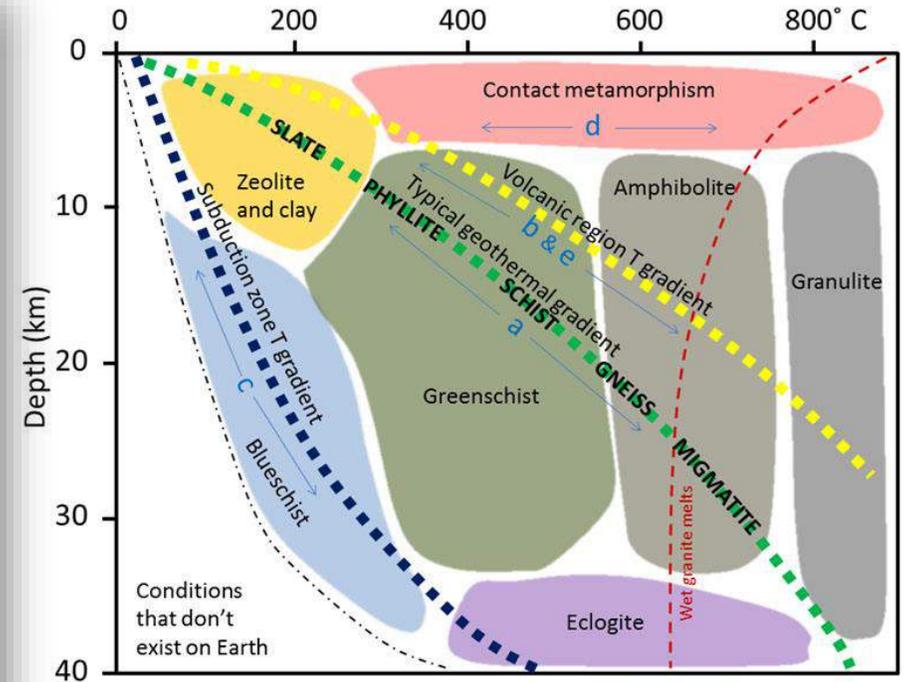
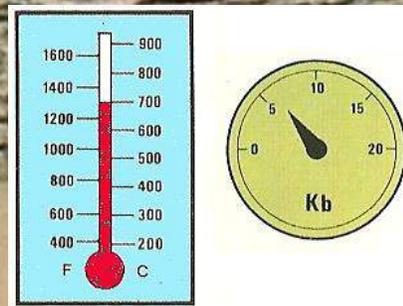


È la maggiore unità tettonica pre-Paleozoico
 Rocce granitoidi (età: 2500 Ma), tettonicamente alternate con sieniti e gabbri (età: 750 Ma)
 Granuliti per grande evento termico (750 Ma)
Neo-Archeano fino a paleo-Proterozoico

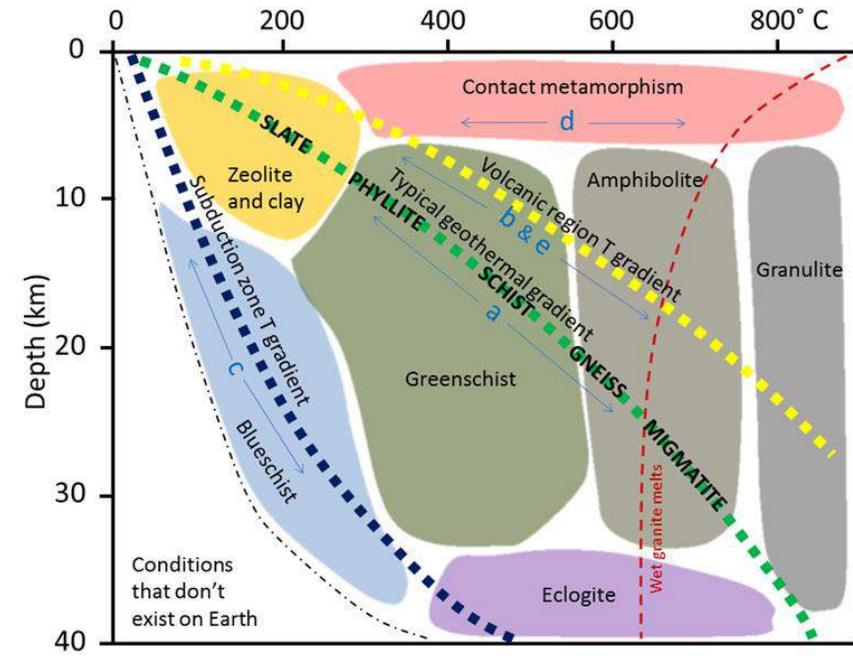
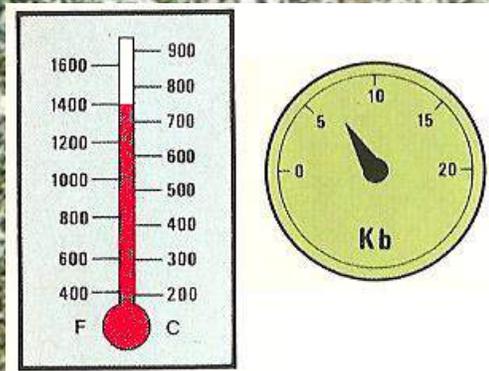
Da un'area sopra una zona di subduzione

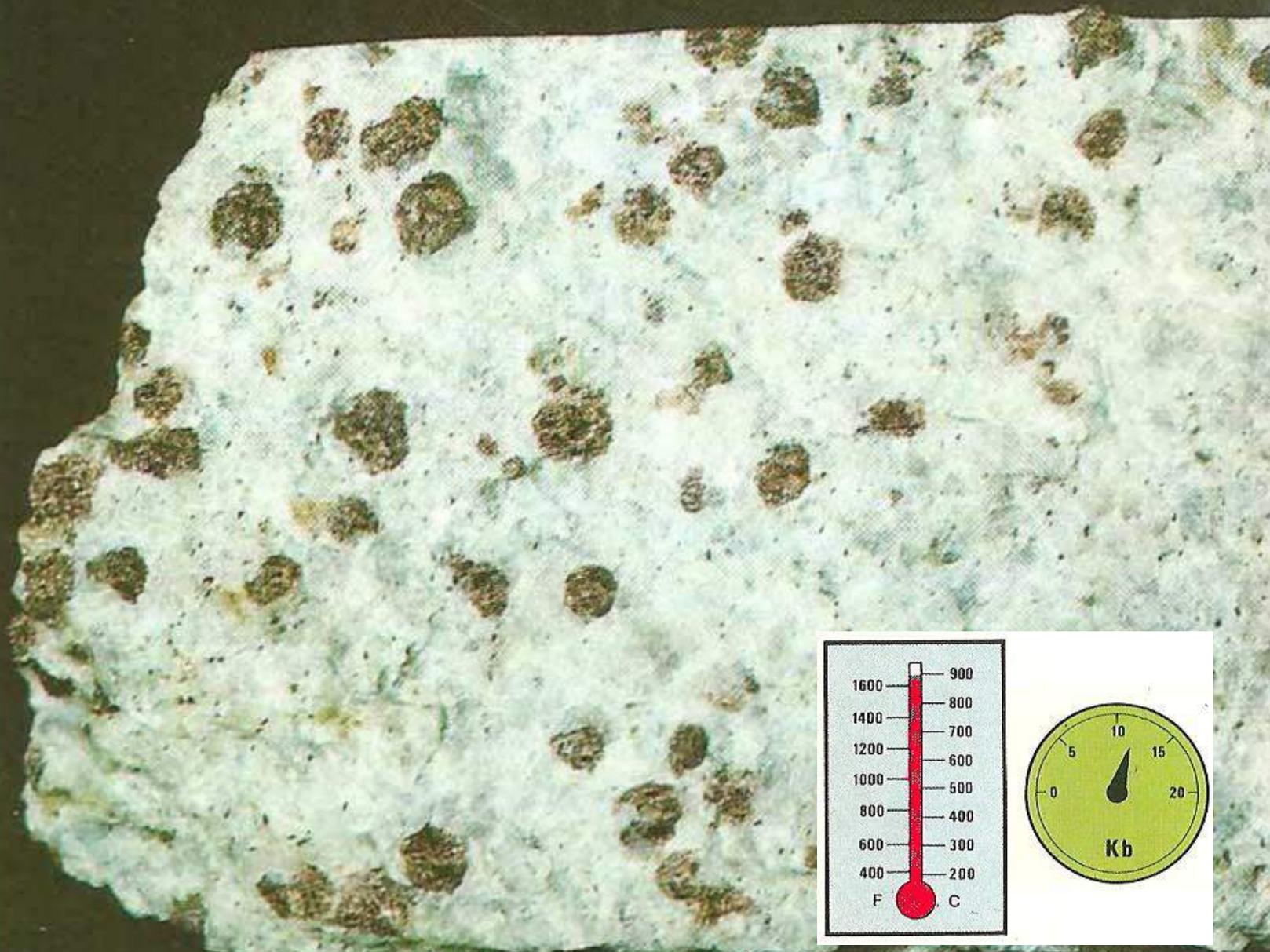


Gneiss

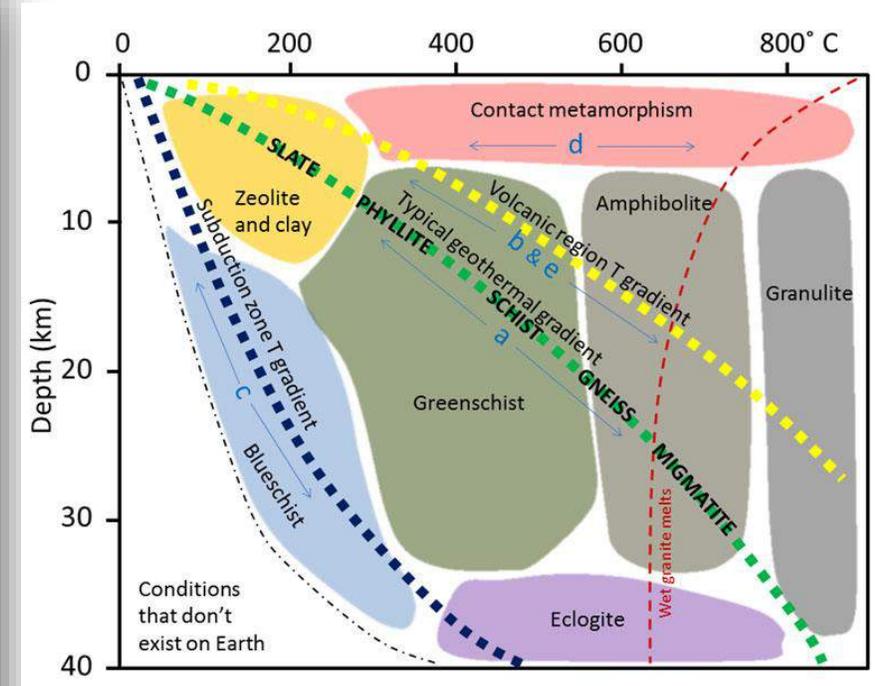
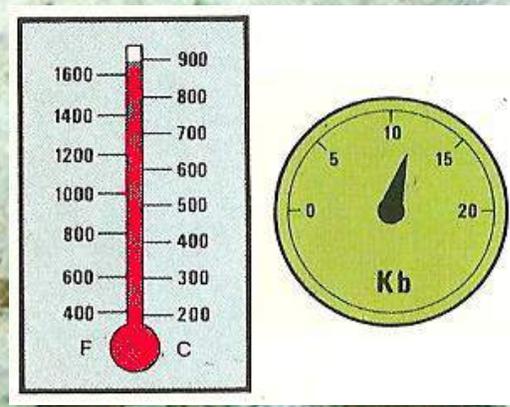


