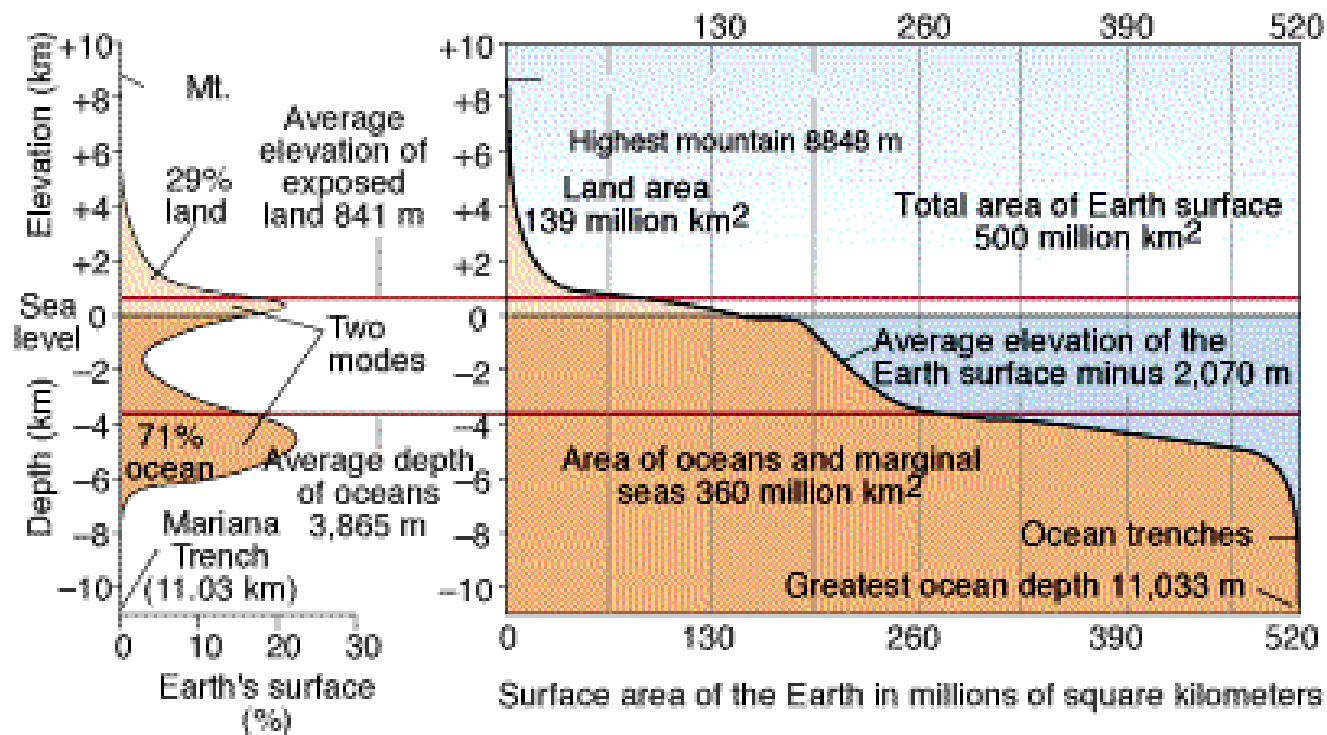


Première carte des fonds océaniques (Heezen et Tharp, 1977): médio-océaniques, zones de fracture, marges continentales, fosses océaniques, monts sous-marins.



© 1998 Wadsworth Publishing Company/ITP



PierreBedard.ca

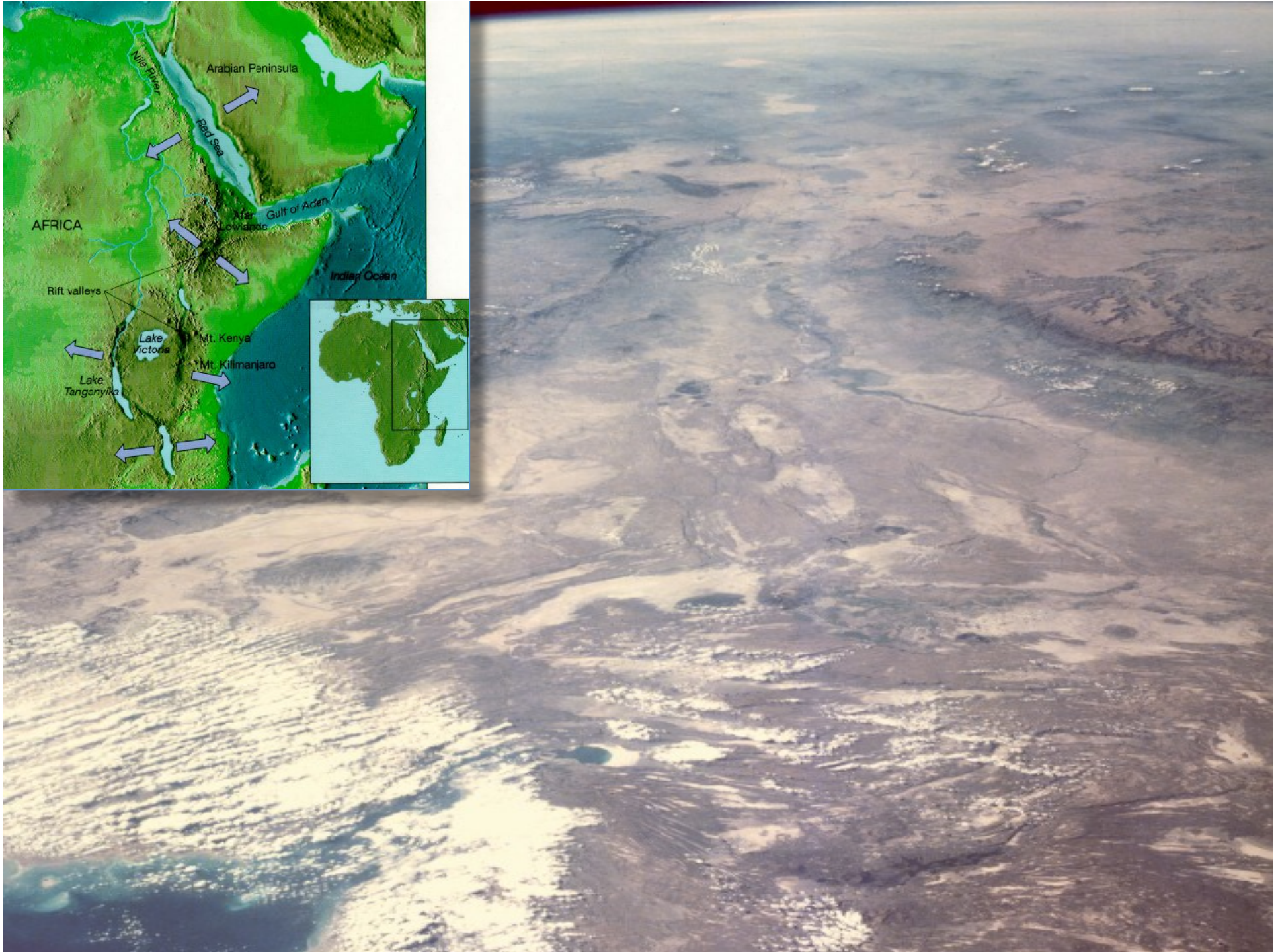
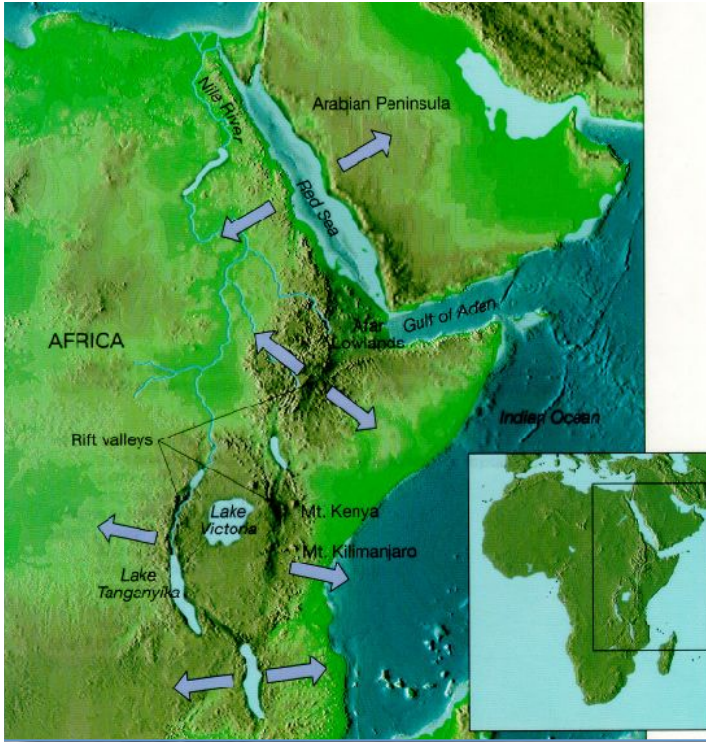


Photographie : Pierre Thomas

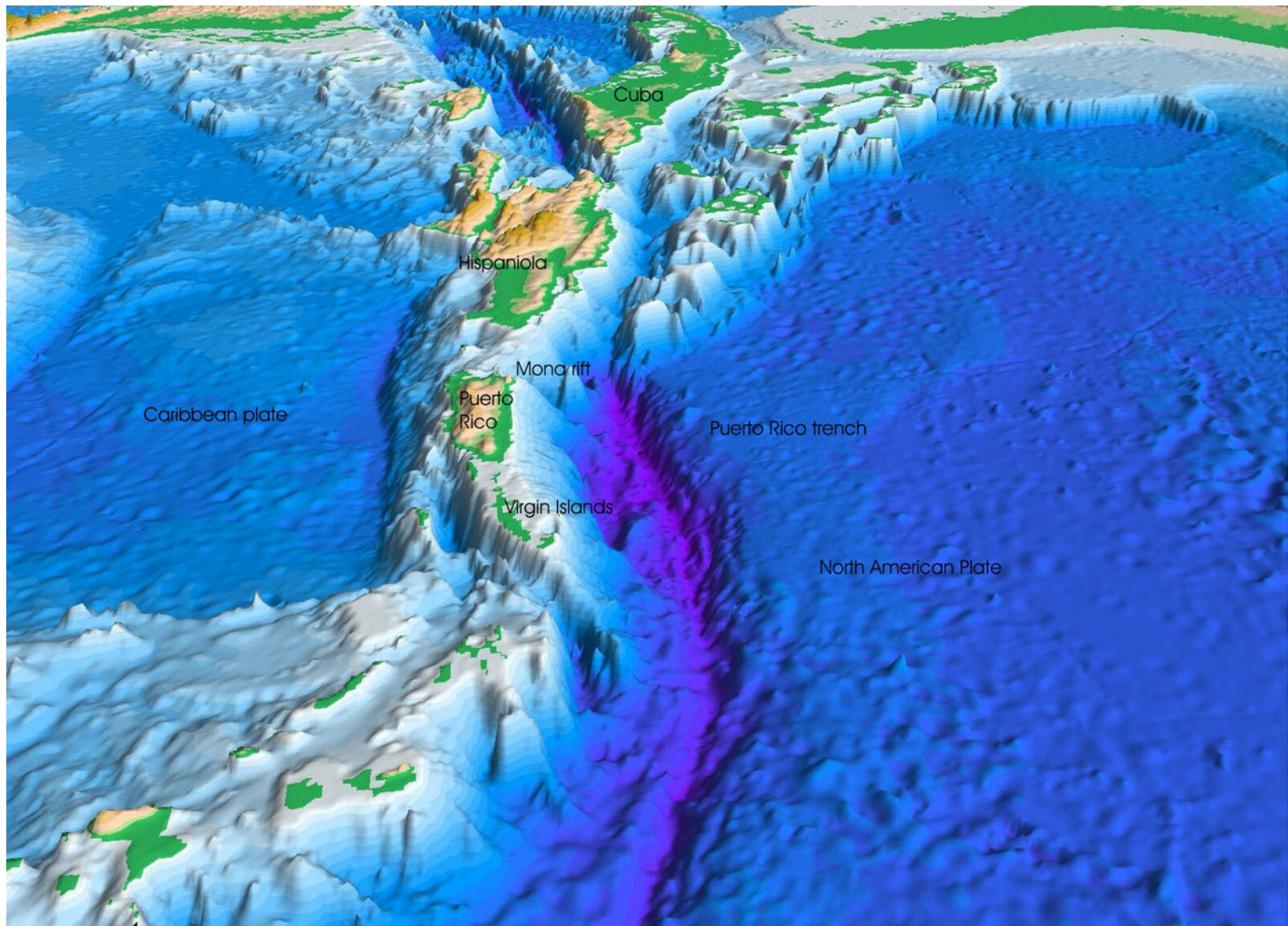


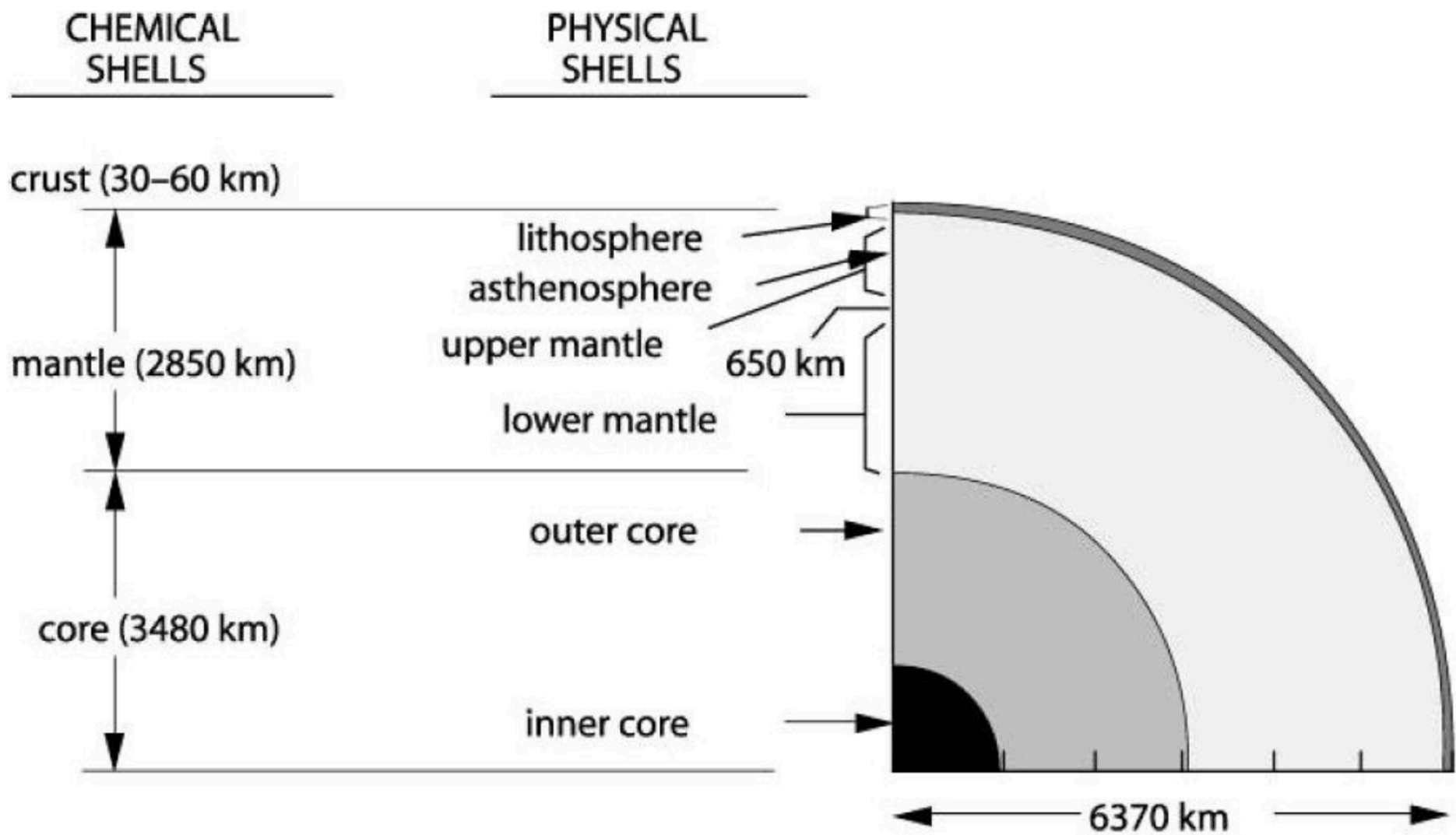


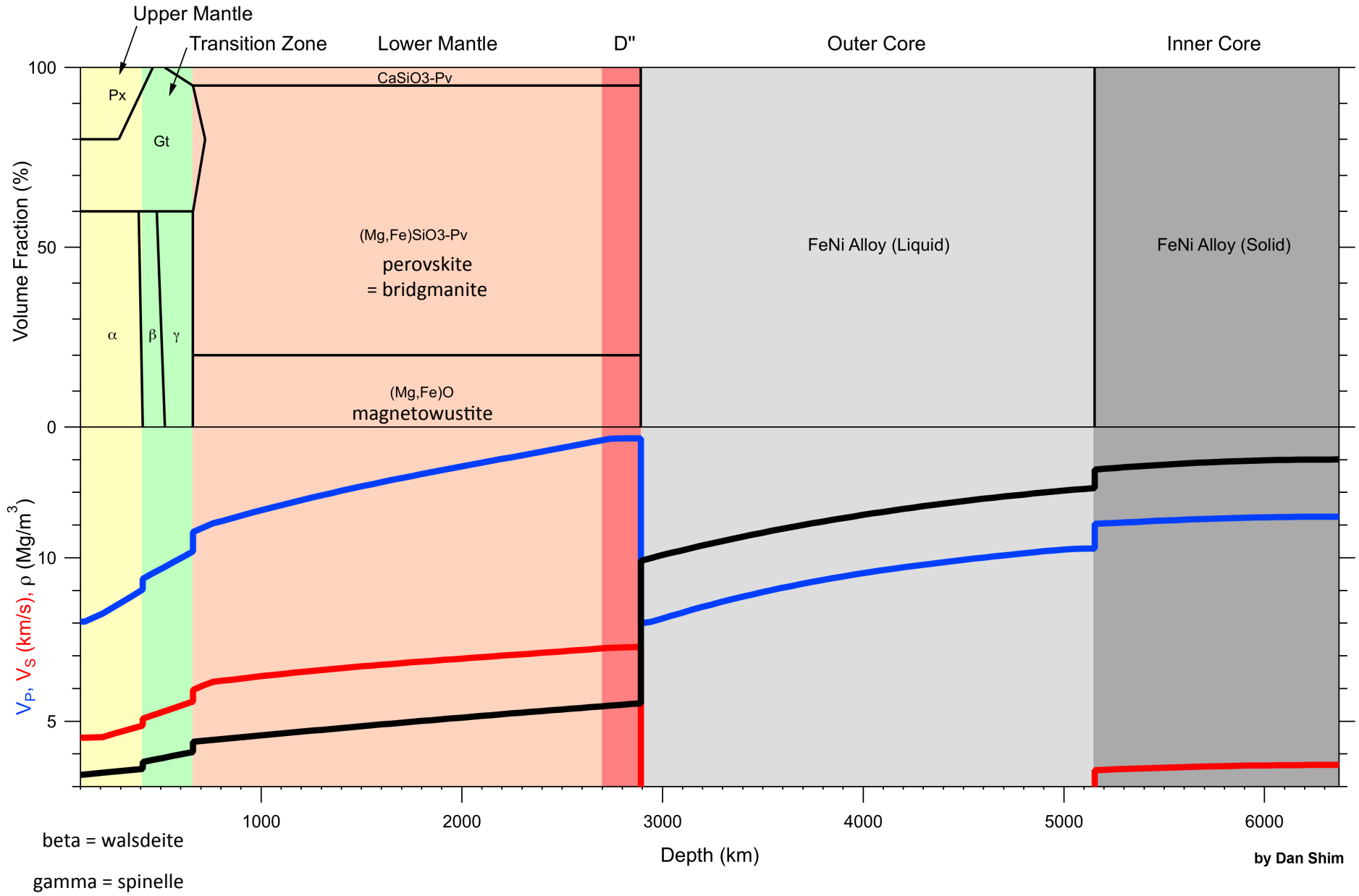
Space-shuttle view to west of the Himalayan foreland basin (left), the Himalayas (snow-covered mountains), and the Tibetan Plateau (low relief plateau with large lakes).

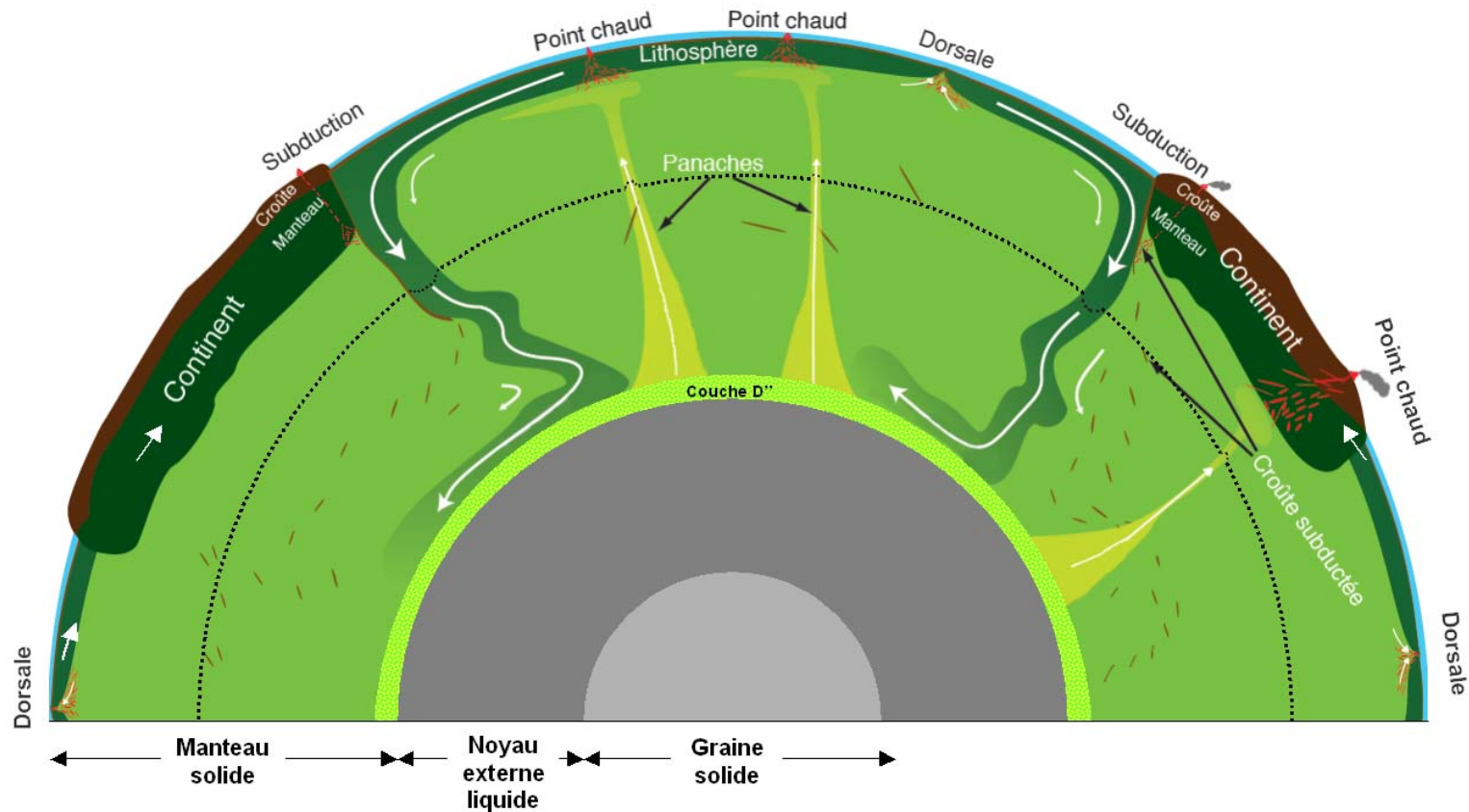




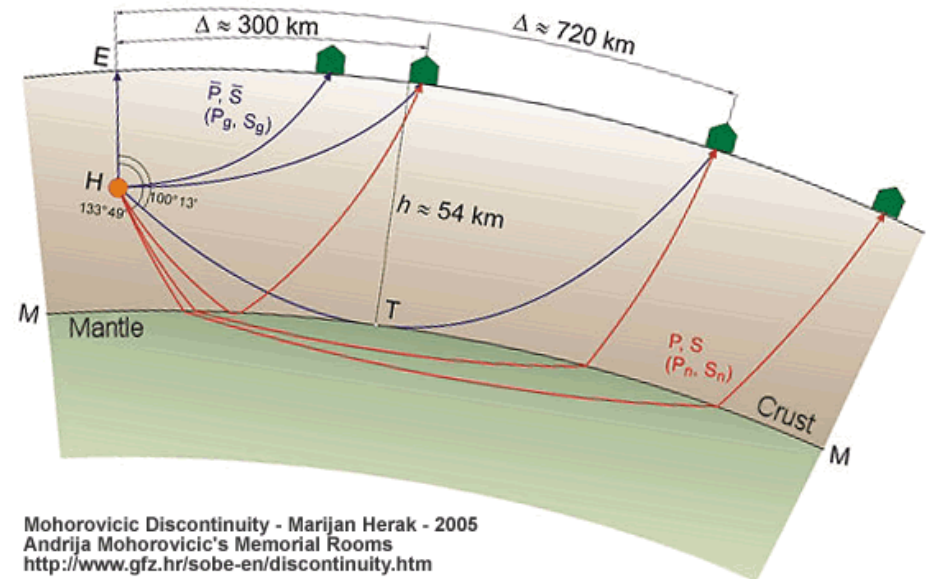
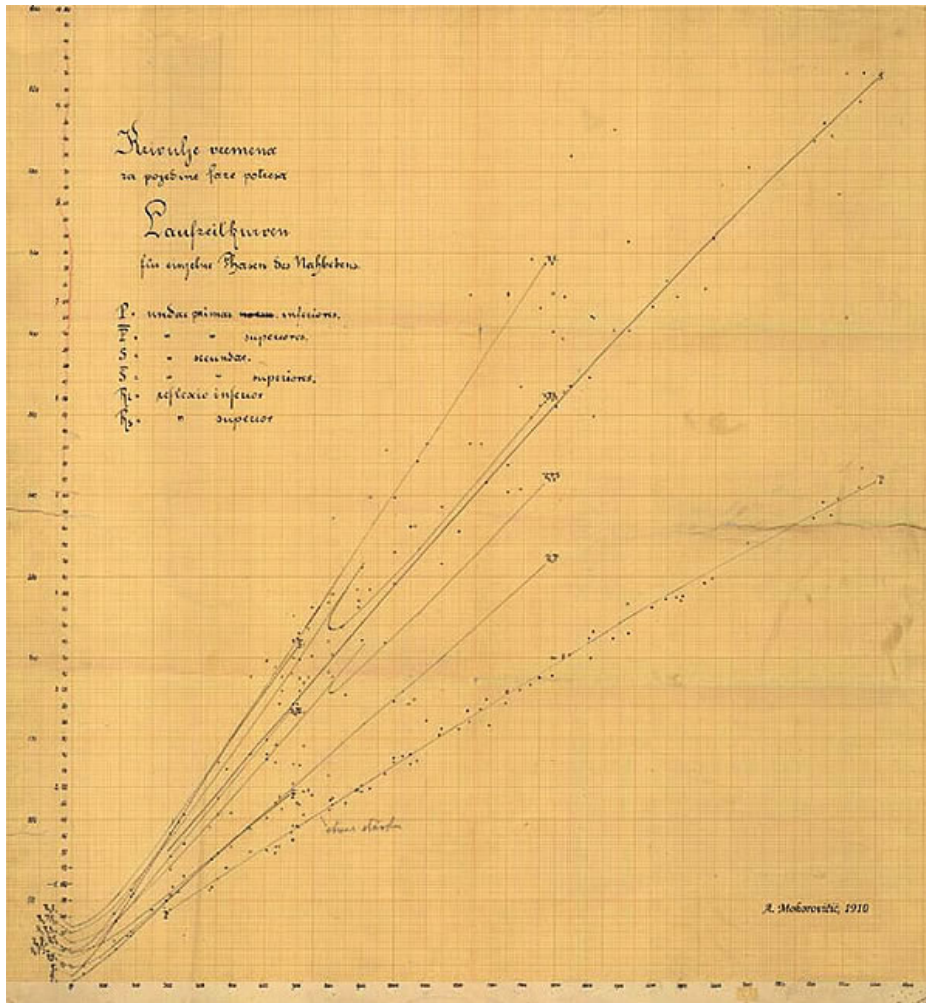




