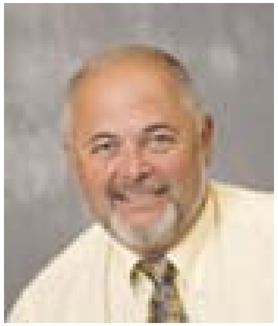
Week 3 Ch 5 PPT

EAPS 10000 Y01
Online Course
Planet Earth
Prof. Lawrence Braile

Welcome to the EAPS 10000 Y01 online course ***Planet Earth*** *(also known as EAPS 100)!*



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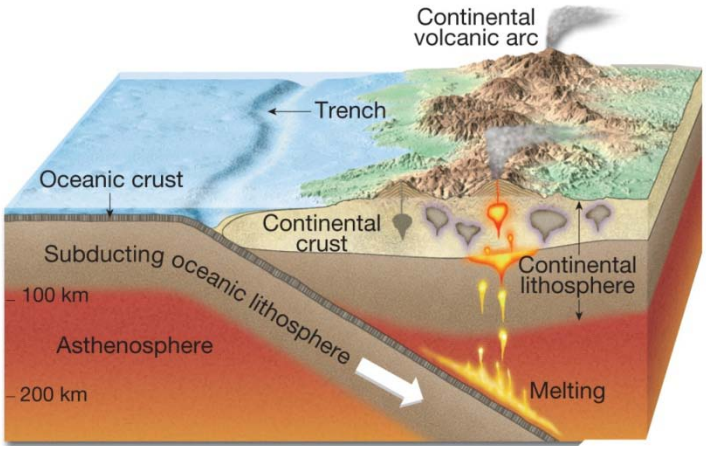
PURDUE UNIVERSITY

Earth Atmospheric Planetary Sciences

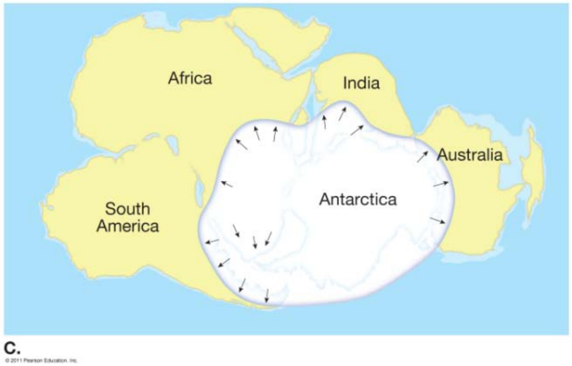
EAPS 10000 Y01 – *Planet Earth* (online course)
Week 3, Chapter 5 (pages 150-187, text)

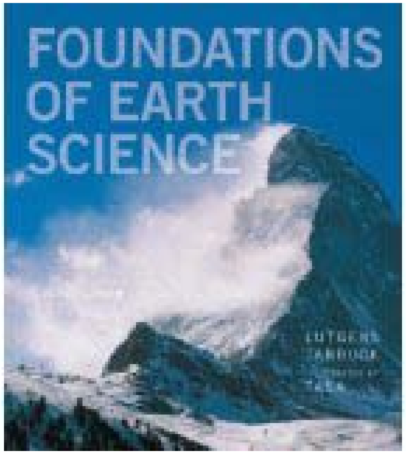
Week	Chapter	Assigned Pages	Major Concepts	Important Terms
3	**5 – Plate Tectonics**	150 – 187	Evidence for plate tectonics, plate boundaries, paleomagnetism, what drives plate motions?	Continental drift, lithosphere, asthenosphere, seafloor spreading, hotspots, magnetic stripes, deep sea trenches, subduction



Convergent plate boundary (like most of west coast of S. America)

Ancient ice age when continents were together





EAPS 10000 Y01 – Planet Earth (online course)
Week 3, Chapter 5 (pages 150-187)

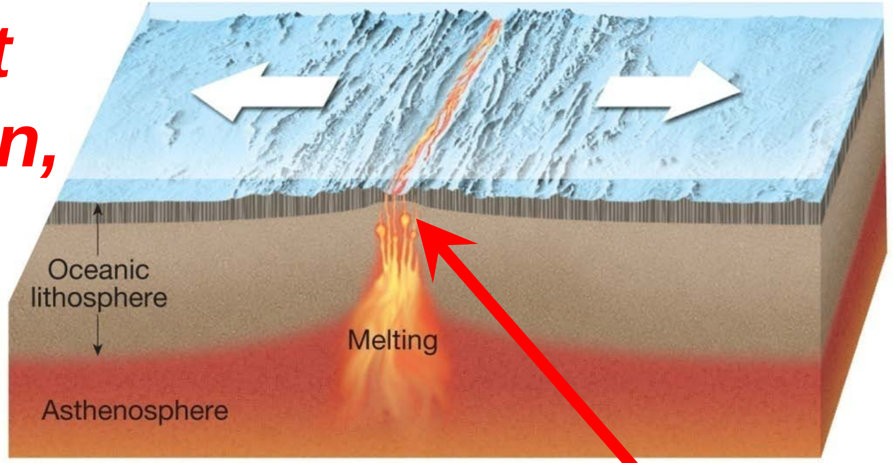
When you have finished reading Chapter 5 and viewing the PowerPoint file for Chapter 5, take the quiz (Qz 4; be sure to read the Syllabus for more information on quizzes). You can use your book, notes, etc. during the quiz.

The PPT files (converted to PDF files) are best viewed with the Full Screen view in browsers.

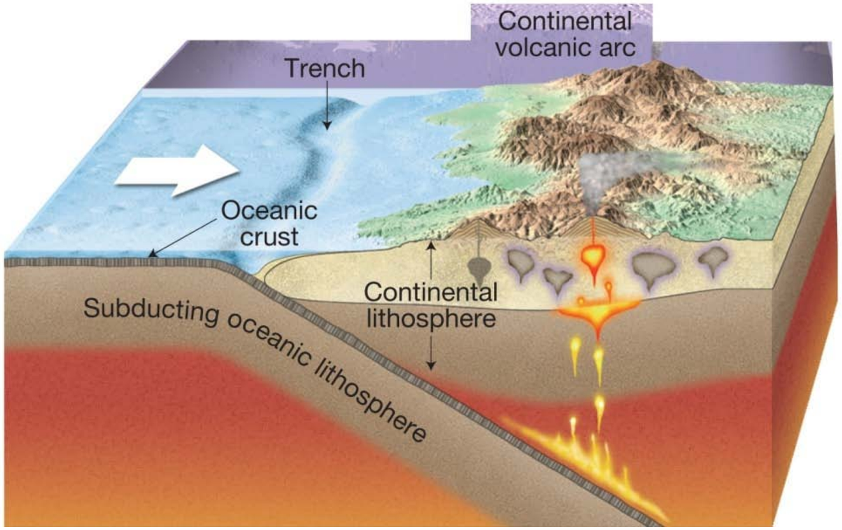
The following slides illustrate some of the important concepts and topics of Chapter 5.

The three types of plate boundaries…
(Figure 5.12, text)

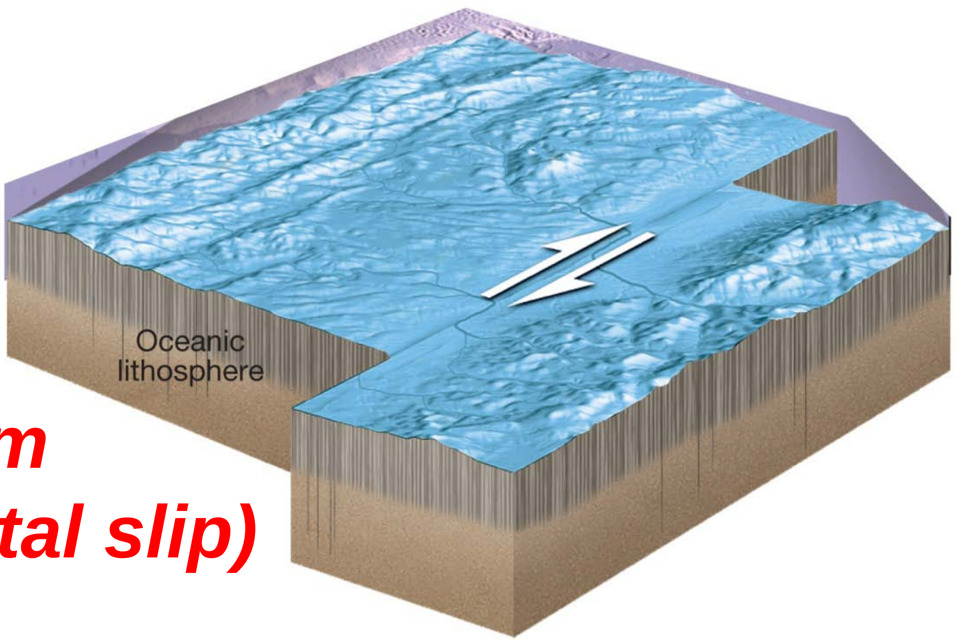
Divergent (extension, moving apart)



Basaltic volcanism (from melting of normal mantle)



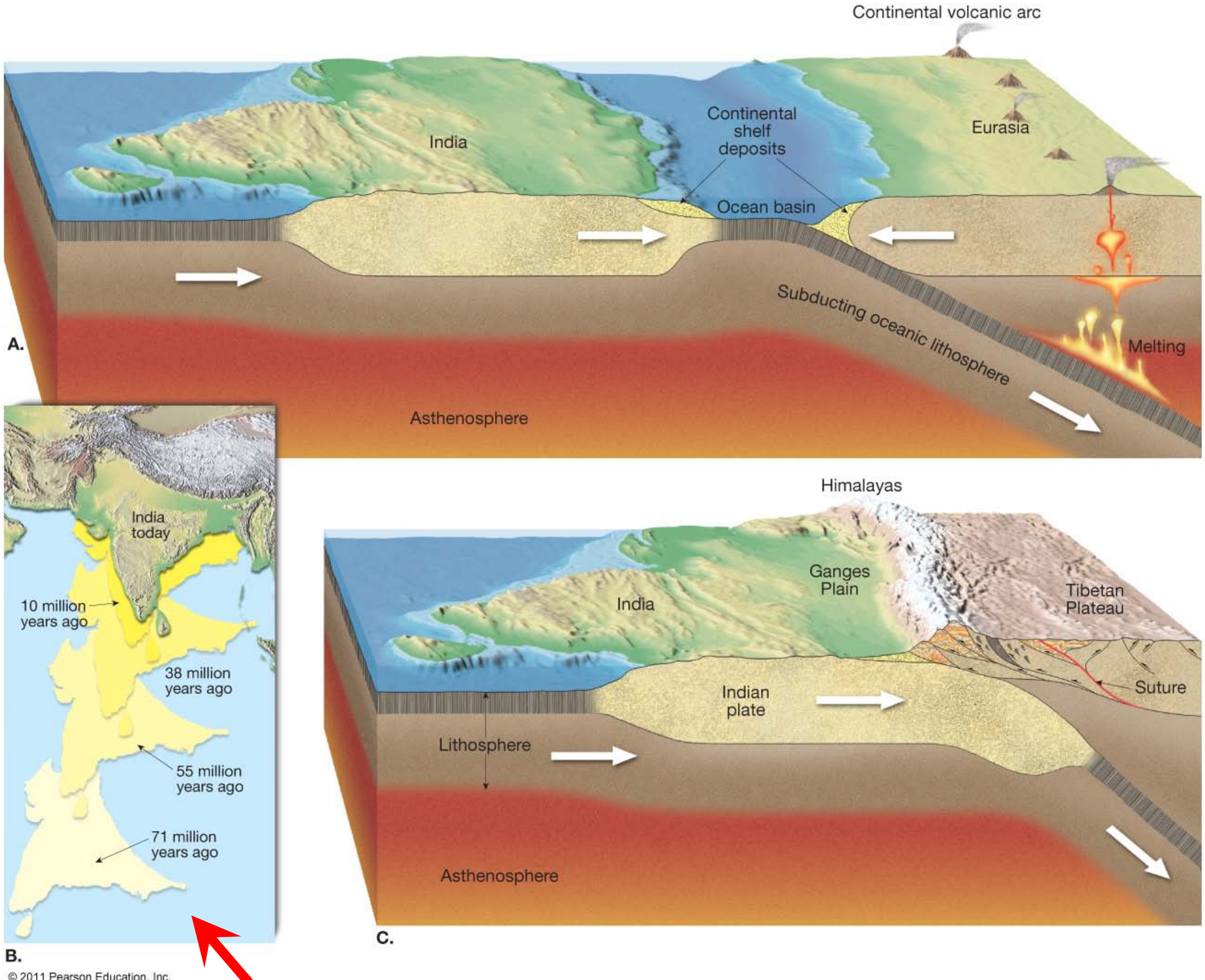
Convergent (collision, moving together)



Transform (horizontal slip)