anfibolite





Granulite







*Parco Nazionale Yosemite,
California*

OCEANO PACIFICO

AMERICA DEL SUD

Cordigliera

Catena costiera

Catena a pieghe

Cratone

fossa

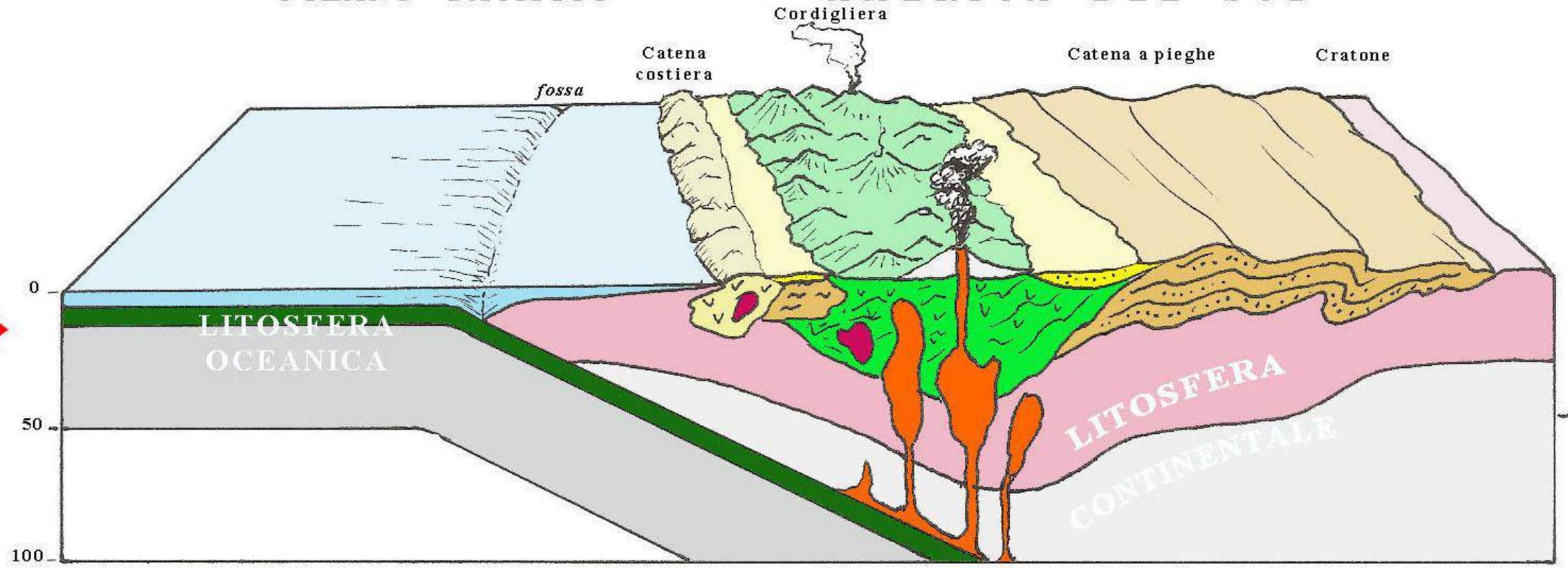
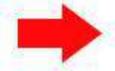
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50

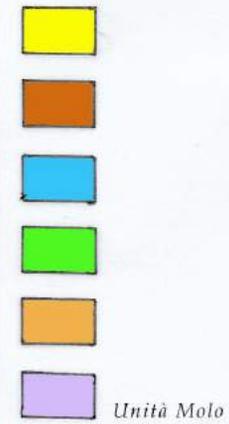
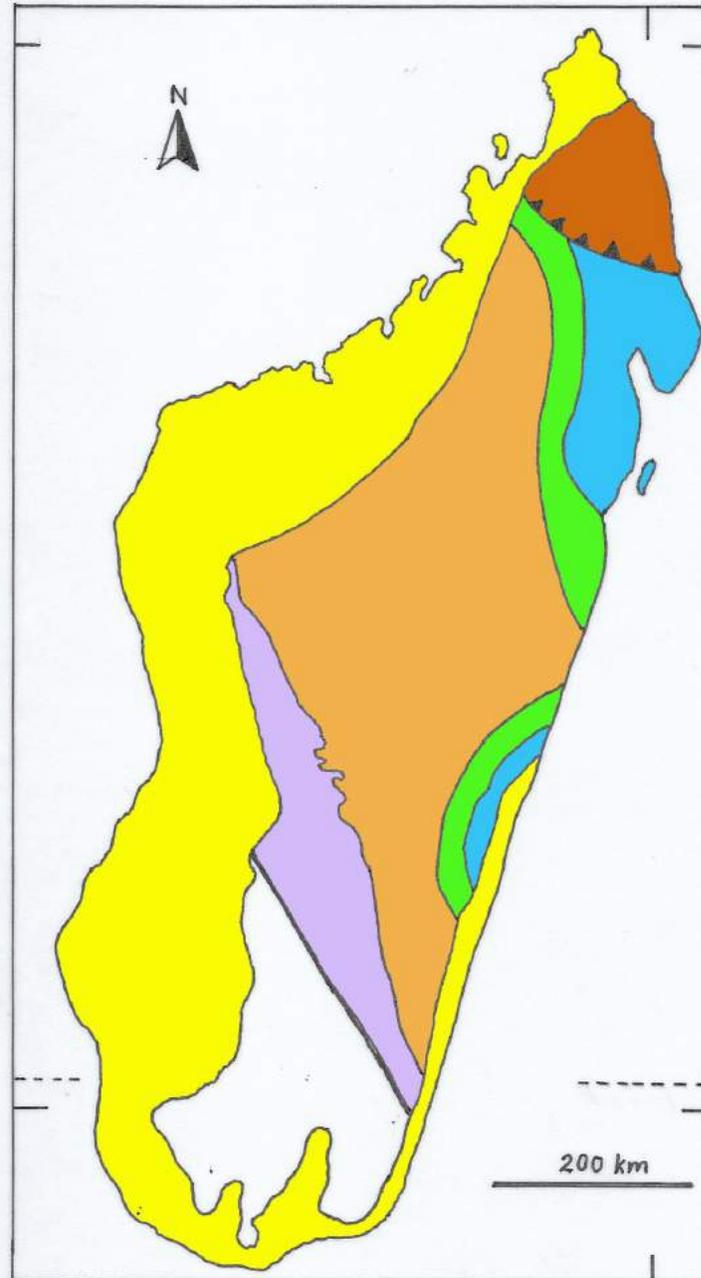
100

LITOSFERA OCEANICA

LITOSFERA CONTINENTALE



Catene metasedimentarie del Neo-Proterozoico

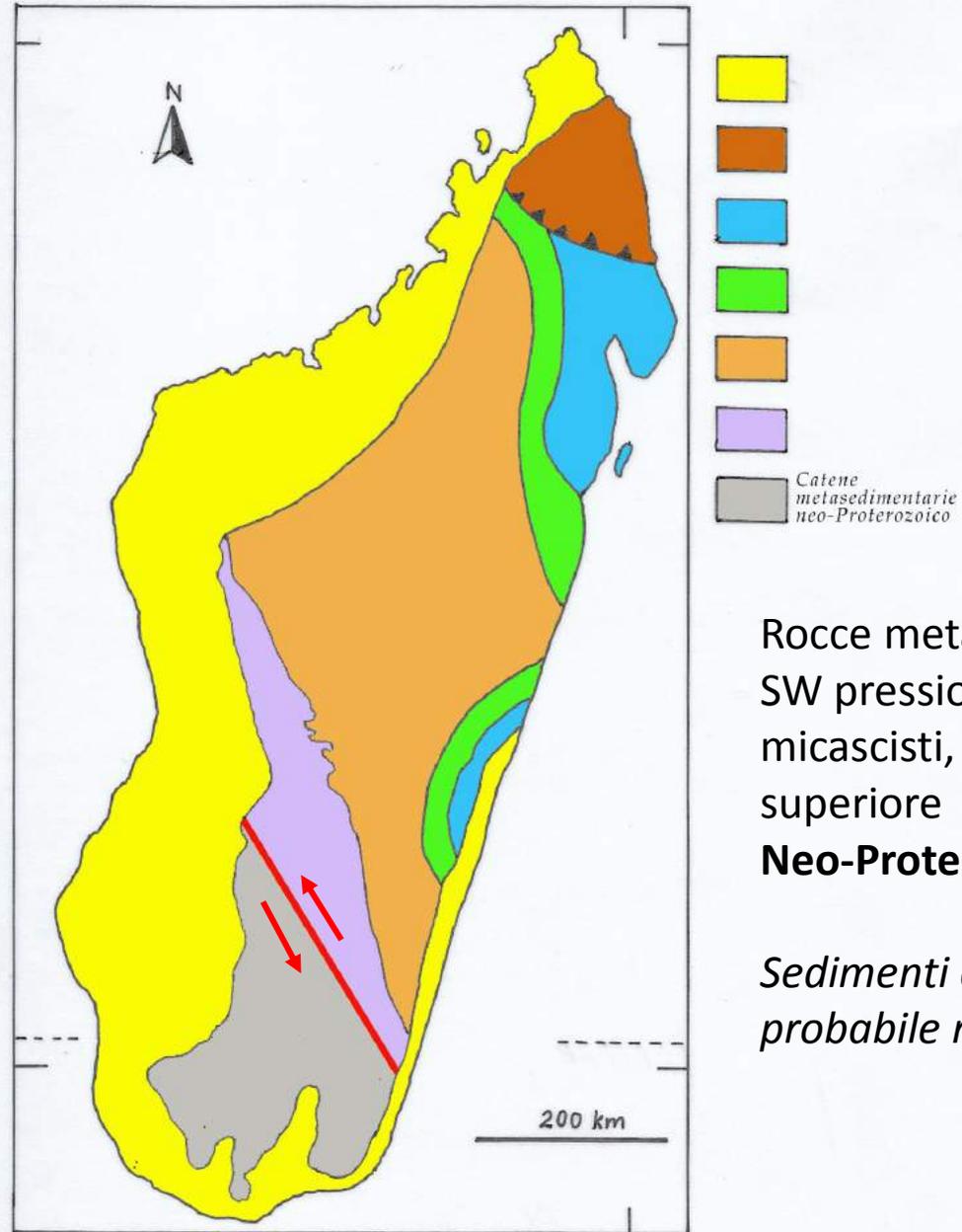


Terreni supracrostaali

Rocce metasedimentarie, da sedimenti in un bacino marino (protoliti 620-560) ; metam. 550 Ma

Neo-Proterozoico

Bacino marino ediacariano tra Blocco Congo e blocchi del Madagascar centrale



Rocce metasedimentarie per temp. elevate (a SW pressioni max nel Madag.: oltre 10 kbar); micascisti, marmi; anfiboliti da mantello superiore

