

A photograph of a steep, layered hillside with a river in the foreground and people on the bank. The hillside shows distinct horizontal geological strata. The river is dark and flows through a rocky bed. Several people are standing on the rocky bank in the foreground, looking towards the river. The sky is clear and blue.

MÓDULO 2: PROCESSOS ENDÓGENOS E EXÓGENOS NA FORMAÇÃO DO RELEVO

- *Forças internas na Formação do Relevo: A Tectônica (Aula 4)*
- *Forças externas: Processos Geomorfológicos (Aula 5)*
- *Forças externas: Intemperismo (Aula 6)*

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Aeroporto de St. George, Utah (EUA)



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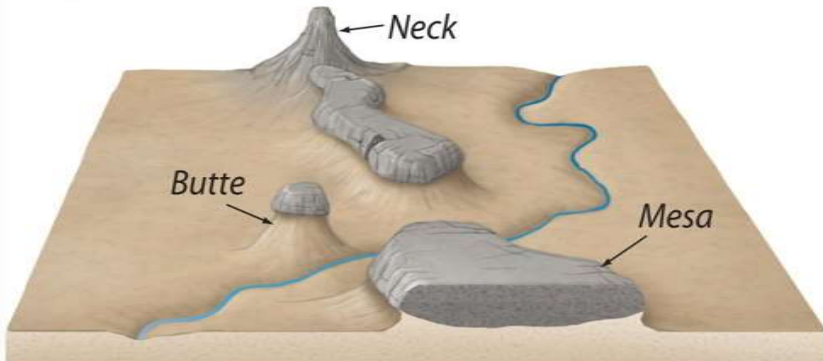
Stage 1: Young lava flow



Stage 2: Landscape begins to erode



Stage 3: More resistant lava stands above surroundings



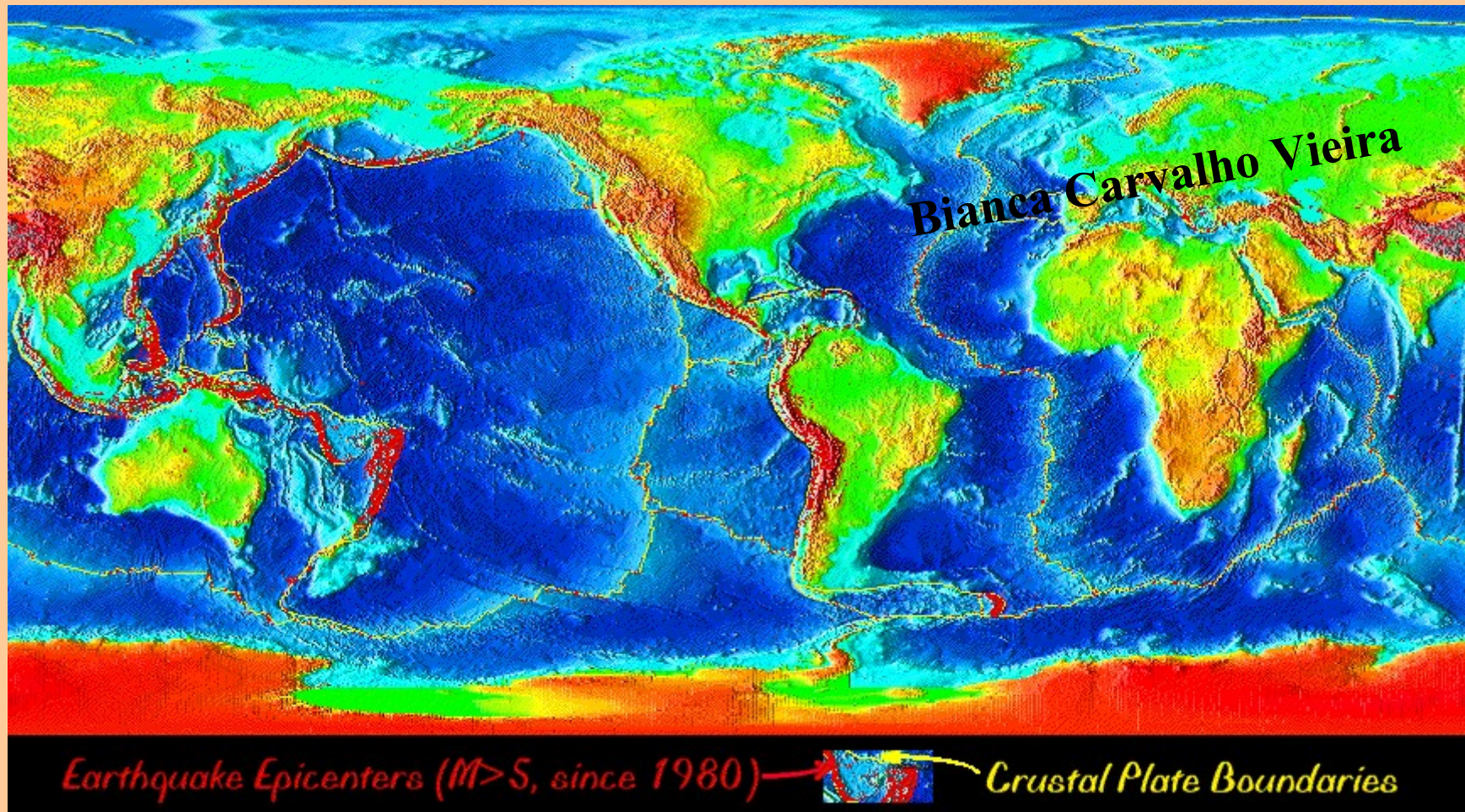
Time

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A Terra está dividida em placas relativamente finas (contendo continentes ou não) que se movem e se chocam provocando terremotos, vulcões, falhas, dobras, cadeias montanhosas, etc.



2 bilhões de anos atrás

- Territórios atuais
- Territórios atualmente submersos
- Territórios submersos há 2 bilhões de anos



1 bilhão de anos atrás



550 milhões de anos atrás

As linhas amarelas indicam os territórios agregados nos continentes



230 milhões de anos atrás



105 milhões de anos atrás



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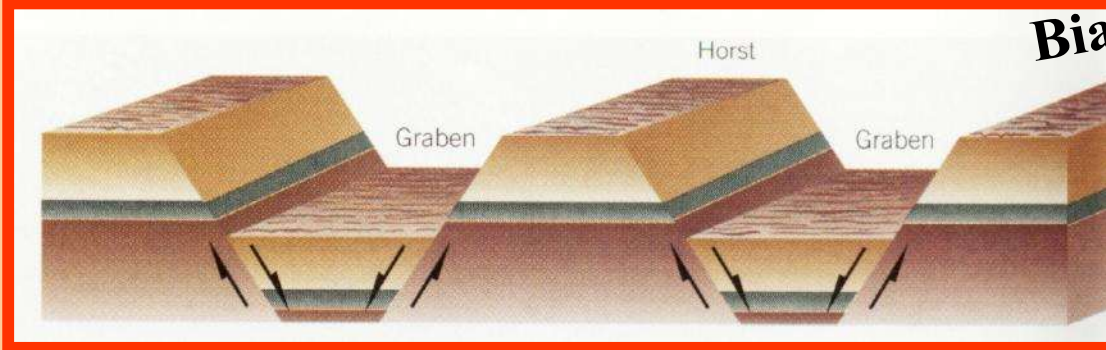


Tectônica de Placas



RESULTADO DE
PROCESSOS INTERNOS

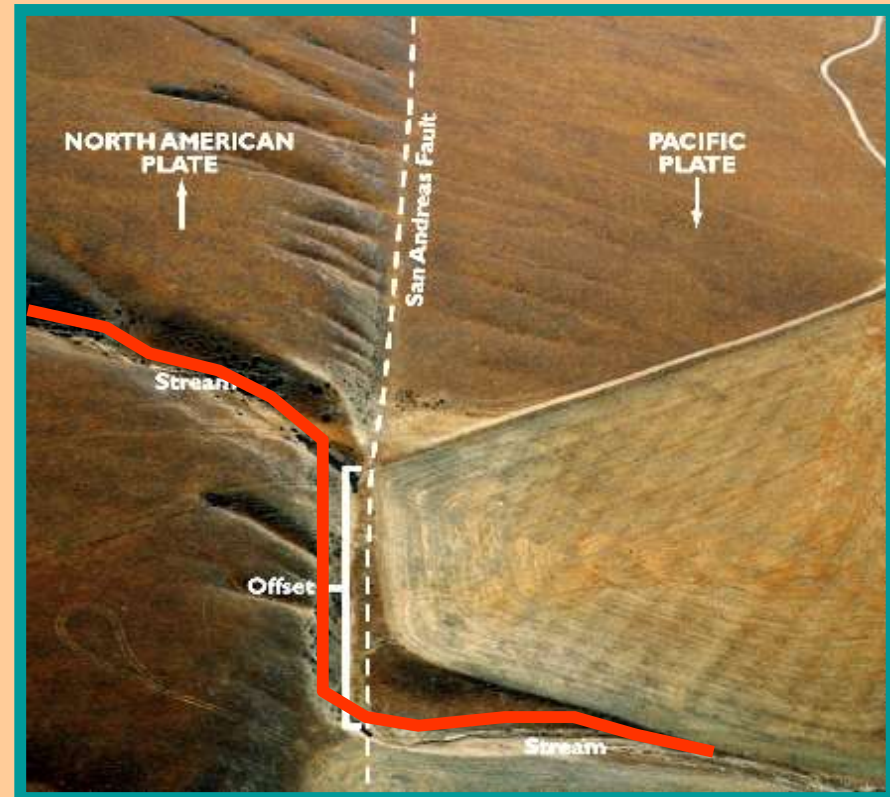
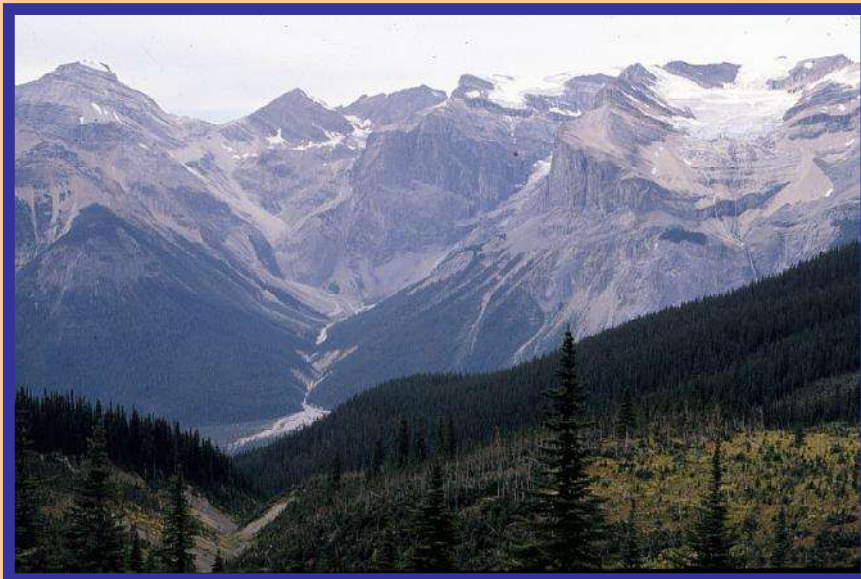
1. Em domínios divergentes a paisagem mais característica são os grábens e os horstes;



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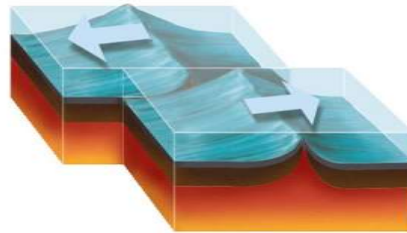
3. Em domínios transcorrentes são as escarpas de falhas, os longos lineamentos e os deslocamentos na drenagem e no relevo.