Plate Tectonics

Convergent boundary, Continent-continent collision Figure 5.21, text

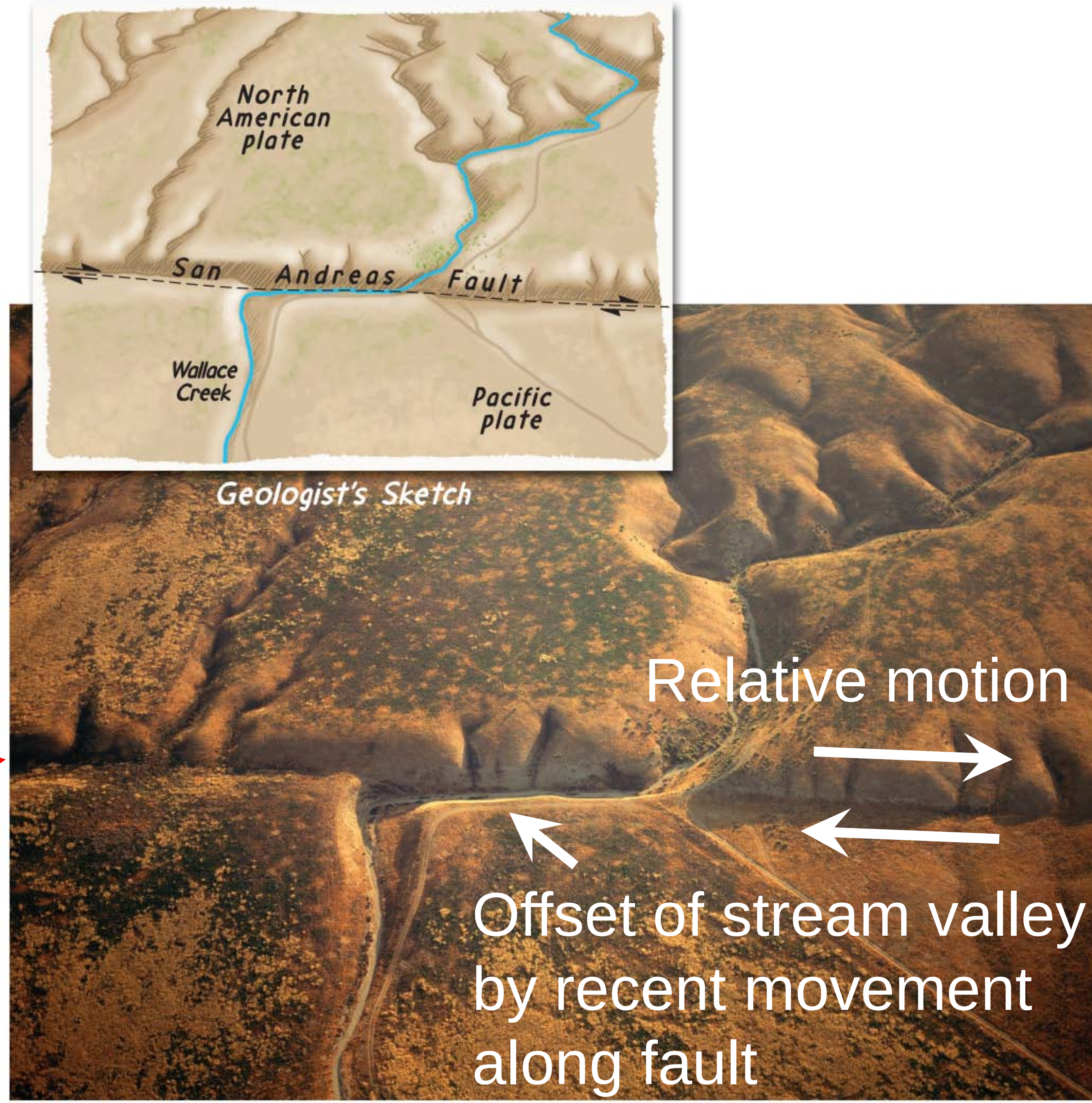


Collision of India plate with Asia over past 70 million years

Plate Tectonics

Transform boundary (horizontal slip); (also called a strike-slip fault) San Andreas fault, Figure 5.24, text

Fault



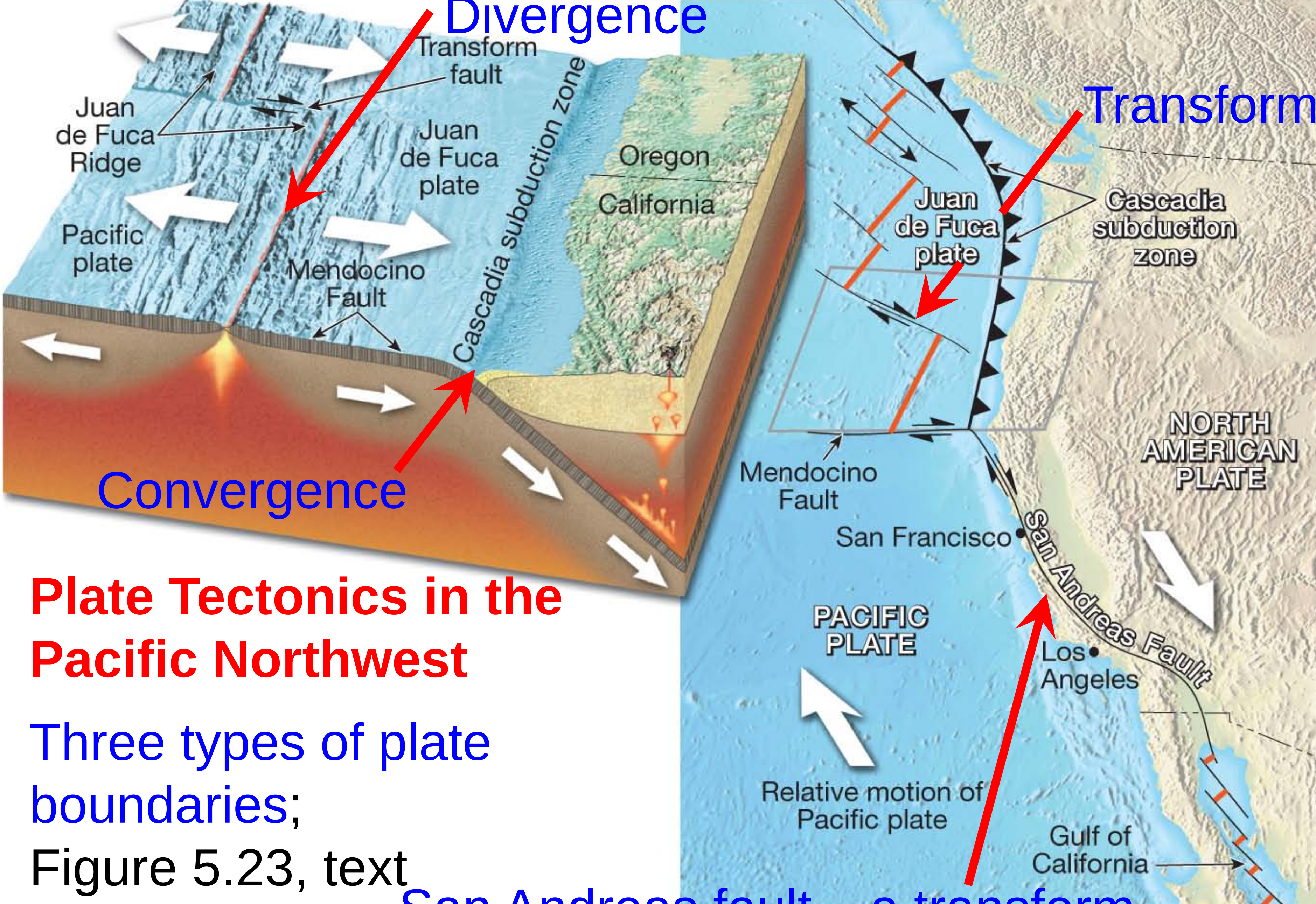


Plate Tectonics in the Pacific Northwest

Three types of plate boundaries;
Figure 5.23, text

San Andreas fault – a transform (horizontal slip) plate boundary)

To better understand plate tectonics and plate motions, see the **animations** (provided by the textbook company) in the Week 3 folder on BB Learn (after you open the animation, push play; there is narration and you can click on “show text” to read explanations):

SeaFloorSpread_Plate_Boundaries_GL.swf
MotionPlateBoundaries_GL.swf
SeaFloorSpread_RockMagnetism_GL.swf
ConvectionTectonics_GL.swf
PangeaBreakup_GL.swf
ConvergMargins_IndiaAsia_GL.swf

Also view the PLATES Atlas pdf file (step through the frames) to see the reconstructed maps of the plates from 200 m.y. ago to the present.

Evidence for Plate Tectonics:

(brief list; see also p. 153-158; p. 171 – 177, text)

1. Fit of the continents
2. Rock and fossil correlation across plate boundaries
3. Ocean age and depth increase away from mid-ocean ridges
4. Deep sea trenches at convergent boundaries

Evidence for Plate Tectonics (continued):

(brief list; see also p. 153-158; p. 171 – 177, text)

5. Earthquakes and volcanoes along plate boundaries
6. Deep earthquakes in subducted lithospheric slab at convergent boundaries
7. Magnetic stripes parallel to mid-ocean ridges (divergent boundaries)
8. Hotspot tracks