Neo-Proterozoico

Sedimenti e lembi di crosta oceanica: probabile rift vulcanico

La formazione del megacontinente Gondwana

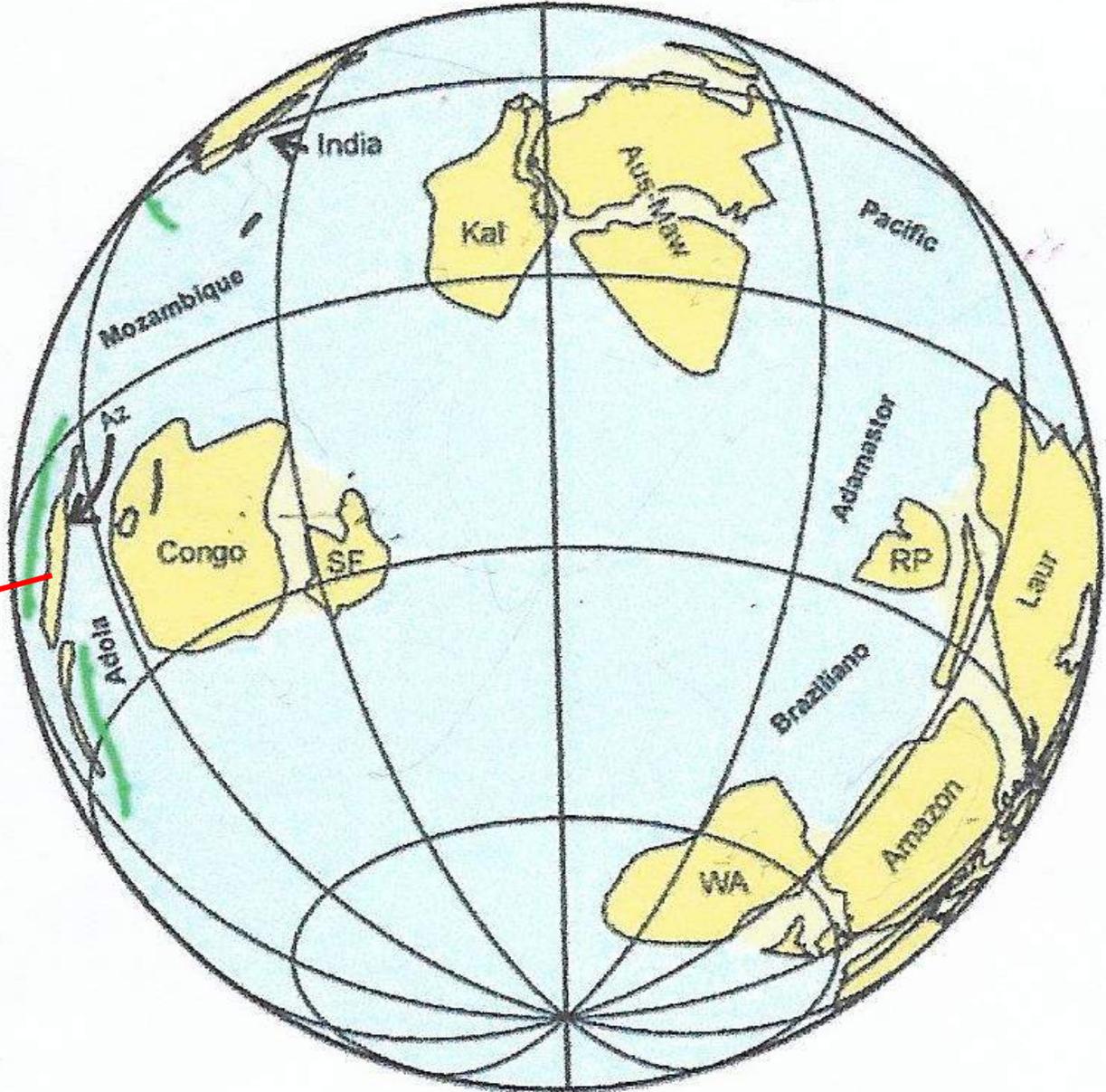
Sulla strada verso il Pangea



Rodinia

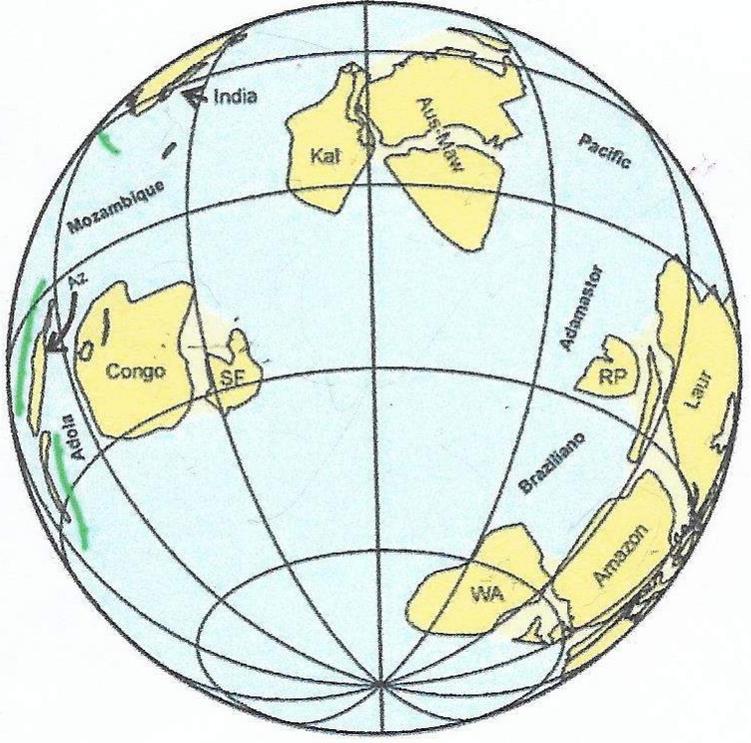
1 Ga

750 Ma



Antico continente
AZANIA

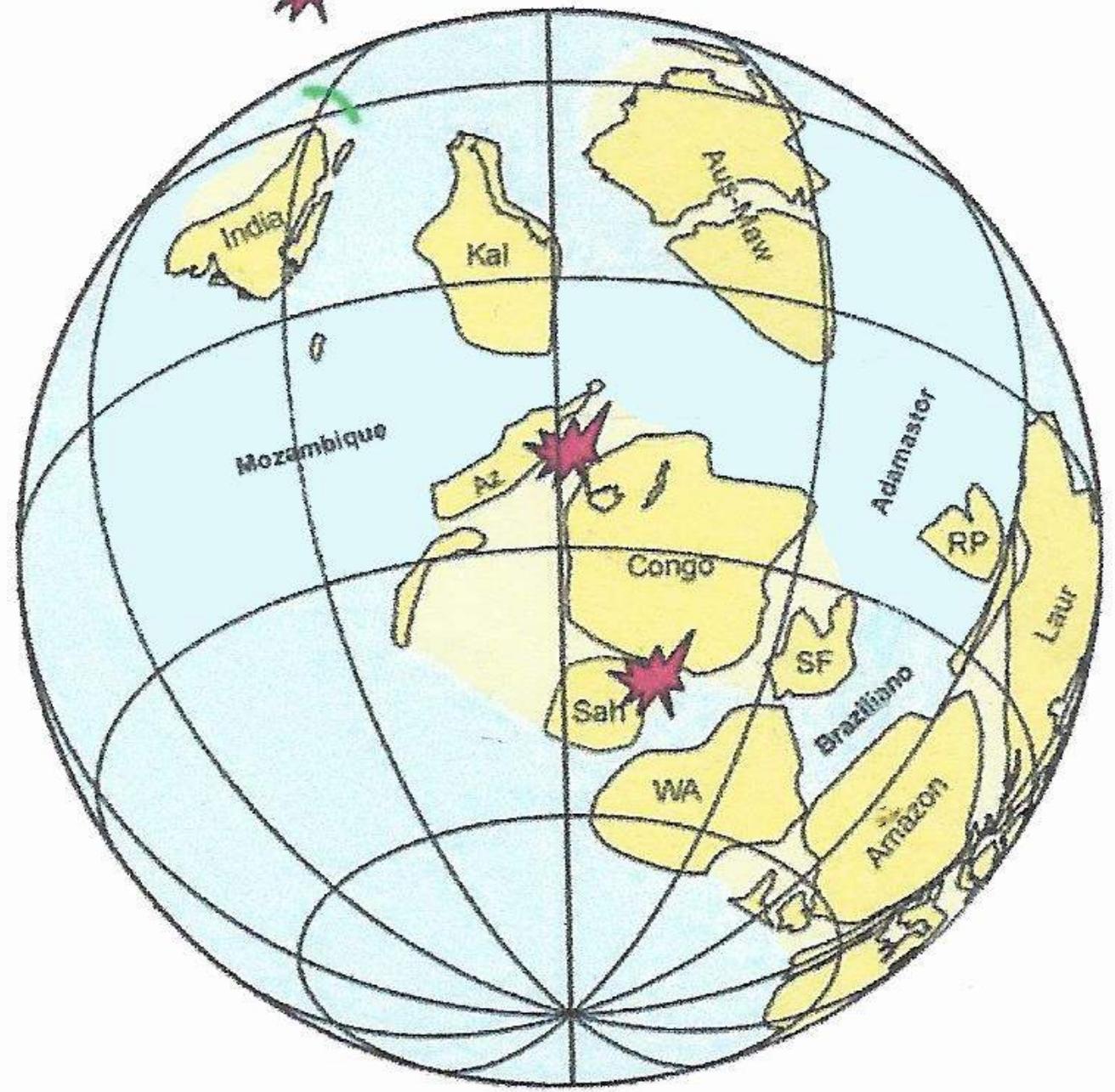
750 Ma



630 Ma

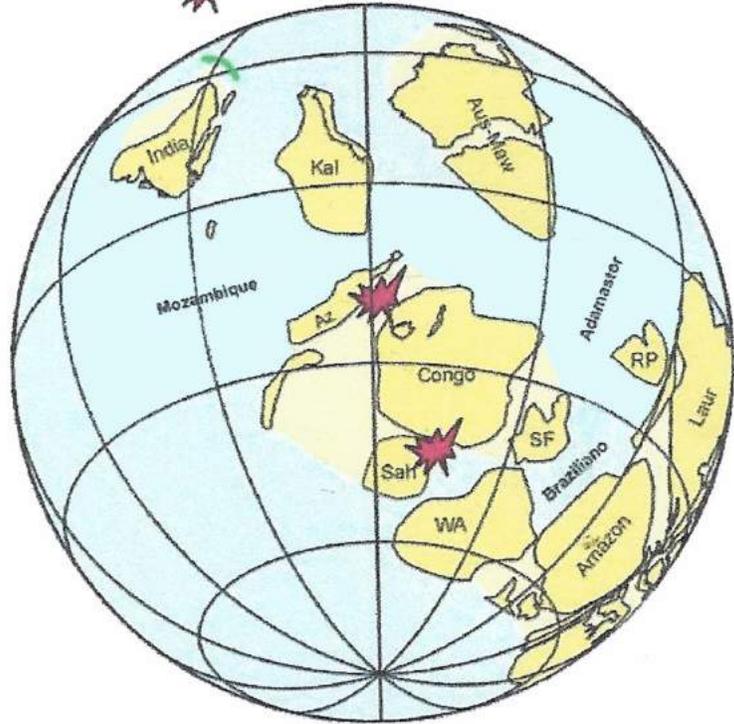


= Schematic continental collision



630 Ma

 = Schematic continental collision



570 Ma - high latitude Laurentia

 = Schematic intra-continental deformation

