

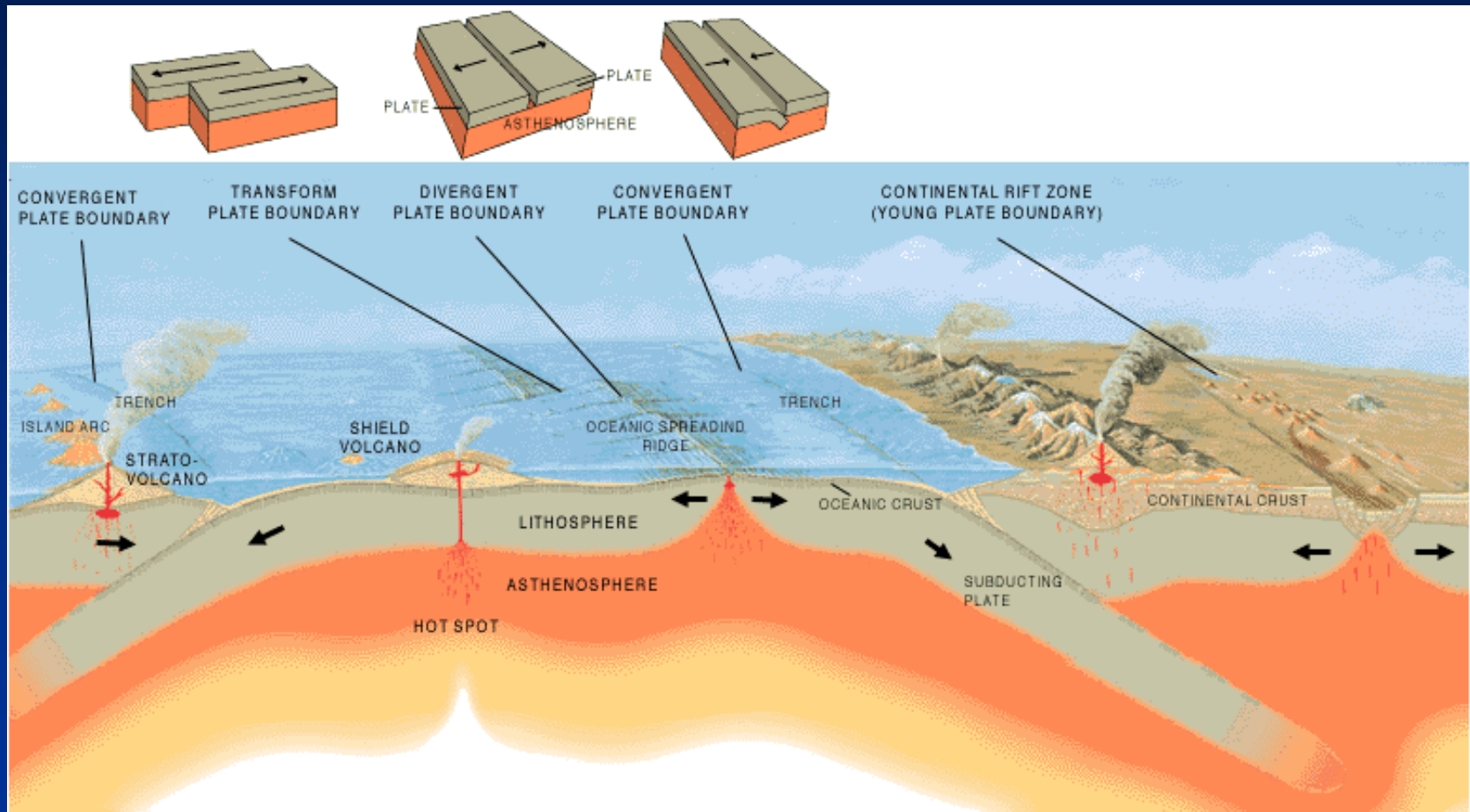
Associazioni di strutture tettoniche

**Dalla scala
dell'affioramento alla scala
regionale**

Immagini e fotografie tratte da:

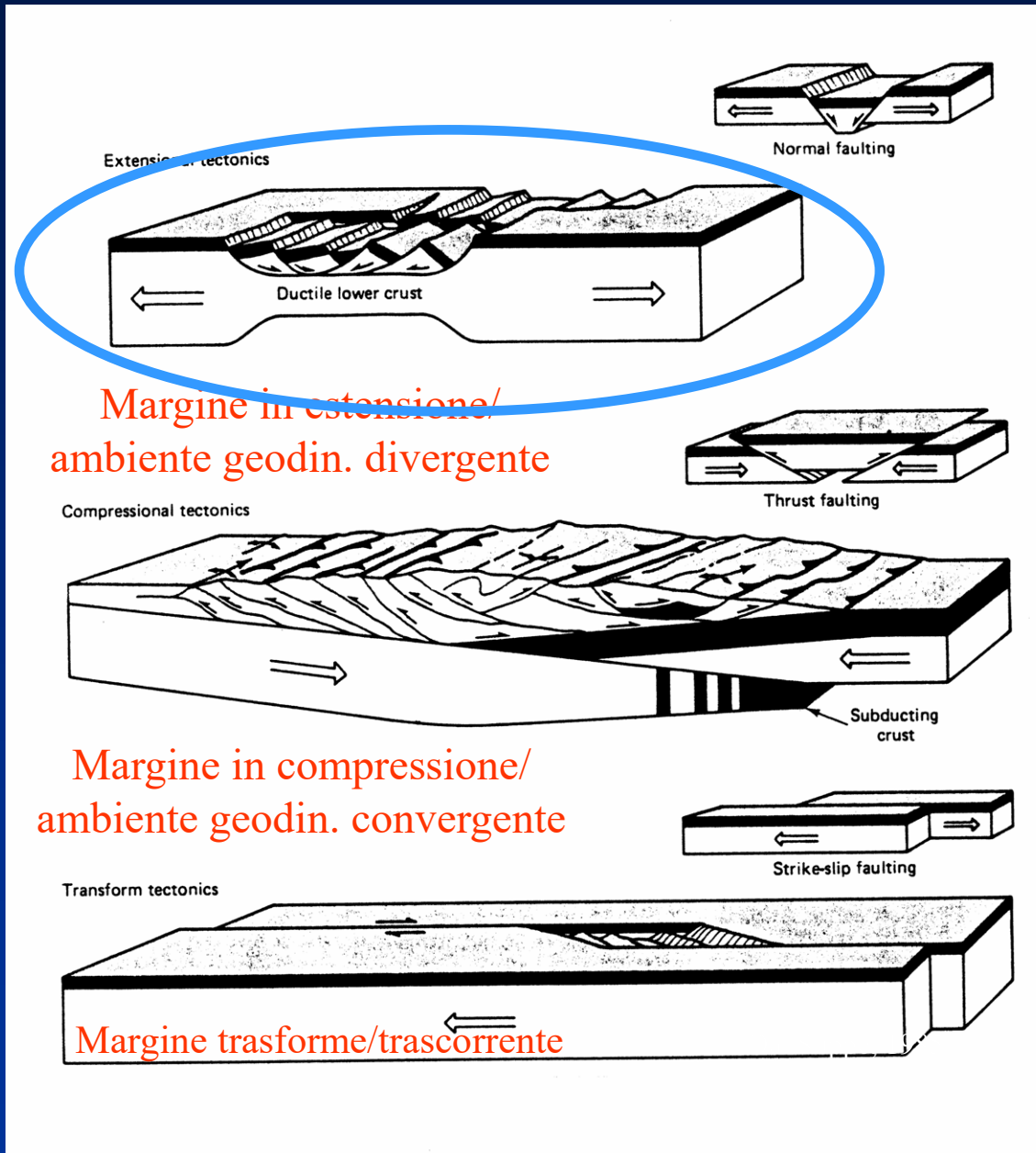
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Tipo di margini di placca e ambienti geodinamici



<http://factsanddetails.com/world/cat51/sub323/item2212.html>

Tipo di margini di placca e ambienti geodinamici



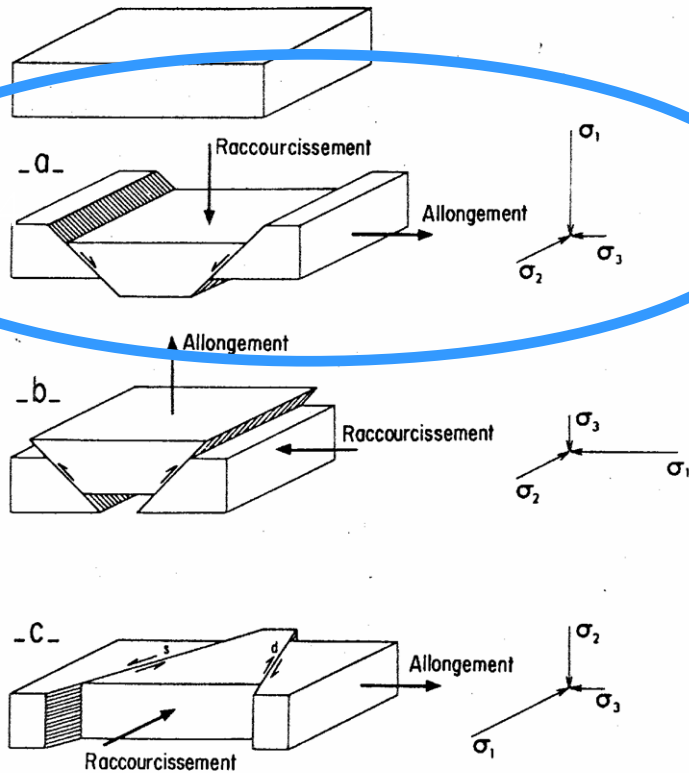
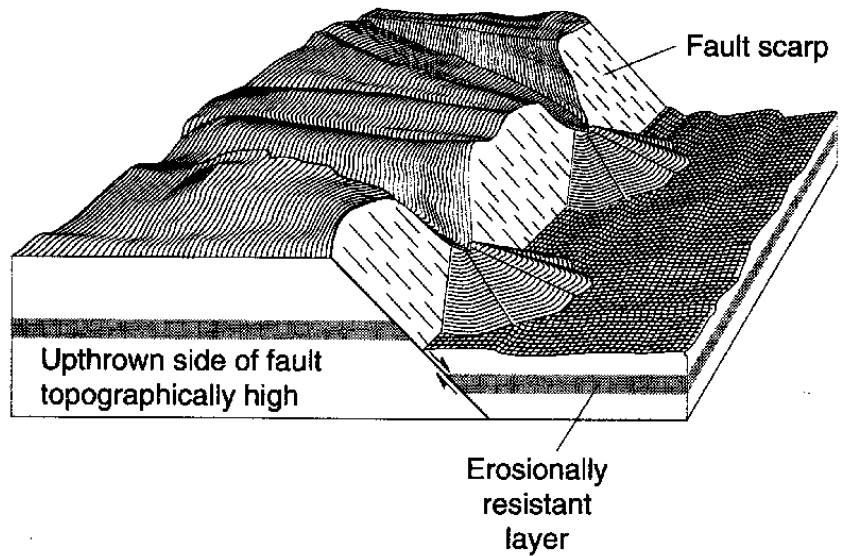


Fig. 5.12 - Systèmes de failles conjuguées. a- Failles normales conjuguées, b- Failles inverses conjuguées, horst. c- Décrochements dextre et senestre conjugués. (Blès et Feuga, 1981. BRGM éd., Orléans).

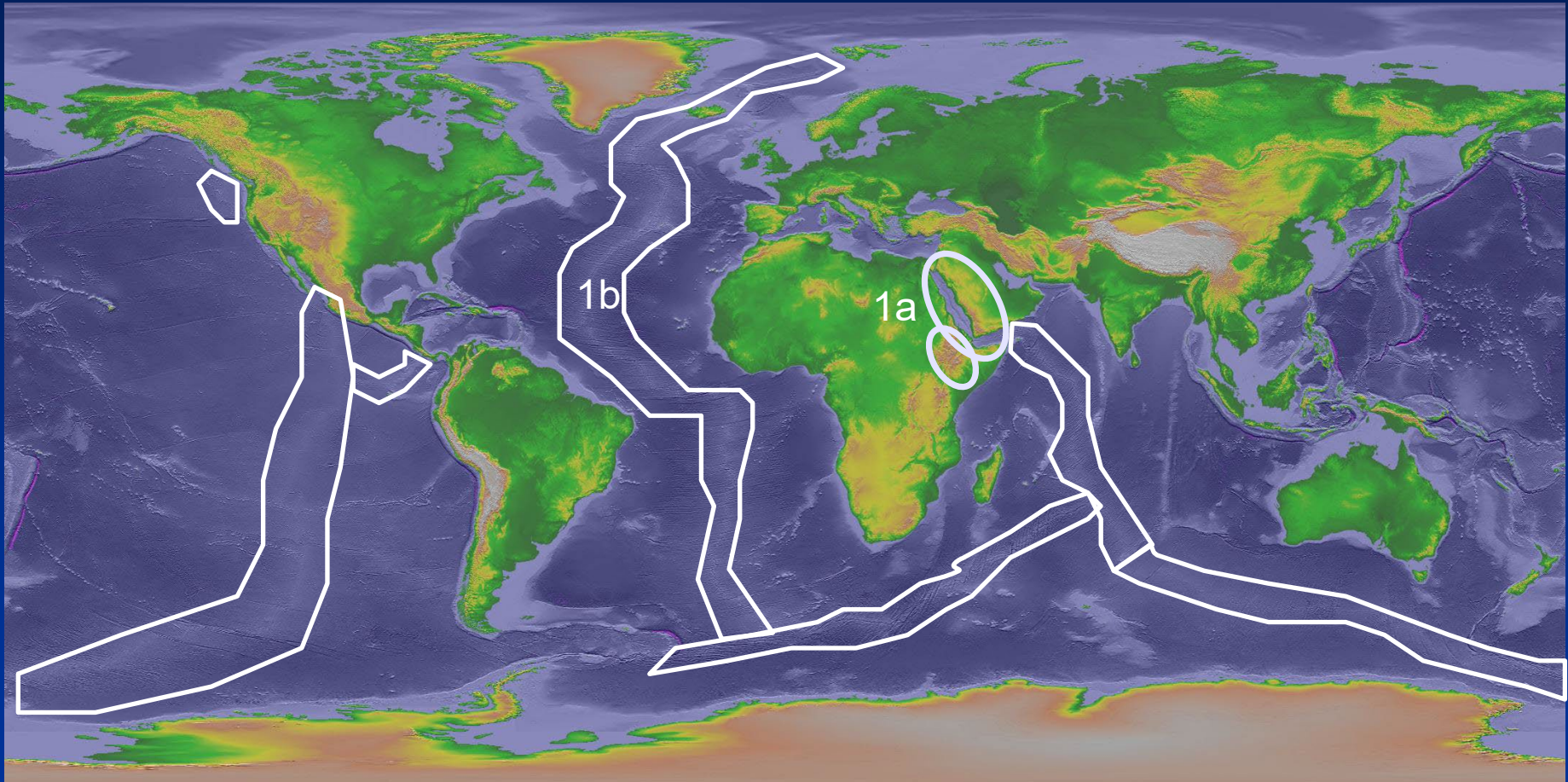
Da Nicolas, 1984



Da Hatcher, 1995

Associazioni di faglie normali

1) associazioni estensionali in ambienti geodinamici divergenti

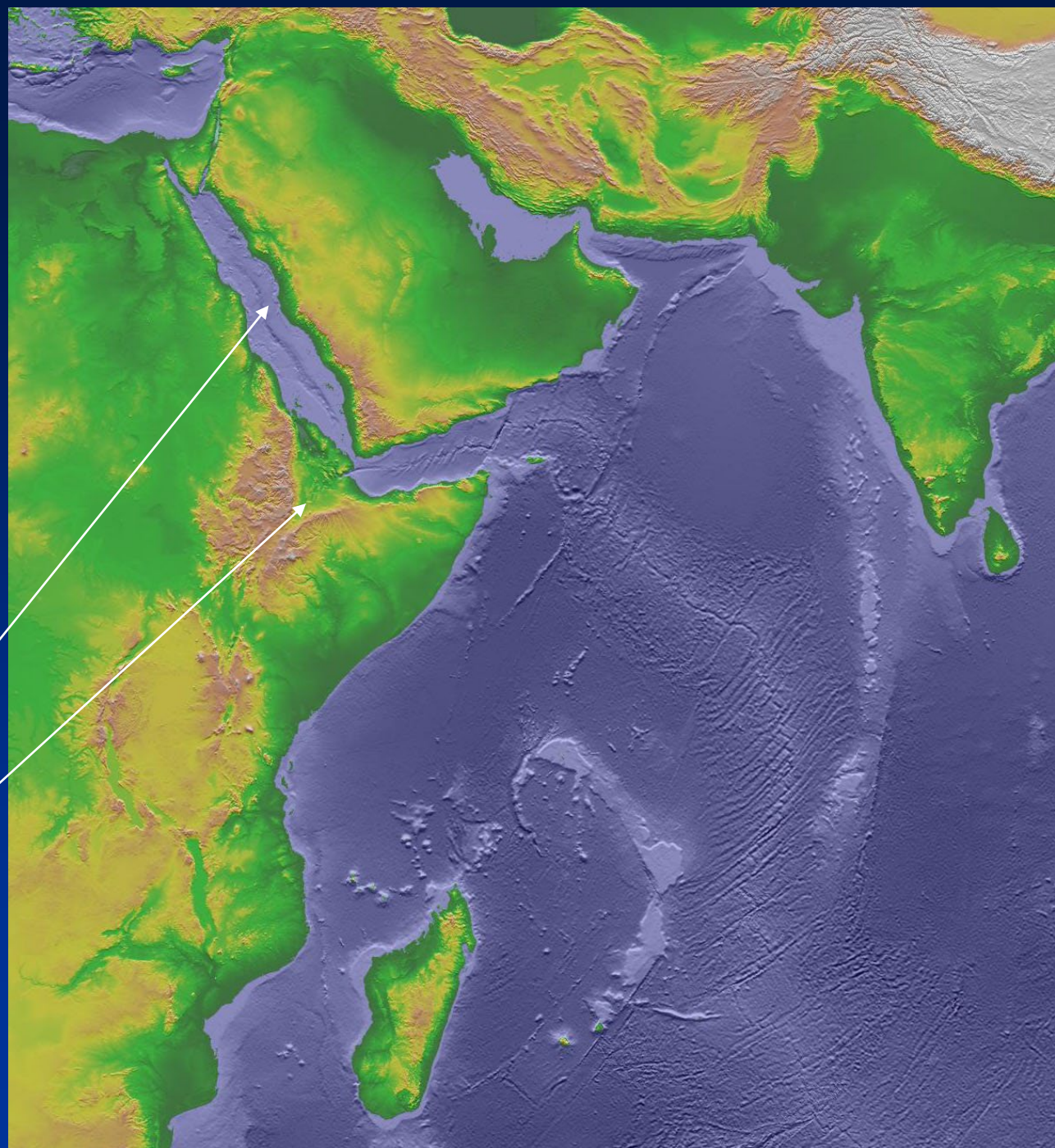


Shaded reliefs e batimetria da NOAA National Centers for Environmental Information (NCEI)

1a) estensione e
assottigliamento
di crosta
continentale che
porta a crosta
oceanica (*from
rift to drift*)

Mar Rosso

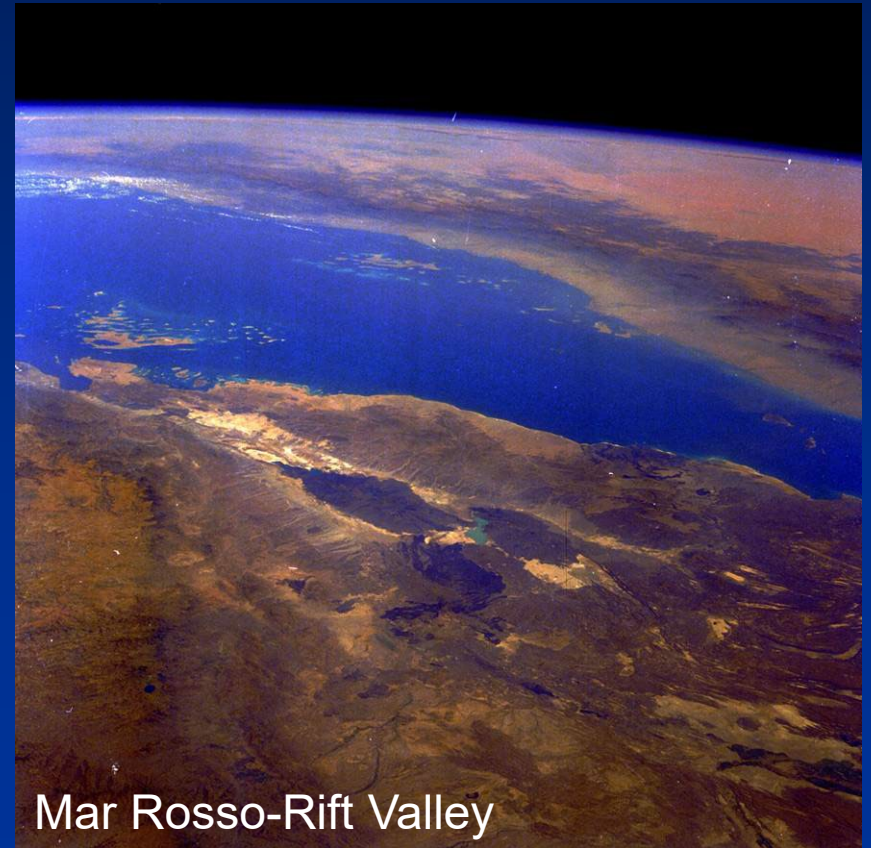
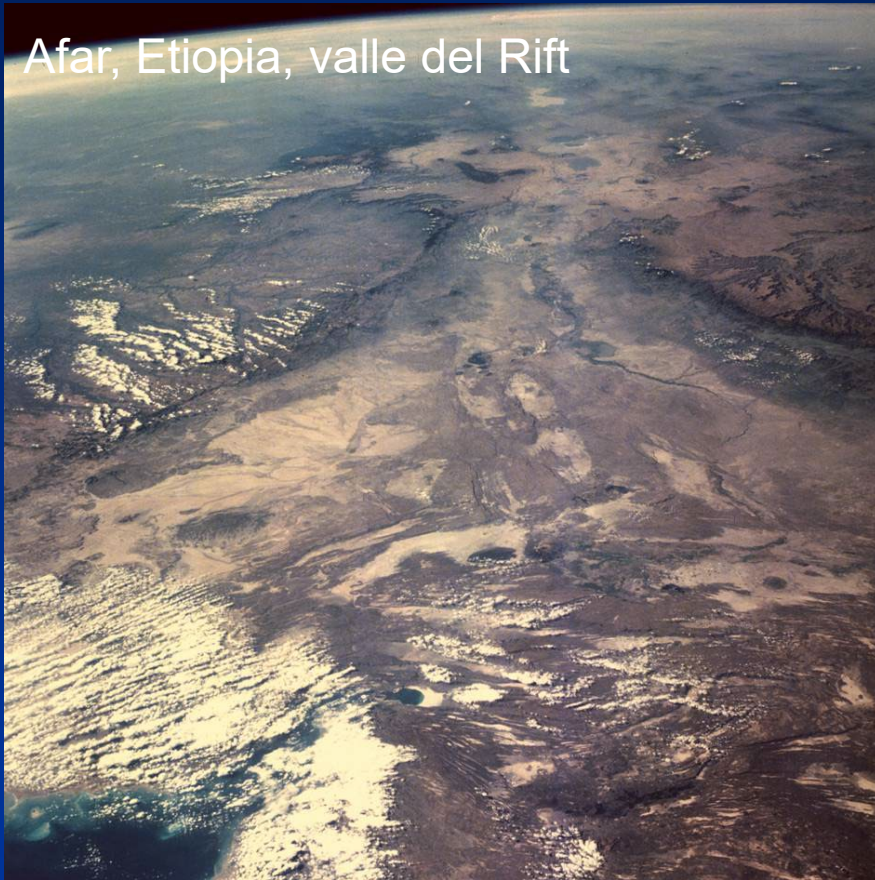
Afar, Etiopia, valle del Rift



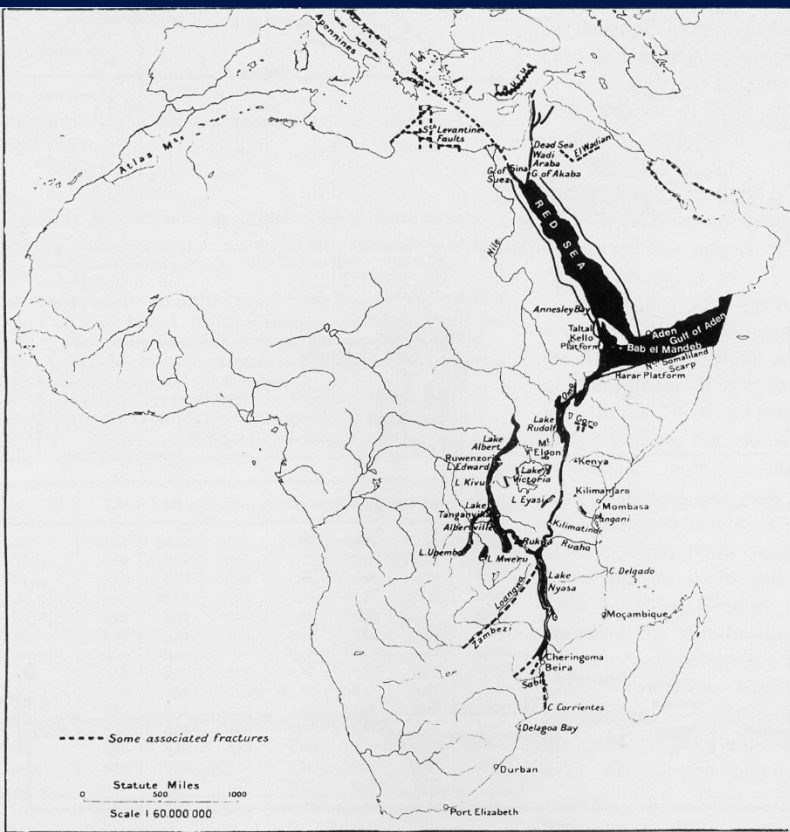
Associazioni estensionali, ambienti geodinamici divergenti

1a) estensione e assottigliamento crosta continentale che porta a crosta oceanica (*from rift to drift*)

