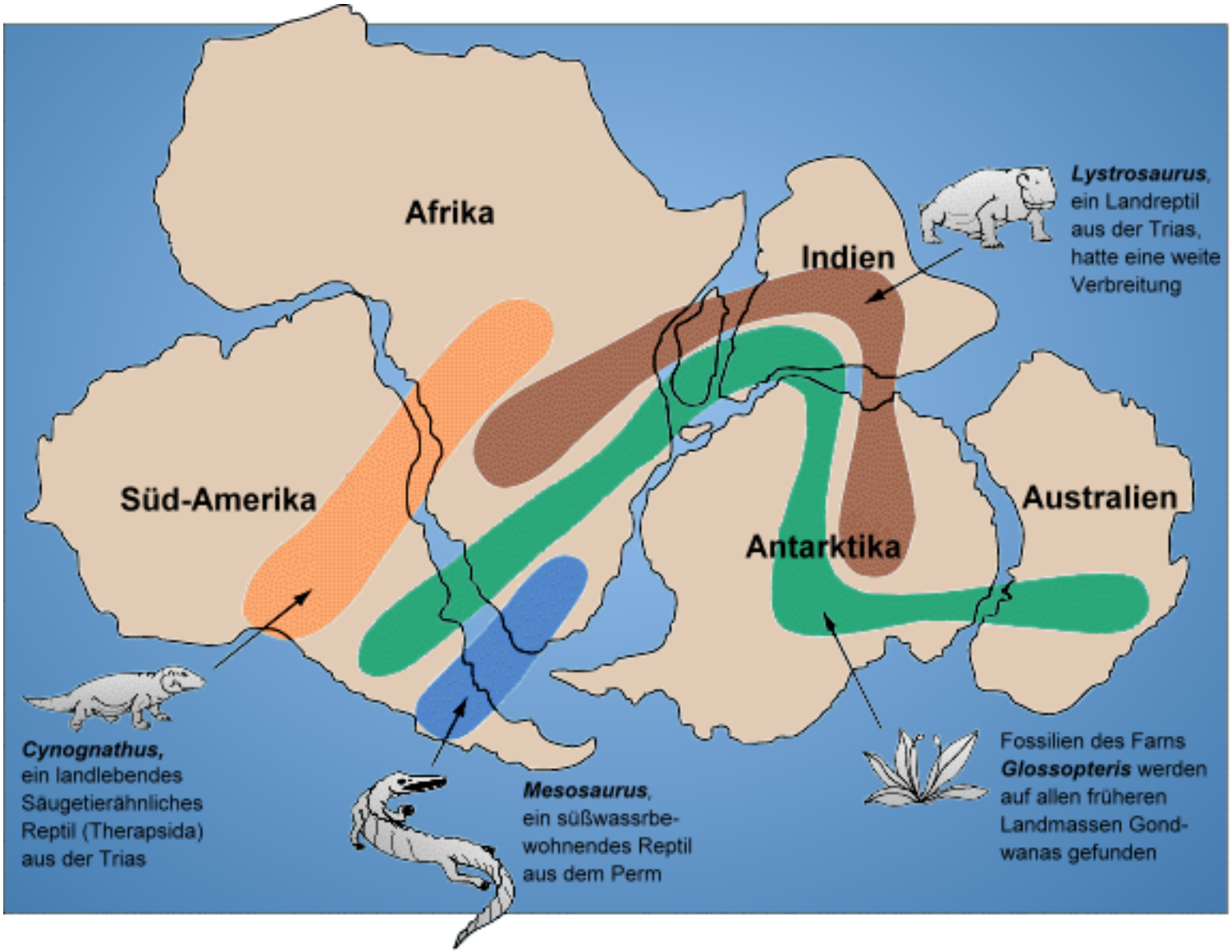
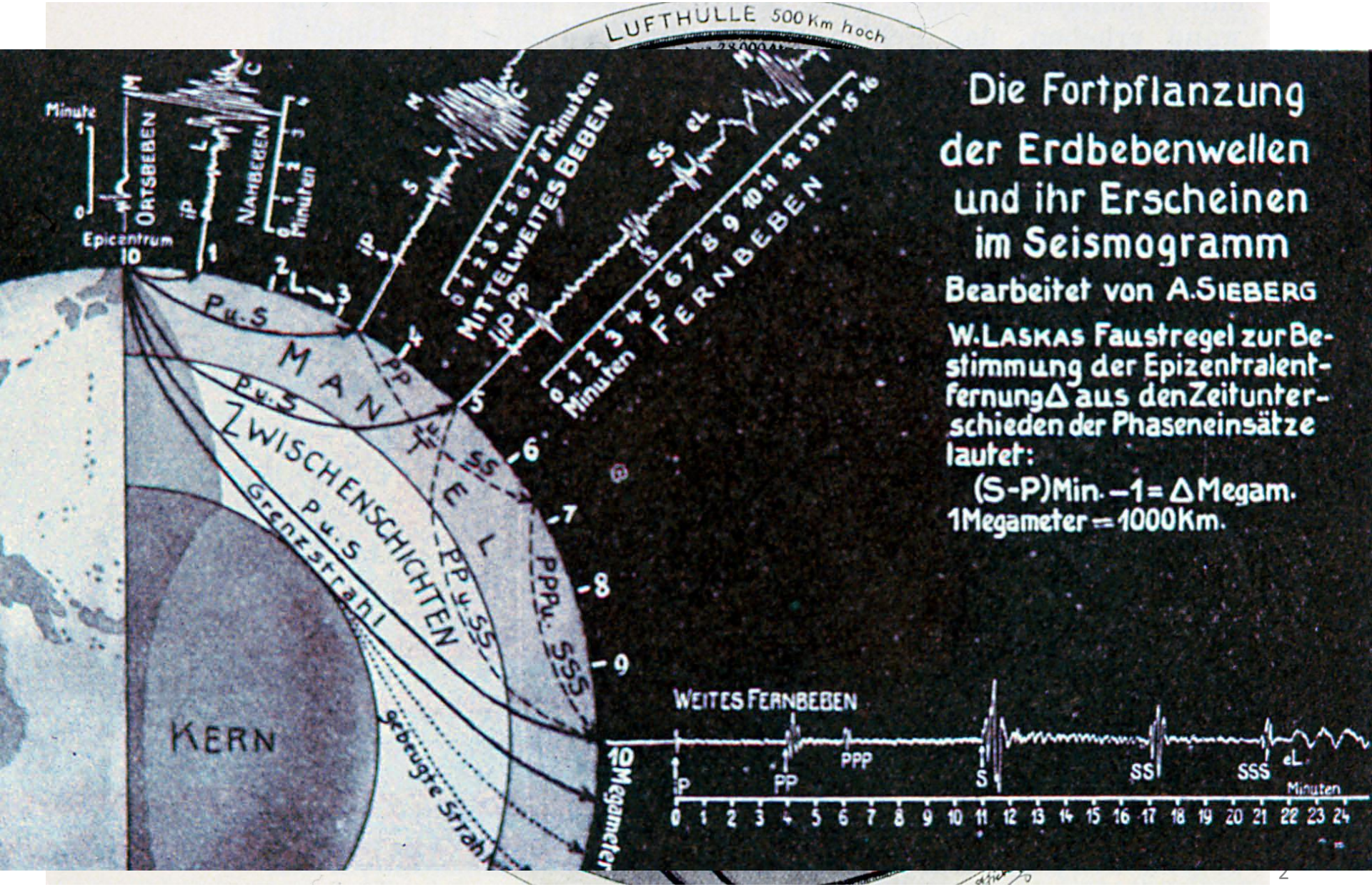
Paleontological considerations about the existence of a super continent



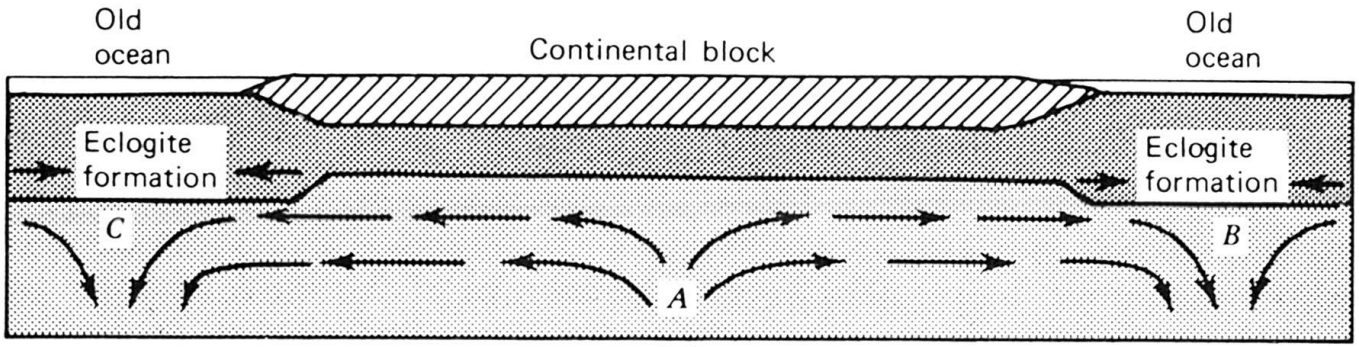
Layering of the Earth : hypothesis about 1920



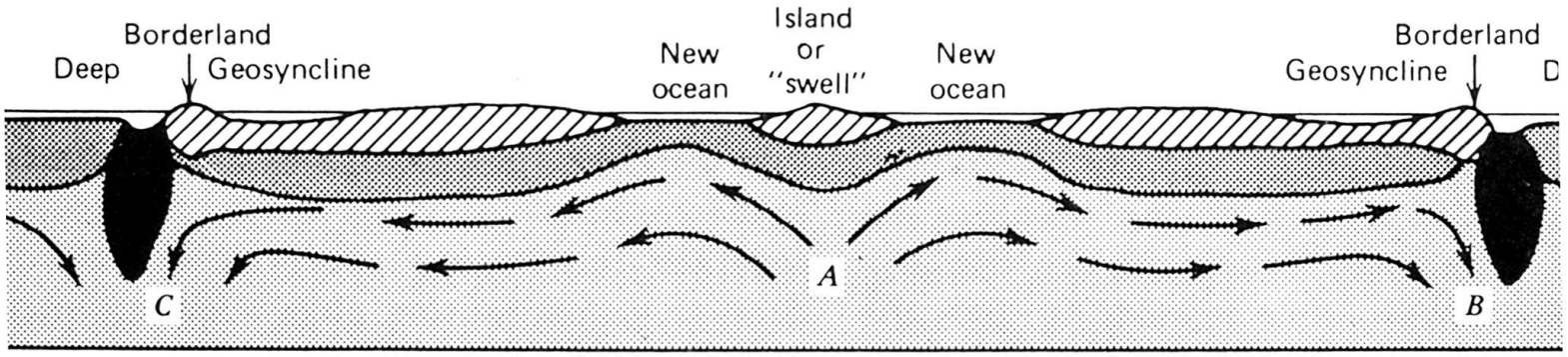
Crust-Mantle-Edge (The Moho)

The Mohorovčić-discontinuity was found in 1910 by the Croatian Geophysicist Andrija Mohorovčić, as he analyzed Seismograms from the earthquake of Pokupsko near to the Croatian Capital Zagreb at 8. Oct. 1909. Mohorovičić was struck, that some P and S earthquake waves arrived later as expected. The waves were flexed in an edge at about 54 km depth [Lit.Bolt, p.95f]. Posterior investigations corroborated these edge (about 30-50 km depth and 5-7 km in oceanic areas), under which begins the dense upper earth mantle (with temperature about the 600°C).

Wegener's theory met with a refusal in his lifetime, because he could not plausibly explain the effective forces. First **Arthur Holmes** (1890 - 1965) proposed 1930 that the movements of the continental plates could: convections-currents hot magmas in the earth mantle.