1. Fit of the continents

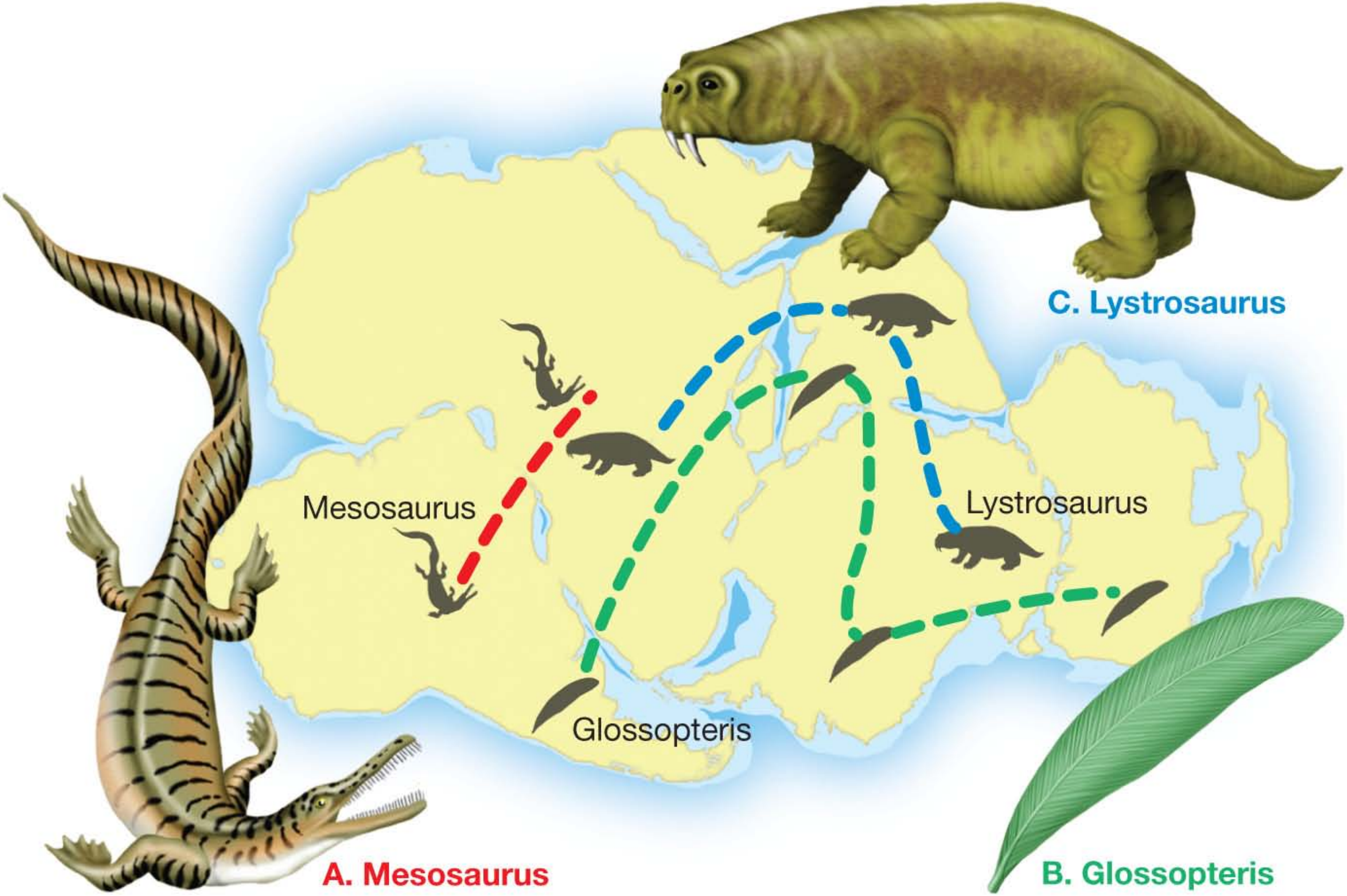
Figure 5.3, text

A. Modern reconstruction of Pangaea

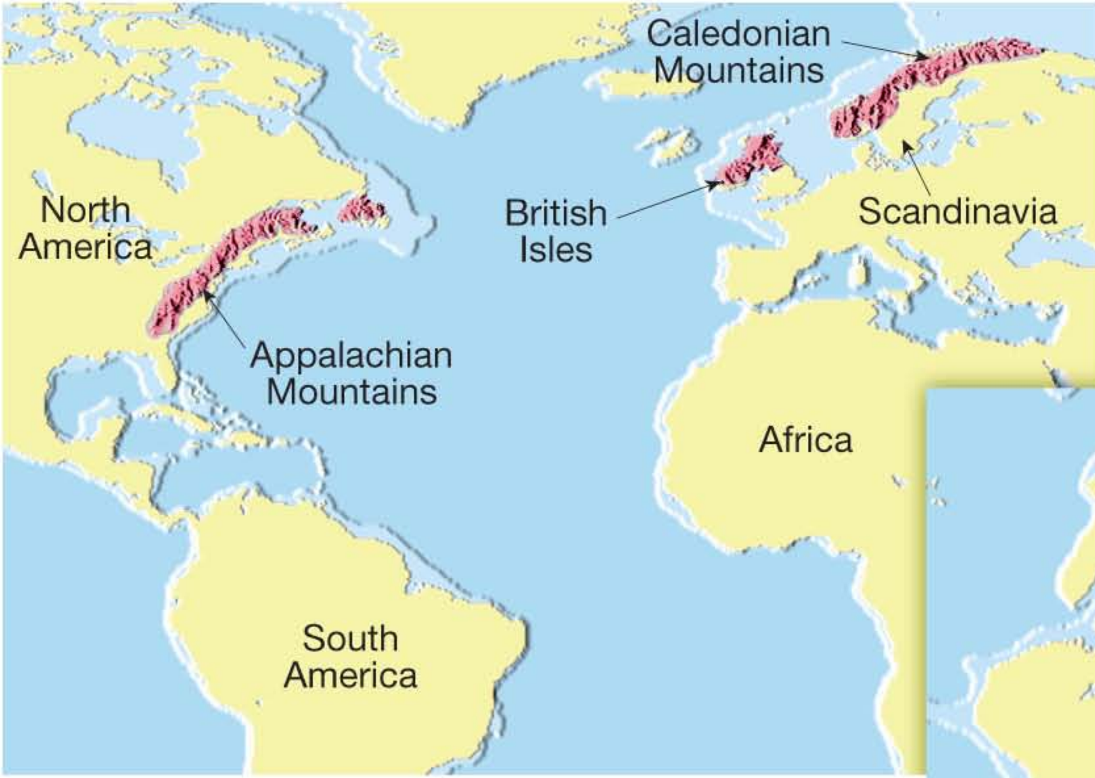
B. Wegener's Pangaea

1. Fit of the continents; continental drift

Figure 5.2, text



2. Rock and fossil correlation across plate boundaries, Figure 5.4, text

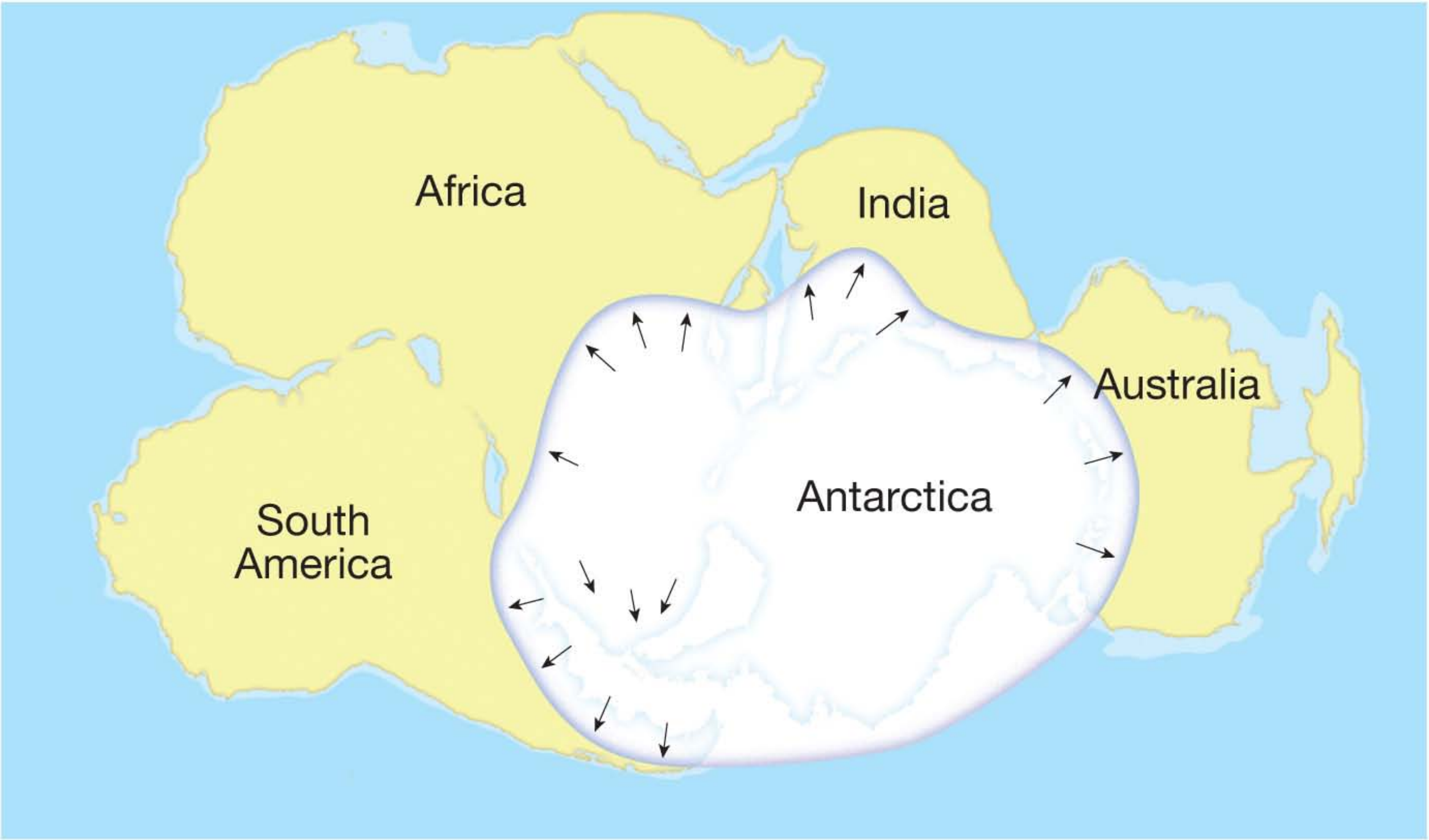


A.

B.

2. Rock and fossil correlation across plate boundaries

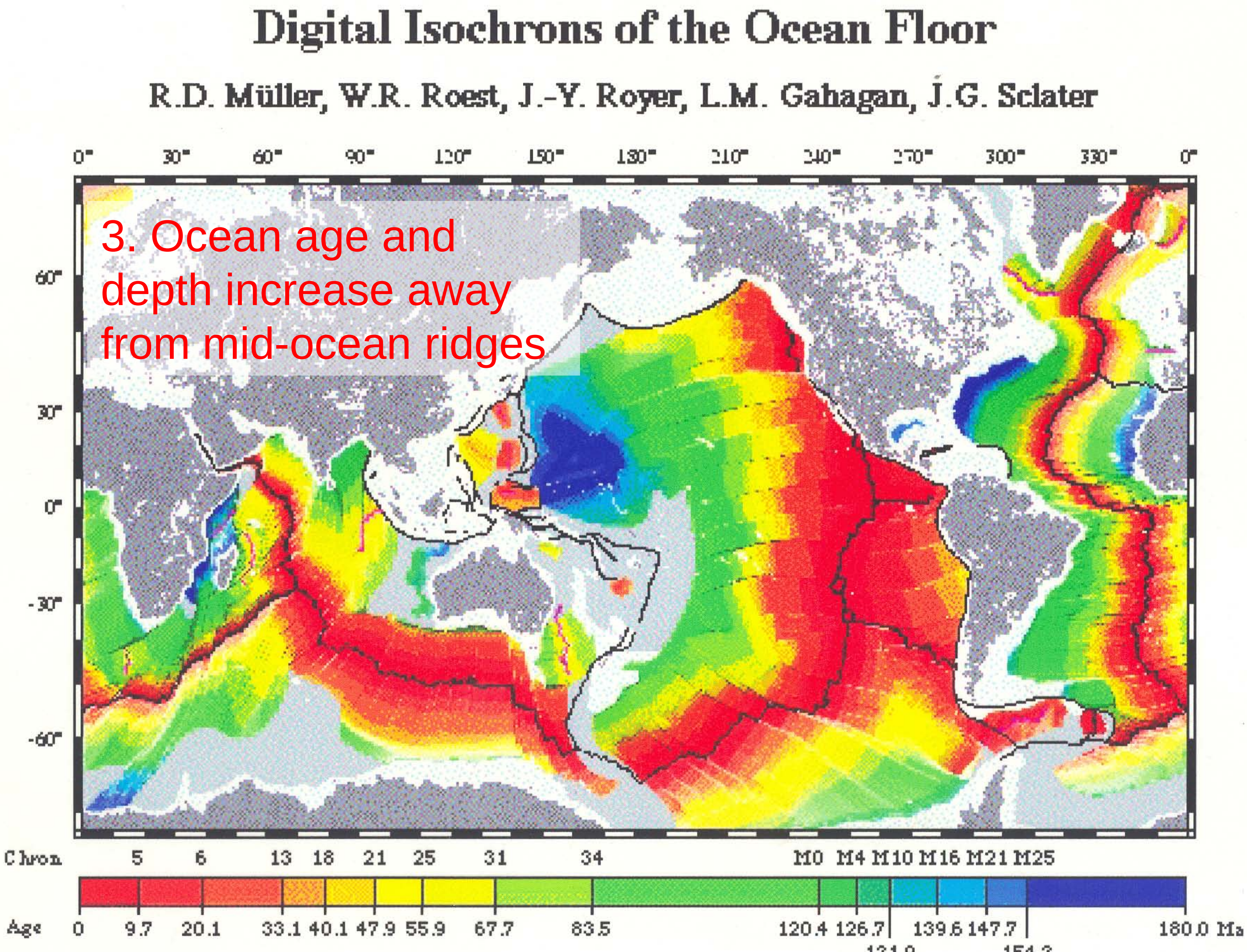
 Figure 5.6, text



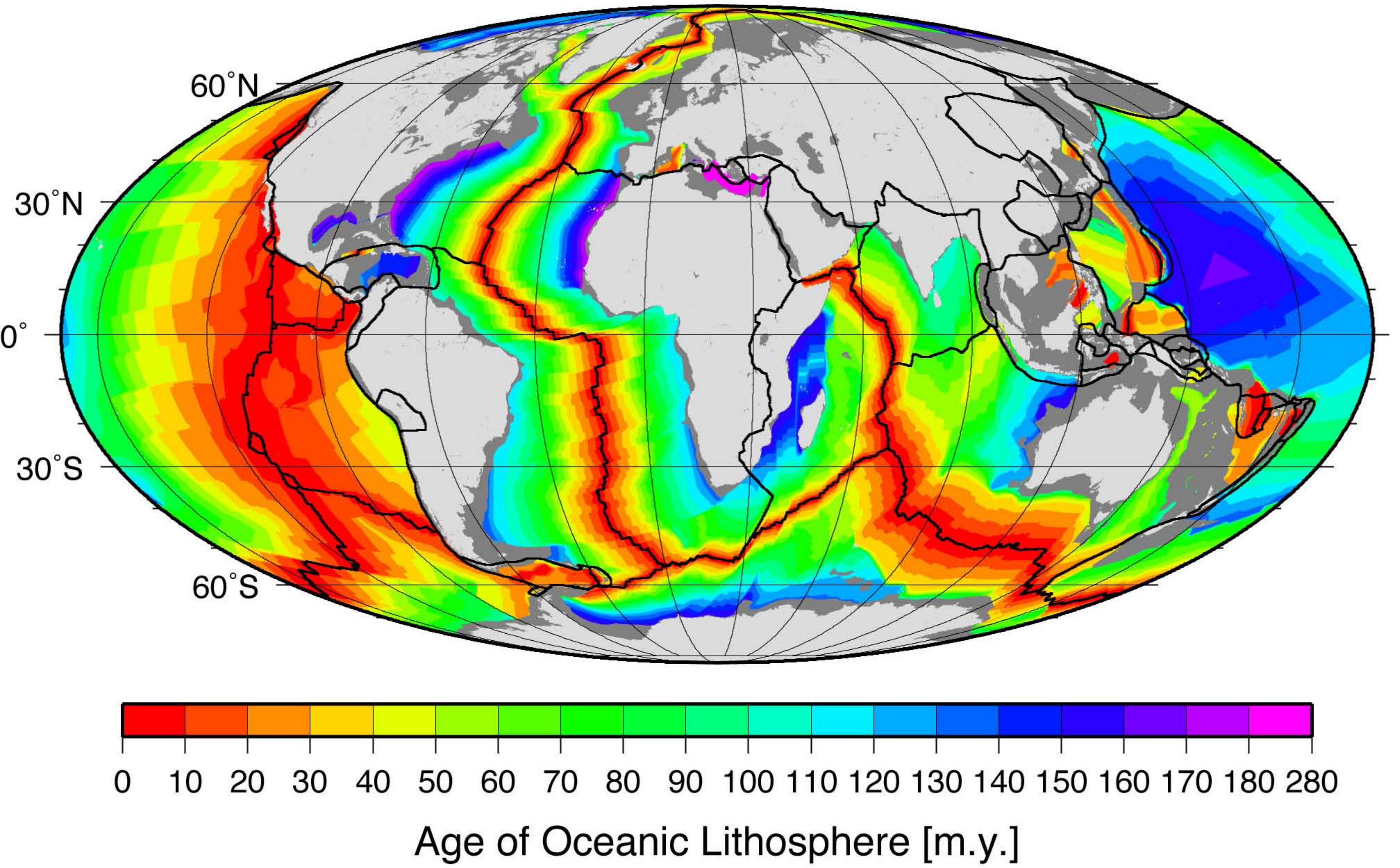
C.