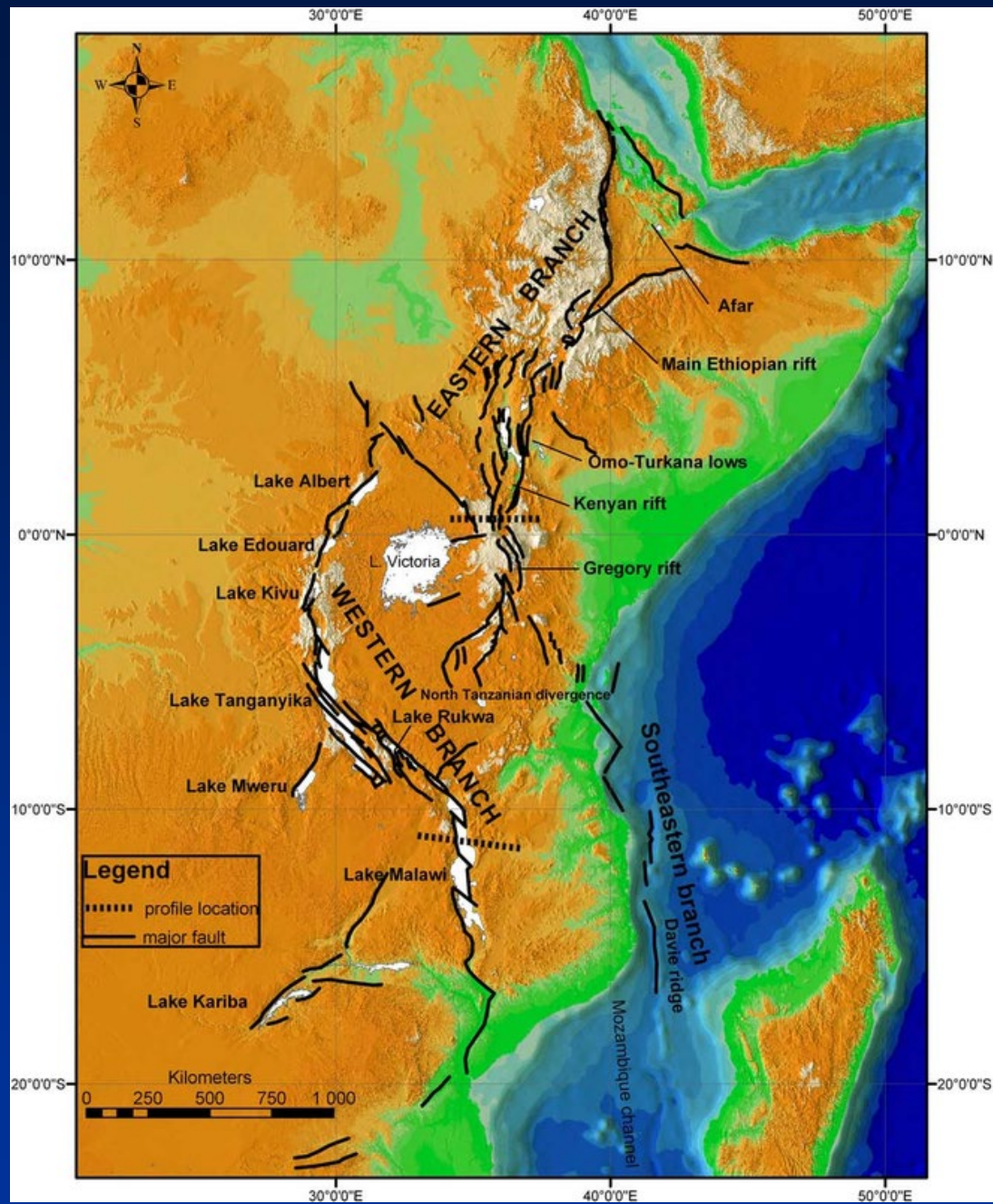
Afar, Etiopia, valle del Rift



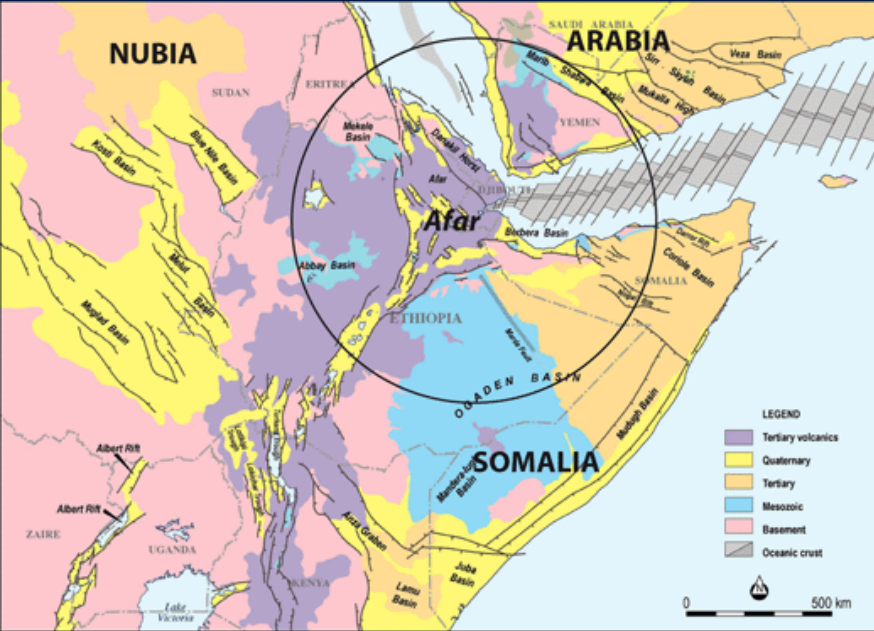
Mar Rosso-Rift Valley



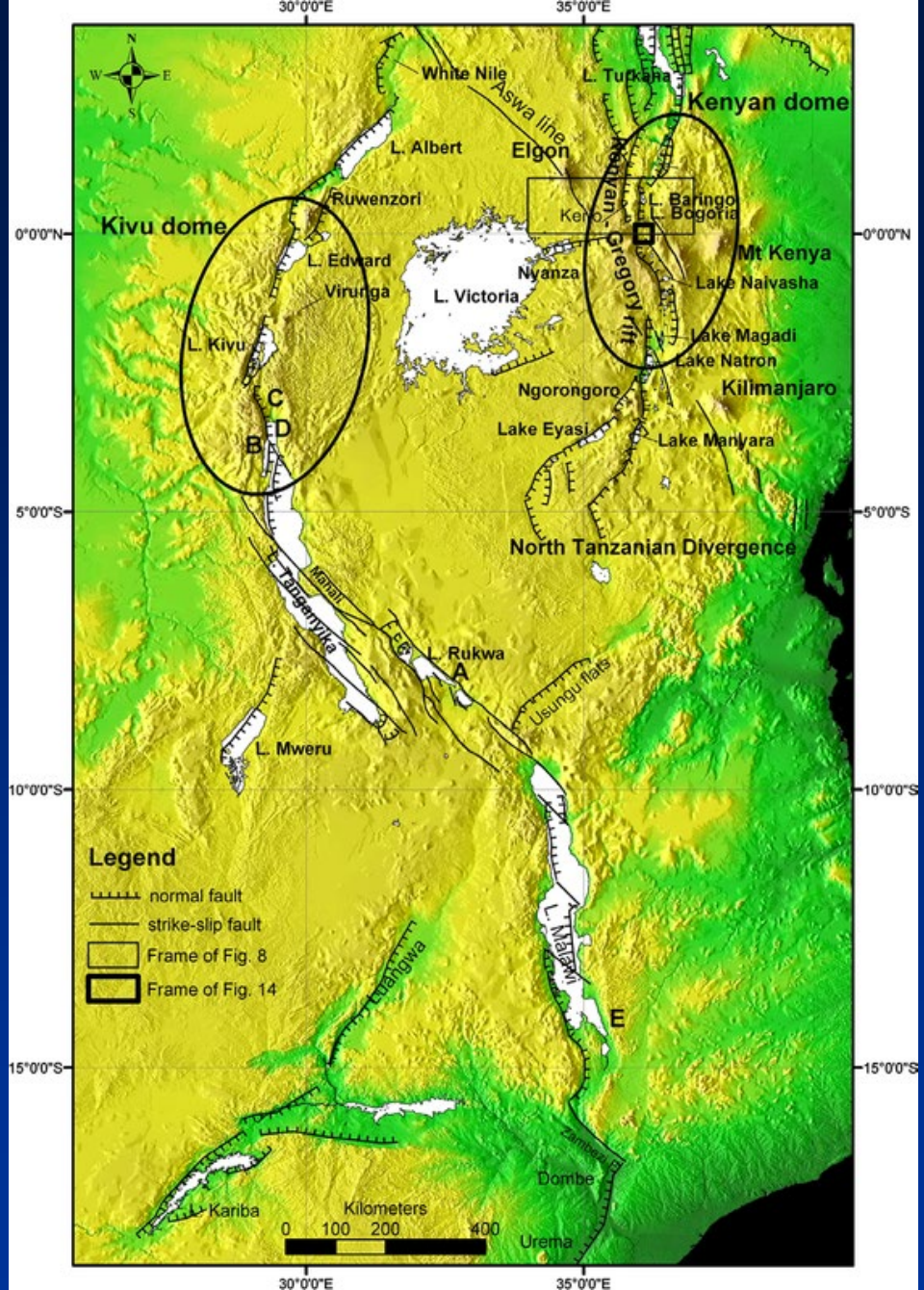
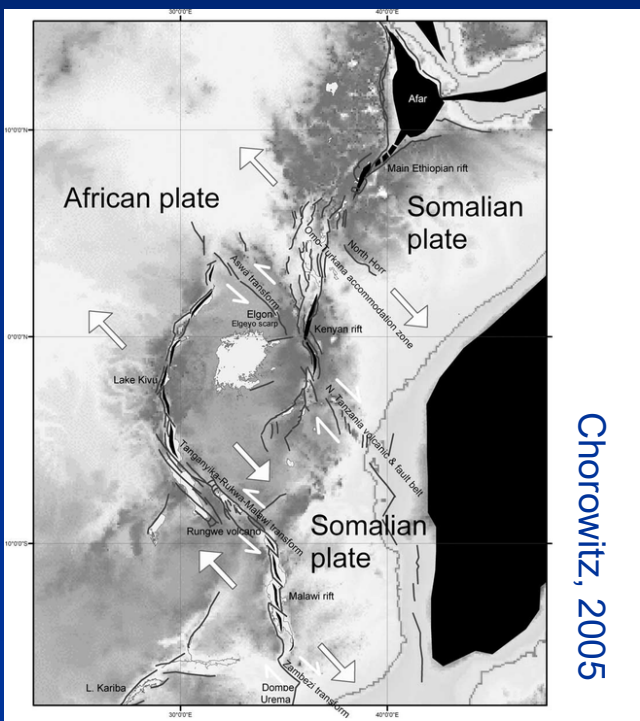
J. Gregory's 1920 map of the East African rift v.



Chorowitz, 2005



Mège et al., 2015



Chorowitz, 2005

associazioni estensionali, ambienti geodinamici divergenti

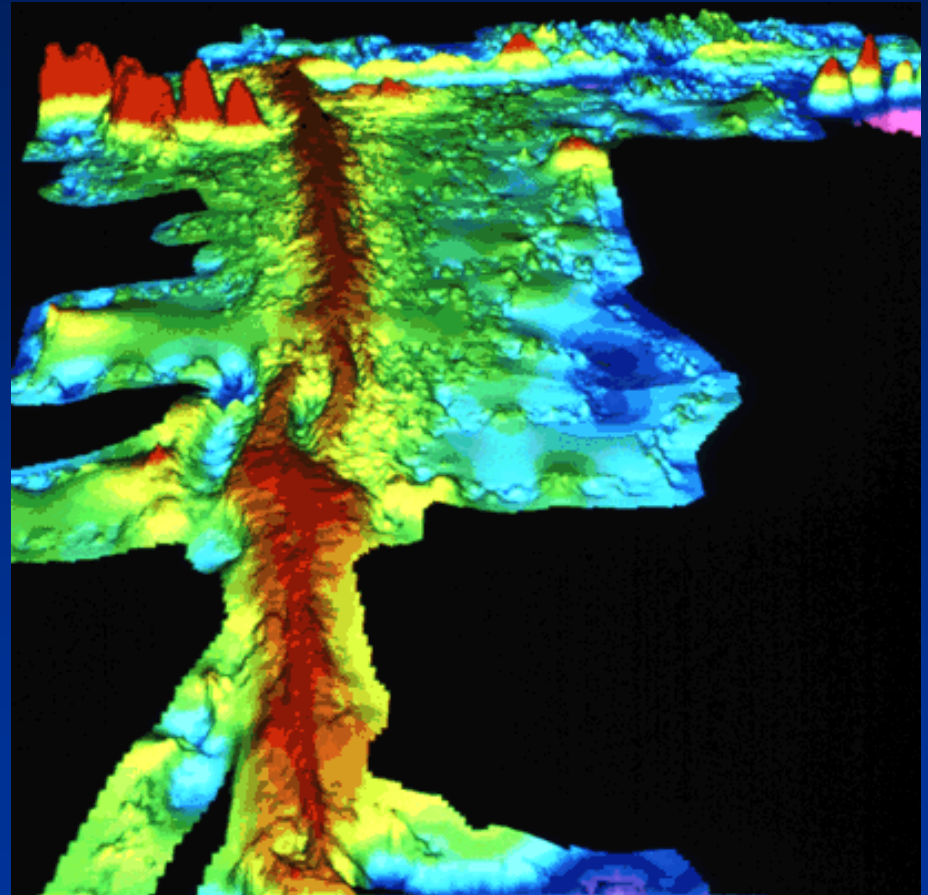
1b) formazione di crosta oceanica, dorsali !!

Islanda, zona di dorsale Thingvellir national park



Da Oddur Sigurdsson, National Energy Authority, Iceland

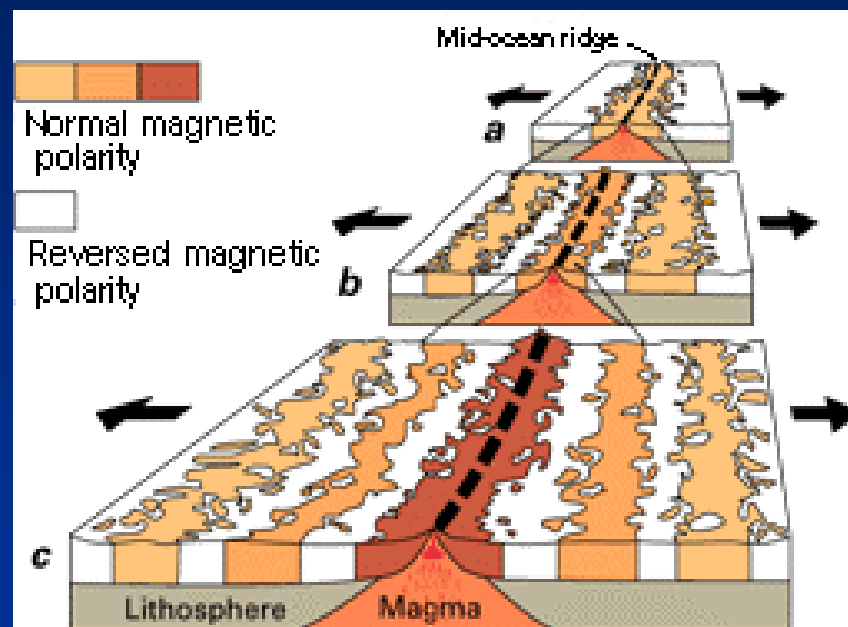
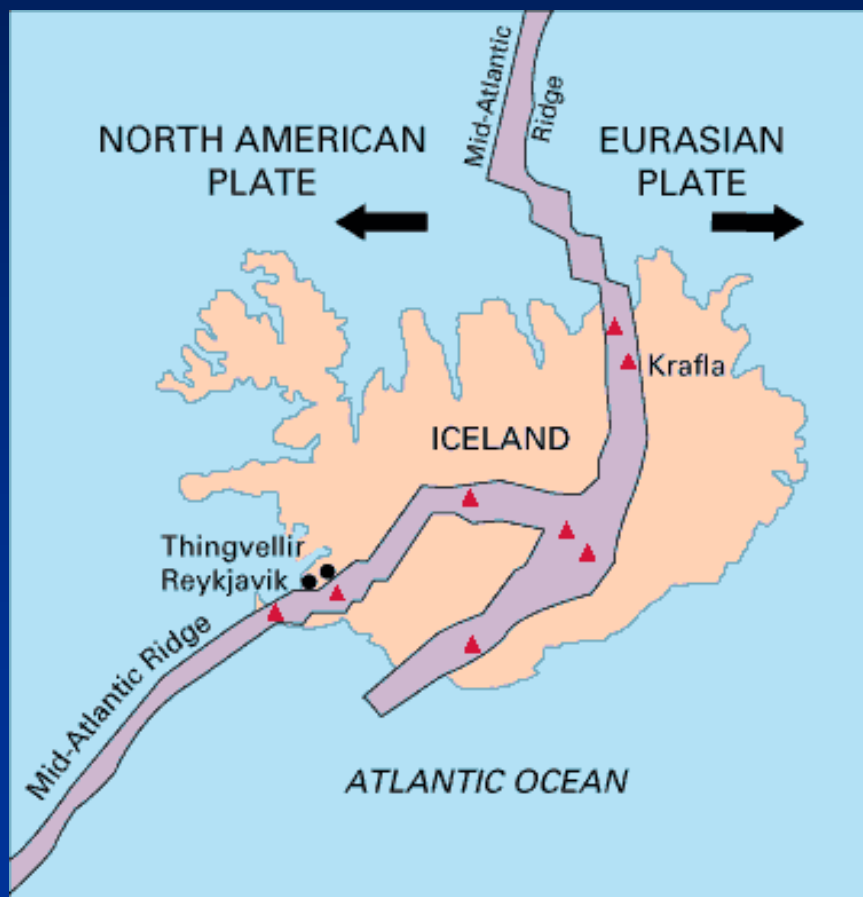
Zona di dorsale medio-oceanica pacifica



<https://pubs.usgs.gov/gip/dynamic/topomap.html> (from Stacey Tighe, University of Rhode Island)

associazioni estensionali, ambienti geodinamici divergenti

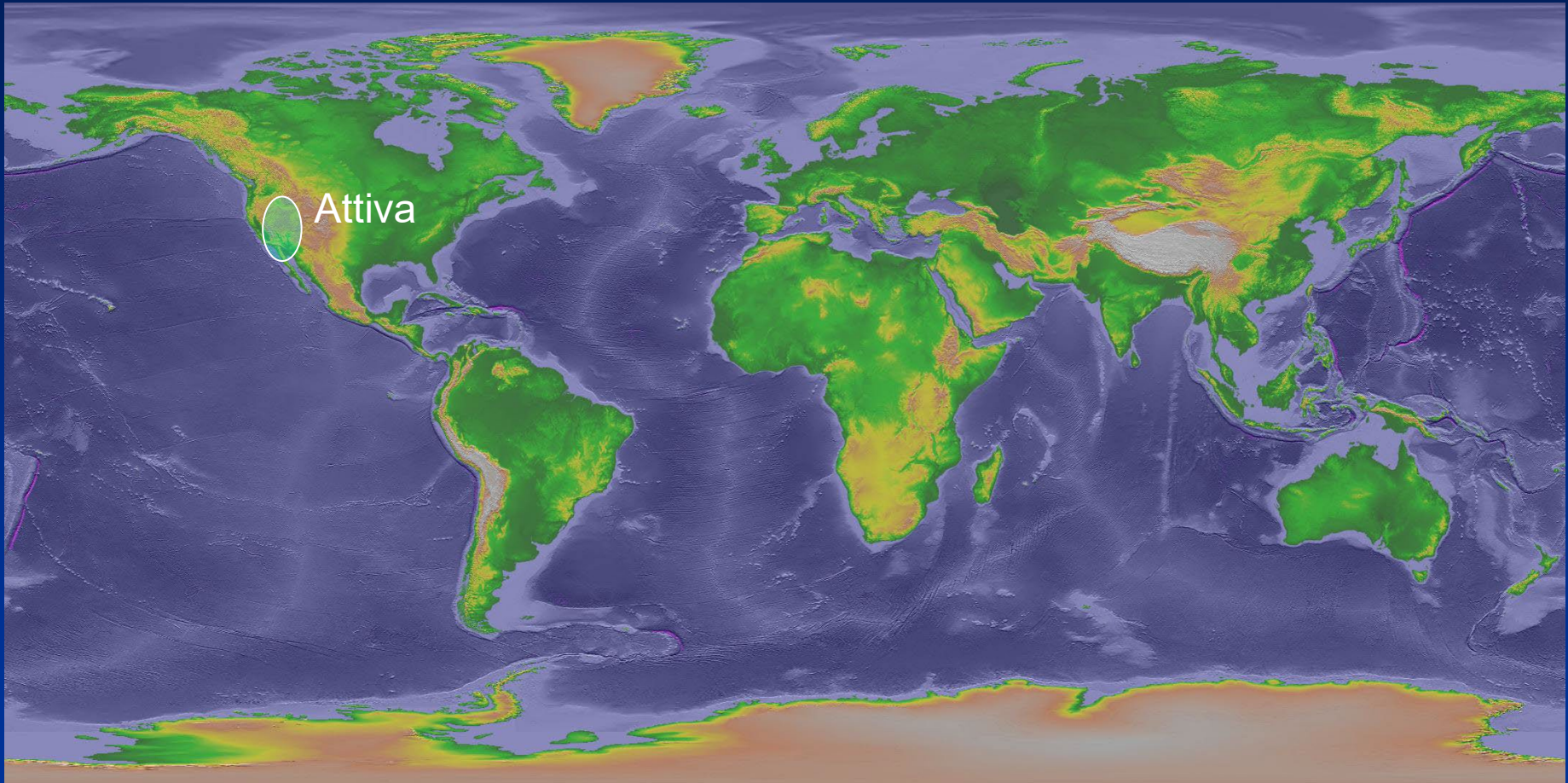
Formazione di crosta oceanica, dorsali !!



<http://factsanddetails.com/world/cat51/sub323/item2212.html>

Associazioni di faglie normali

2a) associazioni estensionali in ambienti geodinamici divergenti prossimi a margini trascorrenti/convergenti

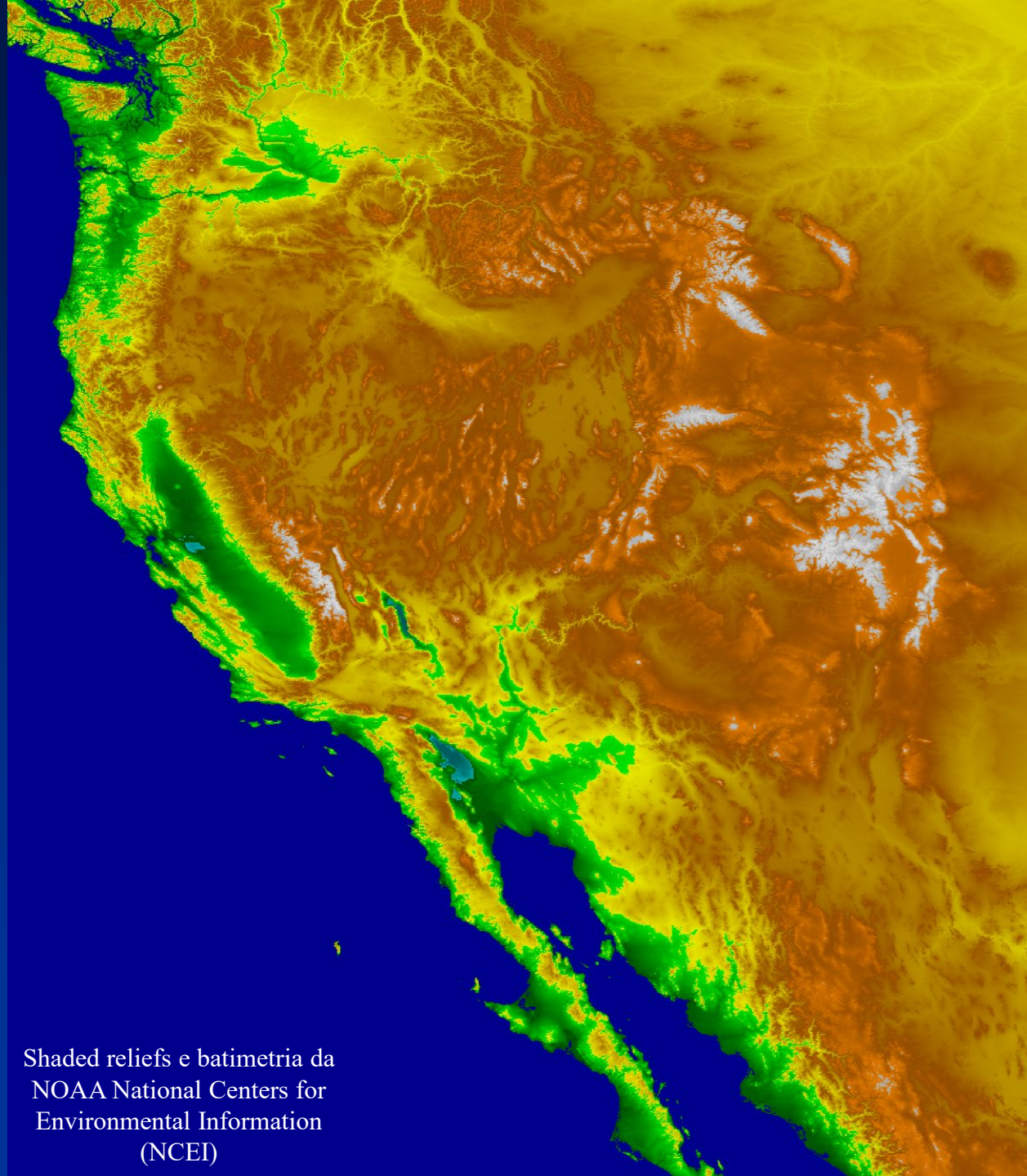


Shaded reliefs e batimetria da NOAA National Centers for Environmental Information (NCEI)

Associazioni
estensionali in
ambienti
geodinamici
divergenti
prossimi a
margini
trascorrenti/
convergenti