2. Em domínios convergentes são os cinturões orogênicos





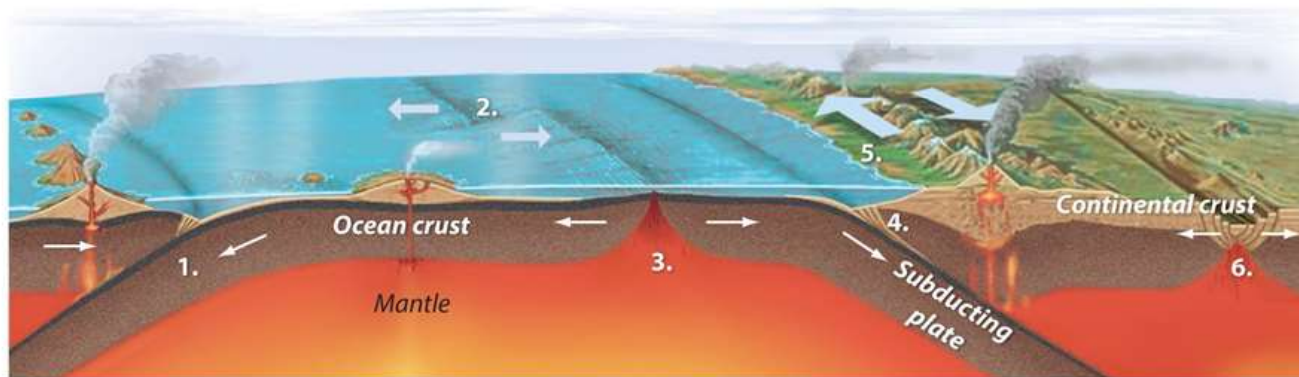
1. Where an oceanic plate **subducts** under another oceanic plate at a **convergent boundary**, a chain of steep, explosive volcanoes, known as an **island arc**, forms.



2. **Marine transform faults** offset spreading ridge segments. These strike slip faults are clearly visible in remotely sensed of sea-floor topography near spreading ridges.



3. **Divergent** boundaries are characterized by **basaltic volcanism** and shoulders uplifted by **thermal buoyancy** of the warm, less dense mantle rock that comes close to Earth's surface here.

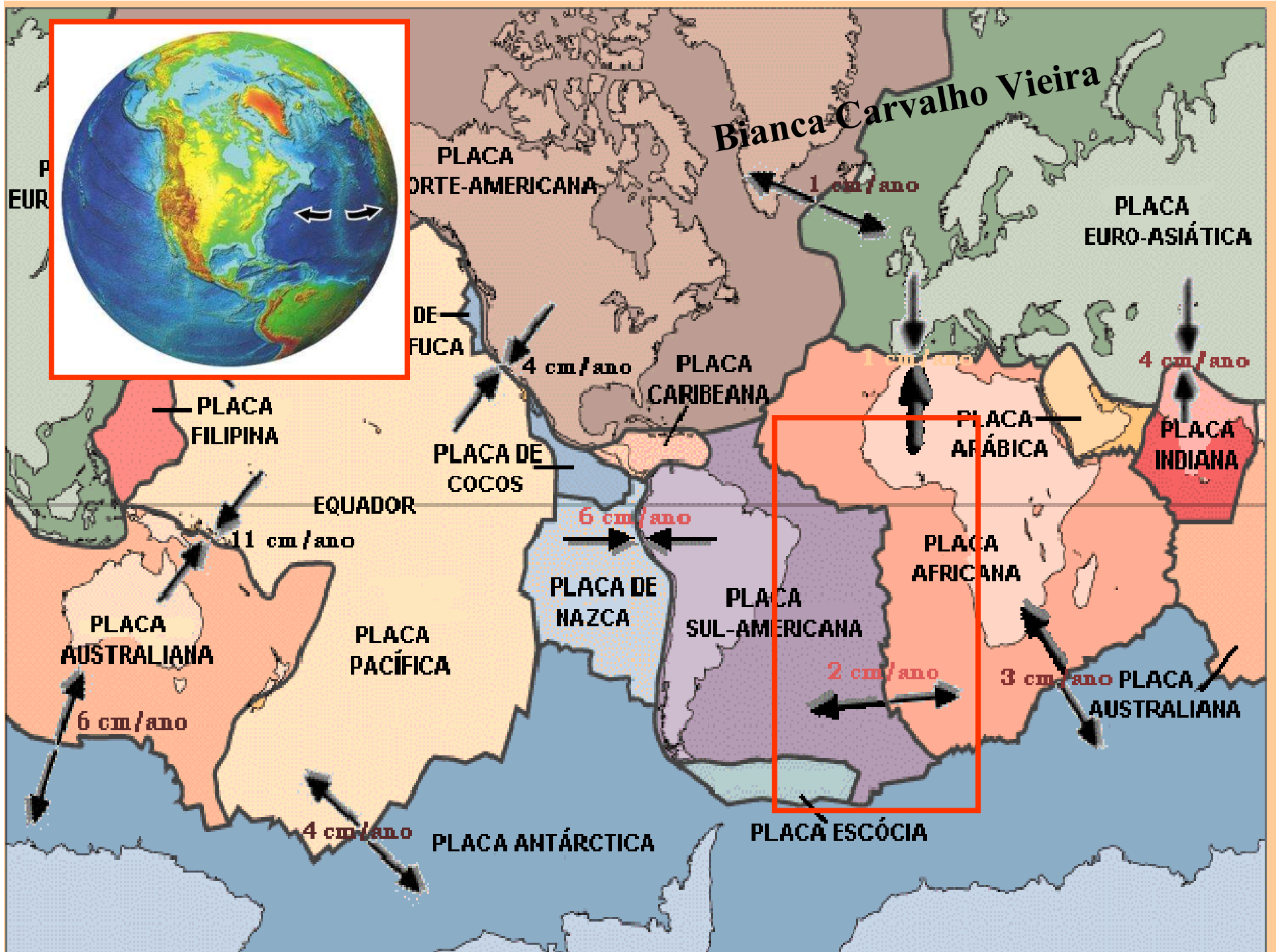


Terrestrial environments

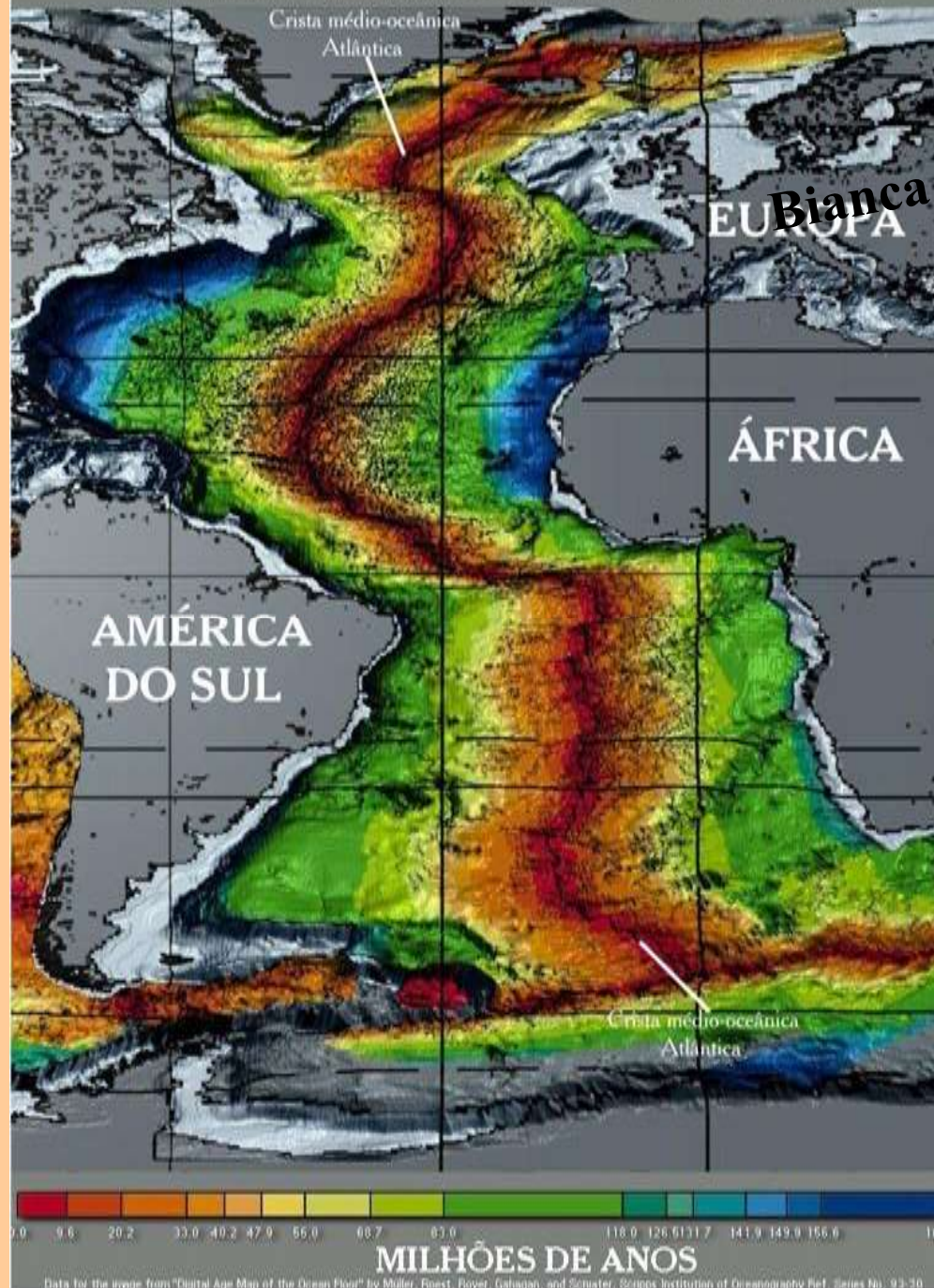


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DOMÍNIOS DIVERGENTES



IDADE DA CRUSTA OCEÂNICA ATLÂNTICA



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Data for the figure from "Digital Age Map of the Ocean Floor" by Müller, Royce, Royce, Galagan, and Schuster, Scripps Institution of Oceanography PI 1, Series No. 93-30