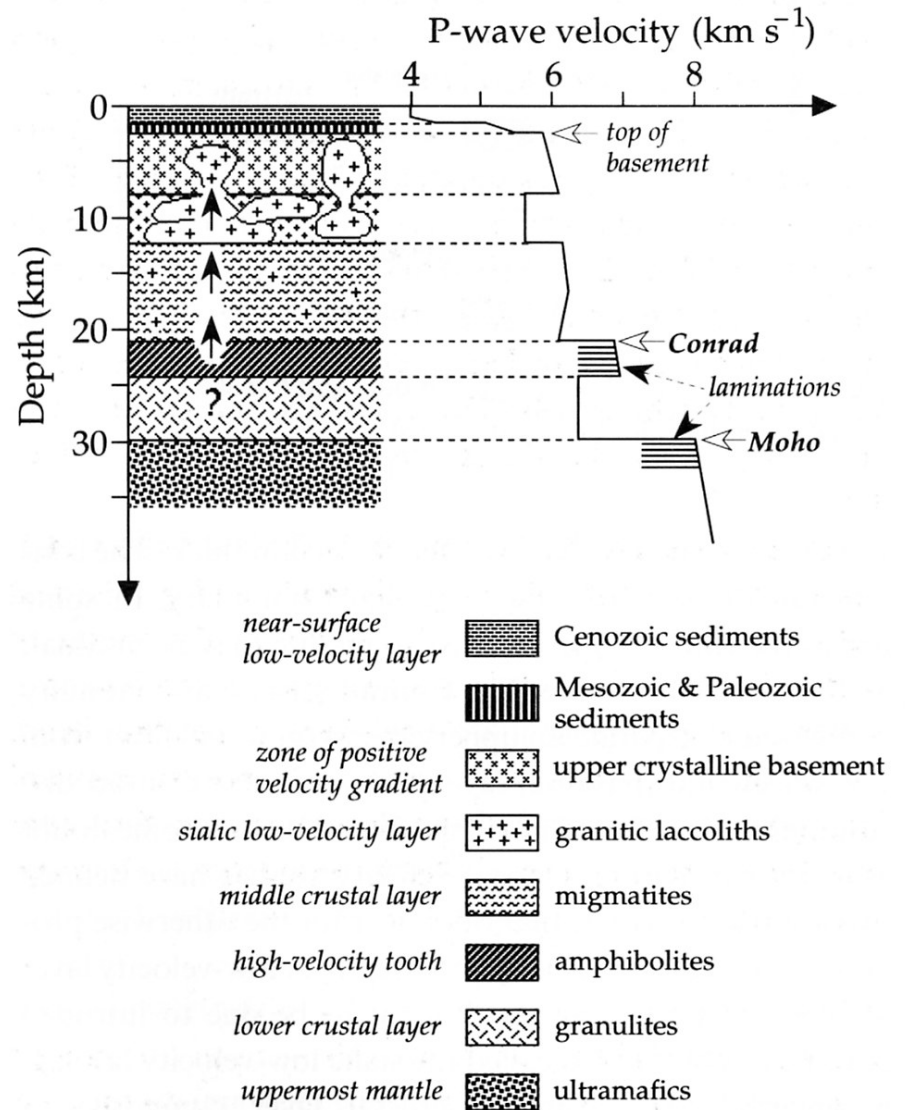
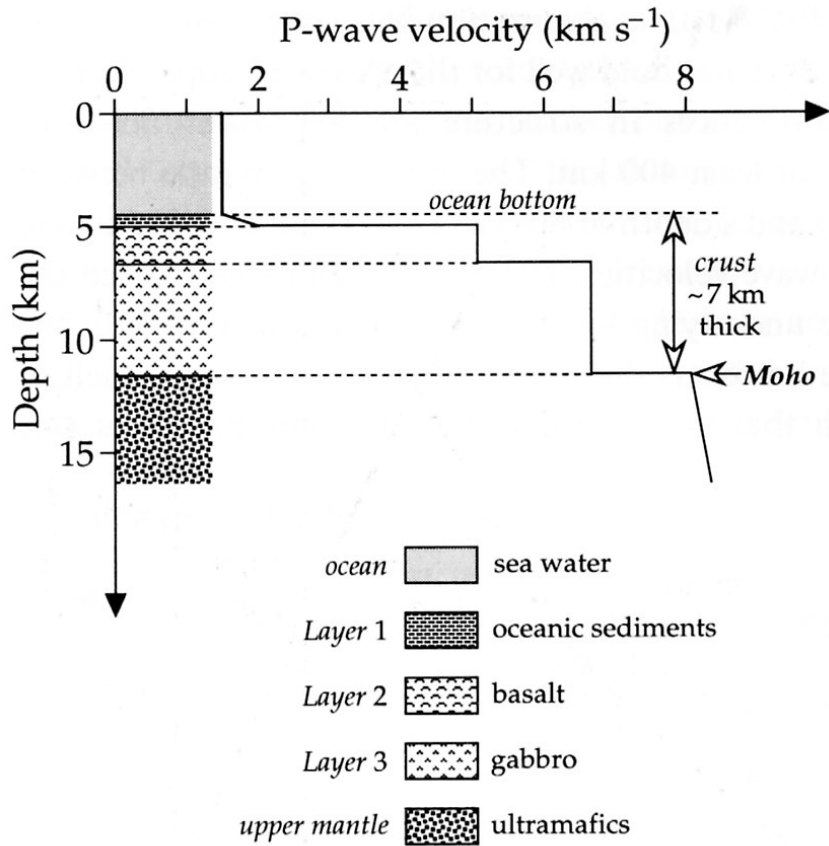




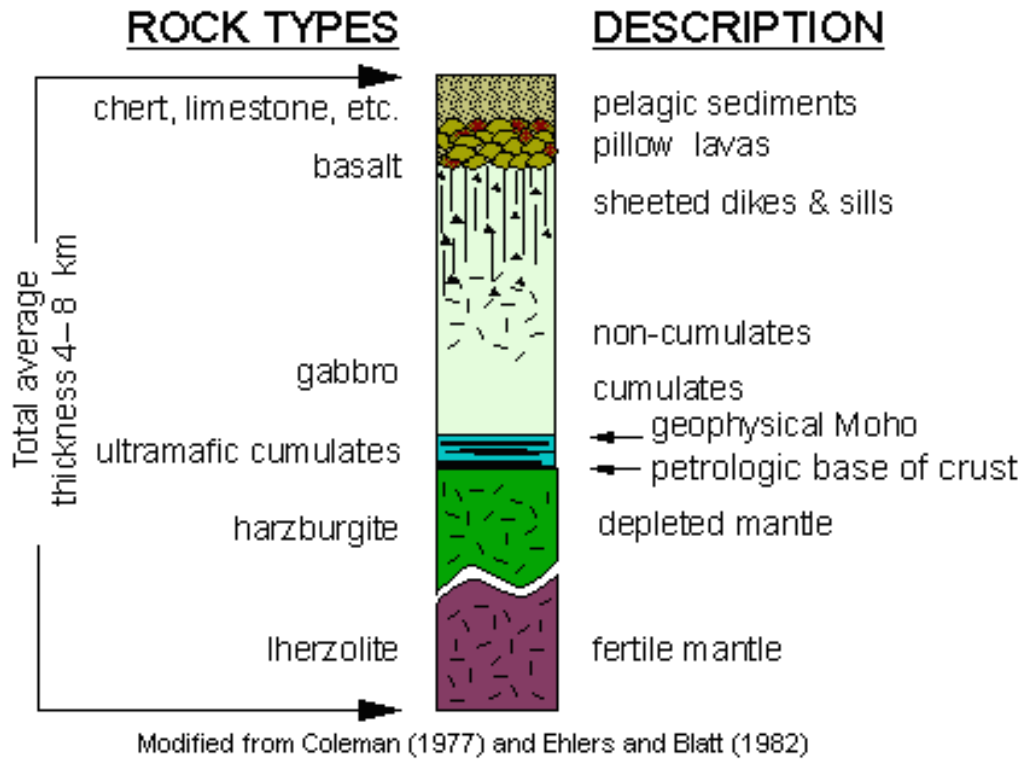
Ce schéma insiste sur l'importance des subductions, qui mettent en mouvement la lithosphère, et sur le côté superficiel et passif des dorsales, qui ne font que combler l'écartement engendré par le mouvement des plaques. Dans ce schéma, la taille des flèches blanches indique la vitesse des mouvements. La petite taille des flèches sous-lithosphériques montre que le manteau asthénosphérique est mis en mouvement par la lithosphère, et non l'inverse comme couramment dit. Les plaques qui subduisent vont vite (≈ 10 cm/an), alors que les plaques qui ne subduisent pas sont très lentes (≈ 1 cm/an). L'ascension des panaches sous les points chaud est également actif et très rapide (> 10 cm/an).

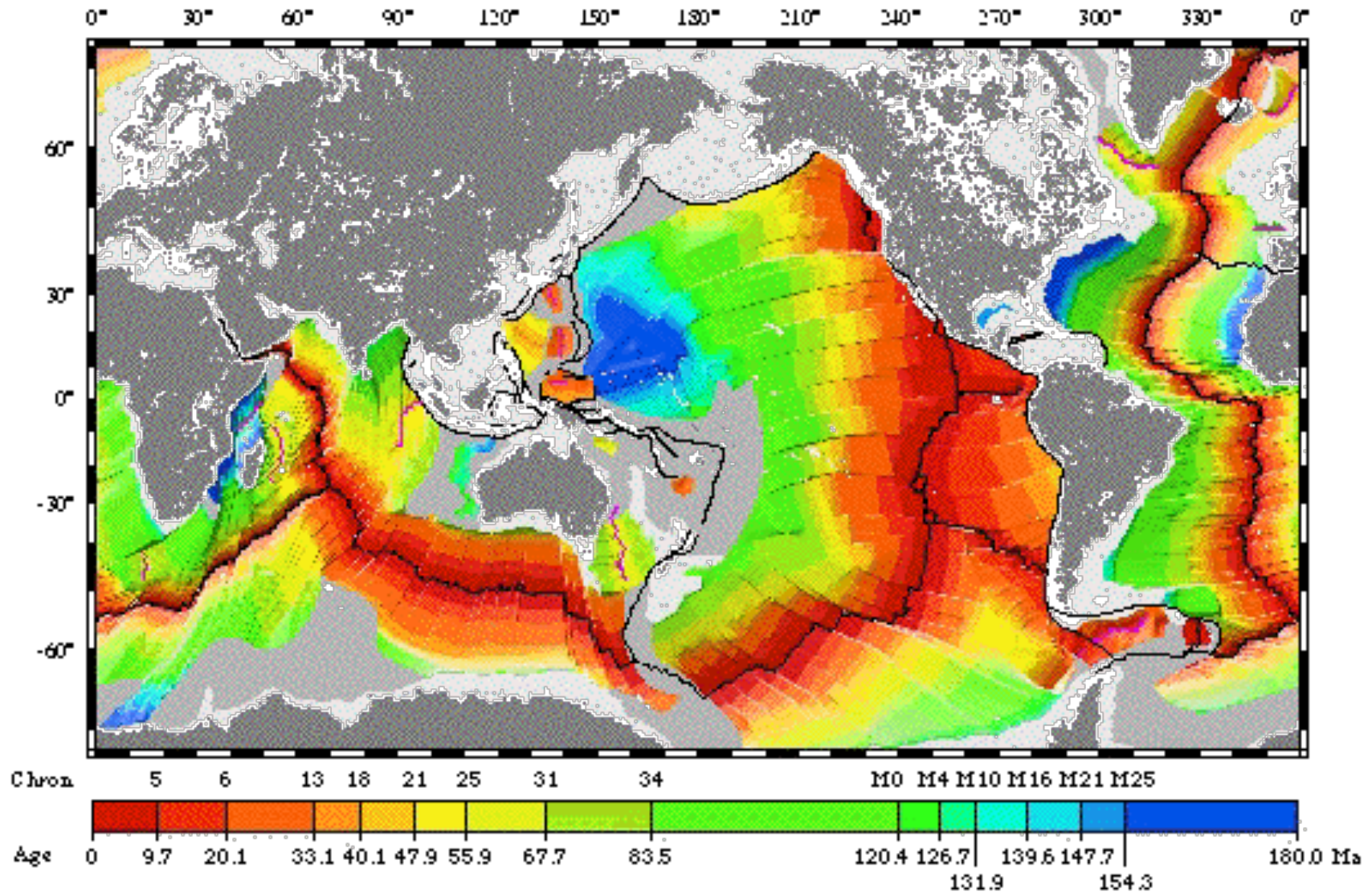


Mohorovicic Discontinuity - Marijan Herak - 2005
 Andrija Mohorovicic's Memorial Rooms
<http://www.gfz.hr/sobe-en/discontinuity.htm>

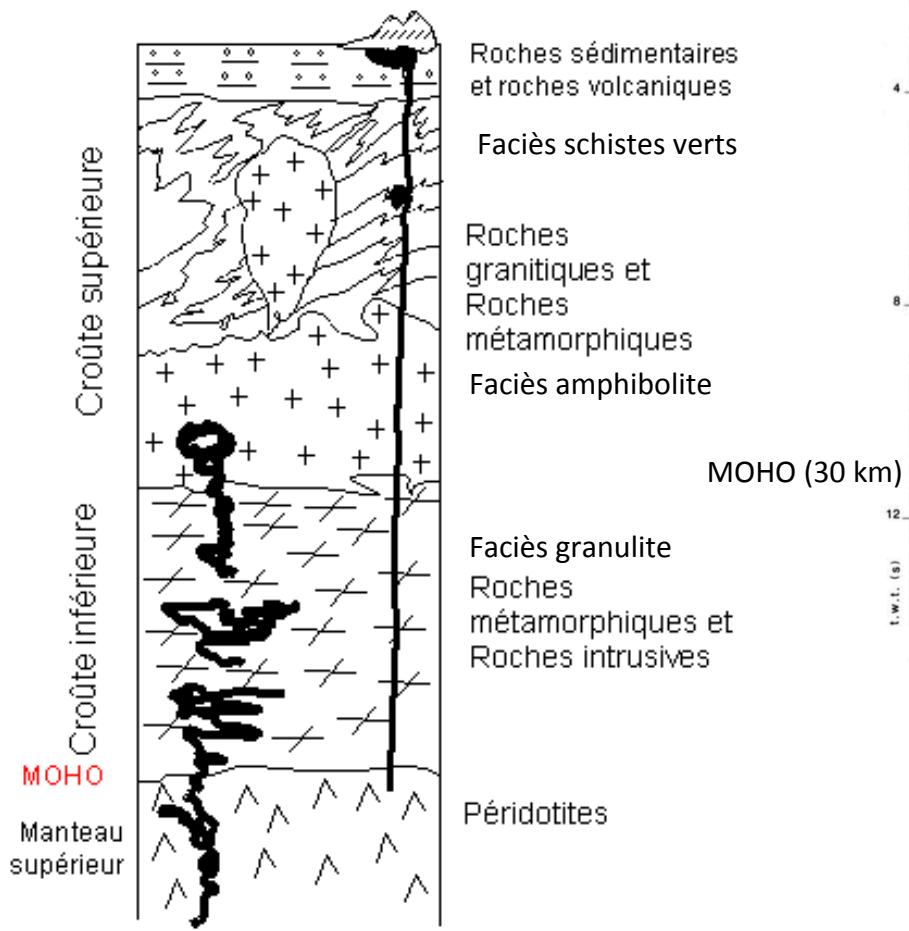


IDEALIZED CROSS-SECTION OF AN OPHIOLITE

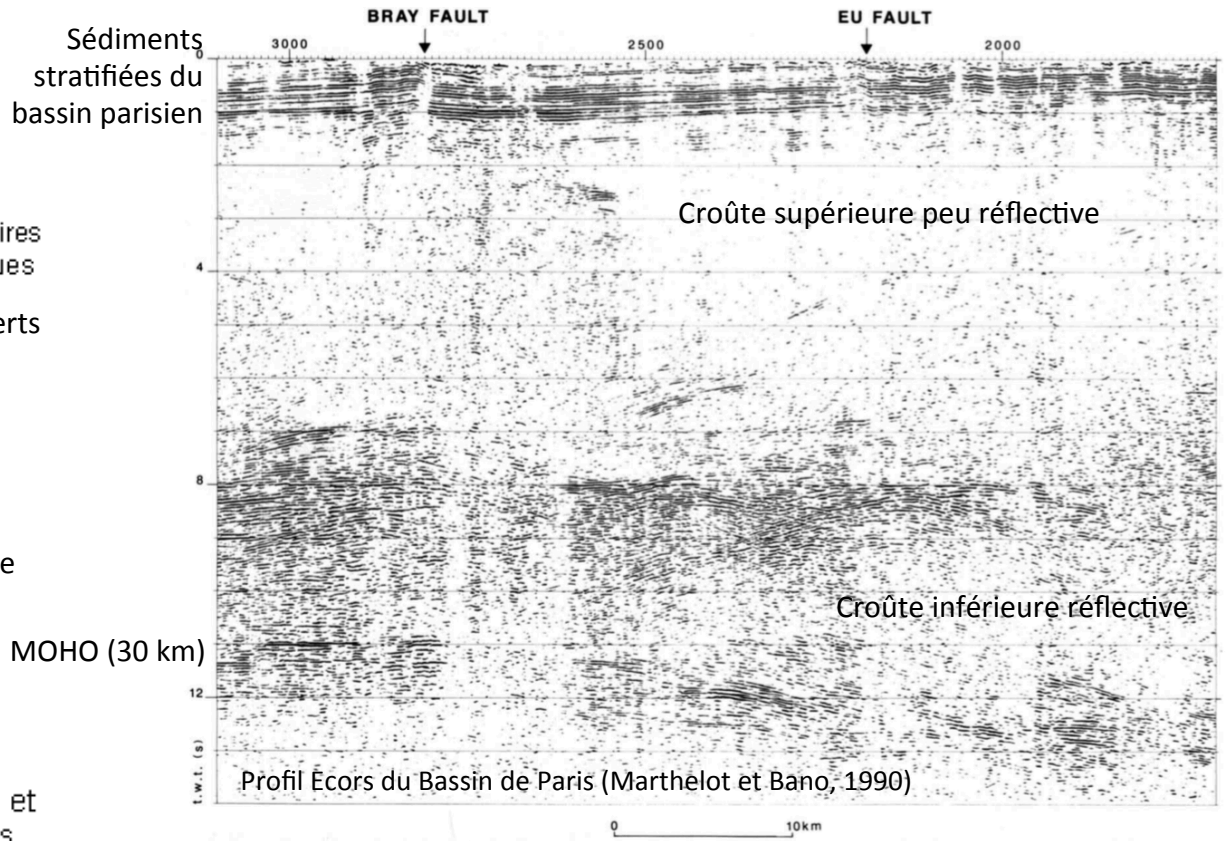




Müller, R.D., M. Sdrolias, C. Gaina, and W.R. Roest 2008. Age, spreading rates and spreading symmetry of the world's ocean crust, *Geochem. Geophys. Geosyst.*, 9, Q04006, [doi:10.1029/2007GC001743](https://doi.org/10.1029/2007GC001743).
https://www.ngdc.noaa.gov/mgg/ocean_age/ocean_age_2008.html

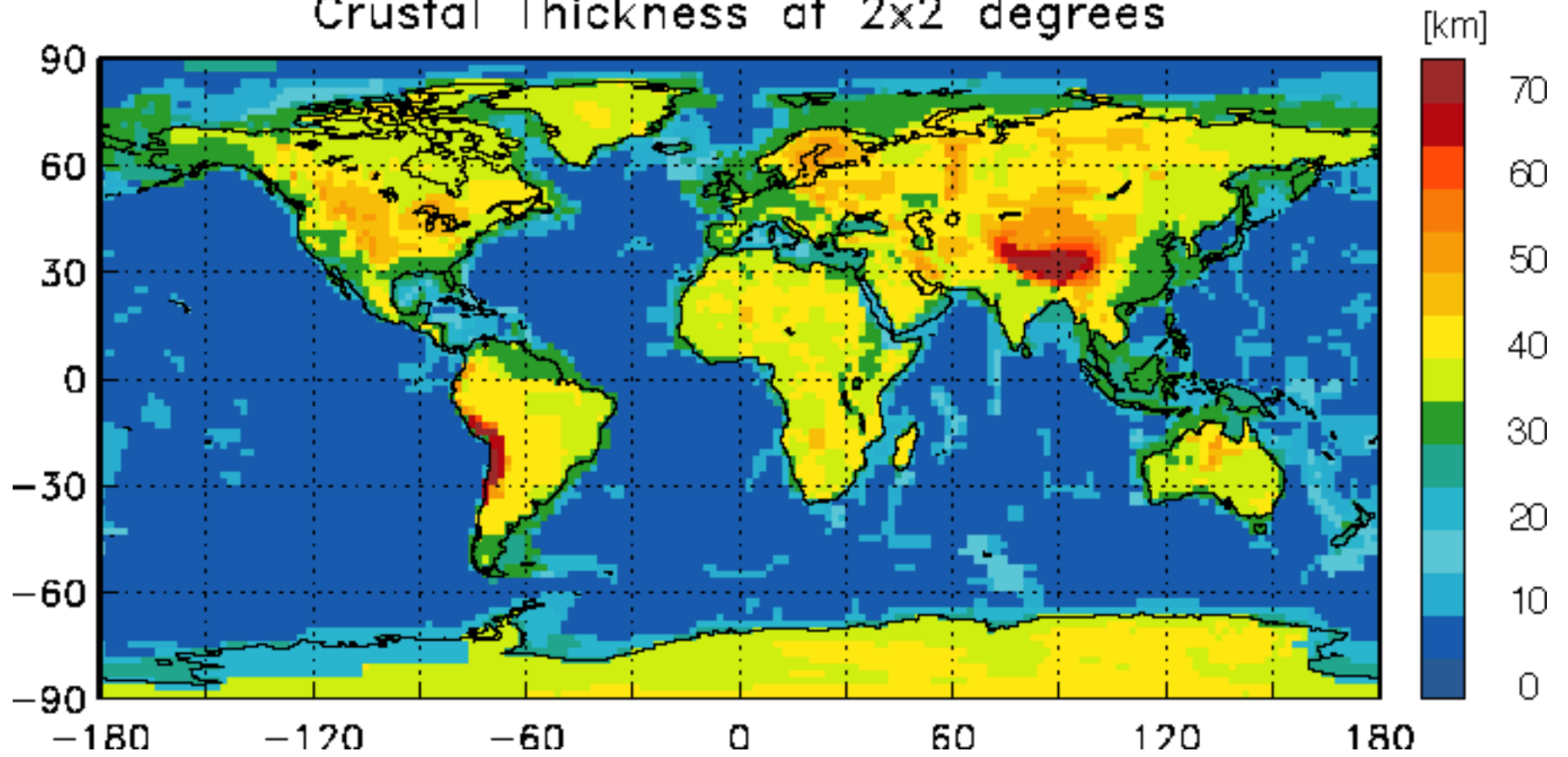


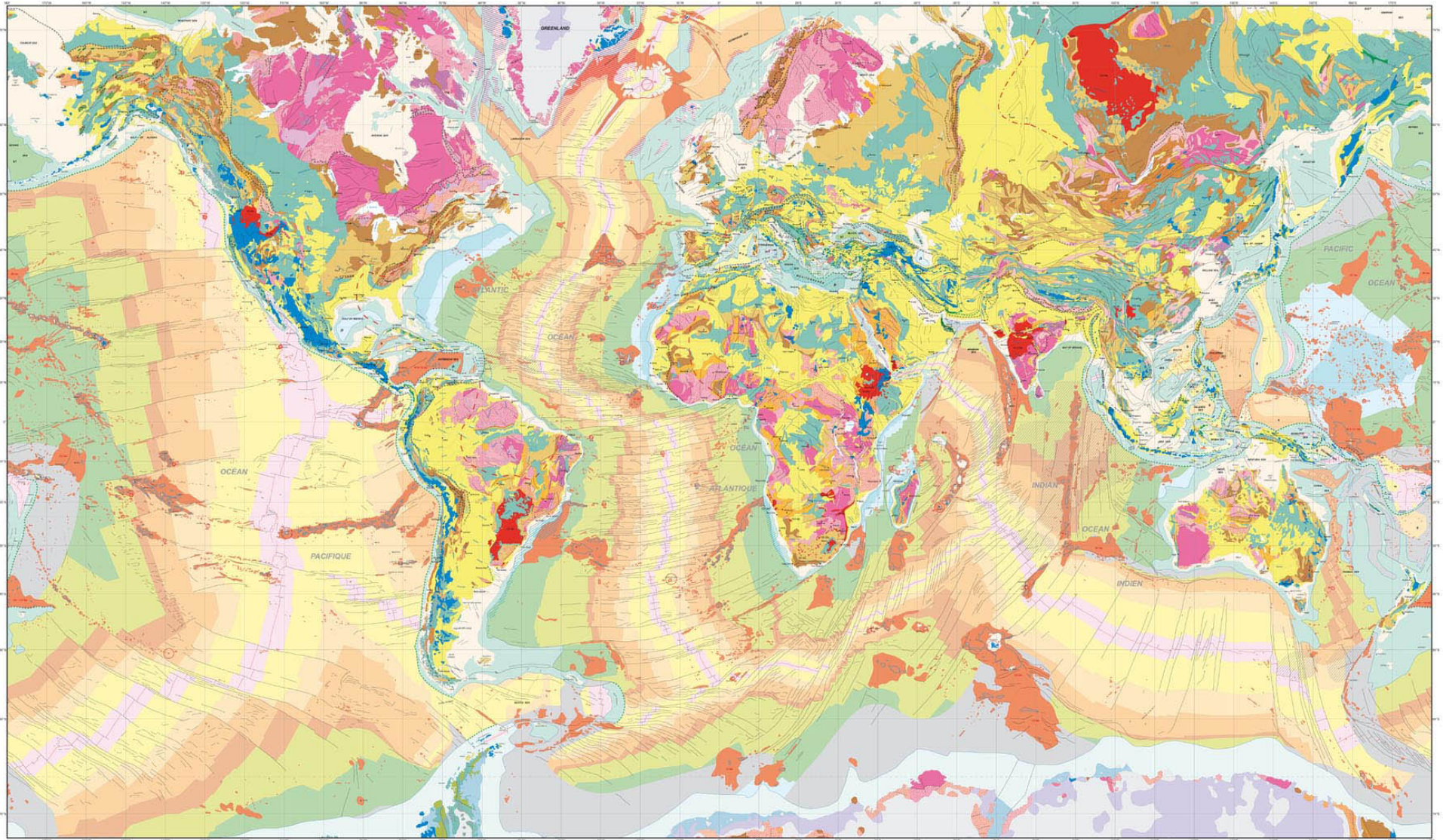
Rudnick and Fountain, 1995)



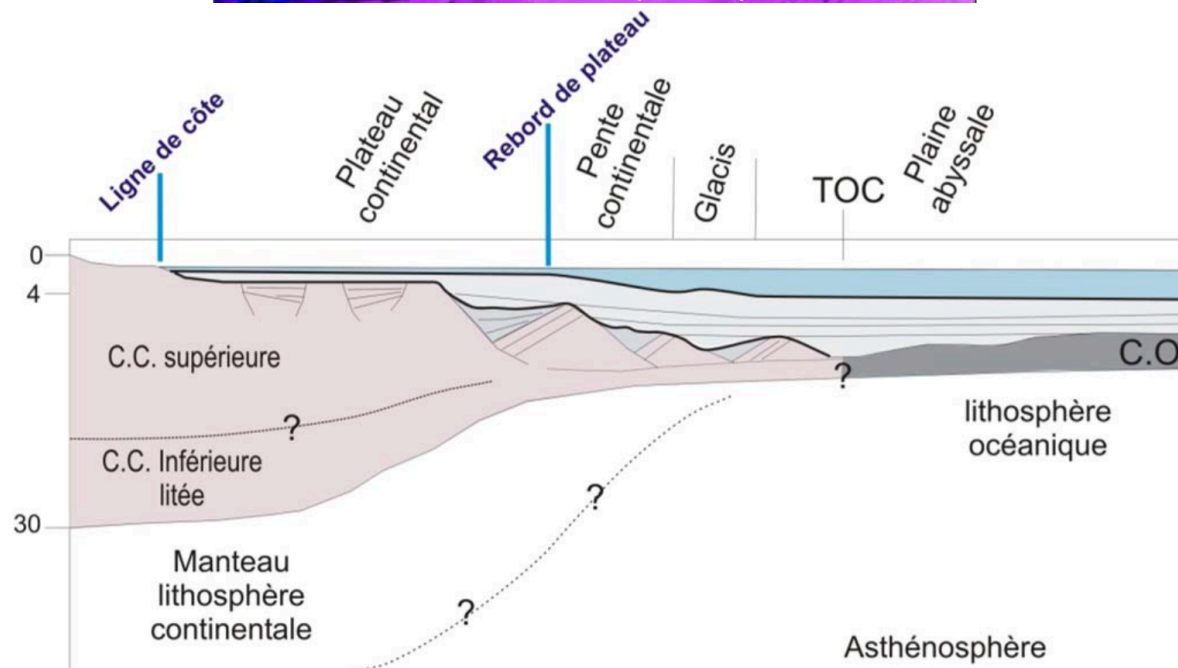
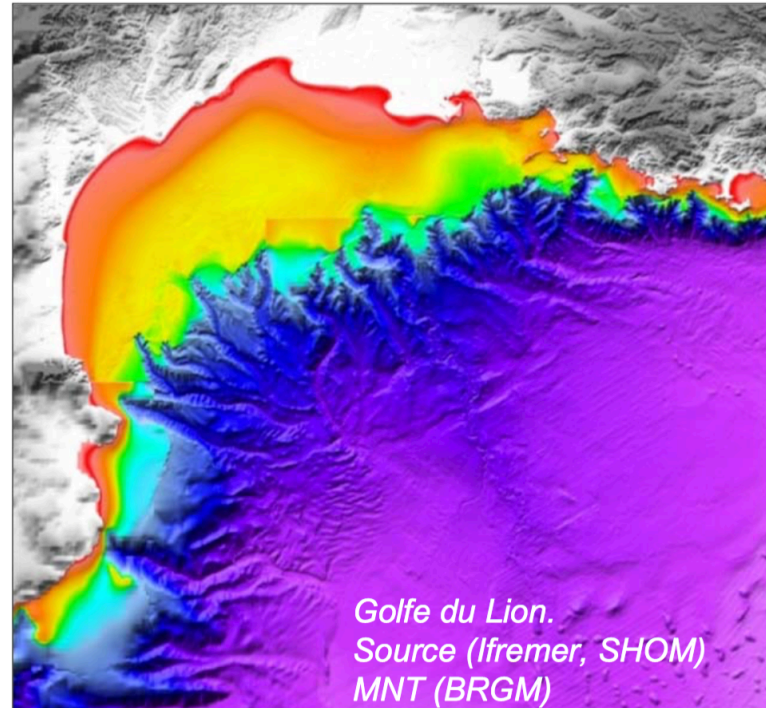
Transition amphibolite → granulite:
 amphibole → pyroxène + H₂O
 biotite → K-feldspath + grenat + orthopyroxène + H₂O.