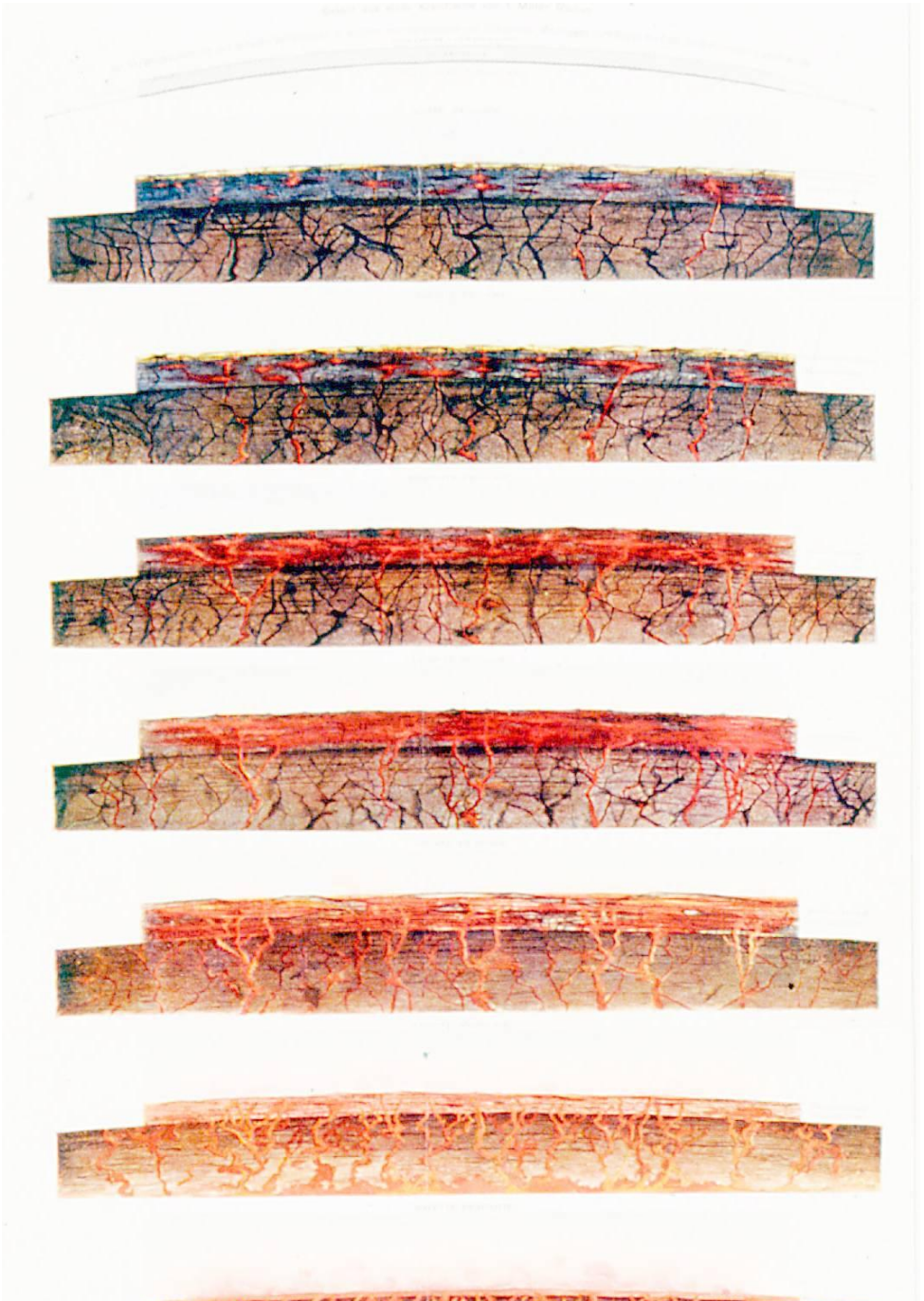
(a)



(b)

1870-1874
Controversy between Alphons Stübel and Wilhelm Reiss about the formation of the volcanoes at the Colombian and Ecuadorian volcanic mountains.

Theory of panzer plates by the volcanologist Alphons Stübel



Discovery many physical und chemical basic principles in 18th and 19th centuries.

Atomic structure and periodic table of the elements

X-rays

Radioactivity

Development modern measuring instrument

Mass spectrometer

X-ray diffractometer

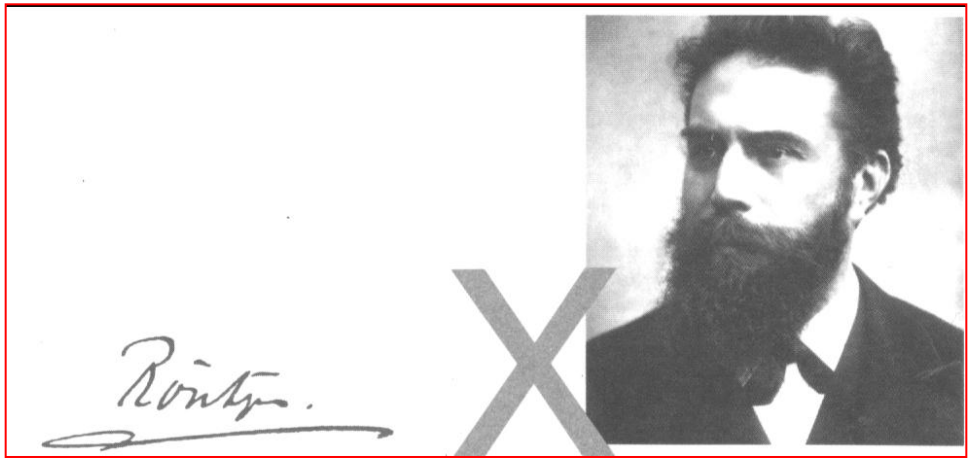
Giant equipments for analysis of element with fluorescent x-ray radiation

Laser ablation in micrometer range coupled to mass spectrometer

➔LAM-ICP-MS

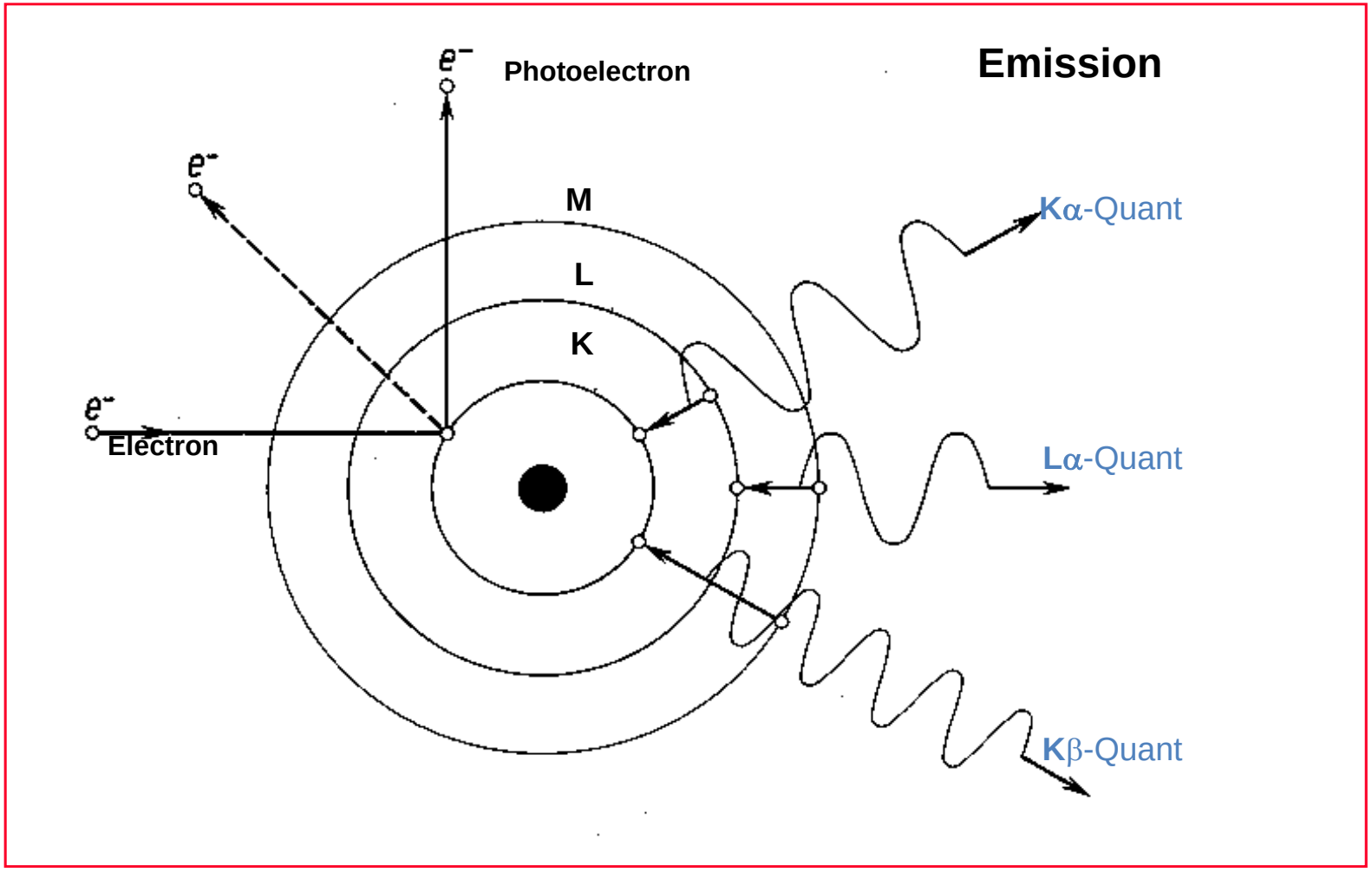
Geodesy with GPS

X-Ray



Wilhelm Conrad Röntgen discovered 1895 the x-ray and obtained for it 1901 the Nobel prize in Physic. 1995 the German Post issued a stamp in his honour.

Principle of the origin characteristic x-ray



The discovery of radioactivity

H. Becquerel (1852 - 1908) discovered 1896 the radioactivity. These discovery happened fortuitous, because he investigated actually about fluorescence and phosphorescence. A plate placed **in the dark** together with an uranium mineral showed a clearly blackening after the developing. Becquerel made more experiments with different minerals and came to the conclusion, that the blackening on the photographic plates was independent as if the mineral showed fluorescence or phosphoresce.