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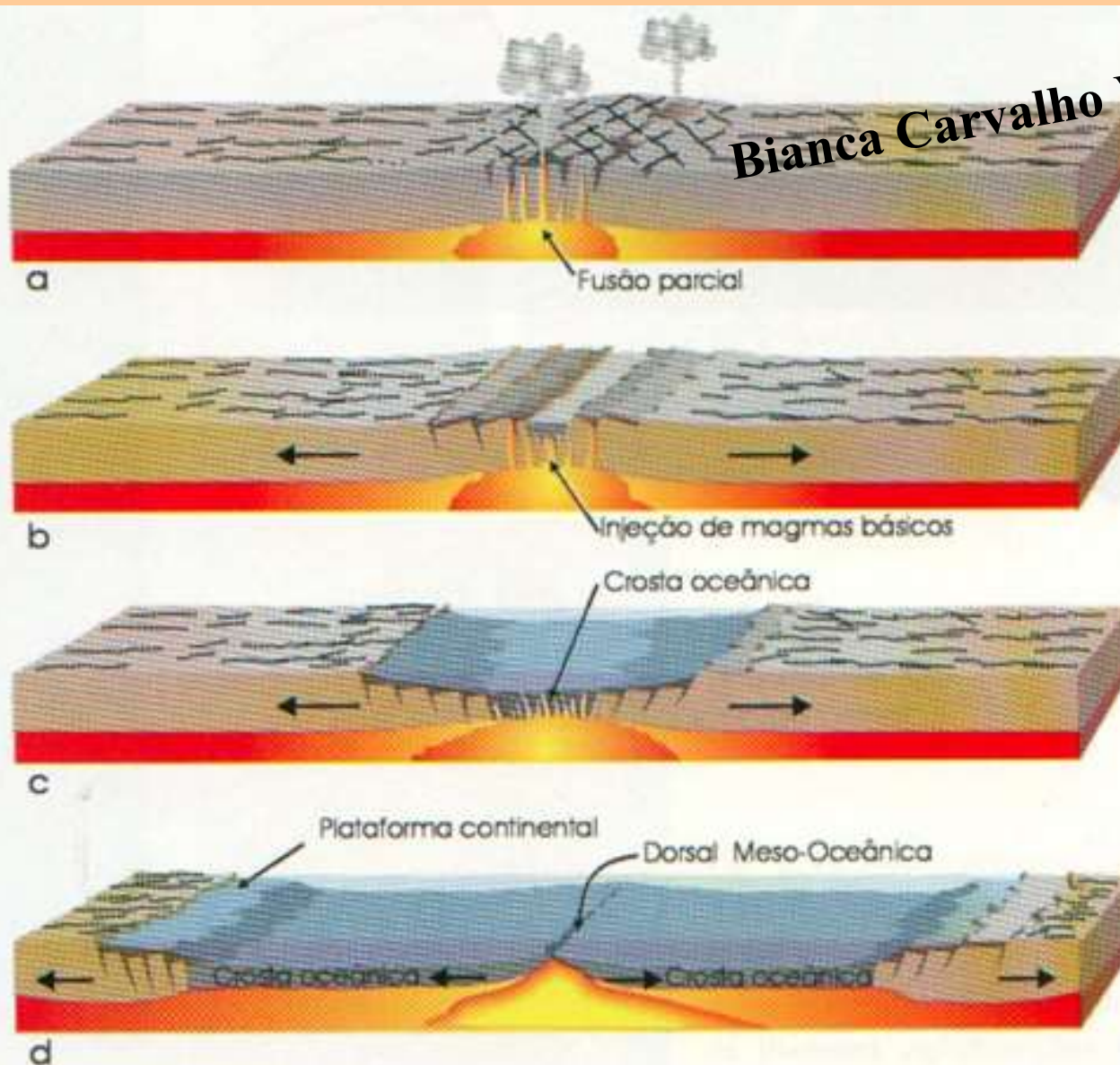
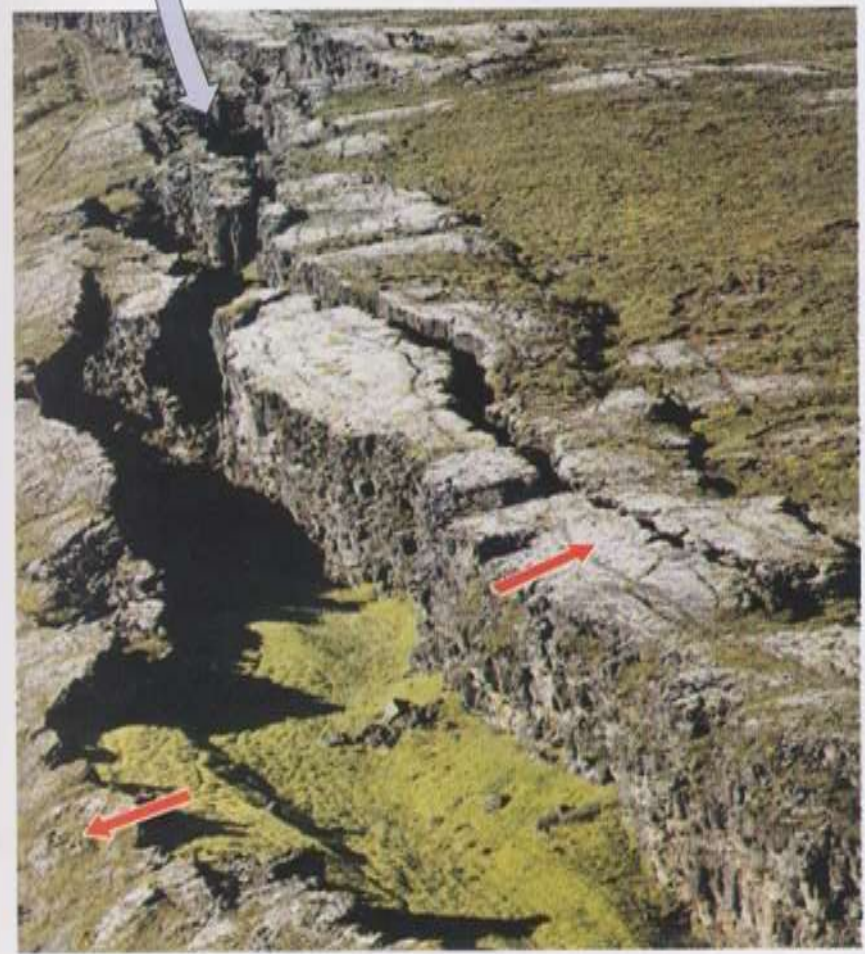


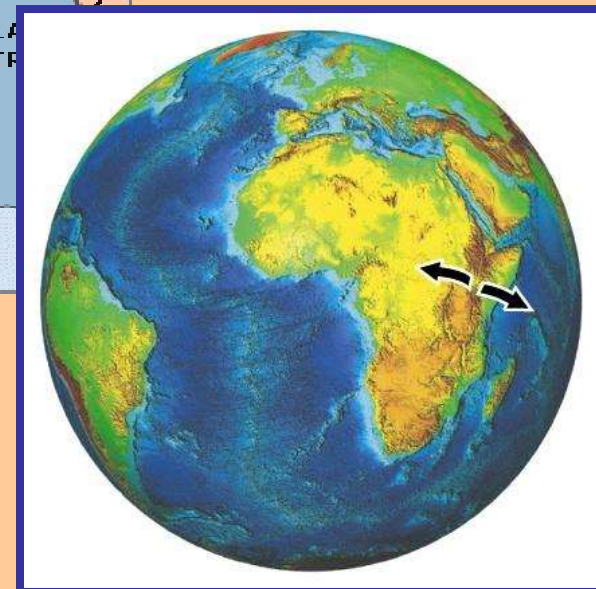
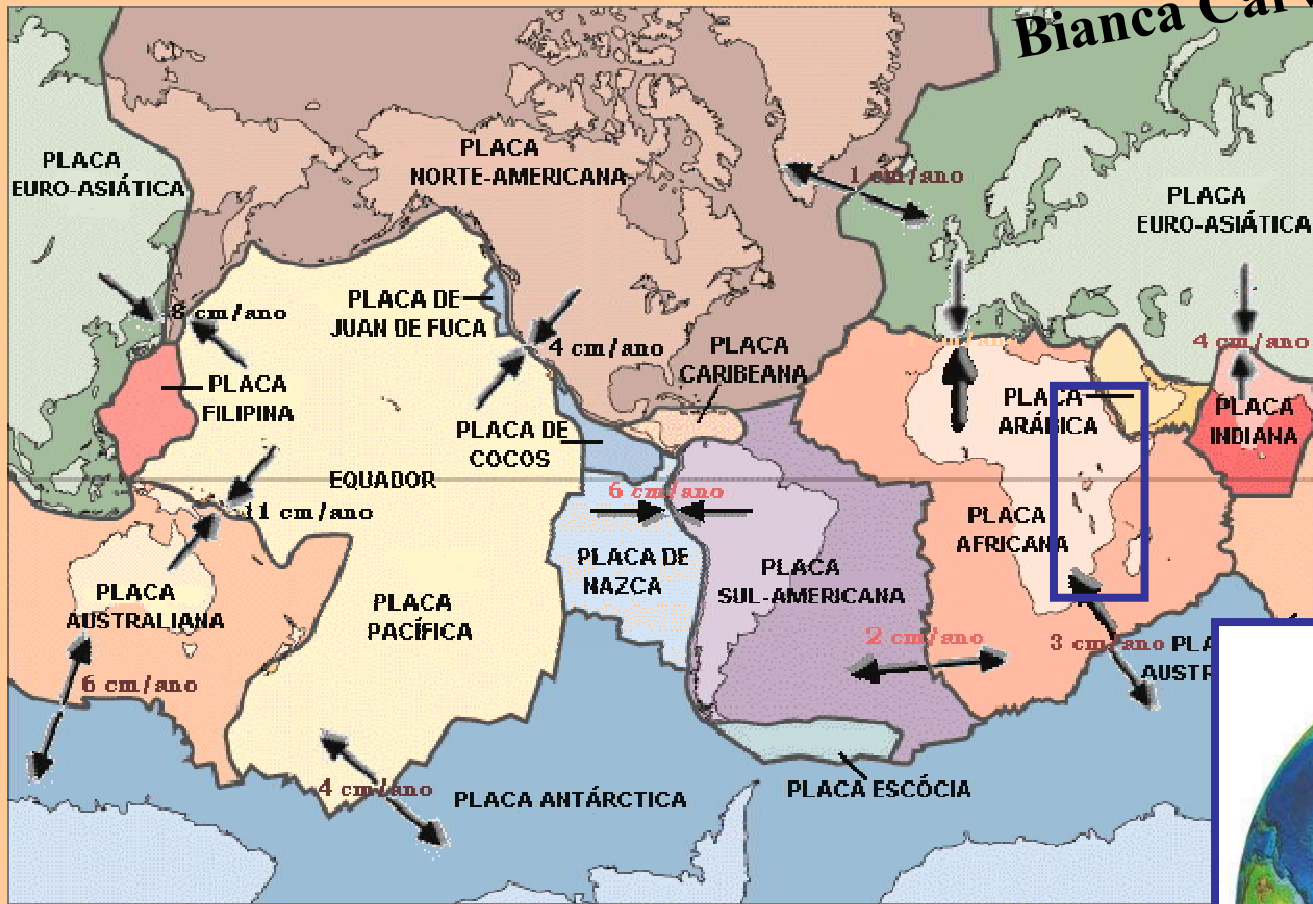
Fig. 6.15 Esquema evolutivo de fragmentação de uma massa continental e desenvolvimento de margens continentais passivas.

