

De quelques secondes...



Photo : Yves Gaudemer, IPGP, 2007

Séisme de Fairview Peak (Nevada, 1954,  $M \approx 7$ )

... à quelques (dizaines de) millions d'années ( $10^{15}$  s)



Photo : Chloé Michaut, IPGP, 2005

Tobin Range (Nevada)

De quelques millimètres ( $10^{-3}$  m)...



<http://www.geolab.unc.edu/Petunia/IgMetAtlas/meta-micro/quartzmicaschist.X.html>

Lame mince dans un échantillon de schiste

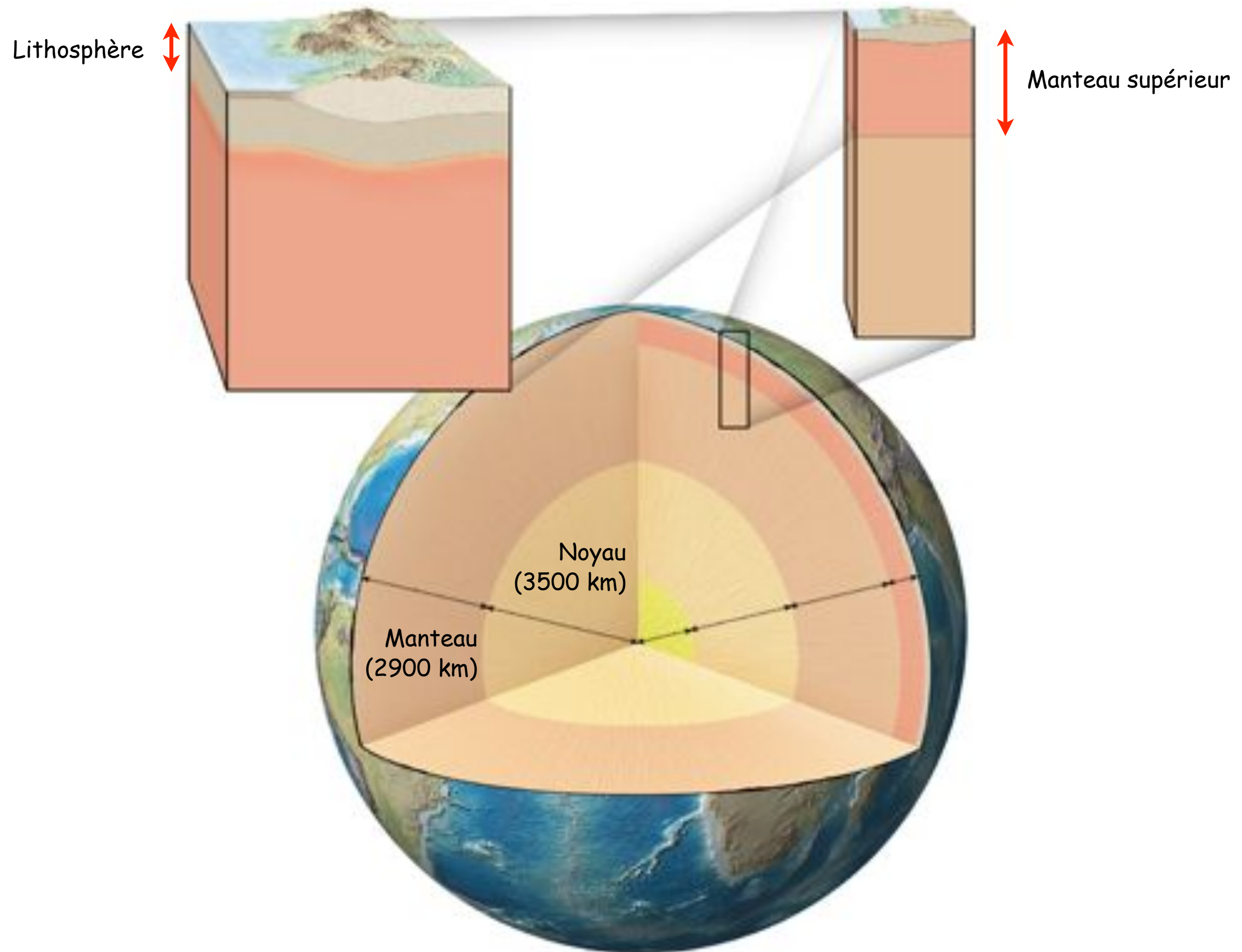
... à quelques milliers de km ( $10^6$  m)



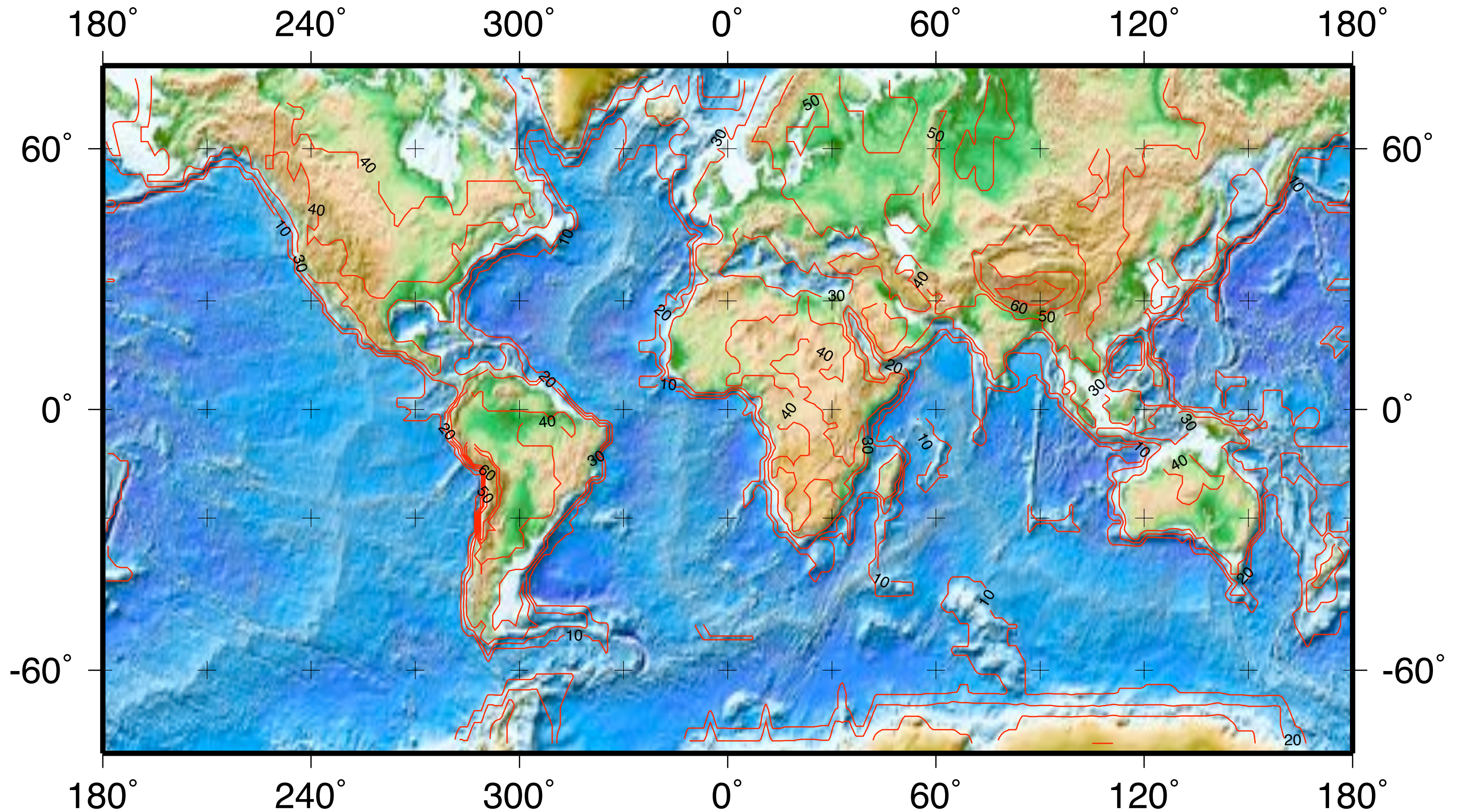
<http://earth.jsc.nasa.gov/sseop/efs/photoinfo.pl?PHOTO=STS41G-120-22>

Himalaya et plateau du Tibet

La lithosphère = enveloppe rigide de la Terre ( $\approx 150$  km)



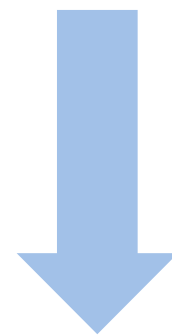
Epaisseur de la croûte :  
- continentale : de 30 à 70 km  
- océanique : de 0 à 10 km