Boltwood (1907): Analysis of U and Pb in Uraninite ➔ 410 and 535 Ma

Richards (1914): Discovery of lead isotopes

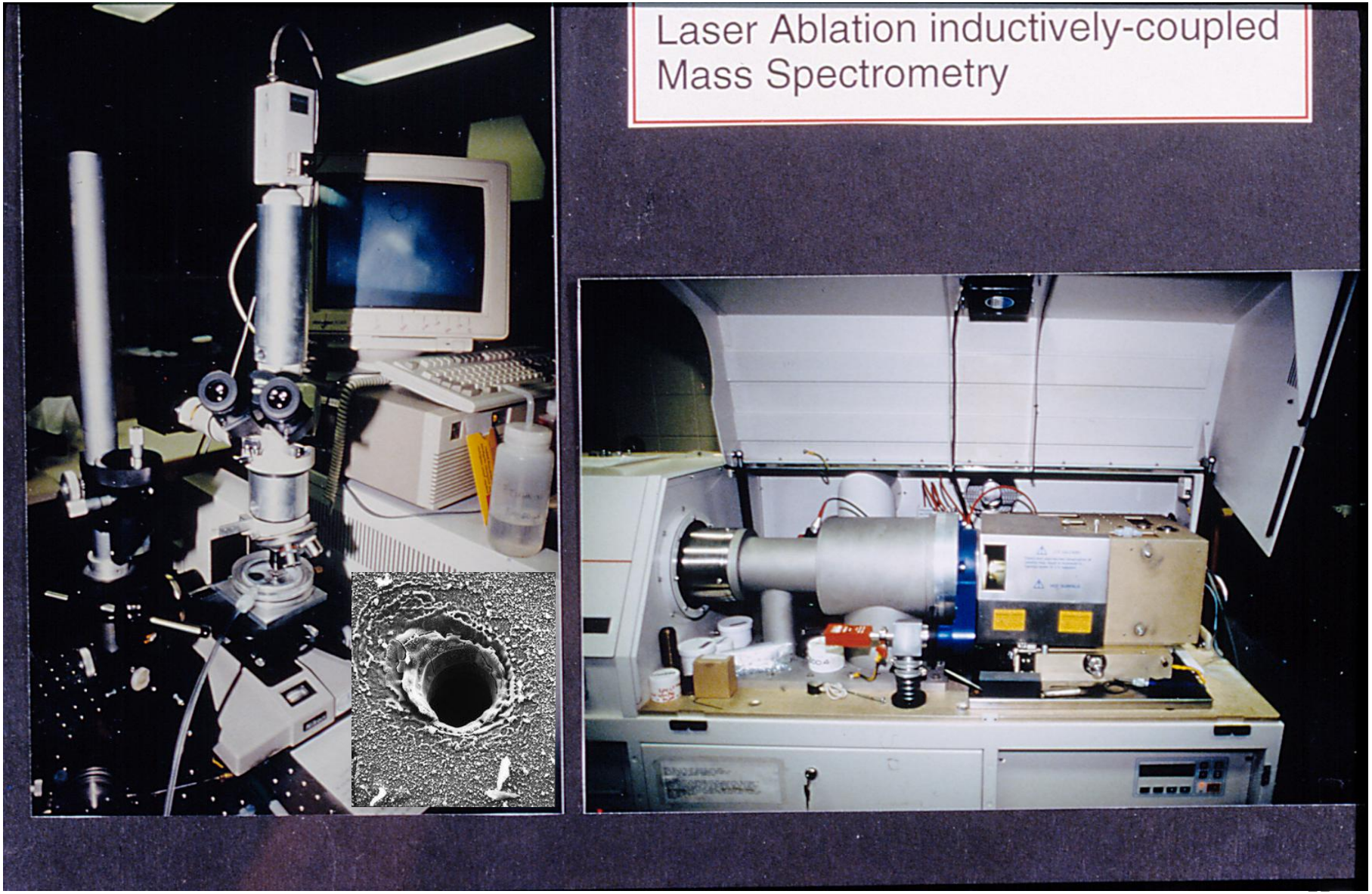
Thomson J.J. (1914): Prototype of a masse spectrometer

Aston F.W. obtained 1922 Nobel prize for further development of masse spectrometer and discovery many isotopes

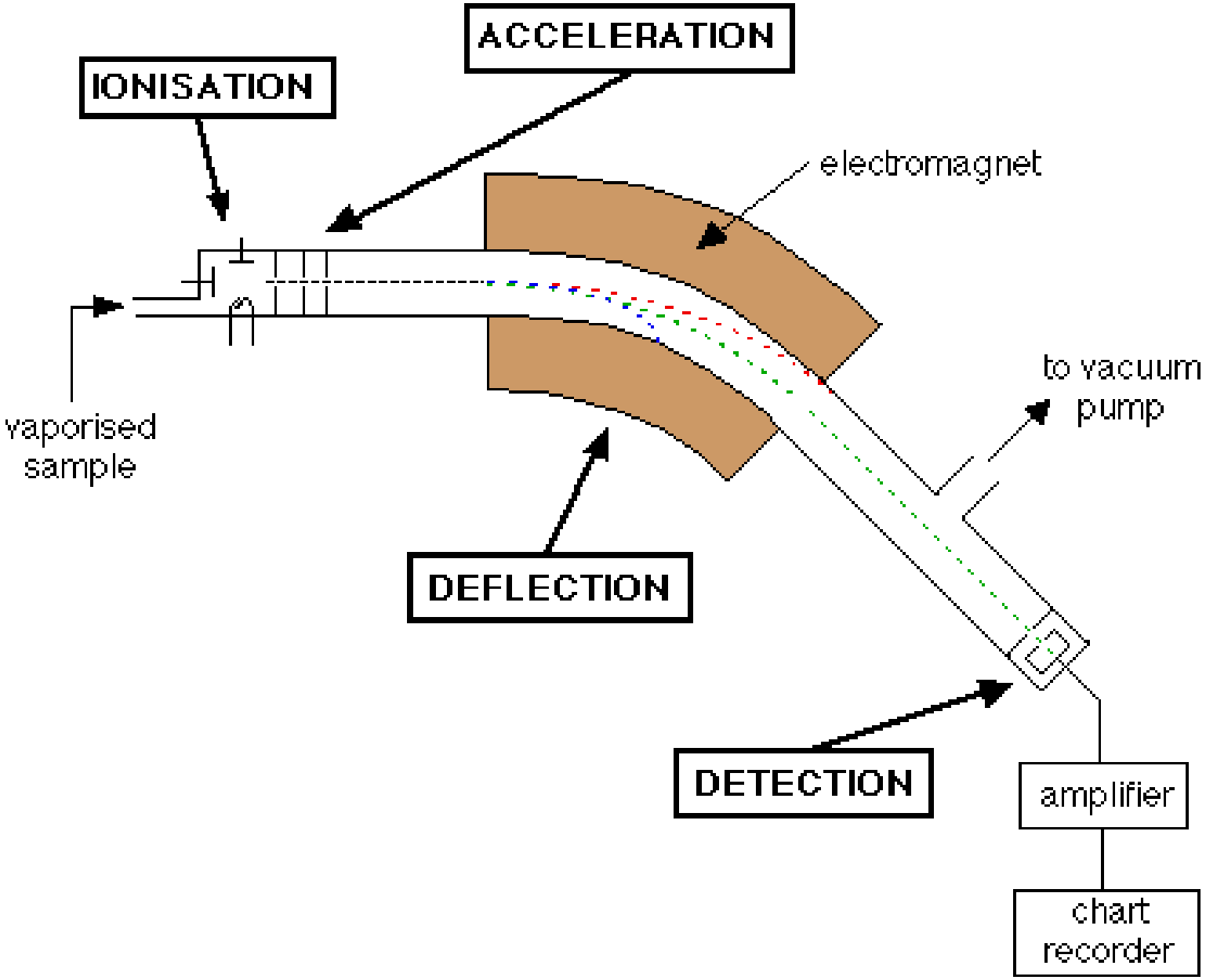
Nier, A.O. and Baxter, G.P. (from 1938): radiometric dating methods

http://www.dmg-home.de/pdf/Radioakt.pdf

Modern micro analytic analyzer for determination of trace element contents in micrometer range