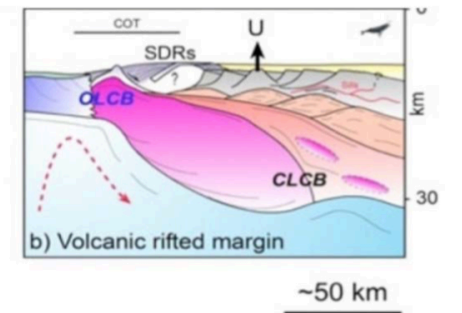
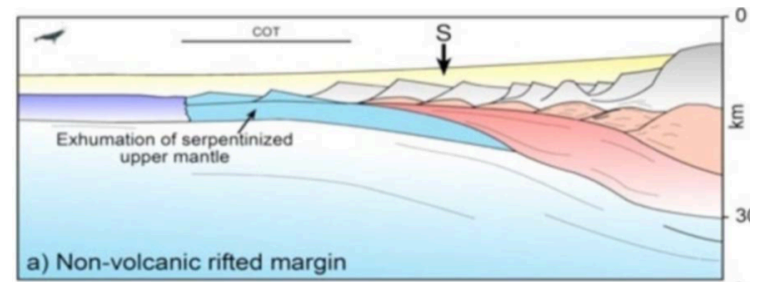
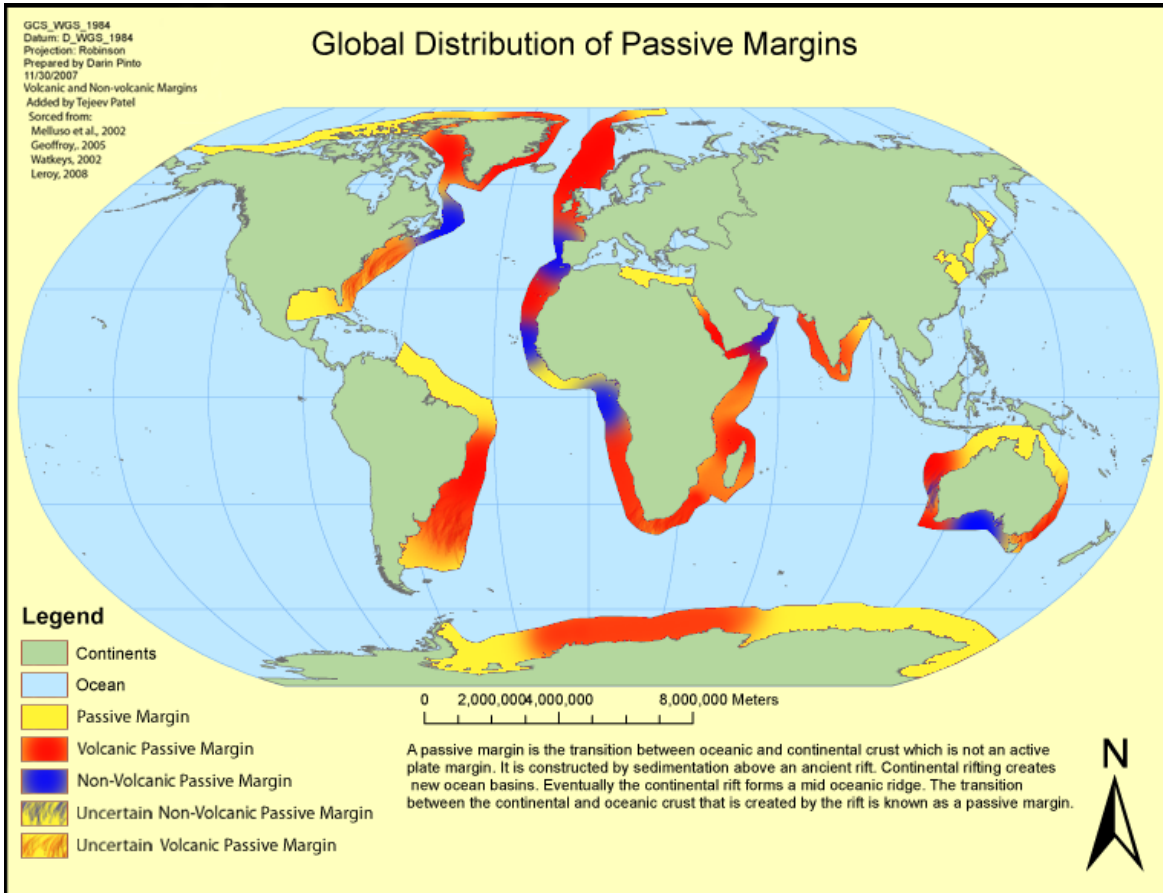
Crustal Thickness at 2x2 degrees



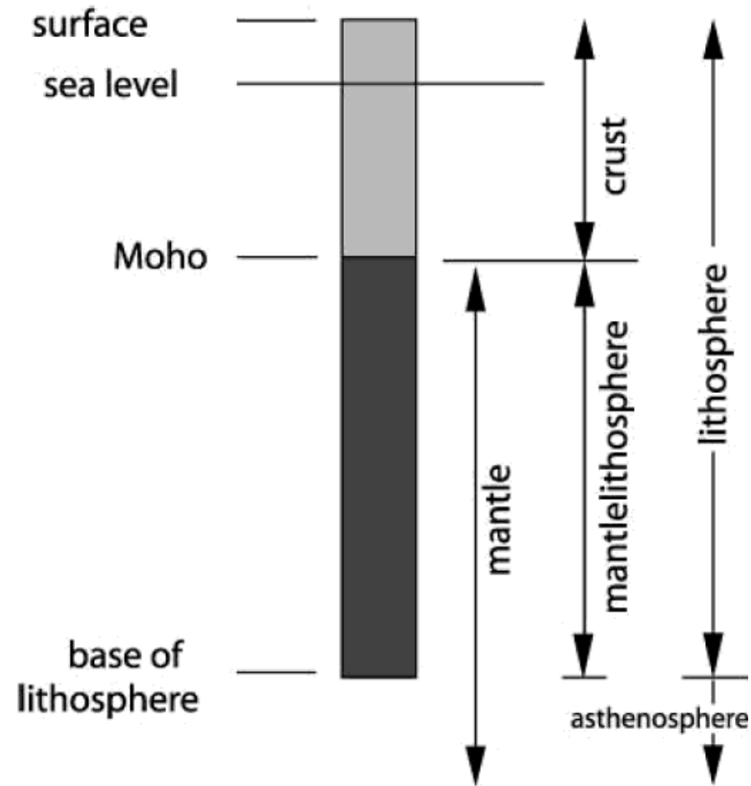


Bouysse P. et al. : J. Ségoufin, H.F. Jepsen, T.C.R. Pulvertaft, C. Gaina, L. Gernigon, G. Grikurov, G. Leitchenkov, K. Gohl, M. Pubellier, S. Shokalsky, Y. Lagabrielle, L. Jolivet, M. Iturralde-Vinent, N. Chamot-Rooke and A. Rabaute, 2010. Geological Map of the World, third edition (2010), Main map in Mercator projection & Polar regions in polar stereographic projection, scale: 1/25.000.000 (242x 108.5 cm), published by CGMW and UNESCO - Commission for the Geological Map of the World.



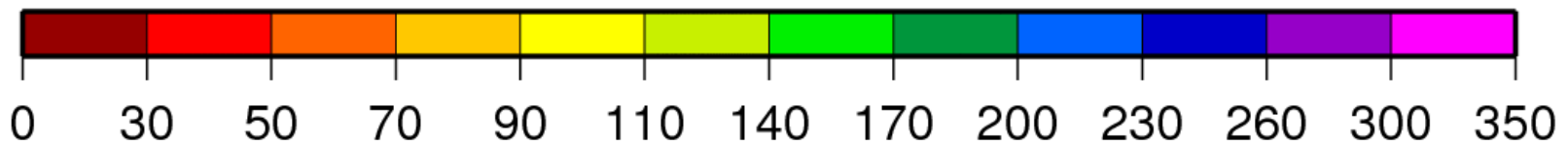
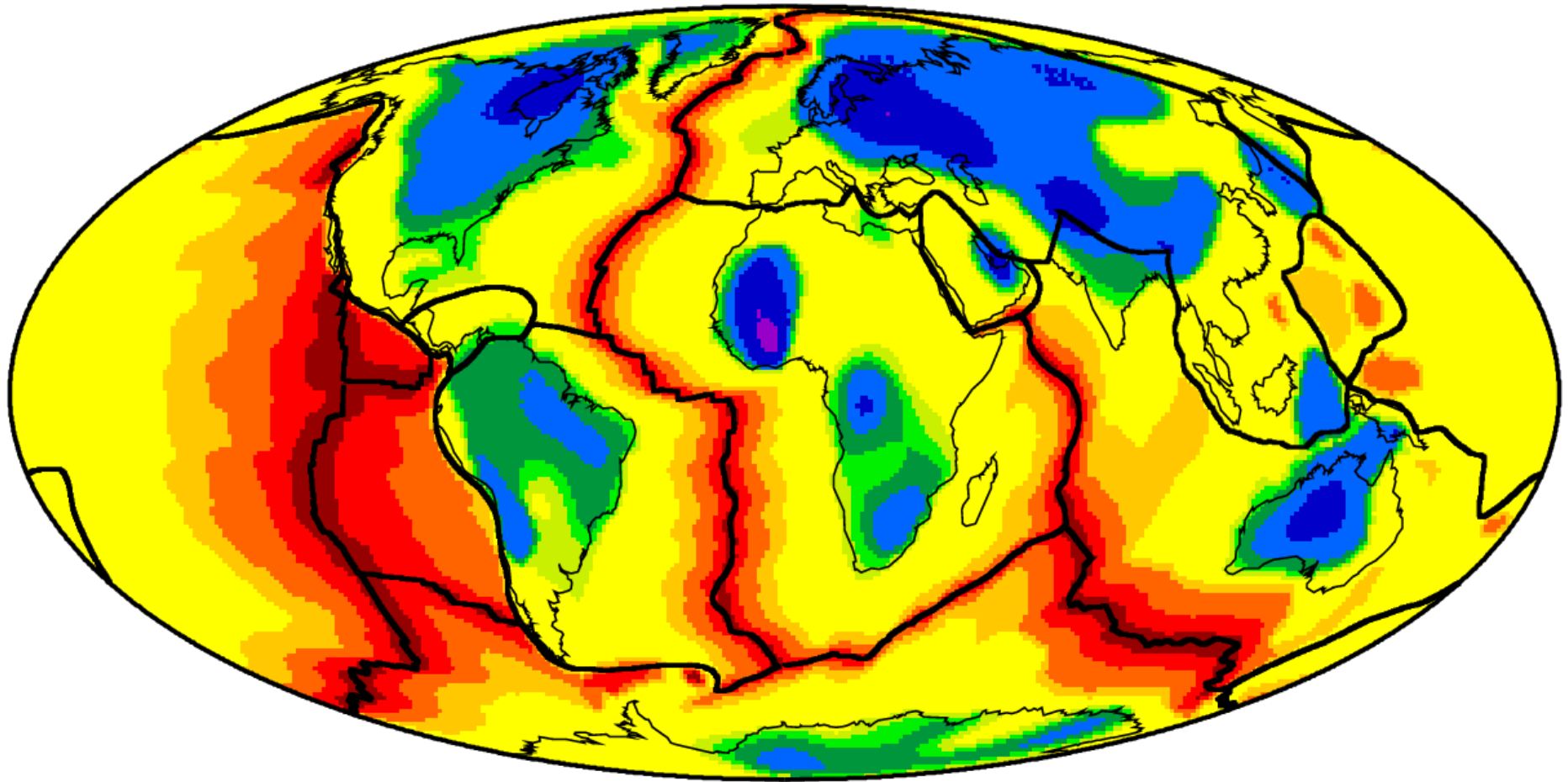


Gernigon et al. (2005)

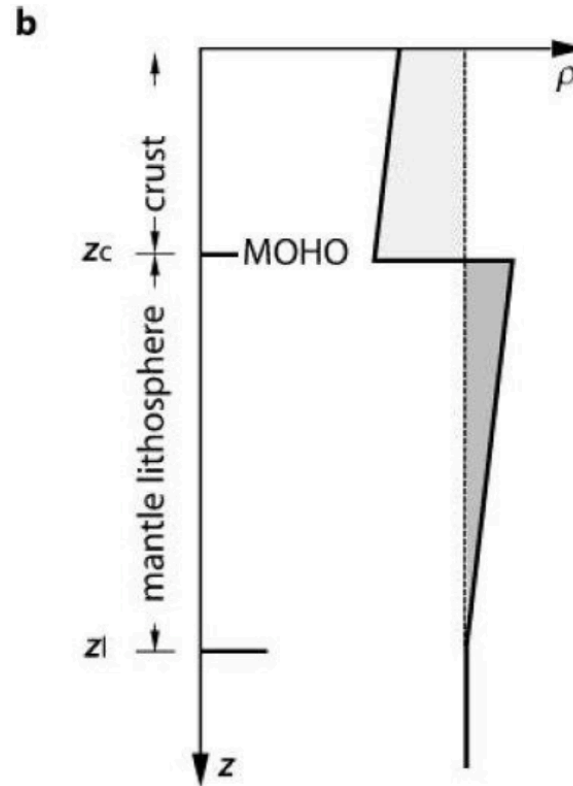
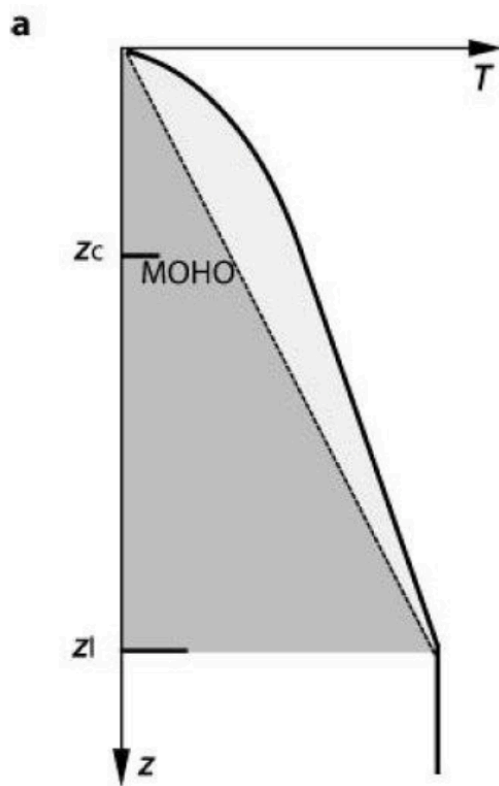


Lithosphere = “a near surface layer of strength of the Earth” (Isacks et al., 1968):

Conrad & Lithgow-Bertelloni [2006] Model for Lithosphere Thickness

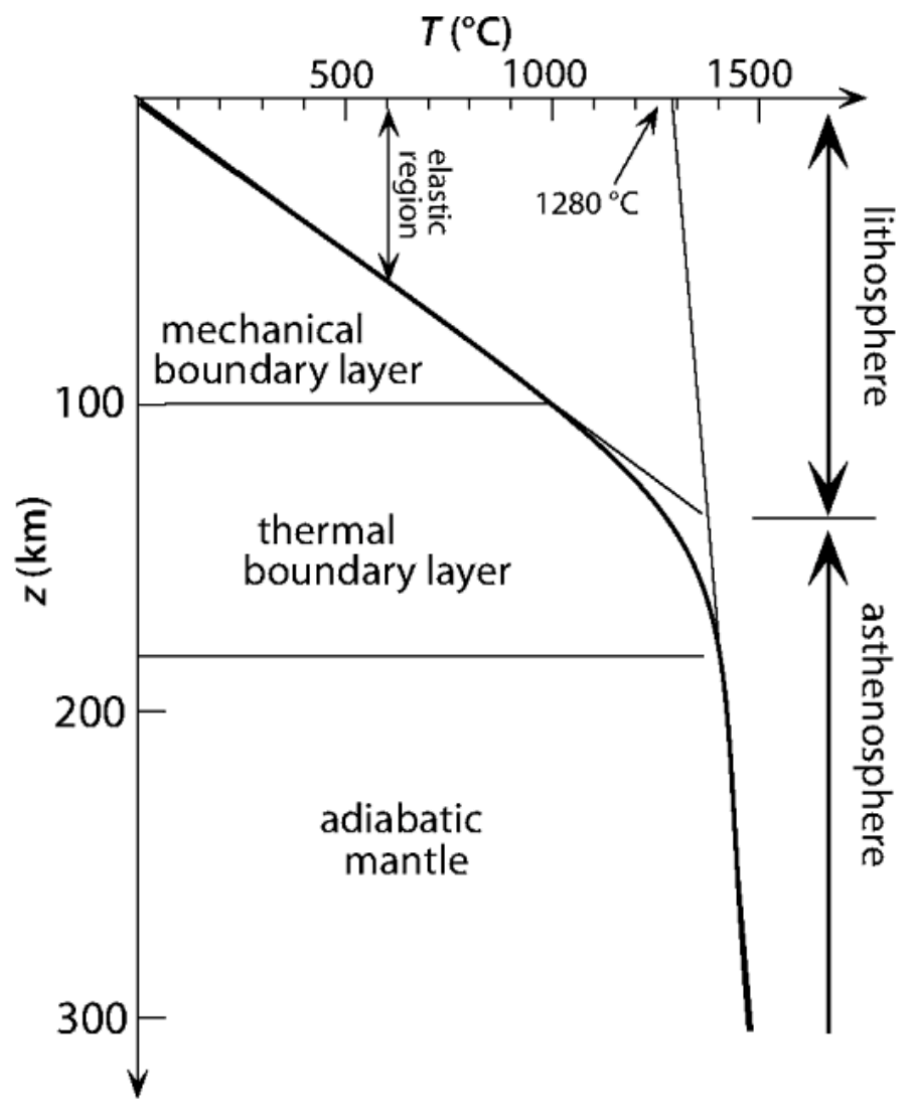


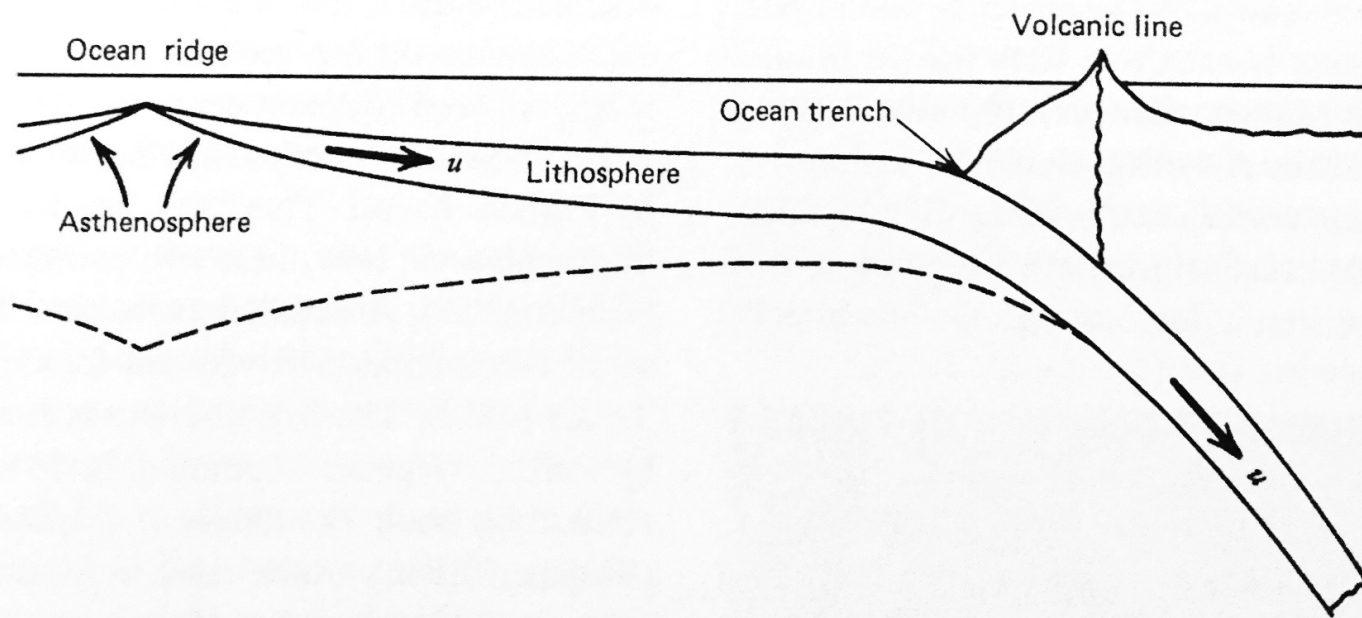
Lithosphere Thickness (km)

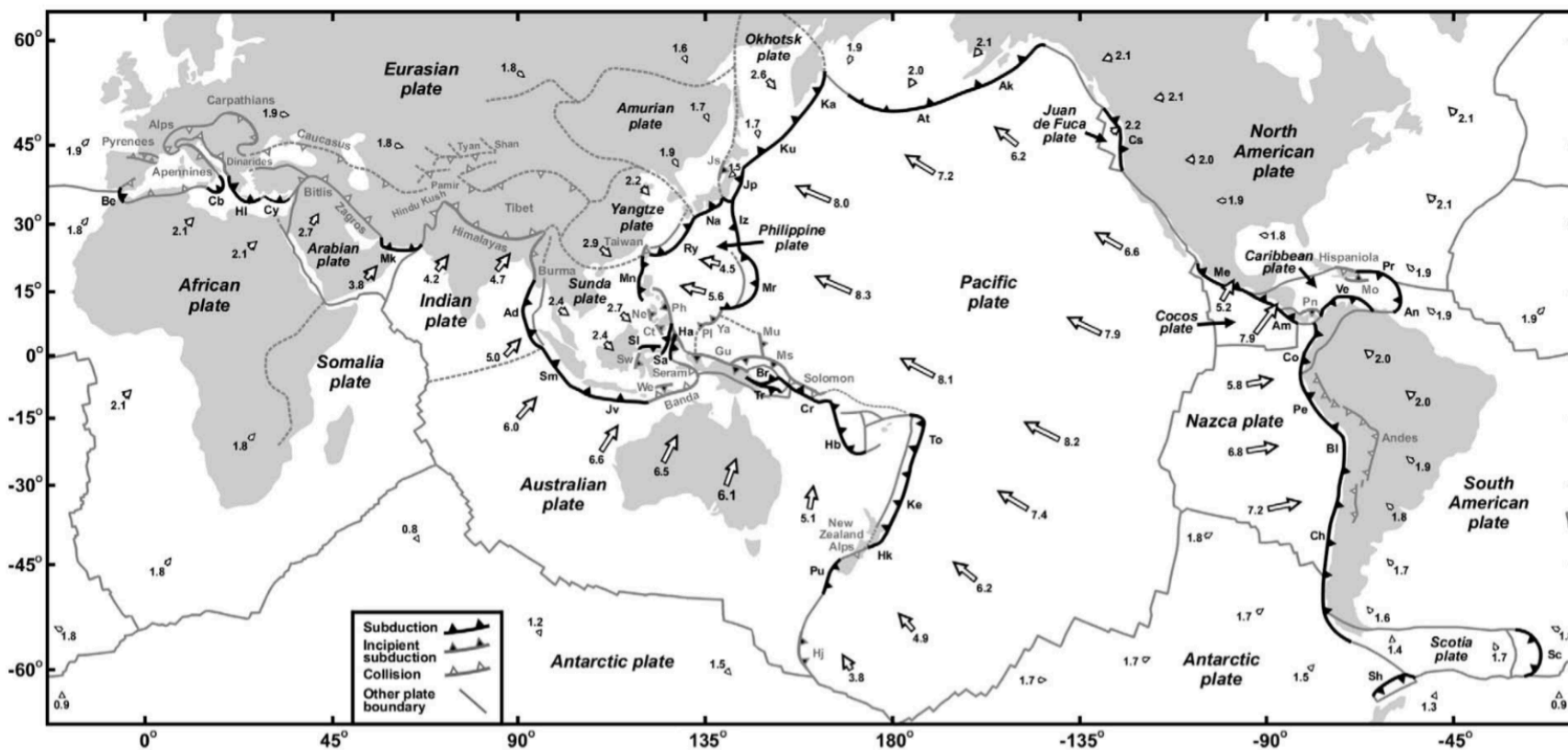
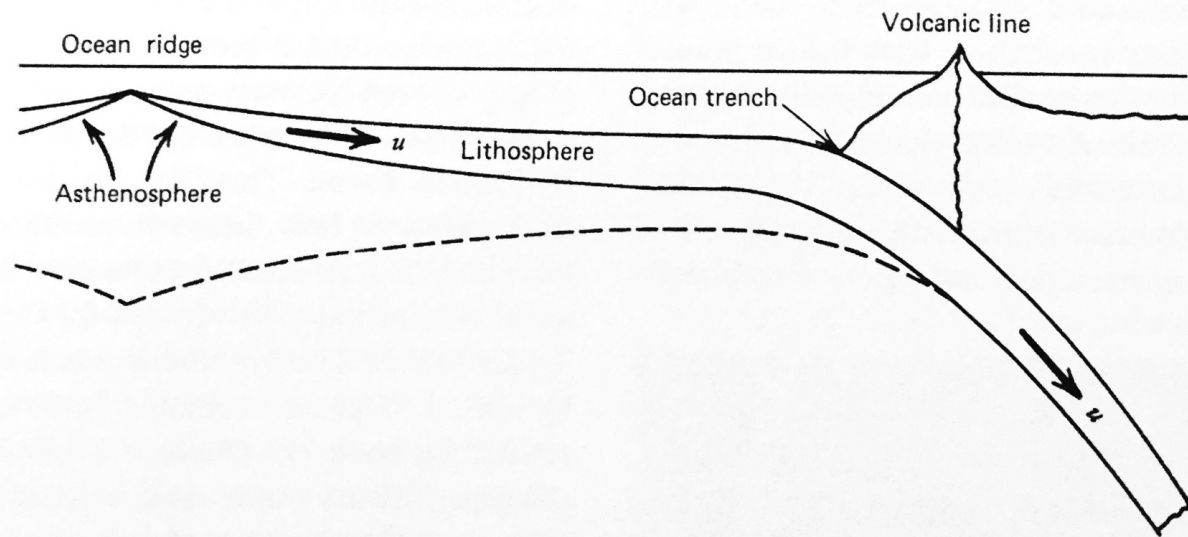


On peut considérer la base de la lithosphère comme l'isotherme de la transition convection/ conduction, typiquement choisi à 1600 K (1327°C). La partie noire correspond à la chaleur transmise par l'asthénosphère par conduction. La partie grise correspond à la production de chaleur interne par radioactivité, surtout contenue dans la croûte continentale où environ la moitié de la chaleur provient de la radioactivité et l'autre moitié de la chaleur conduite du manteau

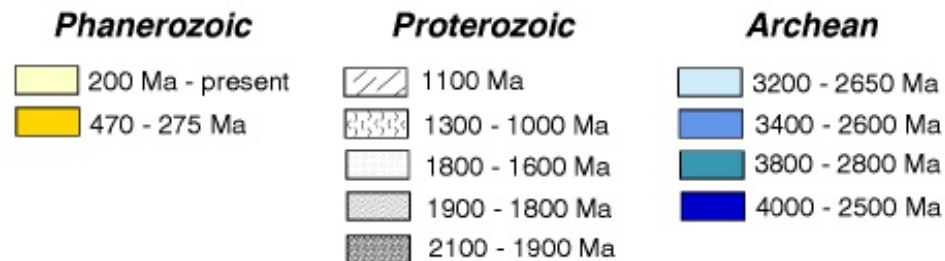
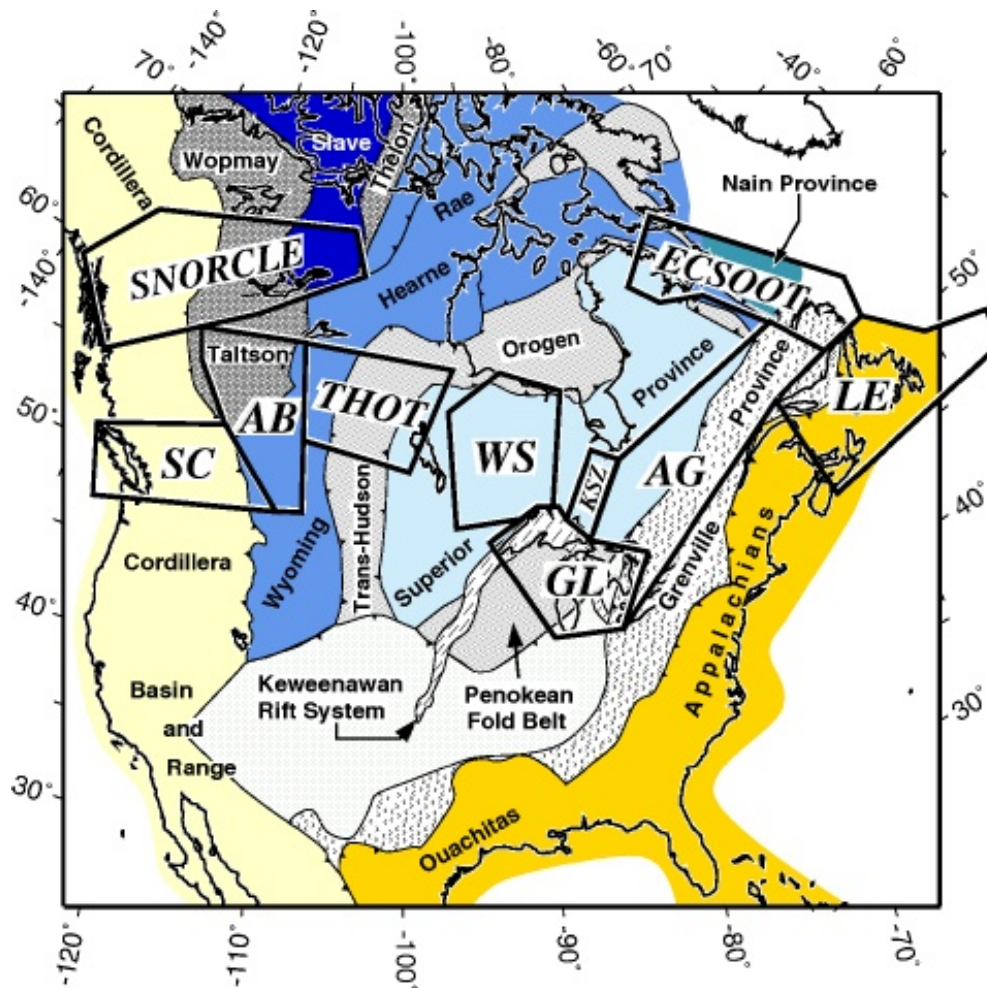
La densité diminue avec la profondeur dans la croûte comme dans le manteau en fonction de la température et du coefficient d'expansion thermique des roches concernées. L'excès de densité dans le manteau lithosphérique (par rapport à l'asthénosphère sous-jacente où la convection homogénéise densité et température) est à peu près égal au déficit de densité dans la croûte.