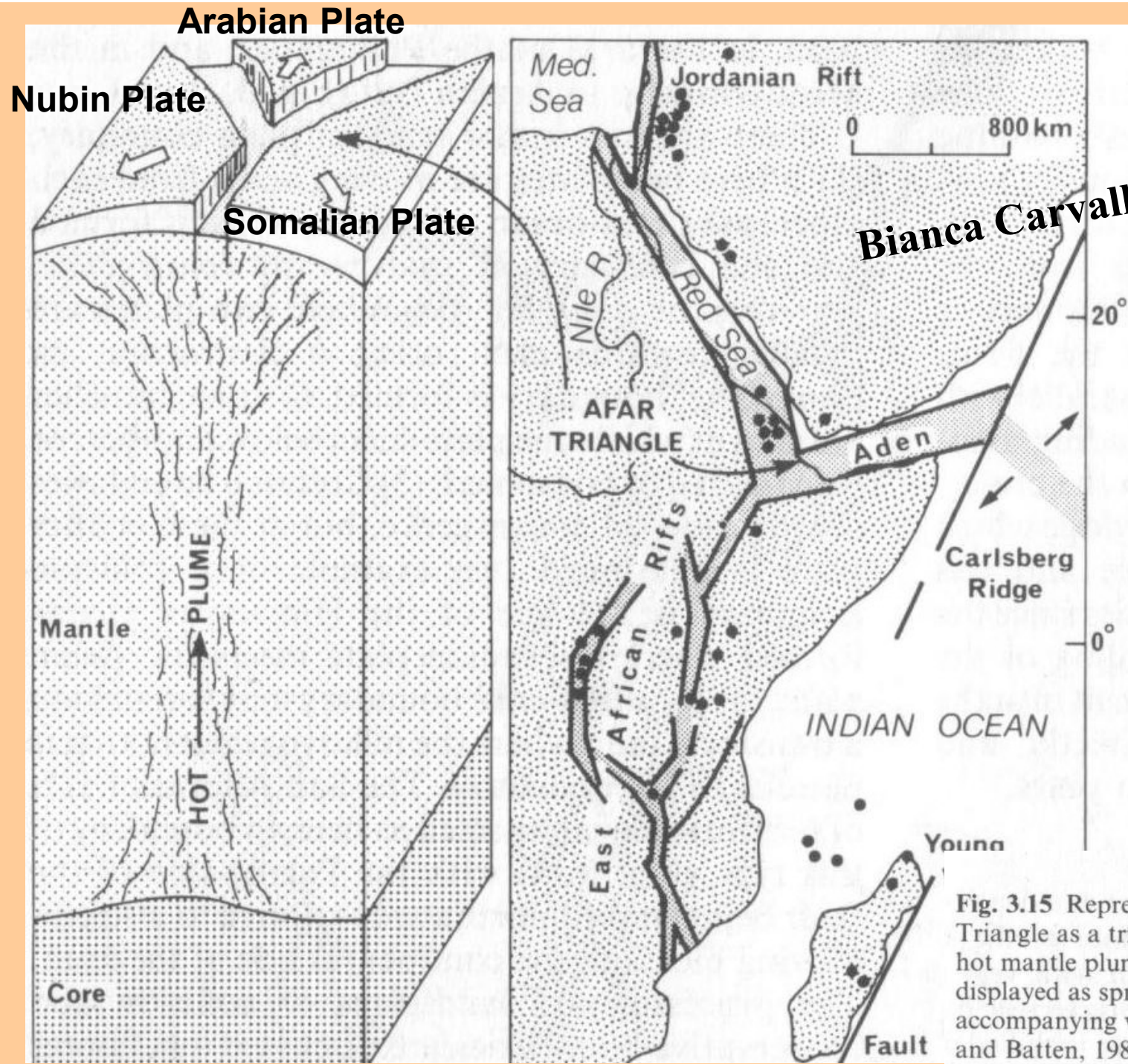


Fonte: PRESS et alli. *Para Entender a Terra*. Porto Alegre: Bookman, 2006. 656p.

1. DOMÍNIOS DIVERGENTES

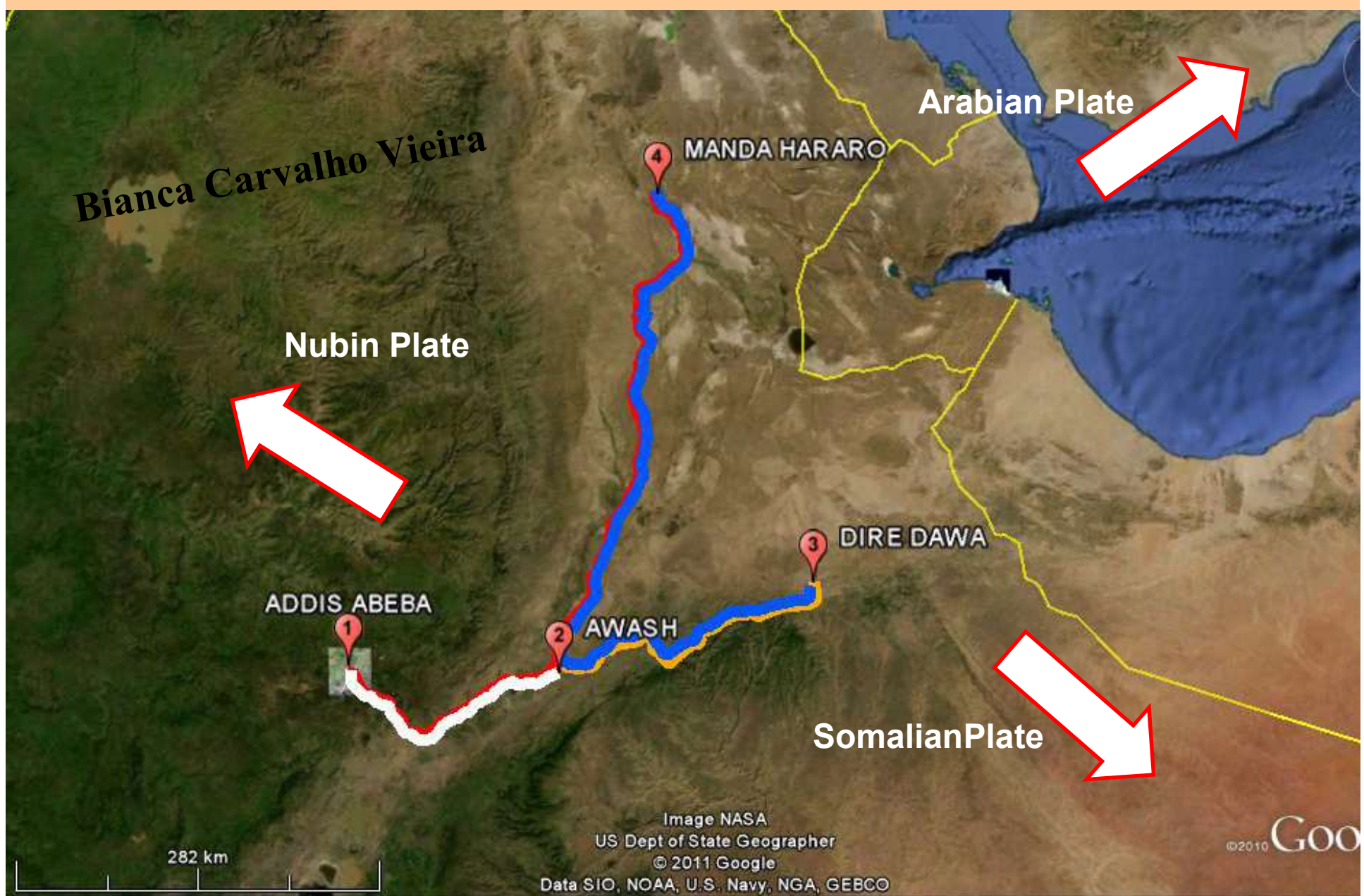
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Fig. 3.15 Representation of the Afar Triangle as a triple junction above a hot mantle plume. The African rifts are displayed as spreading rifts with accompanying volcanism (after Dott and Batten, 1981).



ETHIOPIAN RIFT

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ETHIOPIAN RIFT

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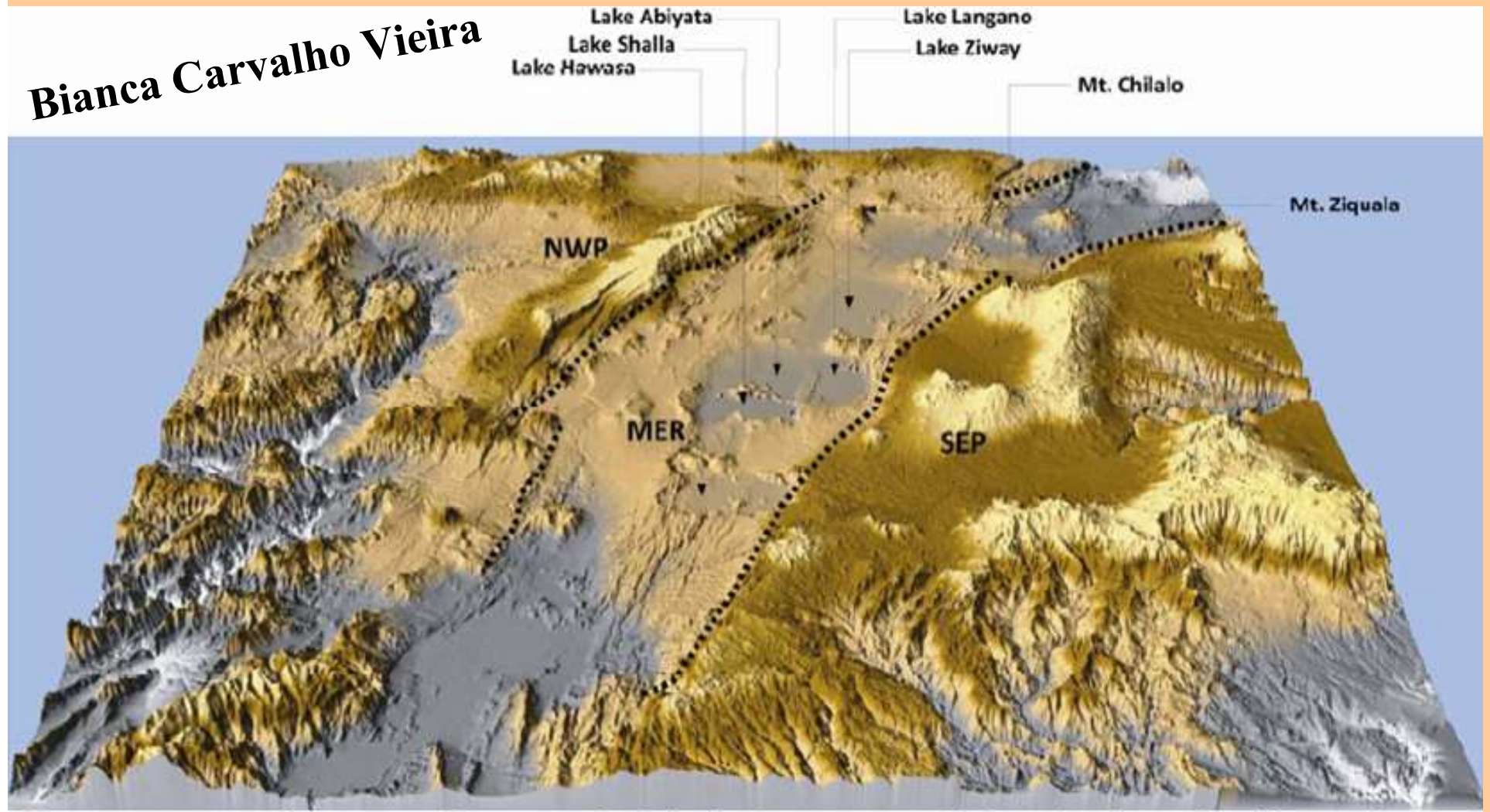
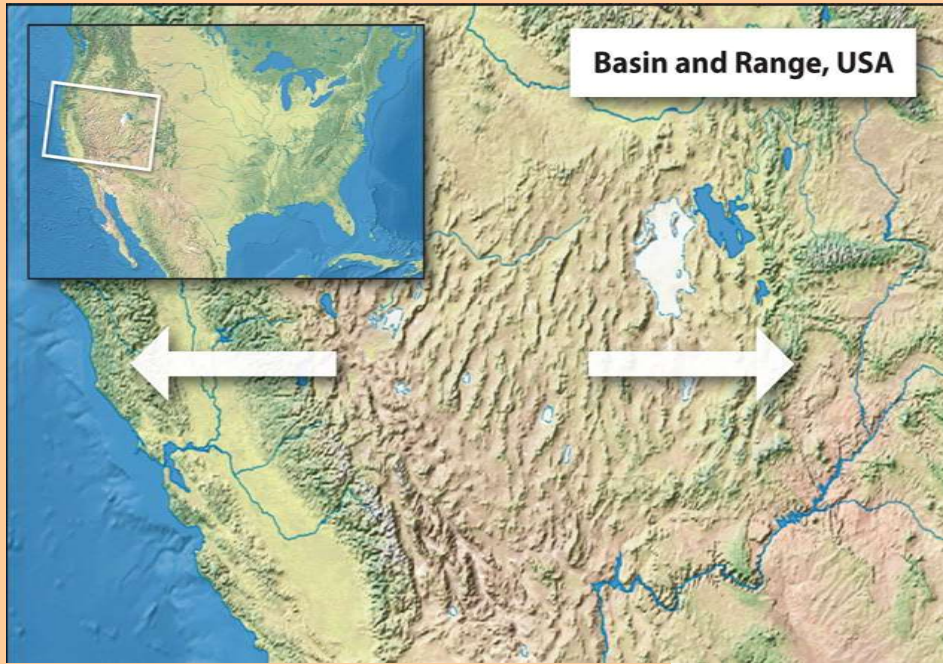
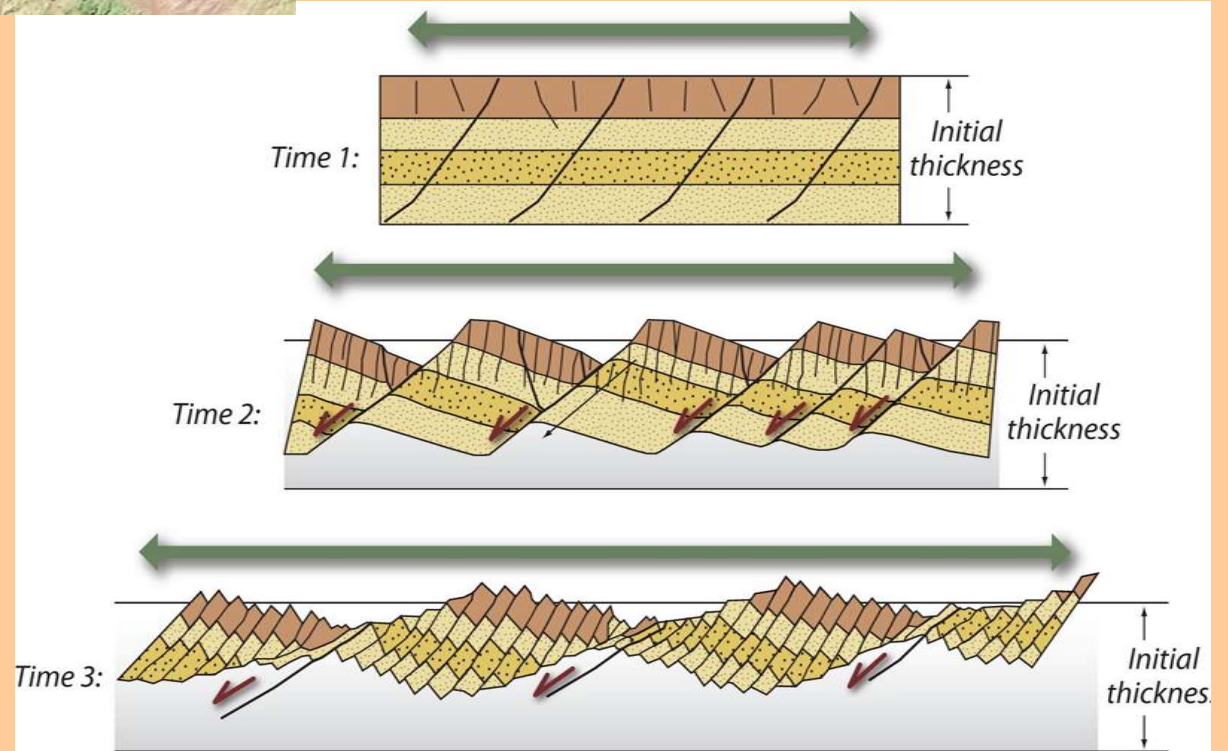