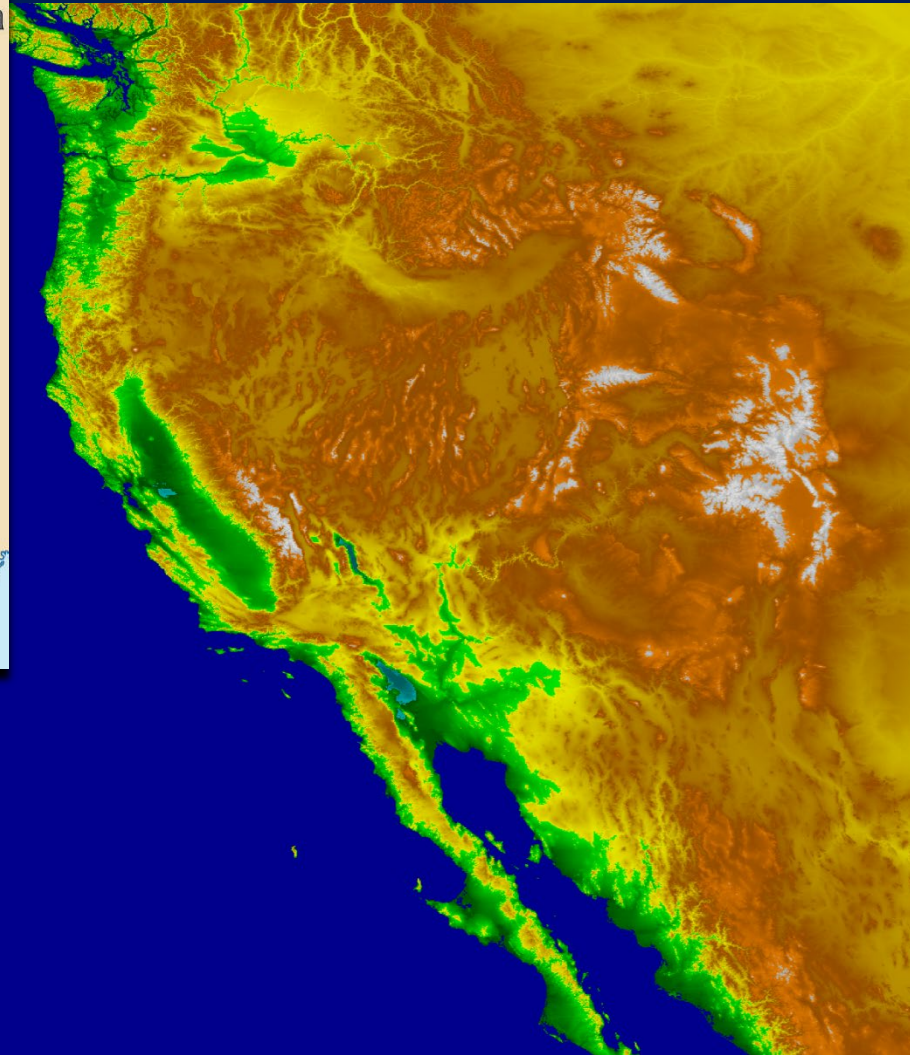
Basin & Range, estensione
intra-continentale

Shaded reliefs e batimetria da
NOAA National Centers for
Environmental Information
(NCEI)



https://commons.wikimedia.org/wiki/File:Tectonic_plates_boundaries_detailed-en.svg

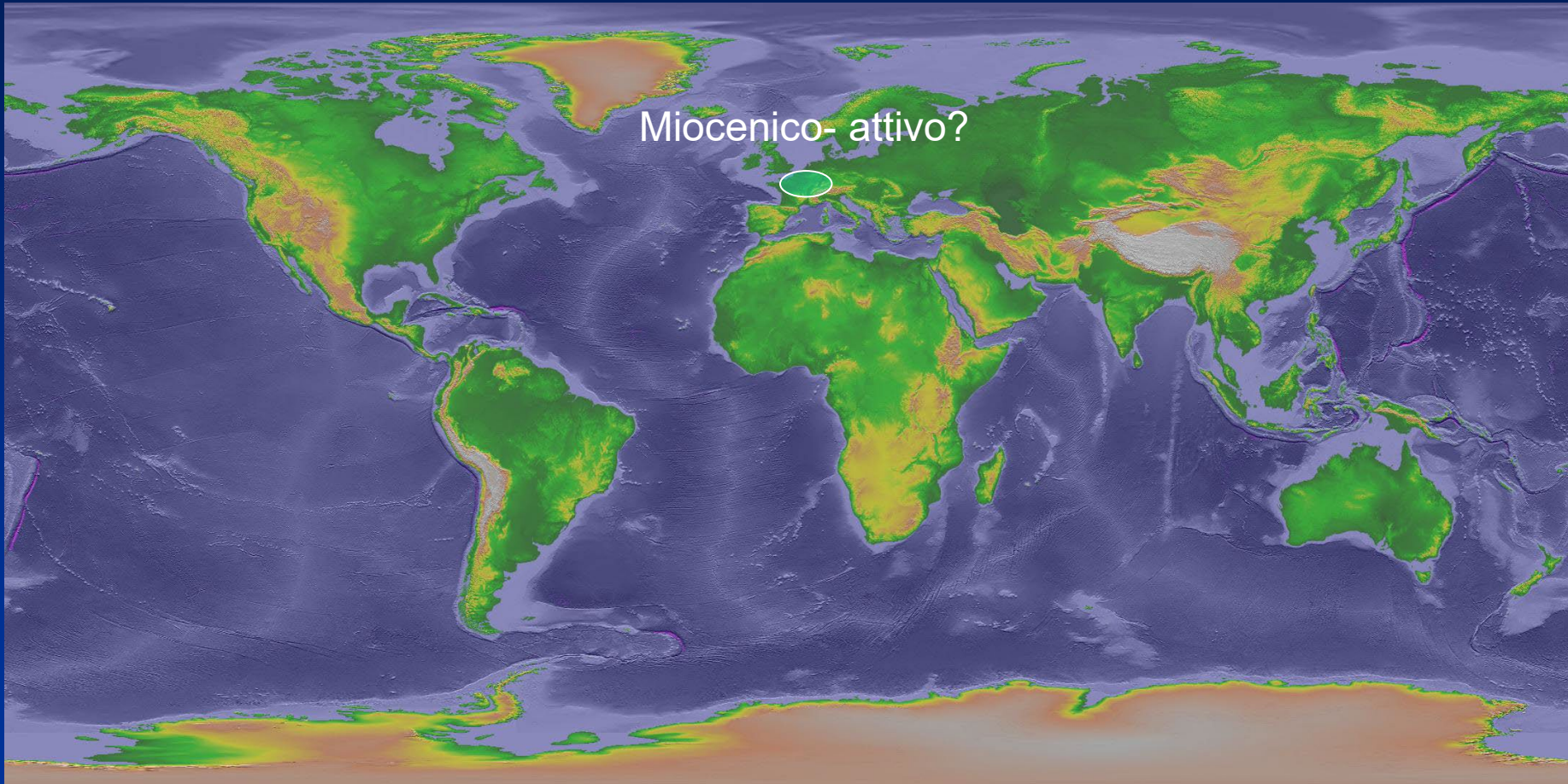
Shaded reliefs e batimetria da NOAA
National Centers for Environmental
Information (NCEI)



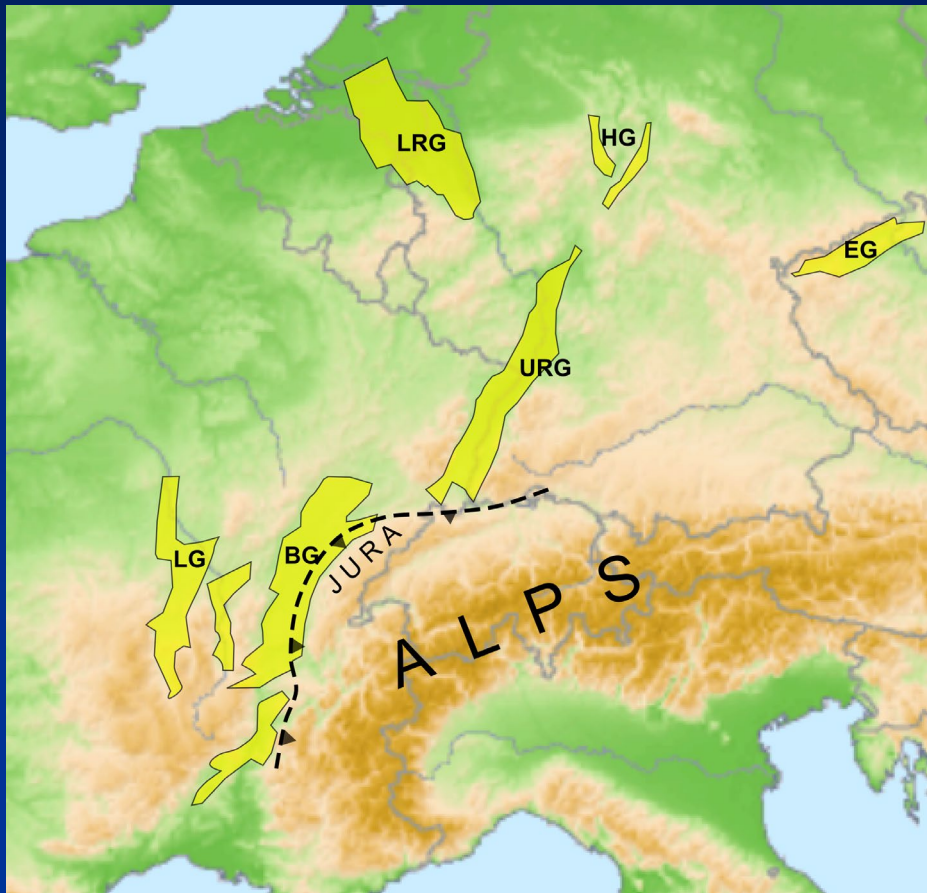
Basin & Range, estensione
intra-continentale, situazione tettonica e
geodinamica regionale

Associazioni di faglie normali

2b) associazioni estensionali in ambienti geodinamici divergenti prossimi a margini convergenti



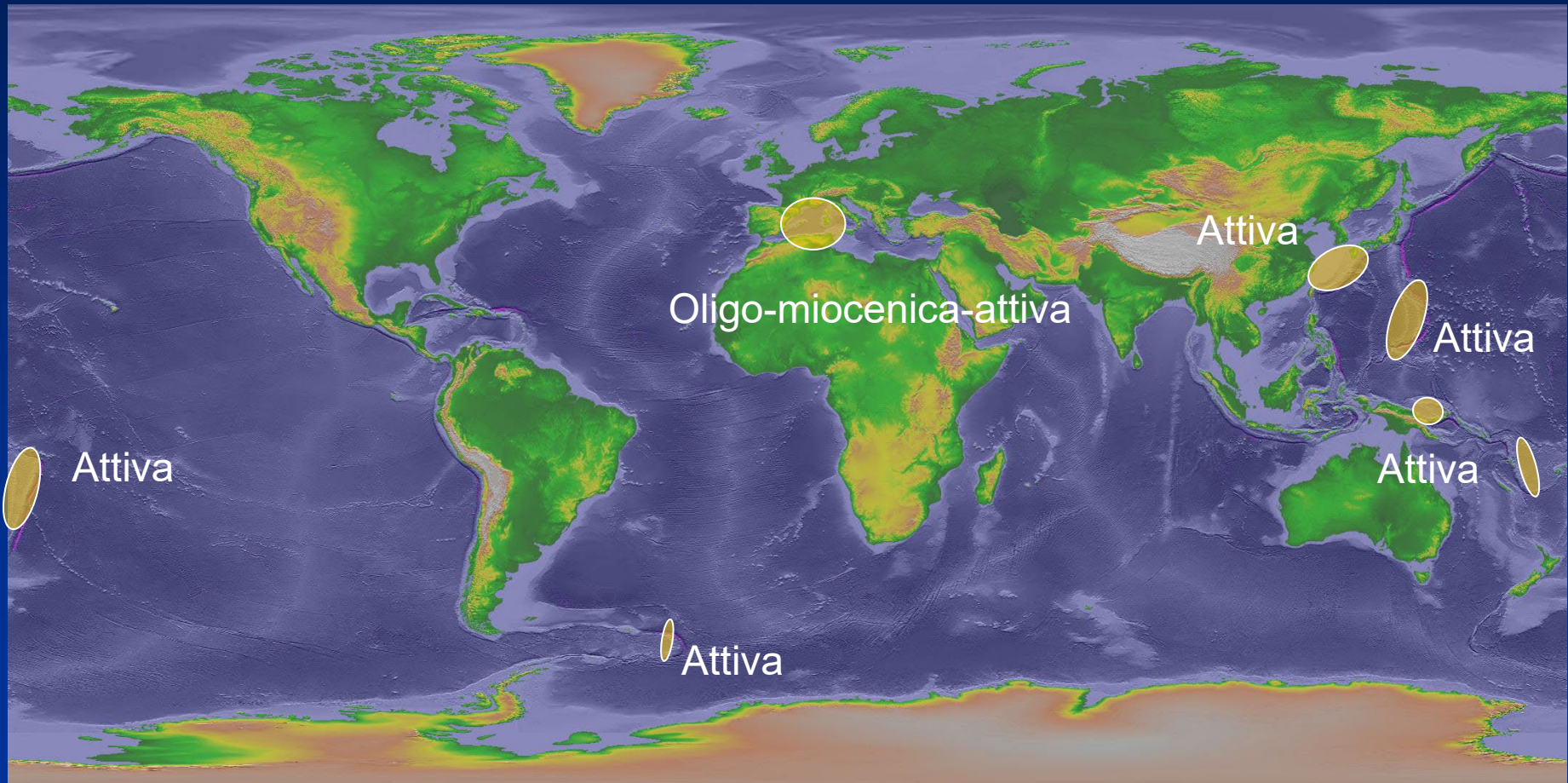
Associazioni estensionali in ambienti geodinamici divergenti prossimi a margini convergenti



Sistema di graben centro-europeo:
LG= g. di Limagne;
BG= g. della Bresse;
URG= Alto Reno;
LRG= Basso Reno;
HG= g. dell'Assia;
EG= g. di Eger.

Associazioni di faglie normali

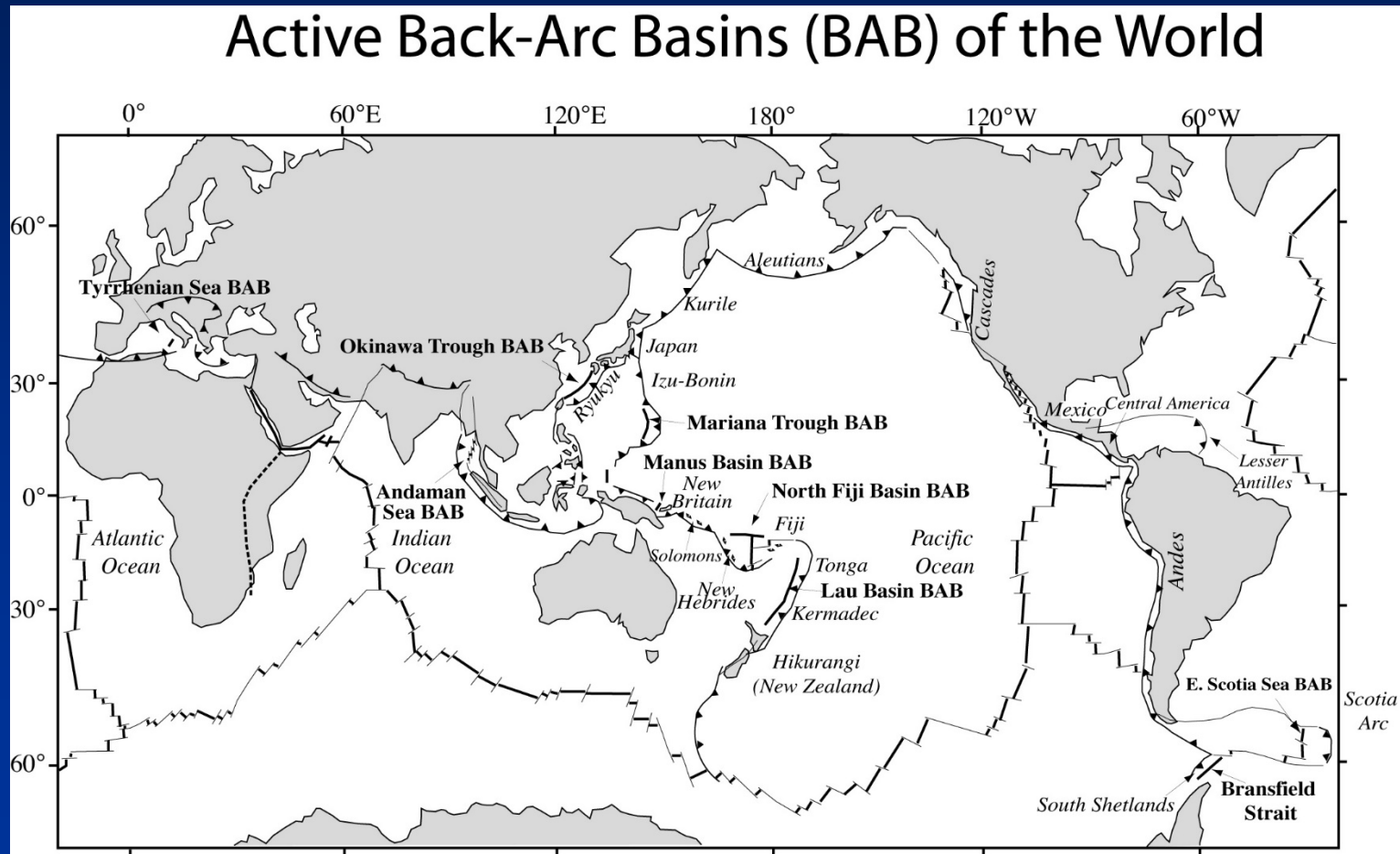
3) associazioni estensionali dovute ad ambienti geodinamici convergenti!!!



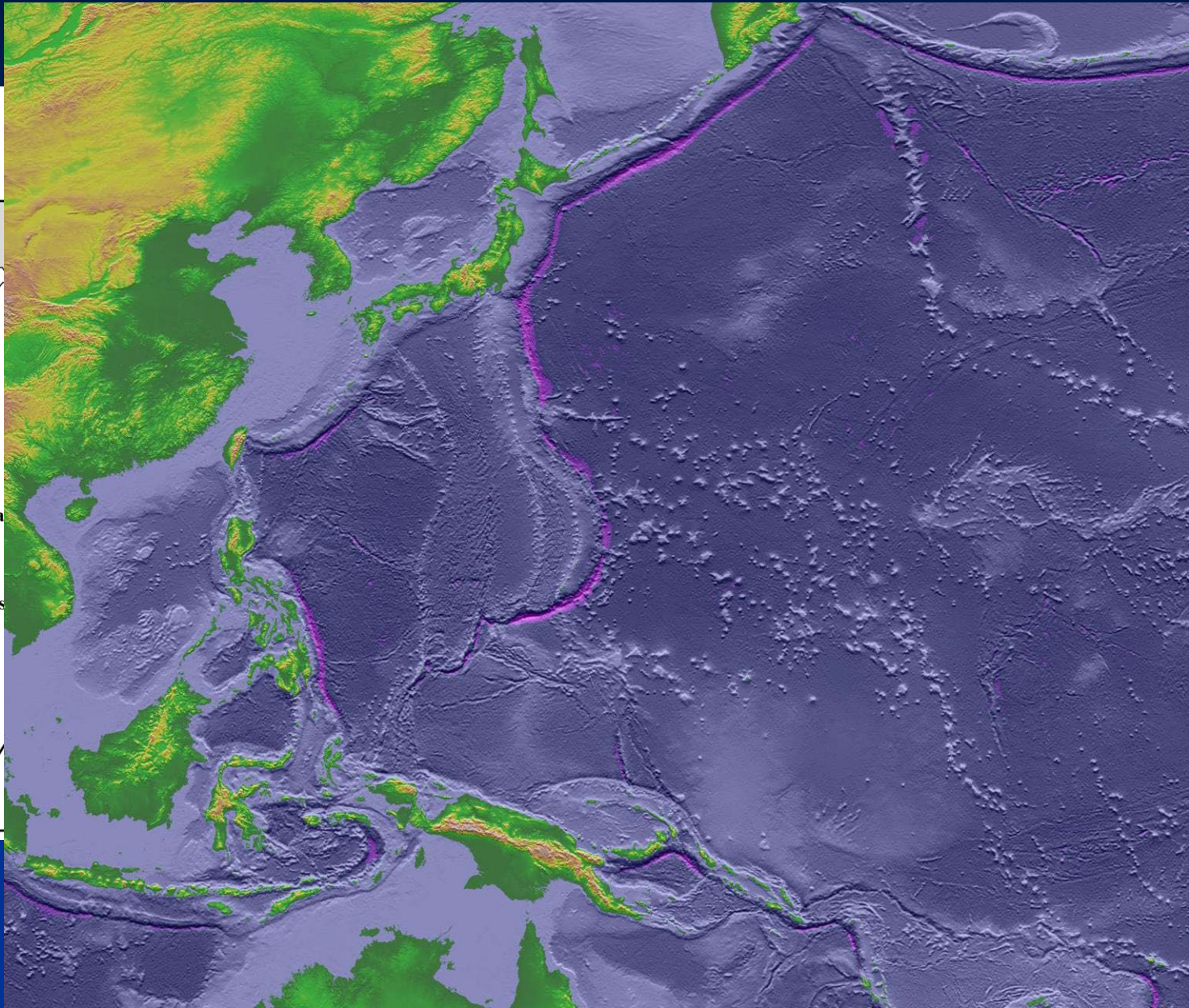
Shaded reliefs e batimetria da NOAA National Centers for Environmental Information (NCEI)

3) associazioni estensionali dovute ad ambienti geodinamici convergenti:

Estesi bacini di retroarco

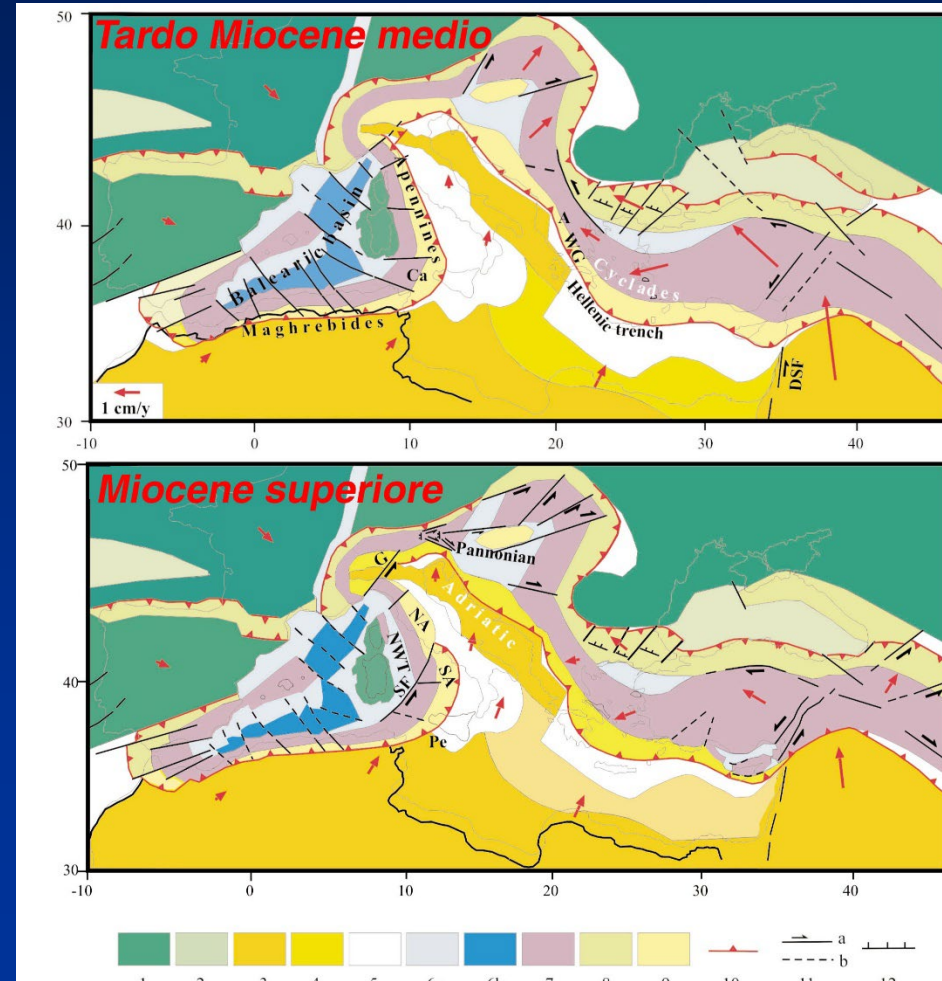
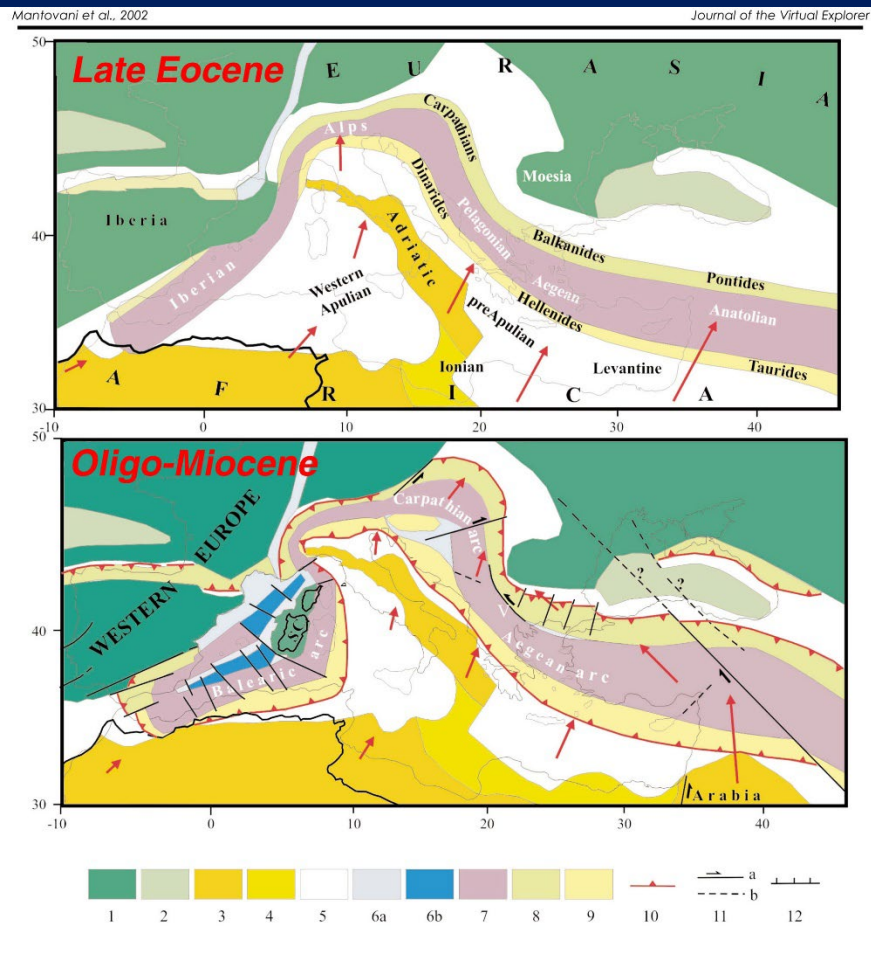