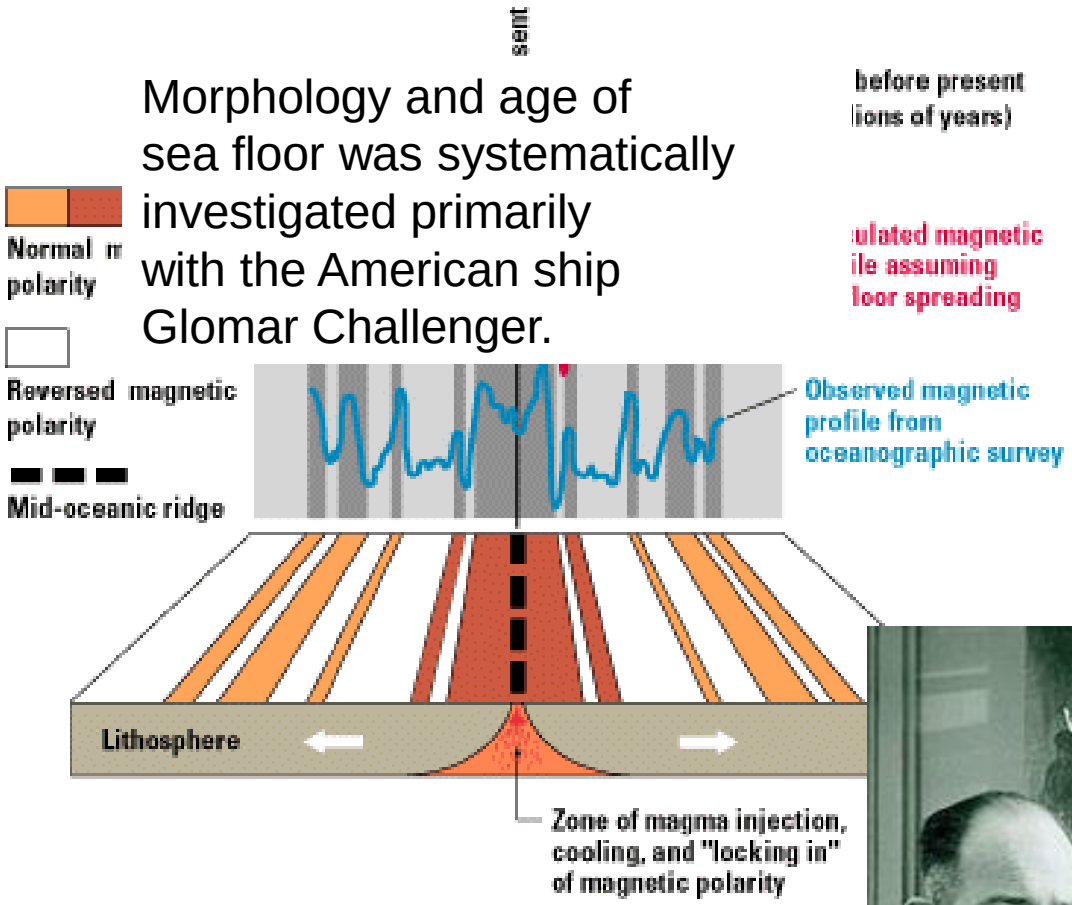


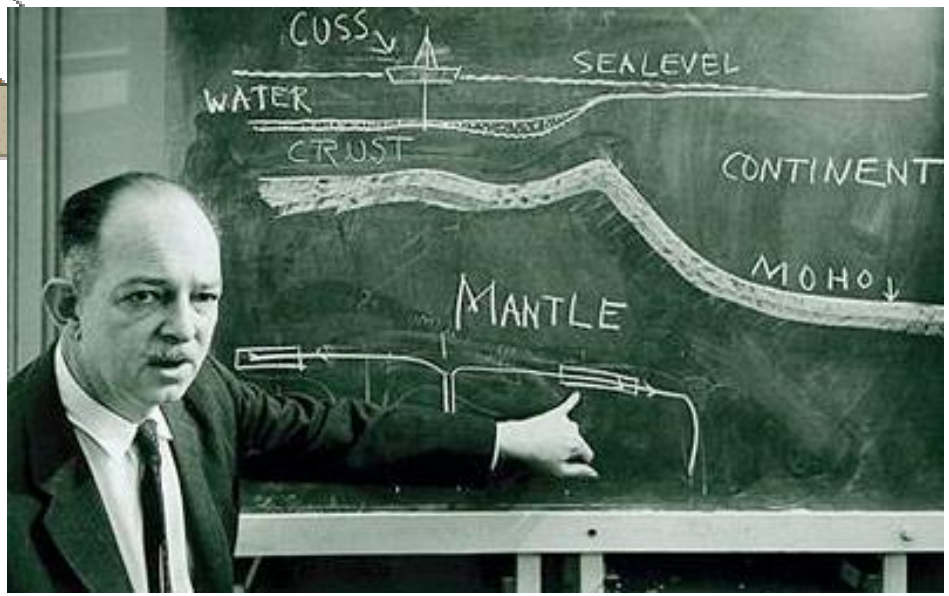
Configuration of a masse spectrometer



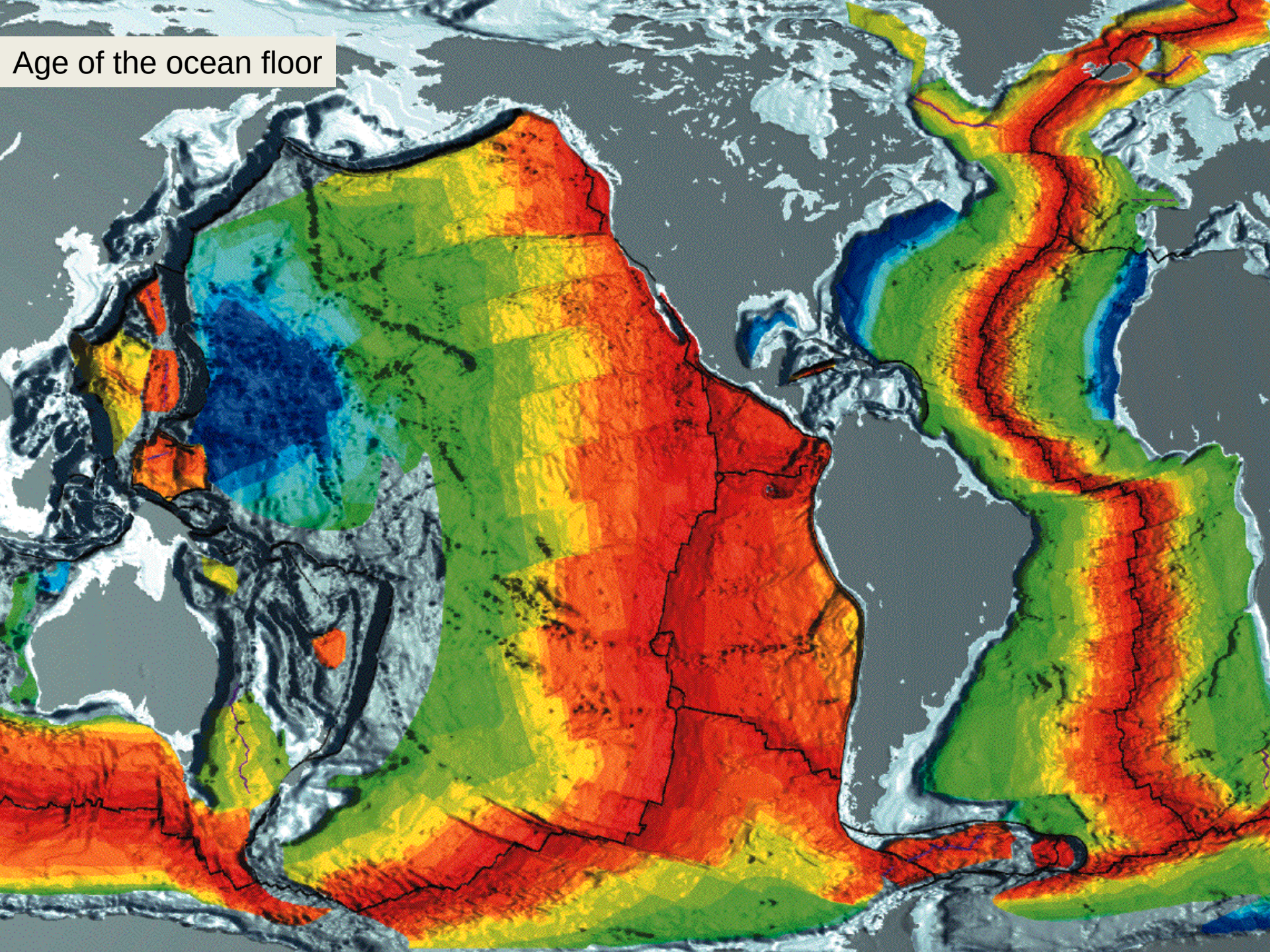
Beginnings of the plate tectonics

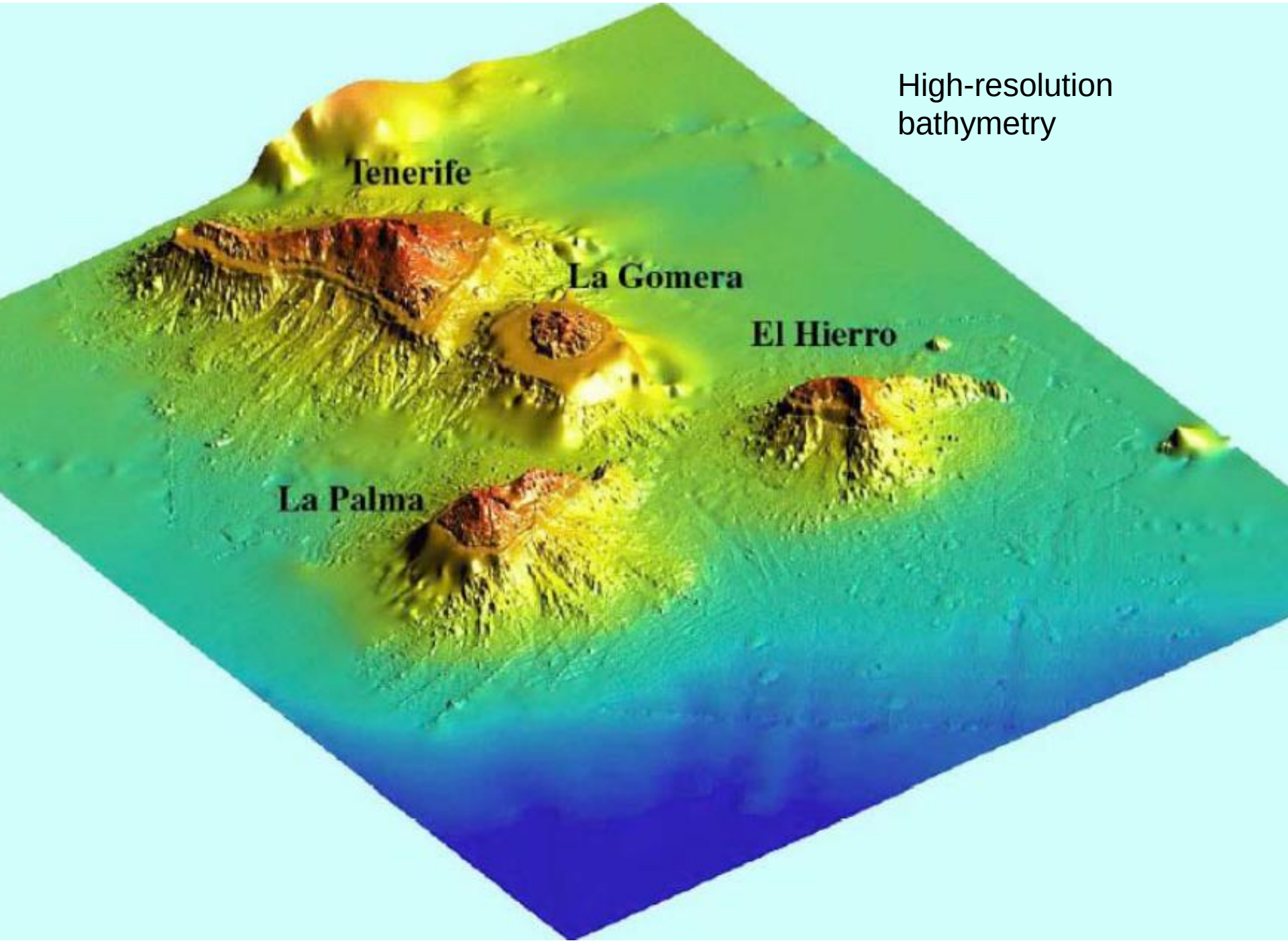
Morphology and age of sea floor was systematically investigated primarily with the American ship Glomar Challenger.