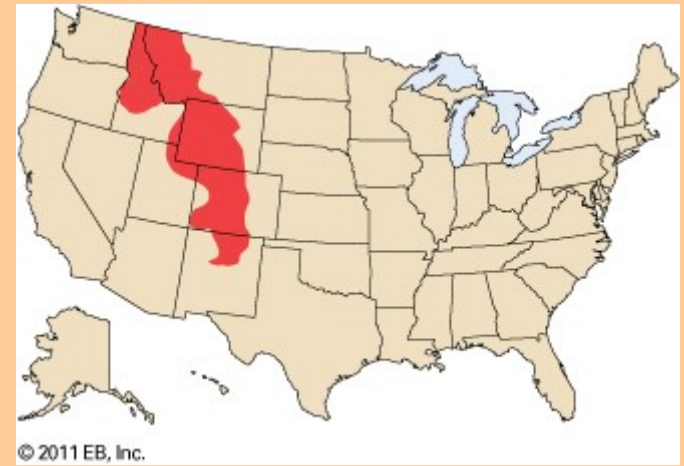
Fig. 2. 3D Map of the central sector of Ethiopia (same area of Fig. 1) where the rift margins and the rift lakes are highlighted.

Fonte: pre-conference excursion guide to the main ethiopian rift (MER) (15 – 17 February 2011)
Editors: Asfawossen Asrat & Mohammed Umer



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<https://www.nps.gov>

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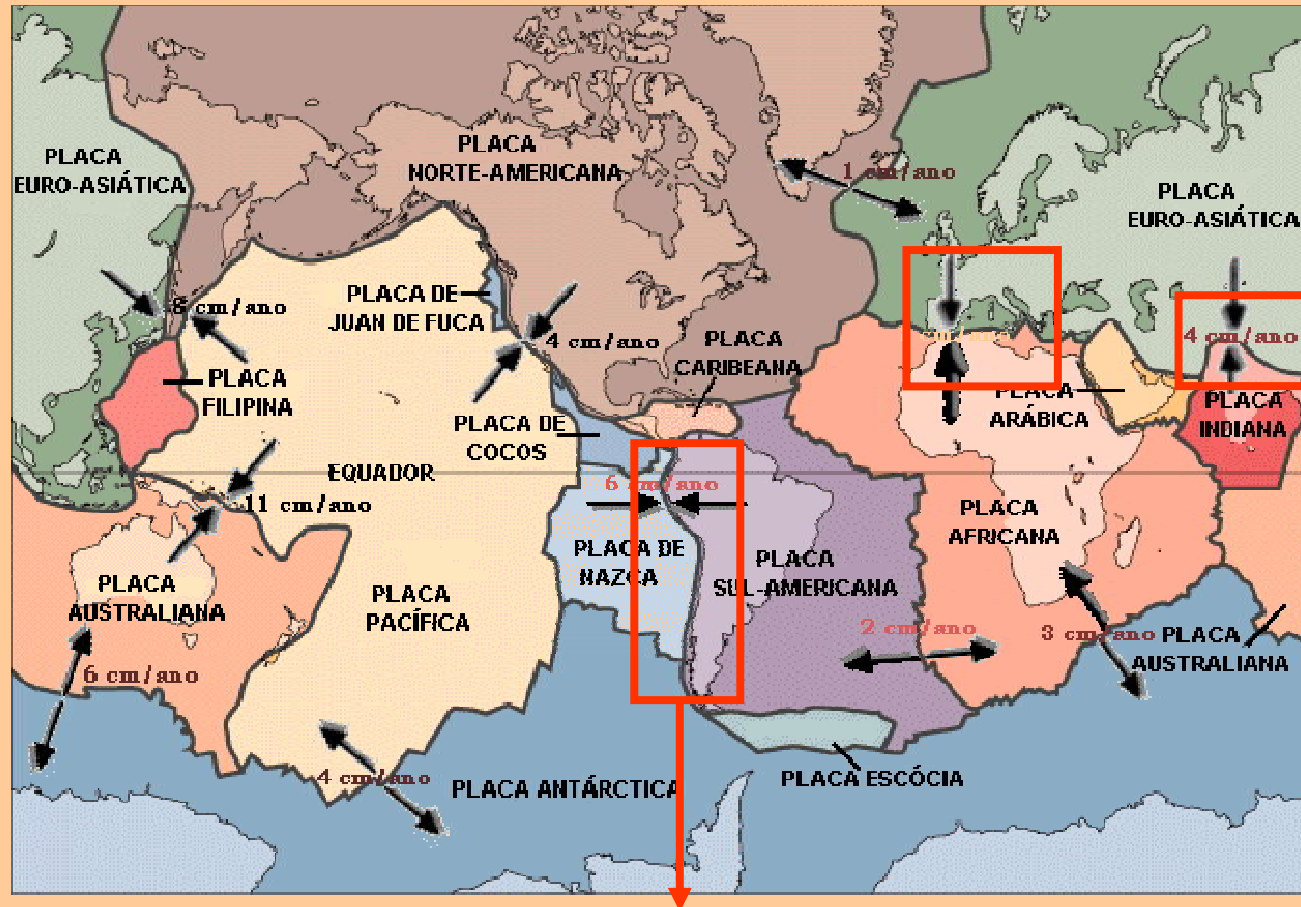


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DOMÍNIOS CONVERGENTES

•Nova crosta é criada - crosta antiga é destruída (reciclada) nas zonas de subducção

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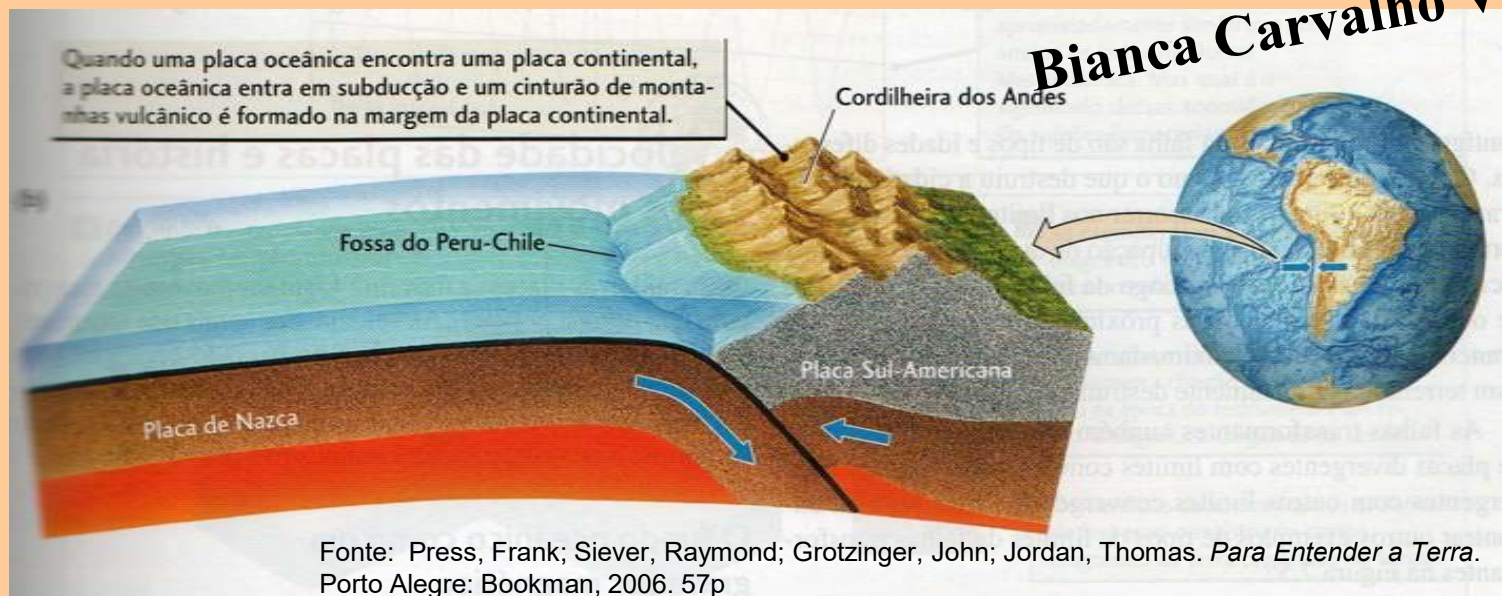


Continental-Continental

Himalaia

Oceânica-continental (Andes)

Oceânica–continental (Andes)



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- **Permiano e o Triássico (separação da Pangea) –**

- **Era Mesozóica (240-206 M. A):**

- Os sedimentos foram dobrados e o magma migrou para superfície e formou vulcões na superfície.
 - Na base desses grandes vulcões existem sedimentos do Paleozóico (antes da separação da Pangea) formando cadeias a leste dos Andes.
 - Em torno de 140 milhões de anos (Jurássico – configuração atual dos continentes) a placa de Nazca empurrou a placa Sul-americana que sofreu subducção.