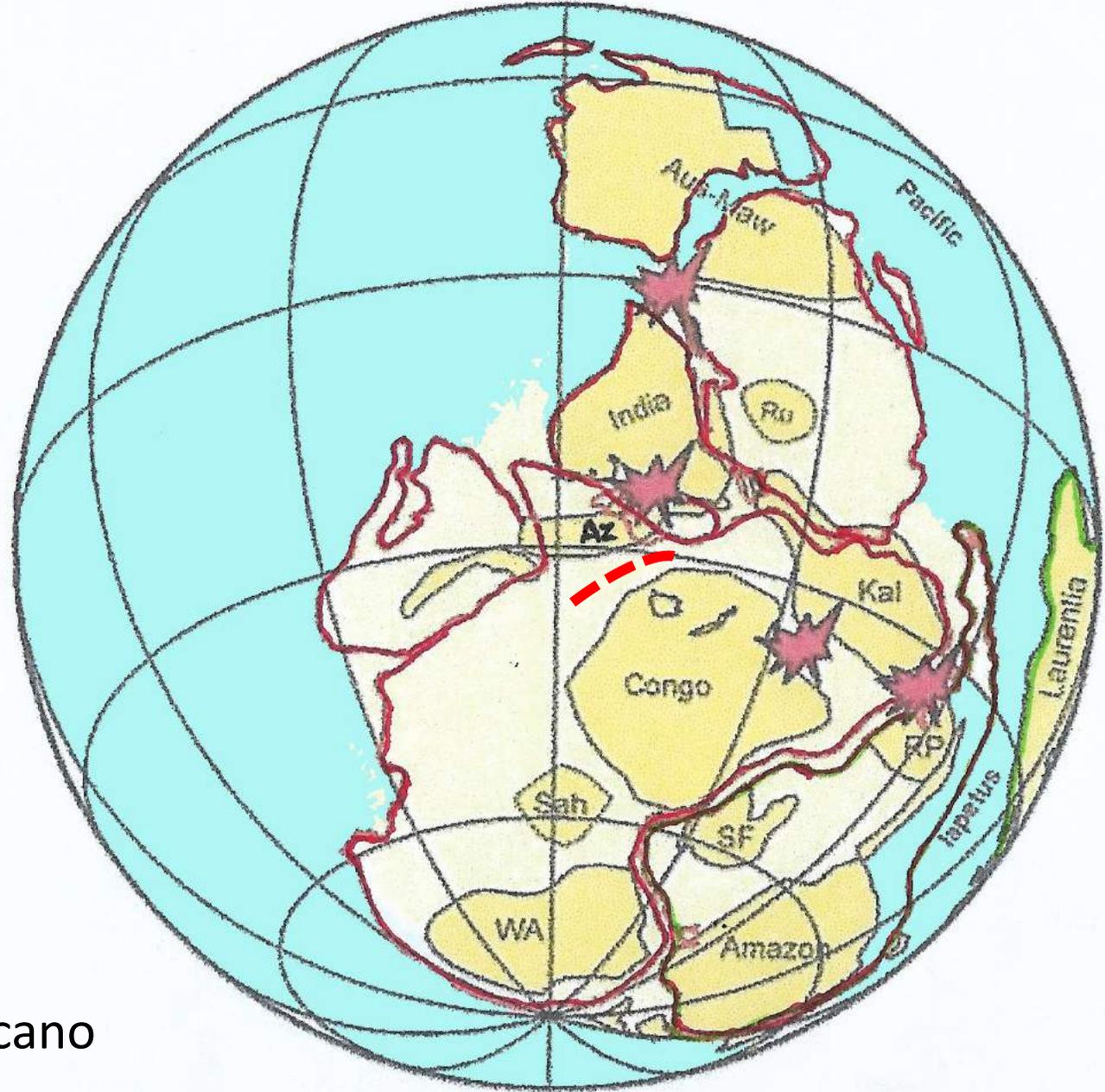


570 Ma - high latitude Laurentia

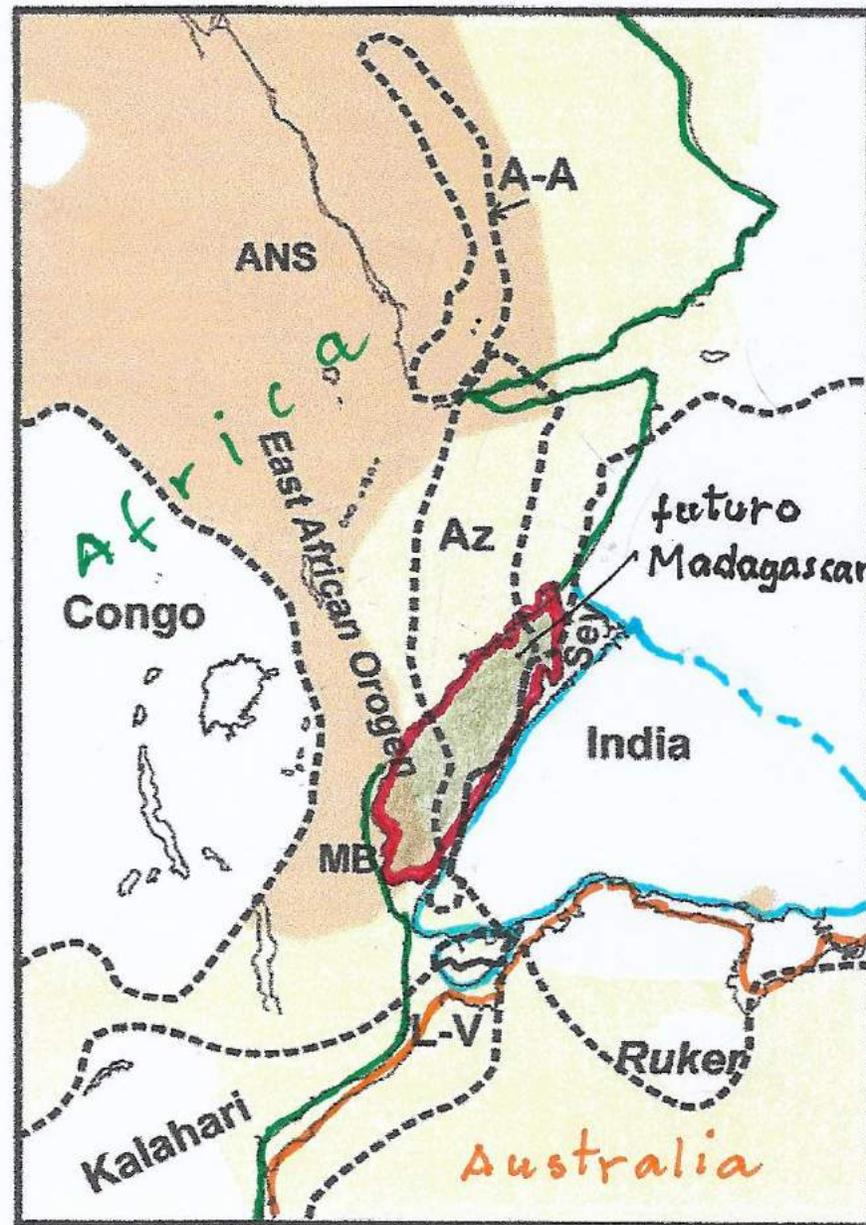
 = Schematic intra-continental deformation



530 Ma - Gondwana



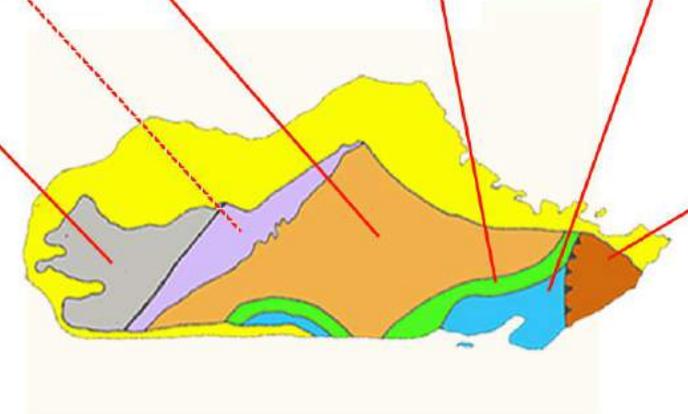
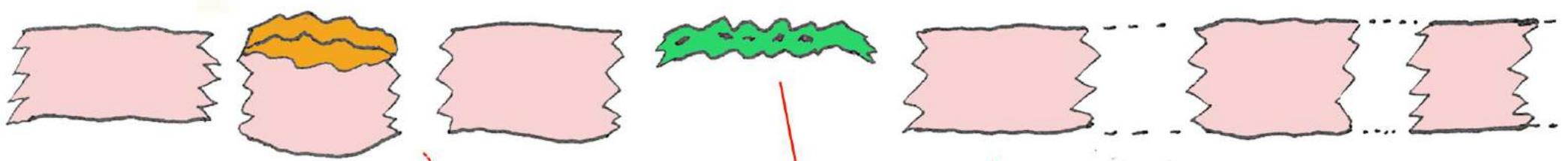
Orogeno Est-africano



Estimated age of final Neoproterozoic terrane amalgamation

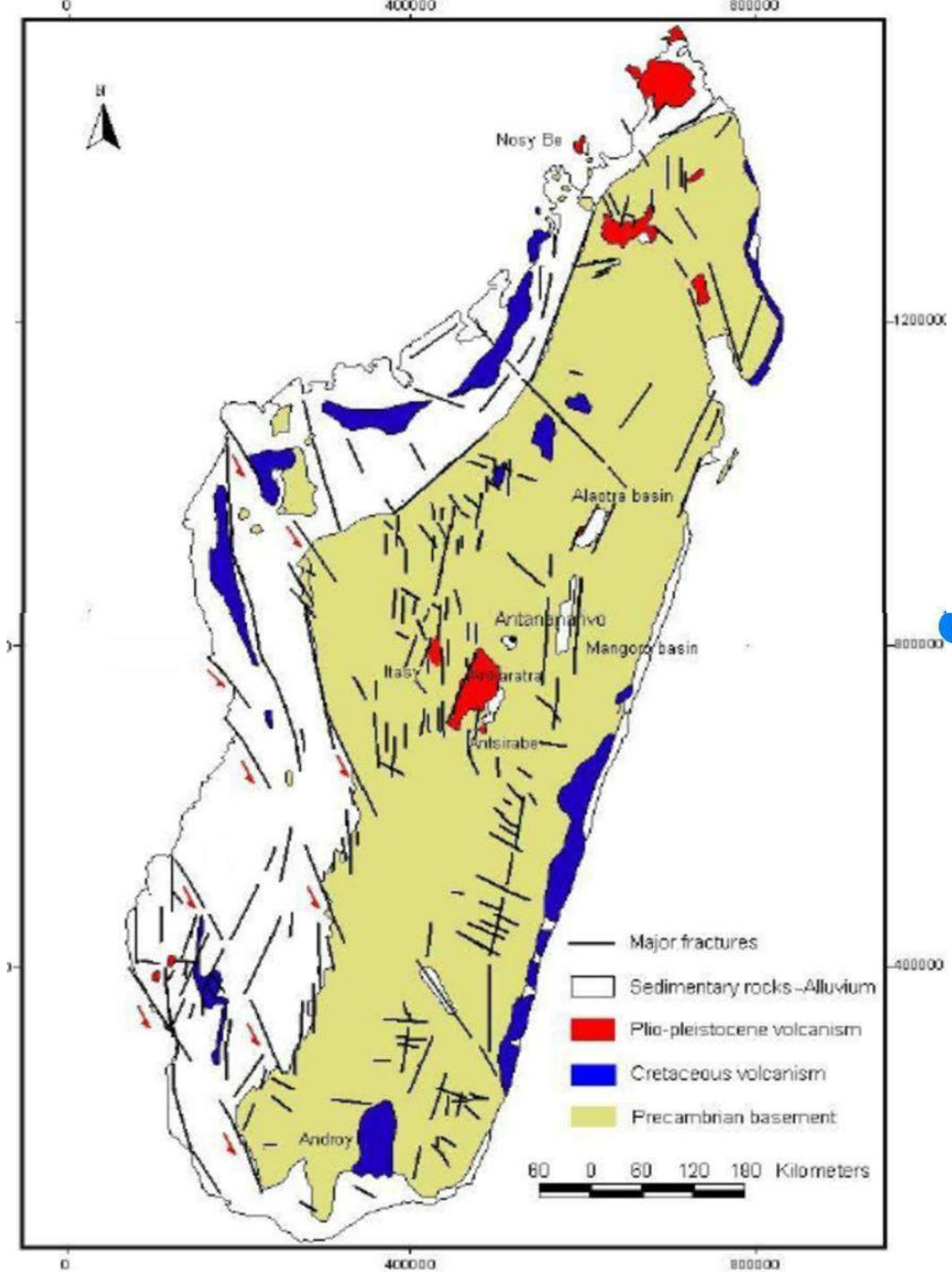
	600-500 Ma
	800-600 Ma

continente sutura oceano continente sutura oceano continente continente
Congo Orogeno Est-africano Azania Betsimisaraka Antongil Bemarivo (Seychelles-India)