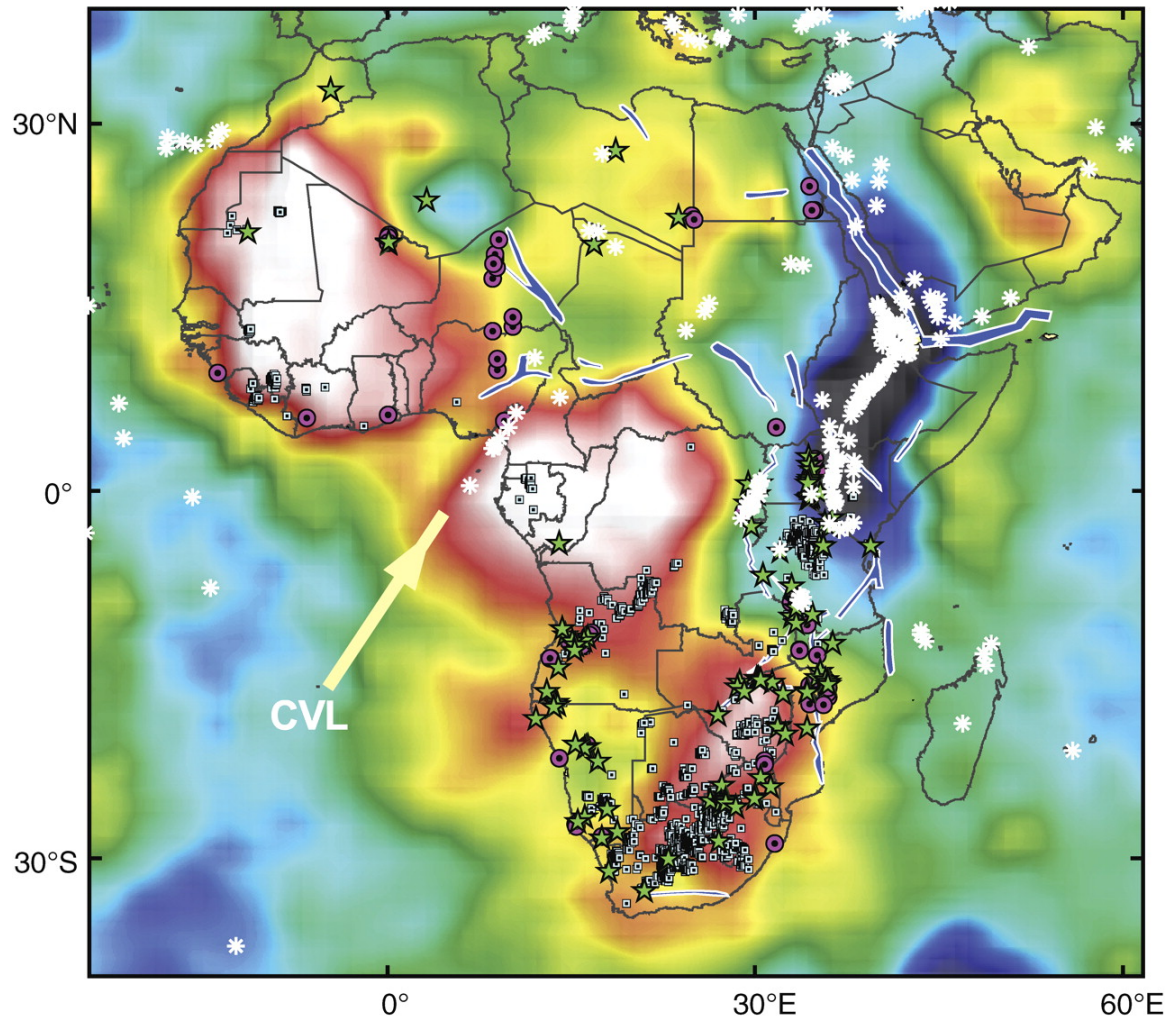


Schellart and Rawlinson, 2013



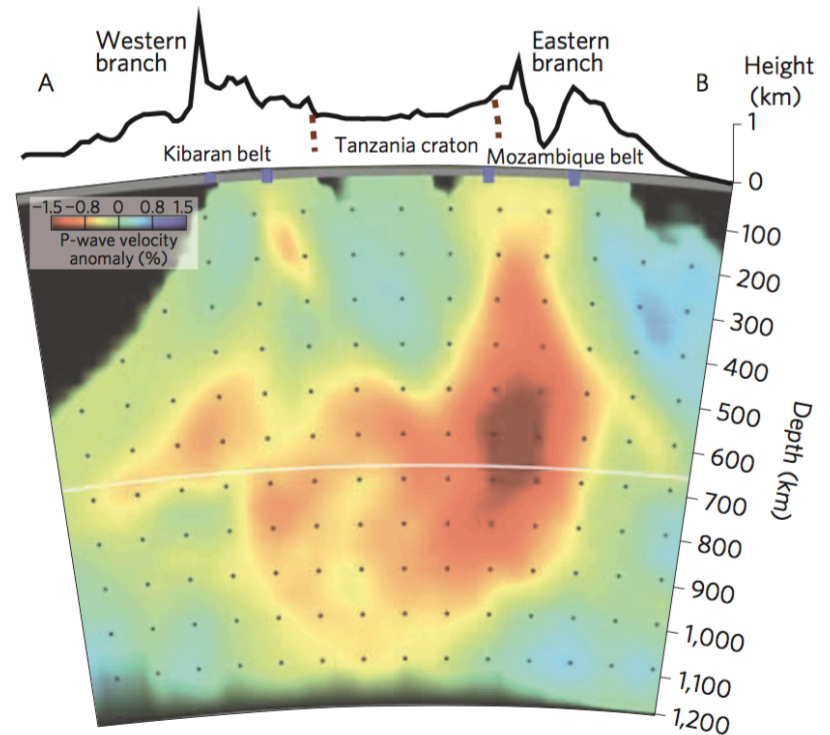
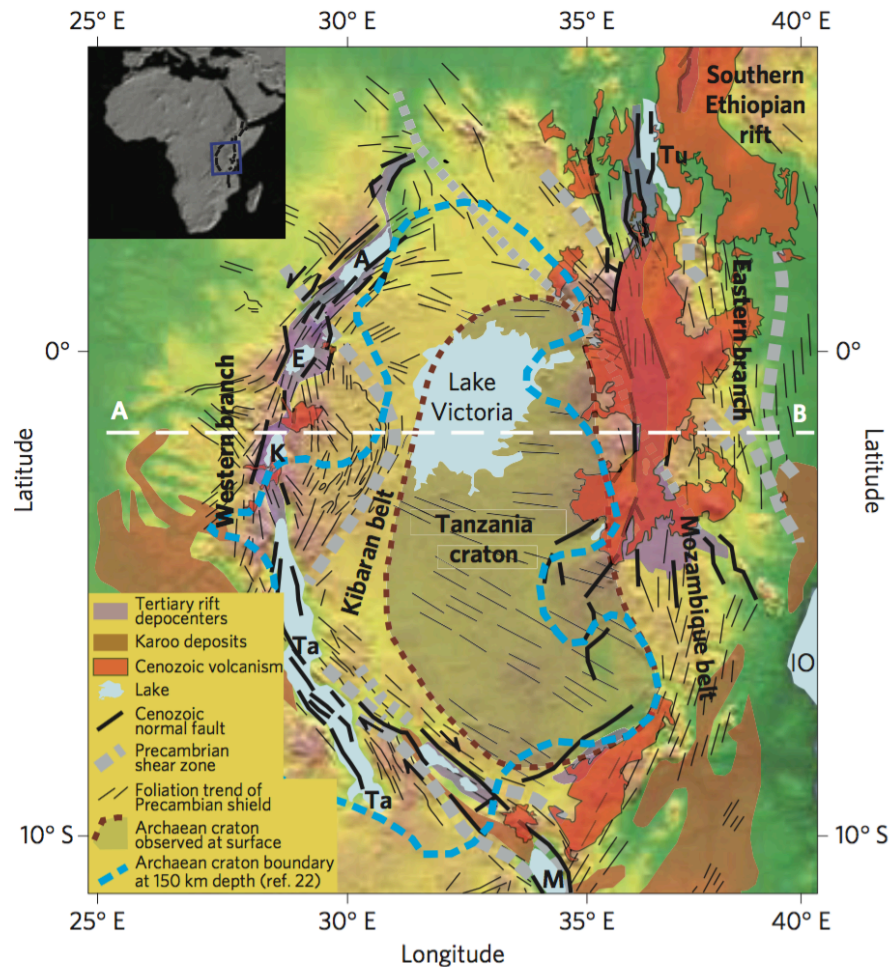
http://www.cliffshade.com/colorado/geo_overview.htm

Distribution of low-volume melts (alkaline rocks, carbonatites, and kimberlites) and Mesozoic to Cenozoic rifts relative to the velocity structure and cratonic blocks (see Fig. 1) of Africa.

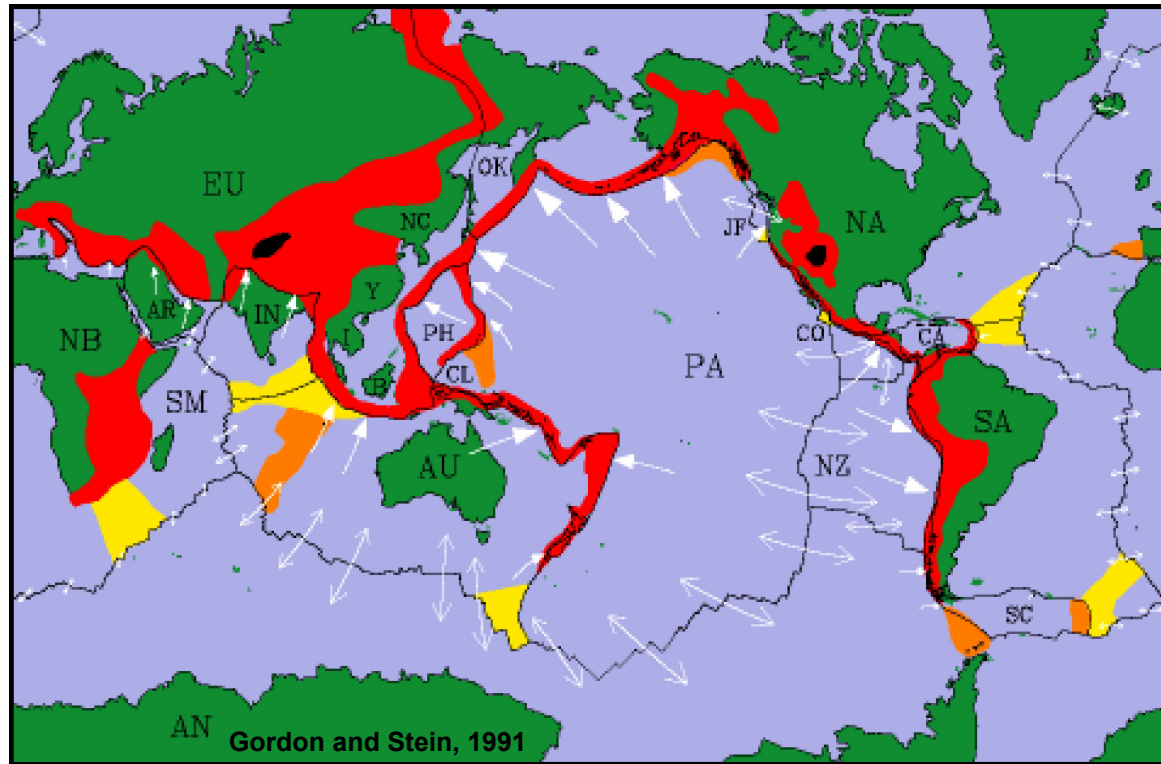


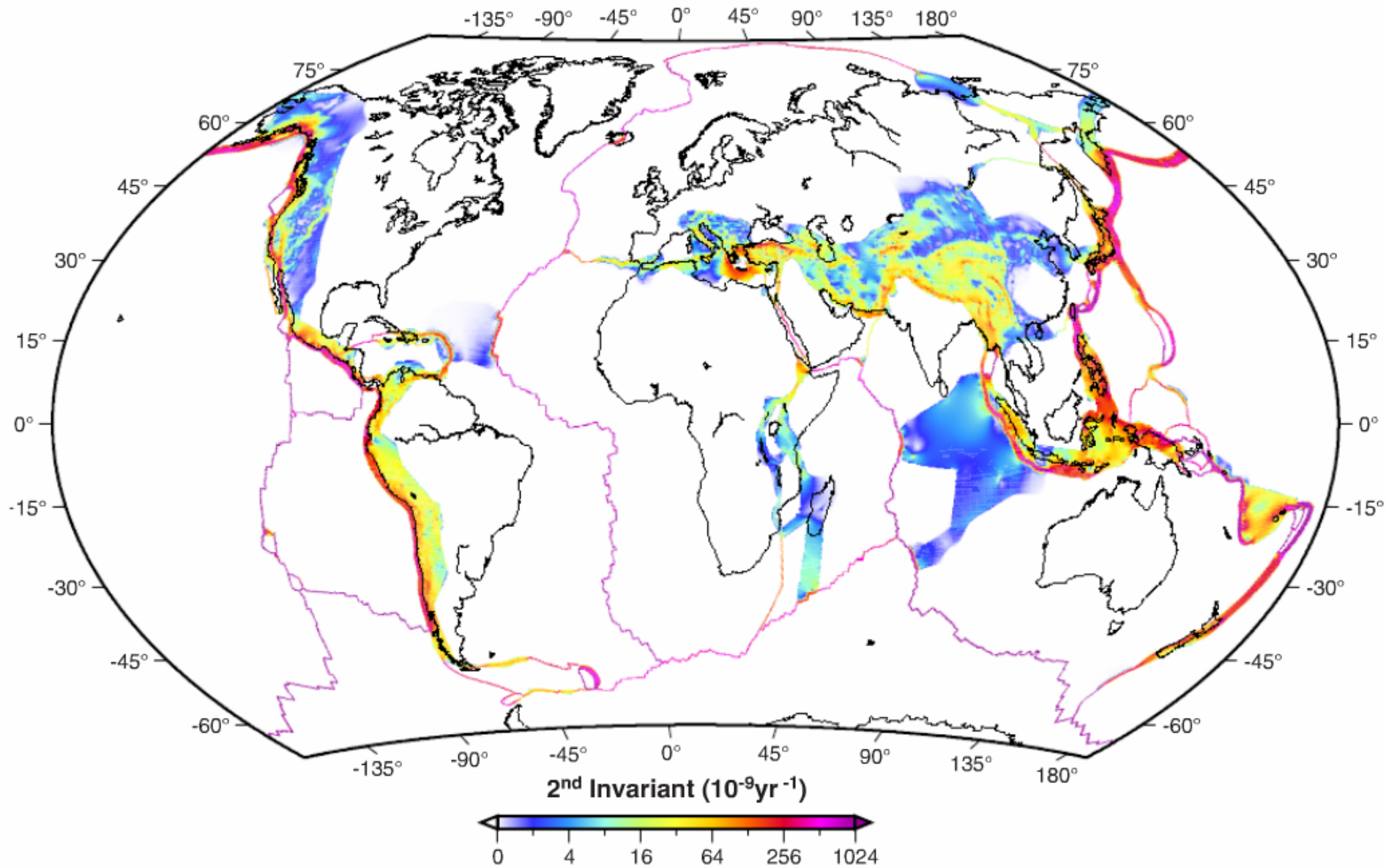
G.C. Begg et al. Geosphere 2009;5:23-50

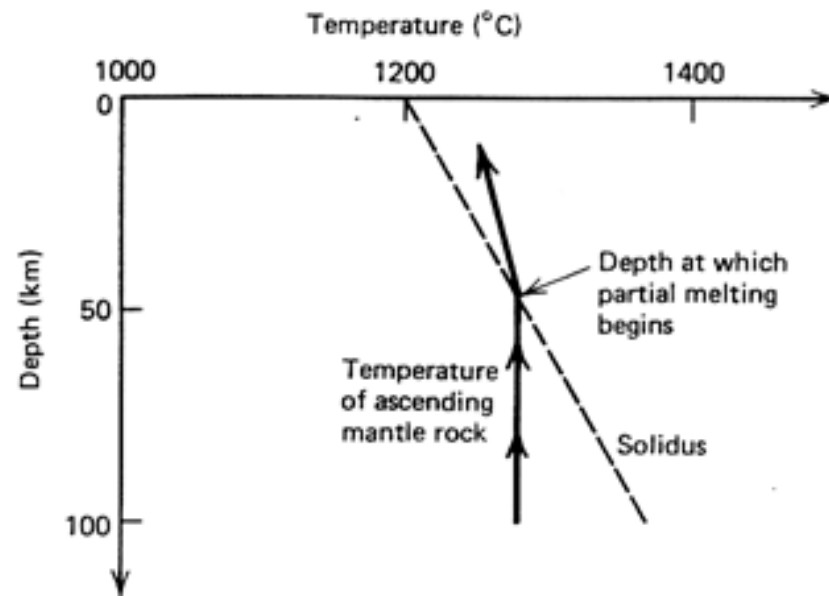
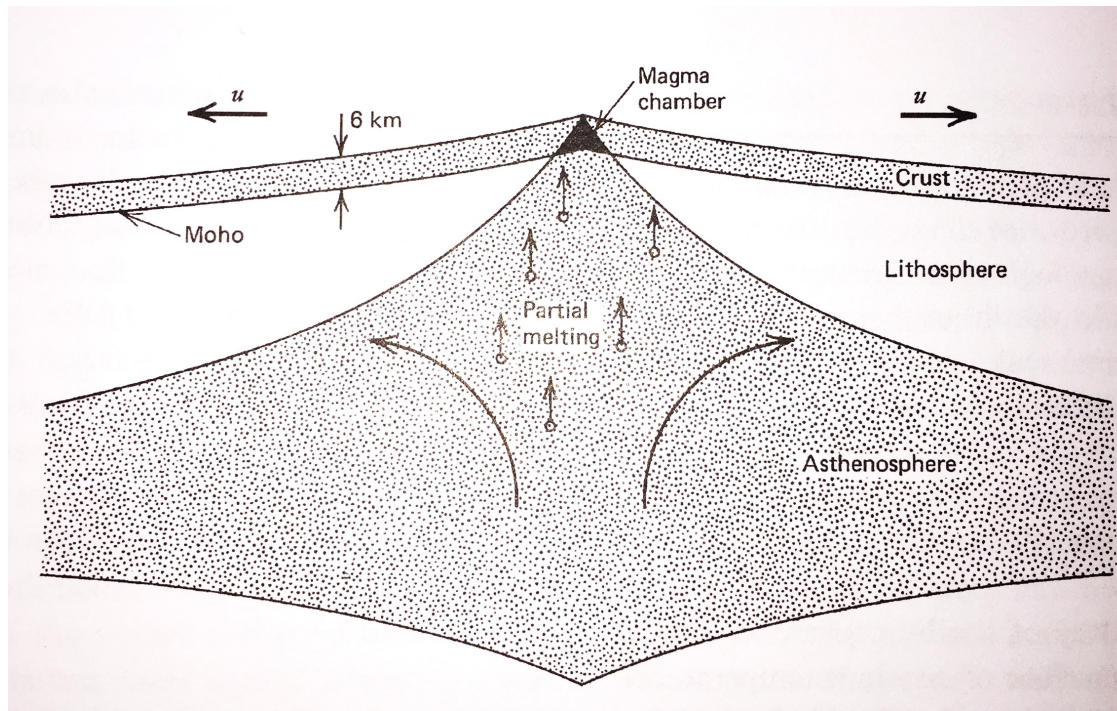


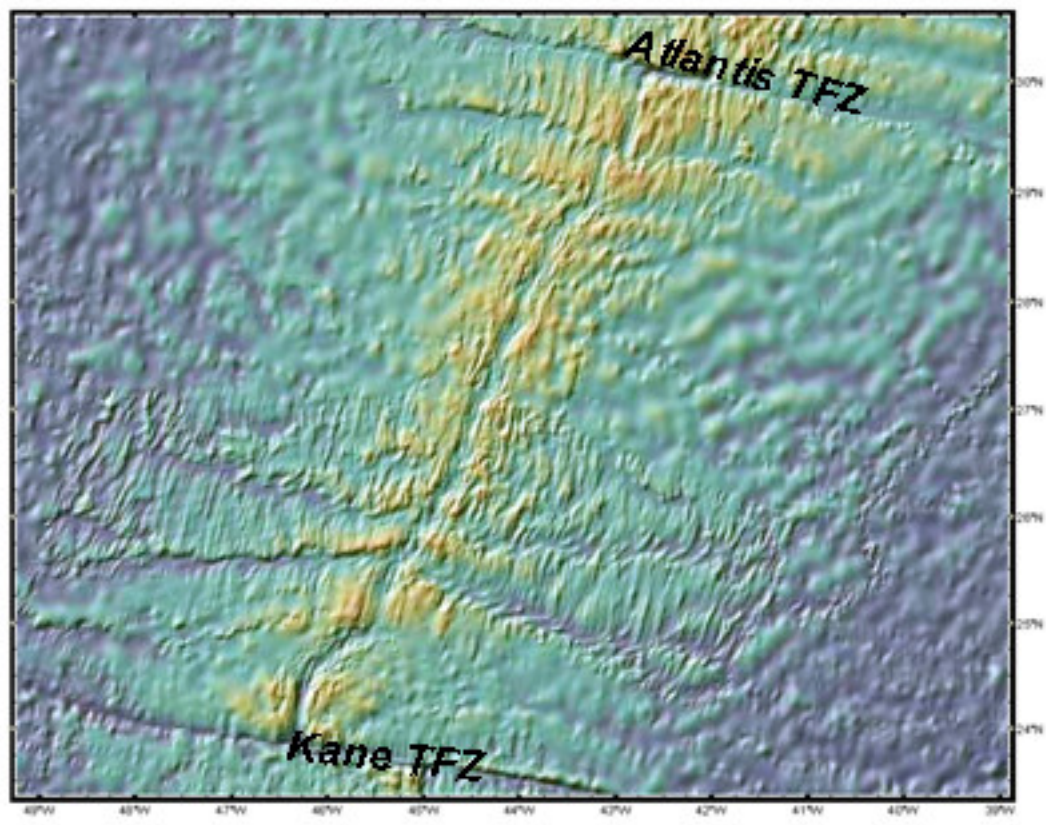
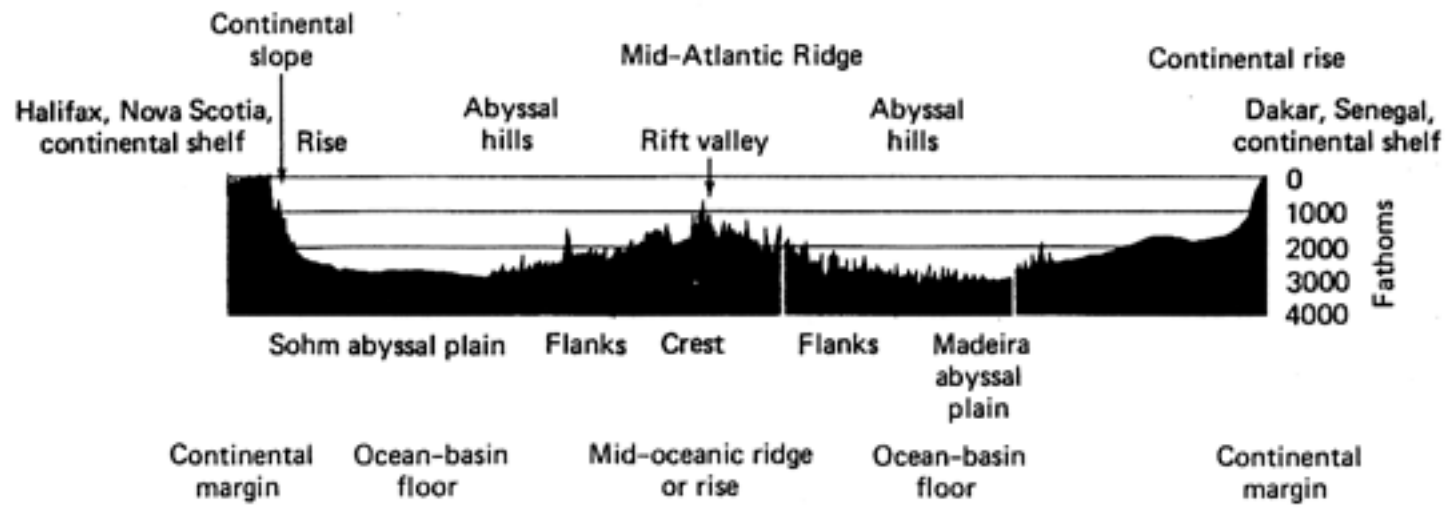


a, Geologic map of the central EAR showing the surface extent of the Tanzanian craton, surrounded on both sides by active rift branches—the magma-poor western rift exhibits low-volume volcanic activity, large ($M > 6.5$) magnitude earthquakes, and hypocentre depths reaching 30–40 km, whereas the magma-rich eastern rift is characterized by a broad zone of shallow (5–15 km) and lower magnitude seismicity, but voluminous Cenozoic (Miocene and younger) volcanism. Note the geometry (dashed blue line) of the craton boundary at 150 km depth²². Tu, Lake Turkana; A, Lake Albert; E, Lake Edward; K, Lake Kivu; Ta, Lake Tanganyika; M, Lake Malawi; IO, Indian Ocean. b, East–west topography profile and seismic P-wave velocity mantle tomography cross-section²² showing thick Tanzanian craton (positive velocity anomalies) underlain by hot mantle material (negative velocity anomalies) deflected towards the eastern rift branch. Profile location is shown in top panel. (Koptev et al. 2015)