**Compositions chimiques très différentes :**

Croûte océanique = basalte

Croûte continentale = granite



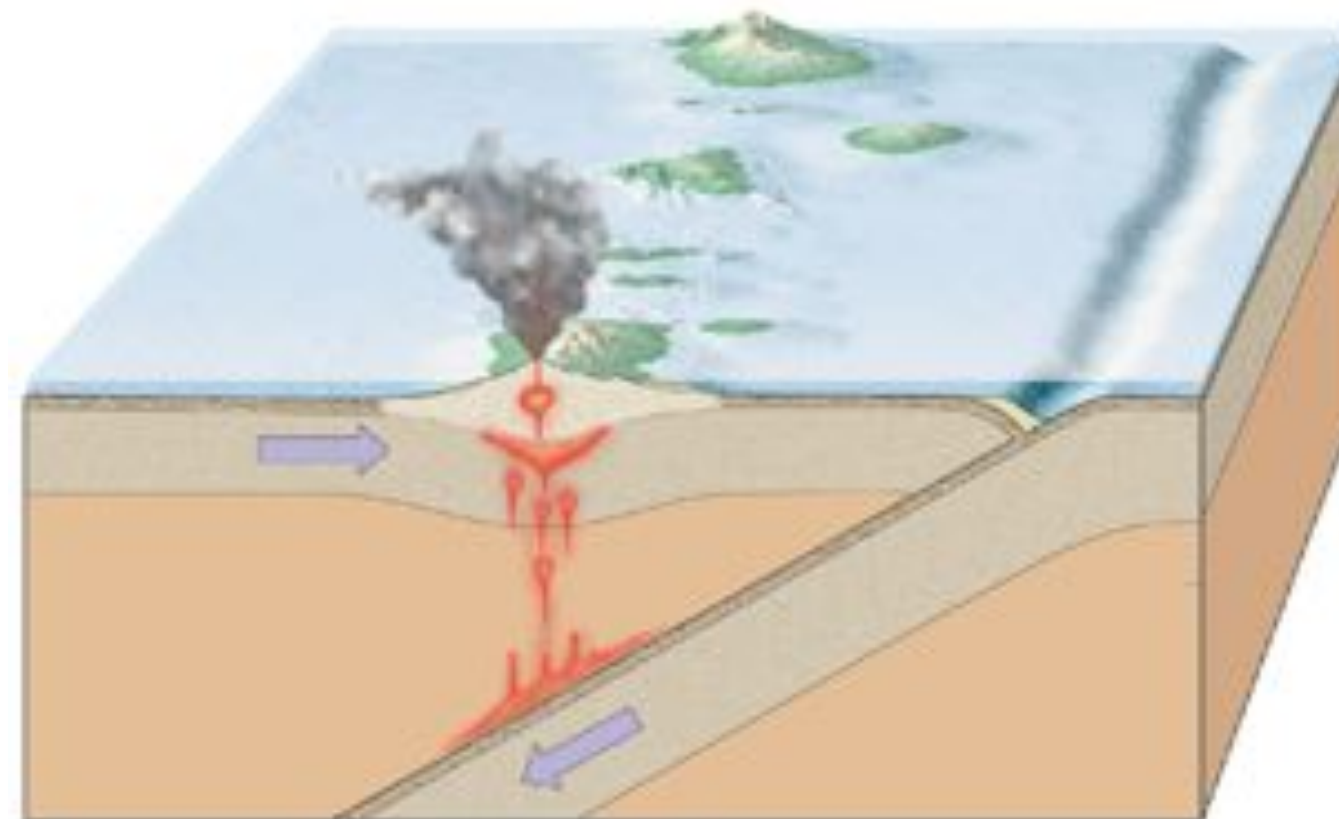
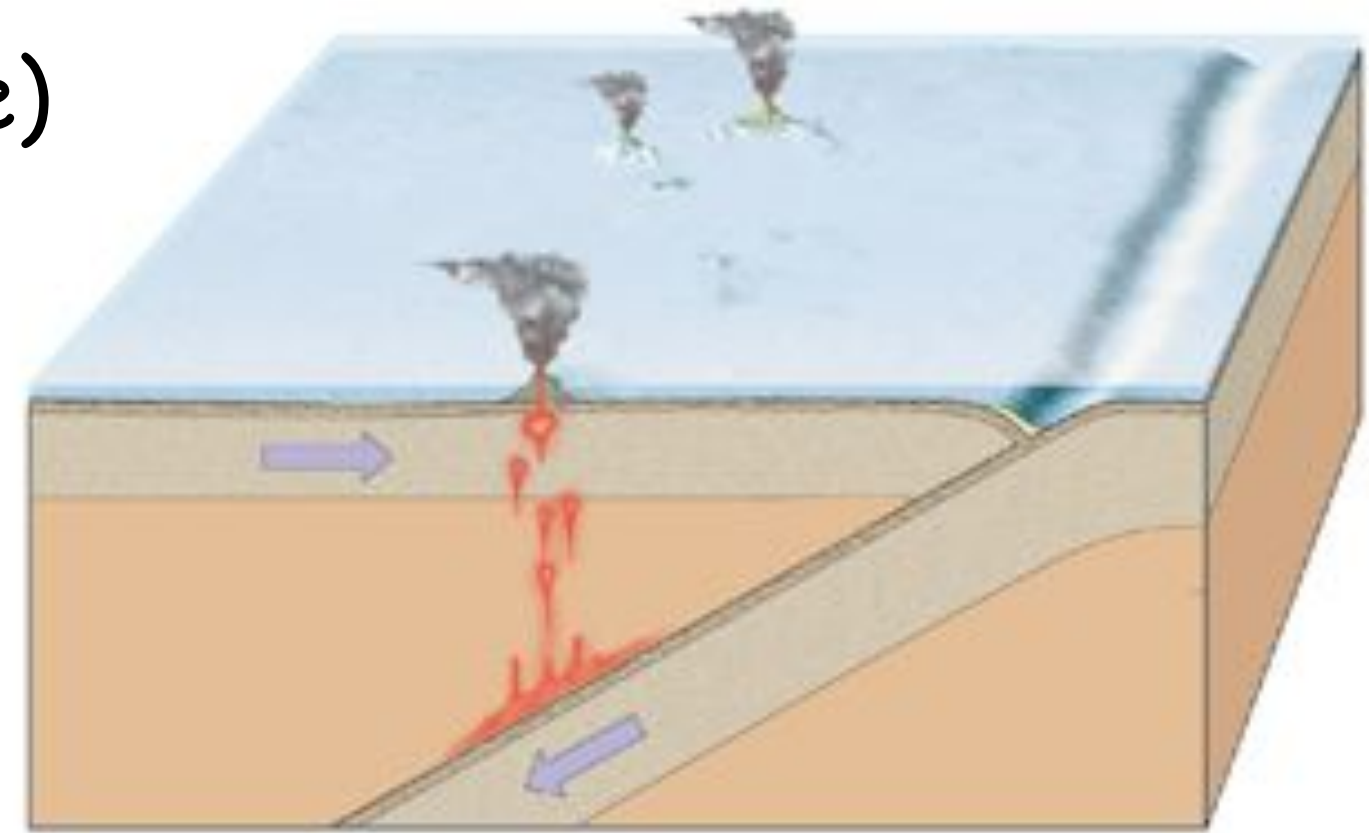
**Densités très différentes :**

Croûte océanique  $\rho_{co} = 3.2 \cdot 10^3 \text{ kg/m}^3$

Croûte continentale  $\rho_{cc} = 2.8 \cdot 10^3 \text{ kg/m}^3$

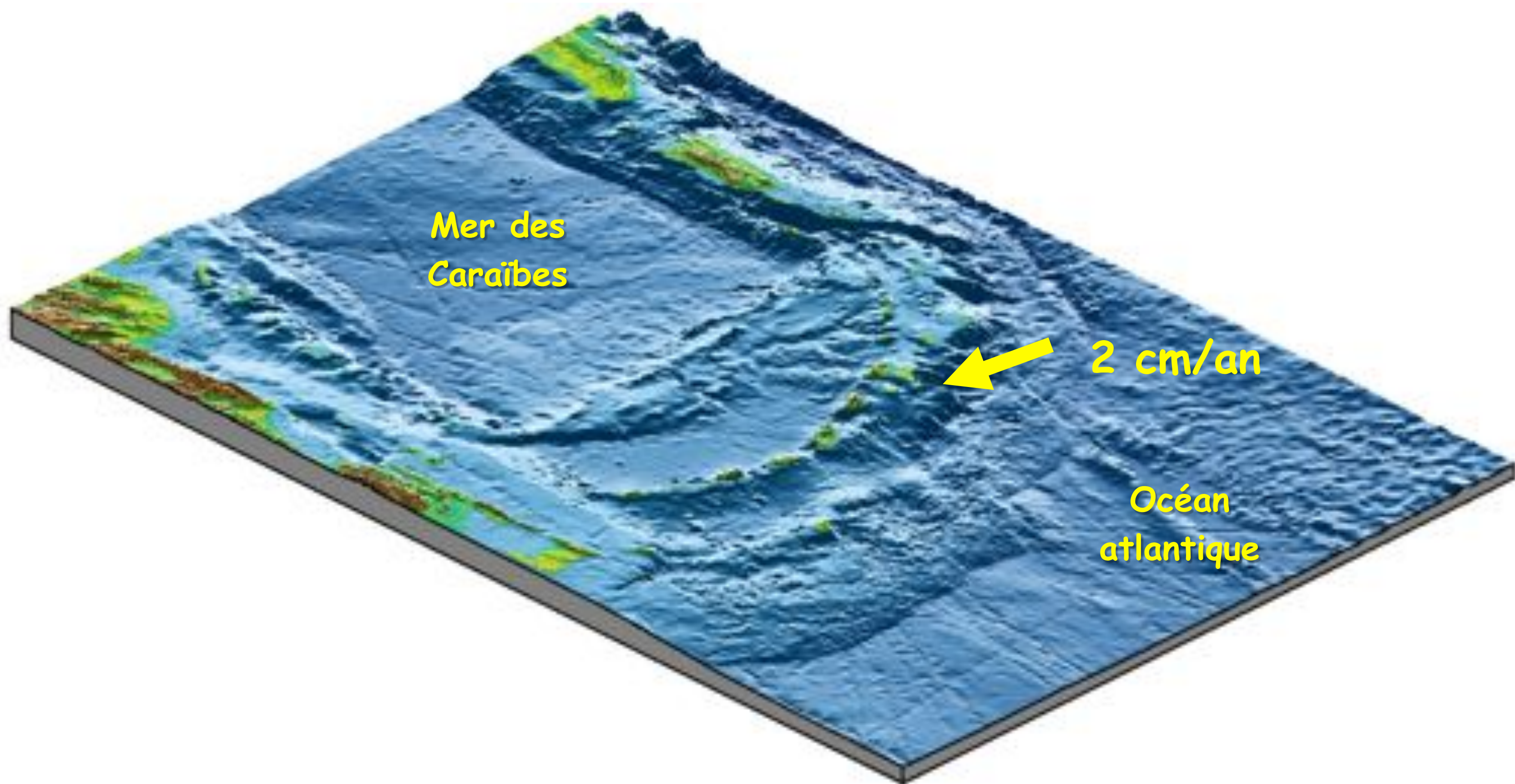
# Collision océan - océan

- Formation d'un arc volcanique (andésitique)
- Sismicité
- Pas de création de relief (autre que les volcans)