Back-Arc Basins (BAB)

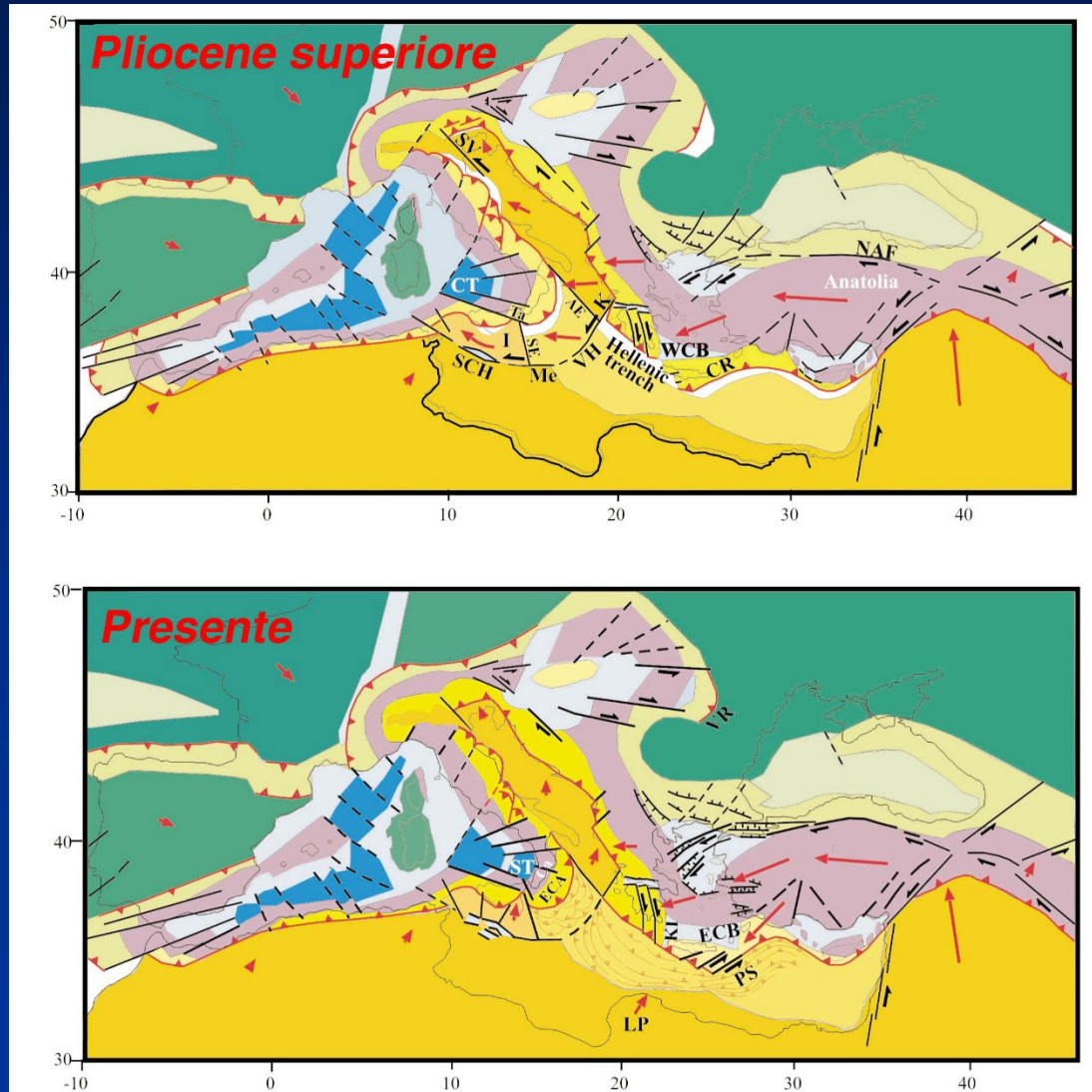


associazioni estensionali dovute ad ambienti geodinamici convergenti: evoluzione oligo-miocenica sino all'Attuale dell'Appennino

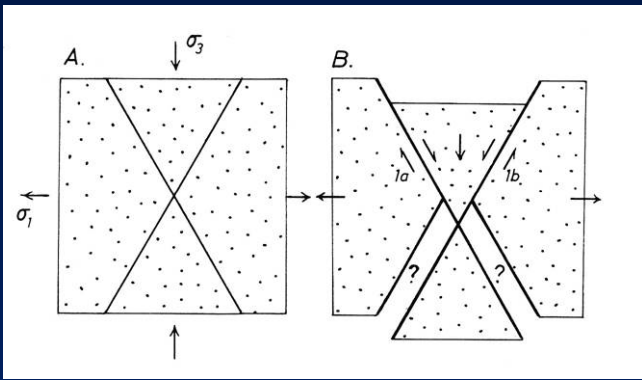
Da Mantovani et al., 2002



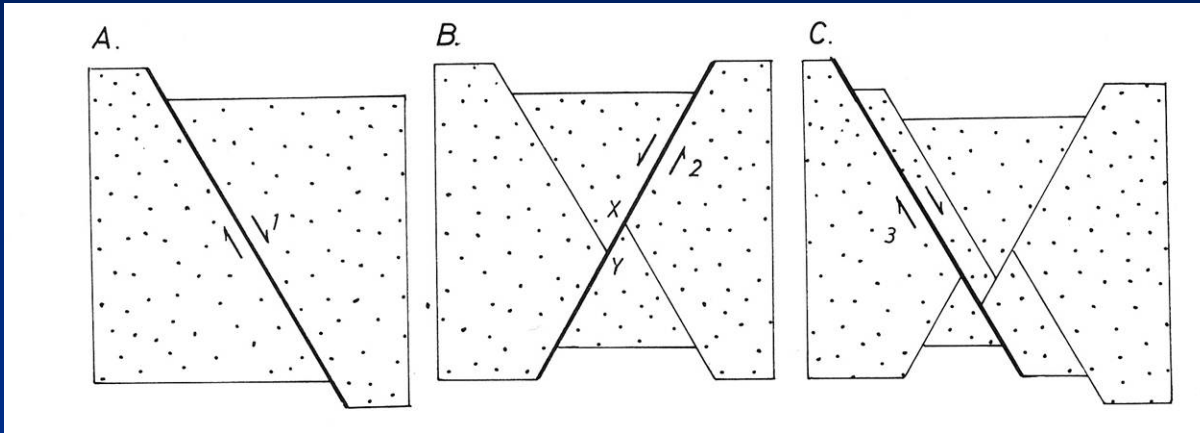
associazioni estensionali dovute ad ambienti geodinamici convergenti: evoluzione oligo-miocenica sino all'Attuale dell'Appennino



Da Mantovani et al., 2002

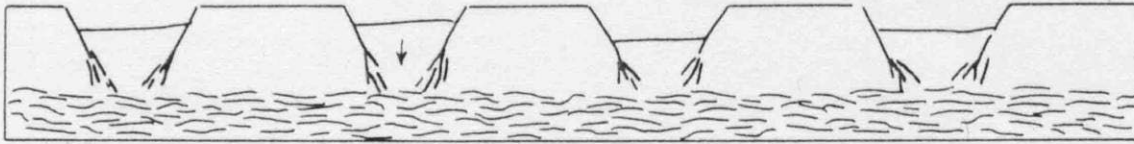


Da Ramsay and Huber, 1987



Solo le associazioni di faglie (coniugate) lavorano!!

FAGLIE NORMALI DIRITTE



a)

FAGLIE NORMALI LISTRICHE



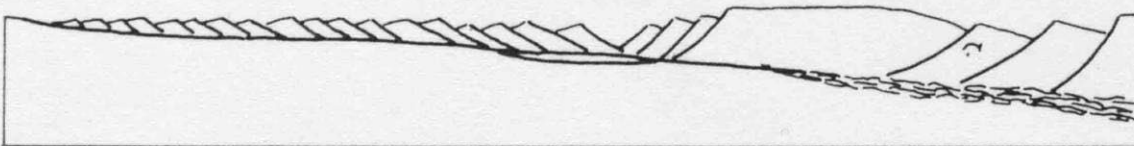
b)

FAGLIE A "DOMINO"



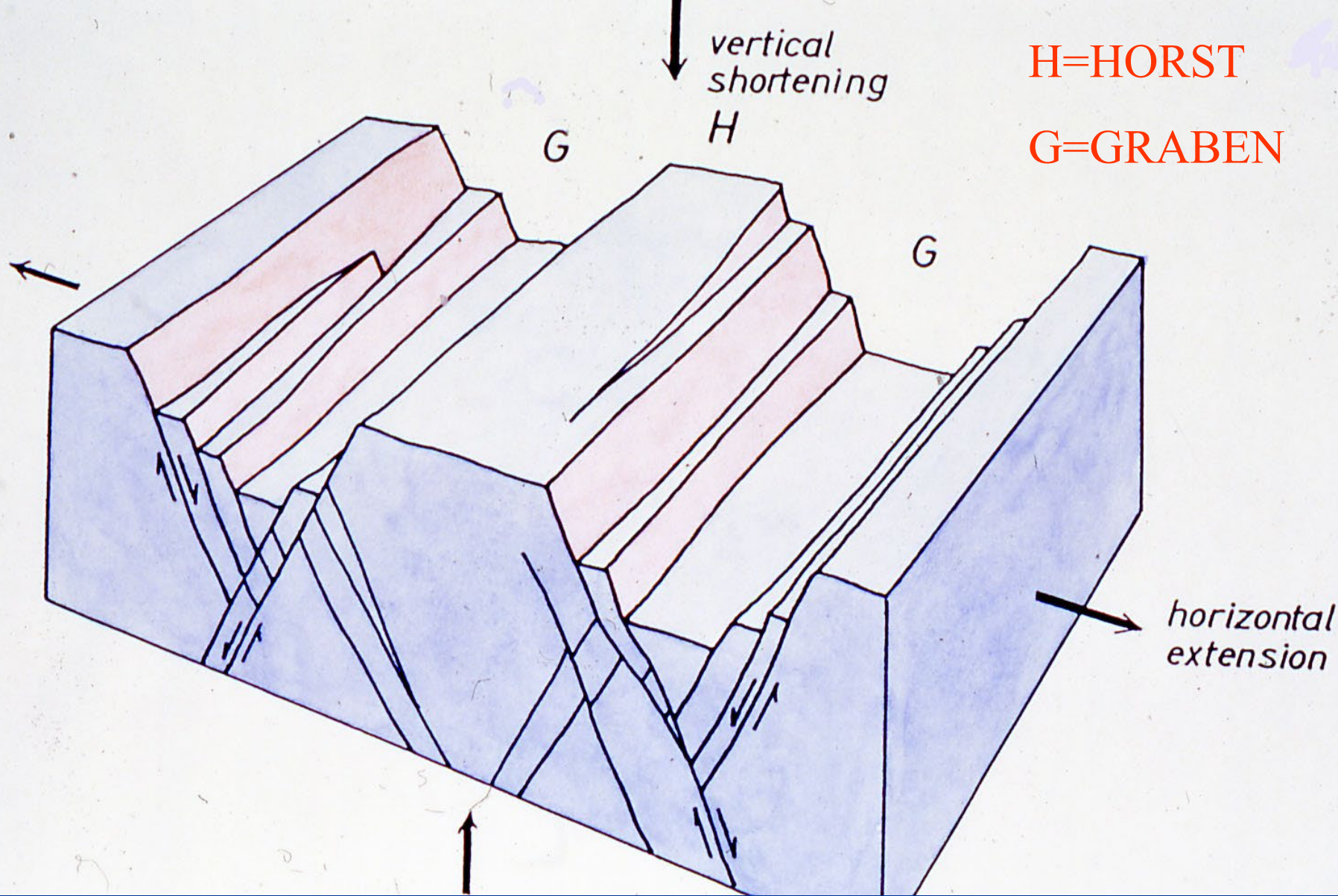
c)

FAGLIE DI DISTACCO (DETACHMENT) A BASSO ANGOLO



d)

Sistemi di
faglie normali:
il problema
della
continuazione
in profondità.
Diverse
geometrie in
superficie e
diversi modelli
concettuali



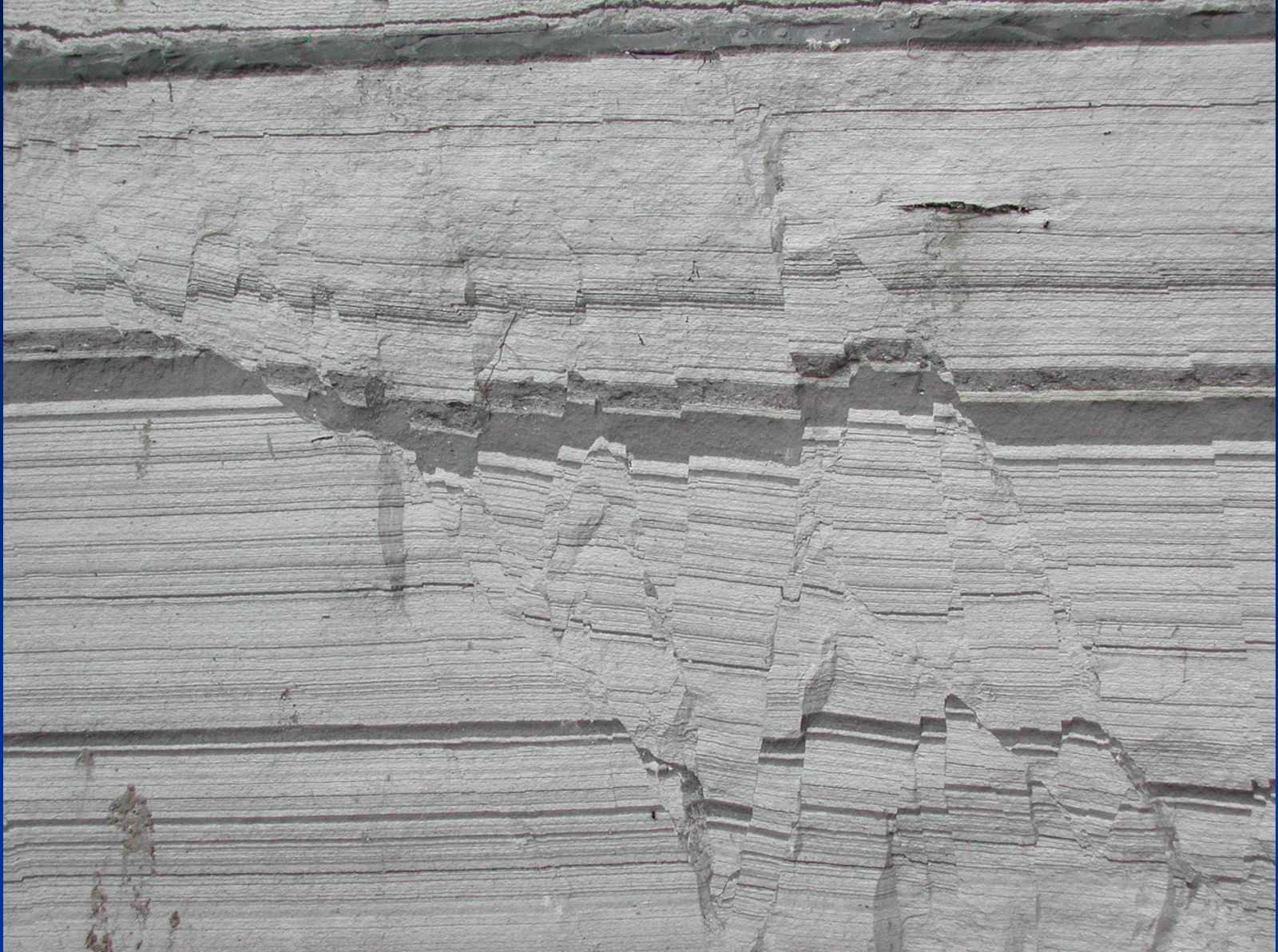
Da Ramsay and Huber, 1987

FAGLIE PIANE

Esempio di grabe (singola fossa) recentissimo e, presumibilmente, attivo



Sistemi di faglie normali: coniugate, faglia principale (master fault) e faglie curve!



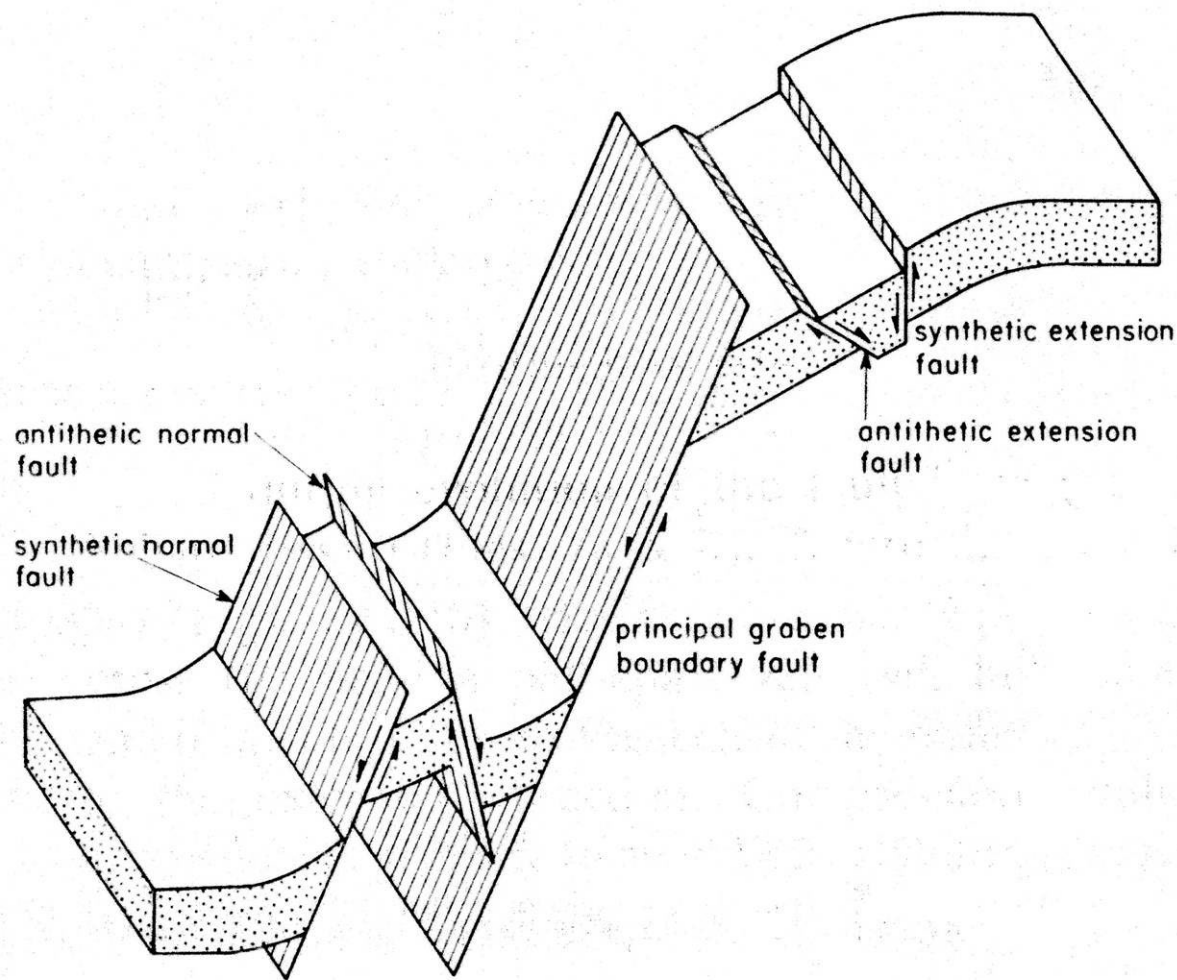


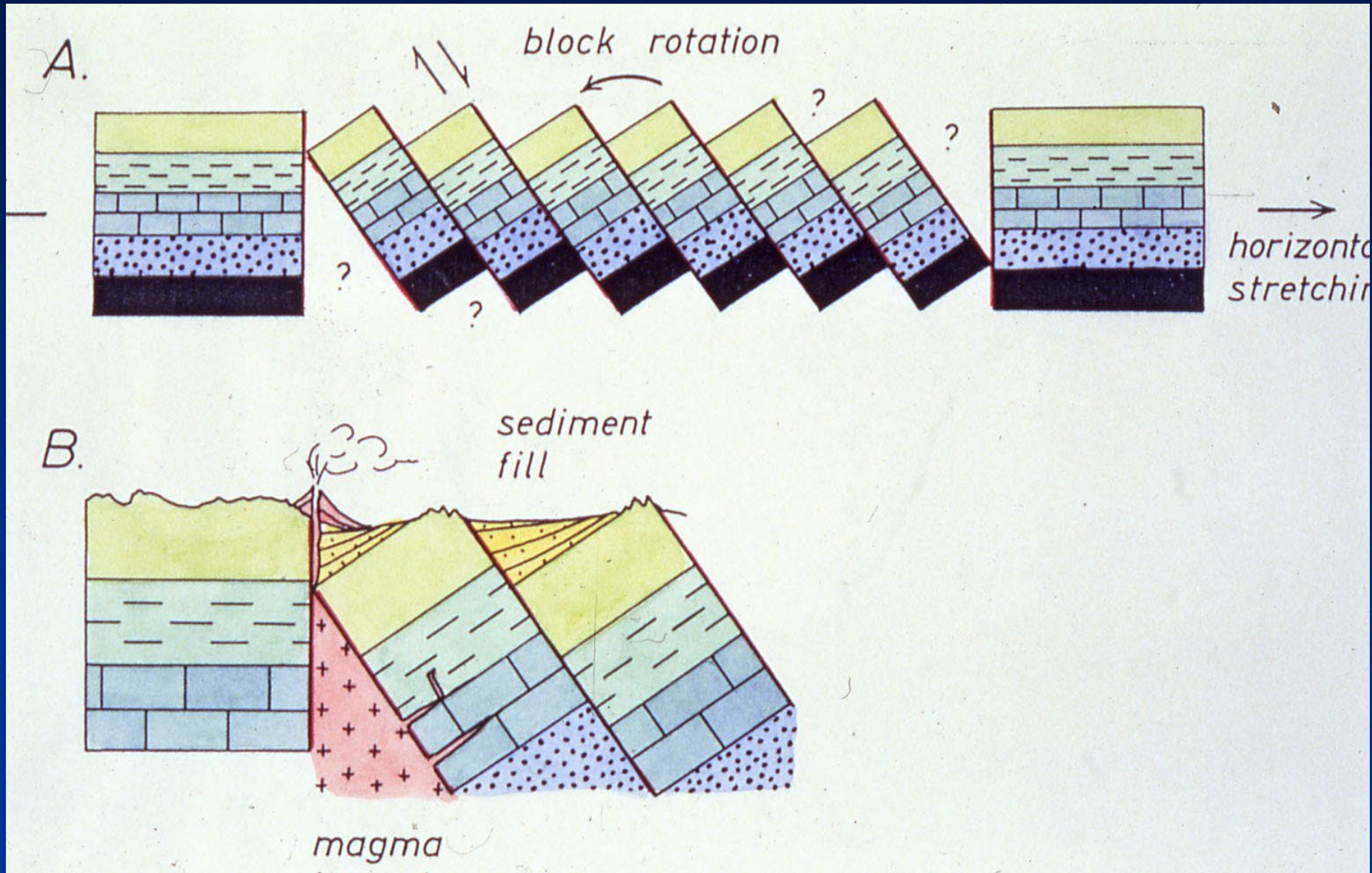
Fig. 6. Structures characteristic of planar high-angle normal fault zones such as those bounding grabens in terrains that have been inhomogeneously extended by a small percentage. After Al Kadhi & Hancock (1980, fig. 6).

Sistemi di faglie normali coniugate: faglia principale, faglie antitetiche e sintetiche

Come si vede in affioramento una faglia normale?
(foto L. Selli)



Sistemi di faglie normali coniugate sintetiche; sistema a domino!



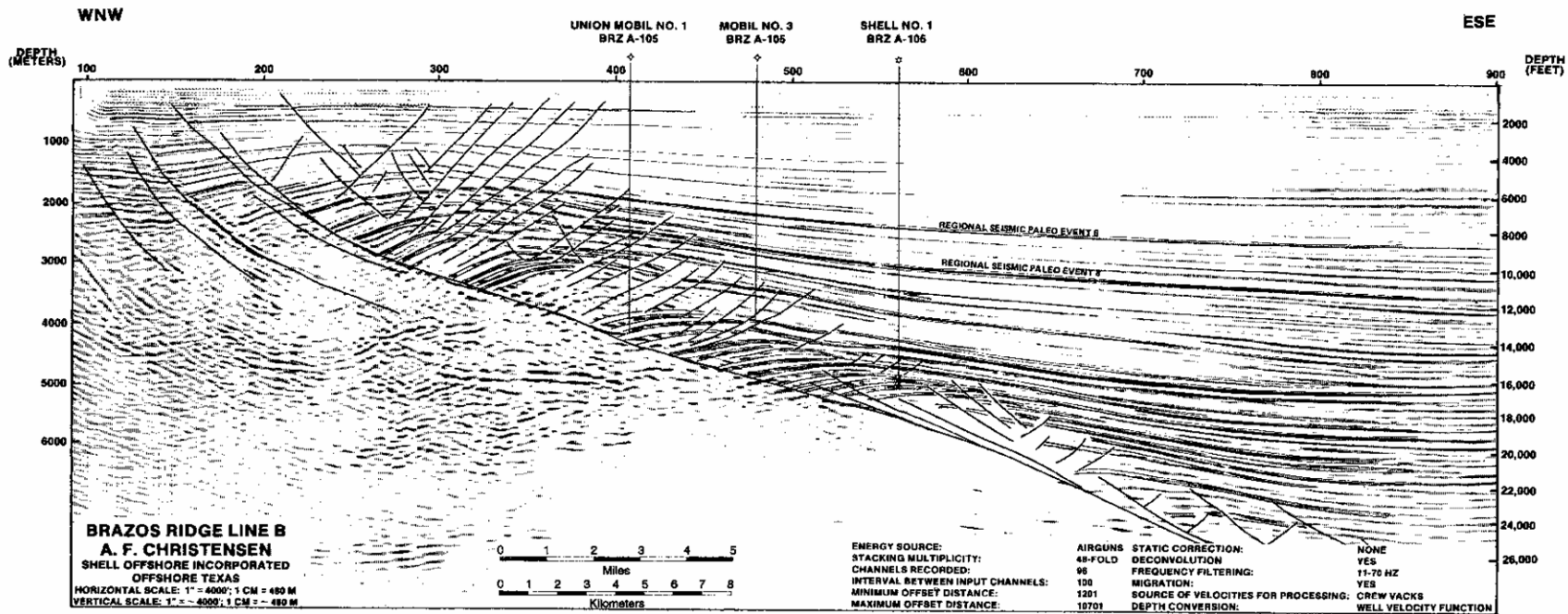
Sistemi di faglie normali coniugate sintetiche; sistema a domino!