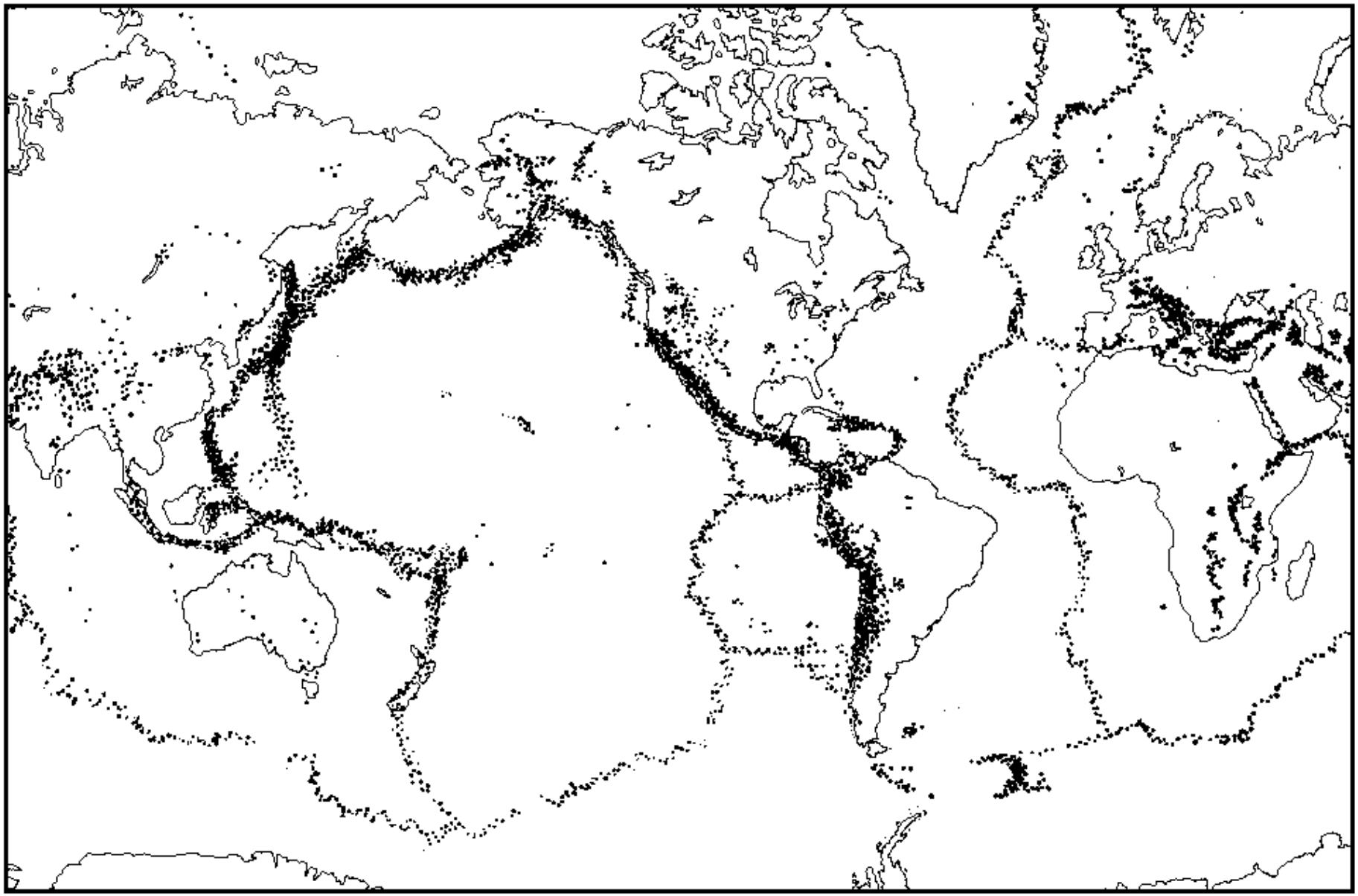
Harry Hess


Age of the ocean floor

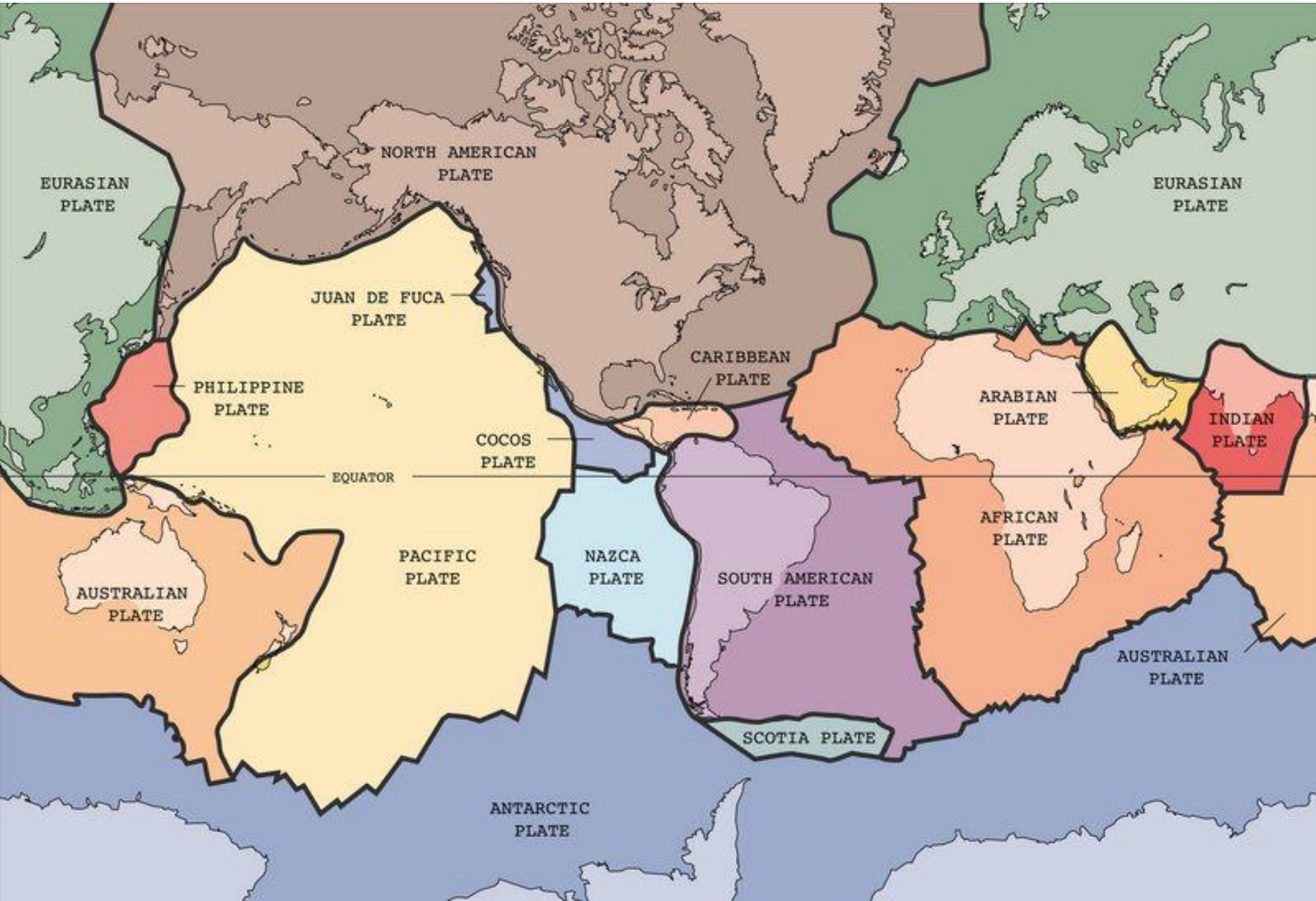


High-resolution bathymetry

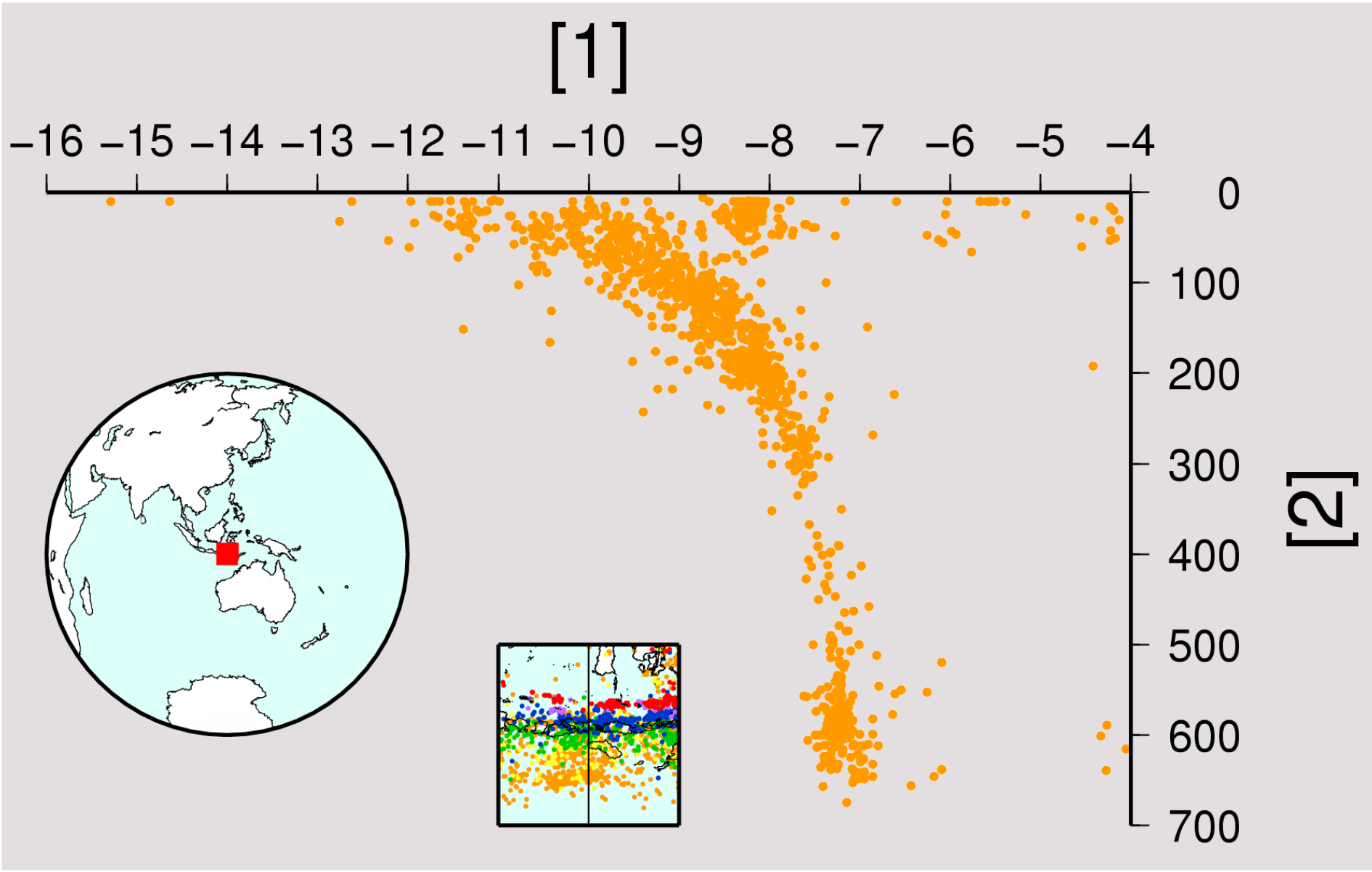
mapping of epicenters ➔ plate margins



Lithosphere plates, which configure the Earth



Depth of the hypocenters under volcanoes (Wadati-Benioff- Zone)



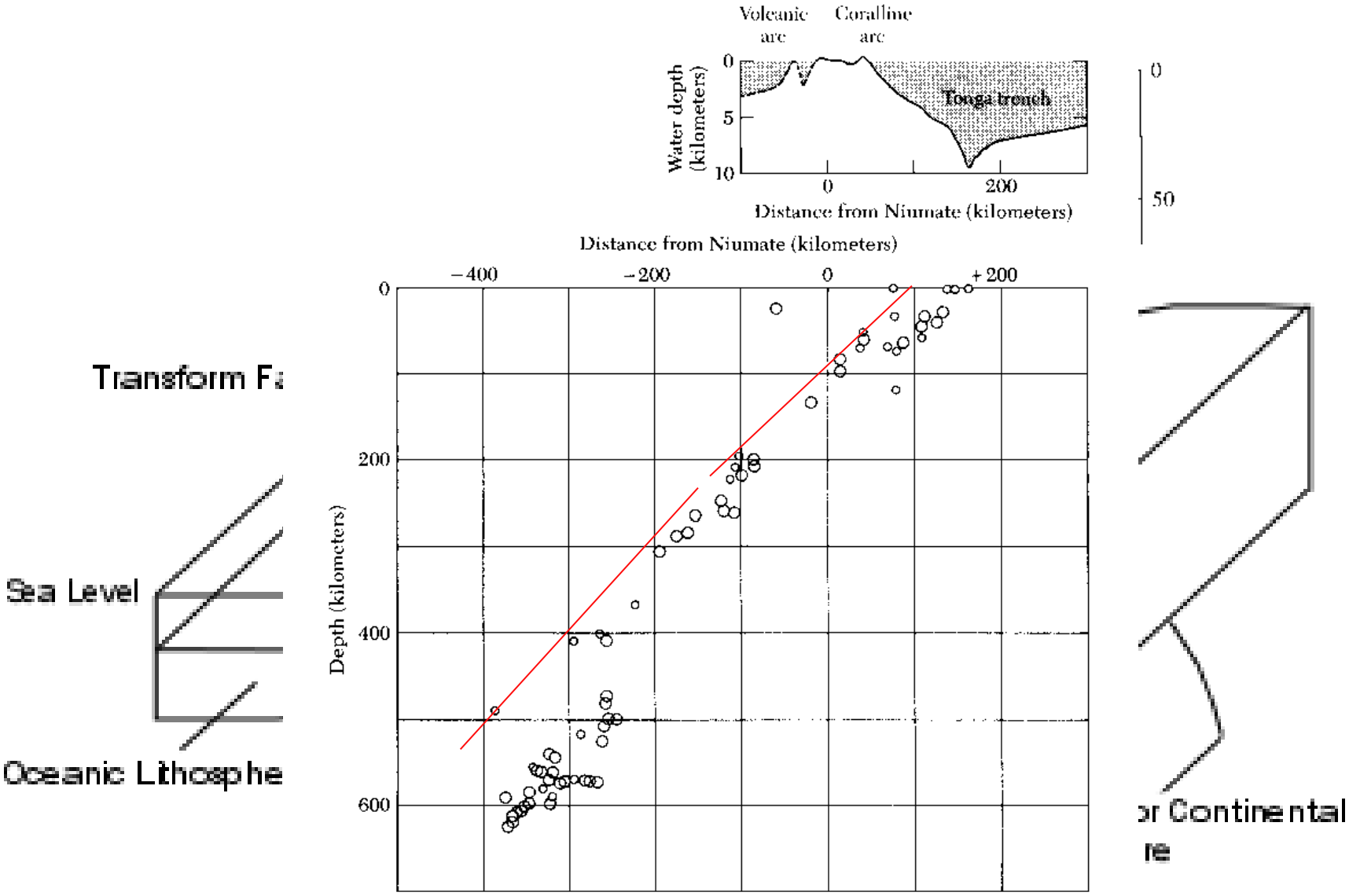
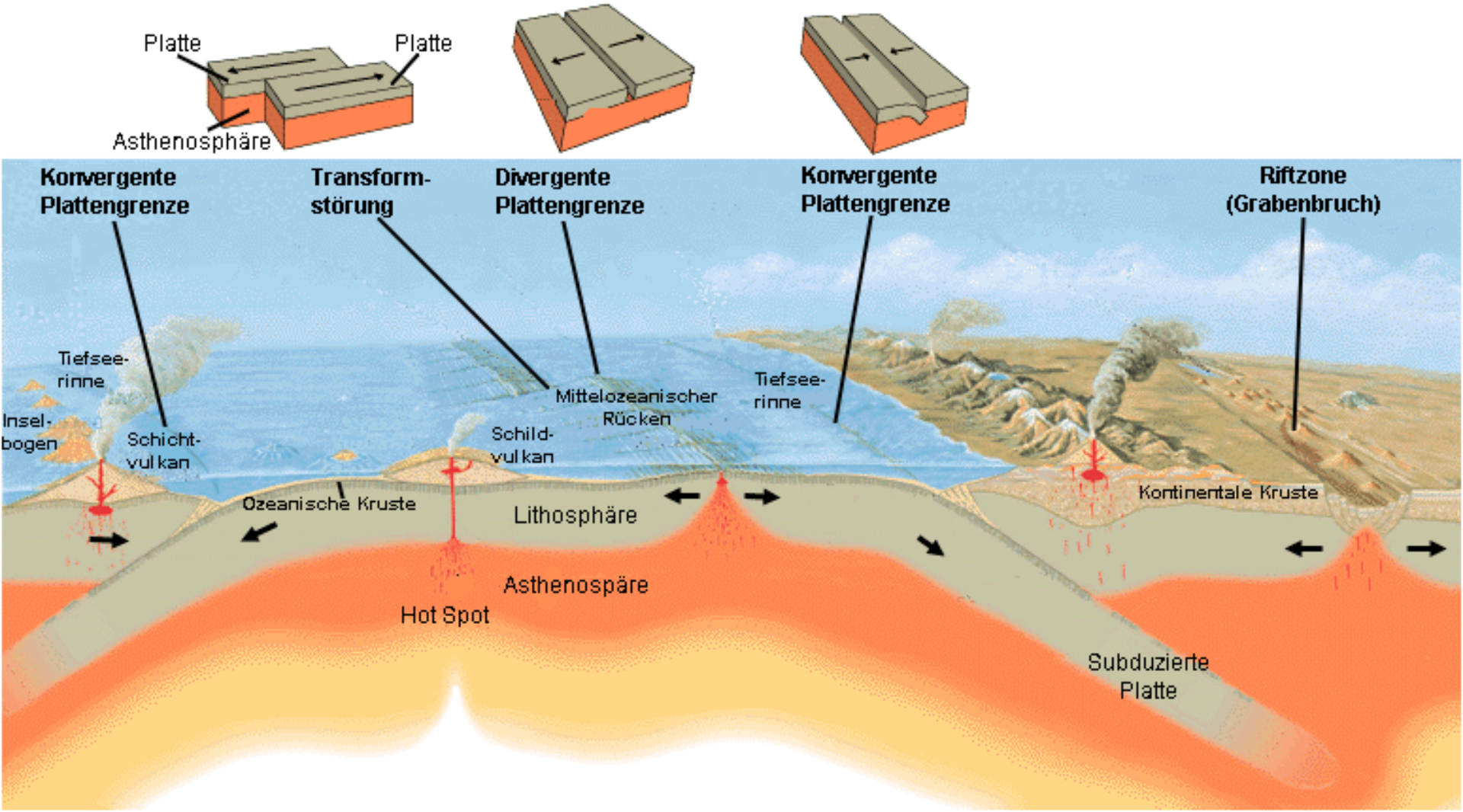