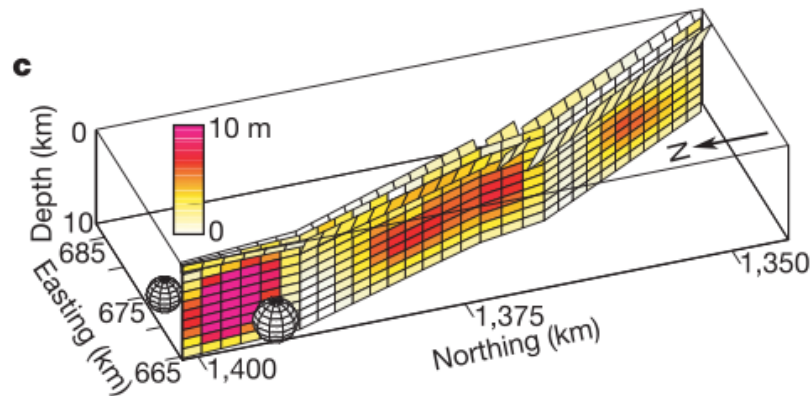
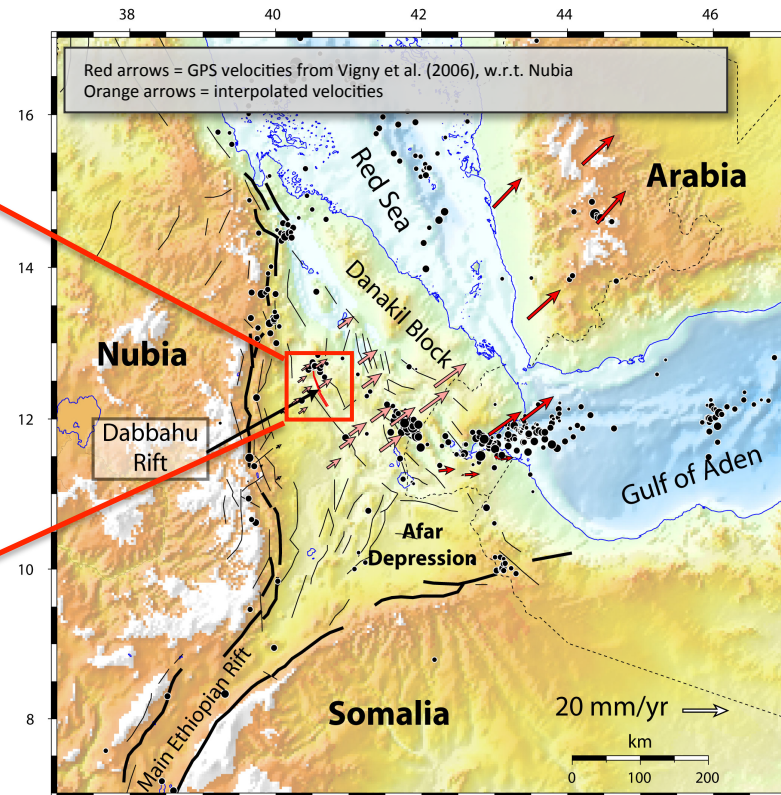
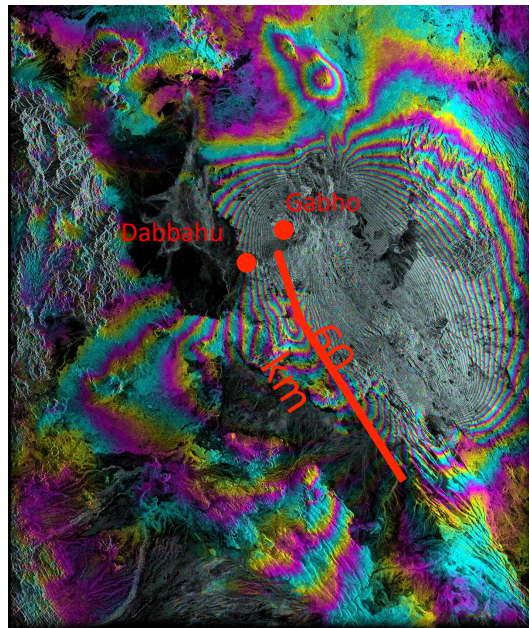


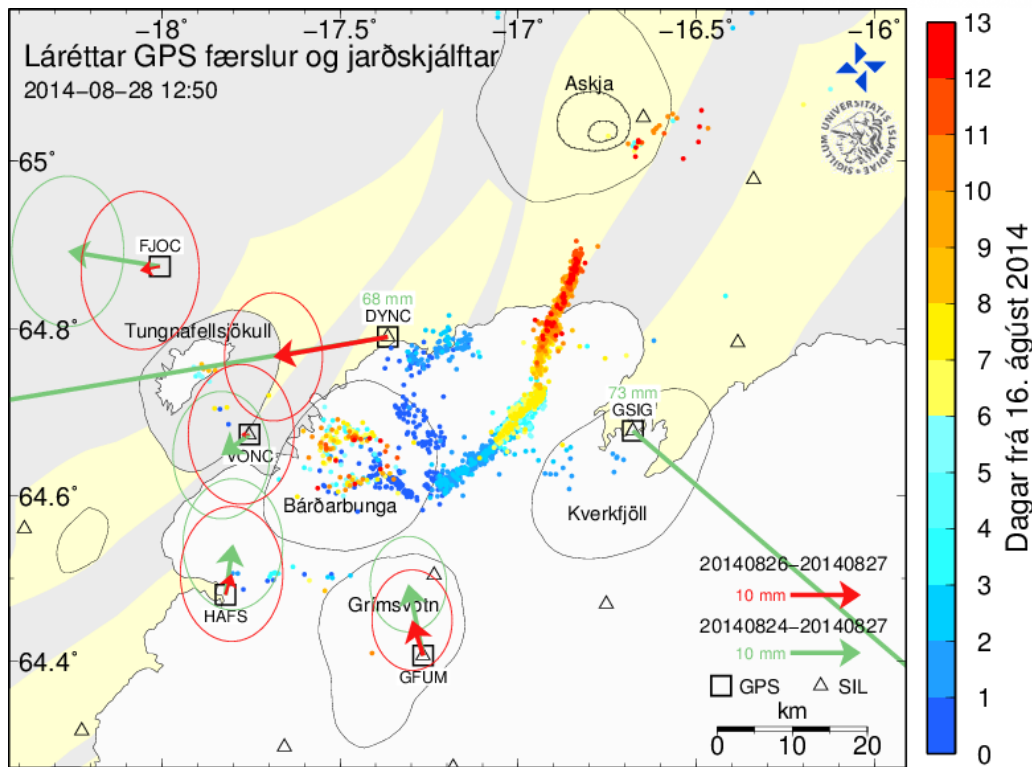




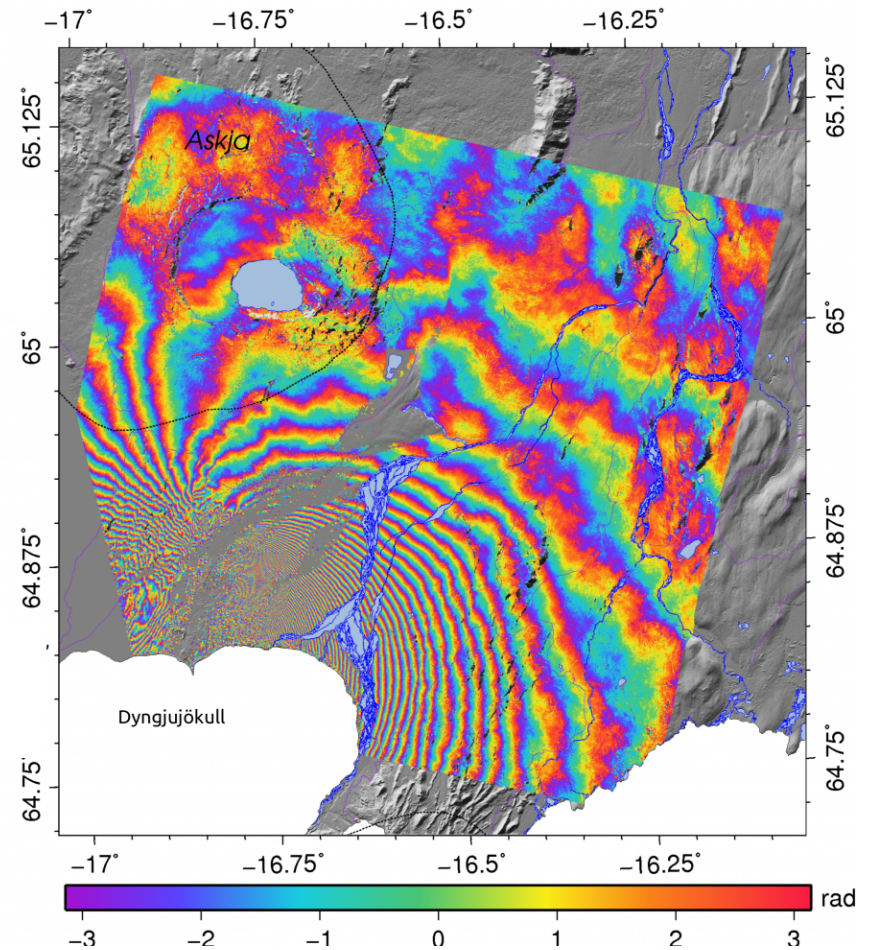


Un épisode de rifting dans un segment évolué

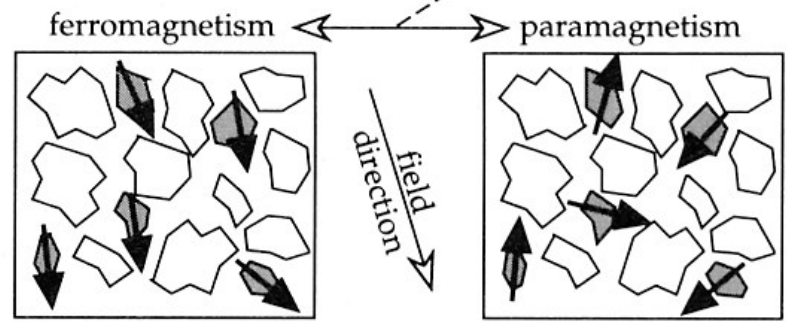
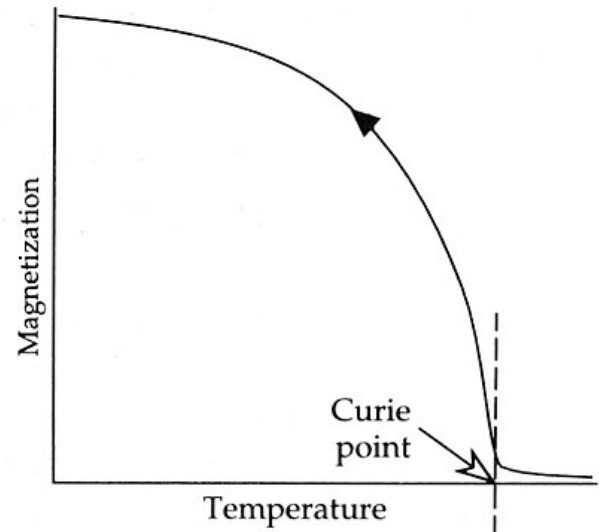




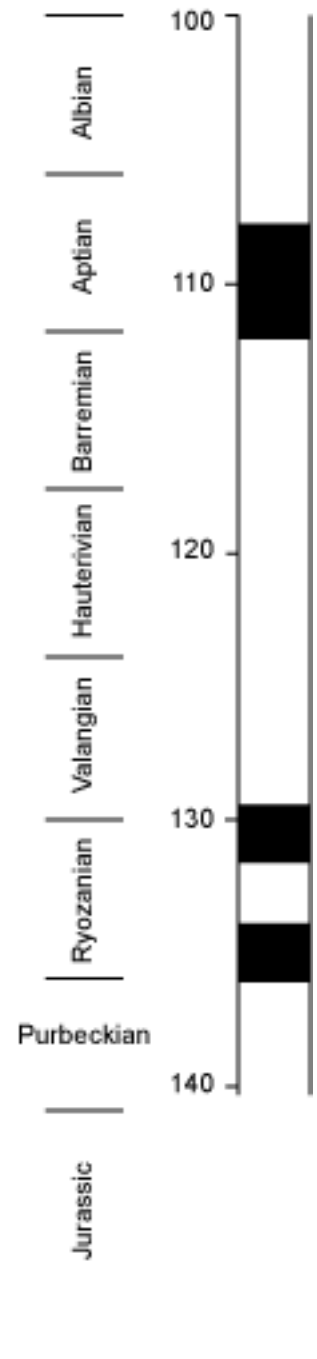
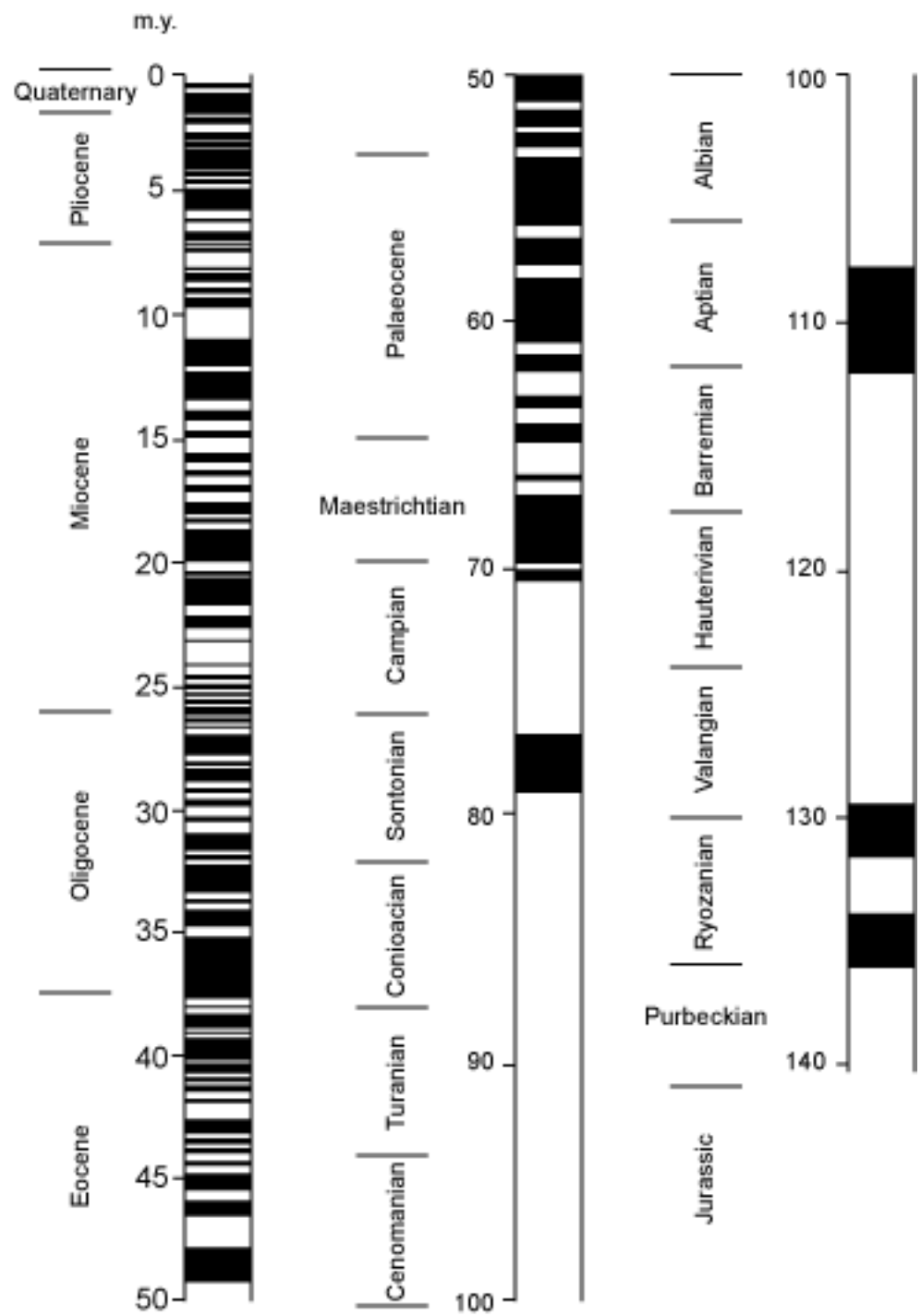
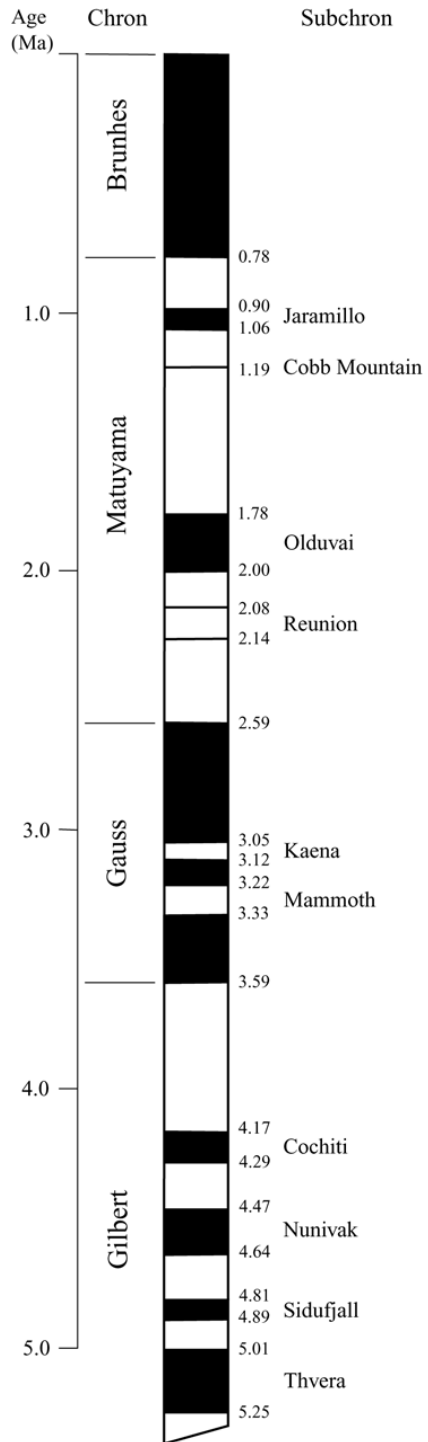
Crise tectono-volcanique du Bardabunga, Islande, août 2014, sismicité et mouvements GPS



Interférogramme (COSMO-SkyMED) couvrant la période 13-29 août 2014. Une frange = 15 mm de déplacement



matrix mineral magnetite grain magnetization direction



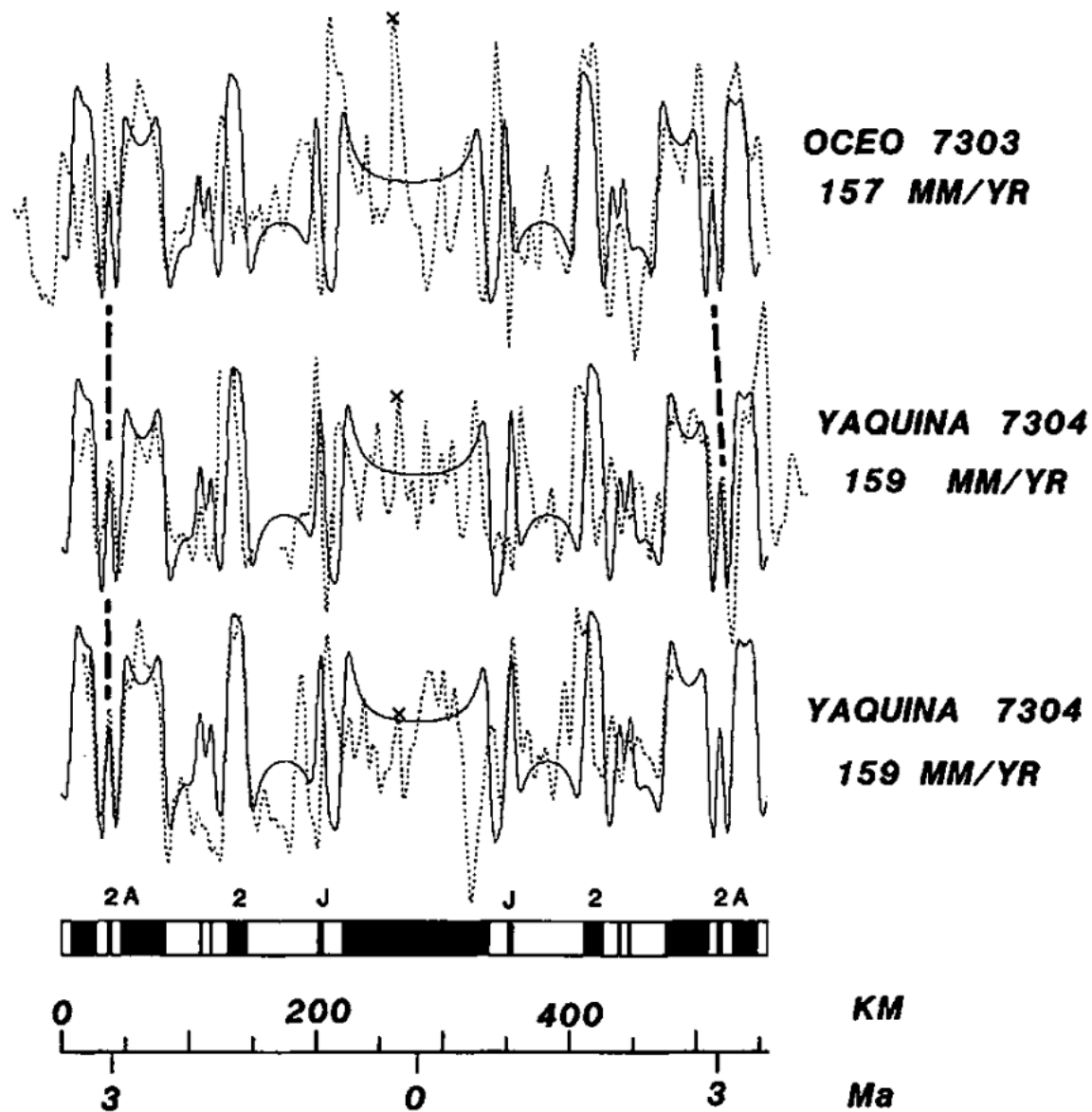
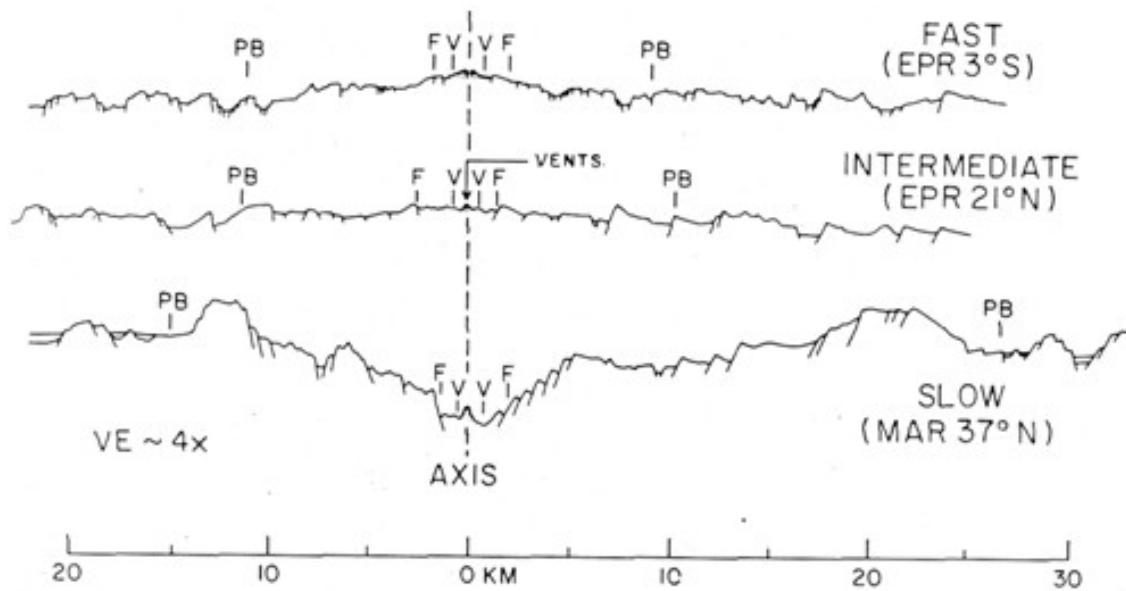
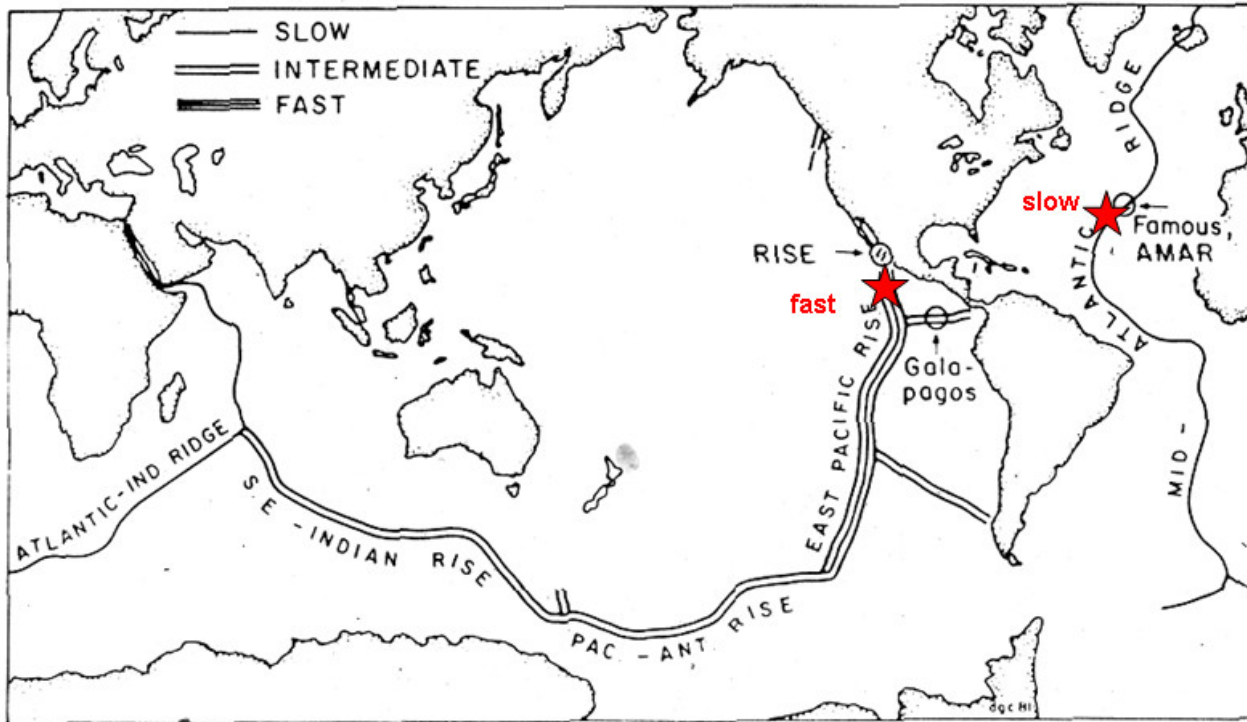
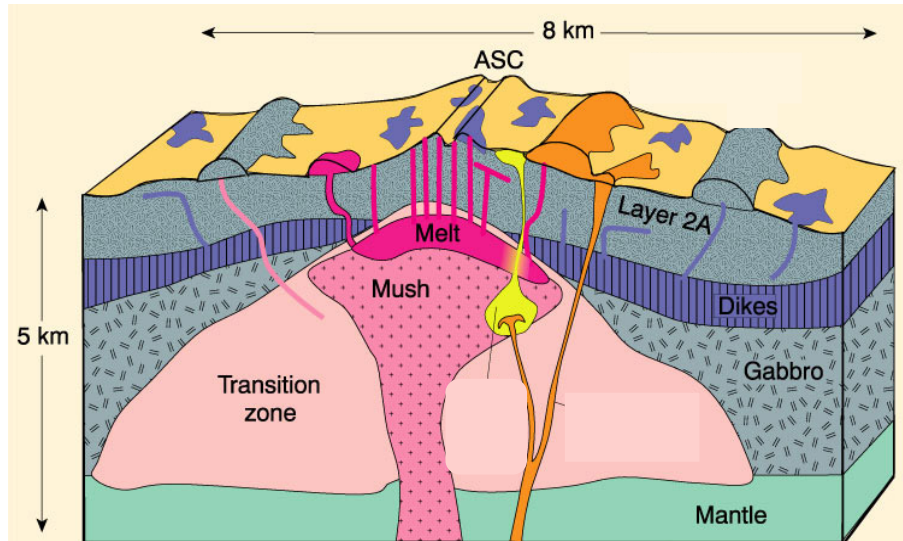