Da Ramsay and Huber, 1987

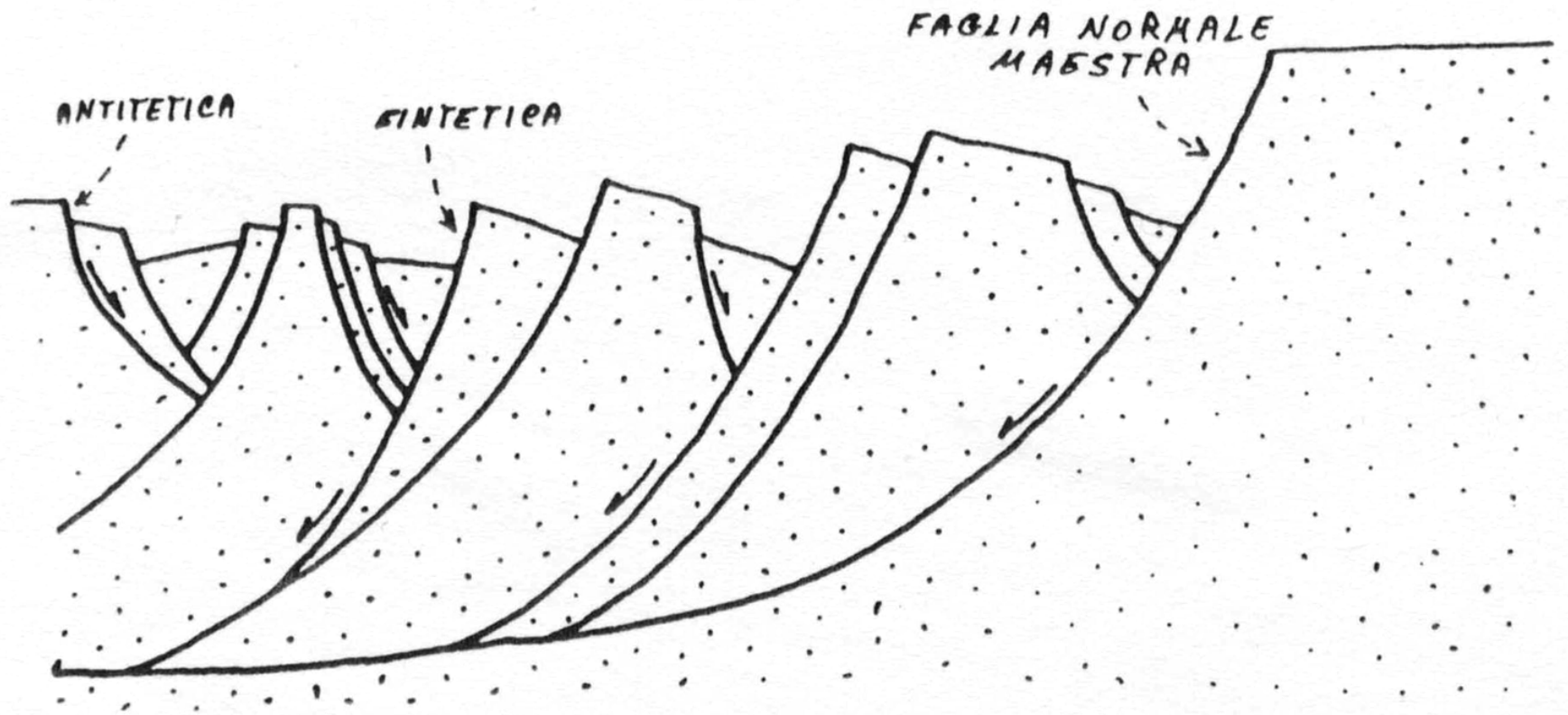


Da Ramsay and Huber, 1987

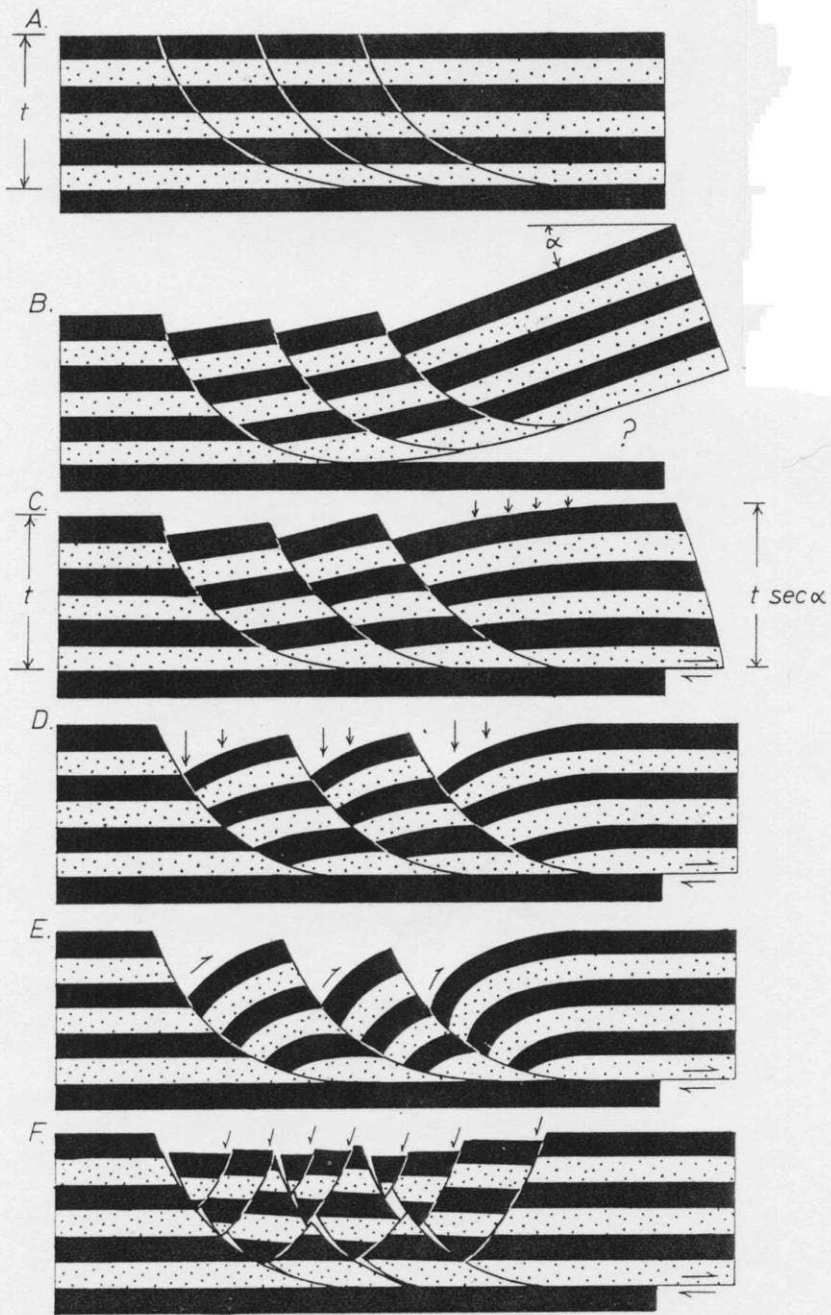


(b)

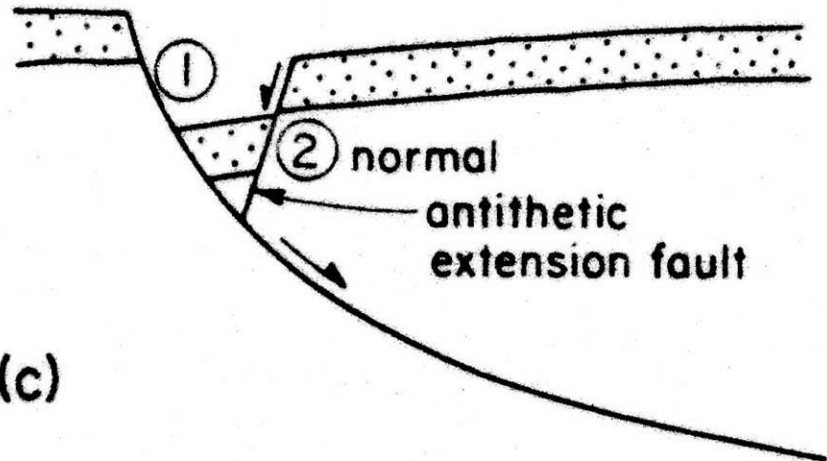
Da Hatcher, 1995



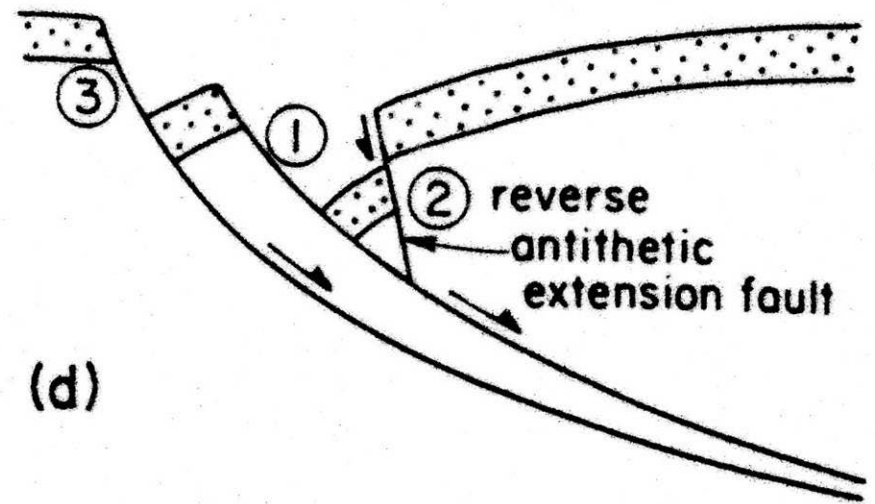
Faglia listrica



Da Ramsay and Huber, 1987

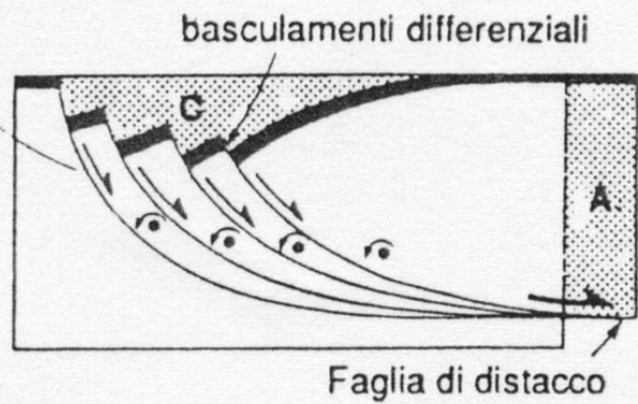
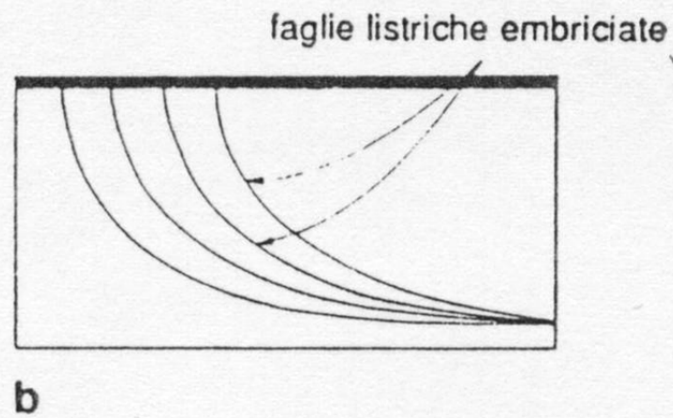
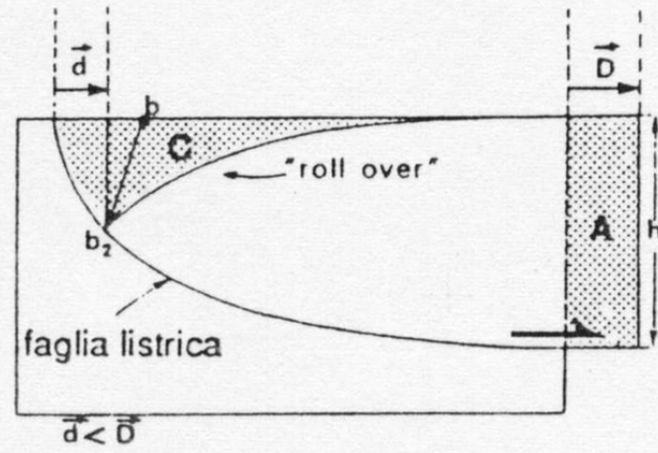
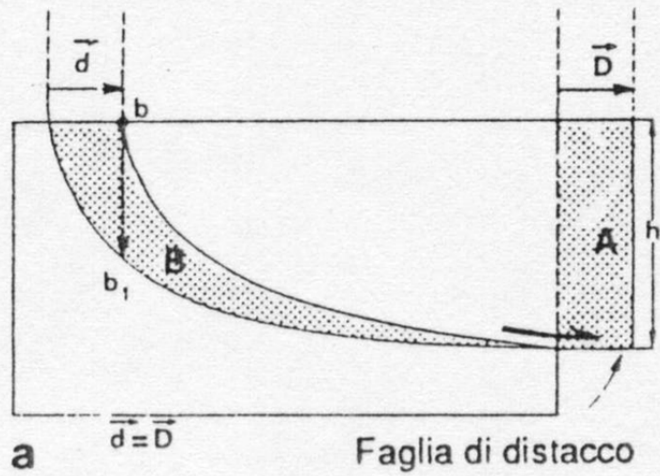


(c)



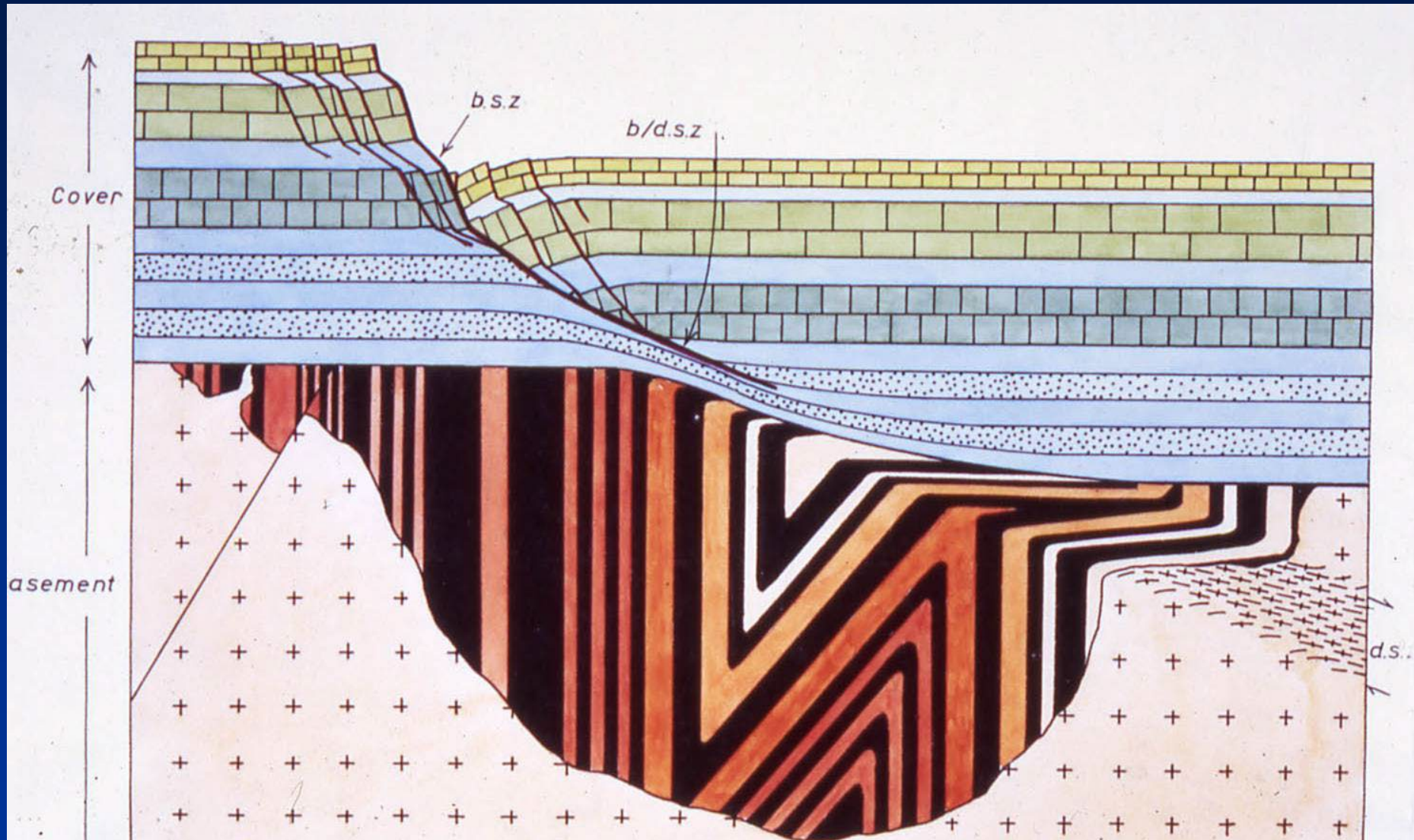
(d)

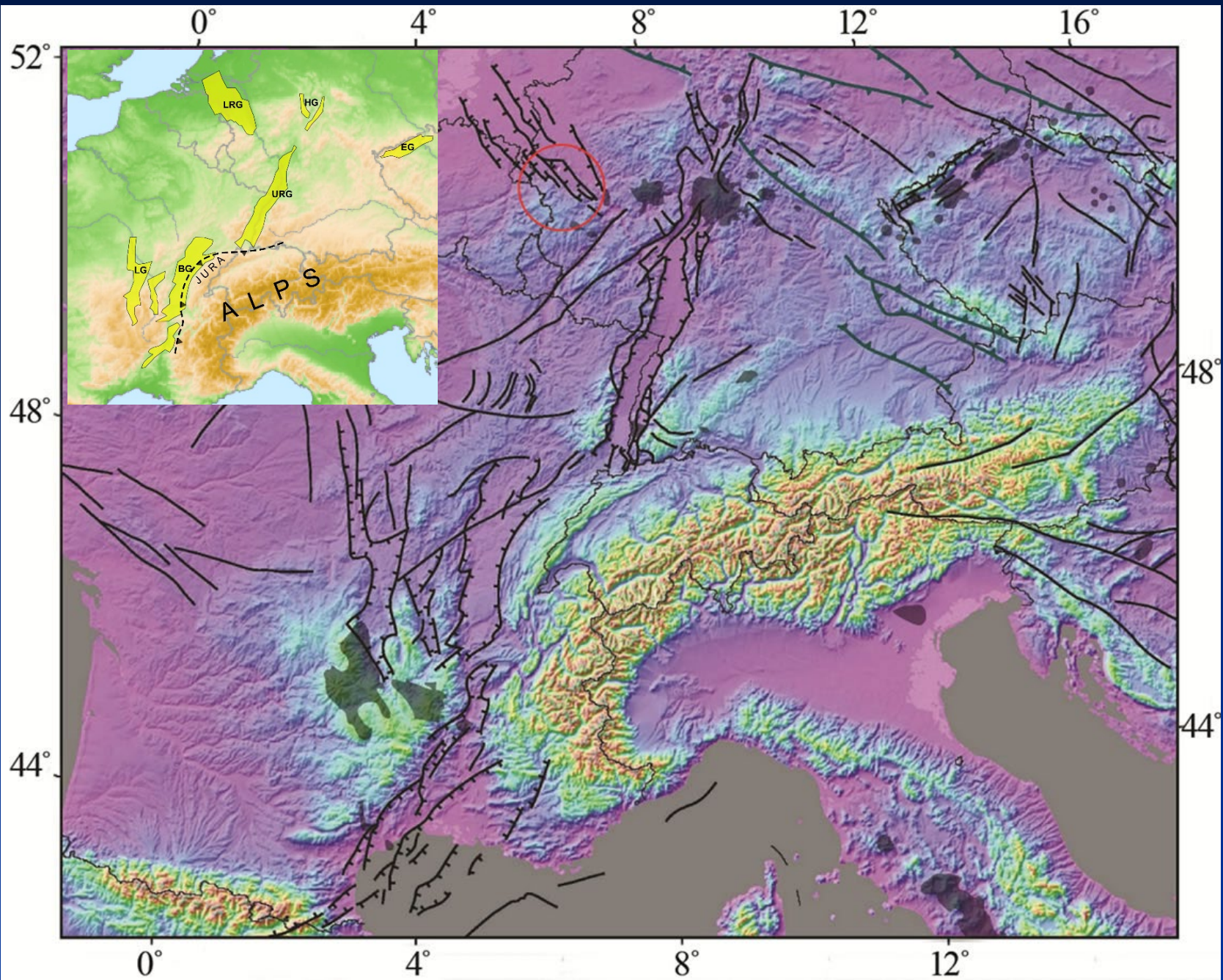
Da Hancock, 1985

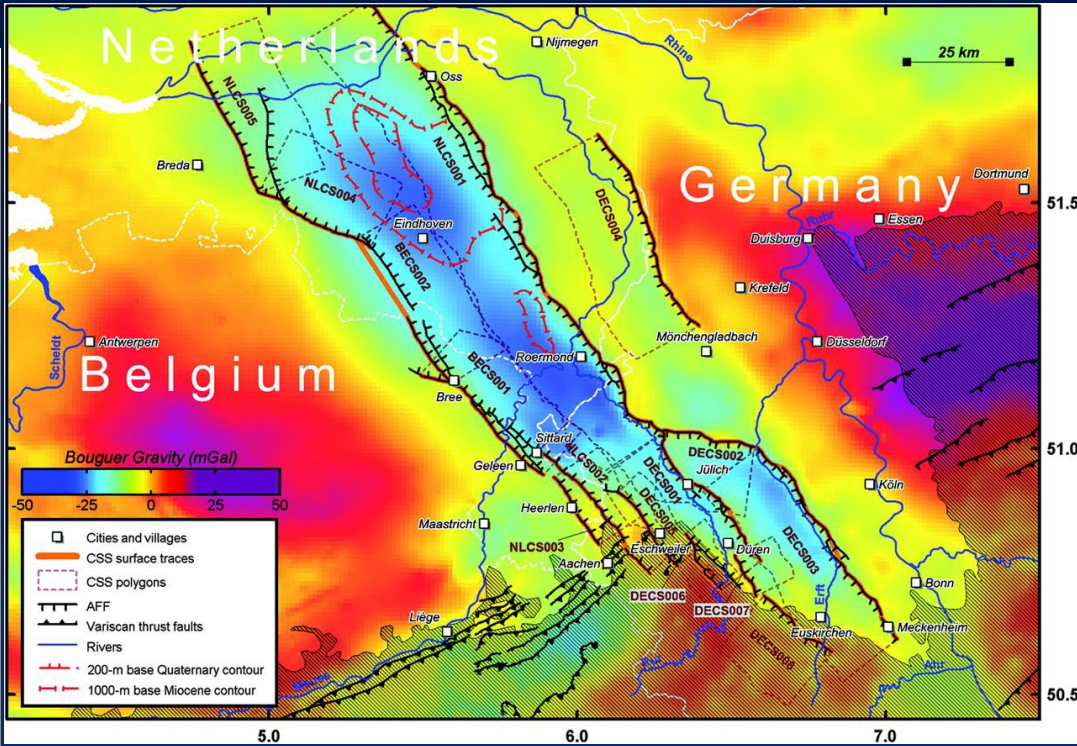
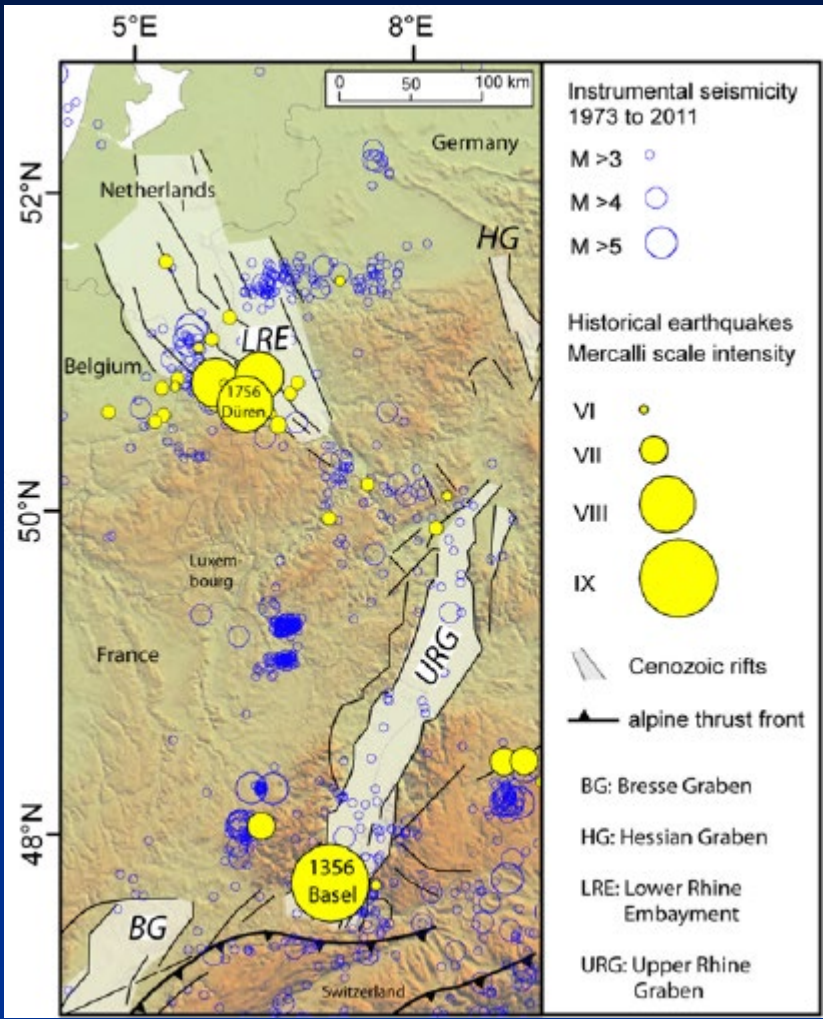