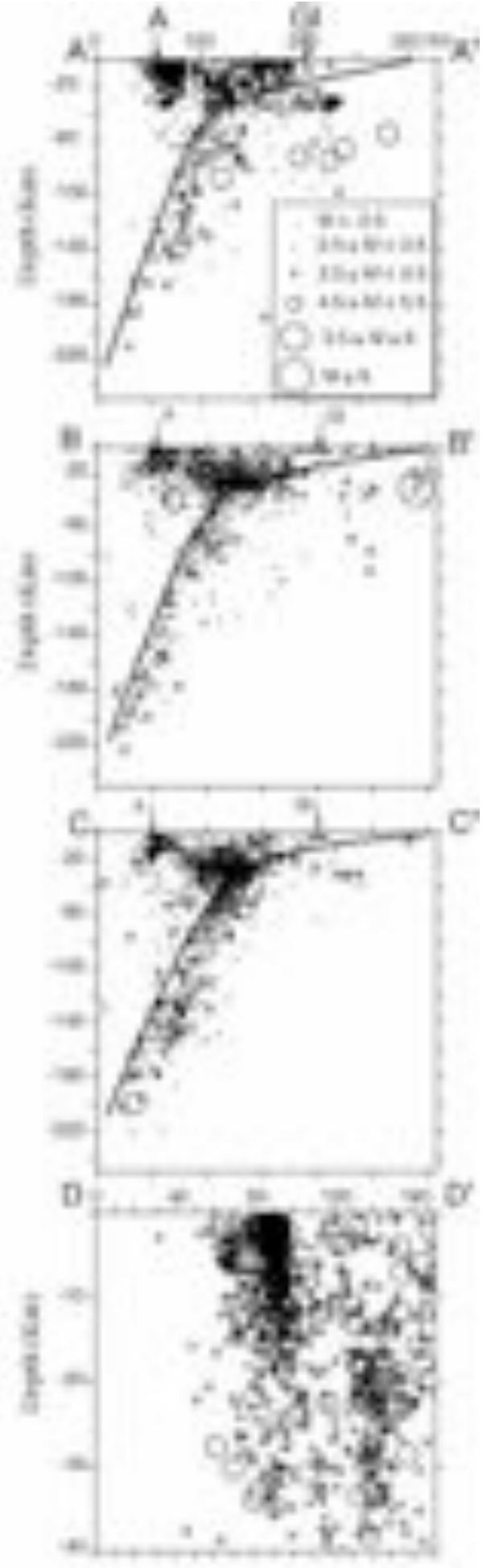


# Exemple : Arc des Antilles



Le risque sismique est également très important

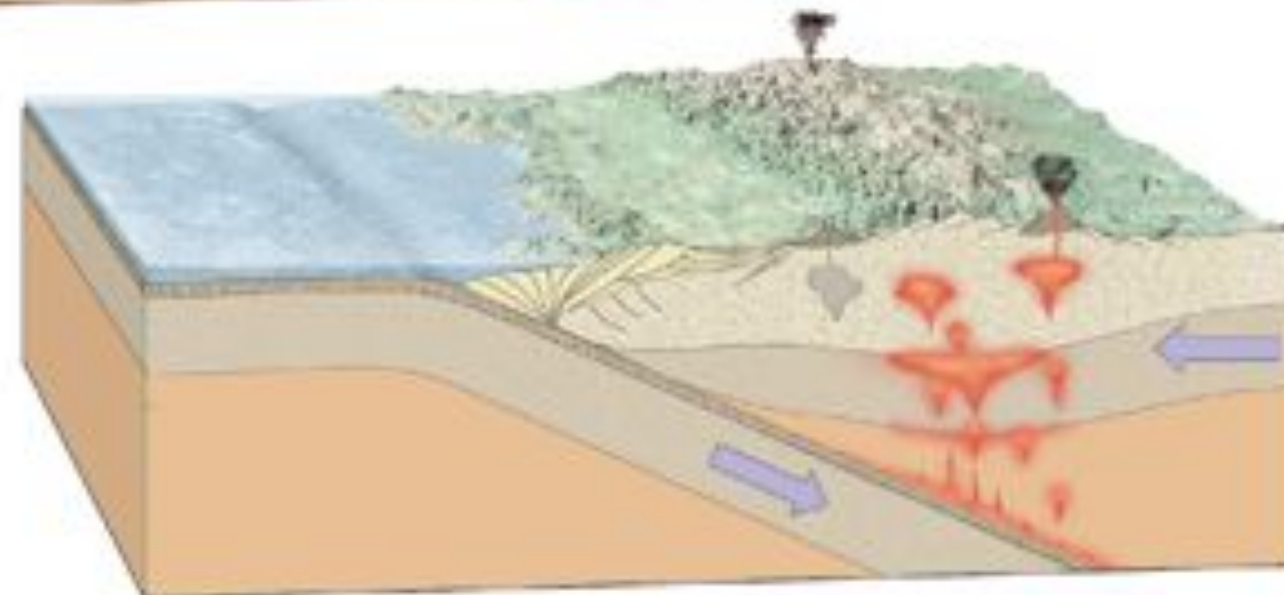
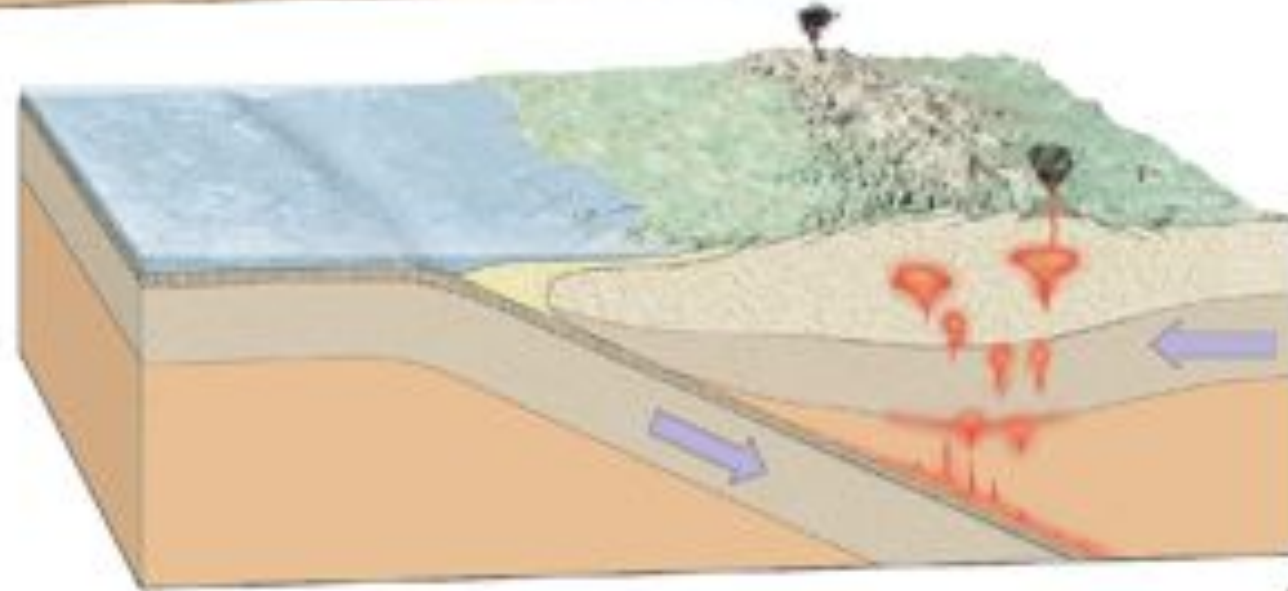
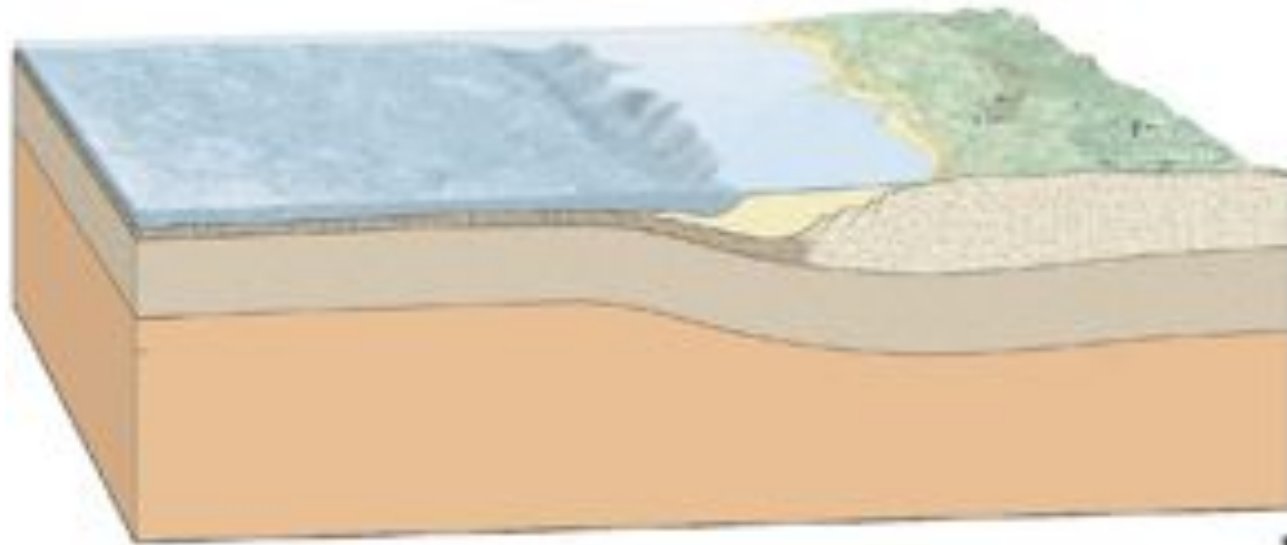
1843  
 $M = 7.5-8$

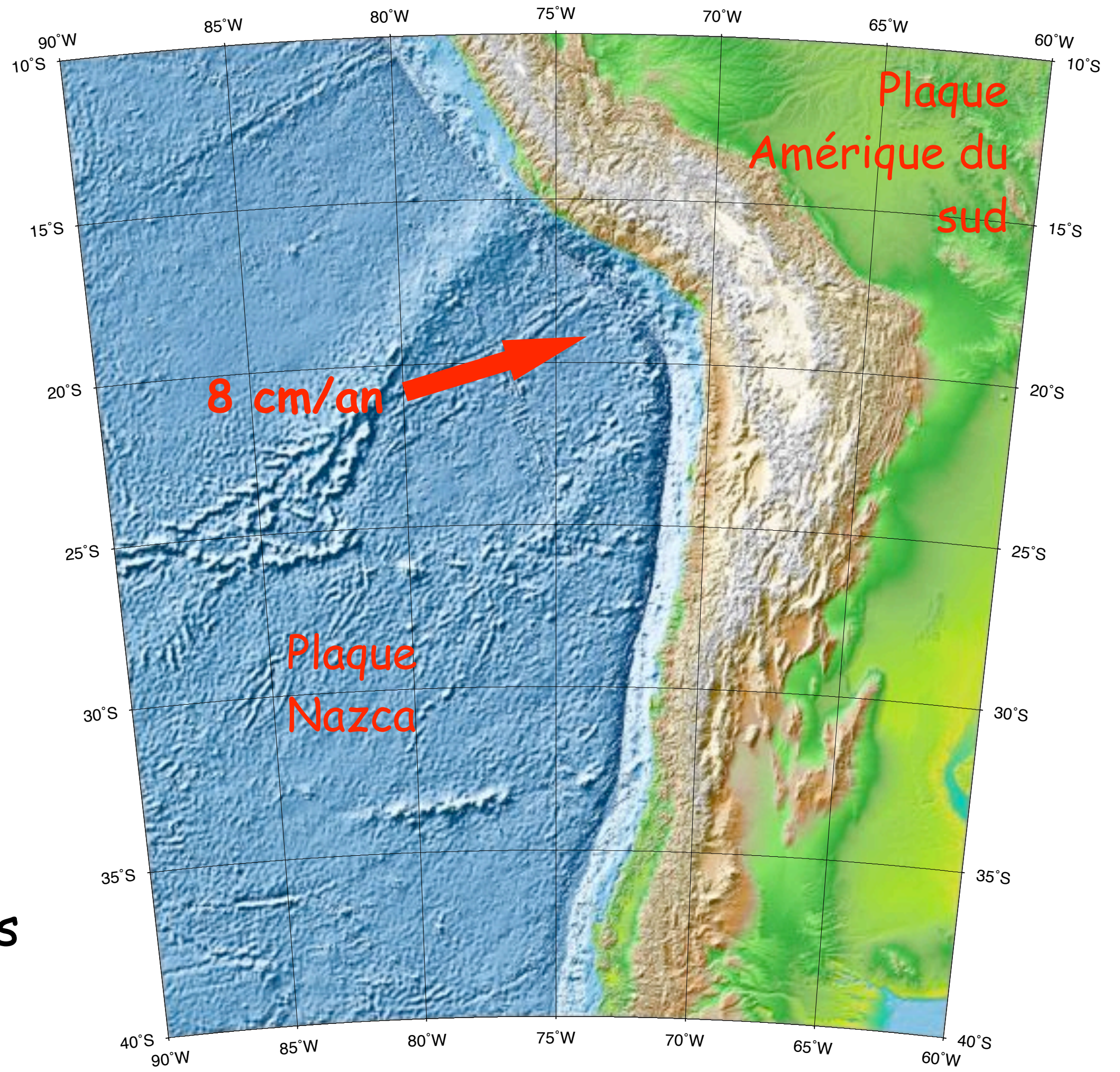


# Collision océan - continent

Formation d'une chaîne de subduction :