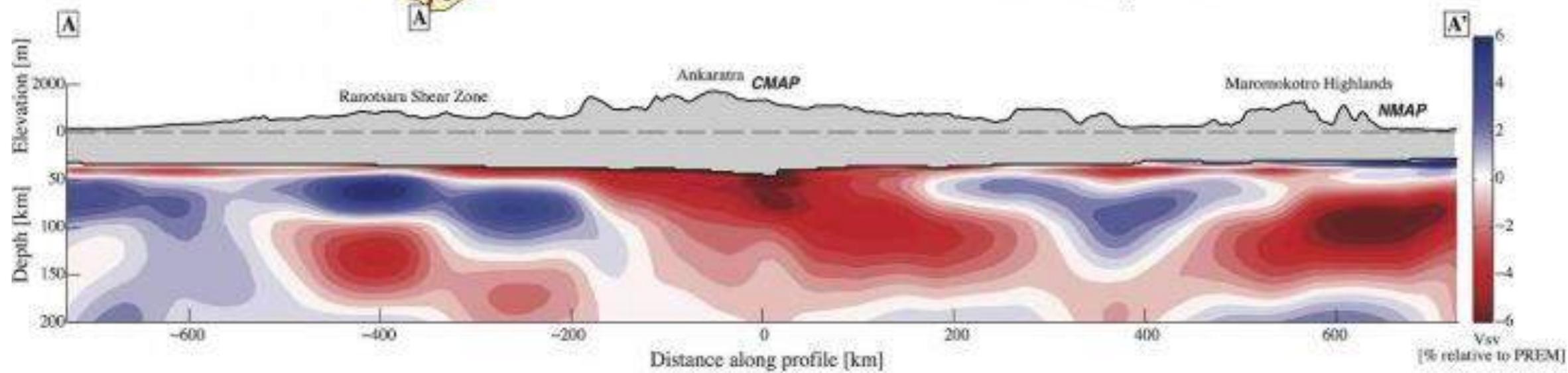
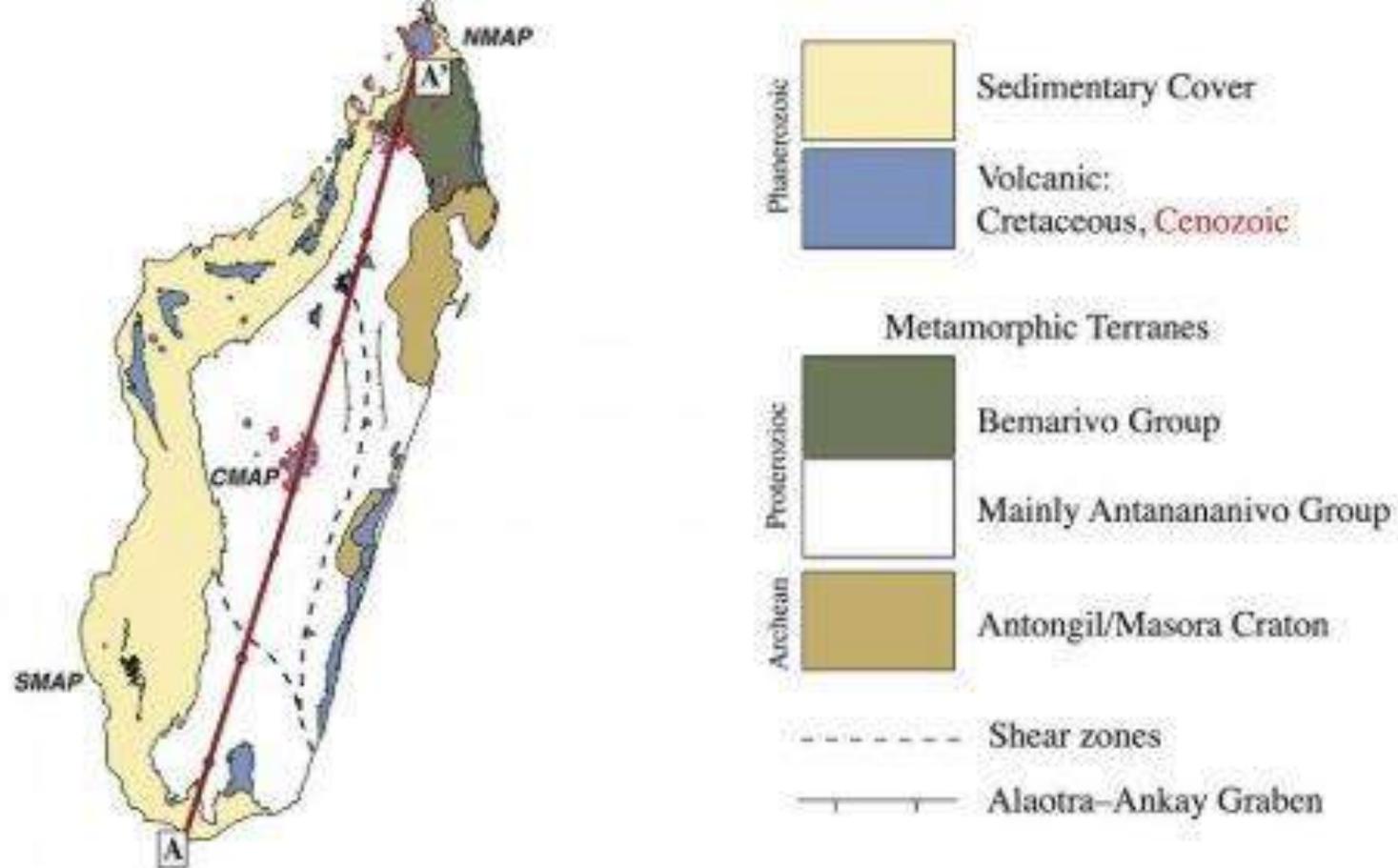
Segni di attività

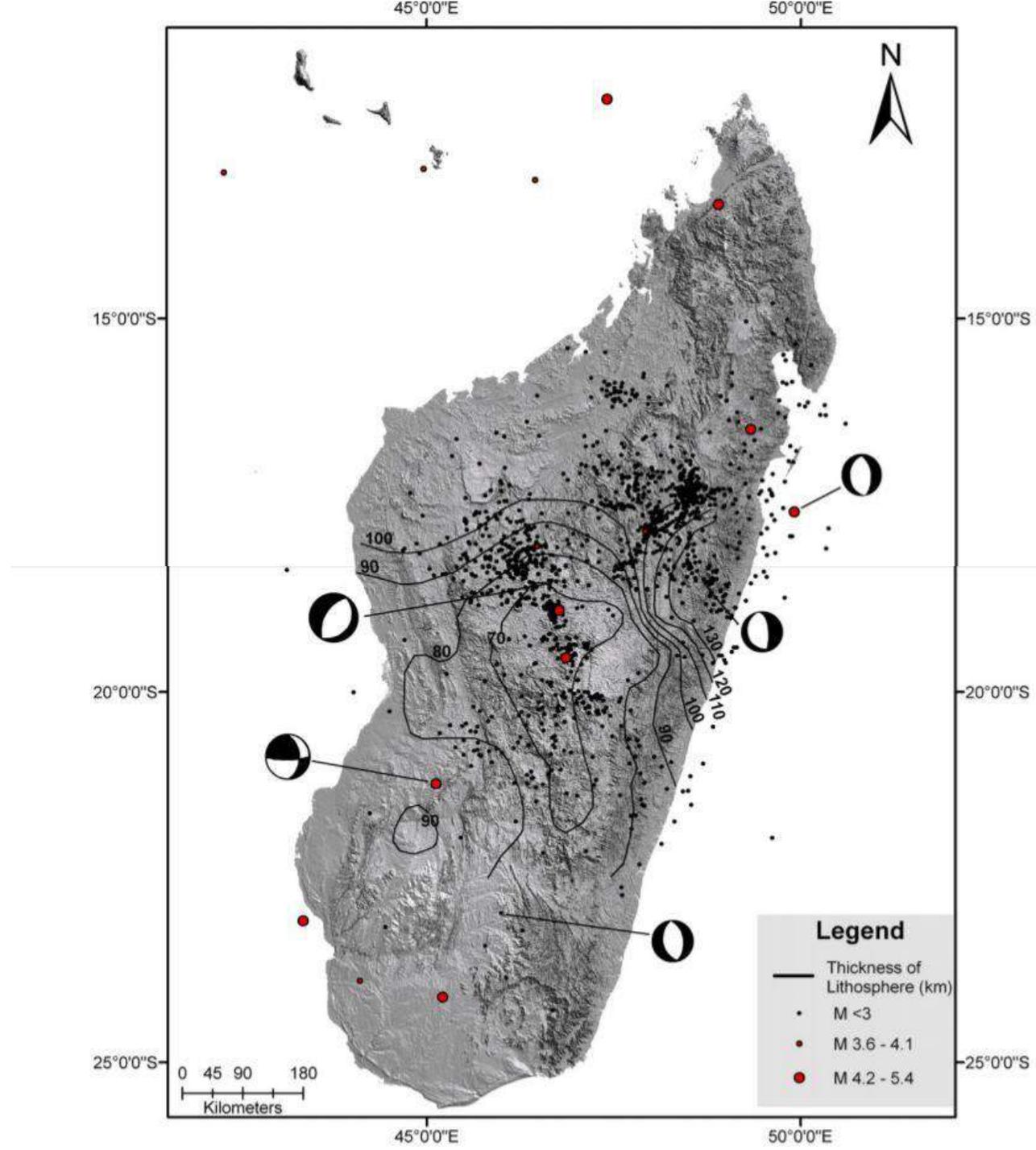
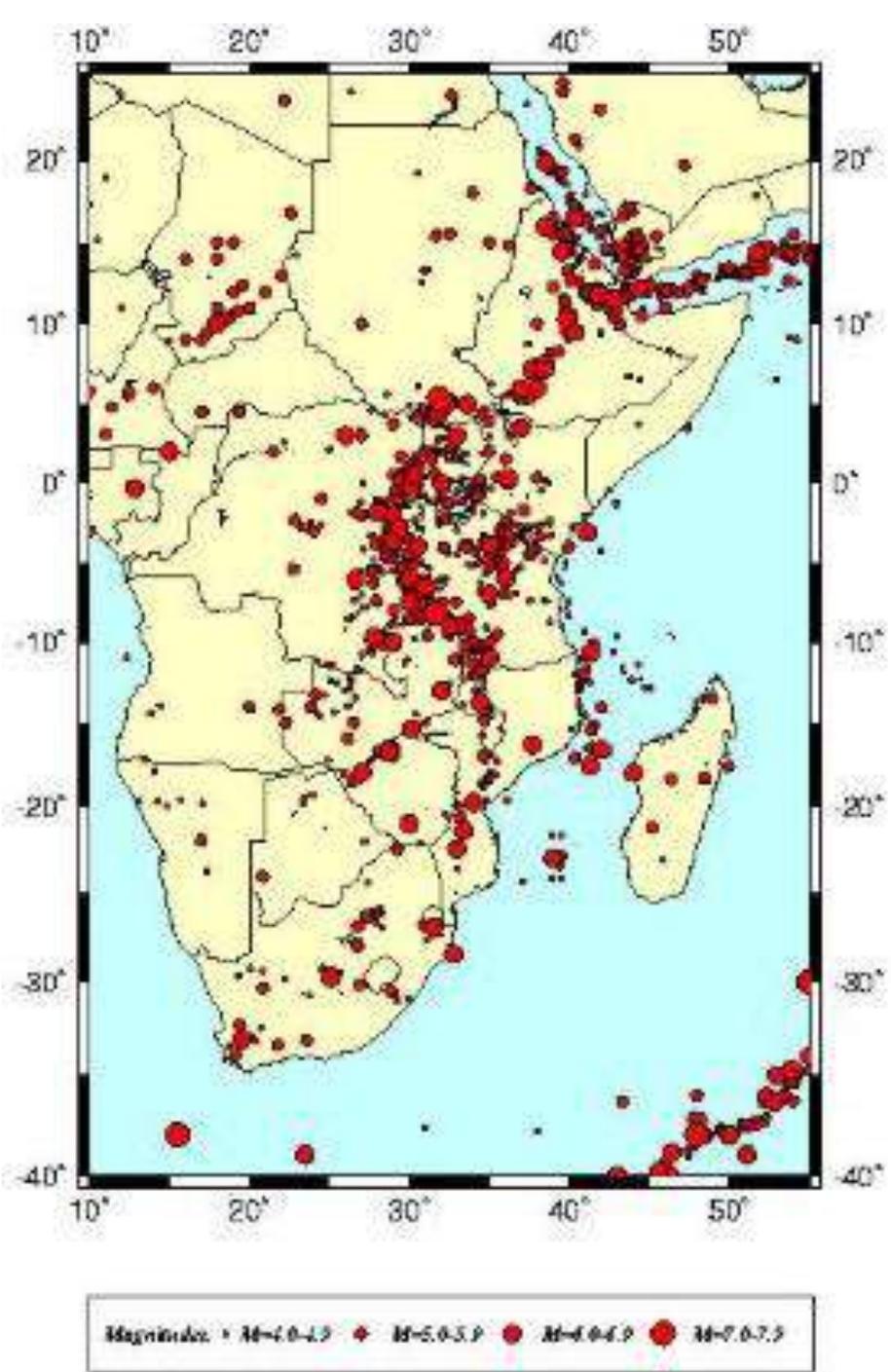
Vulcanismo e sismicità