Da Mercier & Vergely, 1996

Estensione crostale

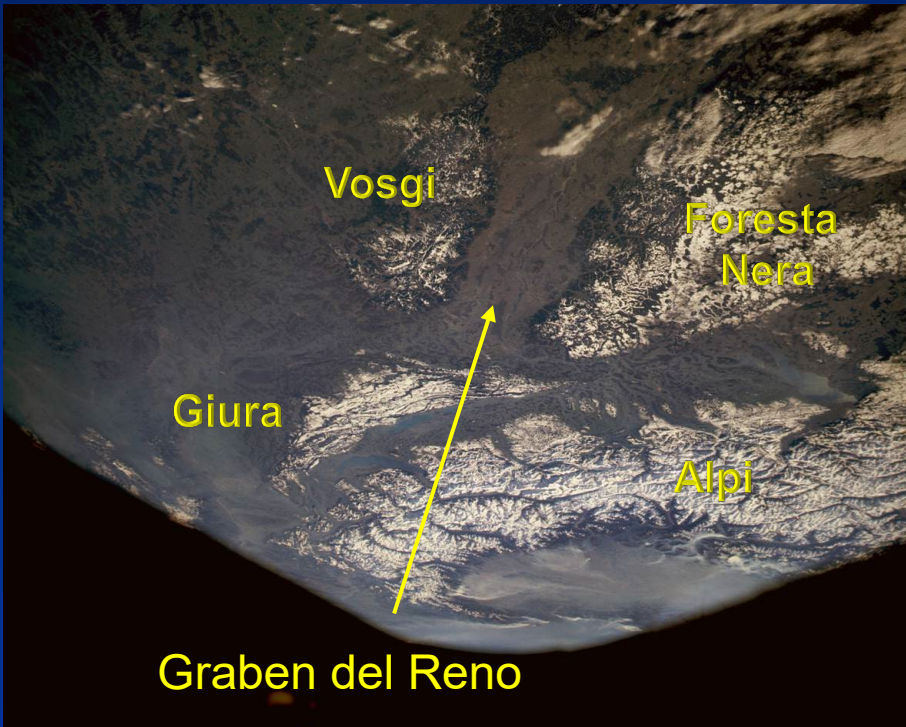
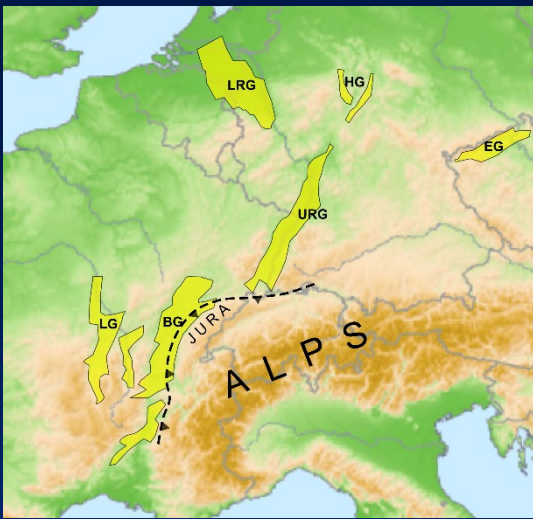


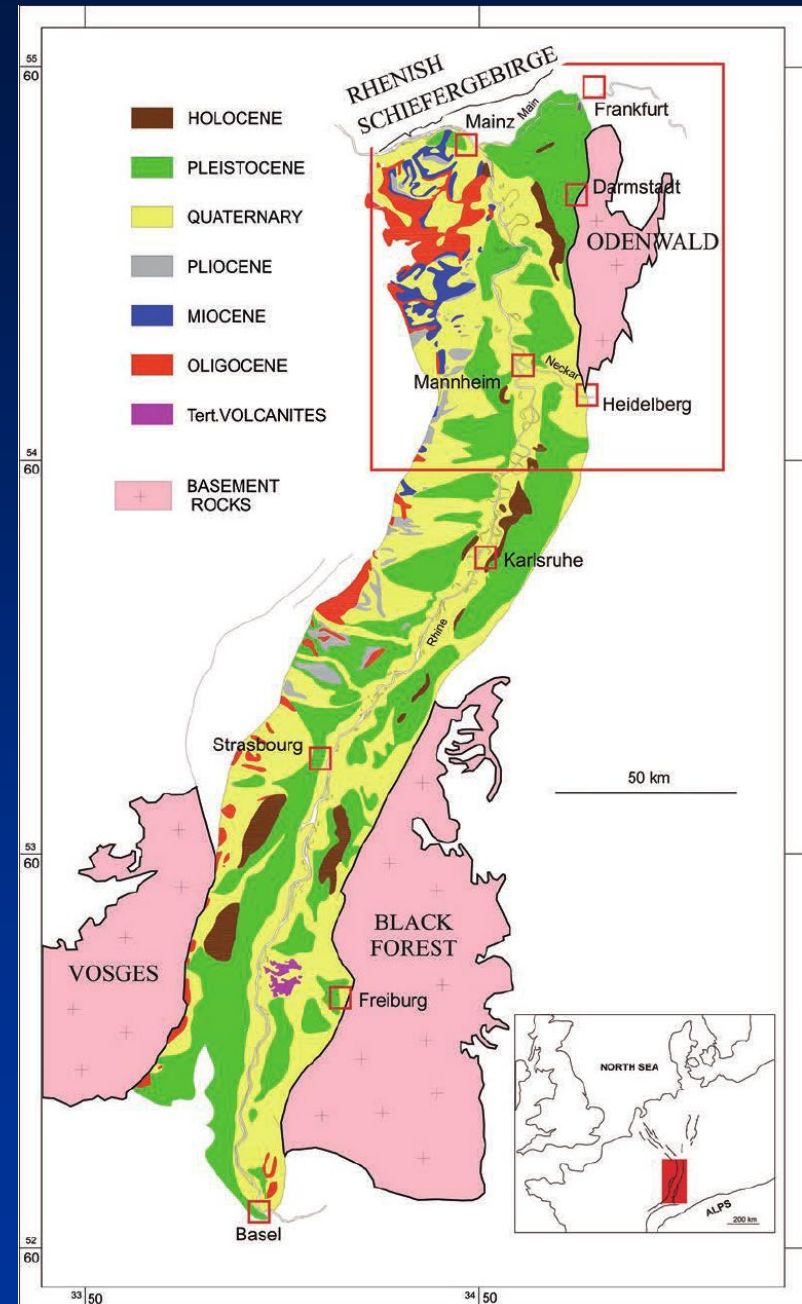
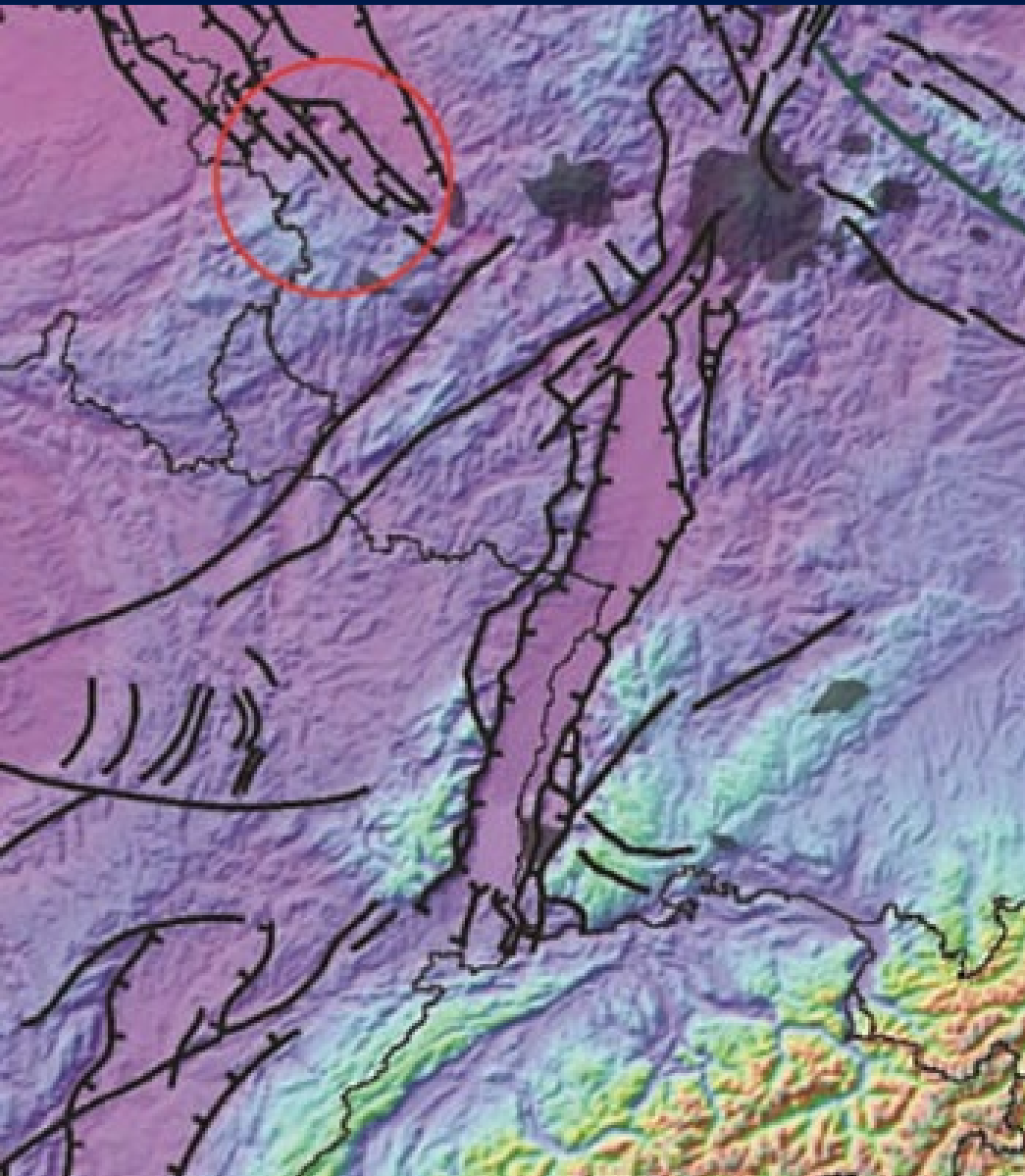




Da Kuebler, 2012

Graben del Reno

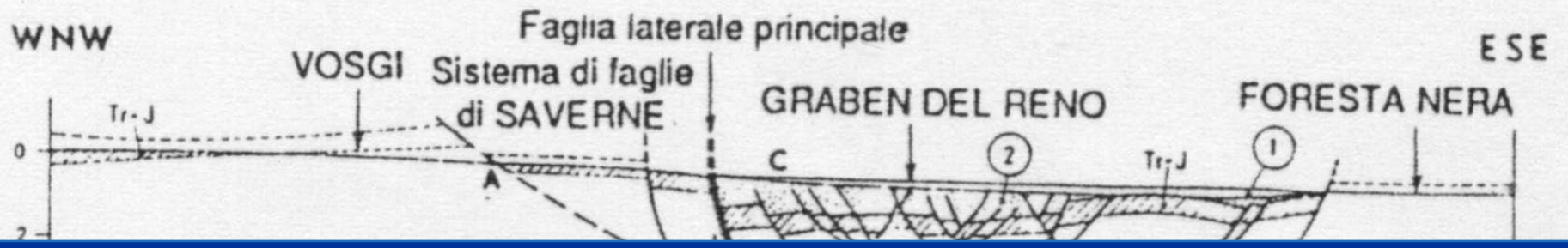


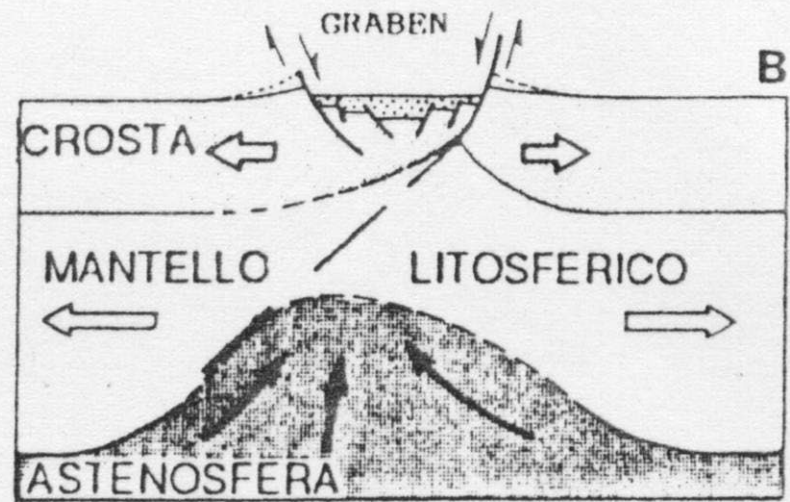
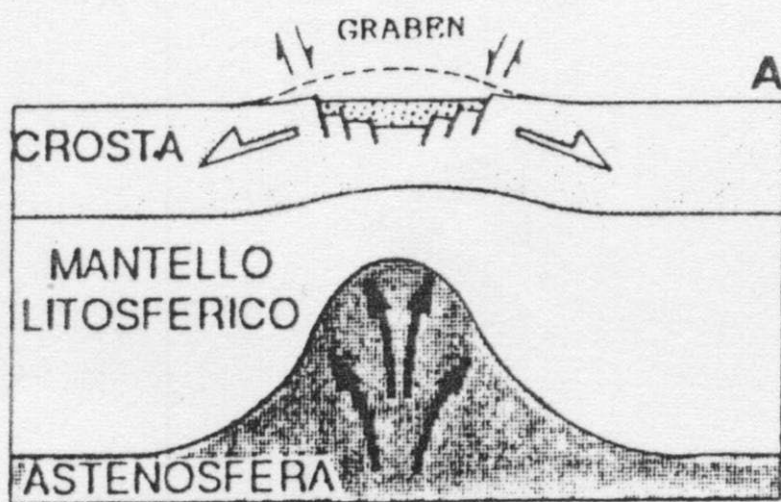


Da Dijkshoorn & Clauser, 2013

Przyrowski & Schäfer, 2015

Da Mercier & Vergely, 1996





Da Mercier & Vergely, 1996

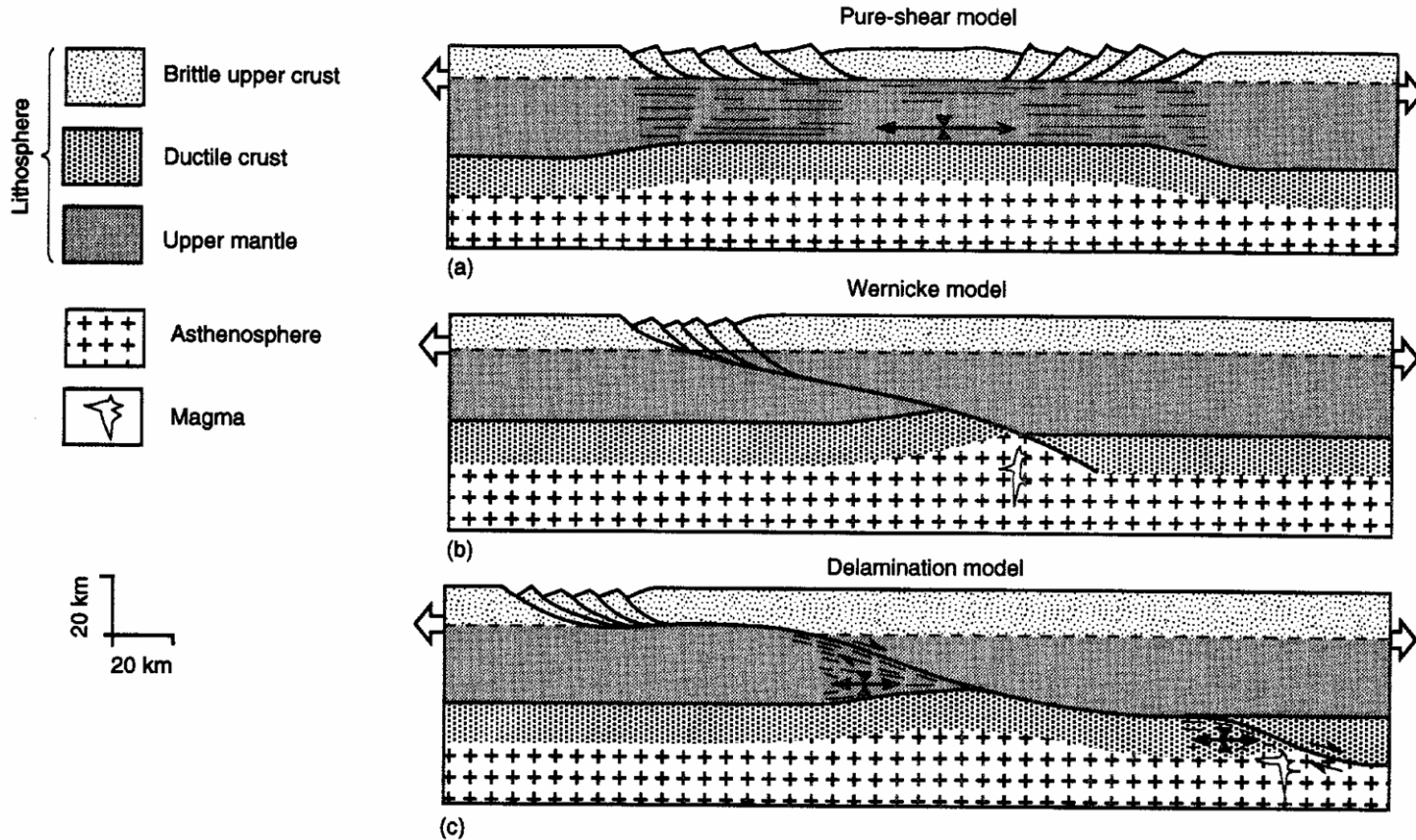


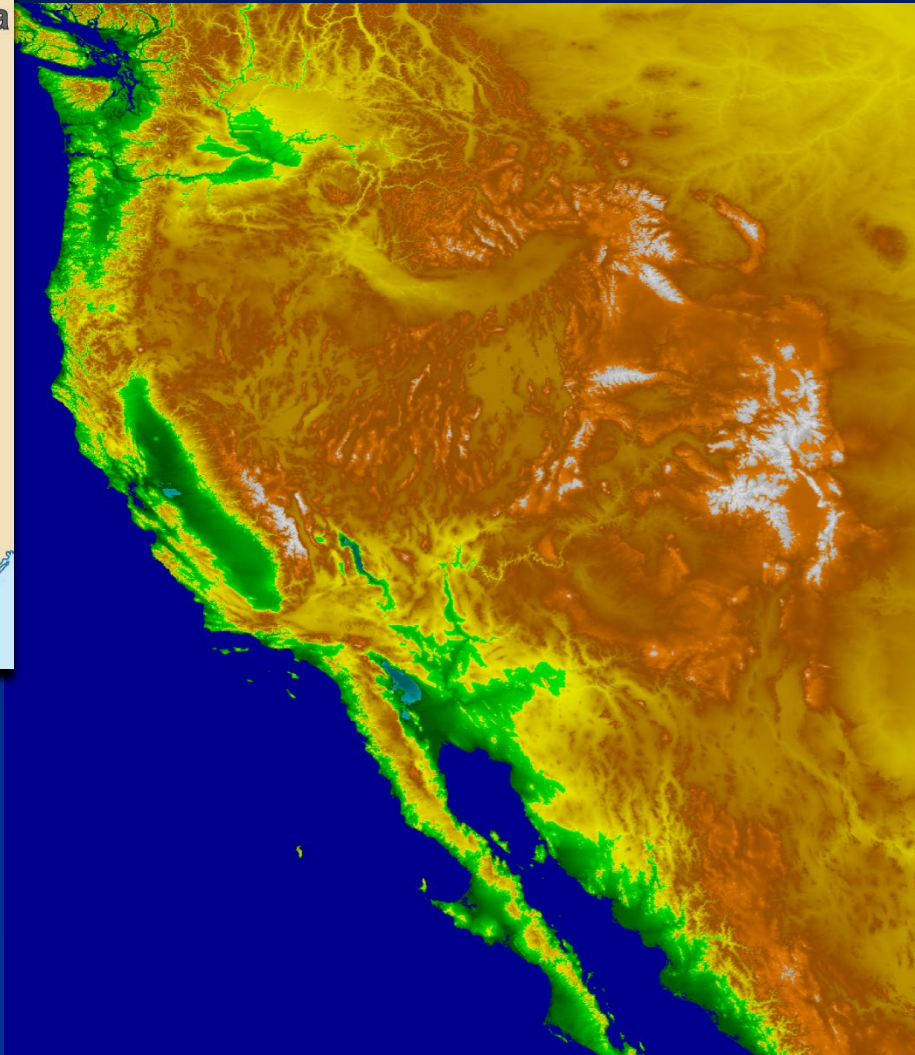
FIGURE 13-15

Three models of extension of continental crust. (a) McKenzie "pure-shear" model: symmetrical rifting and pure shear. (b) Wernicke model: asymmetric rifting with simple shear. (c) Delamination model: asymmetric rifting with simple shear and delamination. (From G. S. Lister, M. A. Etheridge, and P. A. Symonds, *Geology*, v. 14, 1986.)



https://commons.wikimedia.org/wiki/File:Tectonic_plates_boundaries_detailed-en.svg

Shaded reliefs e batimetria da NOAA National Centers for Environmental Information (NCEI)



Basin & Range, estensione intra-continentale

Death Valley National Park, California

compiled by Marli Bryant Miller

Sediments and Sedimentary Rocks

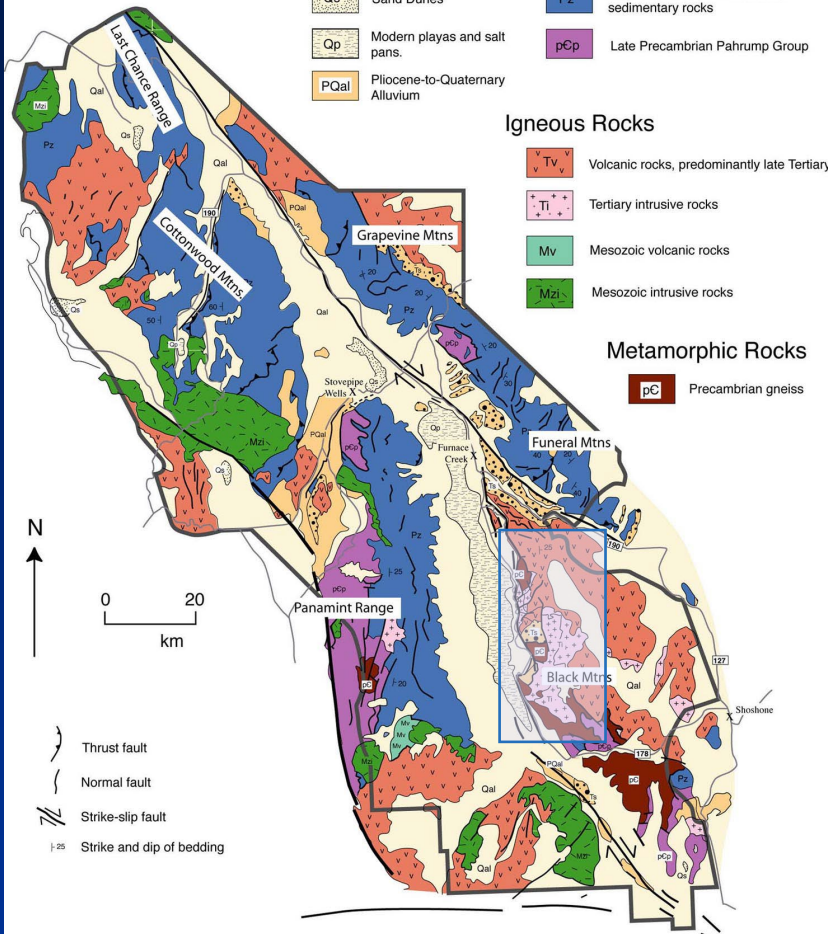
Quaternary Alluvium	Tertiary sedimentary rocks
Sand Dunes	Paleozoic and Late Proterozoic sedimentary rocks
Modern playas and salt pans.	Late Precambrian Pahrump Group
Pliocene-to-Quaternary Alluvium	

Igneous Rocks

Volcanic rocks, predominantly late Tertiary
Tertiary intrusive rocks
Mesozoic volcanic rocks
Mesozoic intrusive rocks

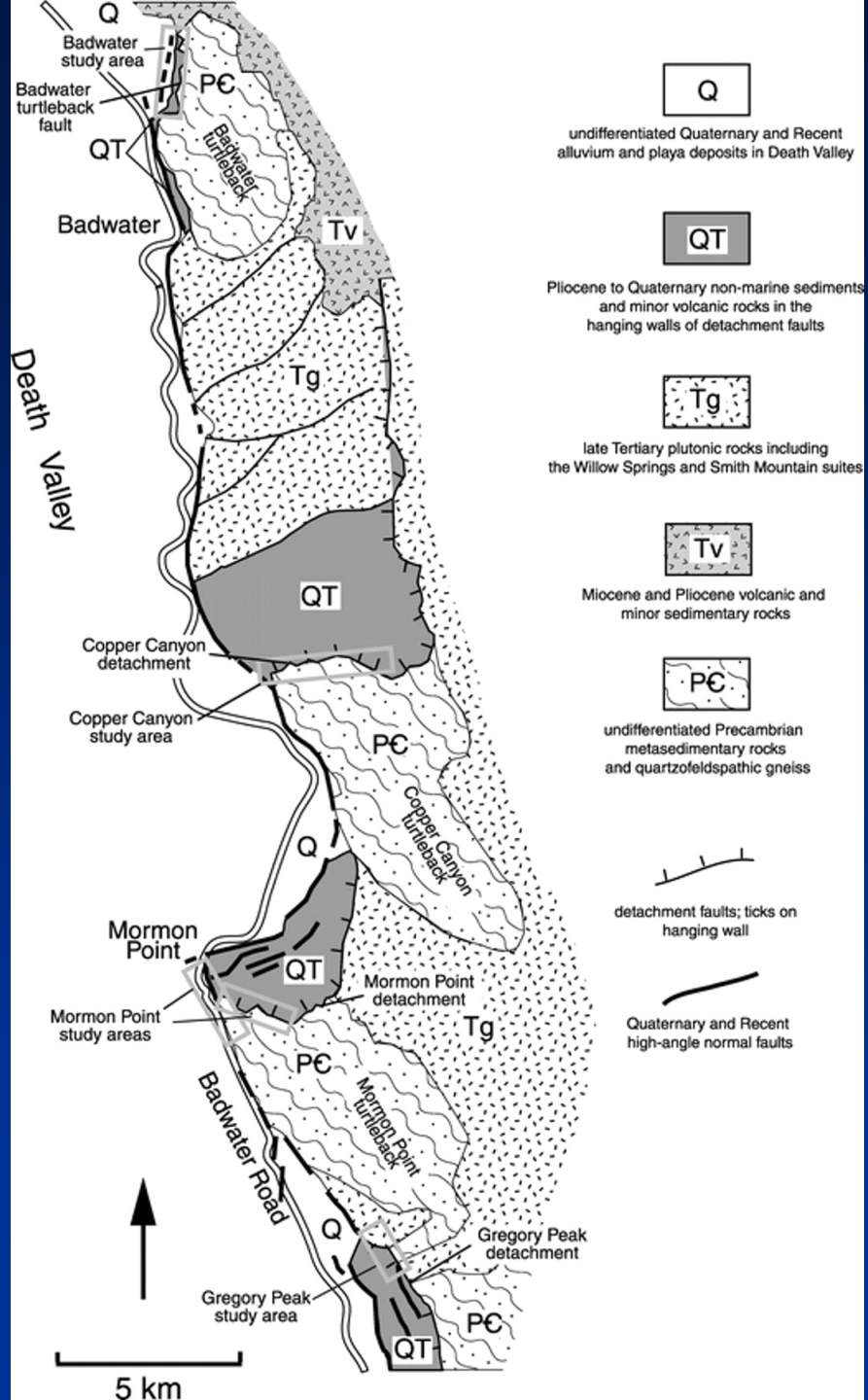
Metamorphic Rocks

Precambrian gneiss



Da Bryant Miller M.