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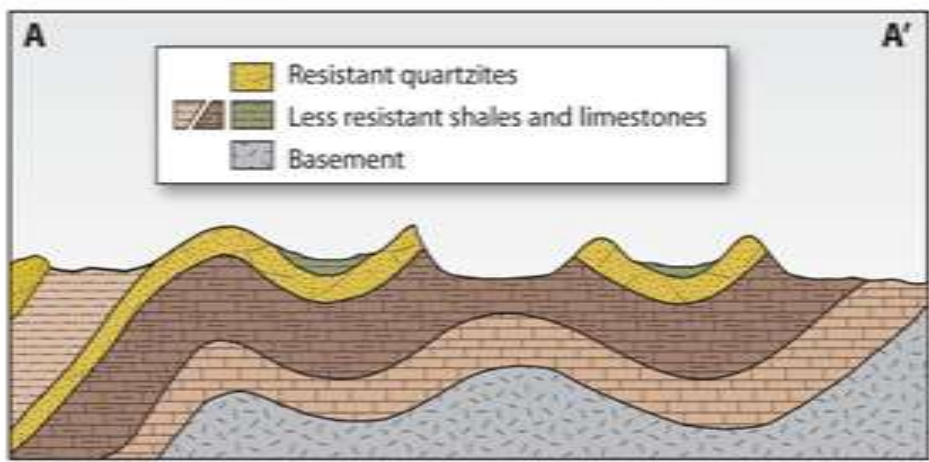
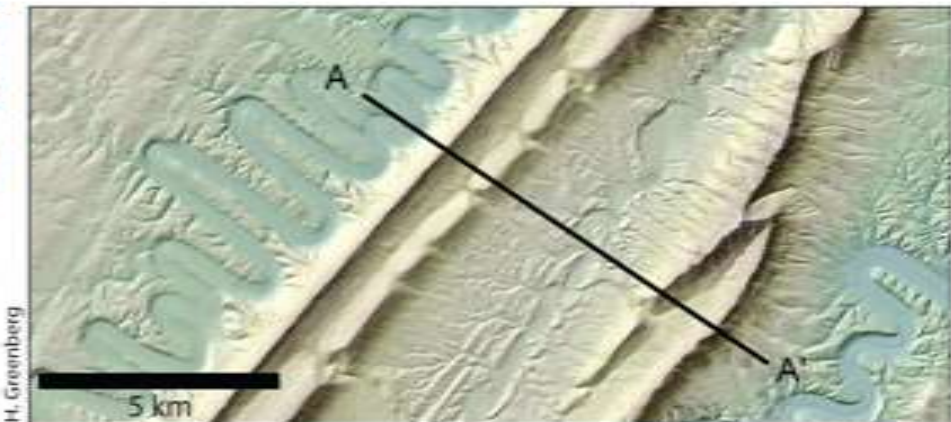
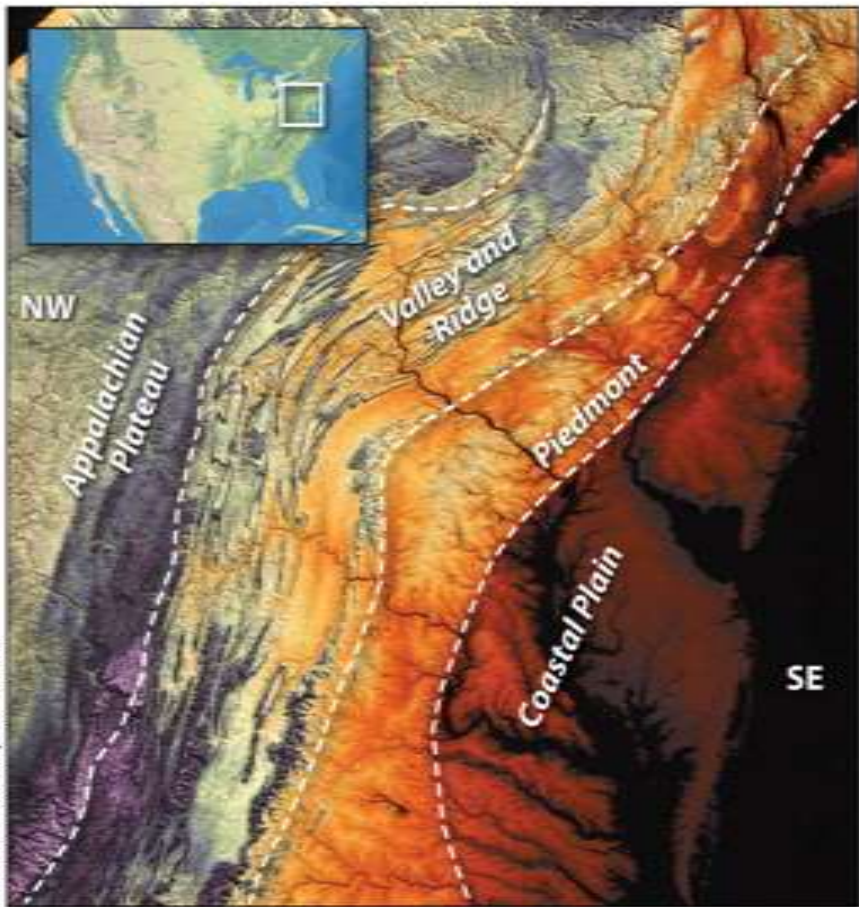
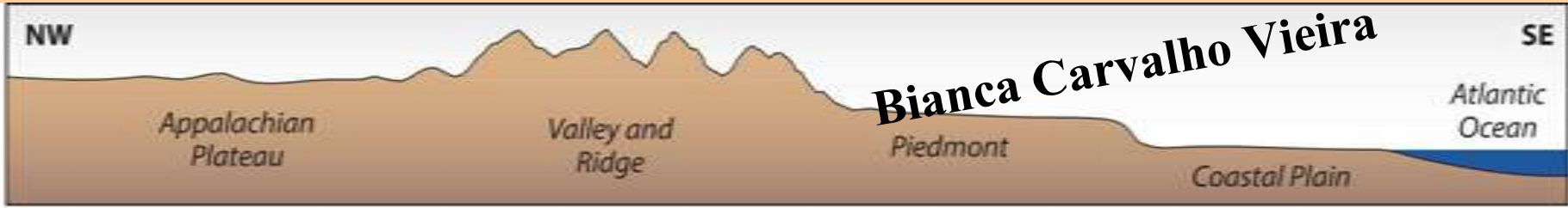
OROGENIA MAIS ANTIGA (PALEOZÓICO):

- Formadas ao longo do Paleozóico antes da formação da Pangéia, no período Permiano-Triássico (290 M. A.). Hoje o relevo encontra-se erodido com níveis baixos de altitude.

- ❖ Ex. 1: APALACHES: colisão no final do Paleozóico (antes da separação da Pangea).

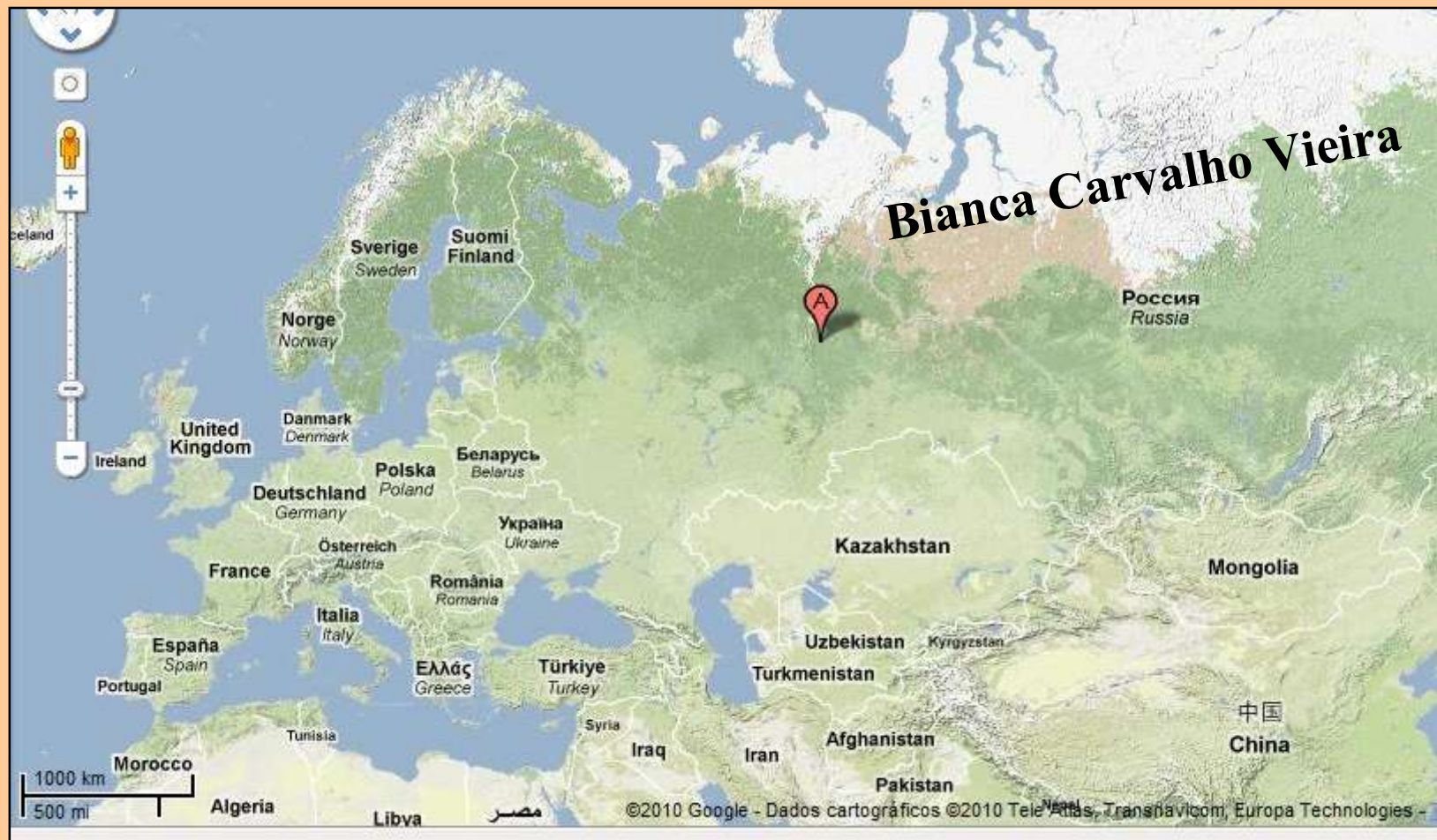
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Bierman, P.R. and Montgomery, D.R. (2014). In: Key Concepts in Geomorphology. W.H. Freeman and Company Publishers New York.

Os Montes Urais ergueram-se há cerca de 250 milhões de anos e sofreram intensa erosão.