2. Rock and fossil correlation across plate boundaries (early Paleozoic glaciation) Figure 5.7, text

3. Ocean age and depth increase away from mid-ocean ridges

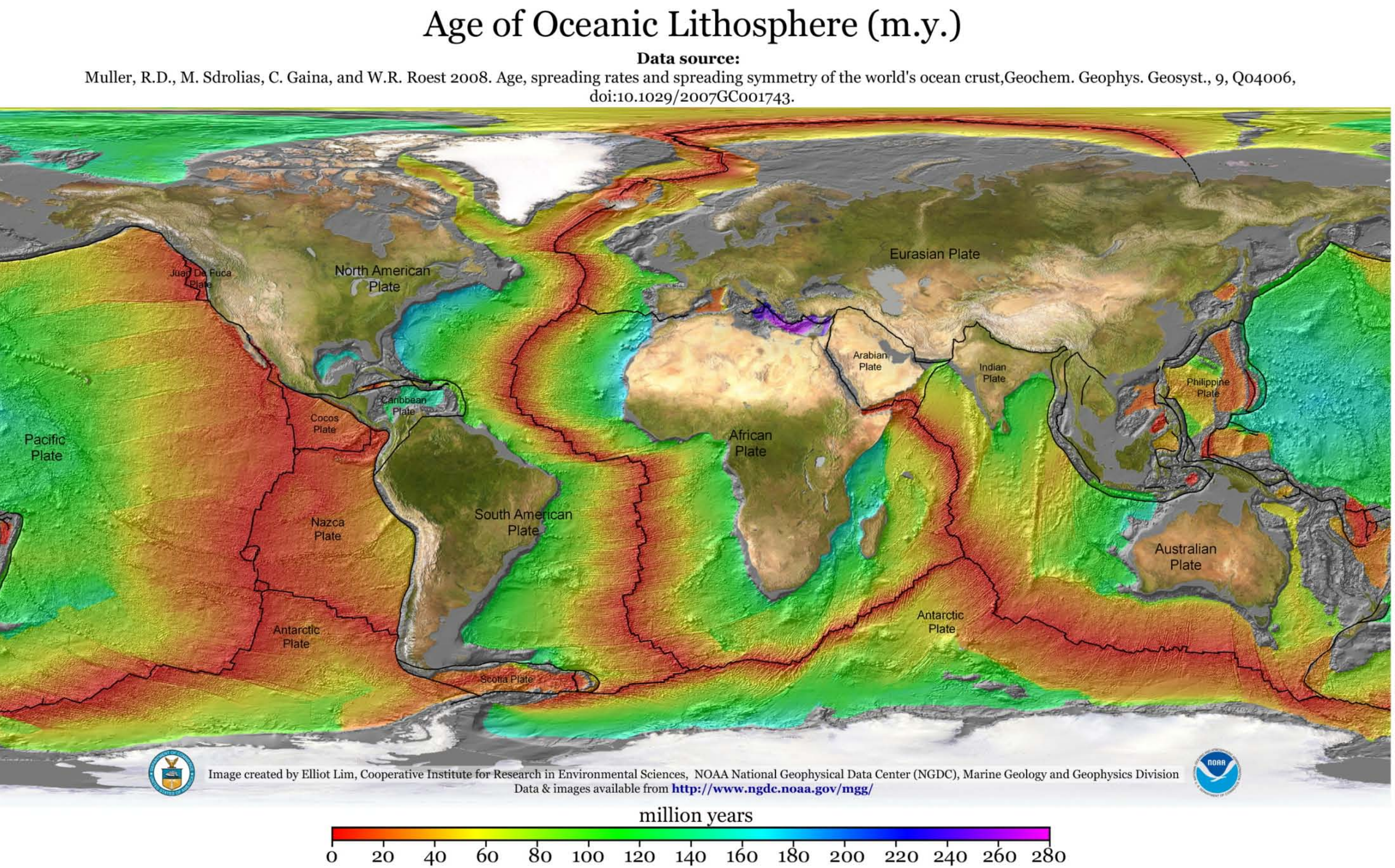


http://gdcinfo.agg.nrcan.gc.ca/app/agemap_e.html



3. Ocean age and depth increase away from mid-ocean ridges

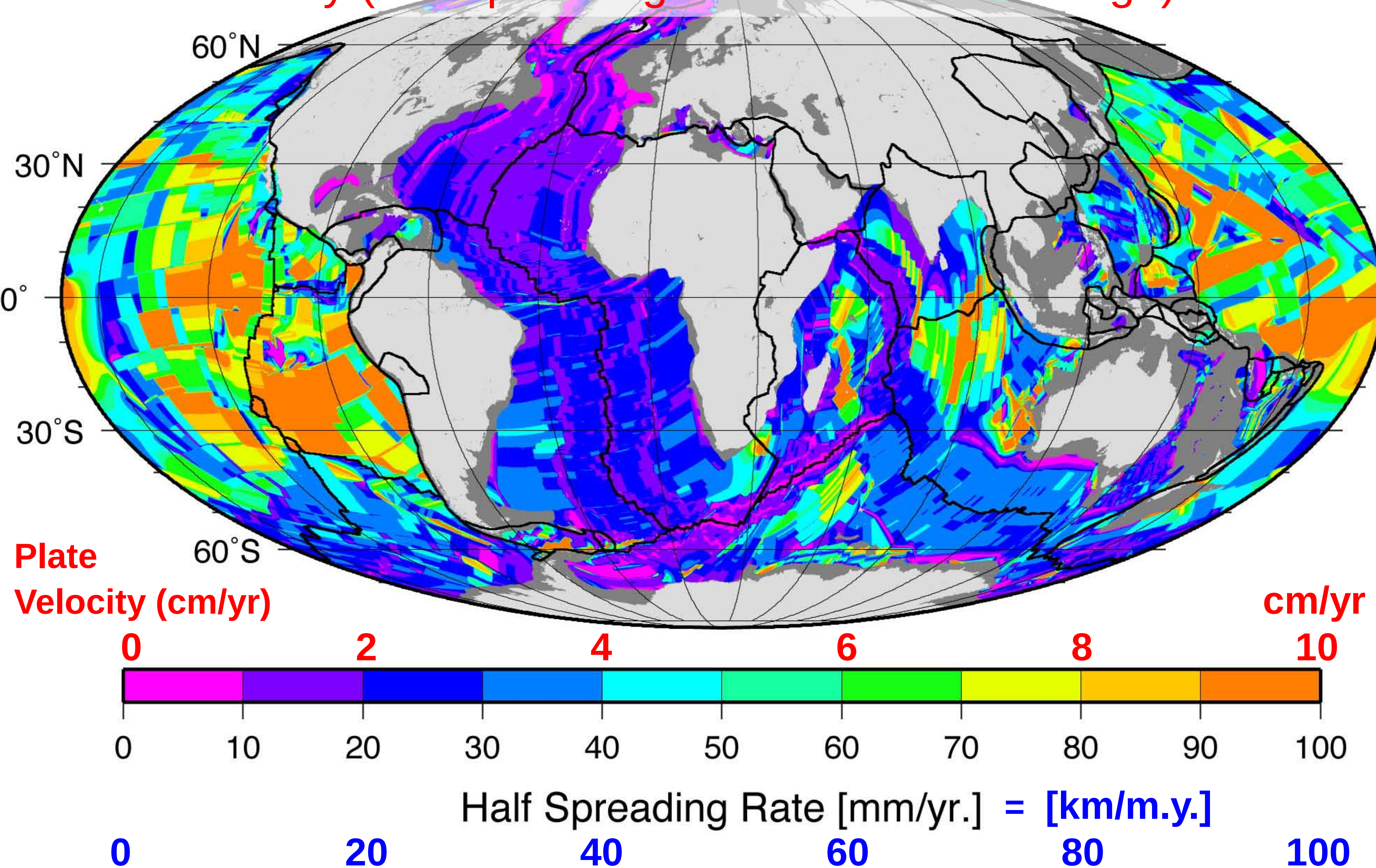
http://www.ngdc.noaa.gov/mgg/ocean_age/ocean_age_2008.html



3. Ocean age and depth increase away from mid-ocean ridges

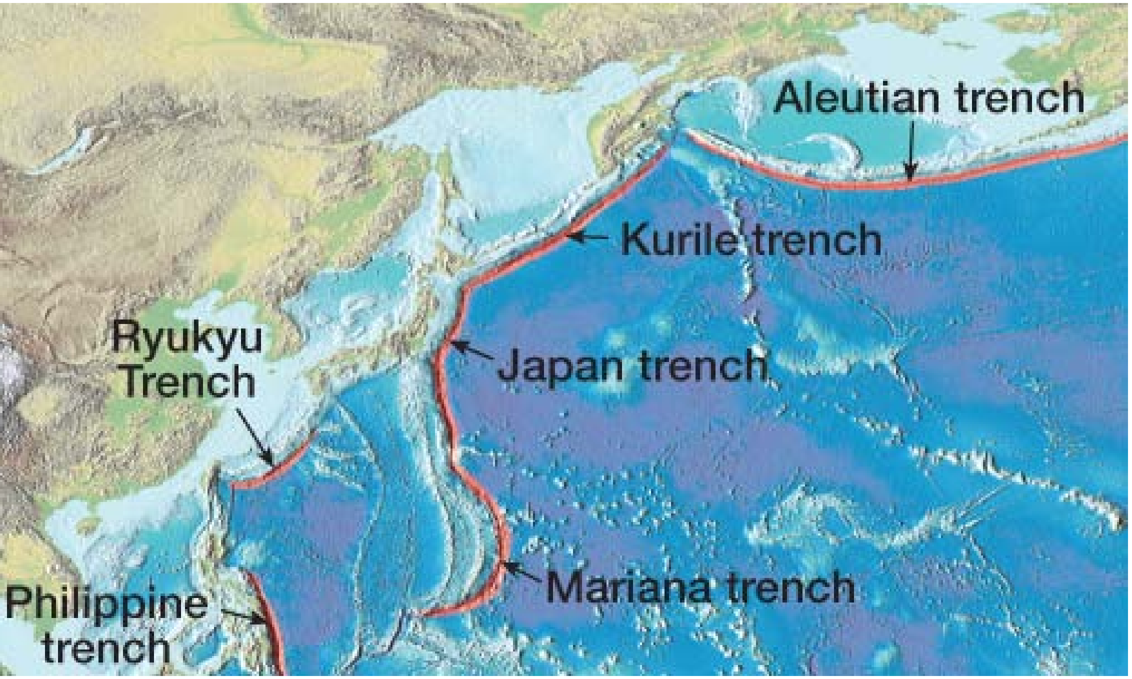
http://www.ngdc.noaa.gov/mgg/image/crustalimages.html

Plate velocity (half spreading rate at mid-ocean ridge)