Valle della morte
(Basin & Range)



Q

undifferentiated Quaternary and Recent alluvium and playa deposits in Death Valley

QT

Pliocene to Quaternary non-marine sediments and minor volcanic rocks in the hanging walls of detachment faults

Tg

late Tertiary plutonic rocks including the Willow Springs and Smith Mountain suites

Tv

Miocene and Pliocene volcanic and minor sedimentary rocks

PC

undifferentiated Precambrian metasedimentary rocks and quartzofeldspathic gneiss

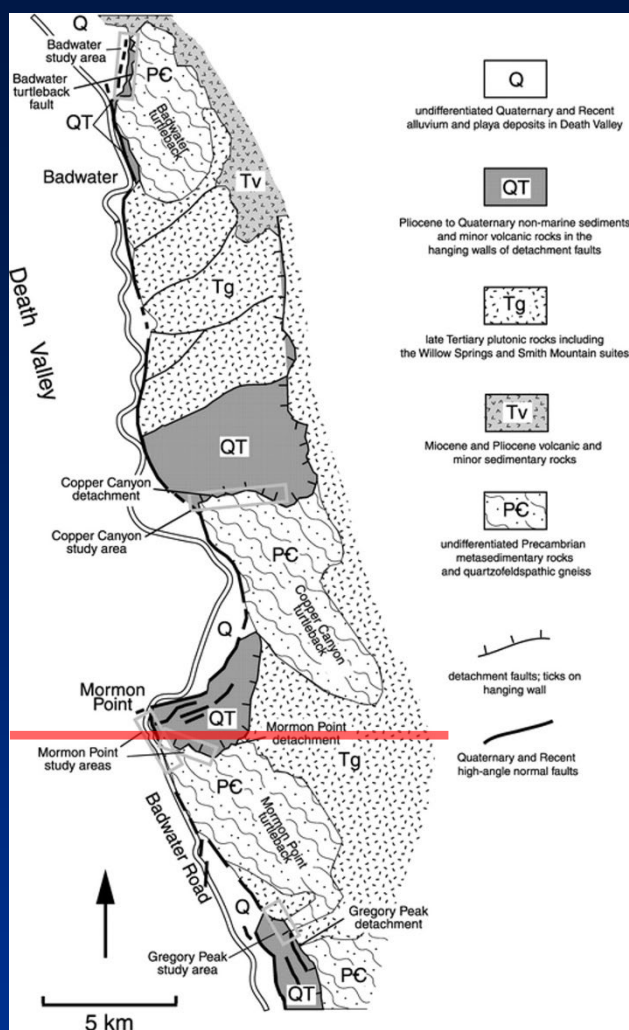


detachment faults; ticks on hanging wall

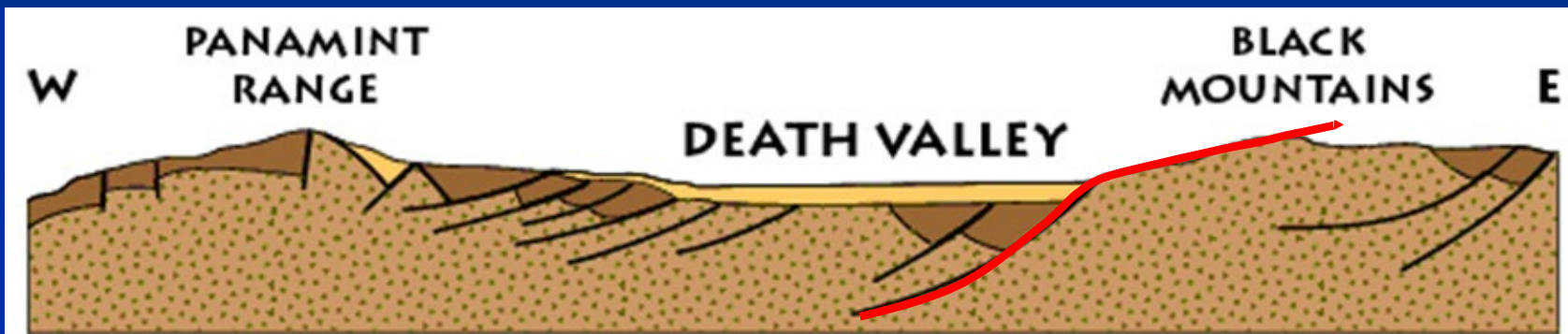


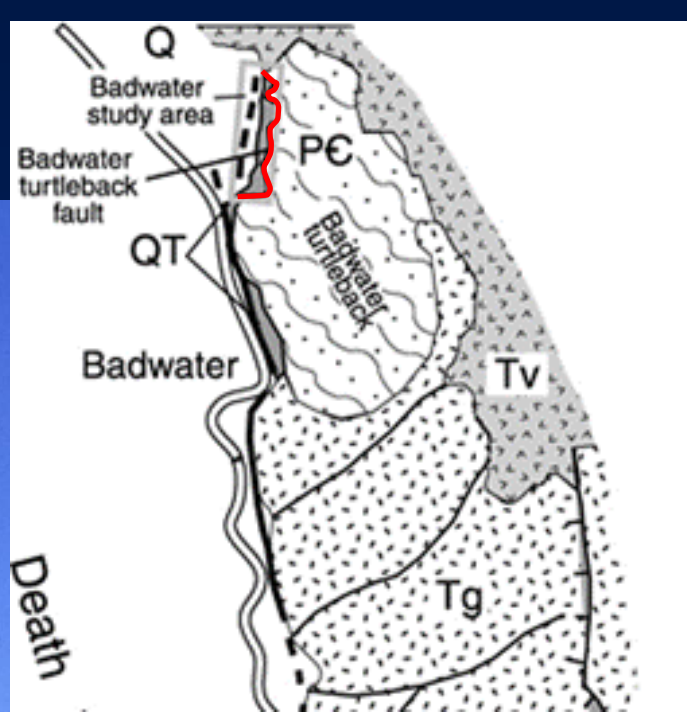
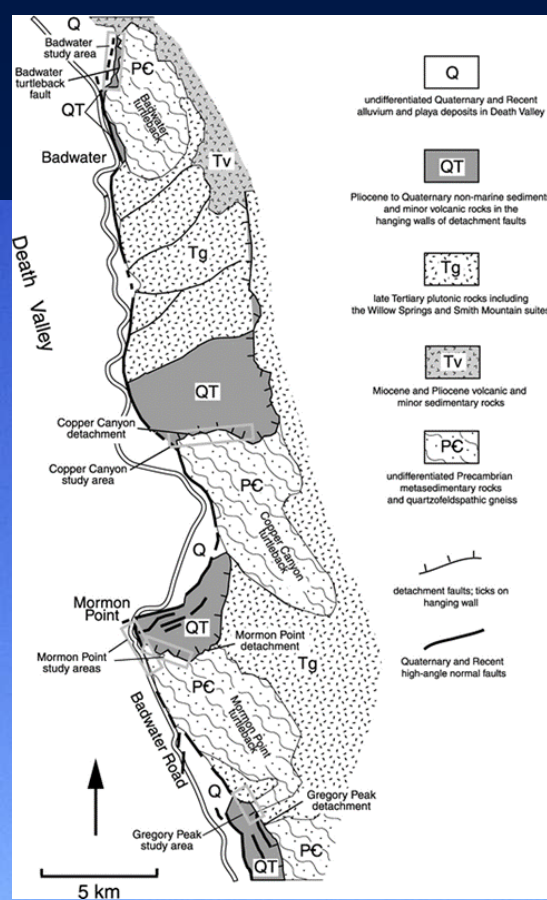
Quaternary and Recent high-angle normal faults

5 km



USGS Geology of Death Valley National Park

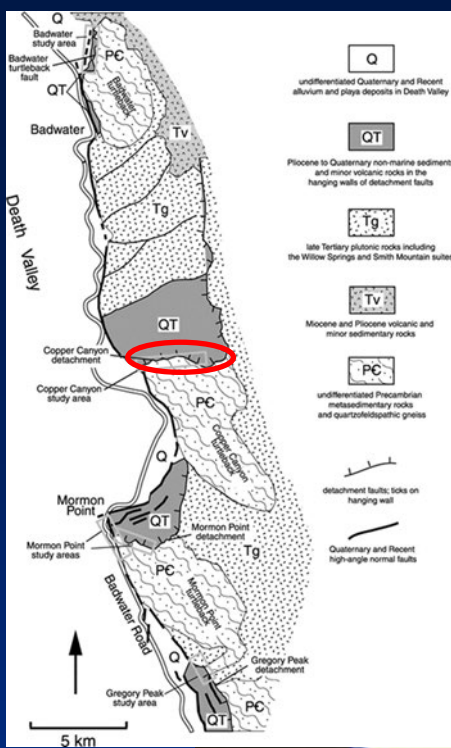




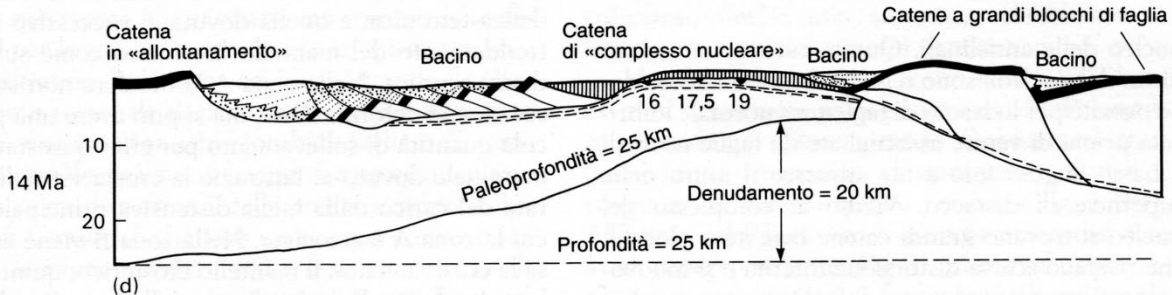
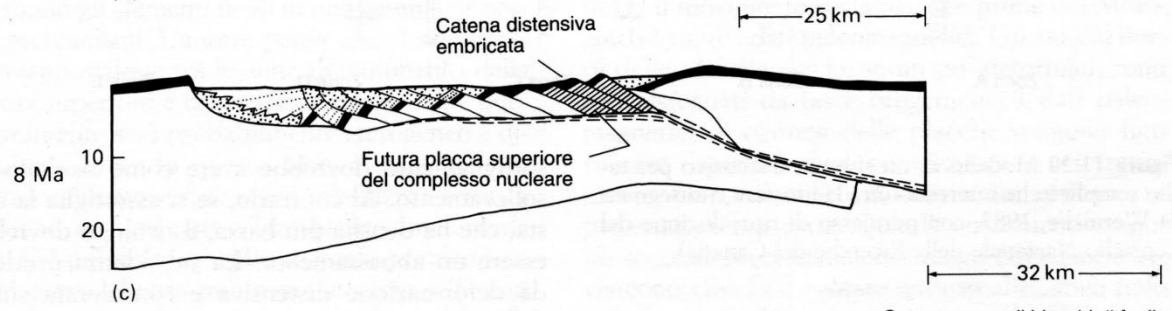
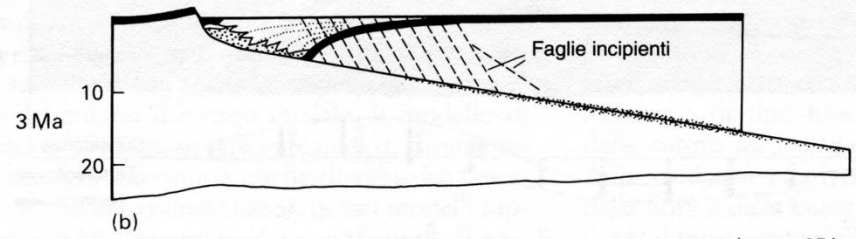
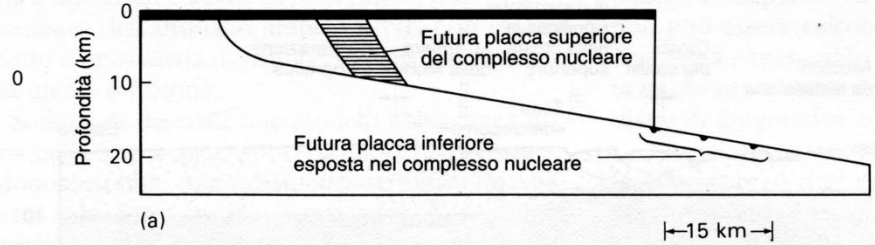
Badwater Turtleback normal fault



Badwater Turtleback normal fault: Copper Canyon fault zone

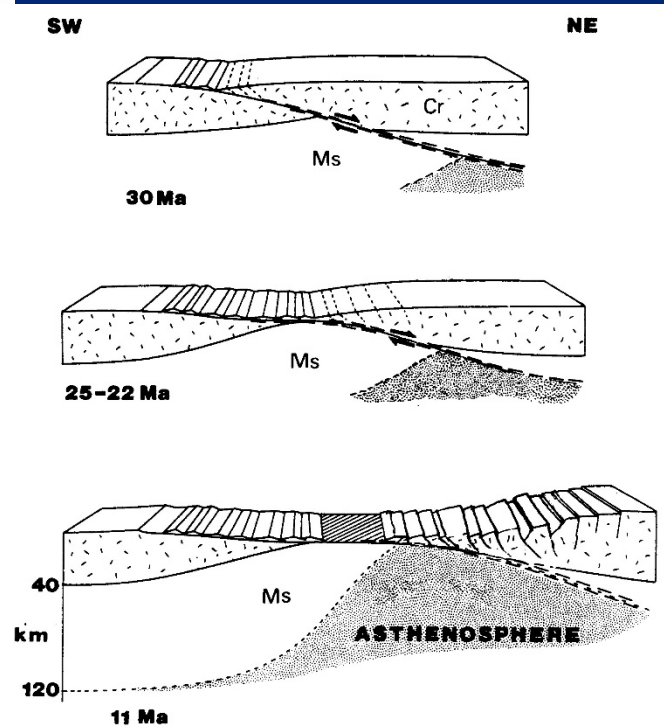


Tempo a 5 mm a^{-1}

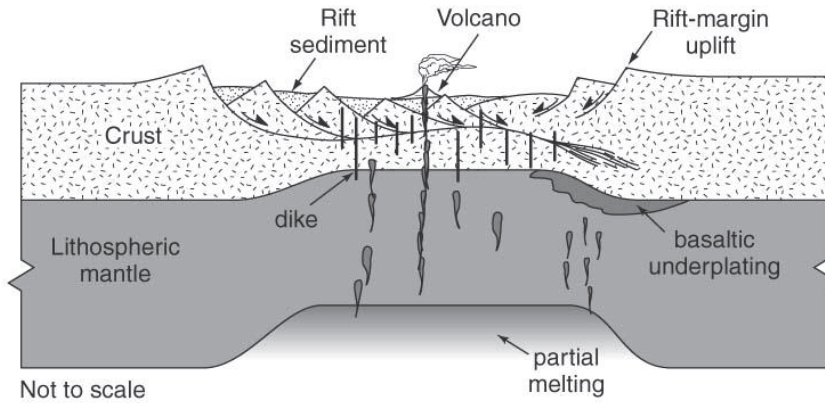


- Riferimento pre-orogenico
- Depositi clastici orogenici: fini-lacustri grossolani
- Rocce molto assottigliate e stirate
- Zona di taglio duttile
- 16,5 Paleoprodifità della placca inferiore del «complesso nucleare»

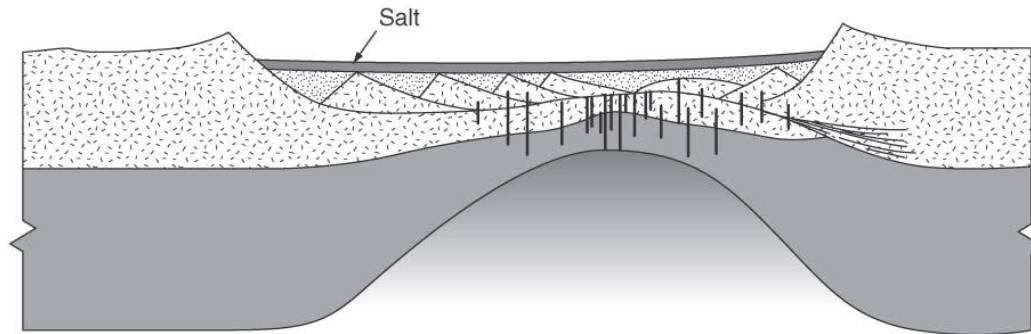
Estensione totale = 72 km (100%)



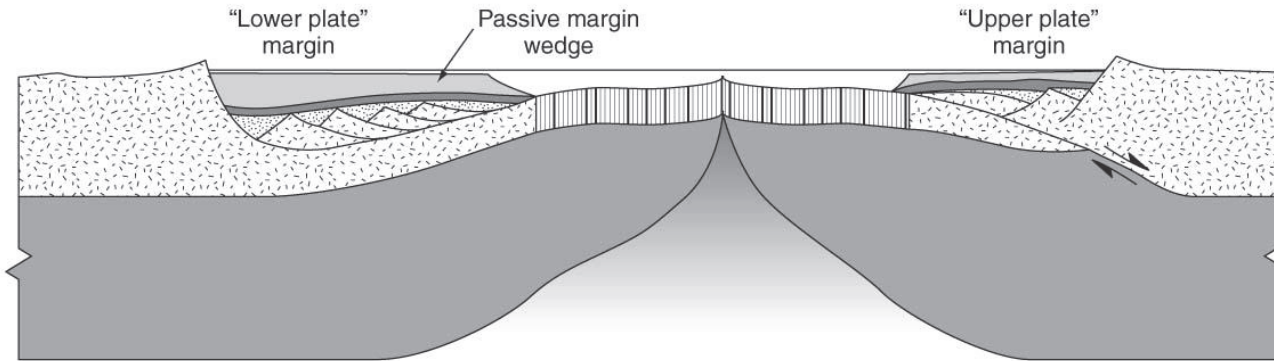
Da van der Pluijm & Marshak, 2004



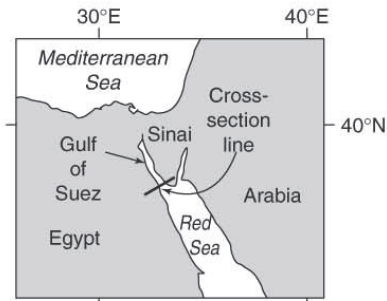
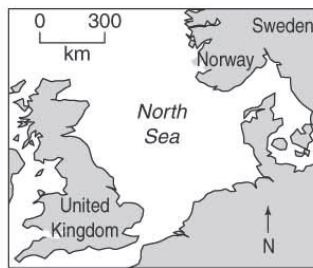
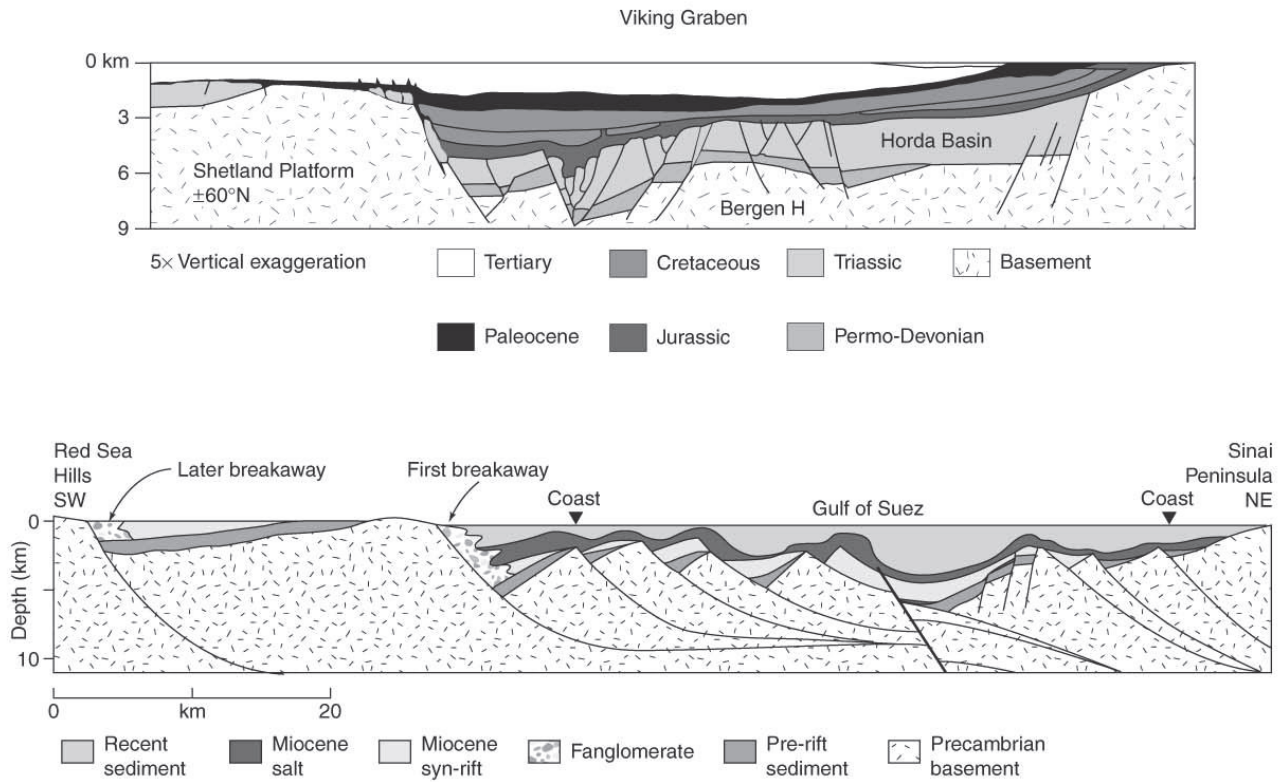
(a)



(b)



(c)



Da van der Pluijm & Marshak, 2004

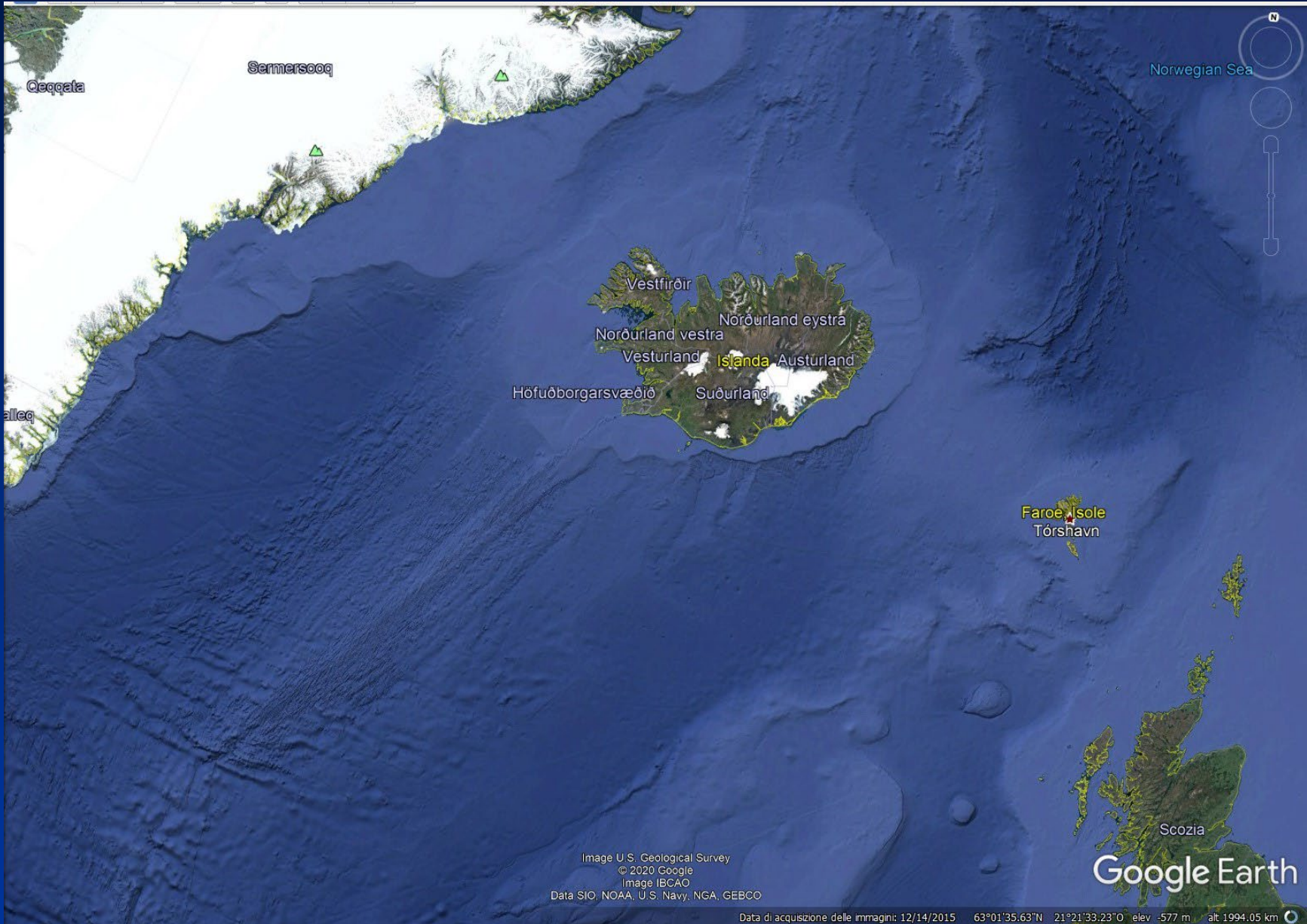
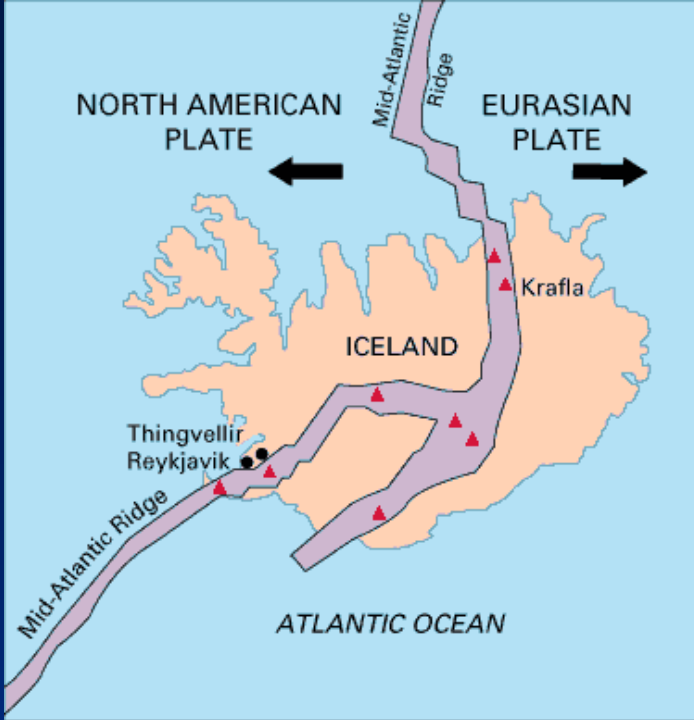