Figure 2.4 Foci of earthquakes in 1965 occurring under the Tonga arc in the southwest Pacific. The vertical section shows that most earthquake centers cluster along a narrow zone starting under the trench and dipping under it at an angle of about 45° to depths of more than 600 kilometers. [Courtesy of B. Isacks, J. Oliver, L. R. Sykes, and *J. Geophys. Res.*]

Plate tectonics

Simplified schoolbook illustration, which in part is false: Why?



Reconstruction of super continent Pangaea before more than 250 ma


Eurasische Platte
Situation heute
Vor 10 Mio. Jahren
Vor 38 Mio. Jahren
Äquator
Vor 55 Mio. Jahren
INDISCHER
Vor 71 Mio. Jahren
OZEAN
Indische Platte
Sri Lanka

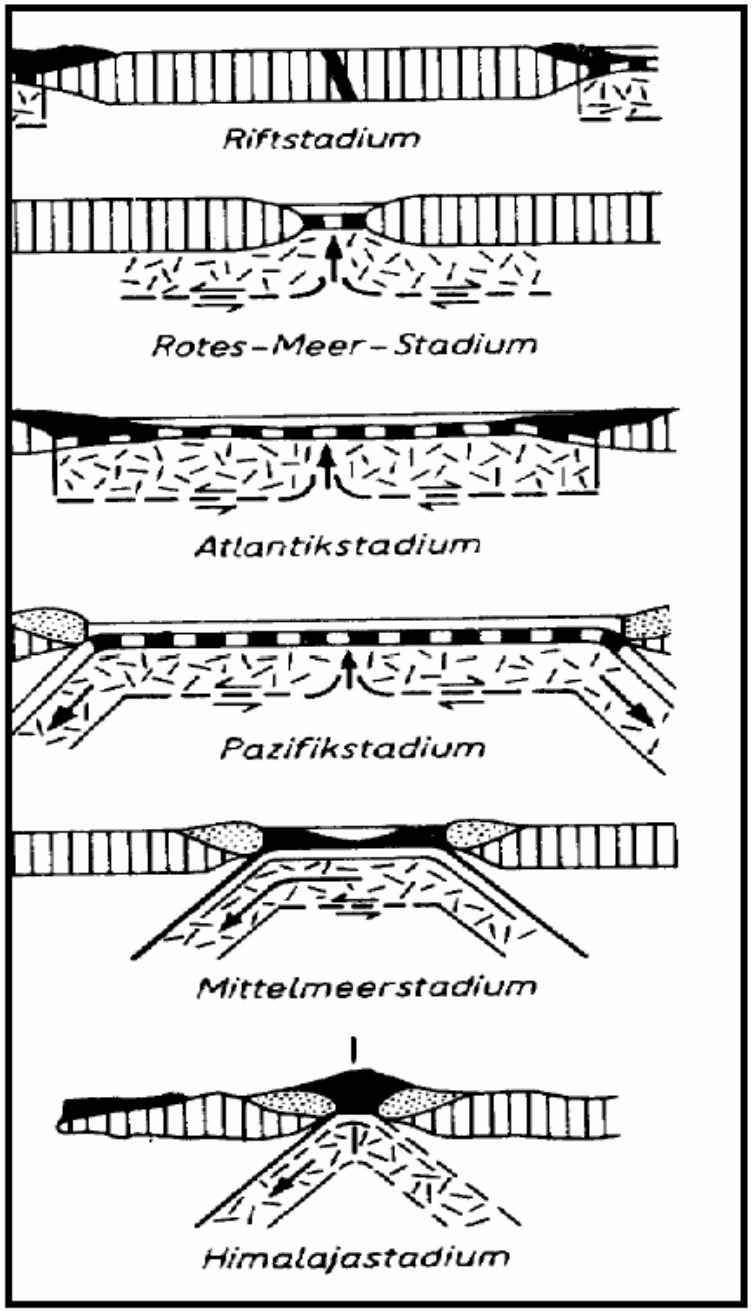
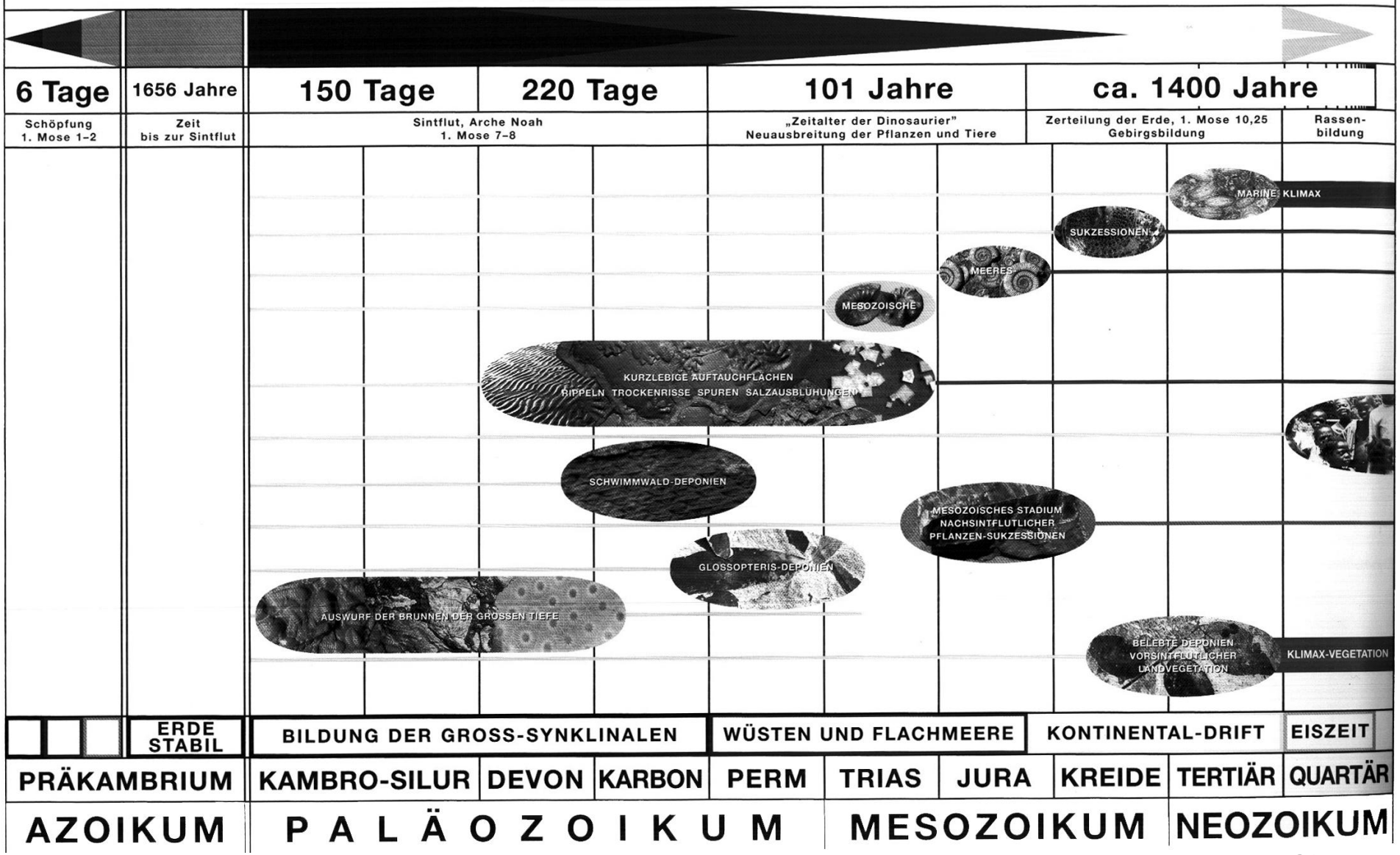