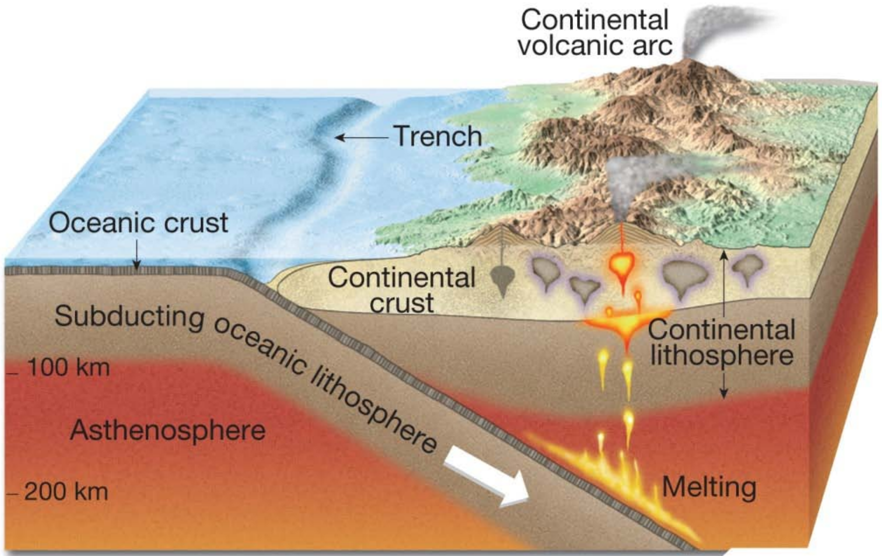


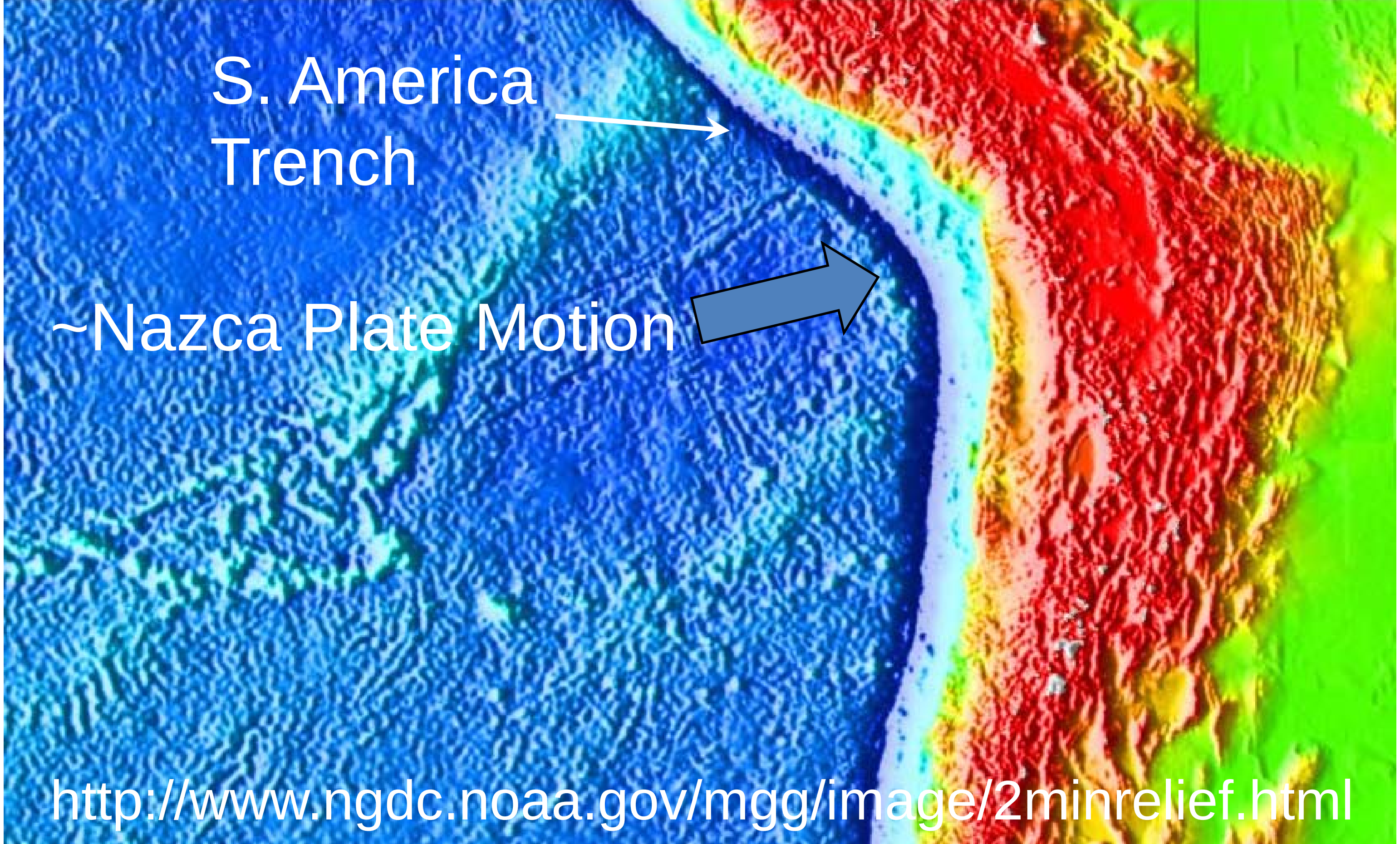
3. Ocean age and depth increase away from mid-ocean ridges

http://www.ngdc.noaa.gov/mgg/ocean_age/ocean_age_2008.html

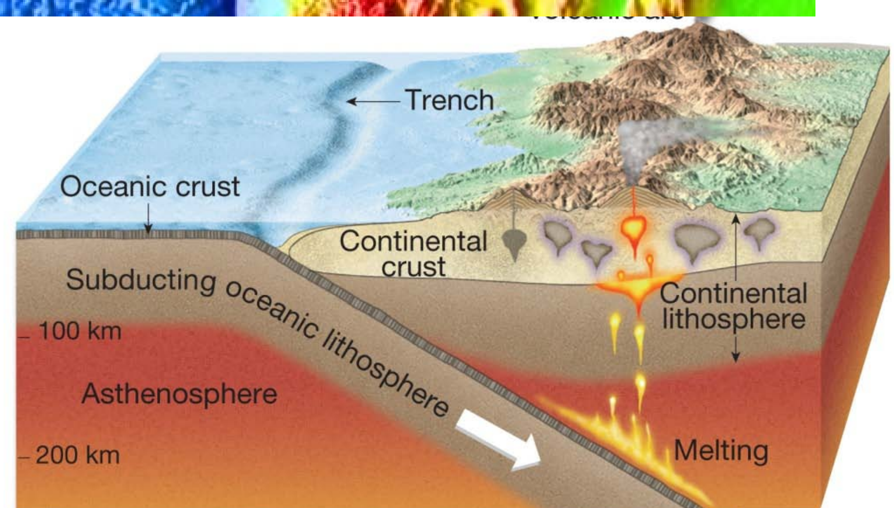


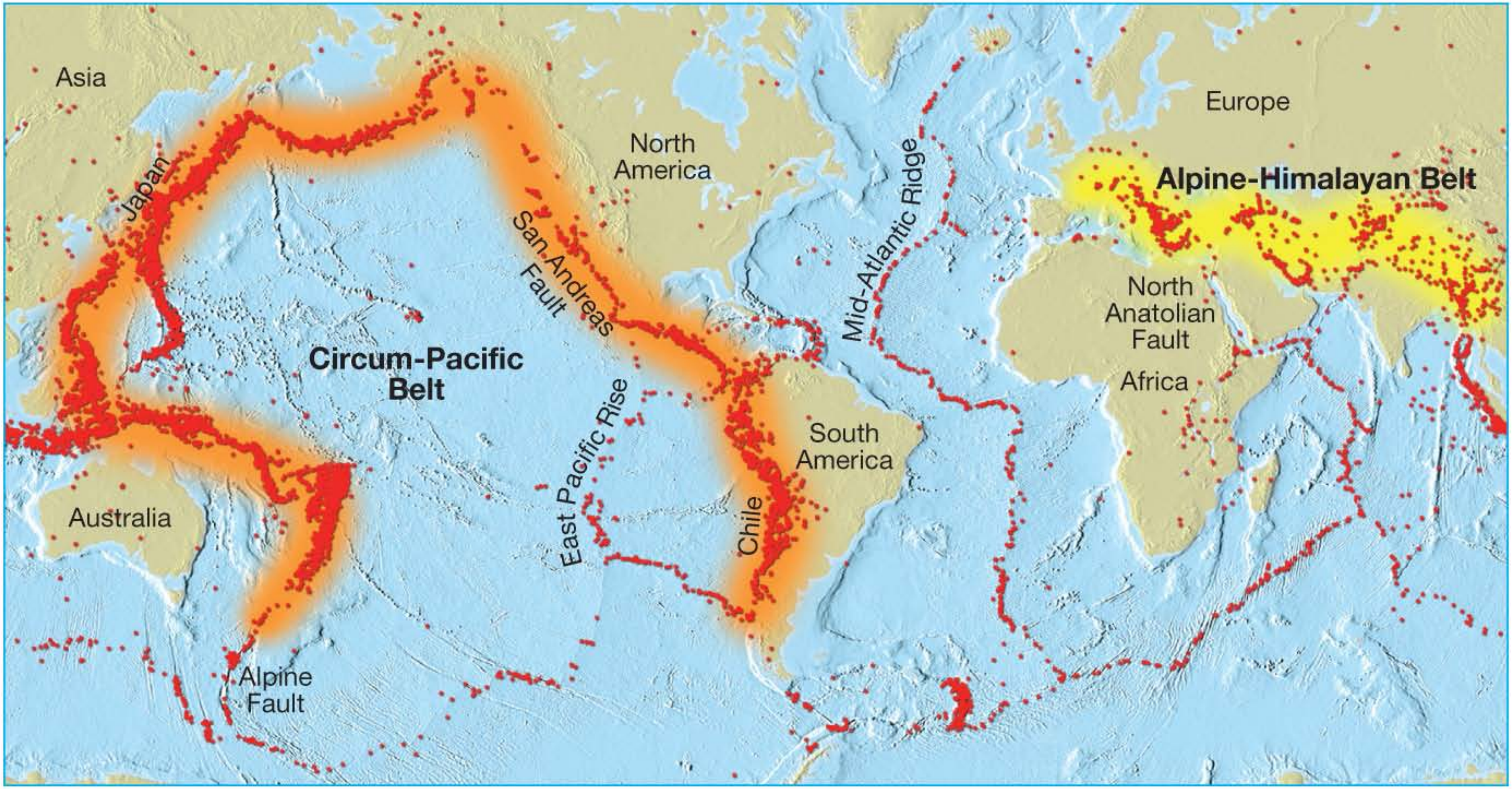
4. Deep sea trenches at convergent boundaries, (close-ups) and subduction model, Figures 5.17A, 5.18, text



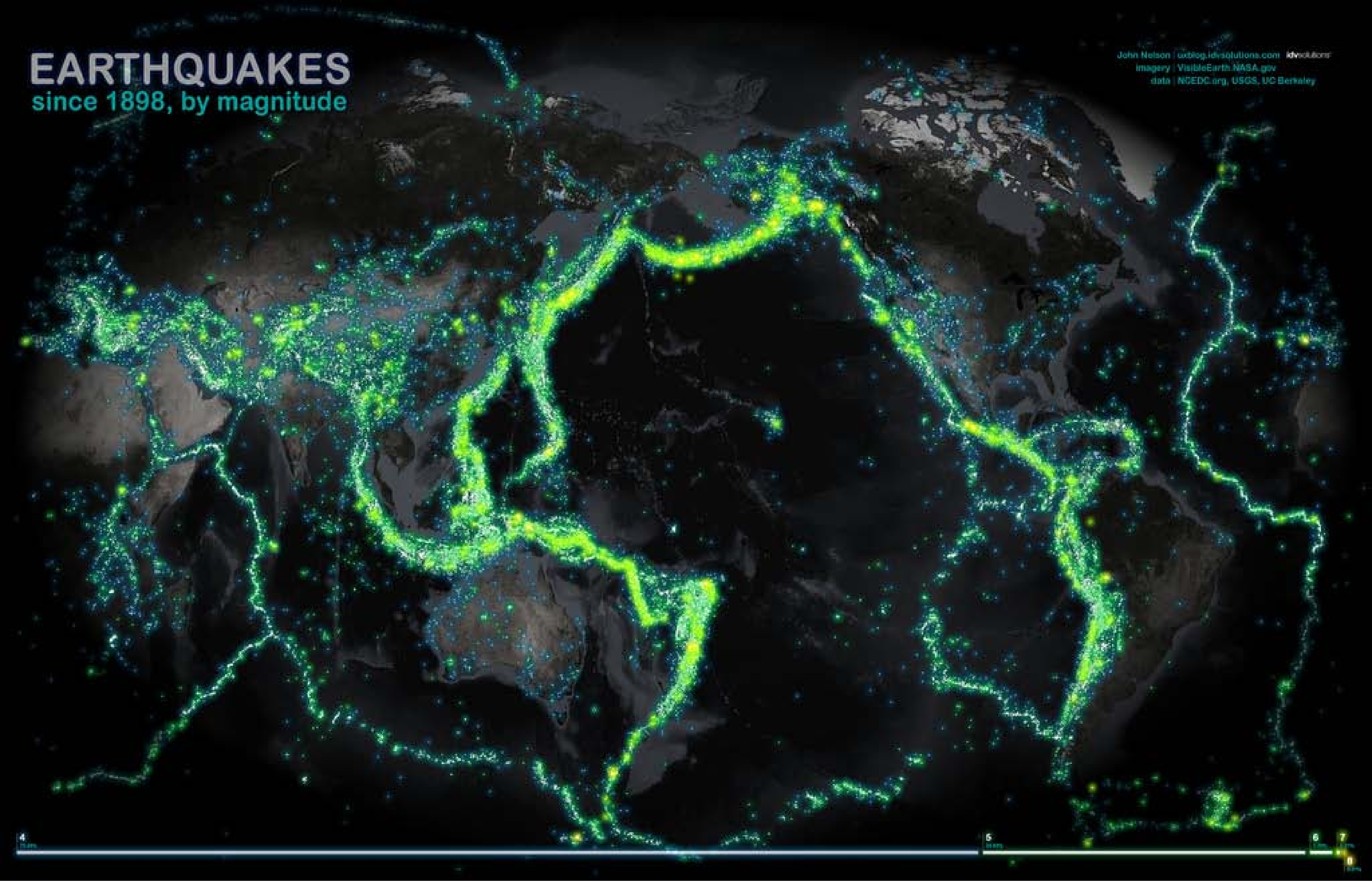


4. Deep sea trenches at convergent boundaries, (close-ups) and subduction model, Figure 5.17A, text





5. Earthquakes and volcanoes along plate boundaries, Figure 6.30, text



Brighter areas indicate higher total energy release (large magnitude eqs and large number of eqs)
http://www.ouramazingplanet.com/3114-world-earthquakes-map.html