Image U.S. Geological Survey
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Image IBCAO
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

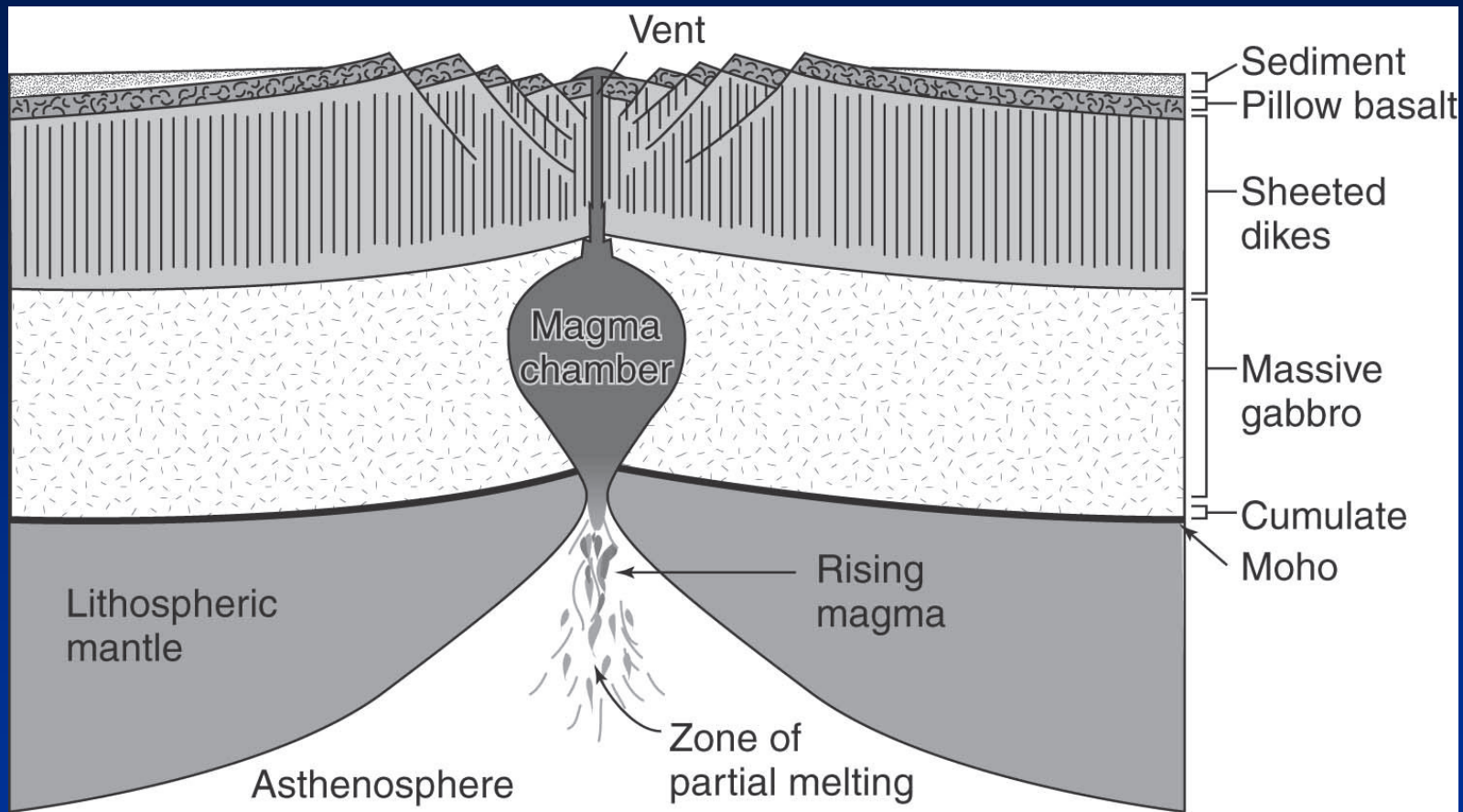
Google Earth

USGS:
<https://pubs.usgs.gov/gip/dynamic/understanding.html>

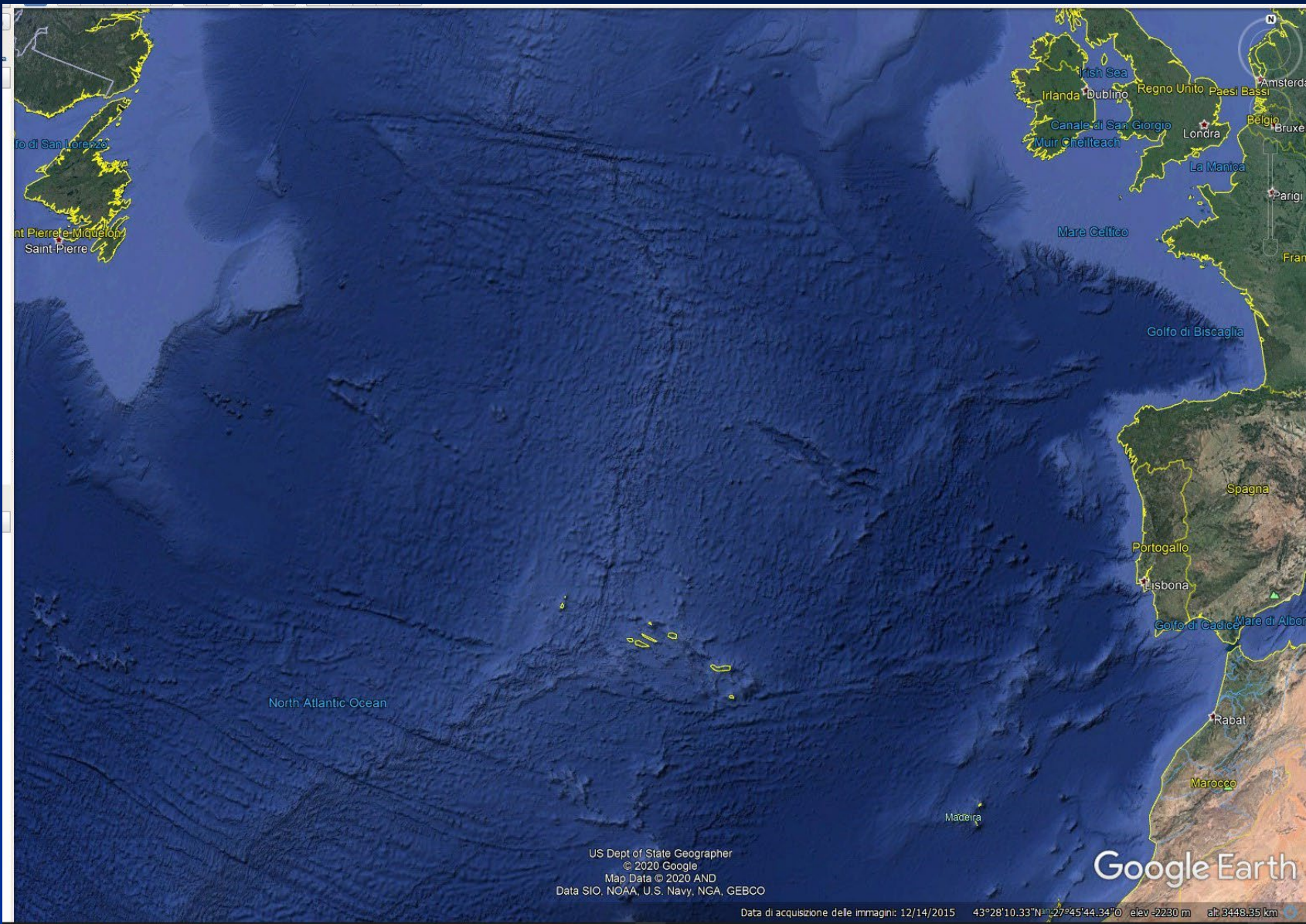


Thingvellir National Park, Iceland

https://commons.wikimedia.org/wiki/File:Iceland_mid_atlantic_ridge.JPG



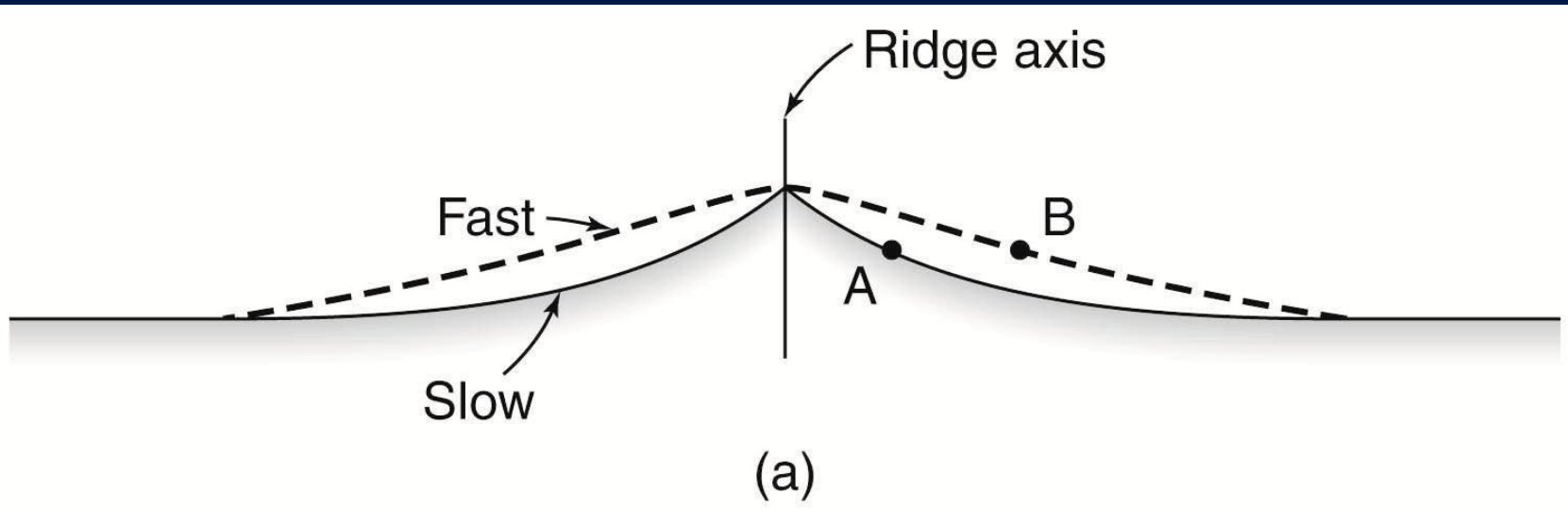
Da van der Pluijm & Marshak, 2004



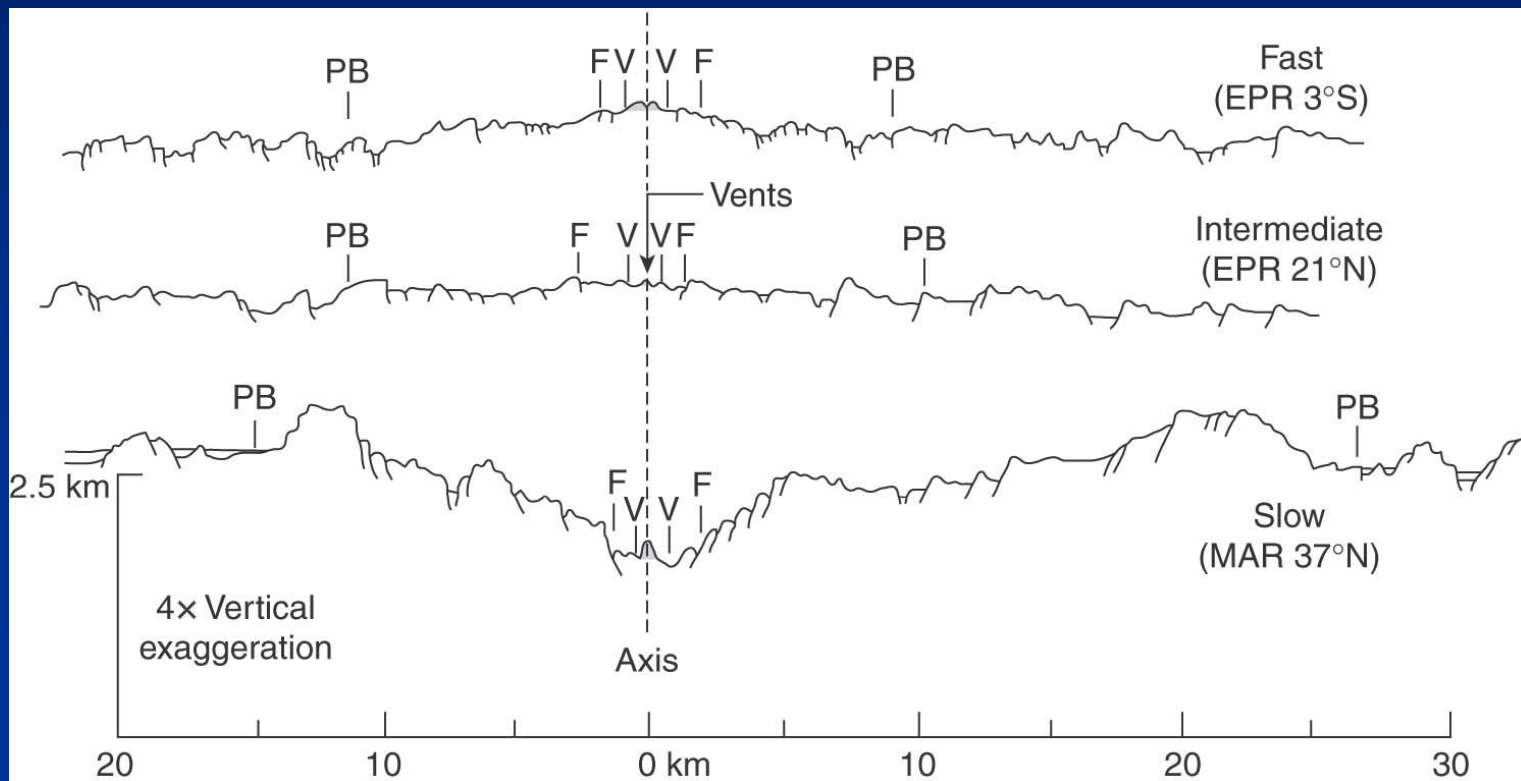
US Dept of State Geographer
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google Earth

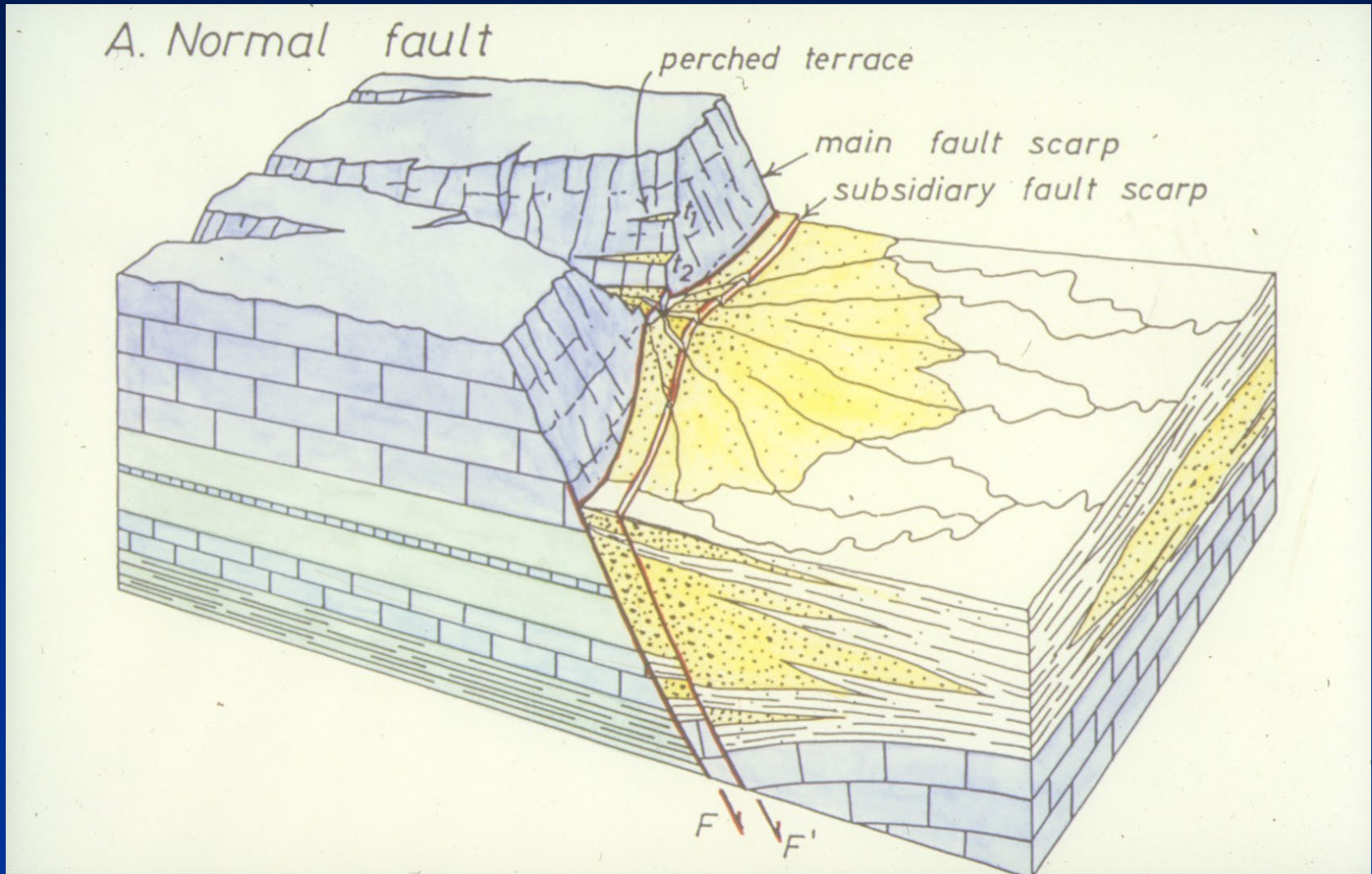
Data di acquisizione delle immagini: 12/14/2015 43°28'10.33"N 127°45'44.34"O elev -2230 m alt 3448.35 km



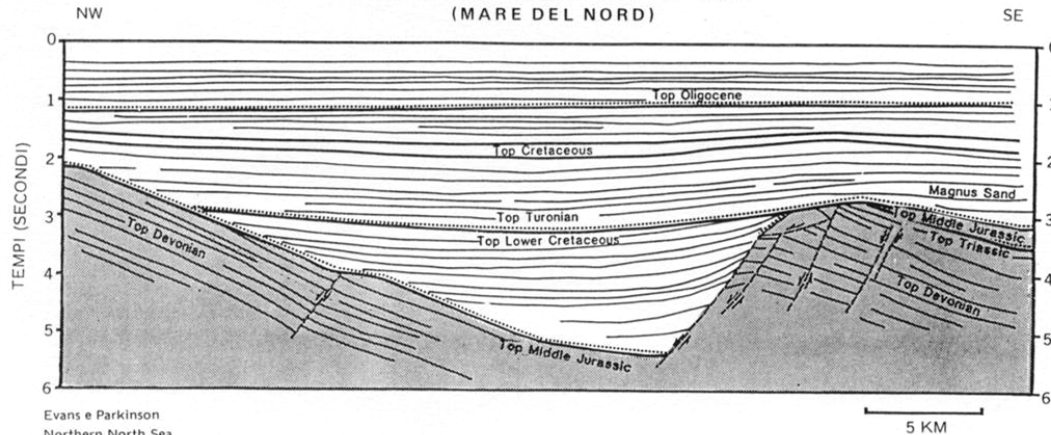
Da van der Pluijm & Marshak, 2004



Faglia normale associata ad erosione (letto) e deposizione (sul lembo di tetto). La forma del bacino sedimentario e la stratigrafia dei depositi è controllata dalla attività della faglia



SEMIGRABEN DEL NORD SHETLAND
(MARE DEL NORD)

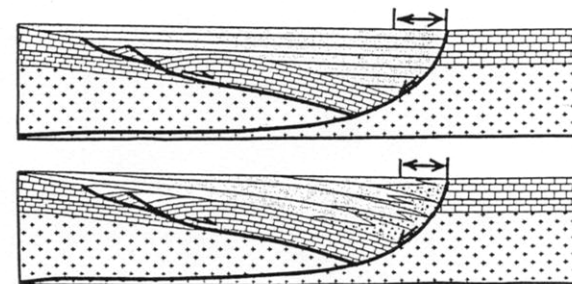
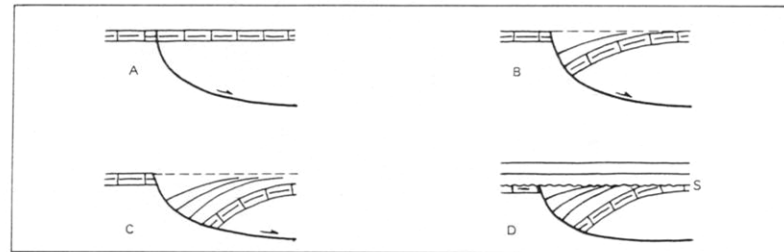


Evans e Parkinson
Northern North Sea
AAPG Studies in Geology Series 15 II (2.2.2 - 9)

Velocità di attivazione della faglia elevata, basso tasso di sedimentazione

Da Bally et al., 1985

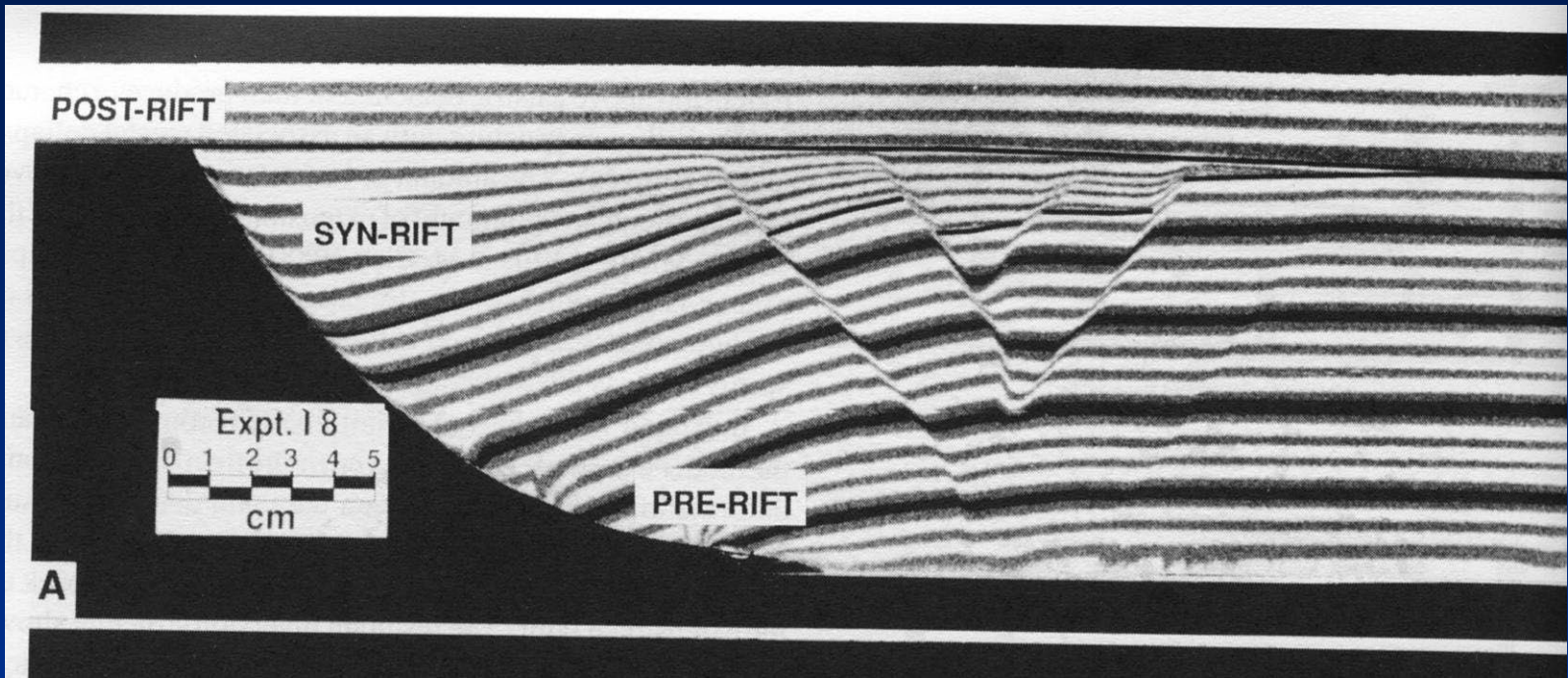
Tasso di sedimentazione elevato, movimento della faglia protratto nel tempo.



I due casi precedenti a confronto

Da Bally et al., 1985

Depositi di pre-, sin- e post-rift.



Da Buchanan & McClay, 1991