- volcanisme (andésitique à rhyolitique)
- sismicité
- déformations crustales

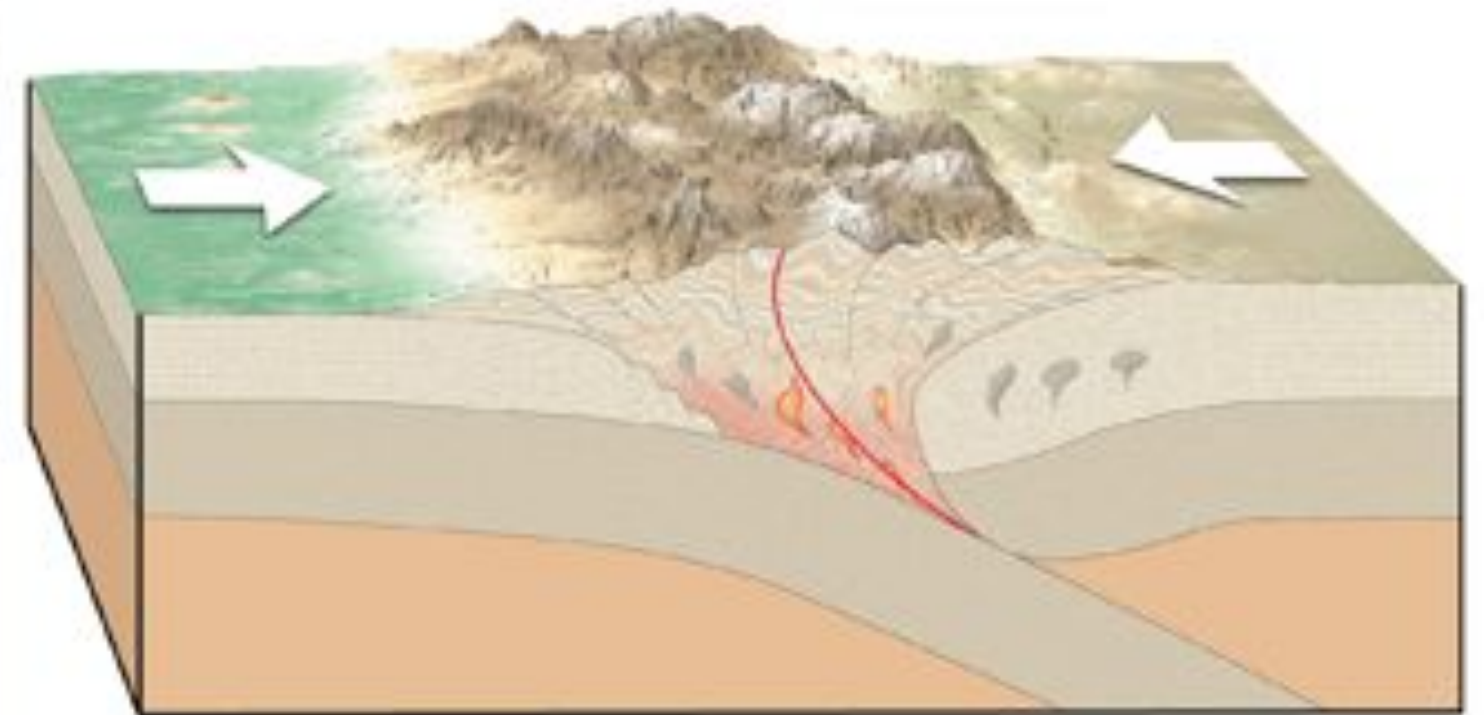
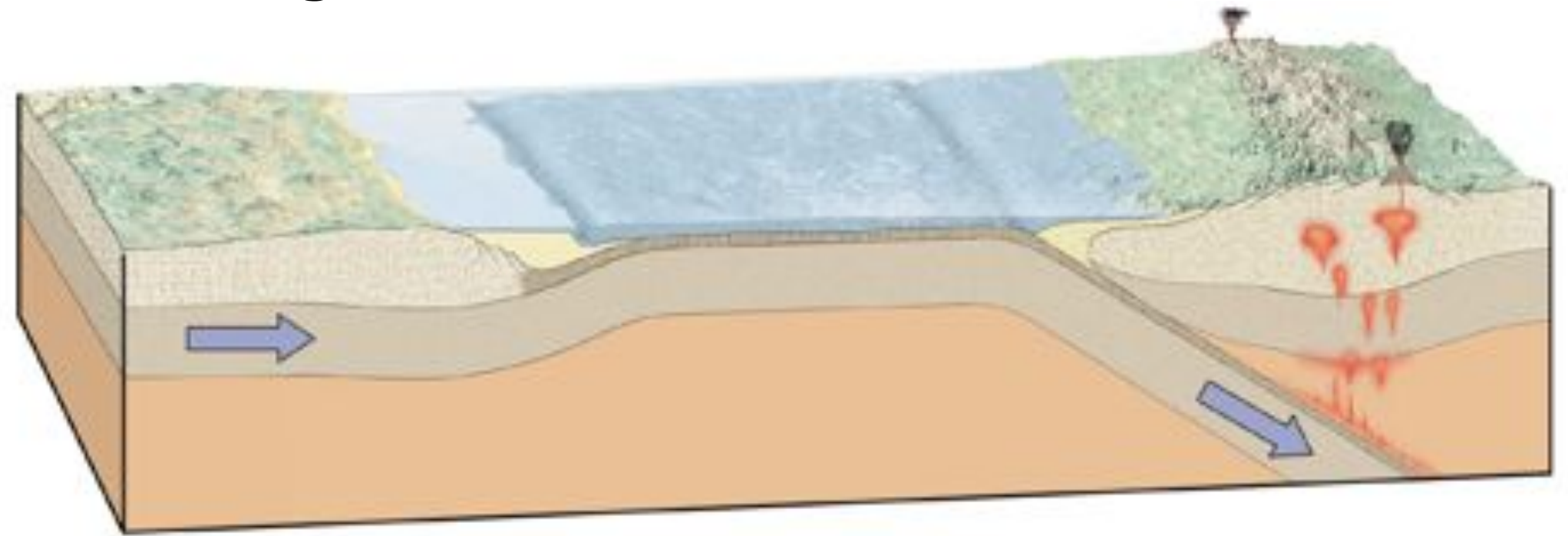