5. Earthquakes and volcanoes along plate boundaries, Figure 7.33, text

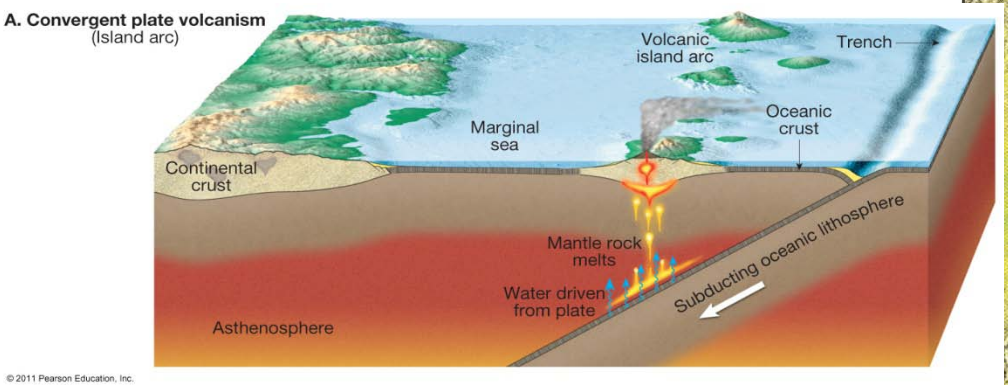
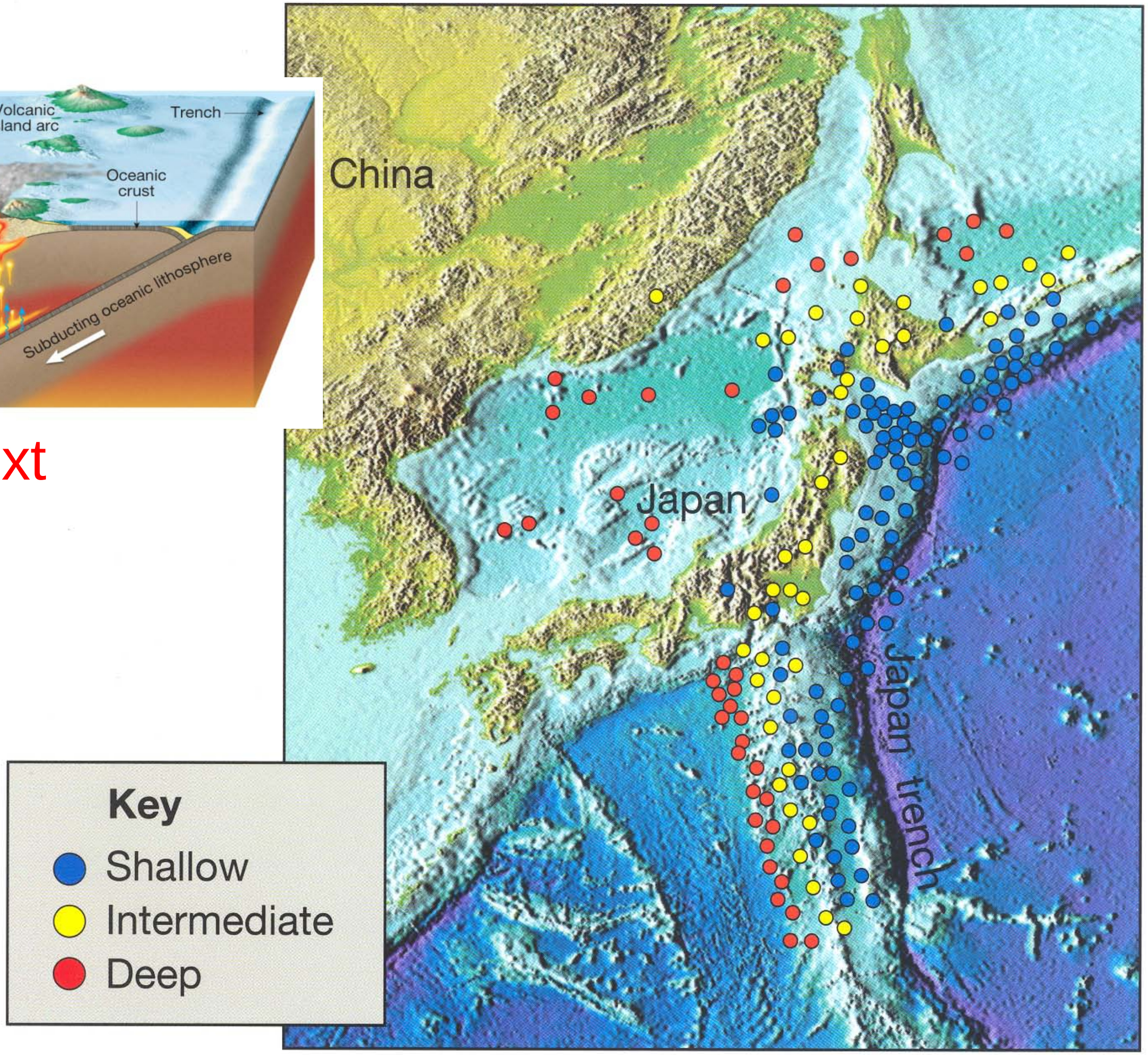
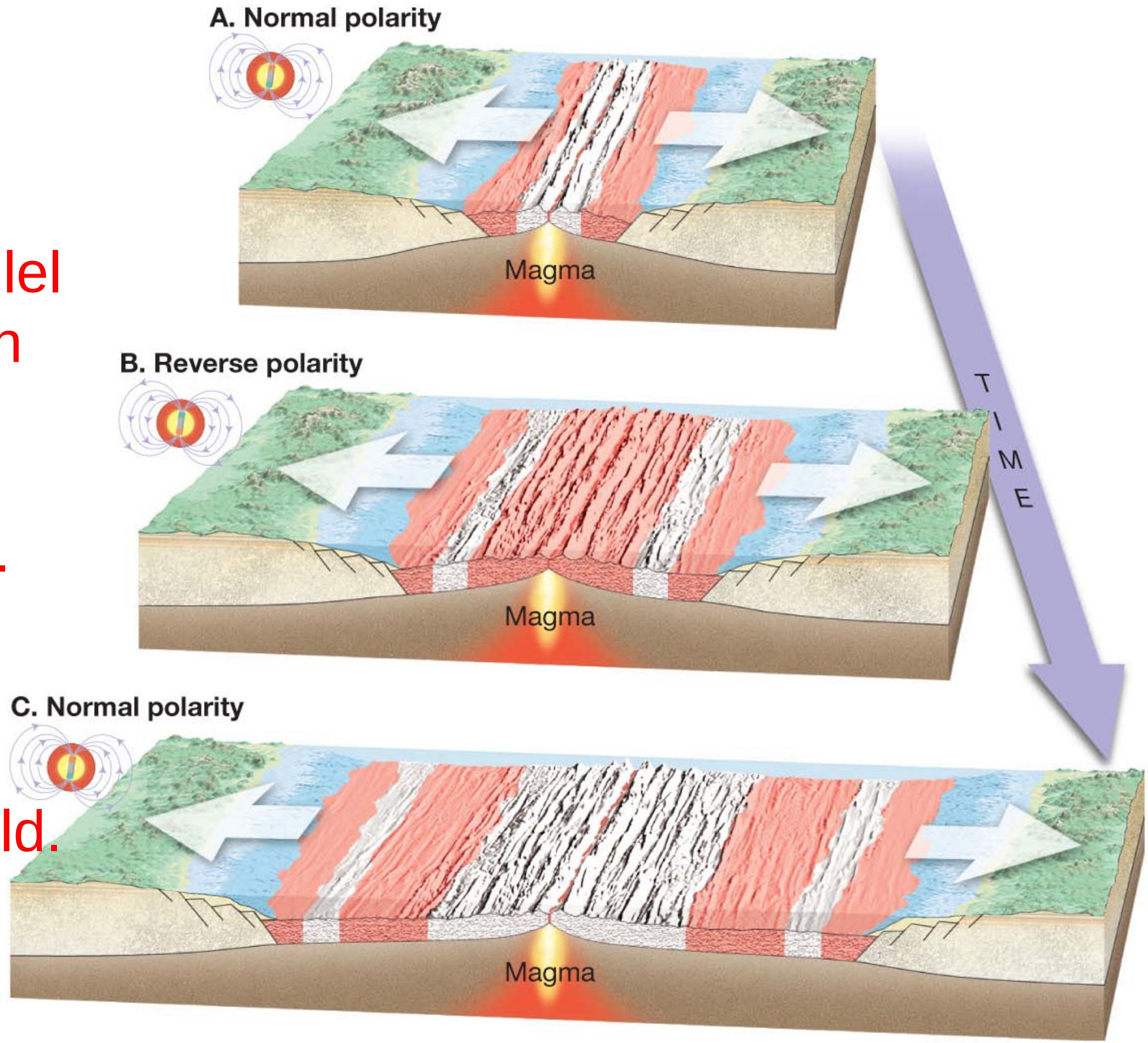


Figure 7.32 text



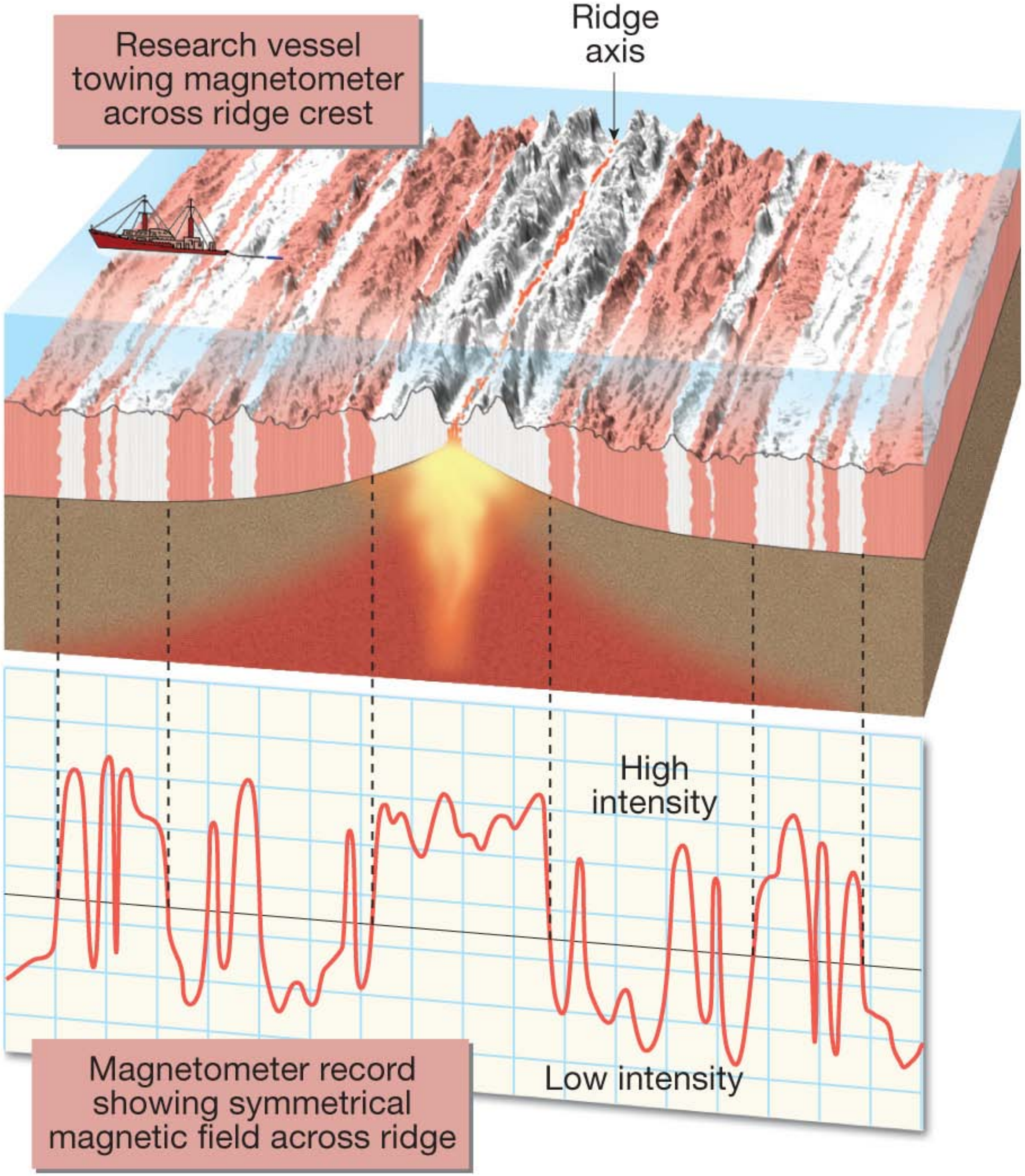
6. Deep earthquakes in subducted lithospheric slab at convergent boundaries (also see Fig. 6.30, text)