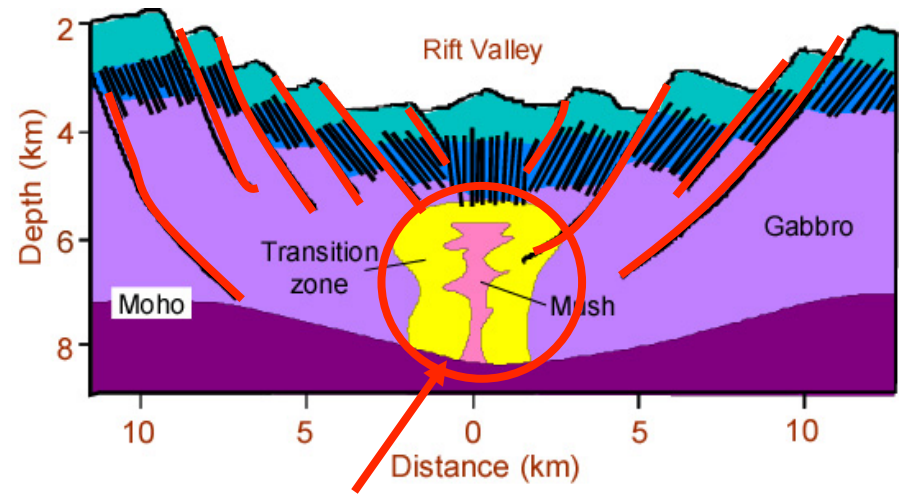
Figure 25. Nazca–Pacific magnetic profiles (obtained from the NGDC archives) from $\sim 31^\circ\text{S}$. Observed anomaly profiles are dashed, whereas computed synthetic anomaly profiles are solid. The



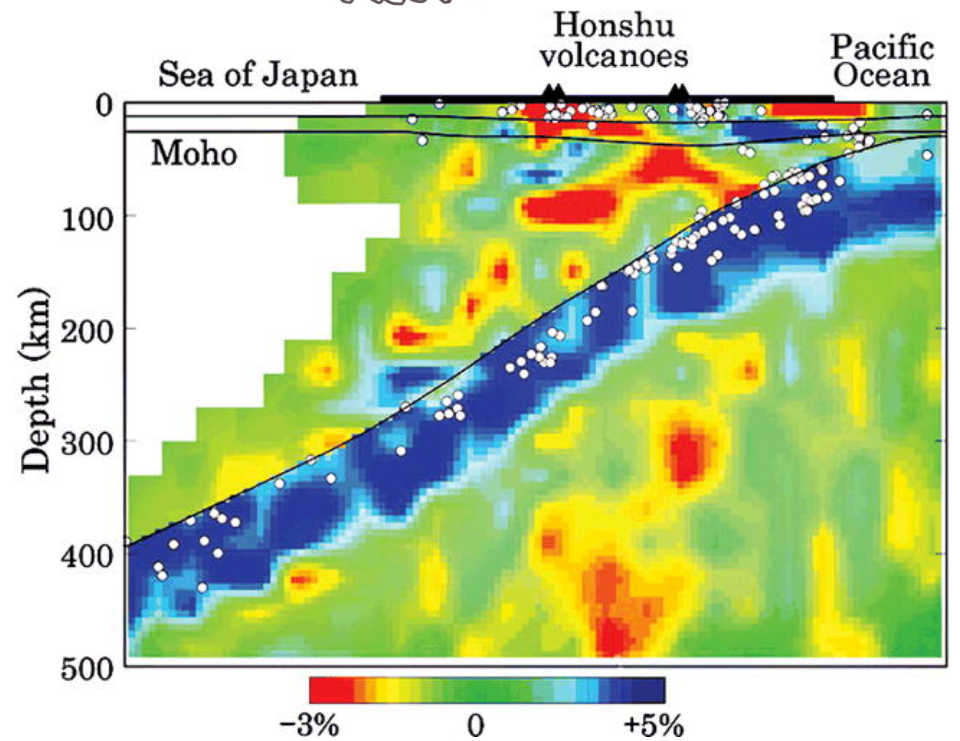
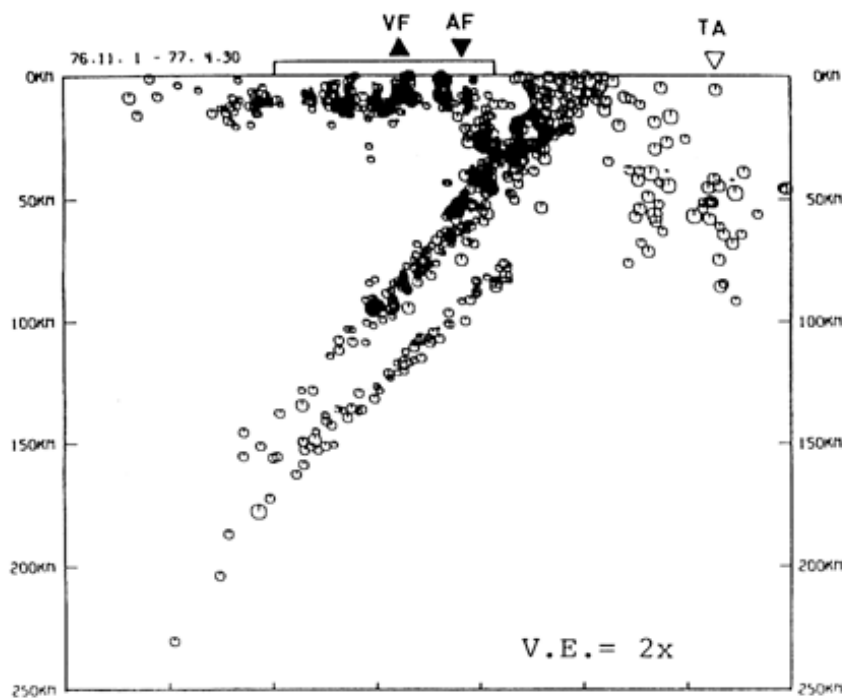
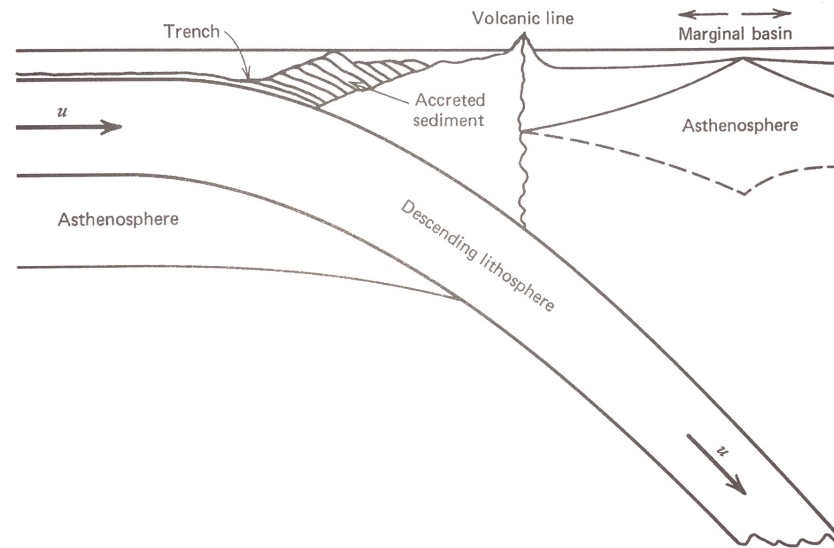
From MacDonald 1982



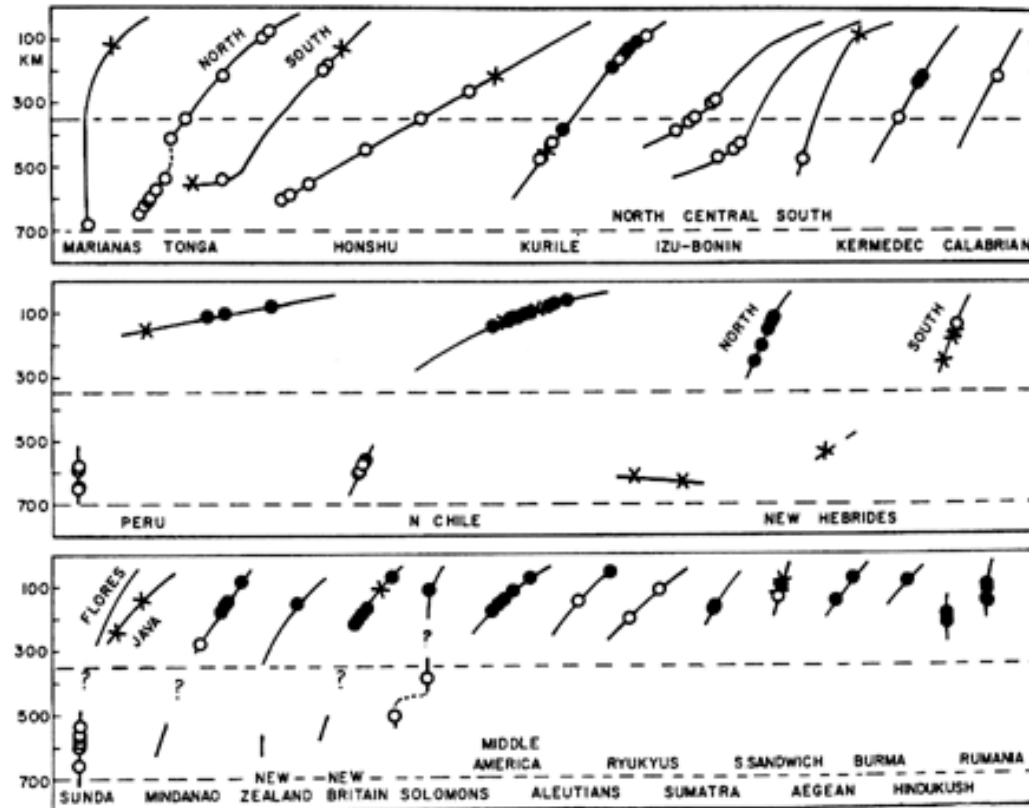
Courtesy of D. Fornari



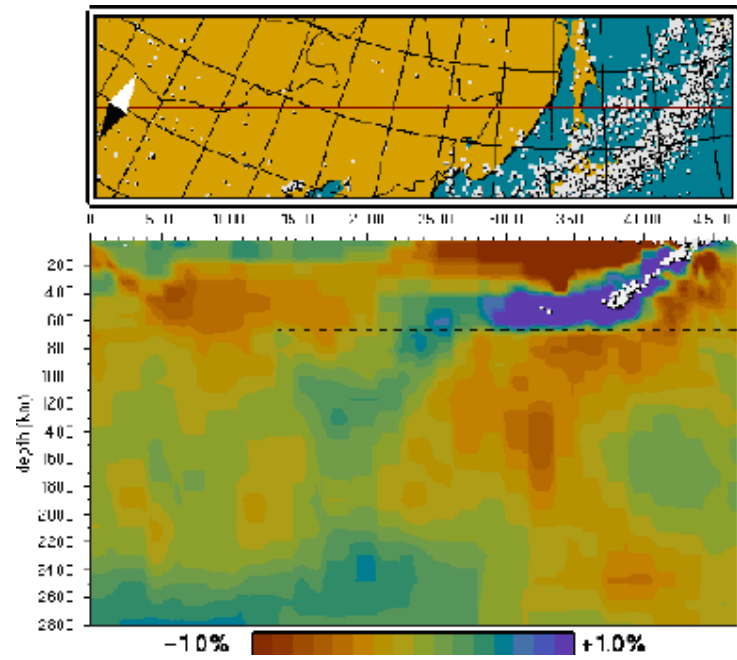
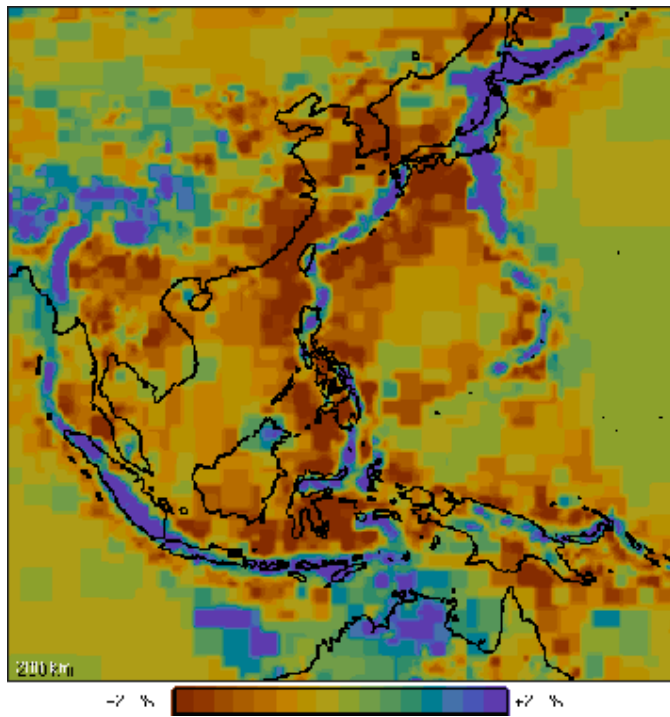
Temporary magma chamber

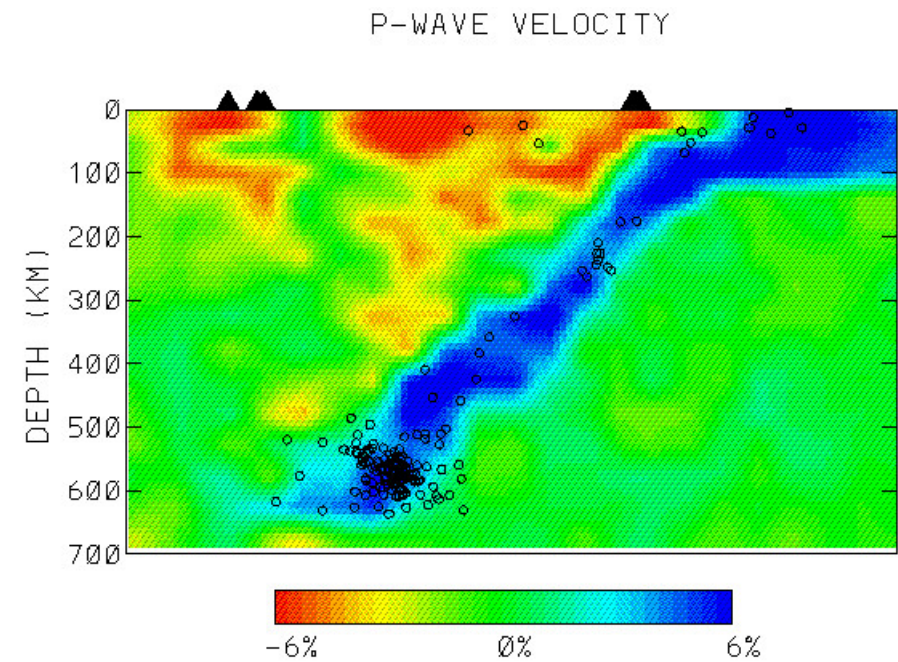
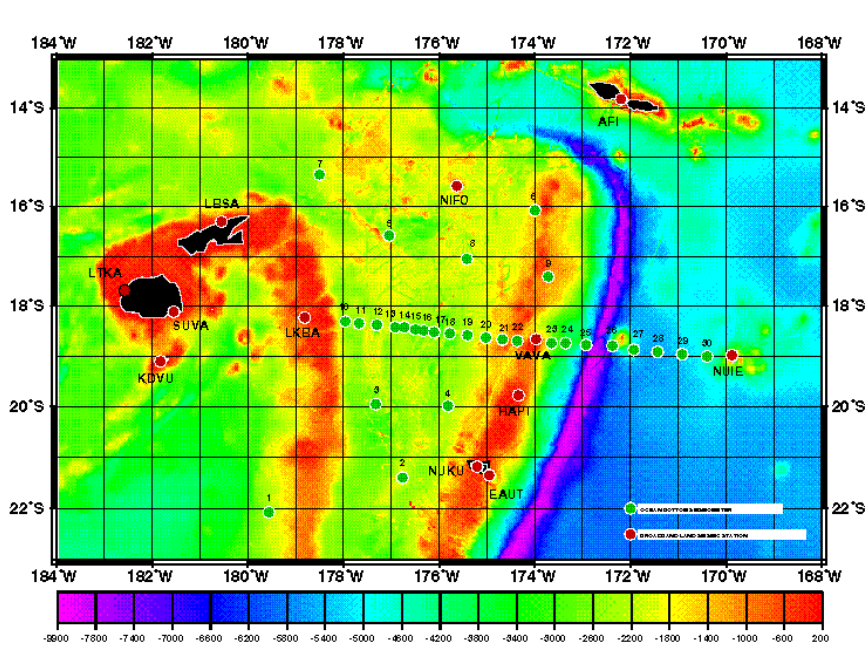


The Wadati-Benioff zone under northern Honshu, Japan, showing two parallel planes of earthquake loci. VF indicates the volcanic front, at the center of the land area (from Hasegawa, 1989).

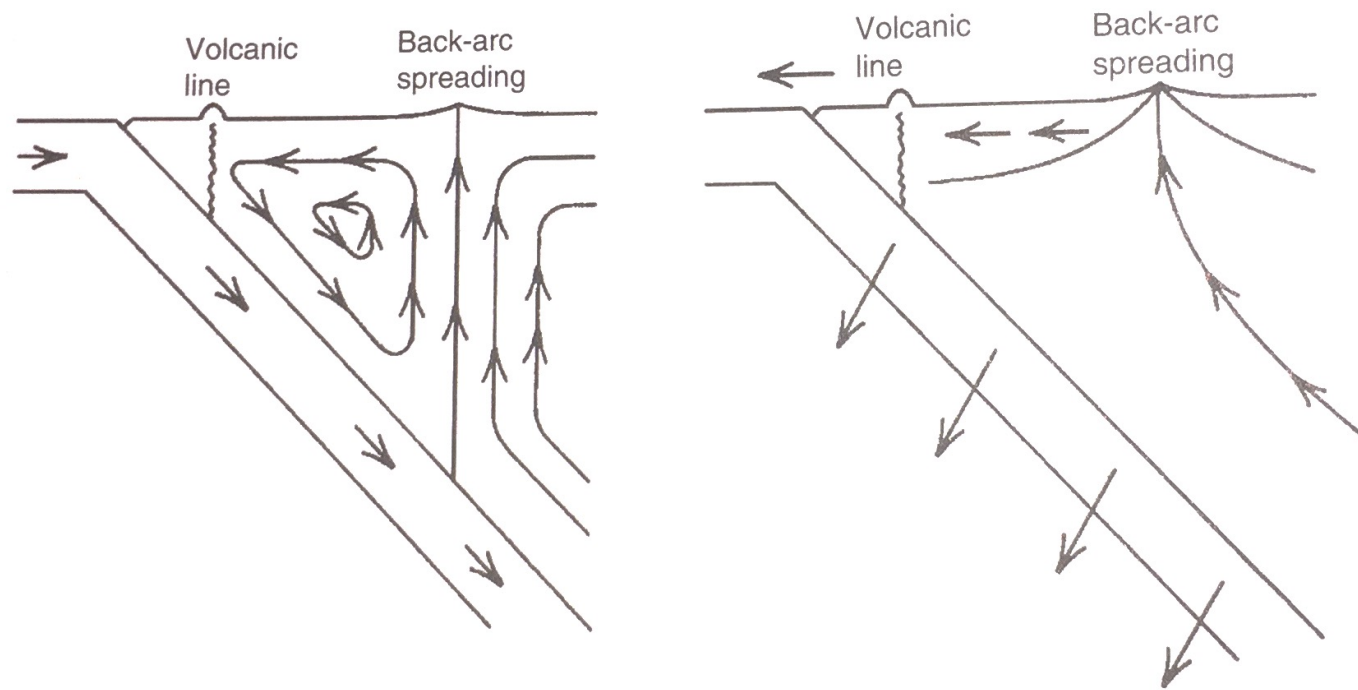


Distribution of down-dip stresses in inclined seismic zones. Open circles show mechanisms with the compressional axis parallel to the dip of the zone. Solid circles show mechanisms with the tensional axis parallel to the dip of the zone. Crosses indicate mechanisms with other orientations. Solid lines show the approximate configuration of the seismic zone (from Isacks and Molnar, 1971).



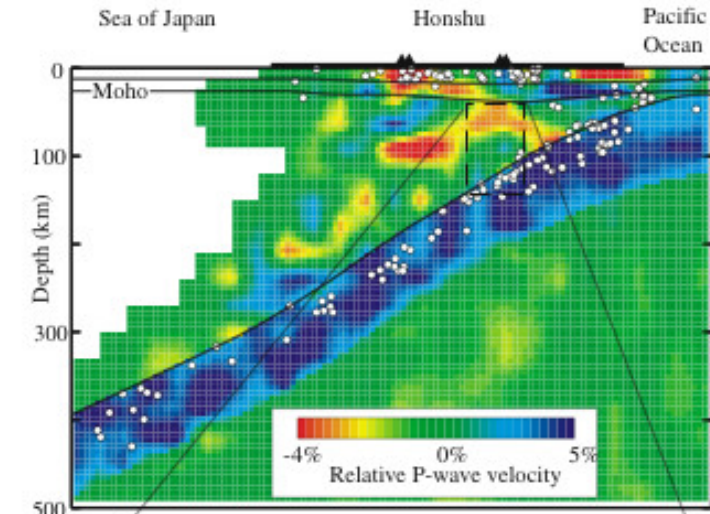


East west vertical cross-section of a P-wave tomographic image of the Tonga Subduction Zone and Lau Backarc Basin from Zhao et al., [1997]. The image was determined by inversion of ~41,000 P-wave arrival times from 926 earthquakes recorded by portable land seismic stations, ocean bottom seismographs, and teleseismic stations. Red and blue colors denote slow and fast velocities, respectively, and the velocity perturbation scale is shown at the bottom.

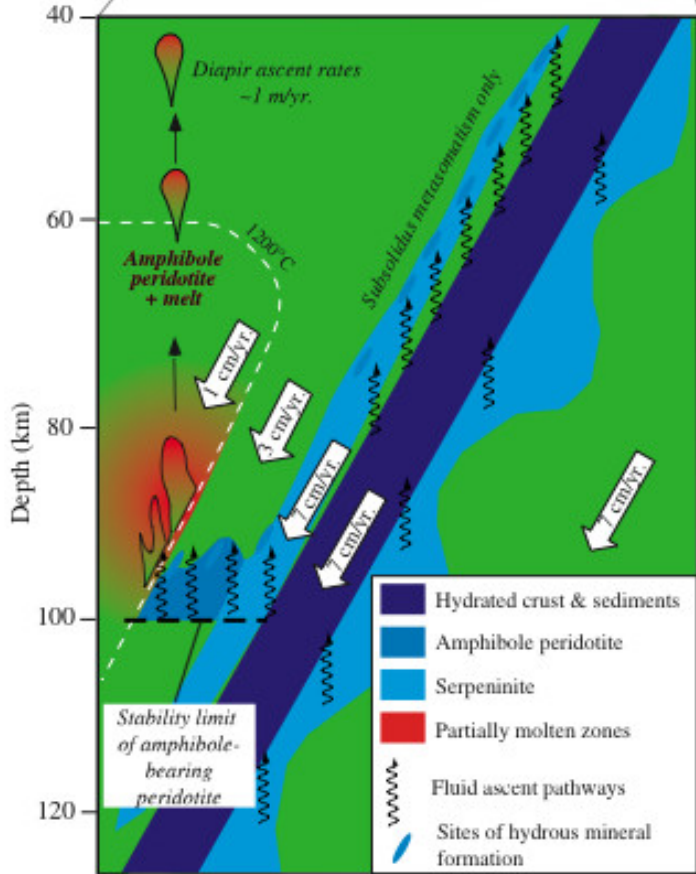


Si la LO plongeait dans un matériau à très faible viscosité – à la limite de l’eau – l’angle de plongement serait de 90° car cette force est verticale dirigée vers le bas. Ce n’est pas ce qui est observé, l’angle de subduction sur Terre est en moyenne de 45° , avec une certaine variabilité. Deux explications sont proposées :

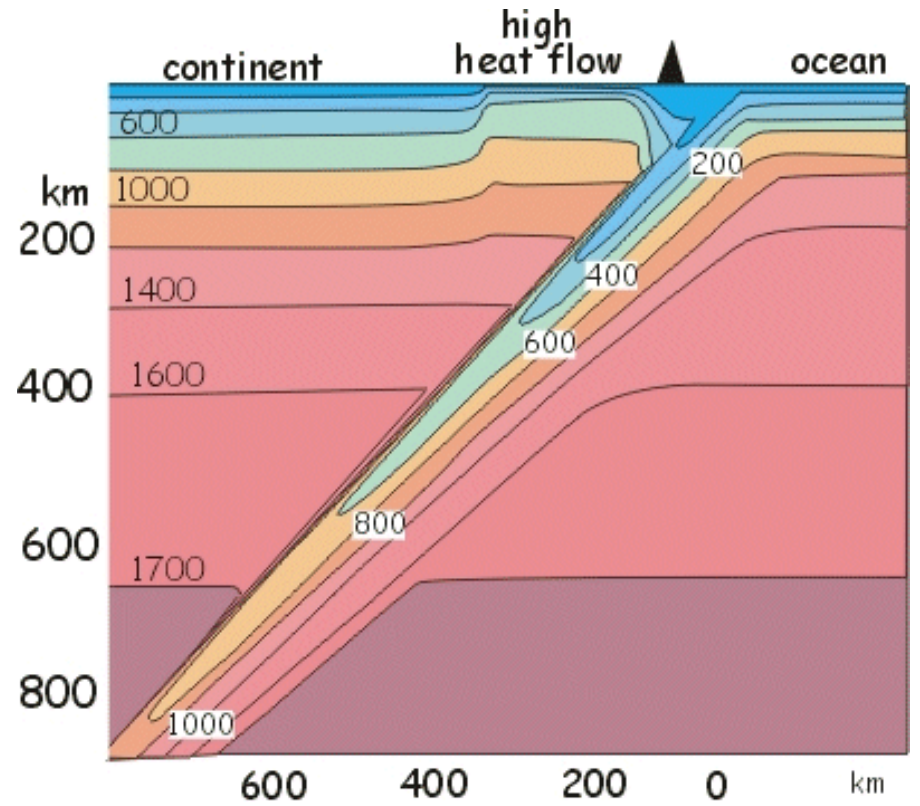
1. Le slab-pull induit un “retrait de la fosse” de subduction qui migre vers l’océan
2. Le slab est soutenu par le flux mantellique sus-jacent. En effet, la subduction de la LO induit un flux de matière dans le coin mantellique, généralement appelé “corner flow”. On peut montrer que ce CF induit une force de pression qui induit un pendage de 45° .