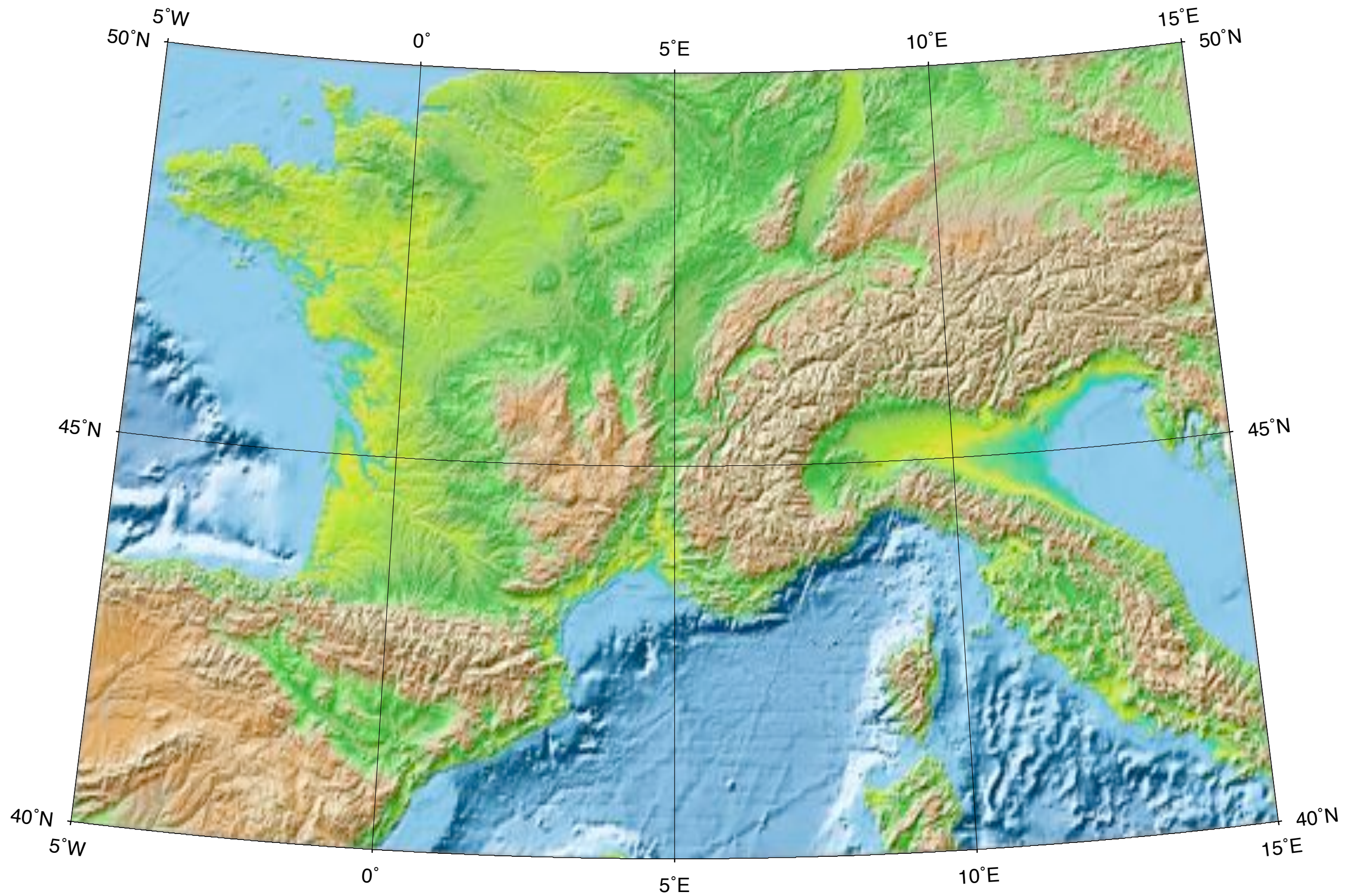
Exemple :  
Cordillère des Andes

# Collision continent - continent

- Formation d'une chaîne de montagnes
- Sismicité
- Magmatisme acide



# En Europe occidentale



# Les Alpes

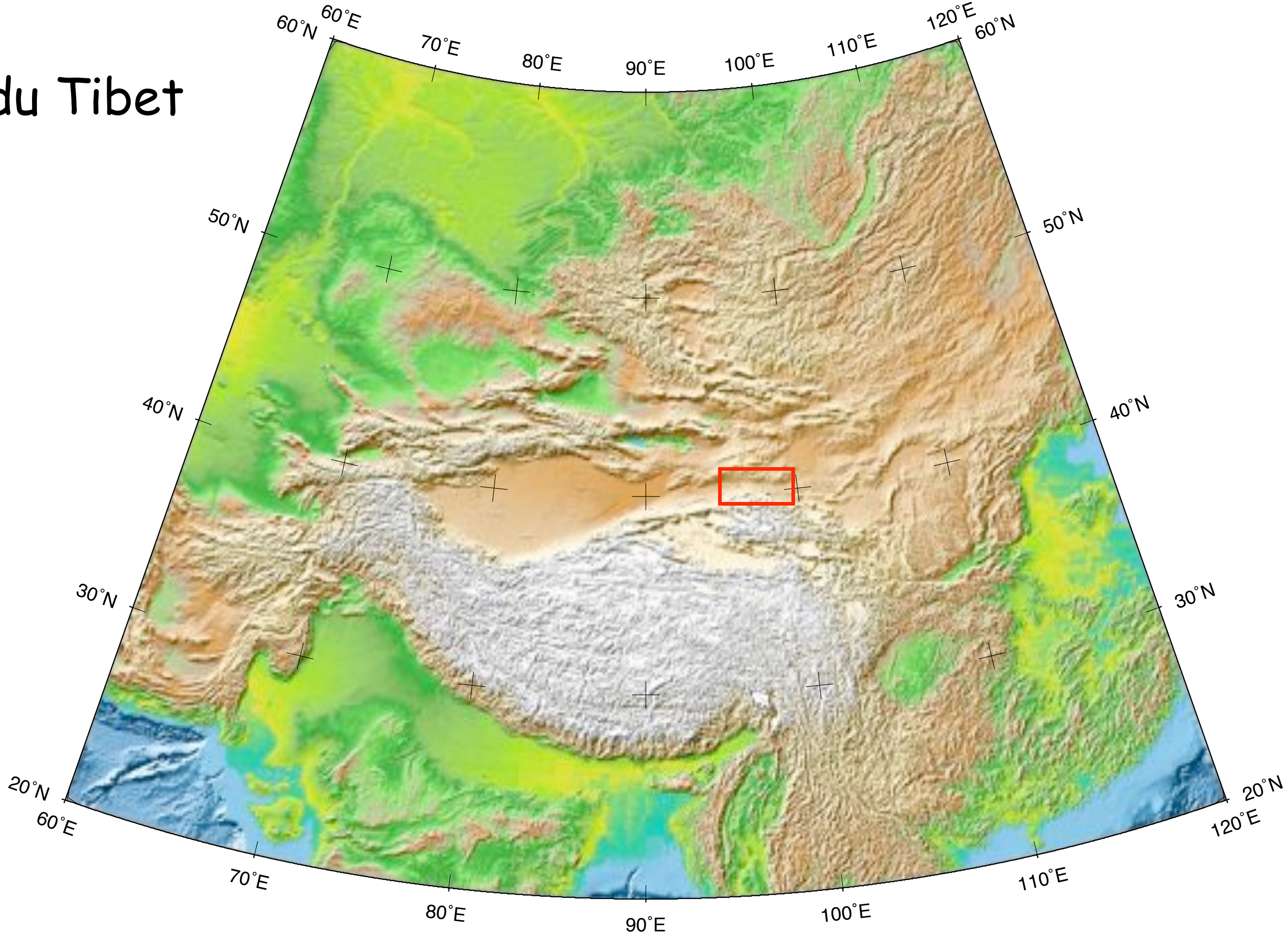


# La chaîne Himalayenne

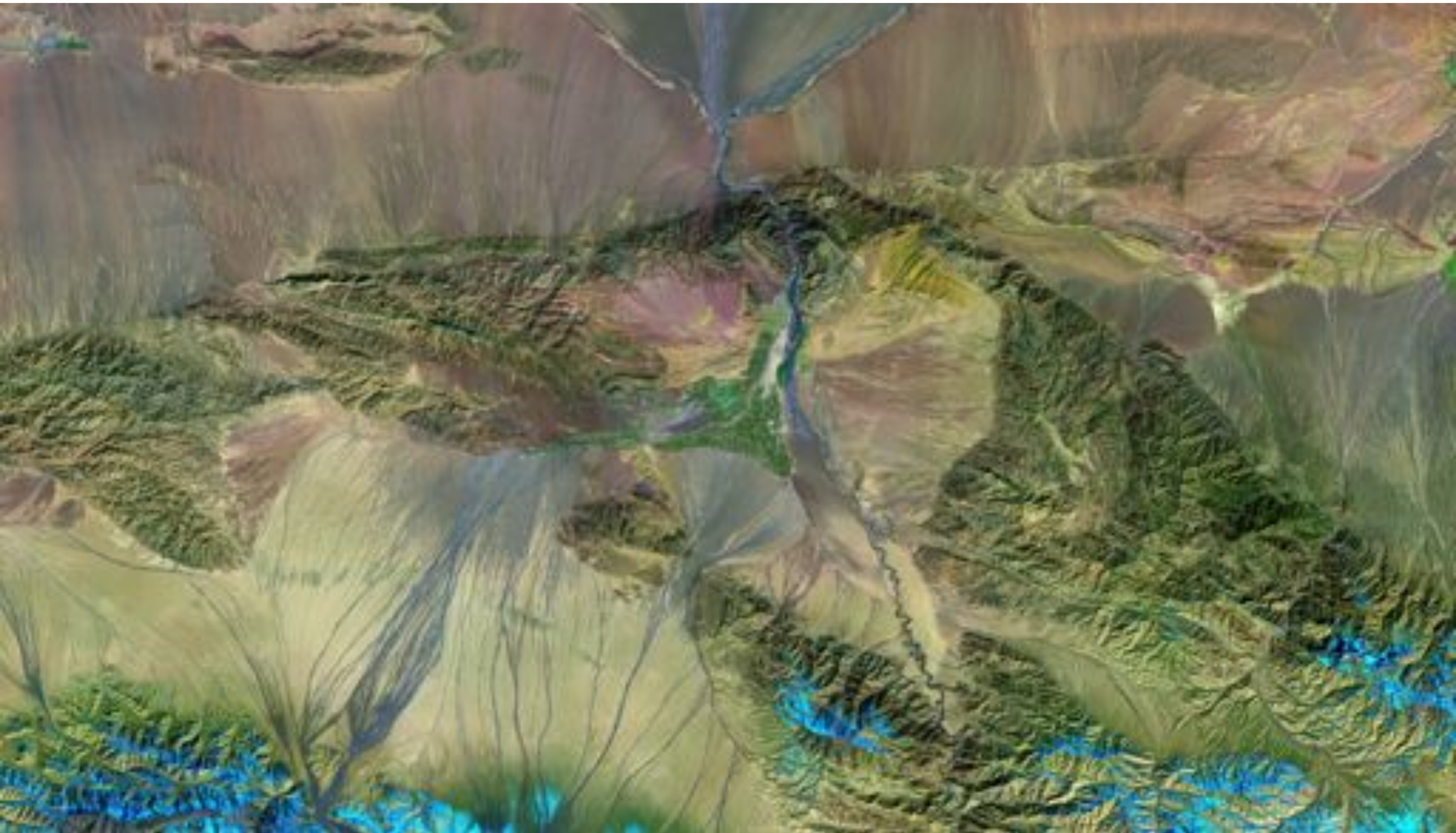




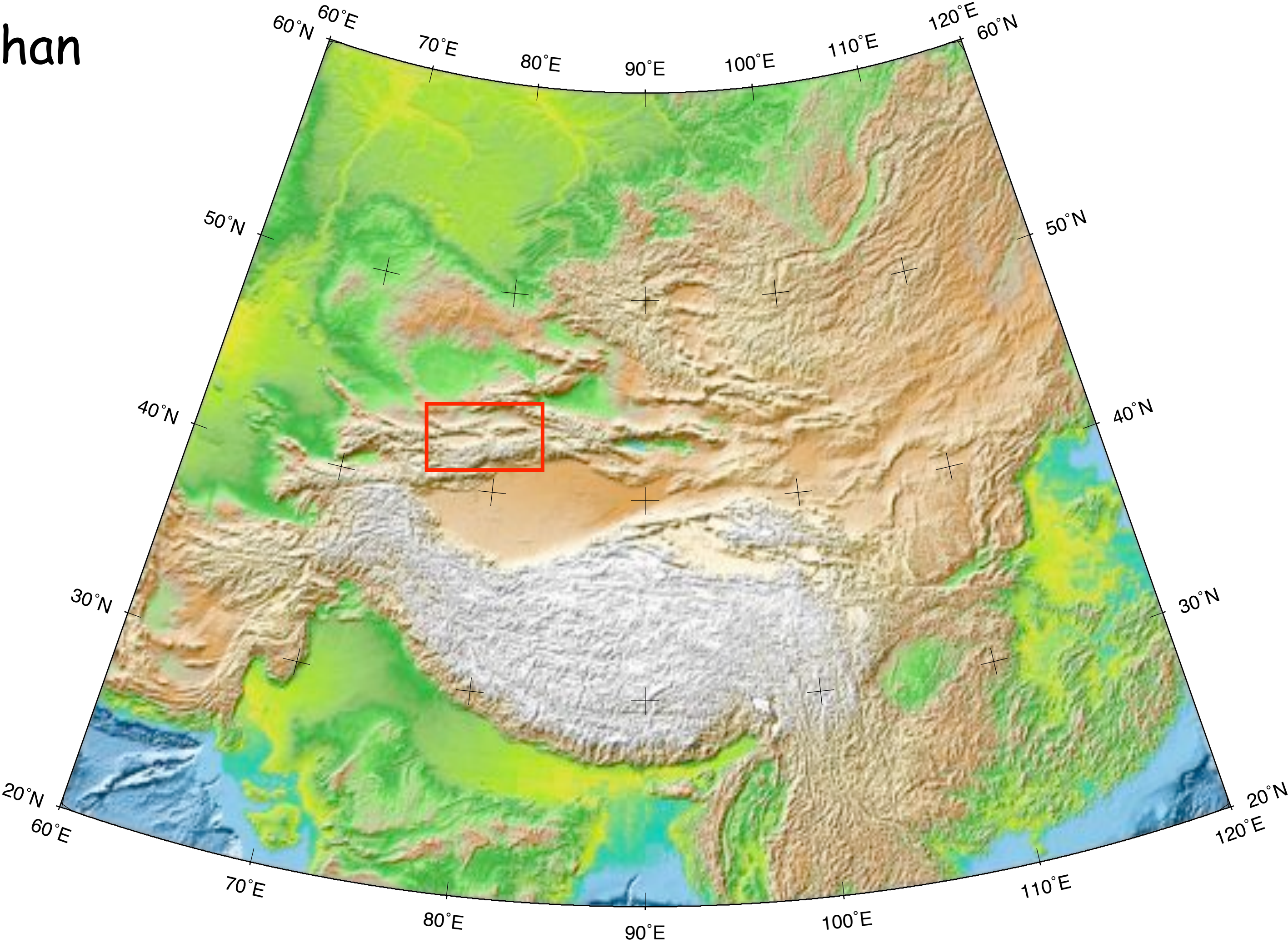
# Au nord du Tibet



# Image Landsat 7



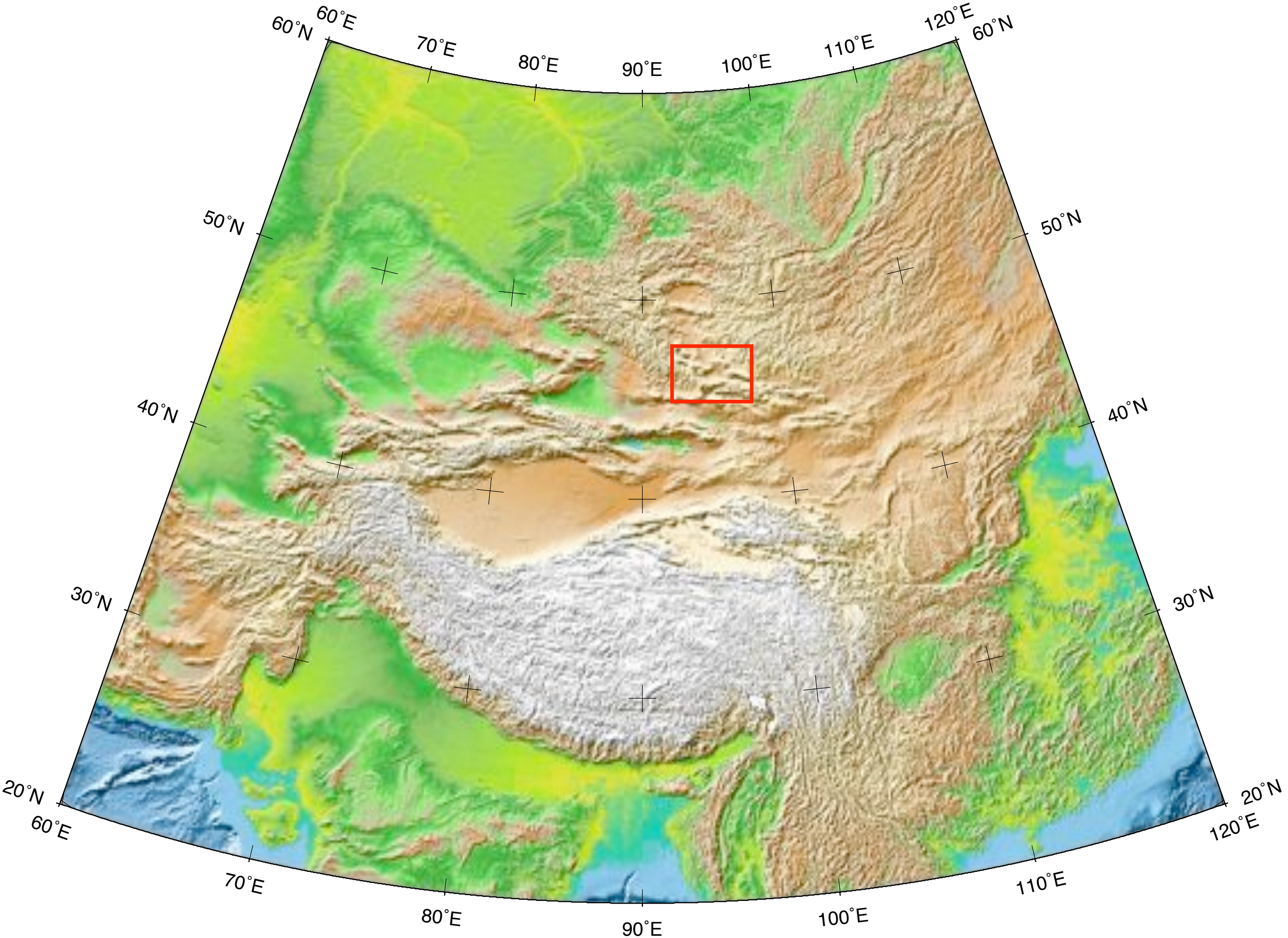