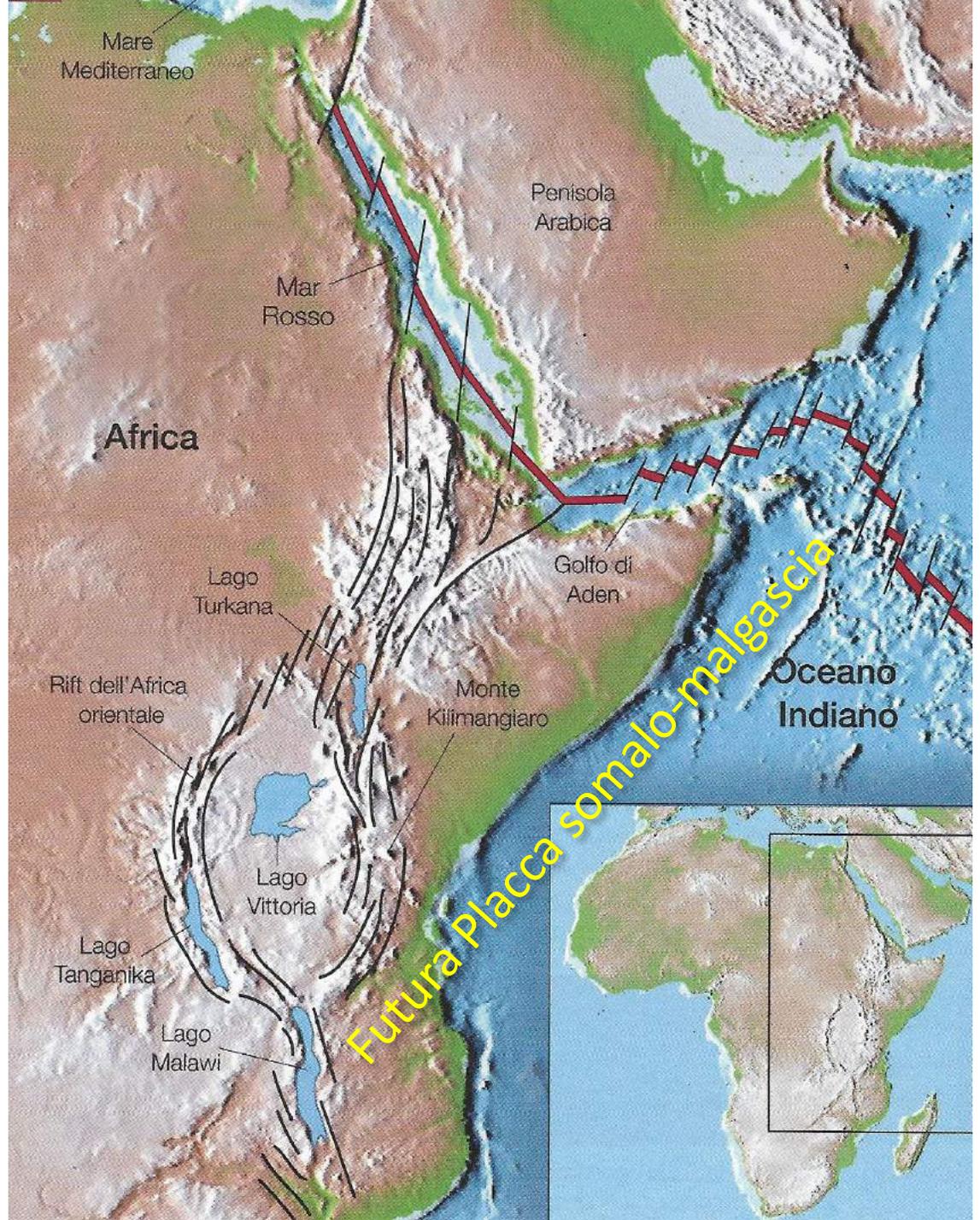




Vulcano Ankaratra







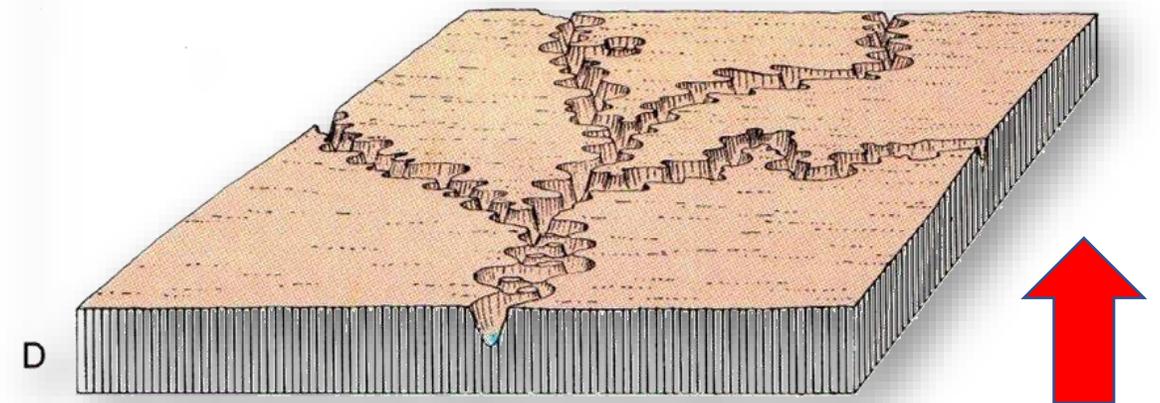
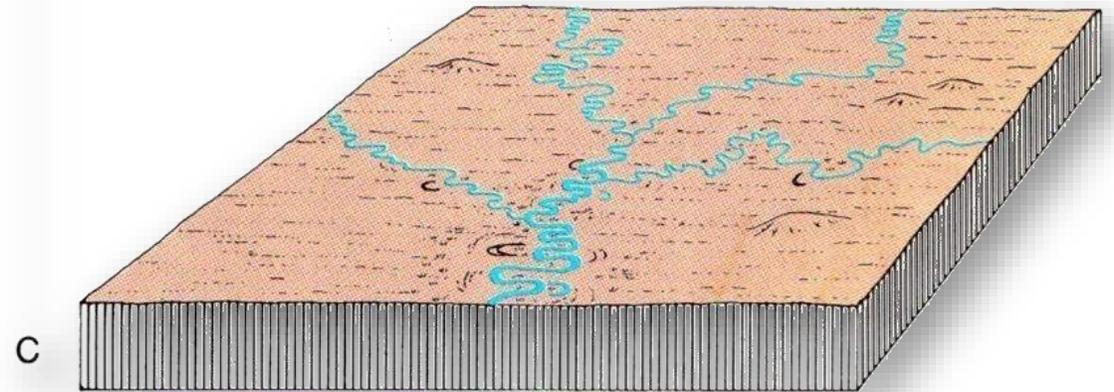
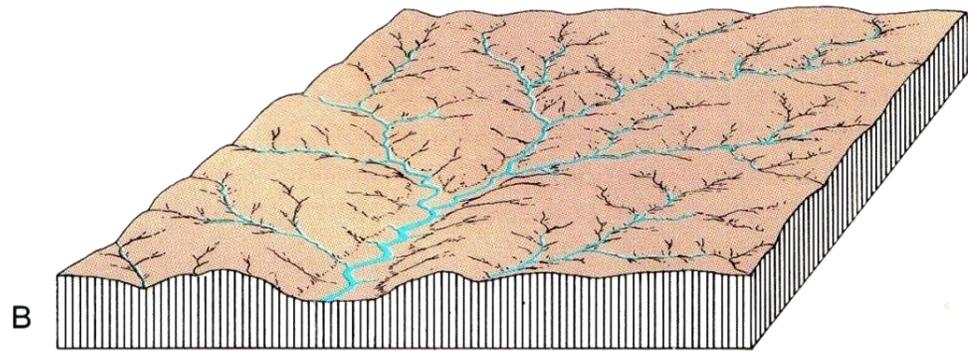
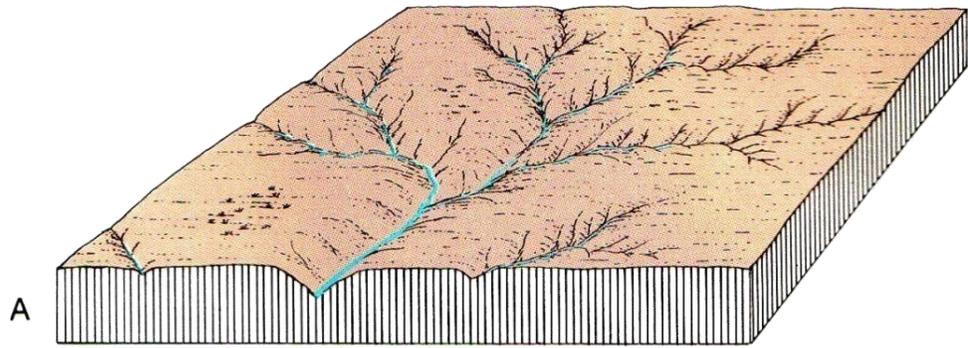
I segni di una nuova giovinezza

Cascate e rapide







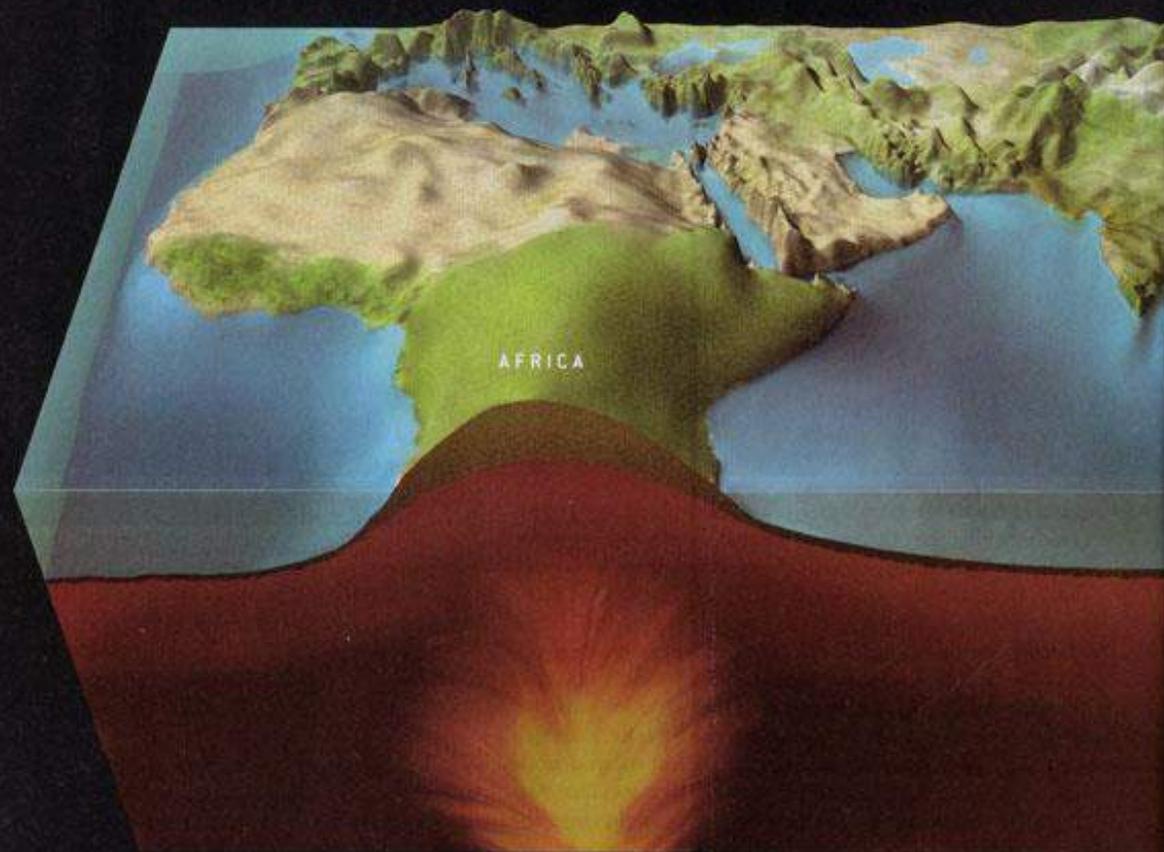


Scolpito dal basso...