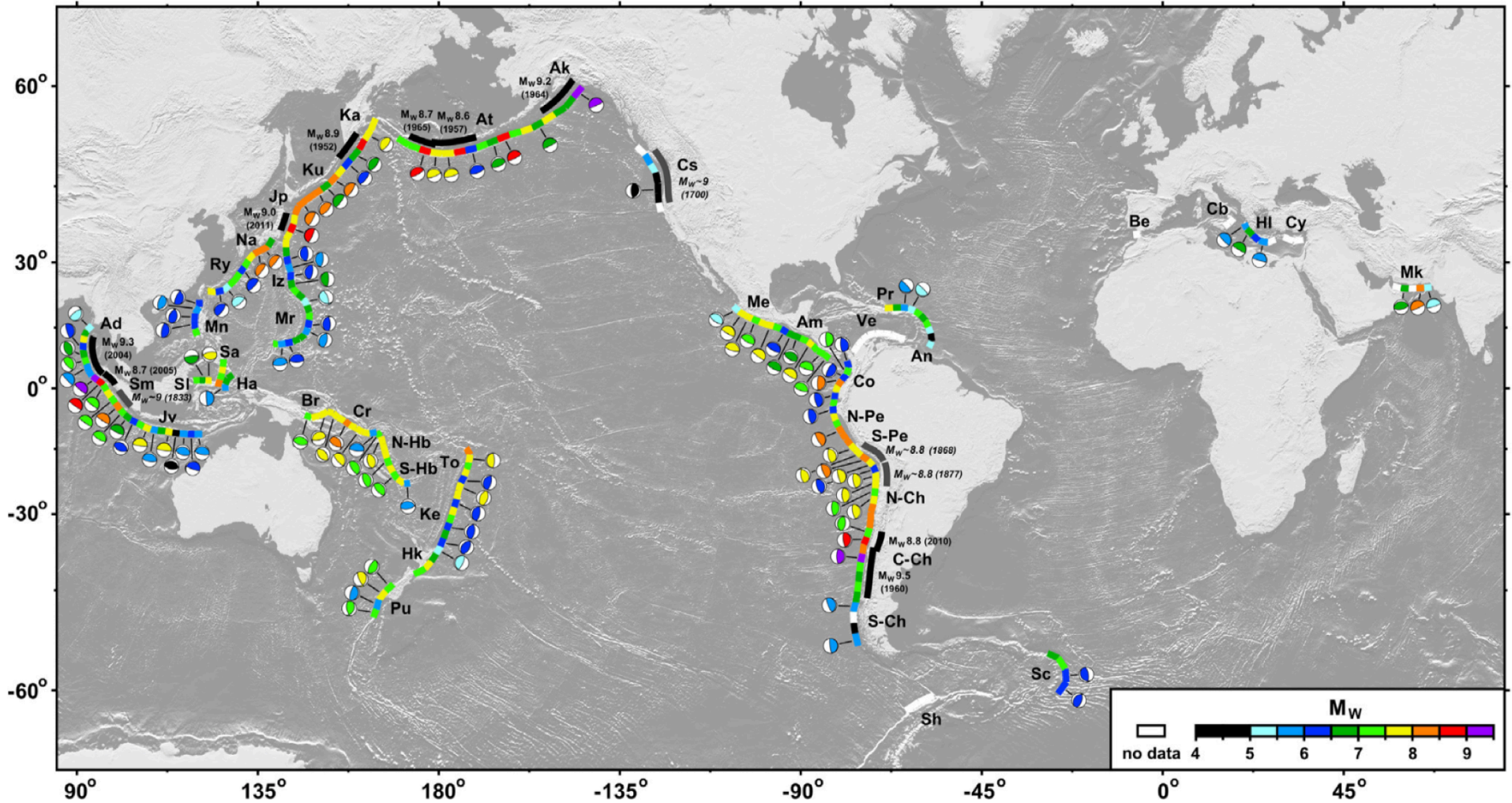


P-wave Tomography
Zhao et al., 1994

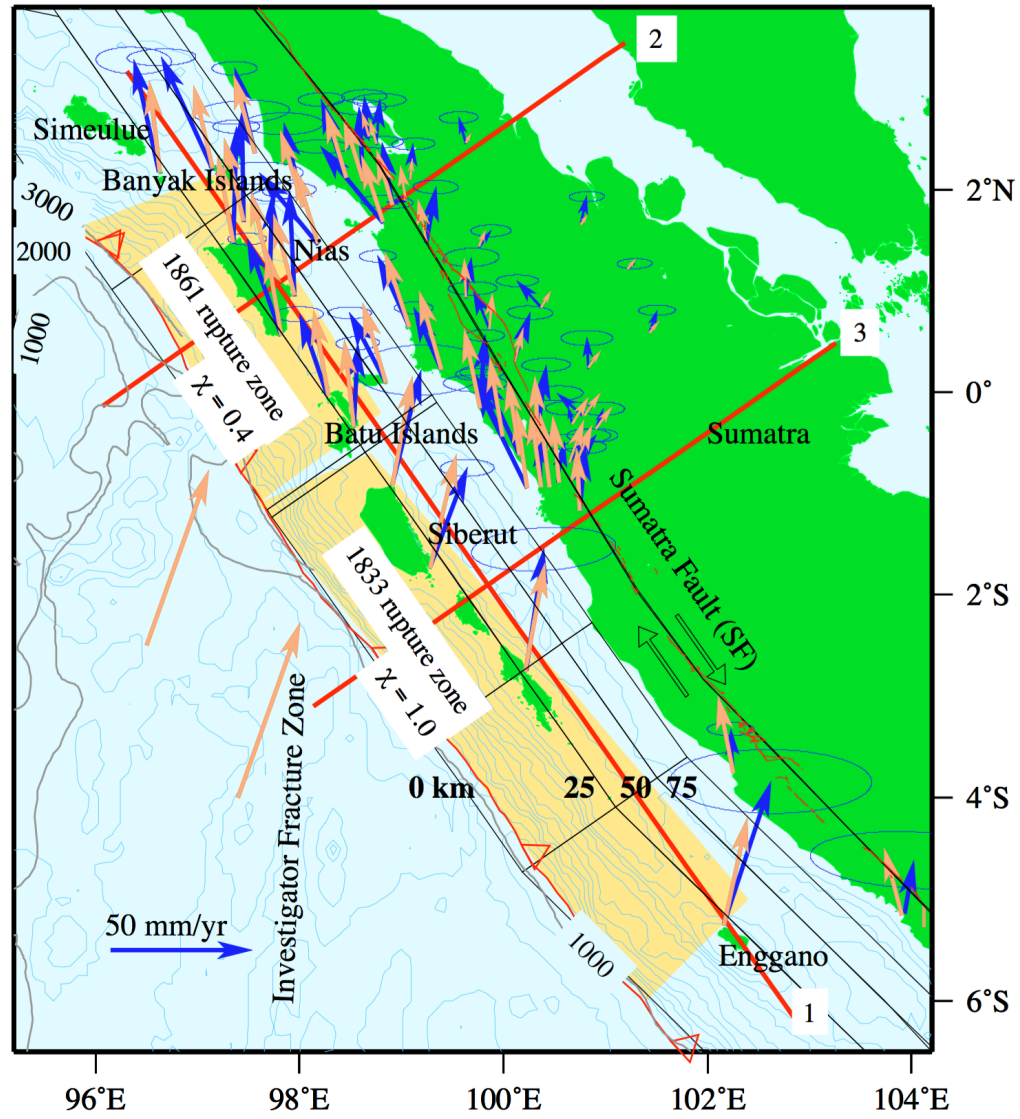


Petro-tectonic Cartoon
Stern, 1998





Global map showing the location of the active subduction zones. Subduction zones have been divided into 200 km segments as indicated by the colored line segments. Color indicates the maximum subduction zone thrust earthquake recorded in that segment in the period 1900–June 2012. For a large number of segments a focal mechanism has been plotted as obtained from the GCMT catalog or from published material (see Section 2). The map also shows the trench-parallel rupture extent of the largest earthquakes ($M_W > 8.5$) whose rupture extent overlaps with multiple trench segments (thick black lines for recorded earthquakes since 1900 and thick grey lines for four “historic” earthquakes before 1900). Numbers indicate the M_W value, while the year of the earthquake is in brackets (recorded earthquakes in bold and “historic” earthquakes in bold italic).



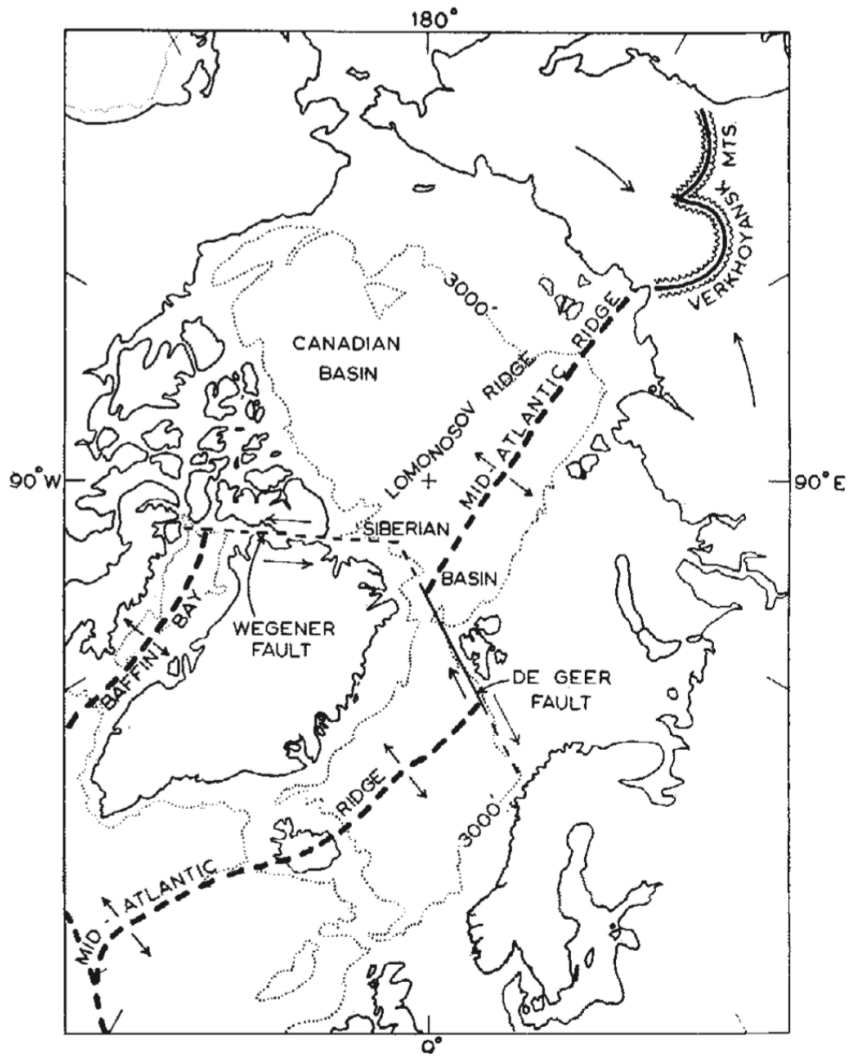


Fig. 5. Sketch map of the termination of the Mid-Atlantic ridge by two large transform faults (Wegener and De Geer faults) and by transformation into the Verkhoyansk Mountains

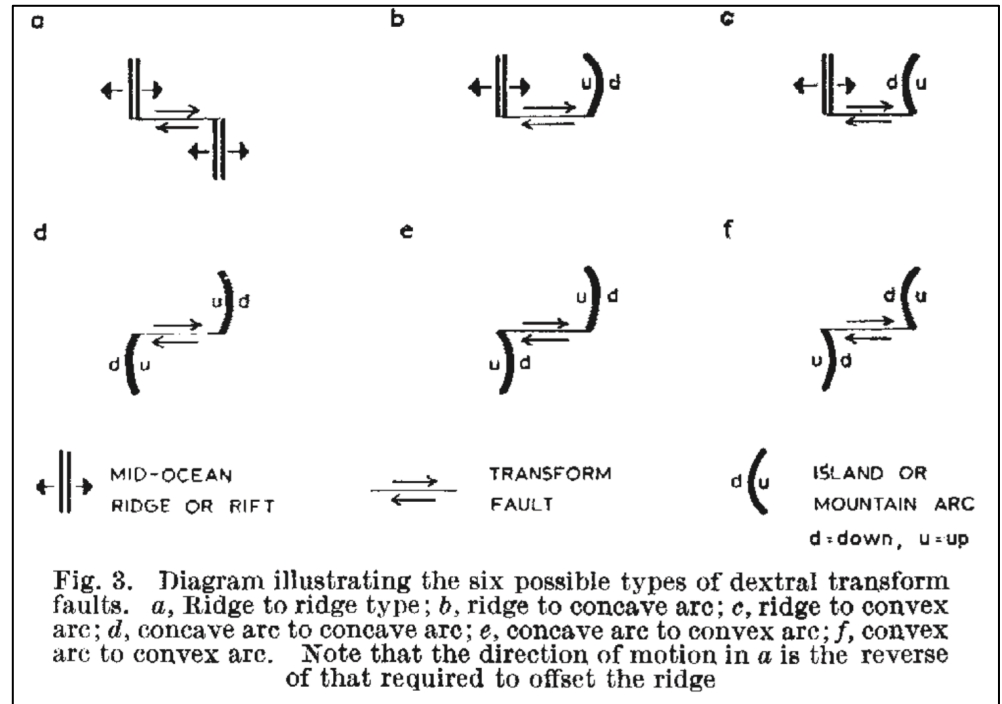
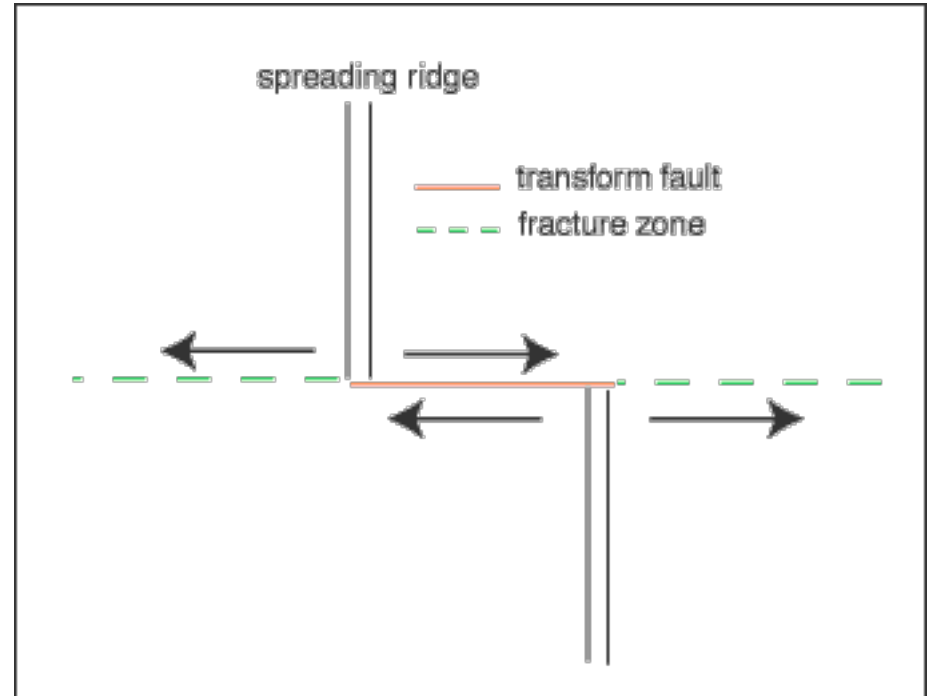
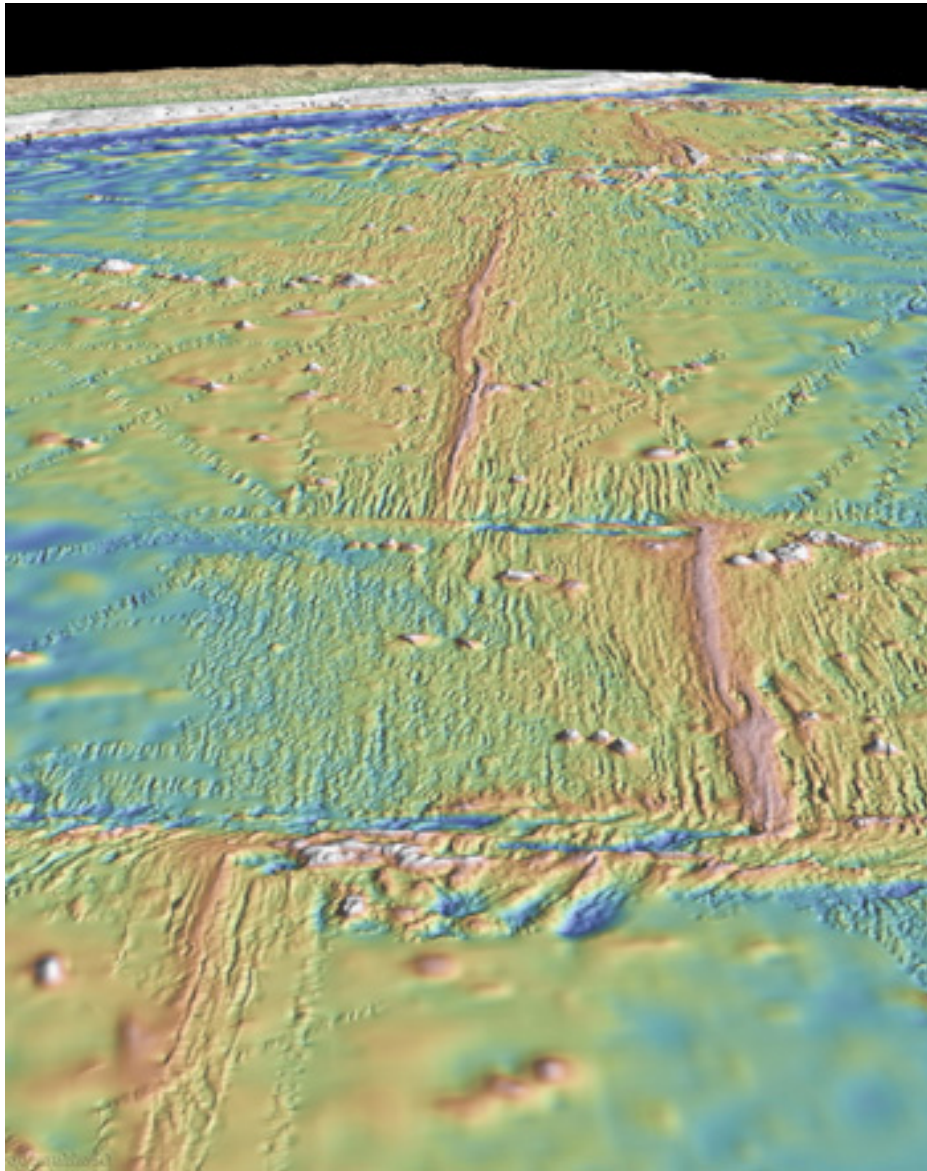
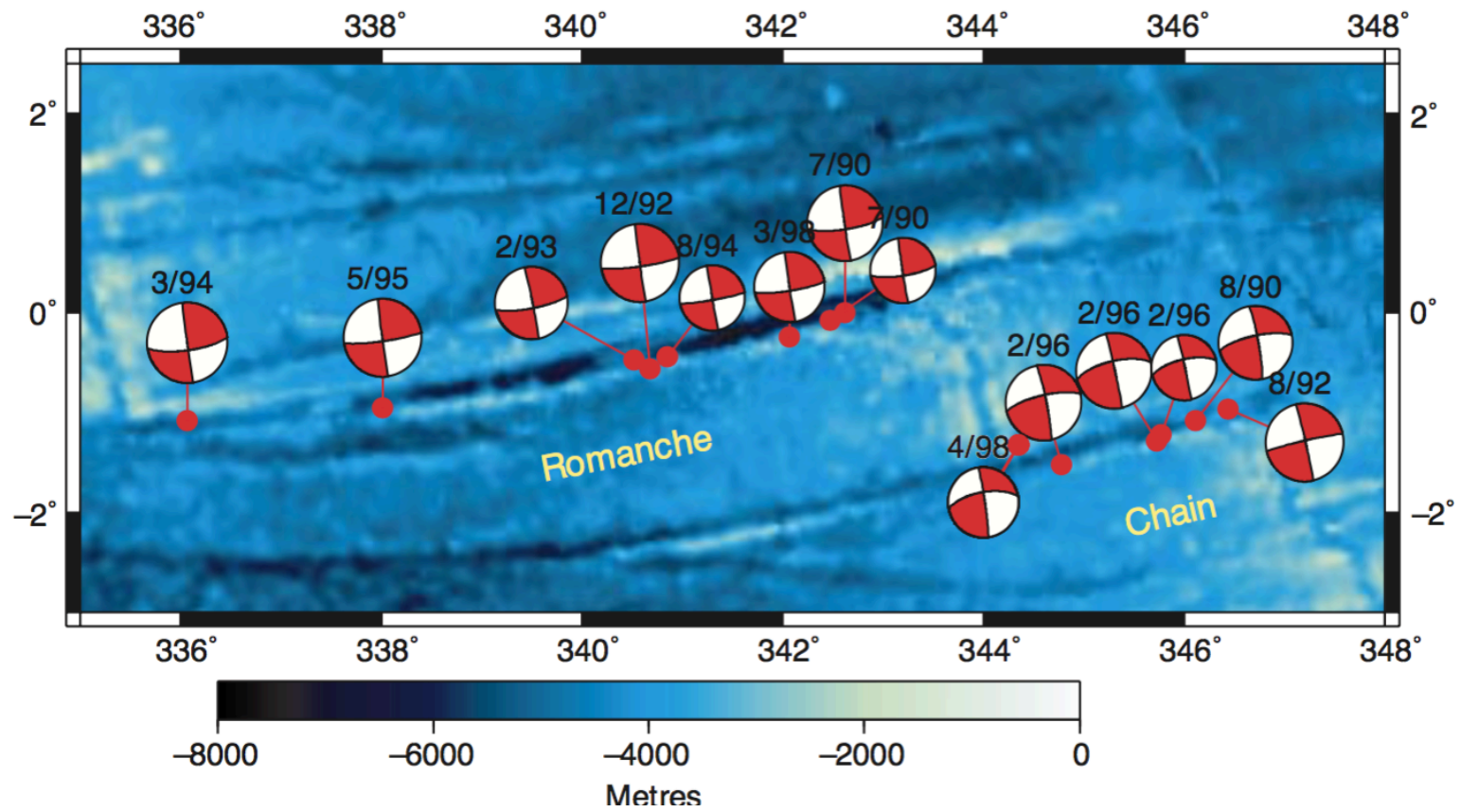
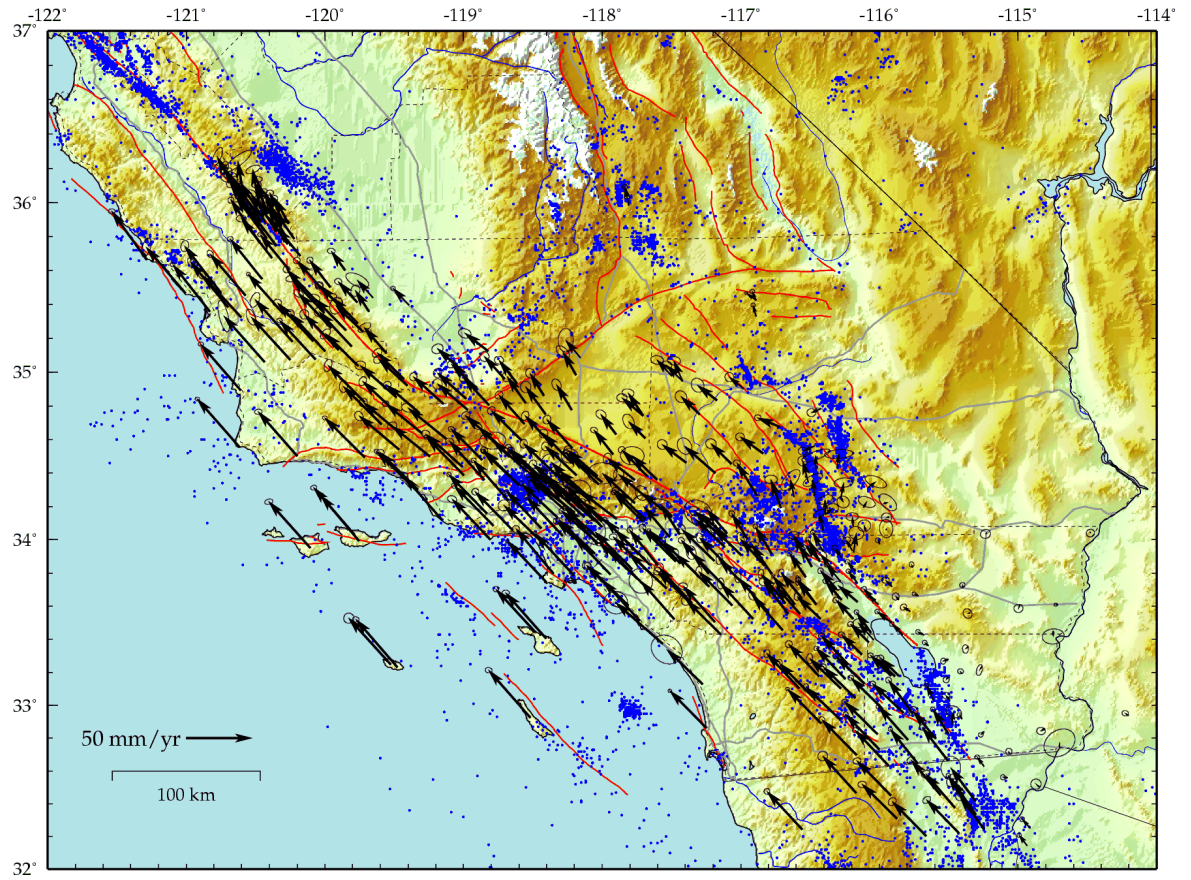
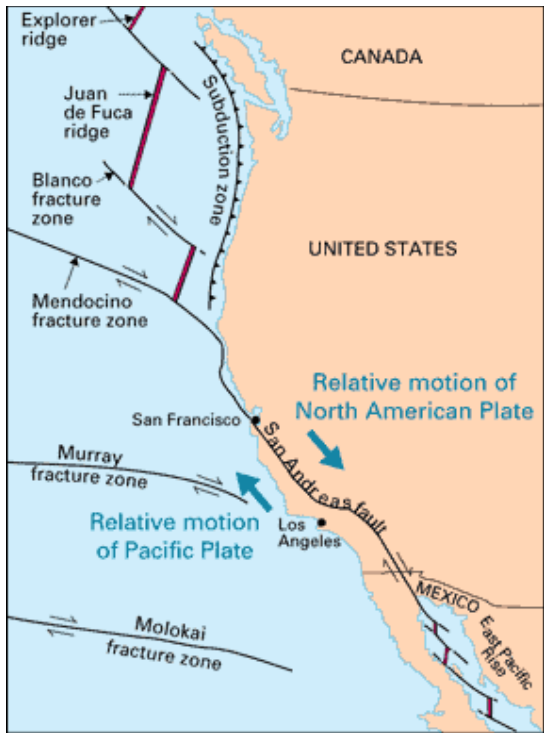


Fig. 3. Diagram illustrating the six possible types of dextral transform faults. *a*, Ridge to ridge type; *b*, ridge to concave arc; *c*, ridge to convex arc; *d*, concave arc to concave arc; *e*, concave arc to convex arc; *f*, convex arc to convex arc. Note that the direction of motion in *a* is the reverse of that required to offset the ridge





R. E. Abercrombie and G. Ekström, "Earthquake slip on oceanic transform faults," *Nature*, 2001.



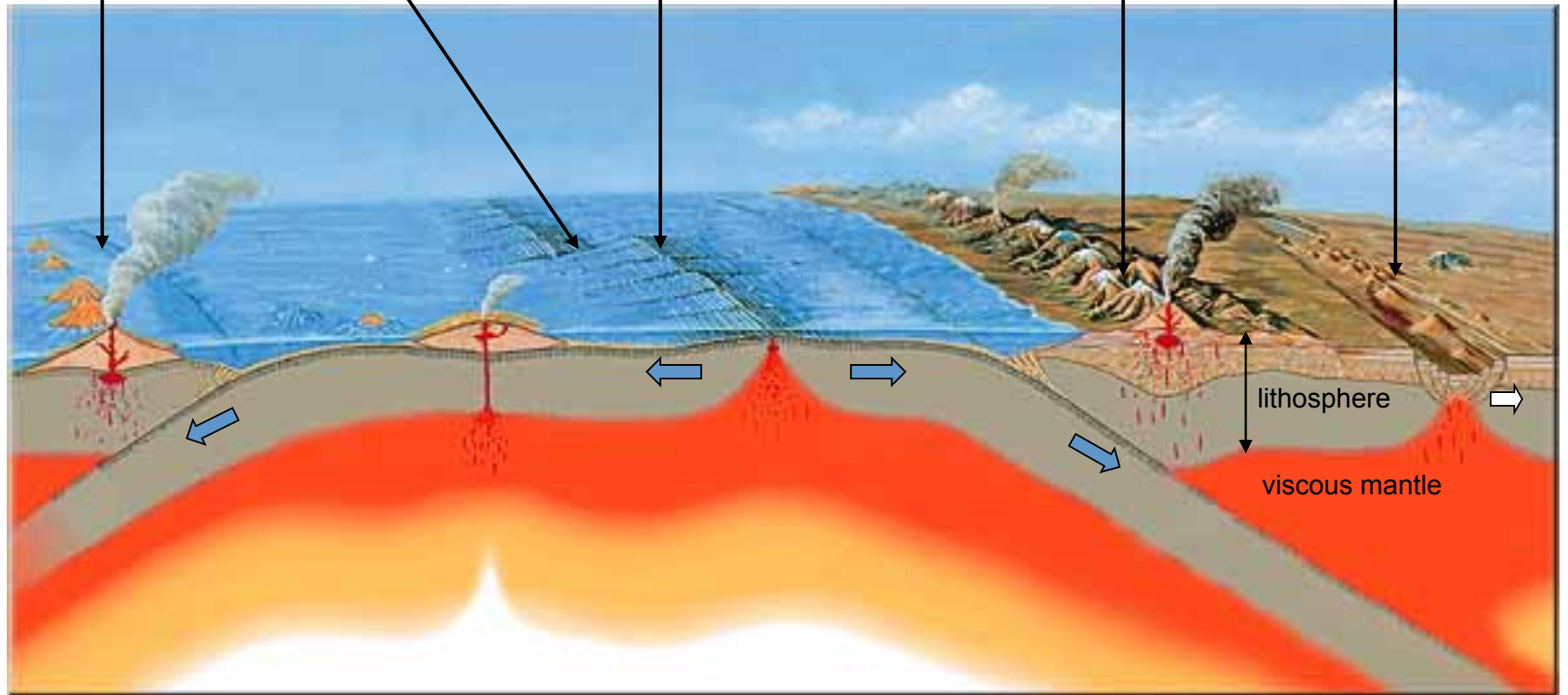
Subduction océan-océan
⇒ arc volcanique

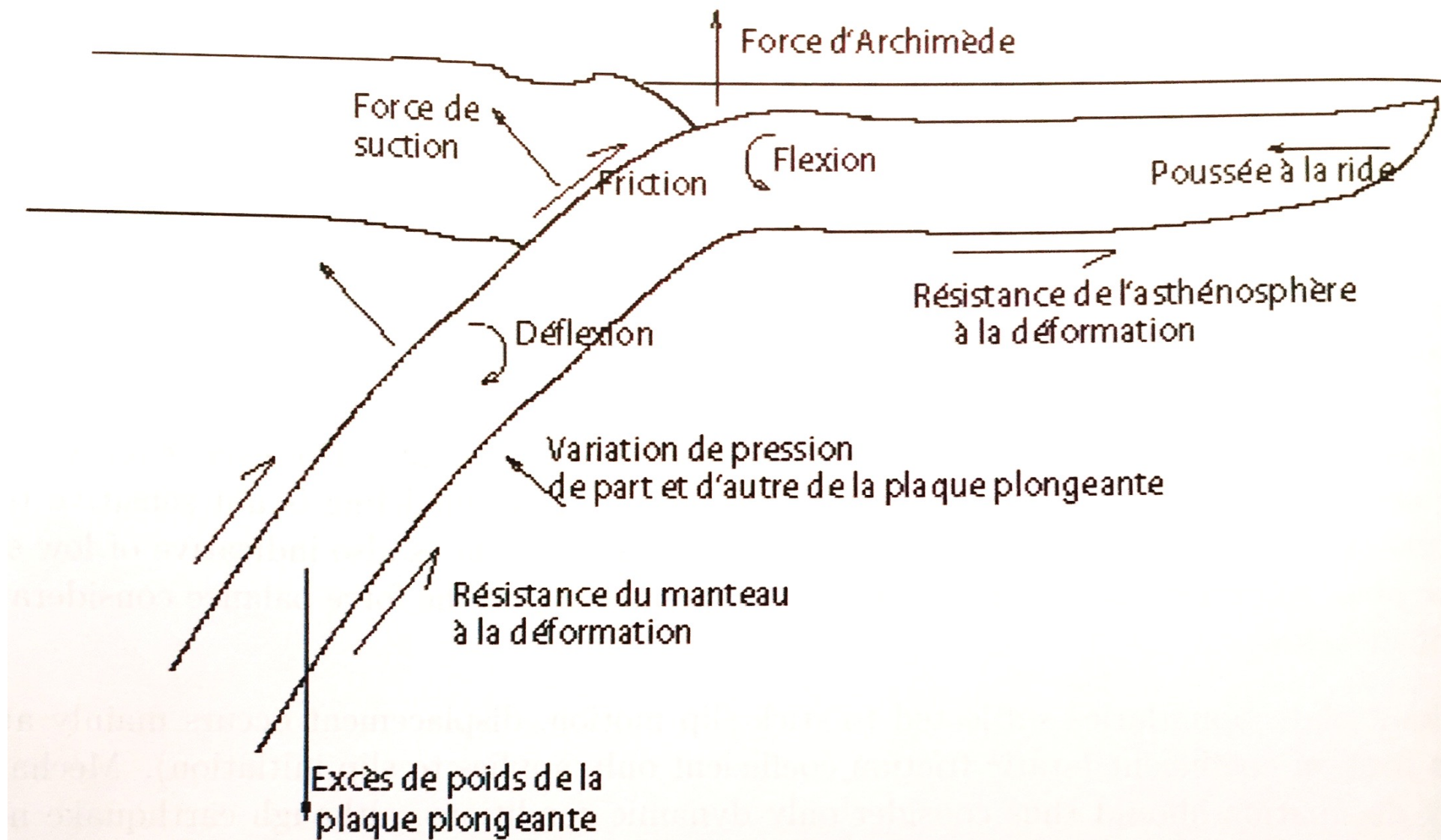
Faïlle transformante
⇒ mouvement cisailant