Abb.: 10 : Wilson-Zyklus; Hohl; R. (Hg.) 1985; S. 263

AUF EINEN BLICK: SCHÖPFUNG - SINTFLUT - ZERTEILUNG DER ERDE - EISZEIT



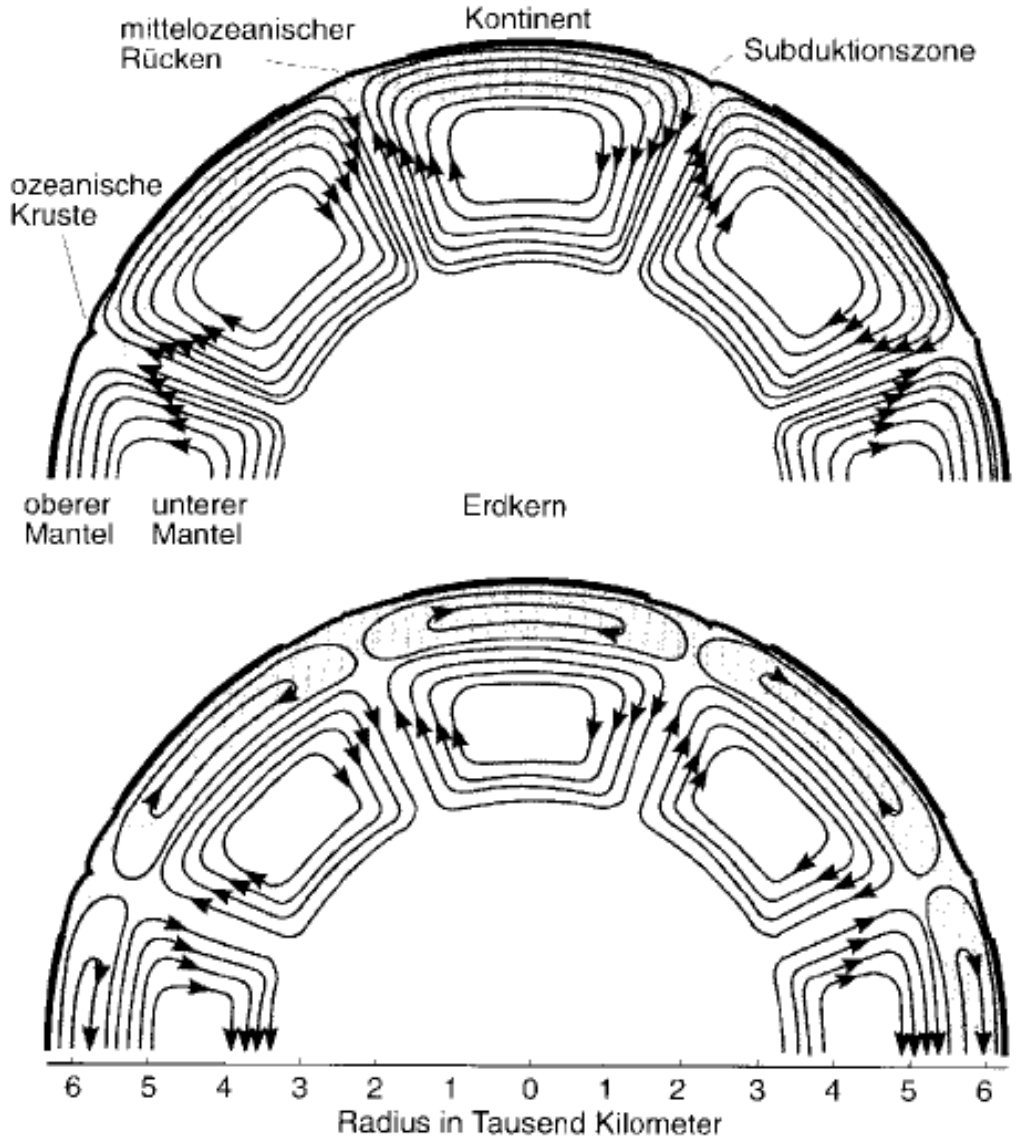
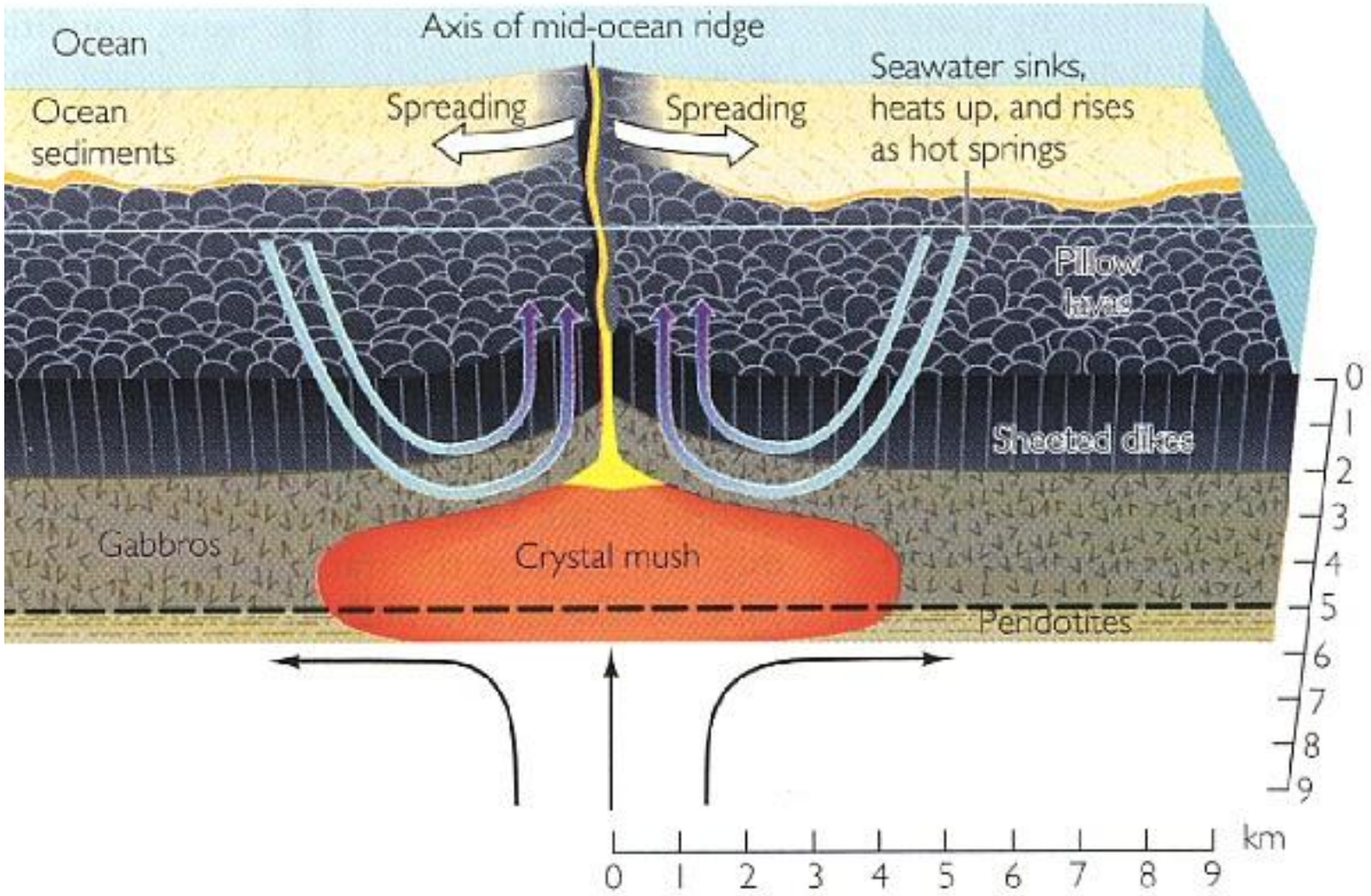
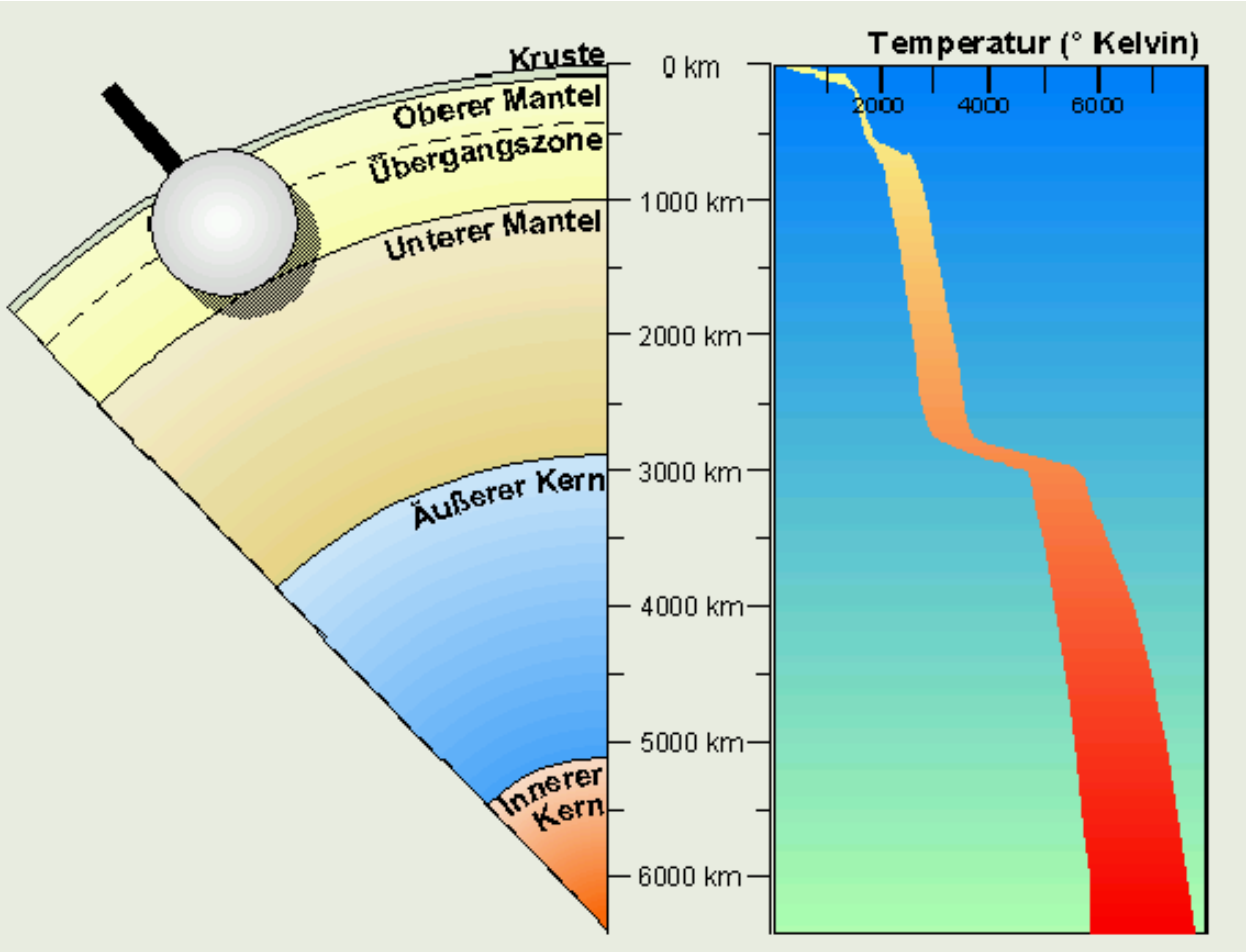


Abb. 3.20. Gegenüberstellung der beiden Hypothesen über das Muster der Konvektion im Erdmantel. Im oberen Bild reichen die Konvektionsströme bis zum Erdkern; im unteren Bild trennt die 660-Kilometer-Diskontinuität zwei Konvektionsströme.

. 2: Illustration about convection currents and convective cells in earth mantle and crust;
nius, Karl; Die Erde im Wandel, Berlin 1995; S.100.