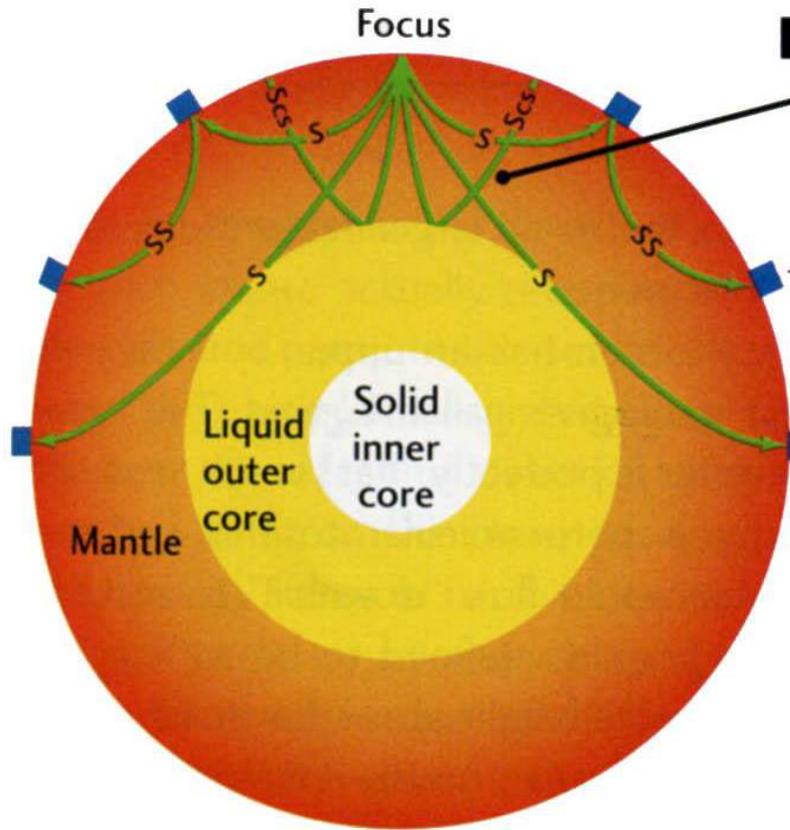
Movimenti nel mantello

Earth from Inside Out

By Michael Gurnis



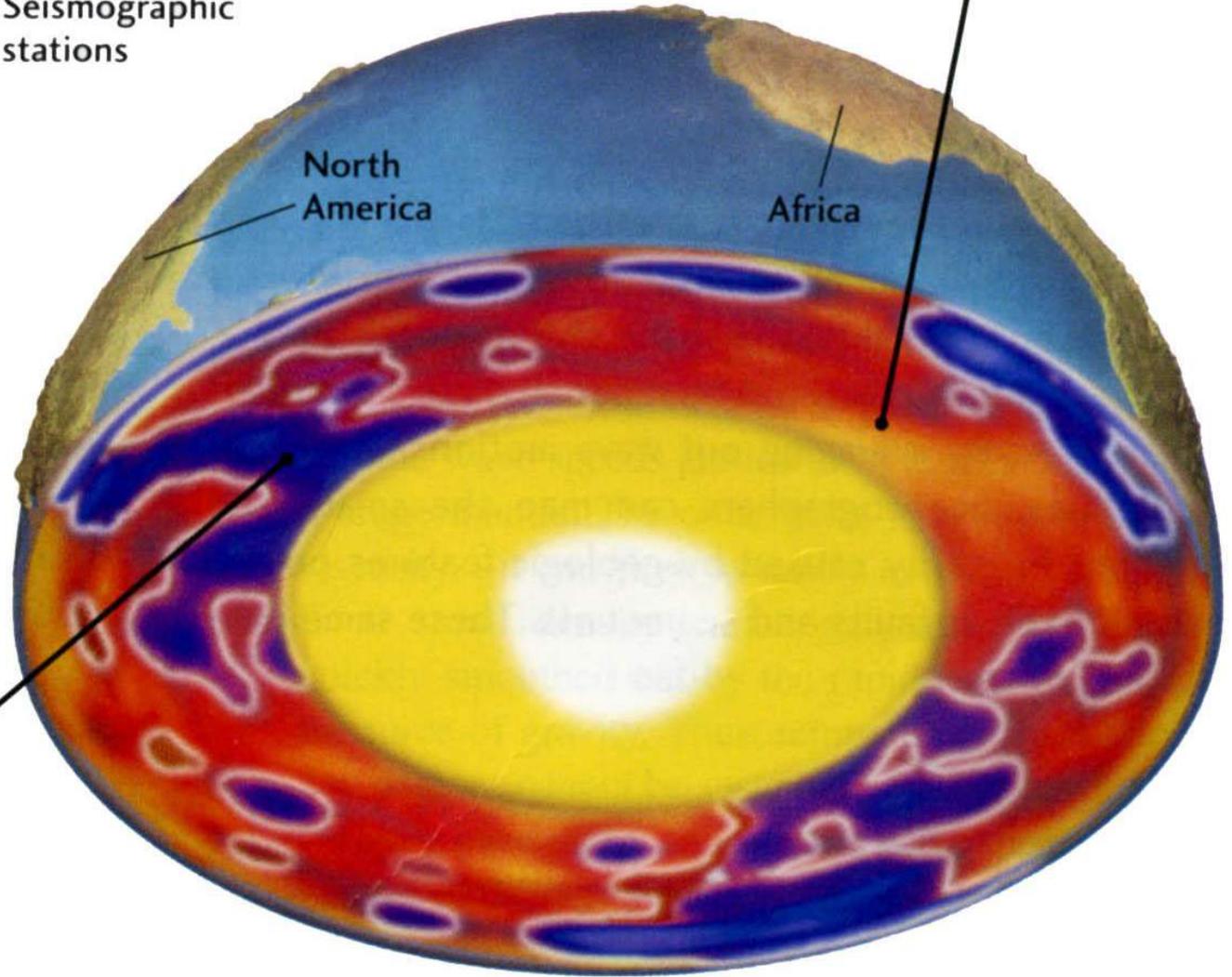
SEISMIC TOMOGRAPHY MAPS THE THREE-DIMENSIONAL STRUCTURE OF THE MANTLE



1 Seismic tomography uses travel times to create three-dimensional images of Earth's interior.

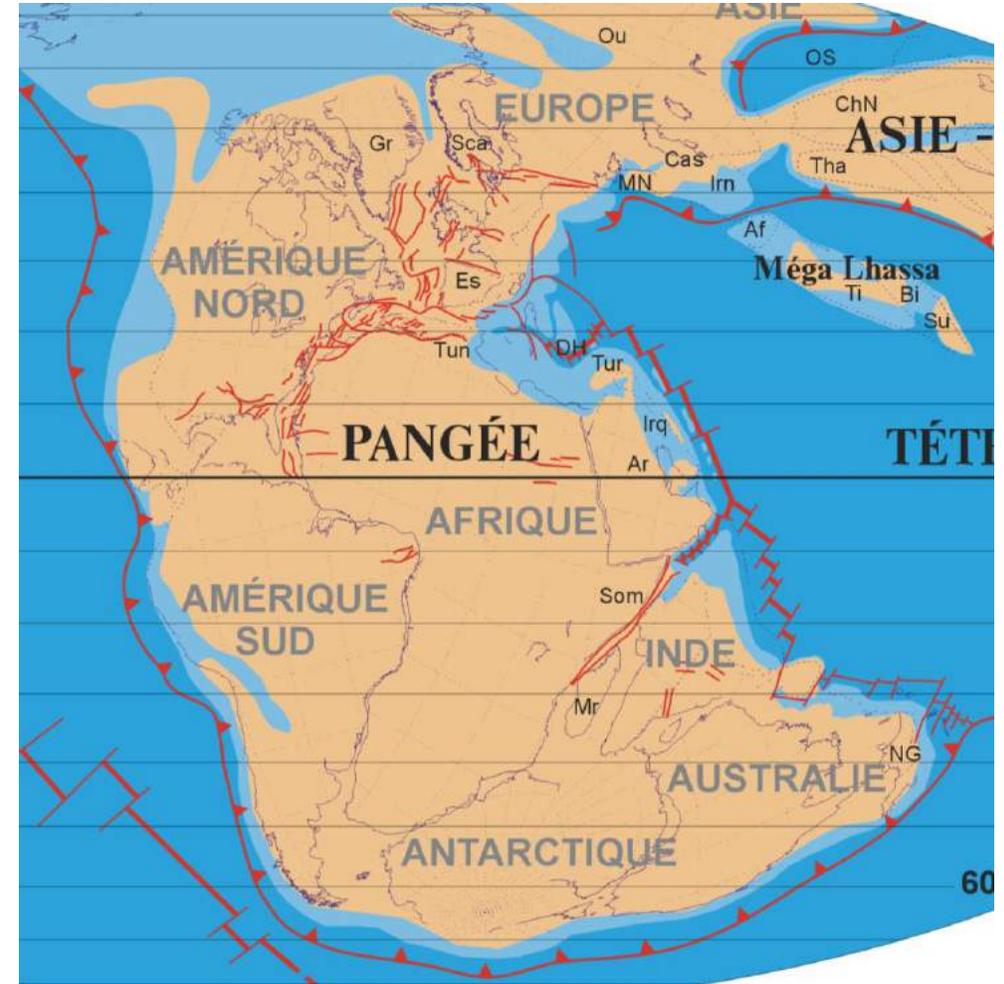
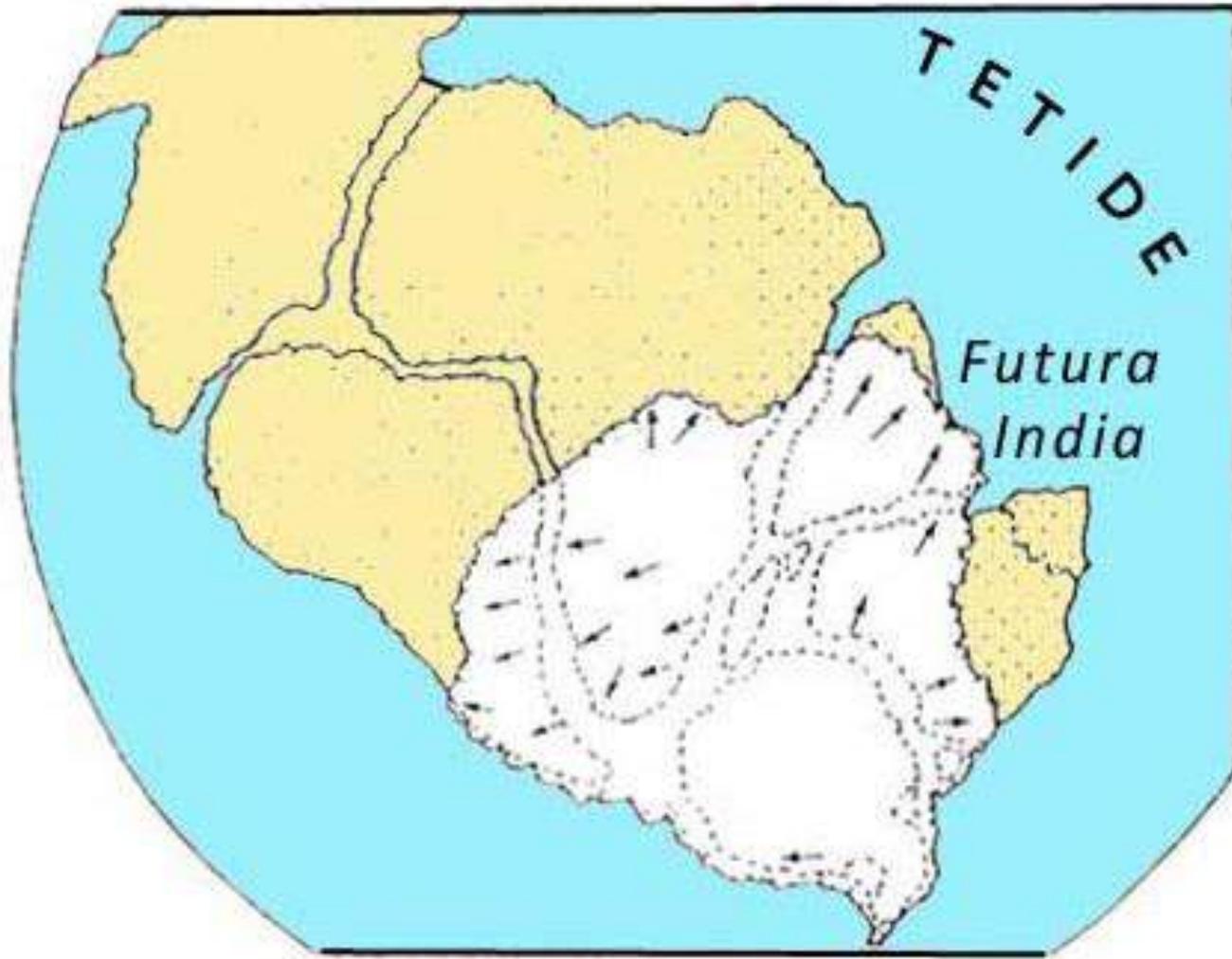
Seismographic stations

2 A tomographic section through Earth reveals hot rocks, such as a mantle plume rising from Earth's core beneath South Africa,...