Ride médio-océanique
⇒ création de croûte océanique

Subduction océan-continent
⇒ volcanisme

Rifting
⇒ rupture des continents





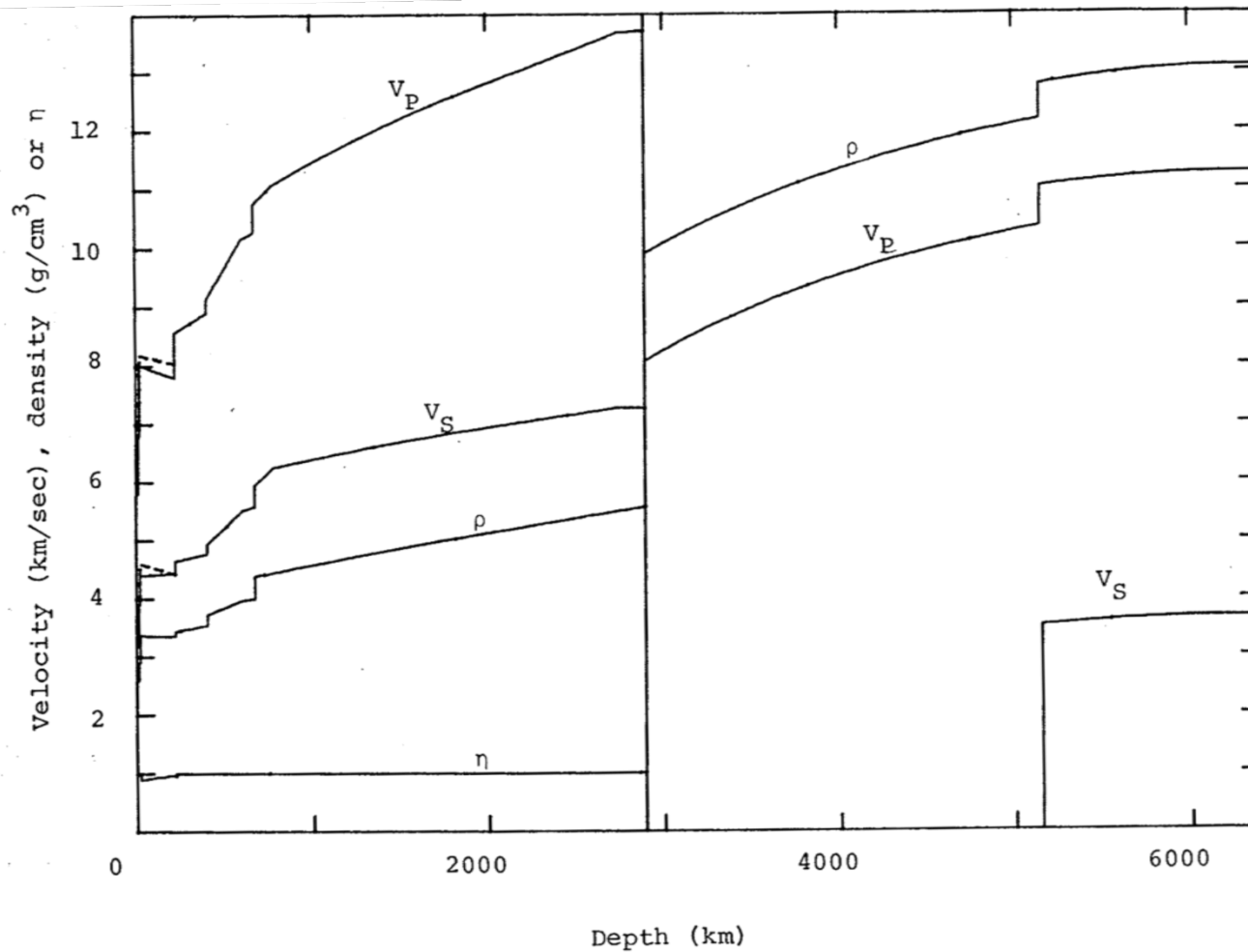
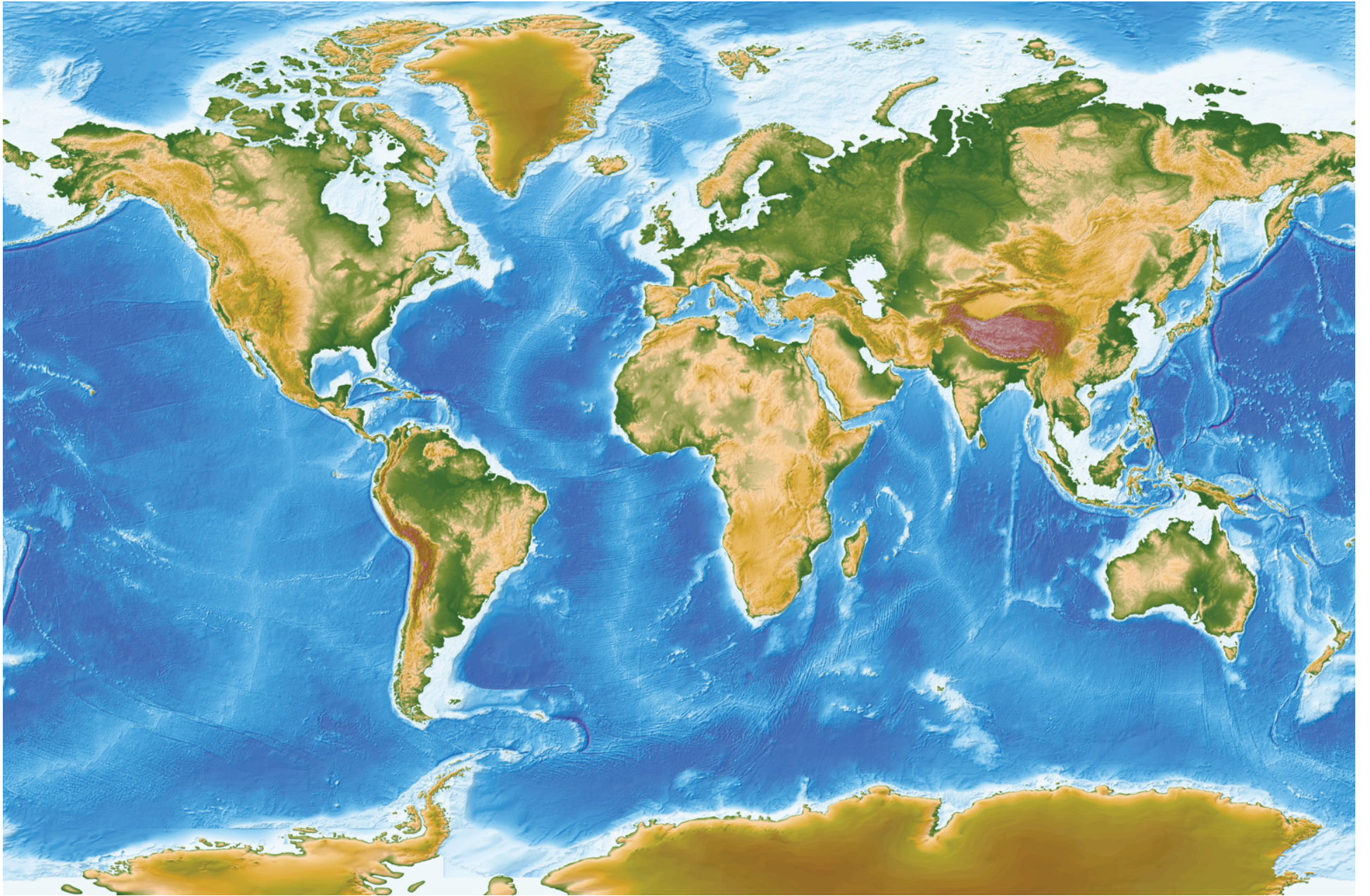
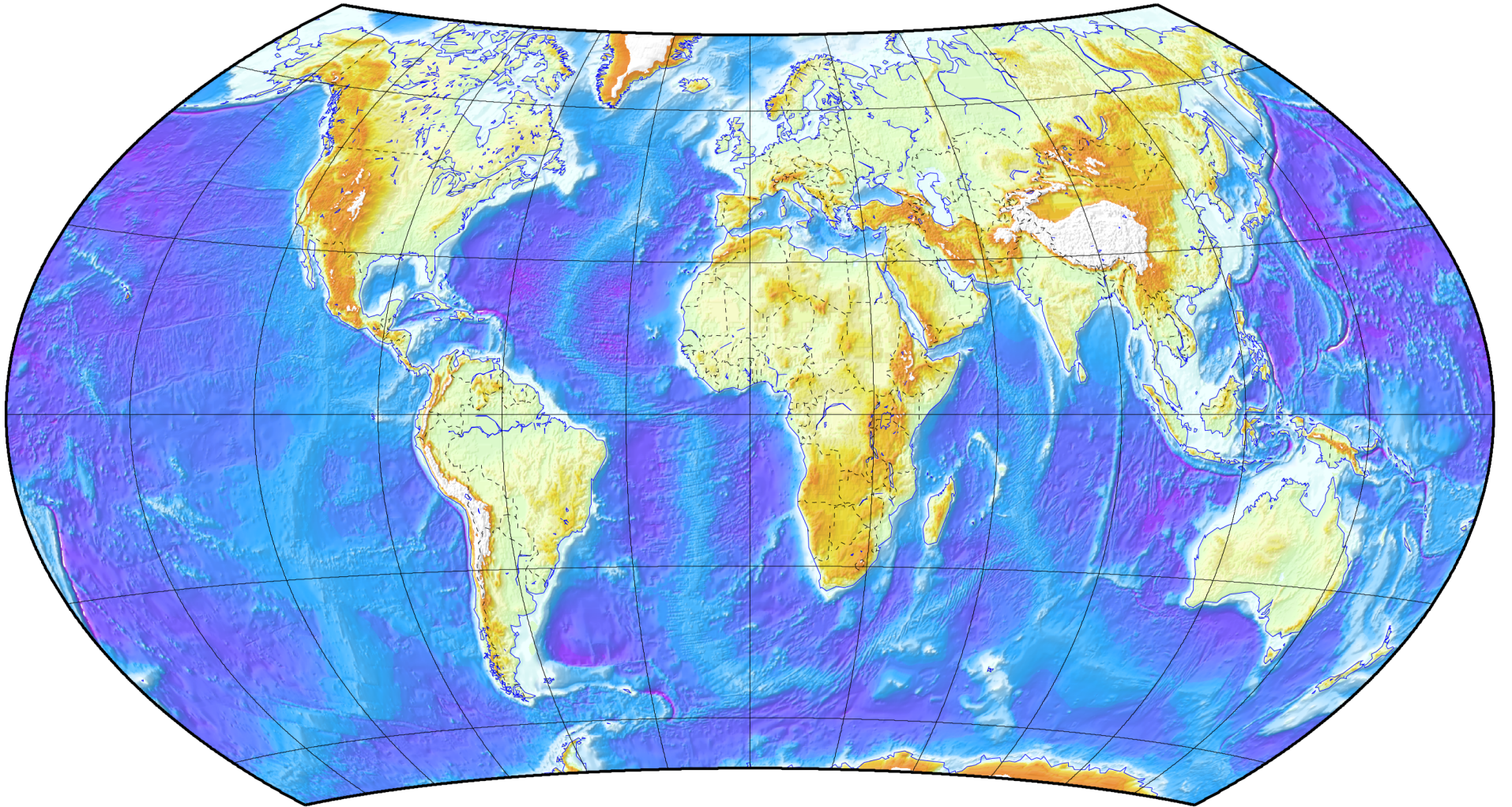
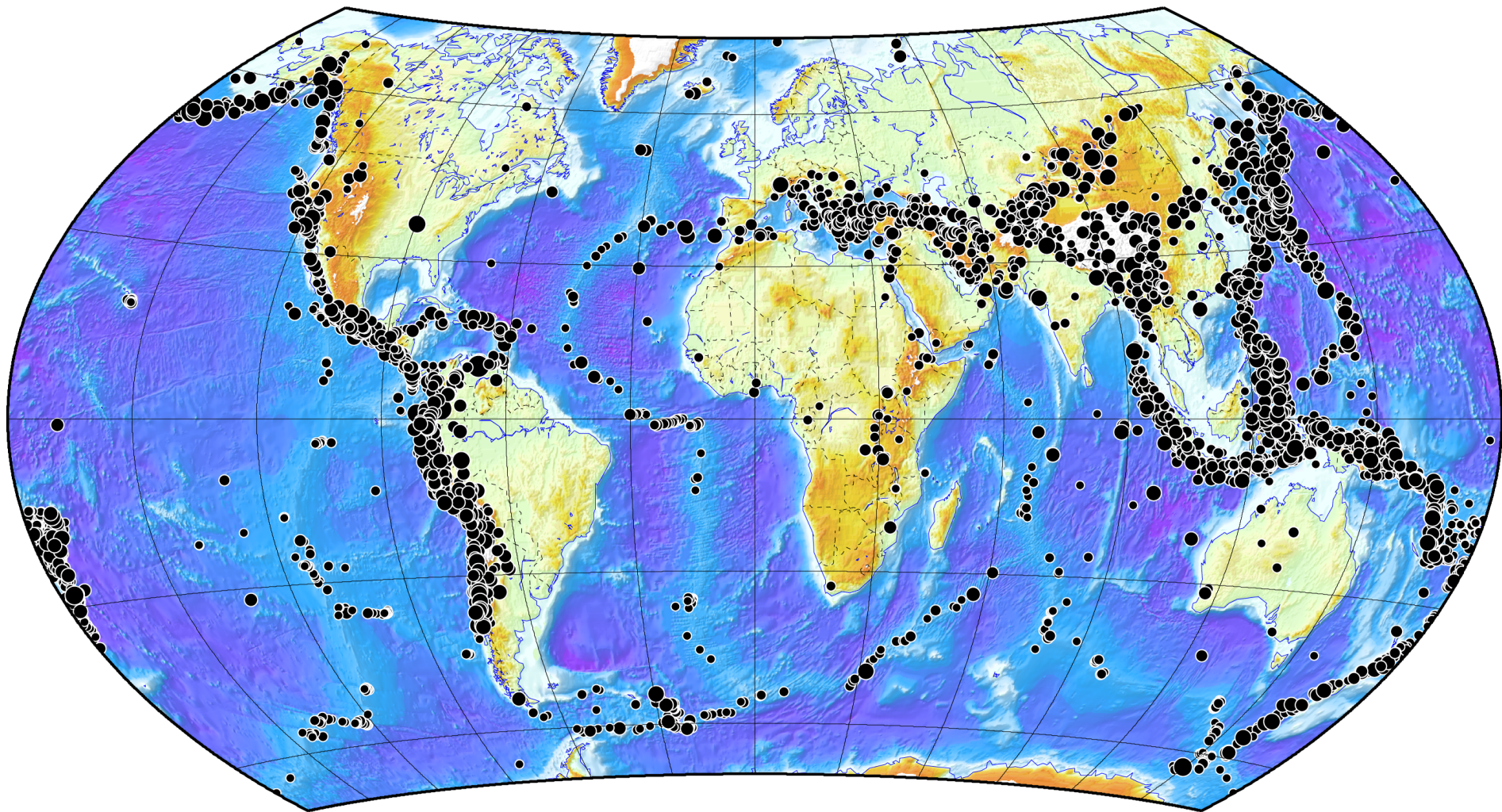
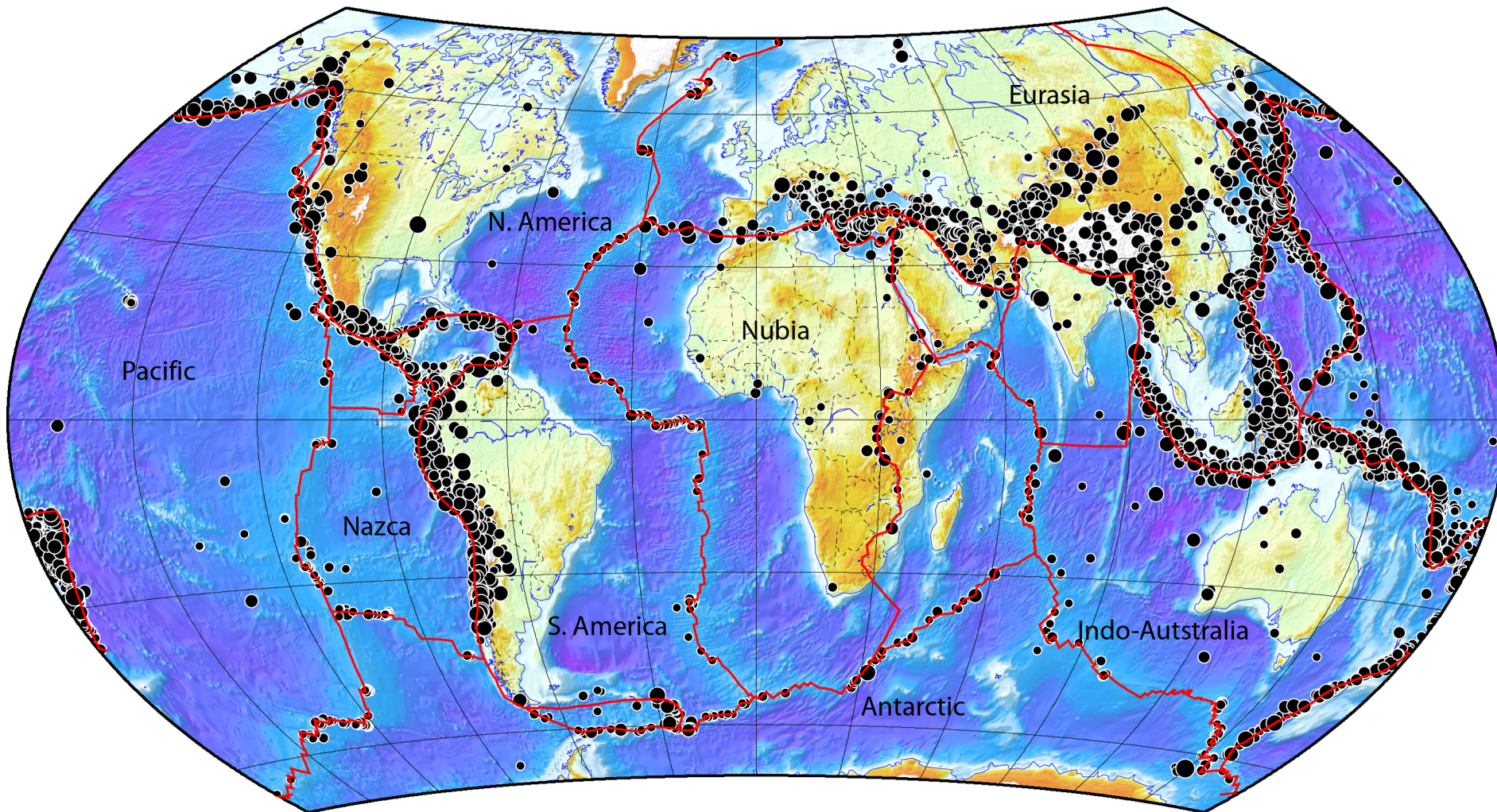


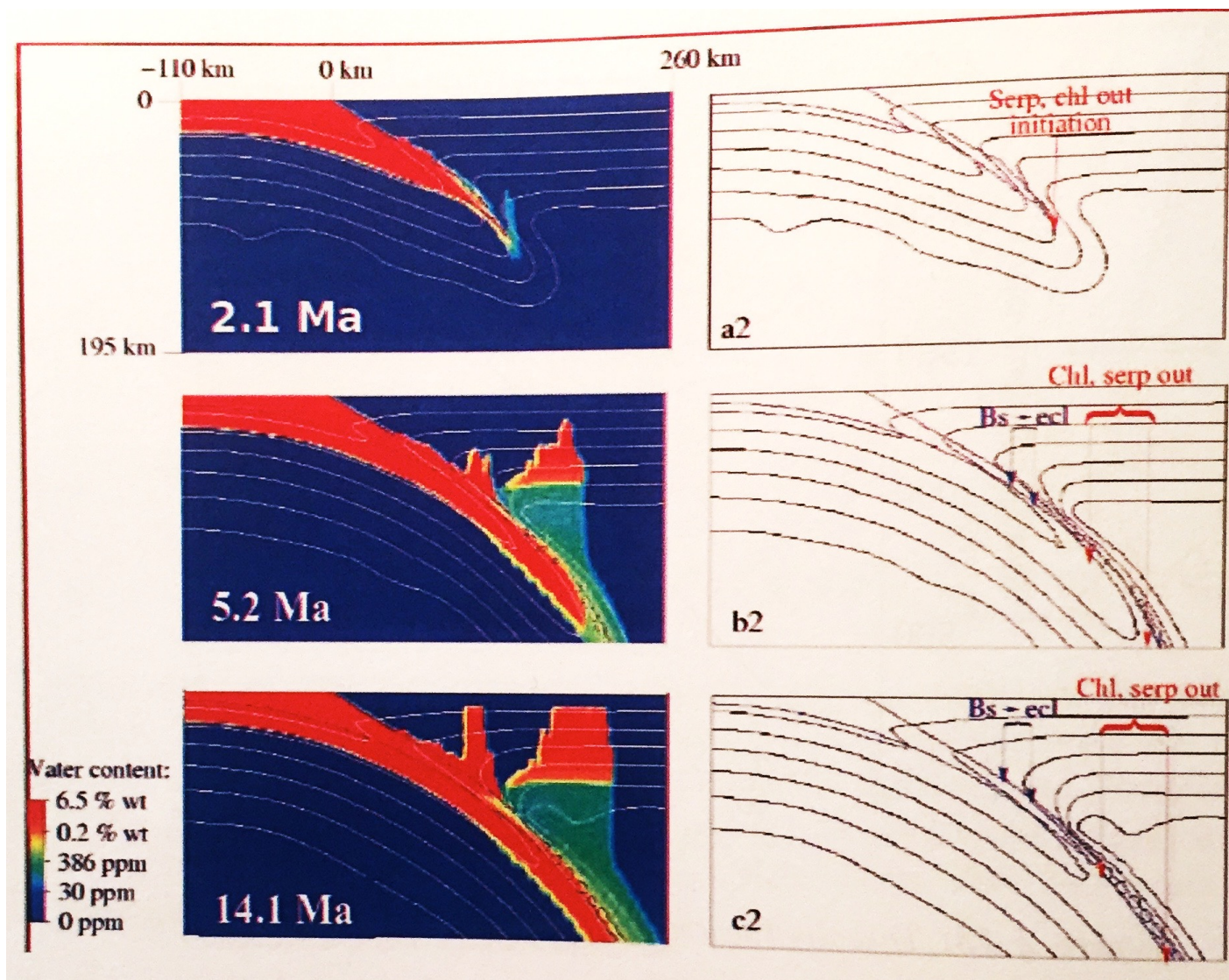
Fig. 8. The PREM model. Dashed lines are the horizontal components of velocity. Where η is 1 the model is isotropic. The core is isotropic.



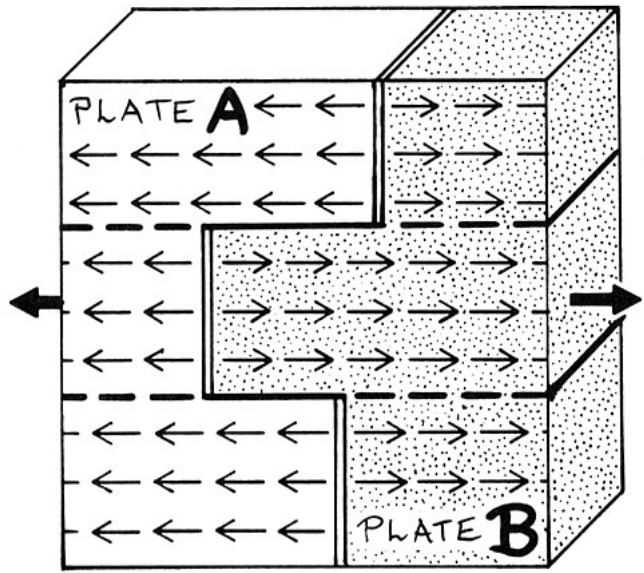




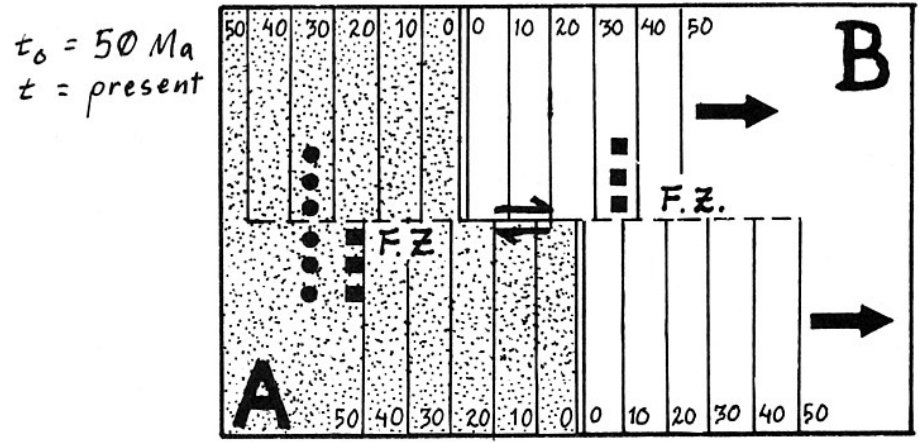
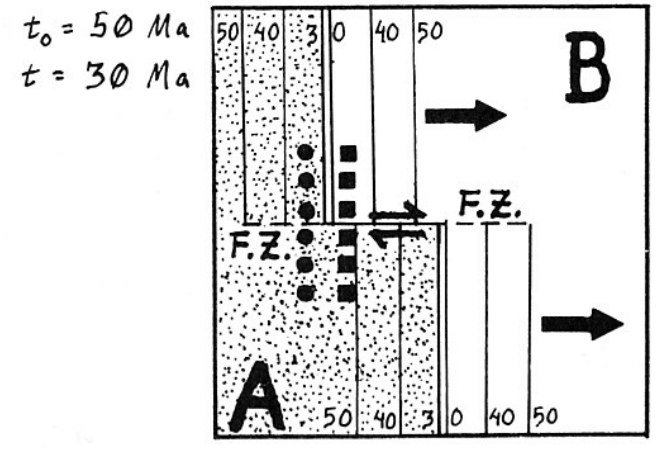




Doin et al.



- Transform with Earthquakes
- Fracture Zone without Earthquakes
- Spreading Center at Rise



- SURVEY MARKERS EMPLACED 30 Ma
- F.Z.** FRACTURE ZONE (inactive fault)
- TRANSFORM (active fault)
- ISOCHRONS (showing age in Ma)
- motion of plate B relative to plate A.