# Le Tienshan



# Image navette spatiale



# L'Altai



# Gobi - Altai

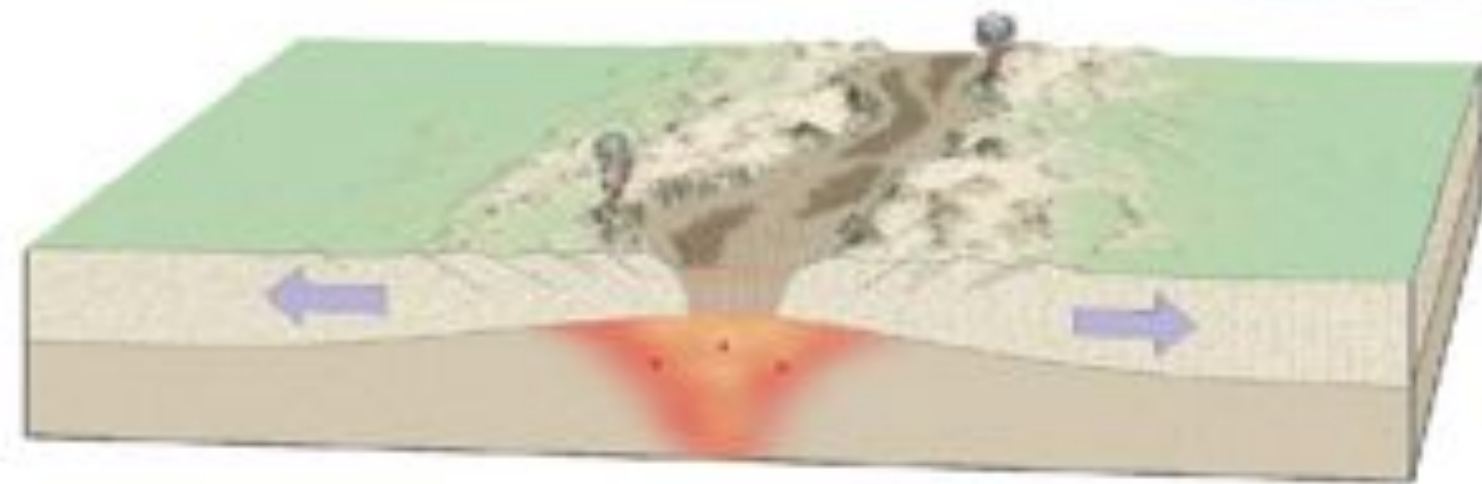


# Rifts = extension localisée

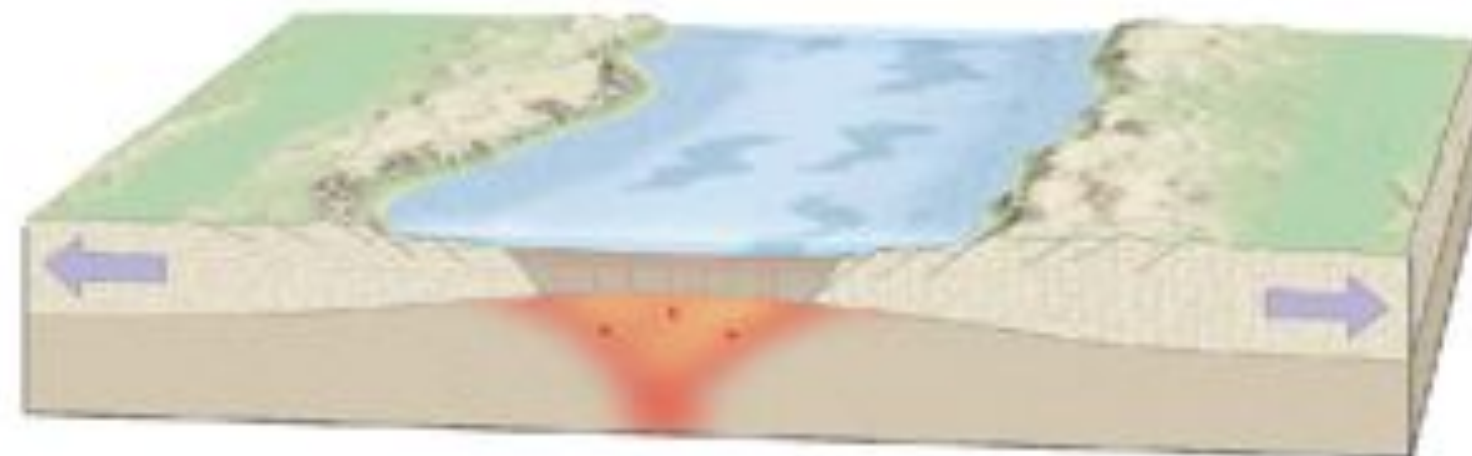
Chine du nord



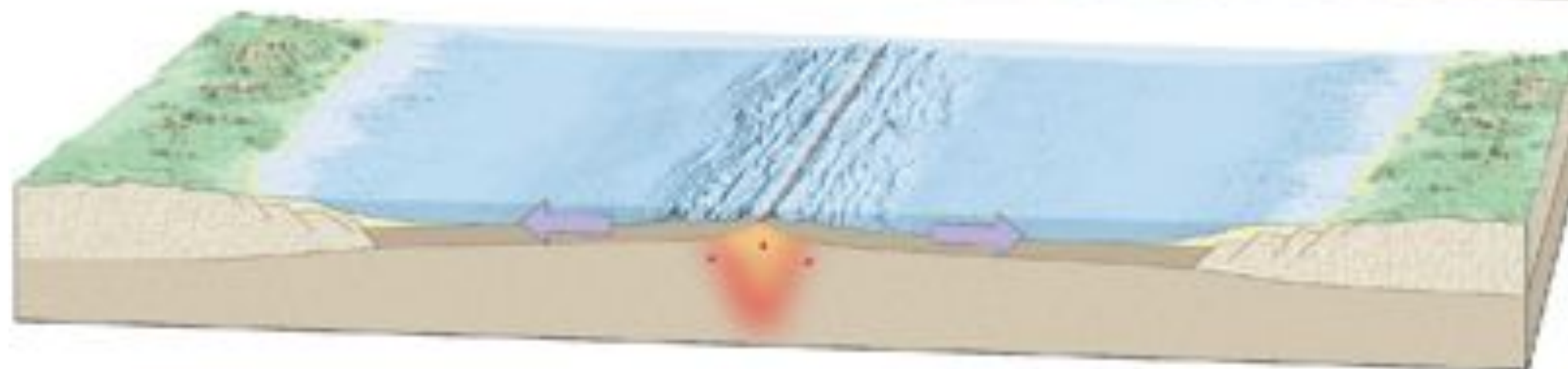
Rift africain  
Baikal  
Graben du Rhin



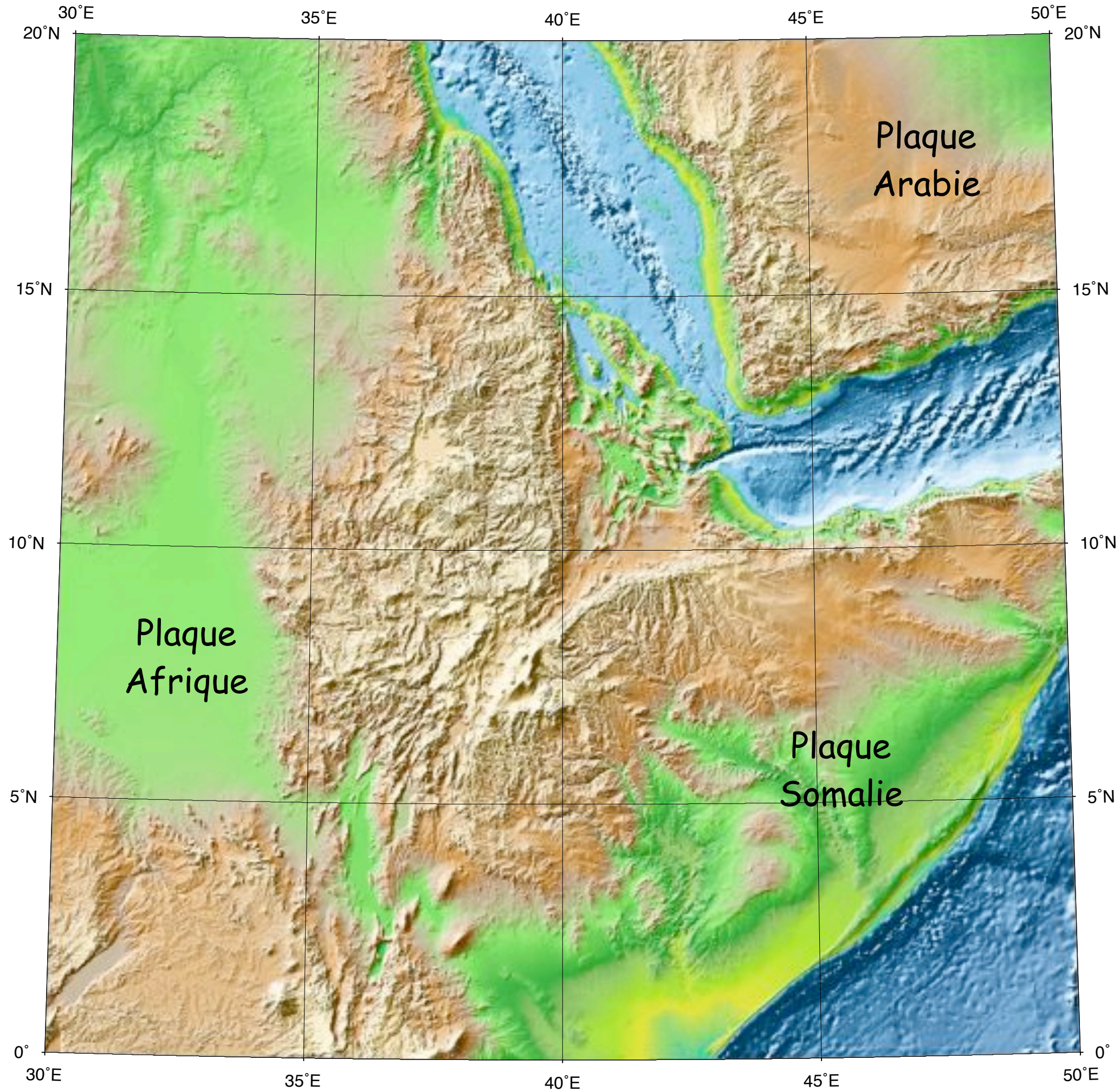
Mer Rouge



Océan

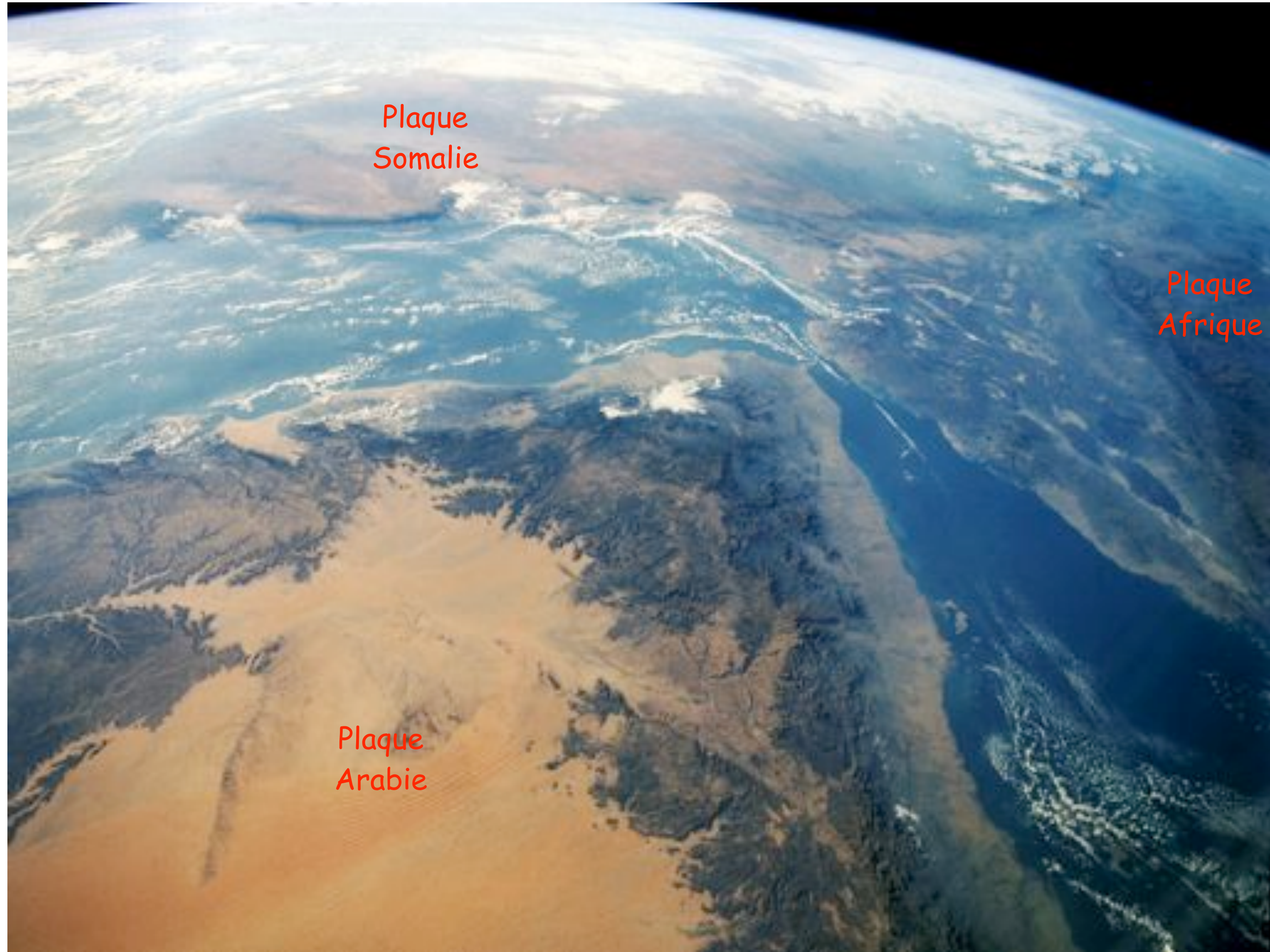