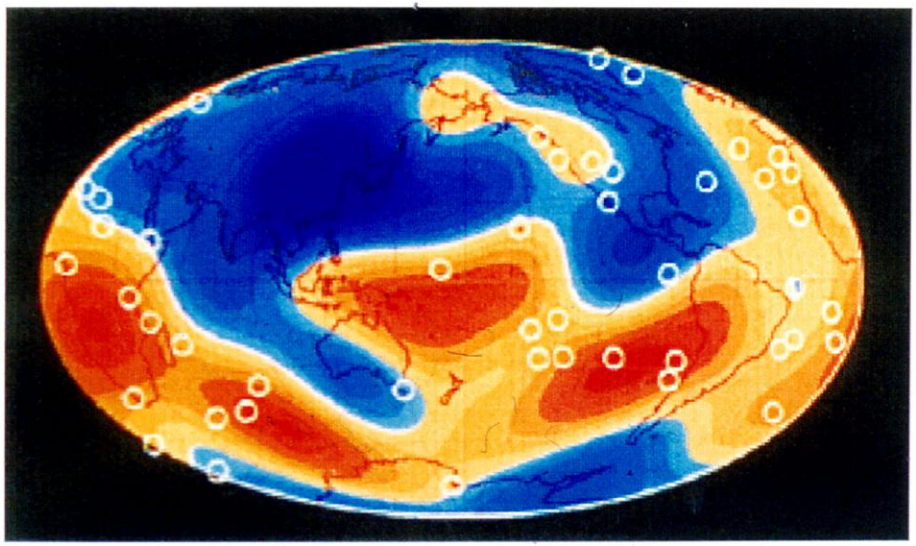

Ocean
Axis of mid-ocean ridge
Seawater sinks,
heats up, and rises
as hot springs
Ocean
sediments
Spreading
Spreading
Pillow
lavas
Sheeted dikes
Gabbros
Crystal mush
Peridotites
0
1
2
3
4
5
6
7
8
9
km
0 1 2 3 4 5 6 7 8 9

Earth constitution

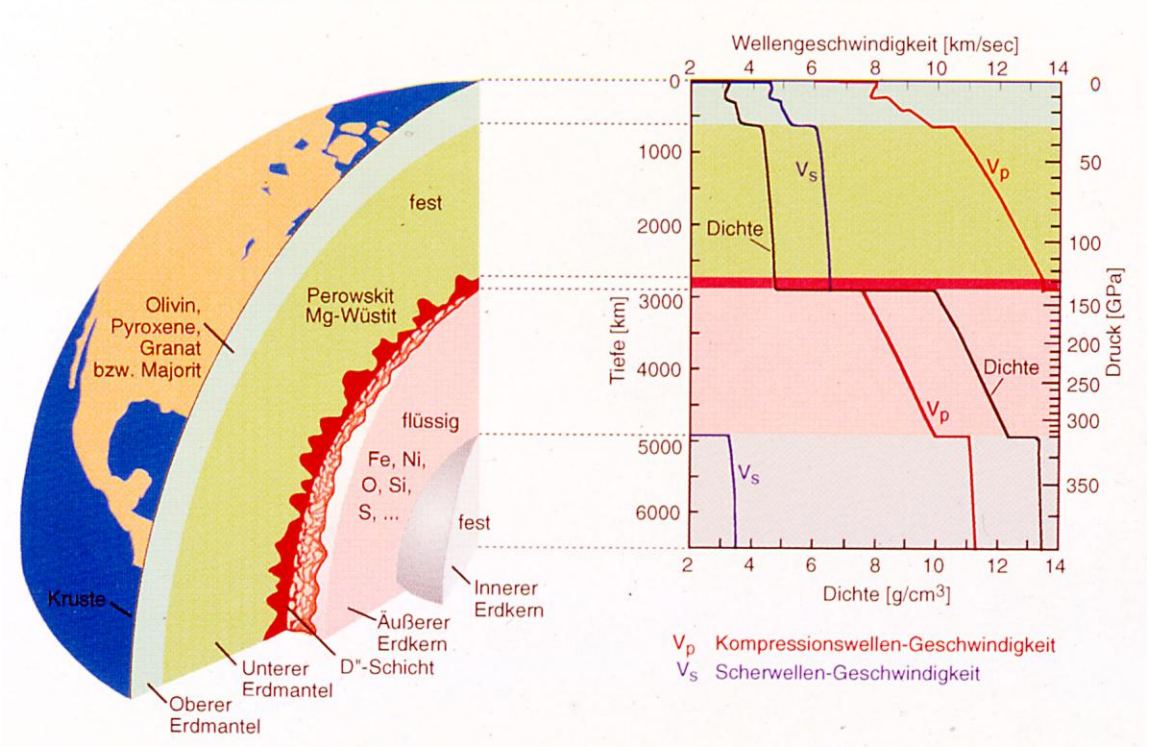


Seismic tomogram of the earth
Blue=rapid; red= slow

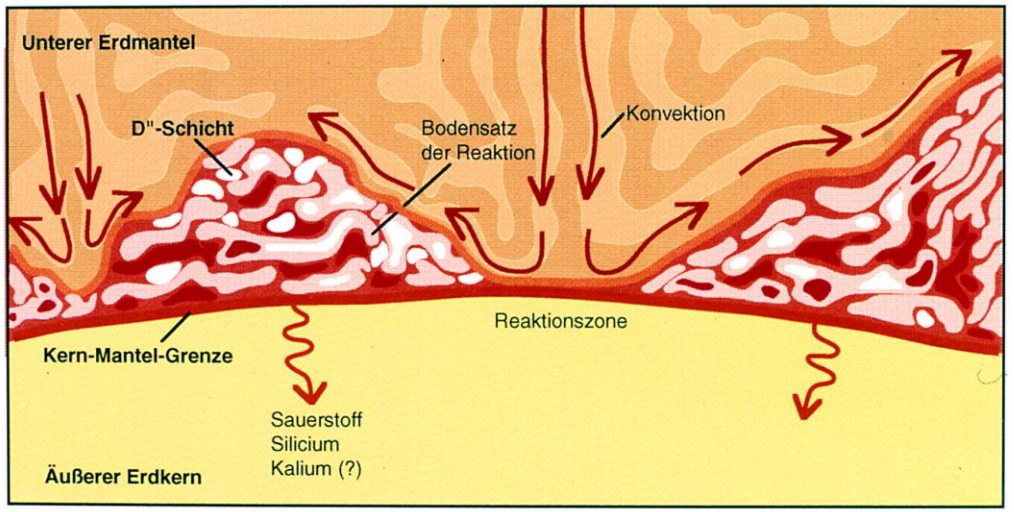
Seismic tomogram of the under earth ,mantle
(red=slow=hot; blue= rapid=cold)
and distribution of the hot spots



Configuration of the earth as well as velocity seismic waves and density



The “D” layer as product chemical reactions at the core-mantle edge



A: Nils Steno has postulated the stratigraphic principle of the sedimentation and died as destitute missioner.

B: The concept “Plinian Eruption“ was formed due to the stone pines form of the eruption column.

C: The neptunistic world view come from the biblical diluvium and it was founded by James Hutton.

D: Abraham Gottlob Werner taught his students Alexander von Humboldt and Göthe a geological world view, which contained the permanent dynamic changes of rock beds.

A: Charles Darwin developed the plutonistic world view, when he investigated the volcanic rocks from the Galapagos-island.

B: The Geosynclinals theory provided not plausible explanation for the formation of volcanism and mountains.

C: Charles Lyell developed the concept of Actualism, which said that the past is the key of the present.

D: The layered structure of the earth was discovered by means of deep drillings.

O: Through the discovery of X-ray could be detected isotopes.

P: With the aid of mass spectrometer could be detected the radioactivity of some rocks.

Q: The Benioff-zone describes a part fused area at the upper mantle.

R: Convection currents at the earth mantle could deliver the driving forces for plate movements.

A: Alfred Wegener inferred from glacial traces in South America and Africa a past jointed super continent Pangaea.

B: The discovery of middle oceanic ridges had led directly to the development of the plate tectonics model.

C: The Benioff-zone described a part melting area at the upper mantle.

D: The Moho mark a density leap in the core-mantle-edge.

H: Creationism (from lat. *creare* “to create“) is the literal interpretation of the holy scriptures related to the origin of the universe and the life.

I: Creationism described the formation of an animal specie.

A: Creationism is supported by approximately 50% of the American society as important thinking.

B: Creationism comprehend a tendency of modern and creative art.

K: The super continent Pangaea united the land masses of Europe, Asian, South and Nord America as well as Australian and Antarctic about 25 million years ago.

L: The Nazca-Plate includes continental and oceanic lithosphere areas.

M: A Wilson-cycle explains the recurring formation of super continents and their subsequent breakup.

N: The Himalaya was formed by the collision of the Indian plate with the Asian plate about 70 million years ago.

Exercise: Examine the figure critically. Where could be the mistakes?

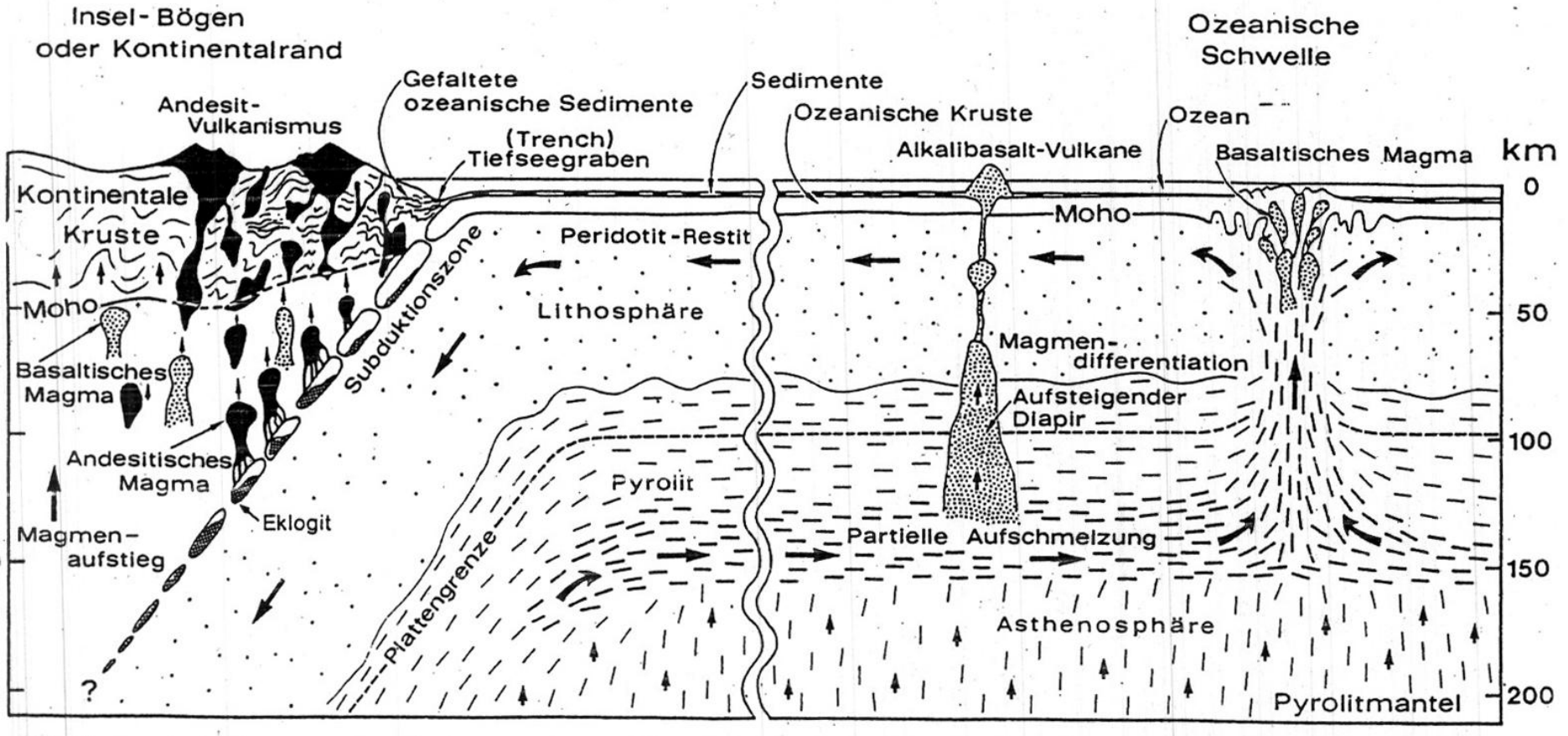


Abb. 16 Petrologisches Modell einer Subduktionszone nach Vorstellungen der Plattentektonik, Schnitt durch Kruste und Oberen Erdmantel. Dargestellt sind die Beziehung einer Peridotit (Lherzolith)- zu einer Pyrolitzone und der Entstehungsort basaltischer und (andererseits) andesitischer Magmen. Aktiver Kontinentalrand (*links*): längs einer Subduktionszone bewegt sich wasserhaltige ozeanische Kruste bzw. Lithosphäre (*Pfeile*) nach unten, wobei es zu einer Hochdruckmetamorphose und unterhalb der kontinentalen Kruste zu Aufschmelzungsprozessen unter Bildung von andesitischen Magmen kommt. Längs der mittelozeanischen Schwelle Bildung neuer ozeanischer Kruste durch Austreten von basaltischem Magma entlang von Frakturen (ocean floor spreading). Konvektionszellen im Oberen Mantel (*Pfeile*) machen die Platten der Lithosphäre beweglich. (Umgezeichnet und leicht modifiziert nach RINGWOOD, 1979, Fig. 2.1)