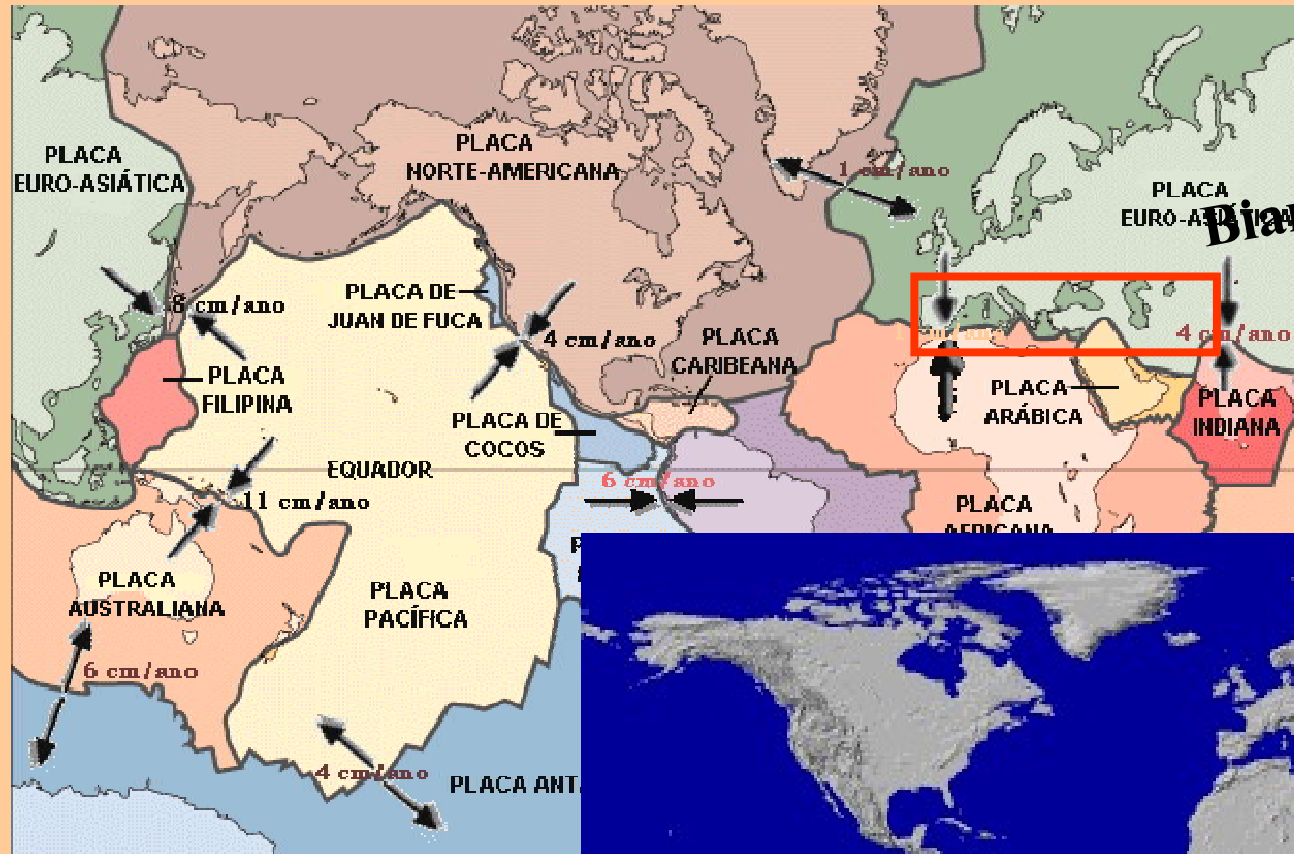




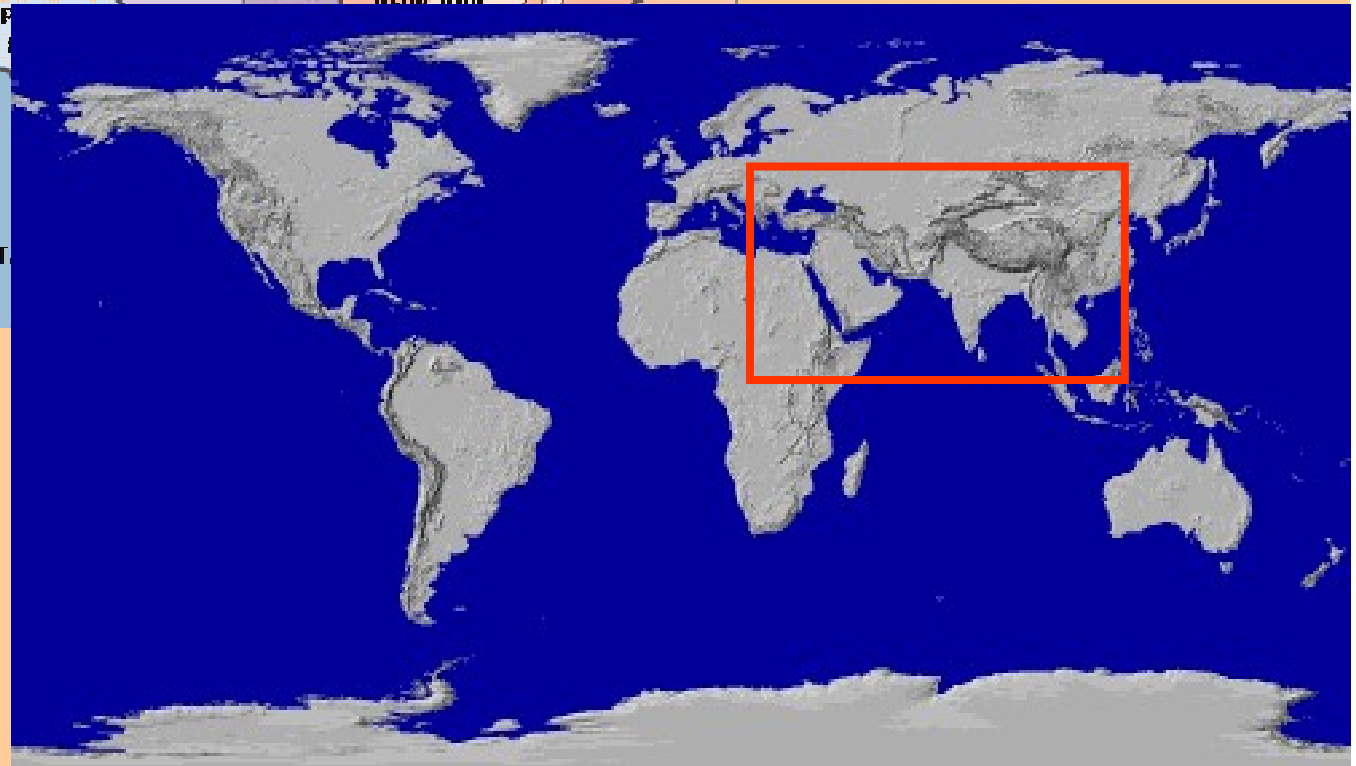
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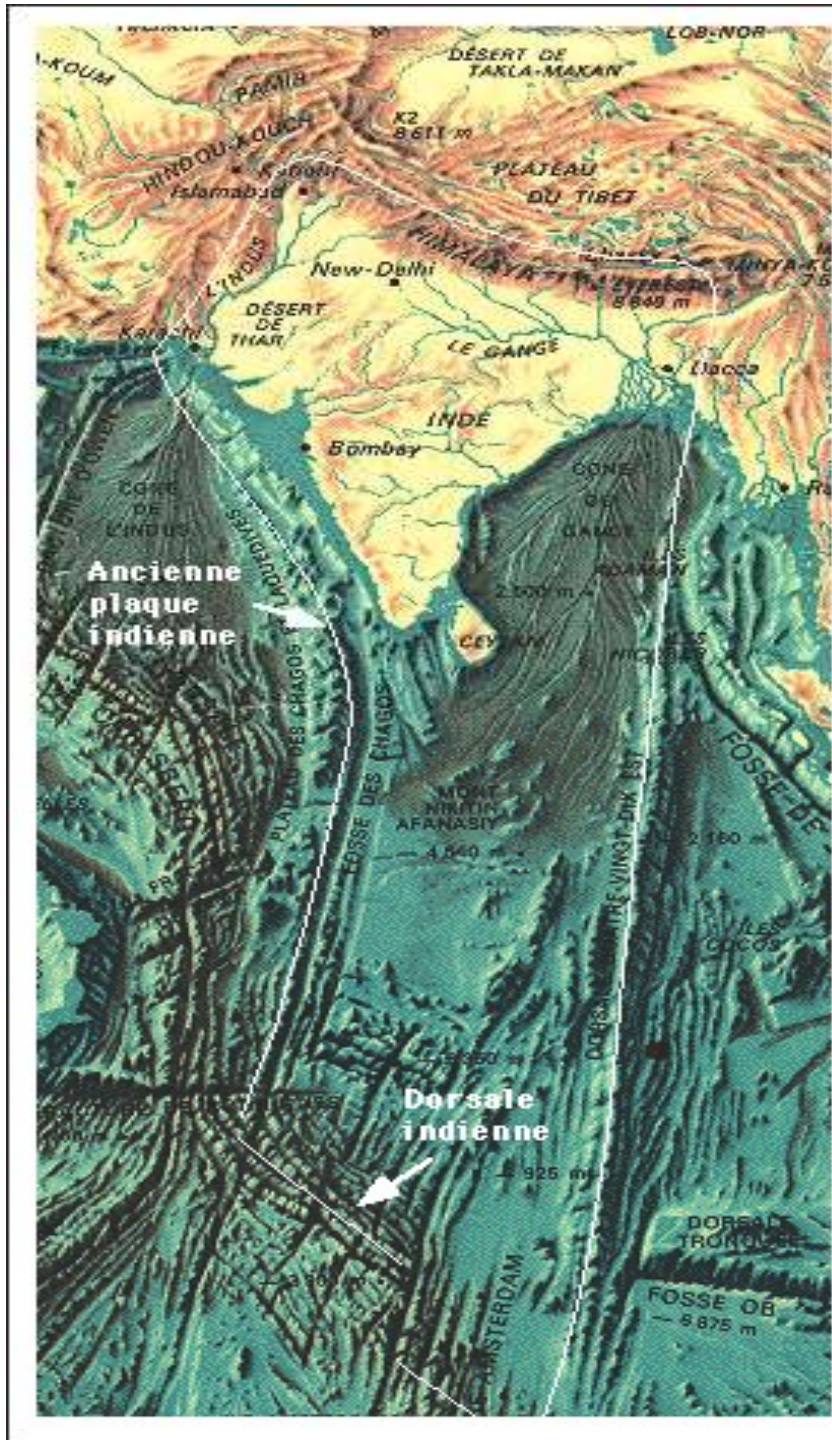
2. DOMÍNIOS CONVERGENTES

Continental-Continental



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- Colisão continental - Era Cenozóica (65 M. A. até hoje) ocorreu ao longo de linhas tectônicas da borda sul da Placa Eurasiana.