# Point triple Mer Rouge - Aden - Rift Ethiopien





# Point triple : Aden - Mer Rouge - Rift Ethiopien



Plaque  
Somalie

Plaque  
Afrique

Plaque  
Arabie

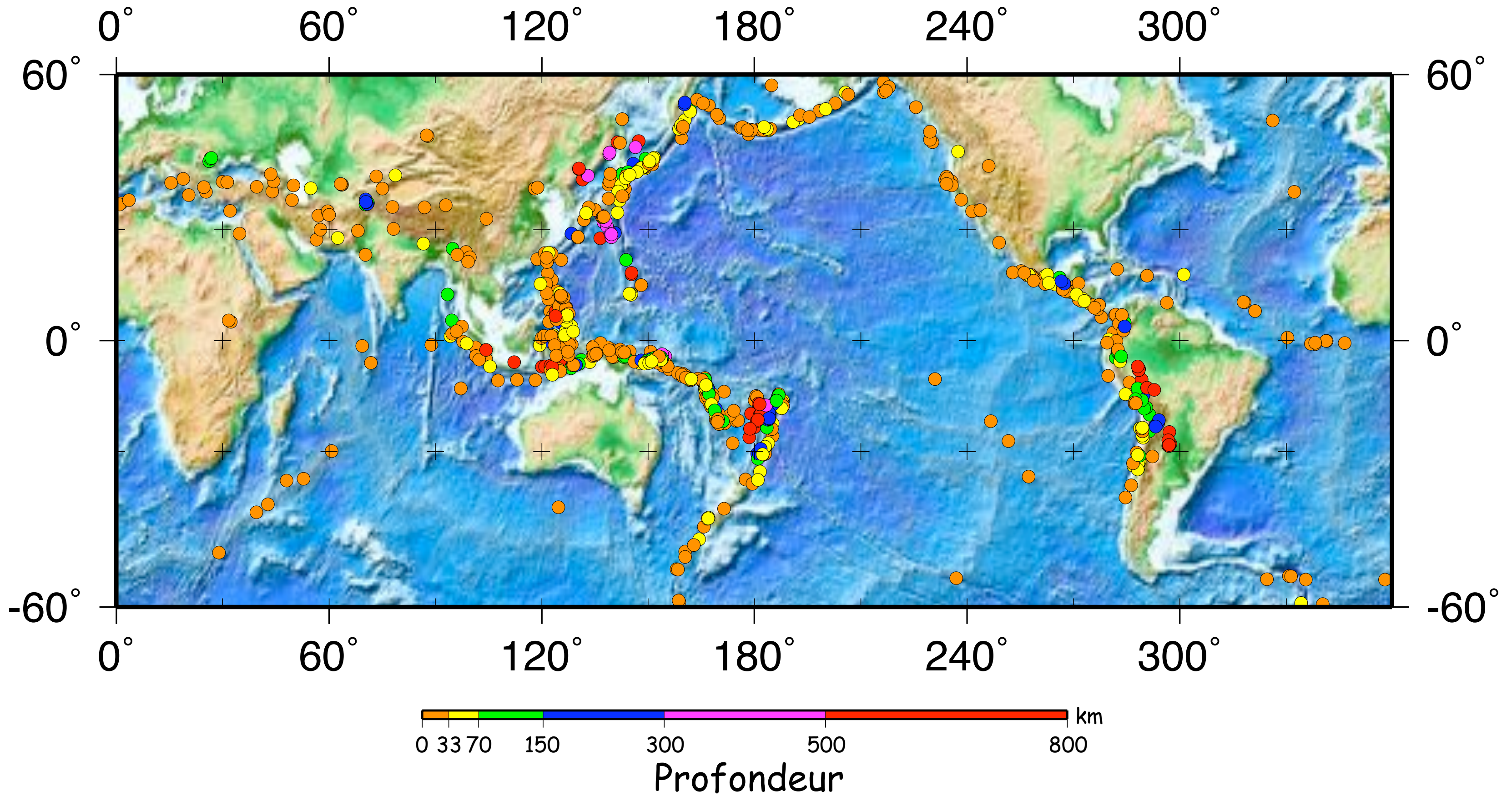
# Région du Basin and Range (Nevada, USA)



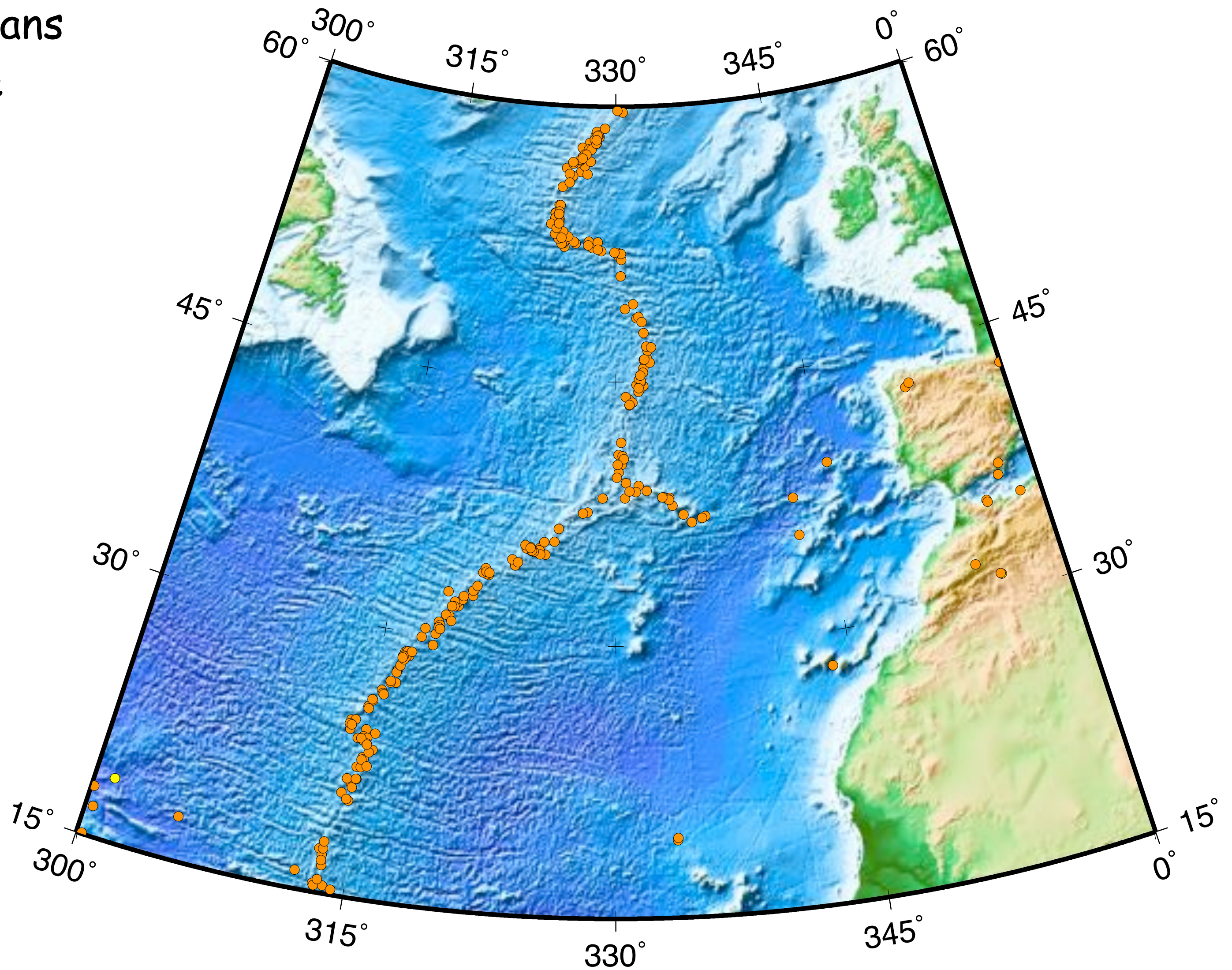
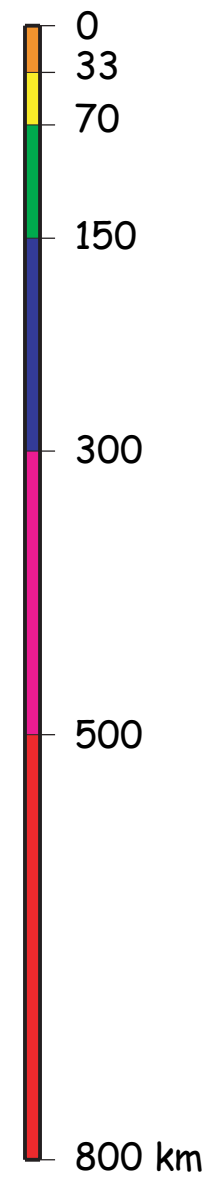
Âge de la lithosphère océanique  $\leq 180$  Ma  
Âge de la lithosphère continentale  $\leq 3.8$  Ga