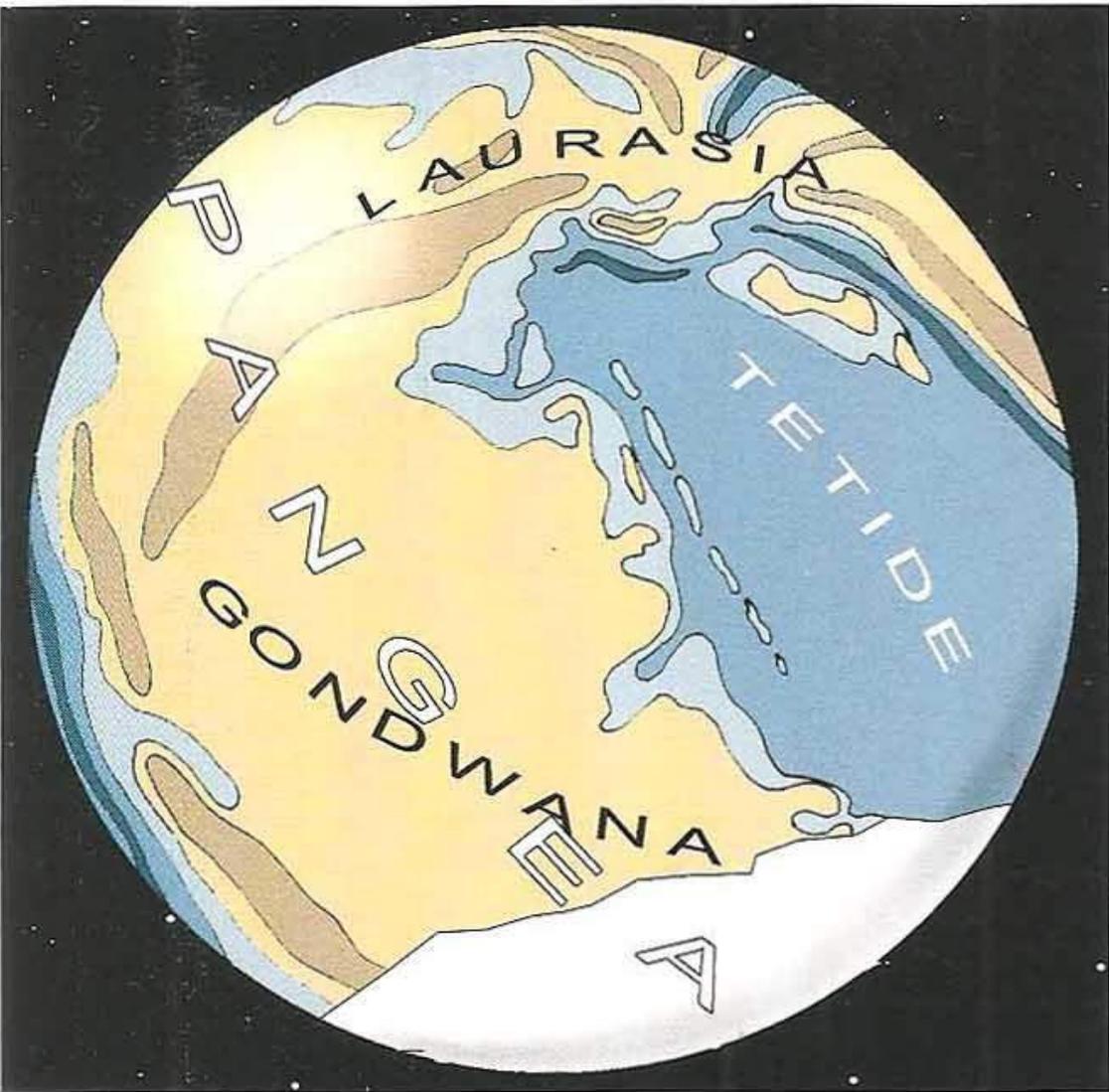


3 ...and colder rocks, such as the descending remnants of the Farallon Plate under the North American Plate.

Ma questa,
è una storia ancora da scrivere...



Glaciazione di Gondwana

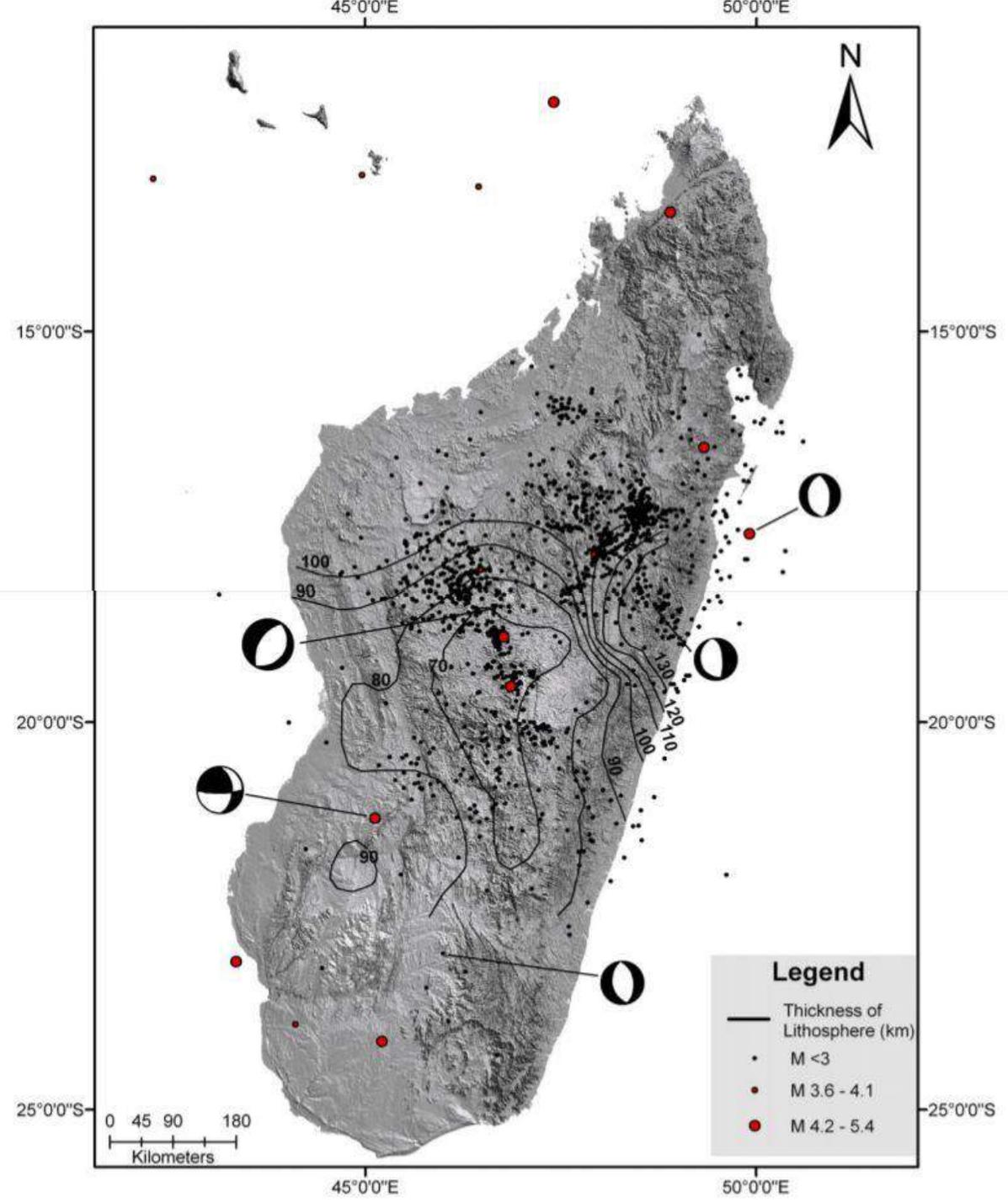


- Pianure
- Catene montuose
- Calotta glaciale
- Mare poco profondo
- Oceano
- Fosse abissali

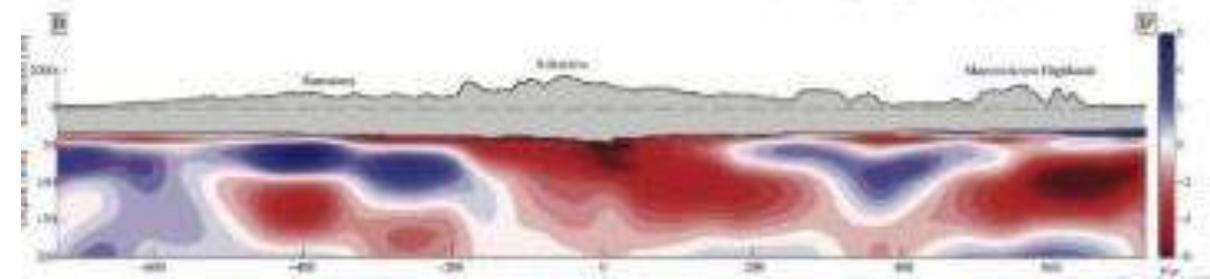
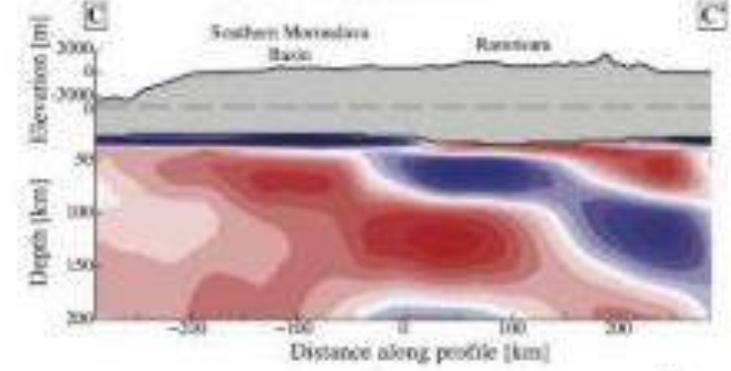
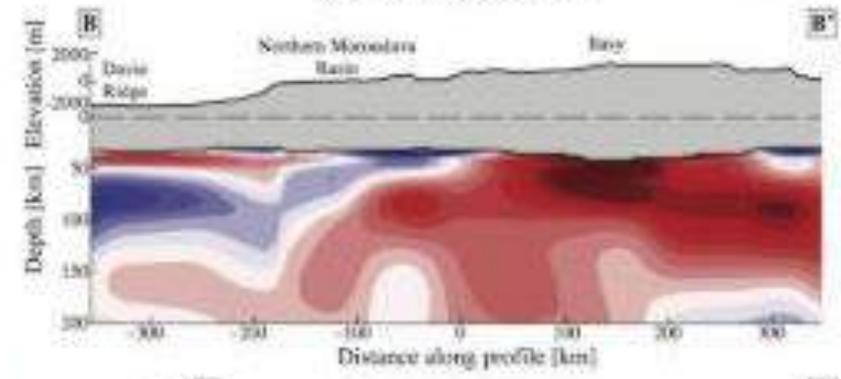
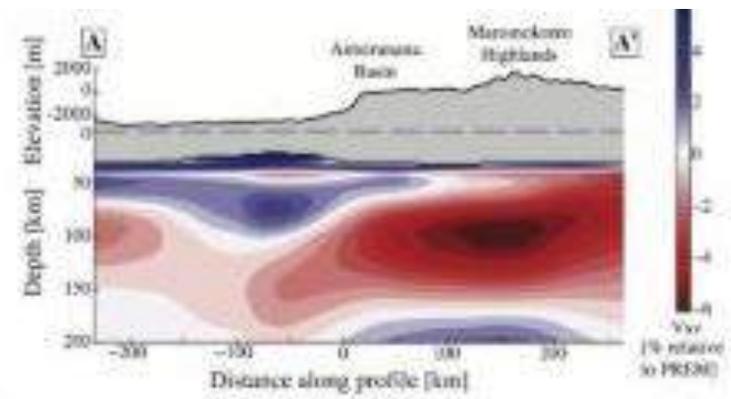
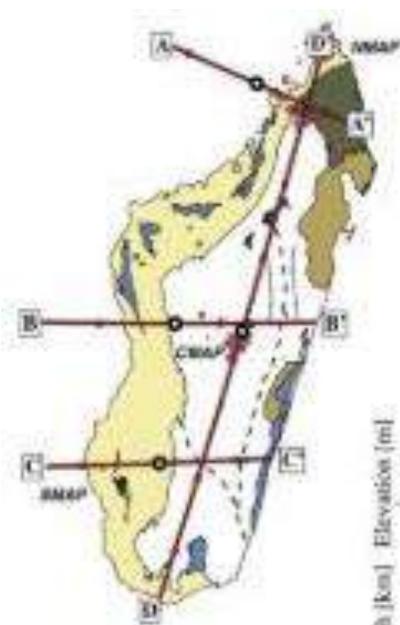


Aspetto della superficie terrestre alla fine dell'Era paleozoica, circa 250 milioni di anni fa, con il supercontinente Pangèa. Nello schema piccolo sono indicati i continenti attuali formatisi con la frammentazione di Pangèa.

PANGEA 250 Ma







-  Granitoïdes et migmatites Archéens
-  Complexes basiques tardi Archéens
-  Croûte Archéenne remaniée, granitoïdes, migmatites et gneiss Protérozoïques
-  Gneiss granulitiques et granitoides Néoprotérozoïques
-  Couverture Phanérozoïque
-  Zones de cisaillement (ZC) Néoprotérozoïques