Relevo dobrado - Espanha

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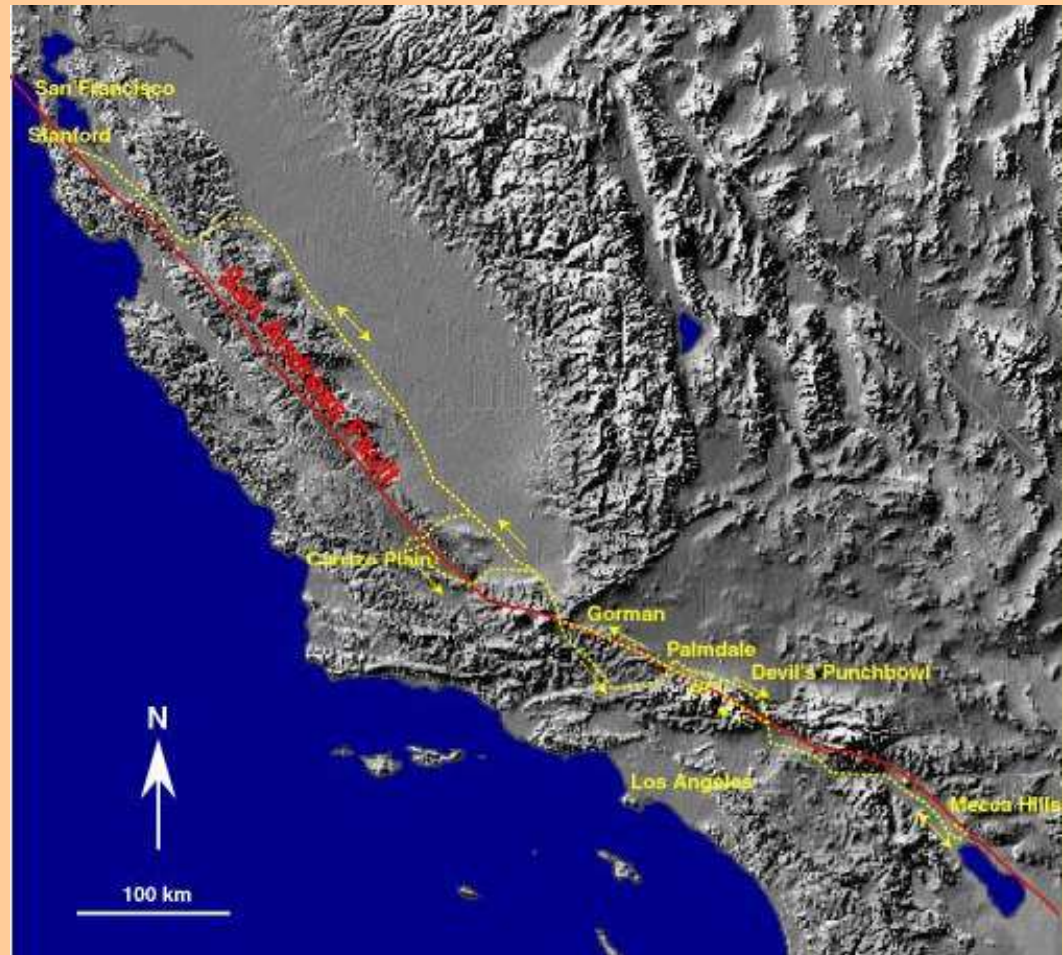
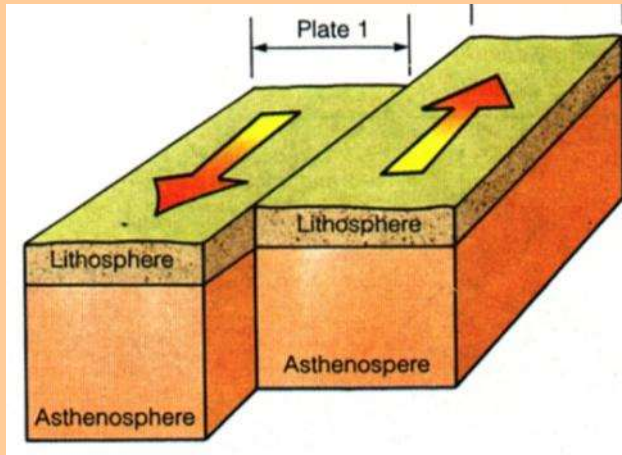
DOMÍNIOS TRANSCORRENTES



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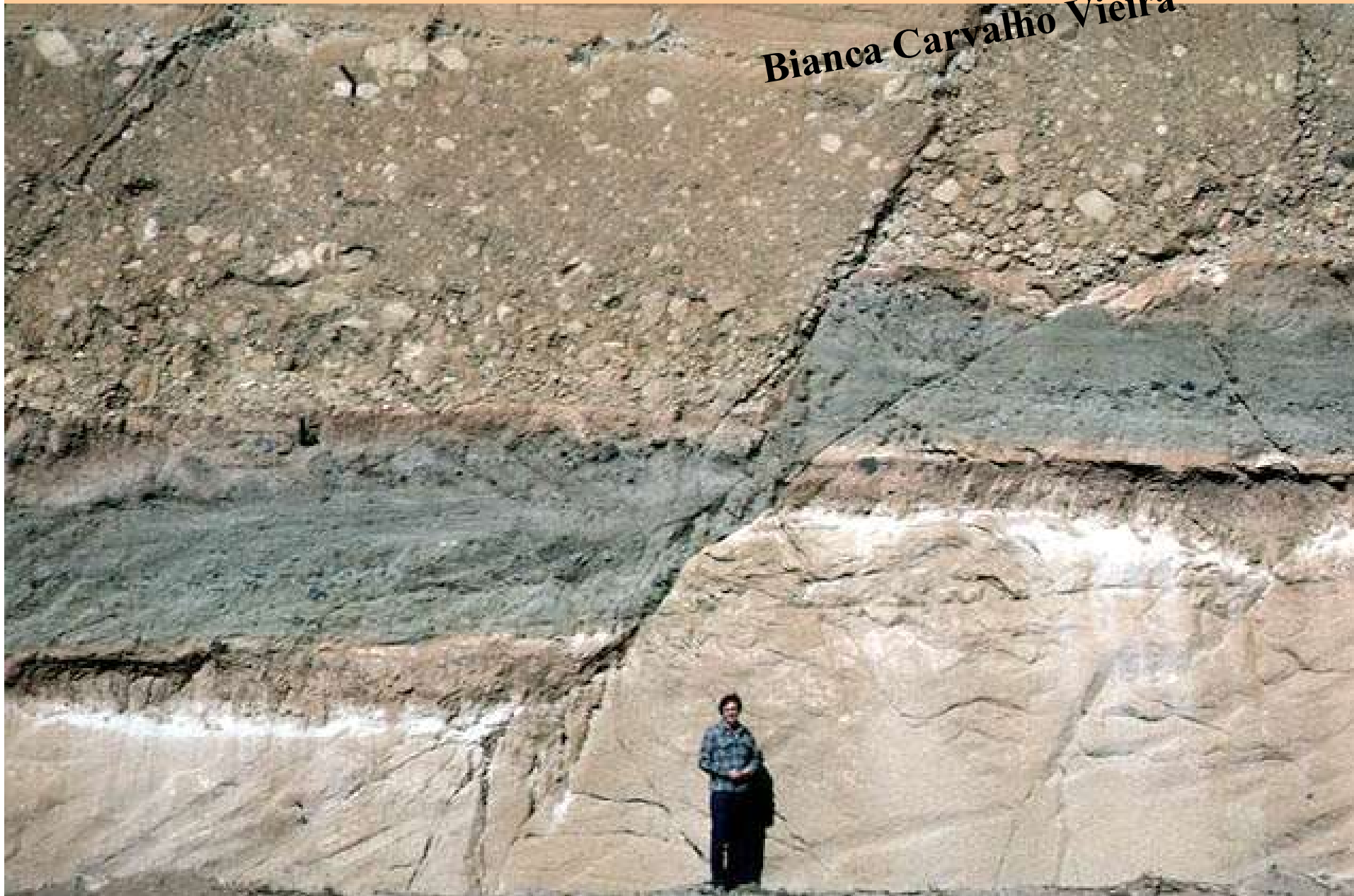


3. DOMÍNIOS TRANSCORRENTES



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Fault trace

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Falha de San Andreas

http://commons.bcit.ca/civil/students/earthquakes/unit1_01.htm



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Falha de San Andreas (Reservatório)

Fonte: http://sepwww.stanford.edu/oldsep/joe/fault_images/BayAreaSanAndreasFault.htm

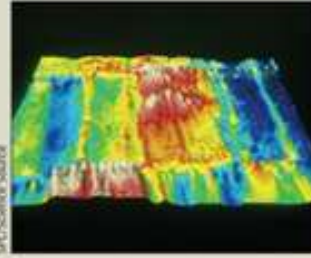
Volcanic activity is concentrated along plate margins and at hot spots. Different tectonic settings produce different styles of volcanism and thus create different and characteristic types of landscapes.

Oceanic island arc

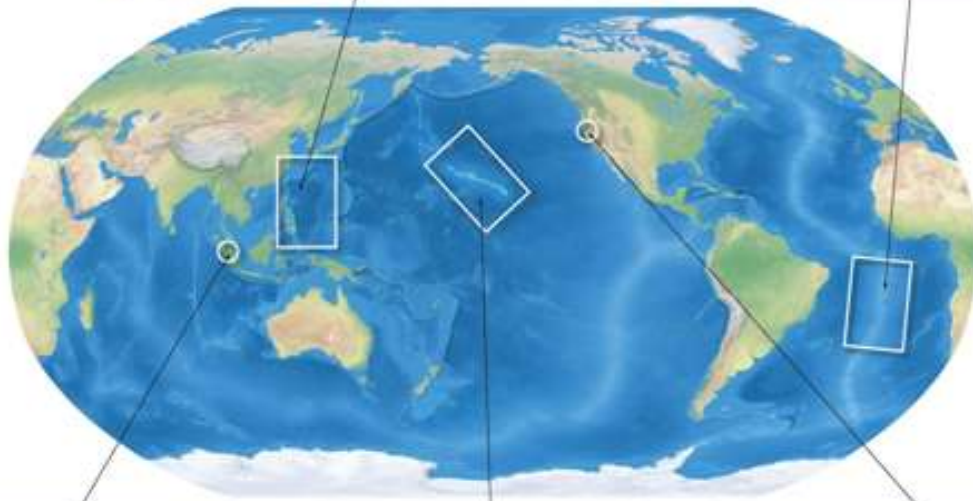


Island arcs are long, linear features parallel to oceanic subduction zones; they are made up of islands built by **stratovolcanoes** over a basaltic platform.

Mid-ocean ridge



Spreading centers at mid-ocean ridges generate mountain chains thousands of kilometers long, the thermally buoyant crust of which rises above the adjacent ocean floor.



Caldera



Explosive, silica-rich eruptions can create immense volcanic **calderas** like the one that underlies Yellowstone National Park or the one at Toba in Indonesia, as shown here.

Hot spot



Oceanic hot spots generate linear chains of basaltic islands, which, as they thermally subside, become **seamounts**. Older islands are progressively more eroded and slowly sink below the ocean surface.

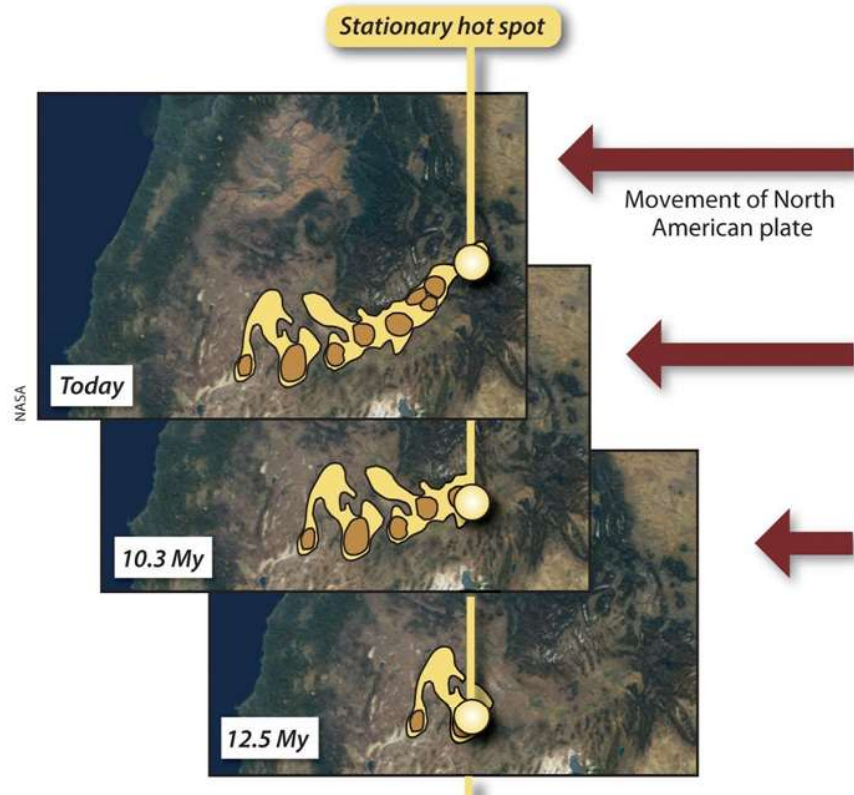
Continental volcanic arc



Volcanic arcs, created by offshore **subduction zones** and built onshore by the eruptions of stratovolcanoes, run parallel to the coast of continents.

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