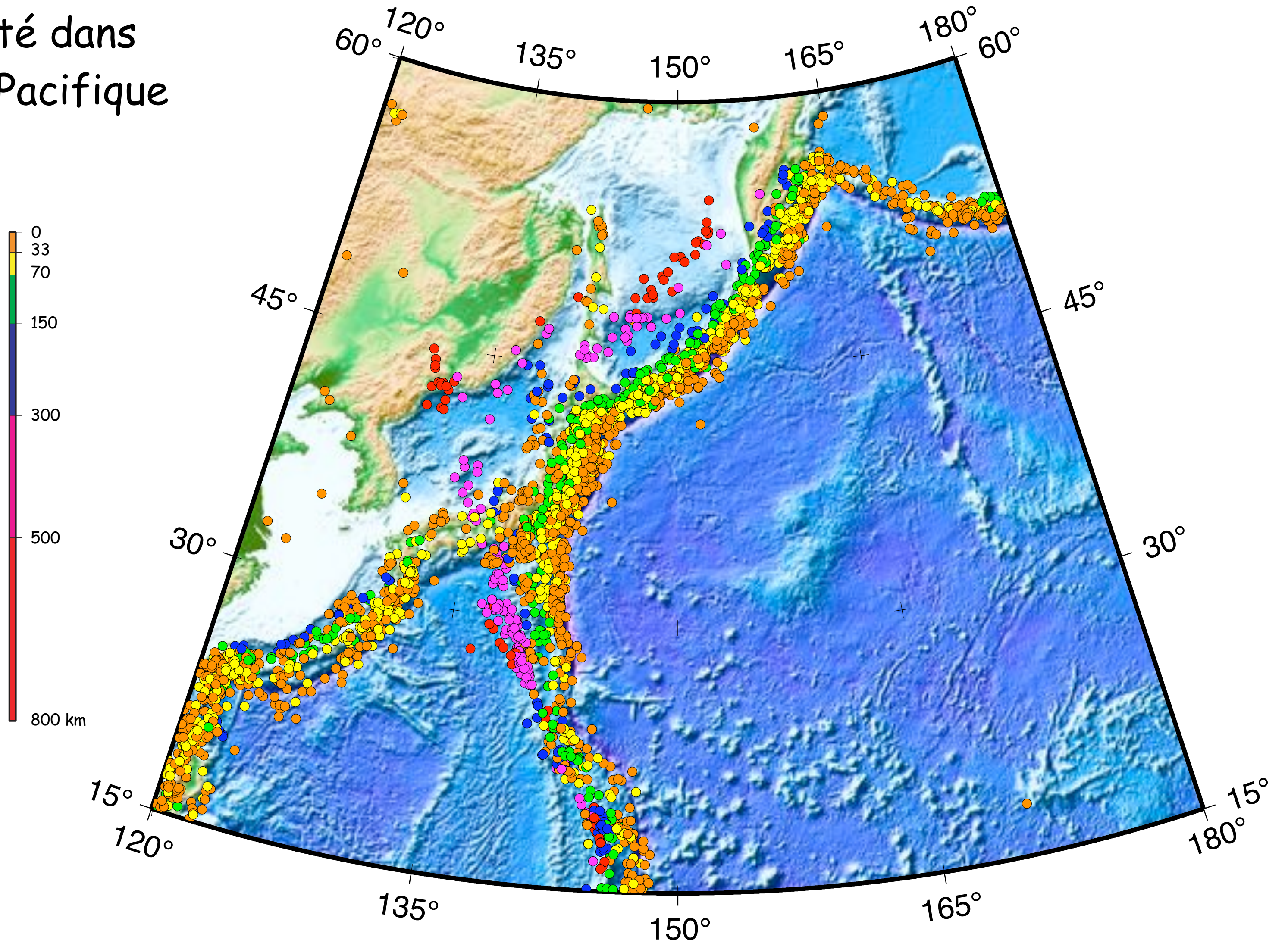
# Sismicité mondiale 1998 - 2002



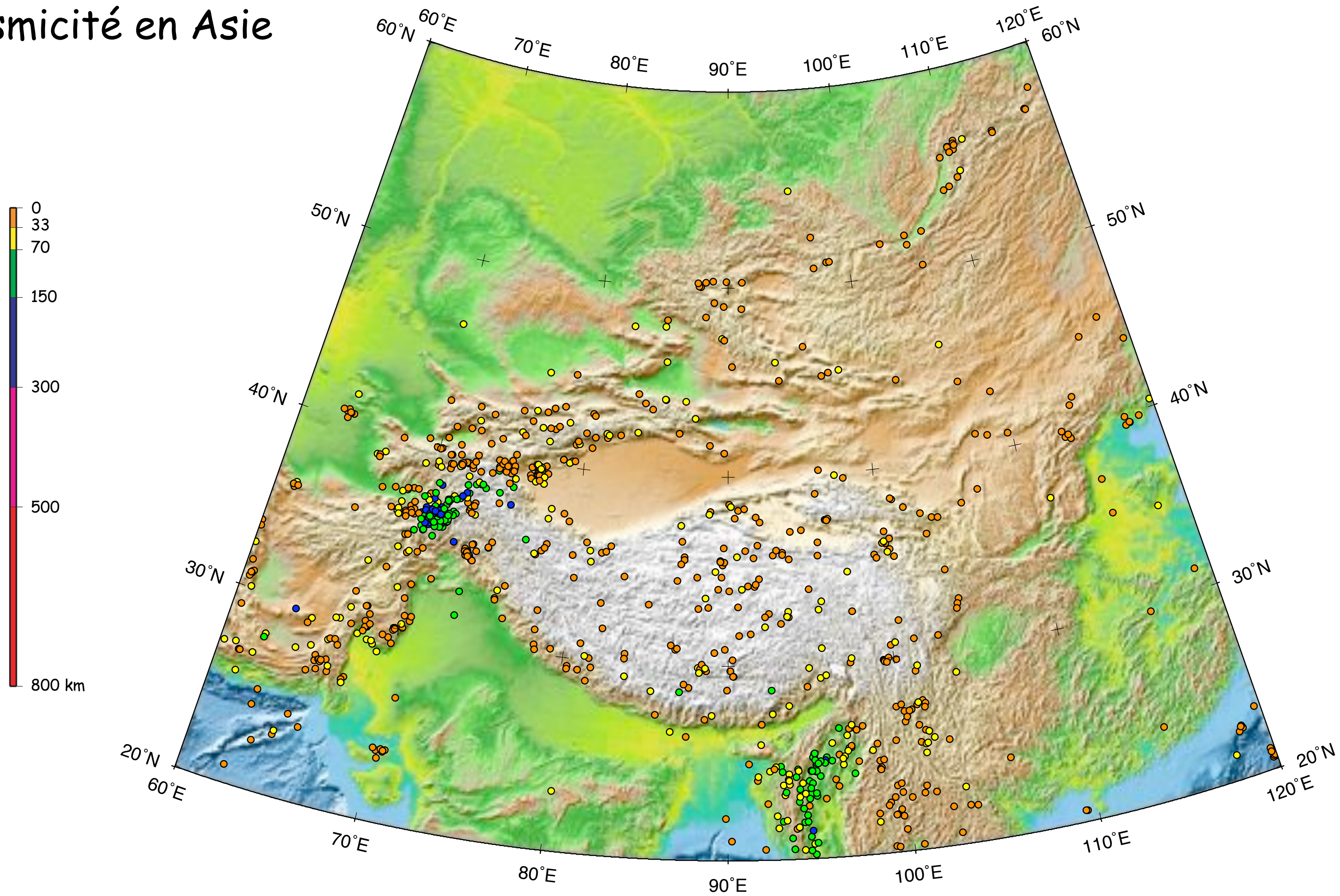
# Sismicité dans l'Atlantique



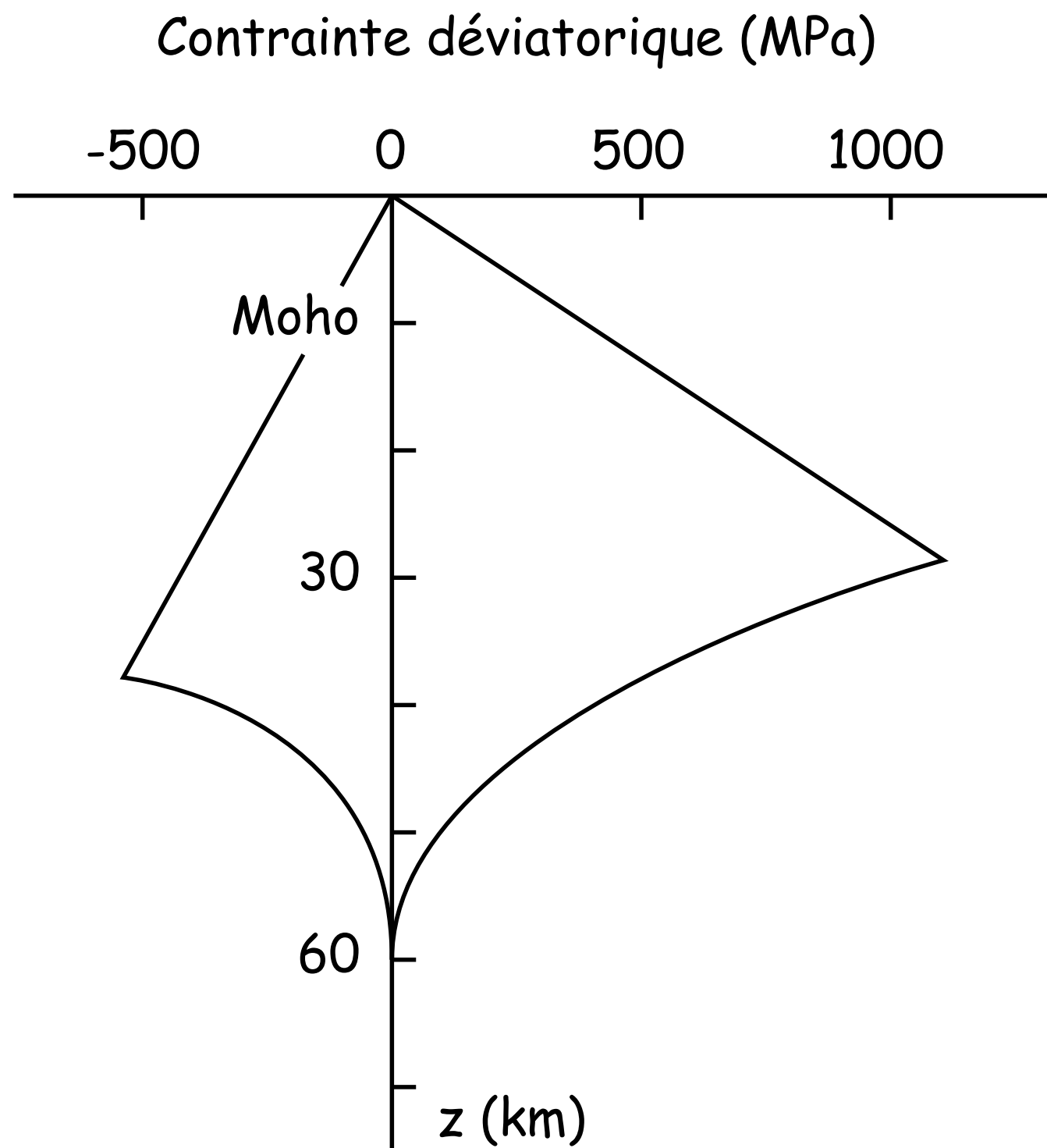
# Sismicité dans l'ouest Pacifique



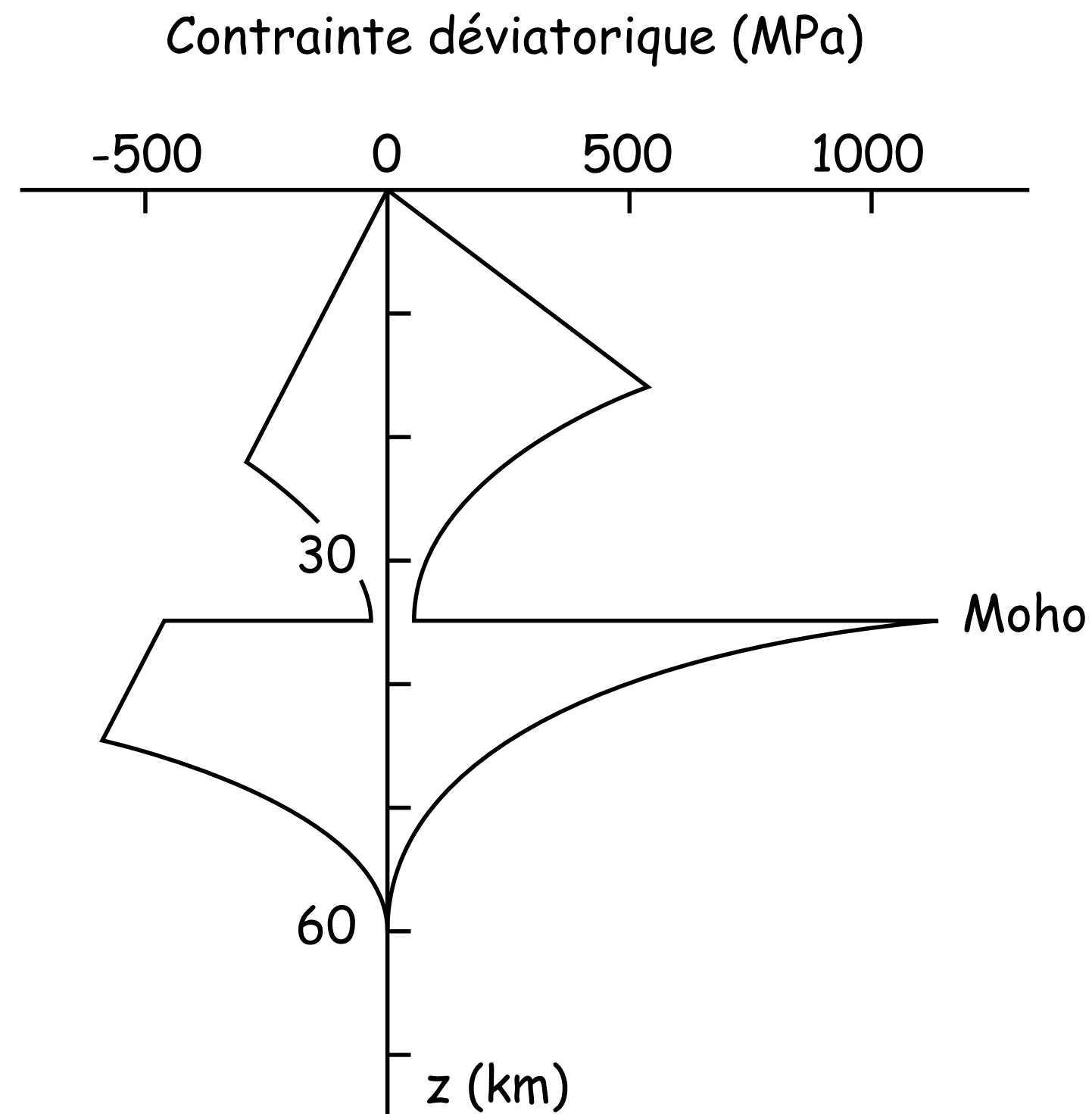
# Sismicité en Asie



# Propriétés mécaniques de la lithosphère



Lithosphère océanique



Lithosphère continentale