7. Magnetic stripes parallel to mid-ocean ridges (divergent boundaries). Due to reversals of the Earth's magnetic field. Figure 5.31, text



7. Magnetic stripes parallel to mid-ocean ridges (divergent boundaries). Due to reversals of the Earth's magnetic field.

Figure 5.30, text

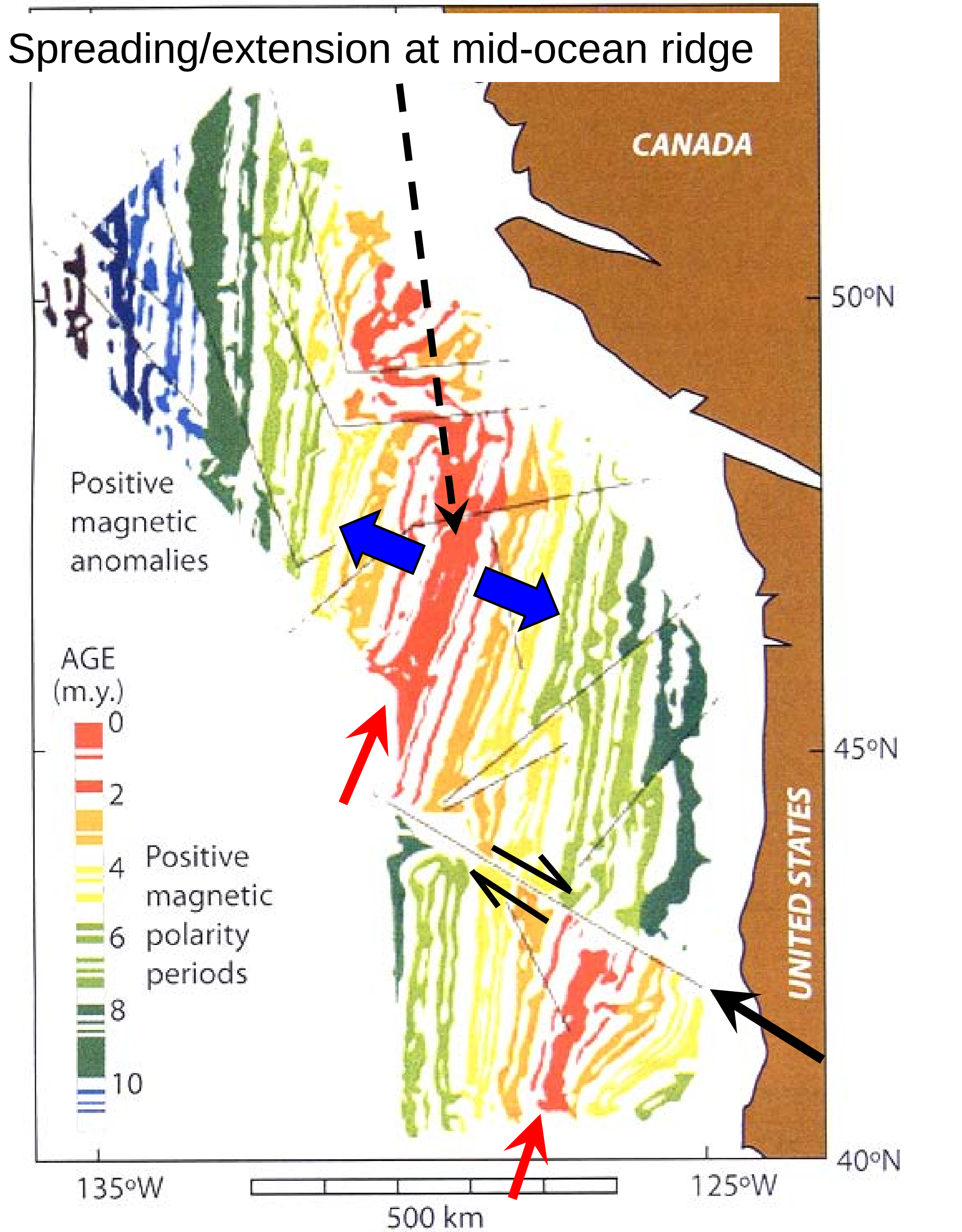


7. Magnetic stripes parallel to mid-ocean ridges (divergent boundaries). Due to reversals of the Earth's magnetic field.

Figure 5.30, text

7. Magnetic stripes parallel to mid-ocean ridges (divergent boundaries). Due to reversals of the Earth's magnetic field. Red arrows and red magnetic stripes show location of current ridges (spreading centers). Other colors indicate crust formed at earlier times (see age scale). Black arrow shows a significant transform fault.

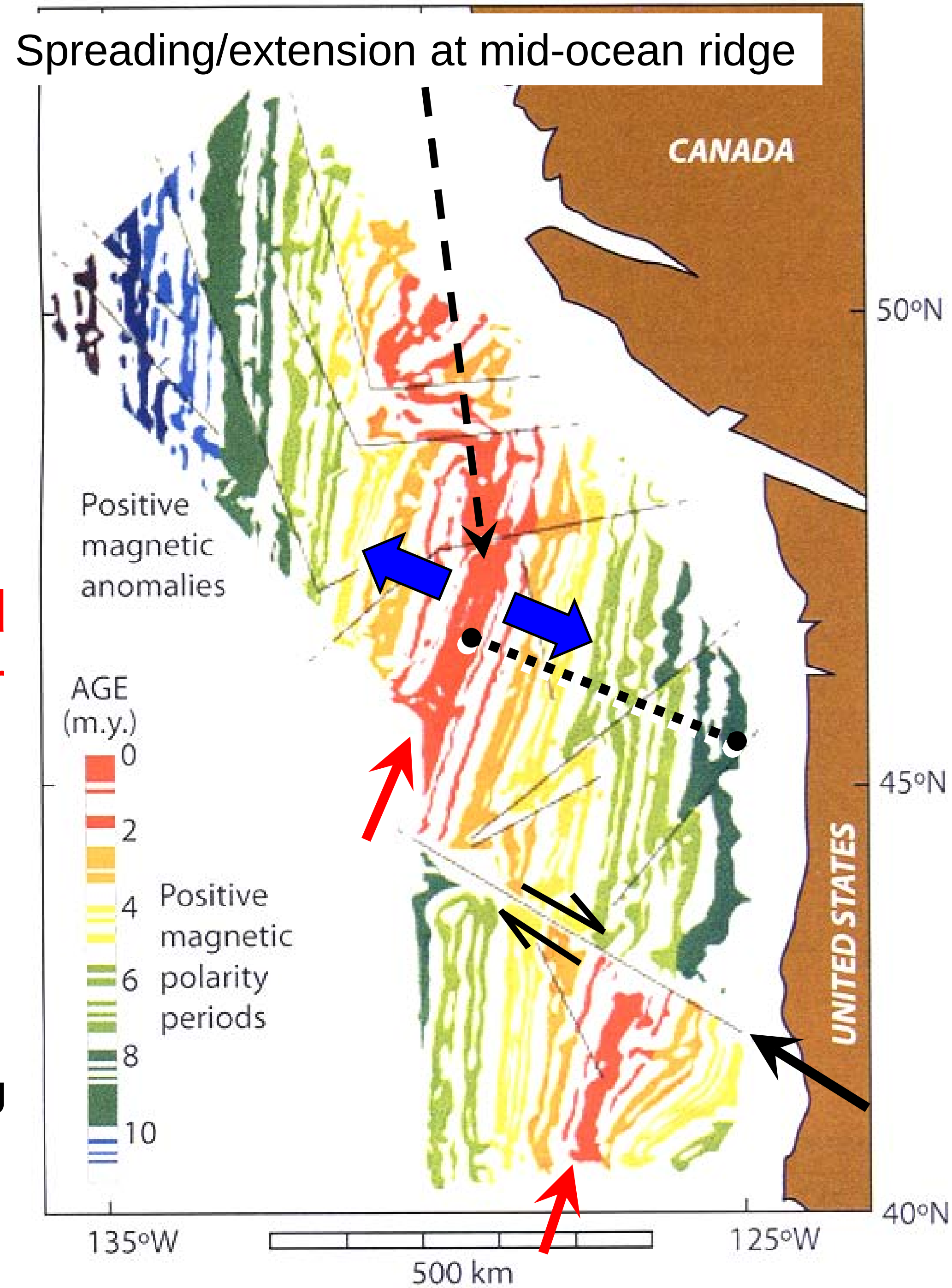
(Modified from: Saltus, R W, and R J Blakely, *GSA Today*, v. 21, December, 2011, p. 4-11.)



7. Magnetic stripes parallel to mid-ocean ridges (divergent boundaries). Age (color code) is given in millions of years (m.y.)

Calculate the plate velocity (divide distance by age; note units) along the dotted line (drawn ~ perpendicular to the magnetic stripes). What is the spreading rate (plate velocity) in km/m.y.? And in cm/yr?

(Modified from: Saltus, R W, and R J Blakely, *GSA Today*, v. 21, December, 2011, p. 4-11.)



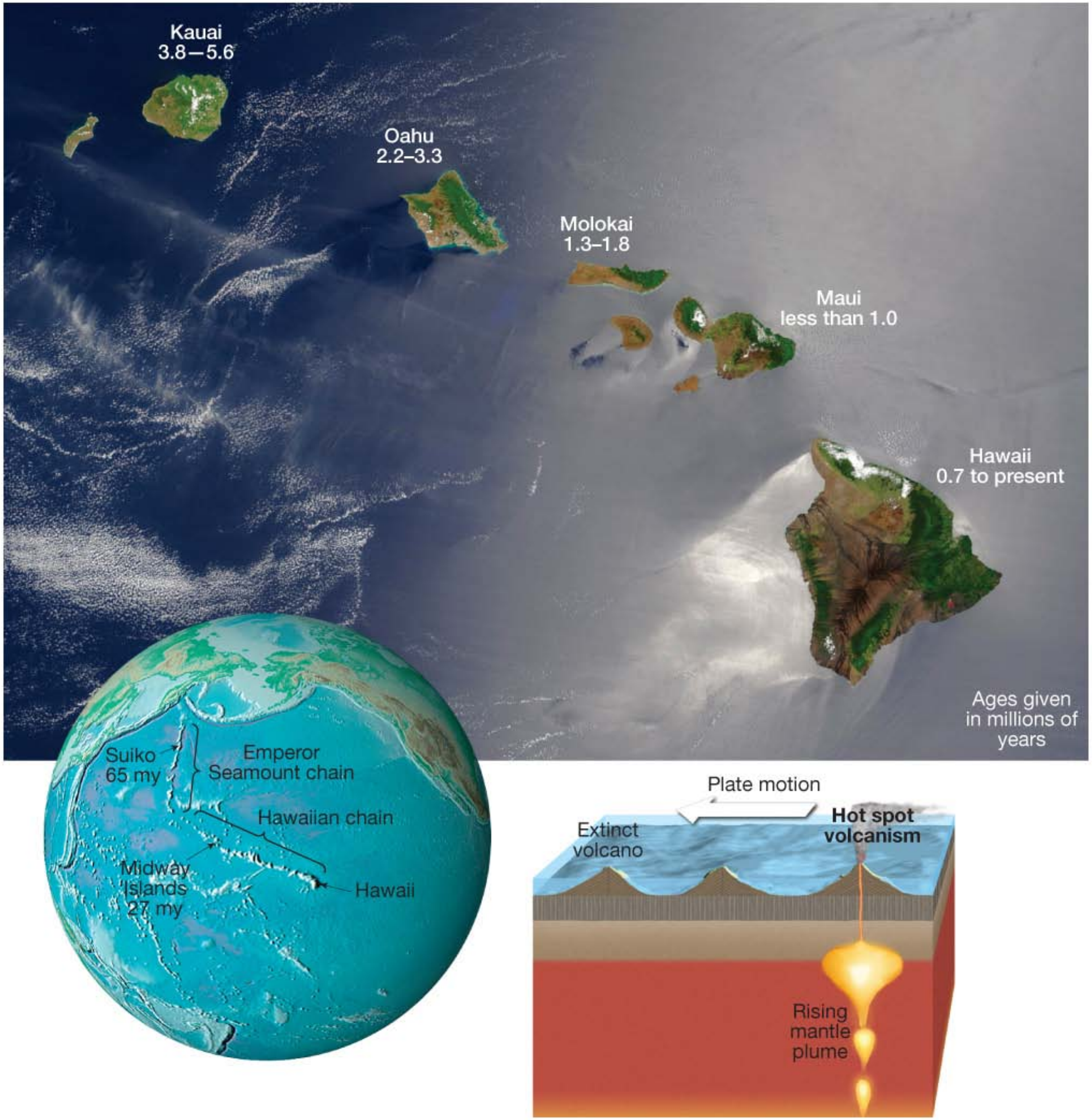


Figure 5.26, text (age in millions of years)

8. Hotspot tracks (like Hawaii) show direction of motion of the lithosphere over a hotspot (by age of volcanic activity)

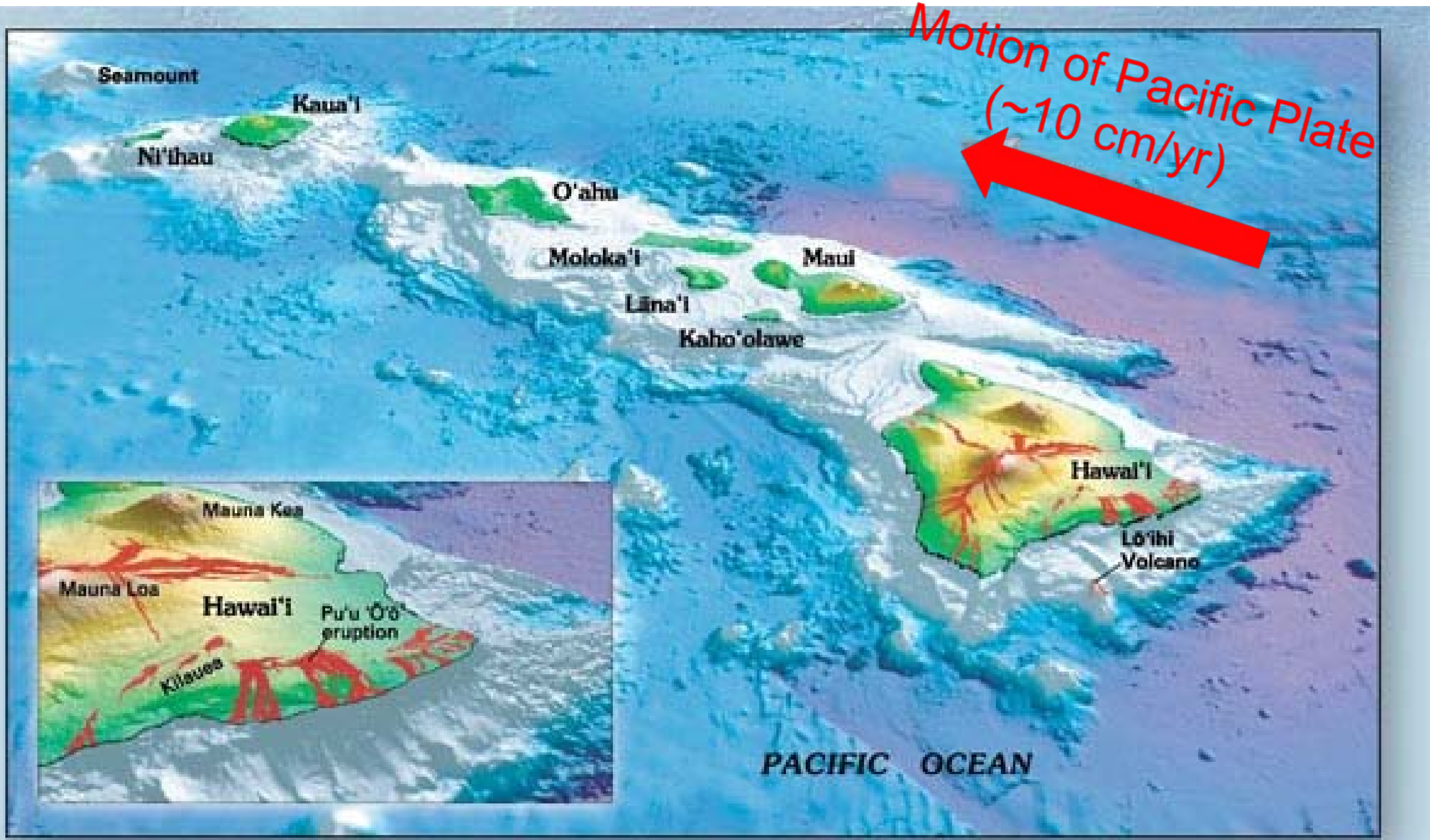


Figure 2.—Oblique view of the principal Hawaiian Islands and (the still submarine) Lō'ihi Volcano. Inset gives a closer view of three of the five volcanoes that form the Island of Hawai'i (historical lava flows are shown in red). The longest duration historical eruption on Kīlauea's east-rift zone at Pu'u 'Ō'ō (inset), which began in January 1983, continues unabated (as of spring 2006). View prepared by Joel E. Robinson (USGS).

http://www.minerals.si.edu/tdpmap/ (Interactive Map)

Driving Mechanism for PLATE TECTONICS:

(What makes the plates move?)

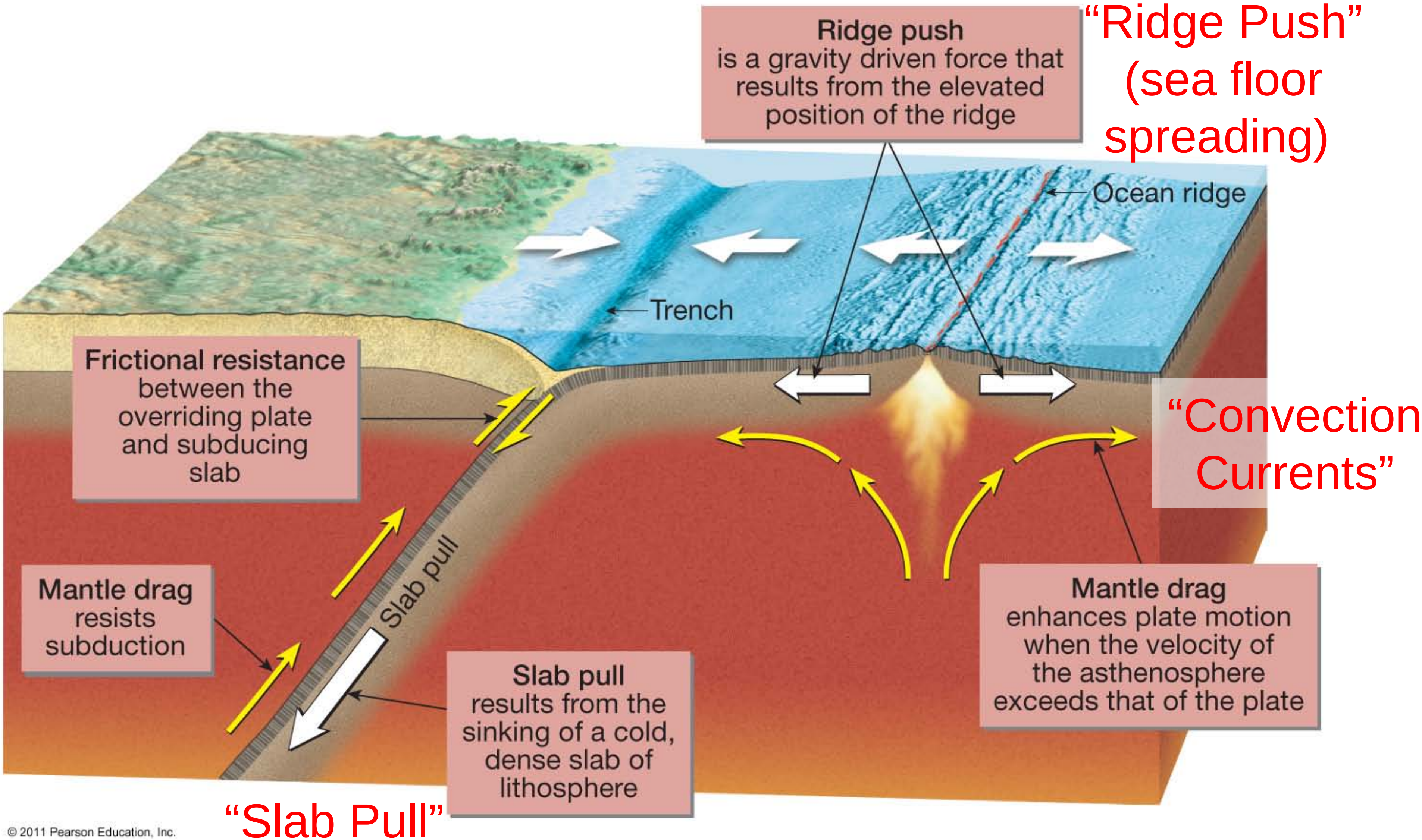
(see also p. 177 – 180, text)

Heat from original heating of Earth and decay of radioactive elements (uranium, thorium, potassium, etc.) in Earth's interior is ultimate cause; viable theories for the driving mechanism are:

1. "Ridge Push" (seafloor spreading) – rising hot material at ridge crests (new lithosphere) pushes plates apart

2. "Slab Pull" – dense, older oceanic lithosphere in subducted slabs sinks

3. Convection currents in hot, solid but soft, partially molten mantle (asthenosphere) convects

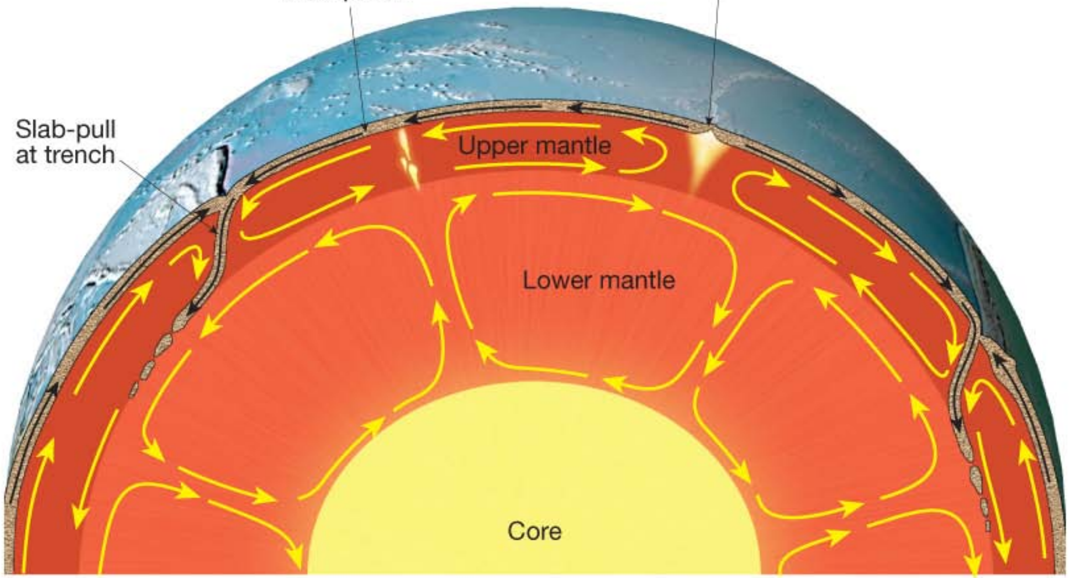


“Ridge Push,” “Slab Pull” and “Convection” mechanisms

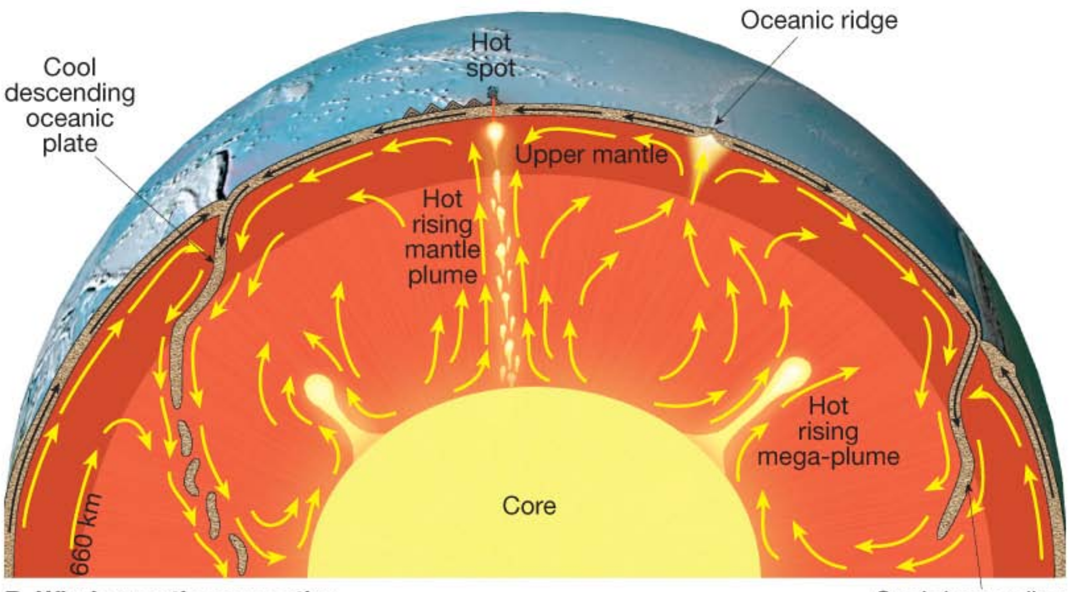
Figure 5.33, text

“Convection Current” mechanisms

Figure 5.34, text



A. Layering at 660 kilometers



B. Whole mantle convection