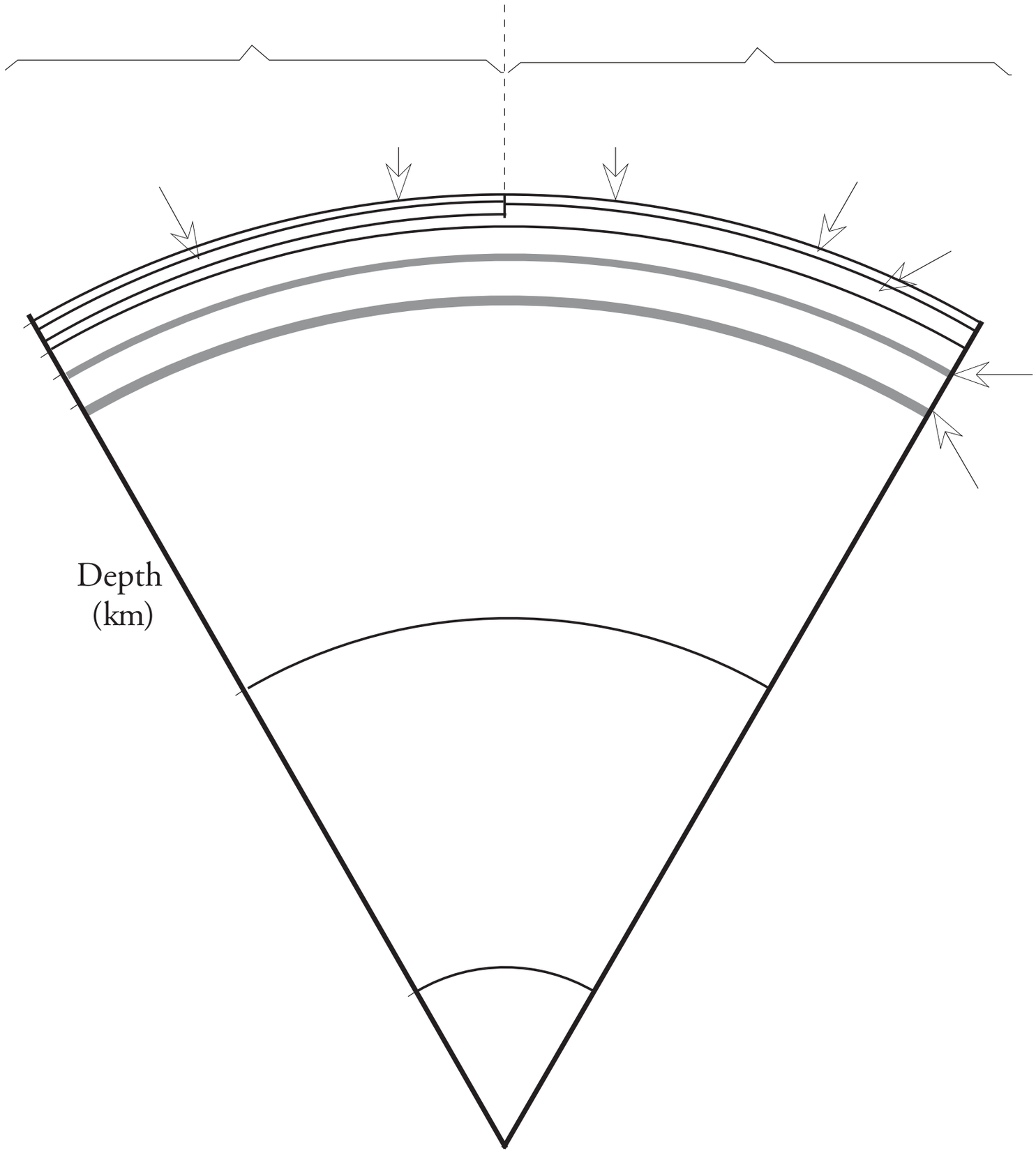
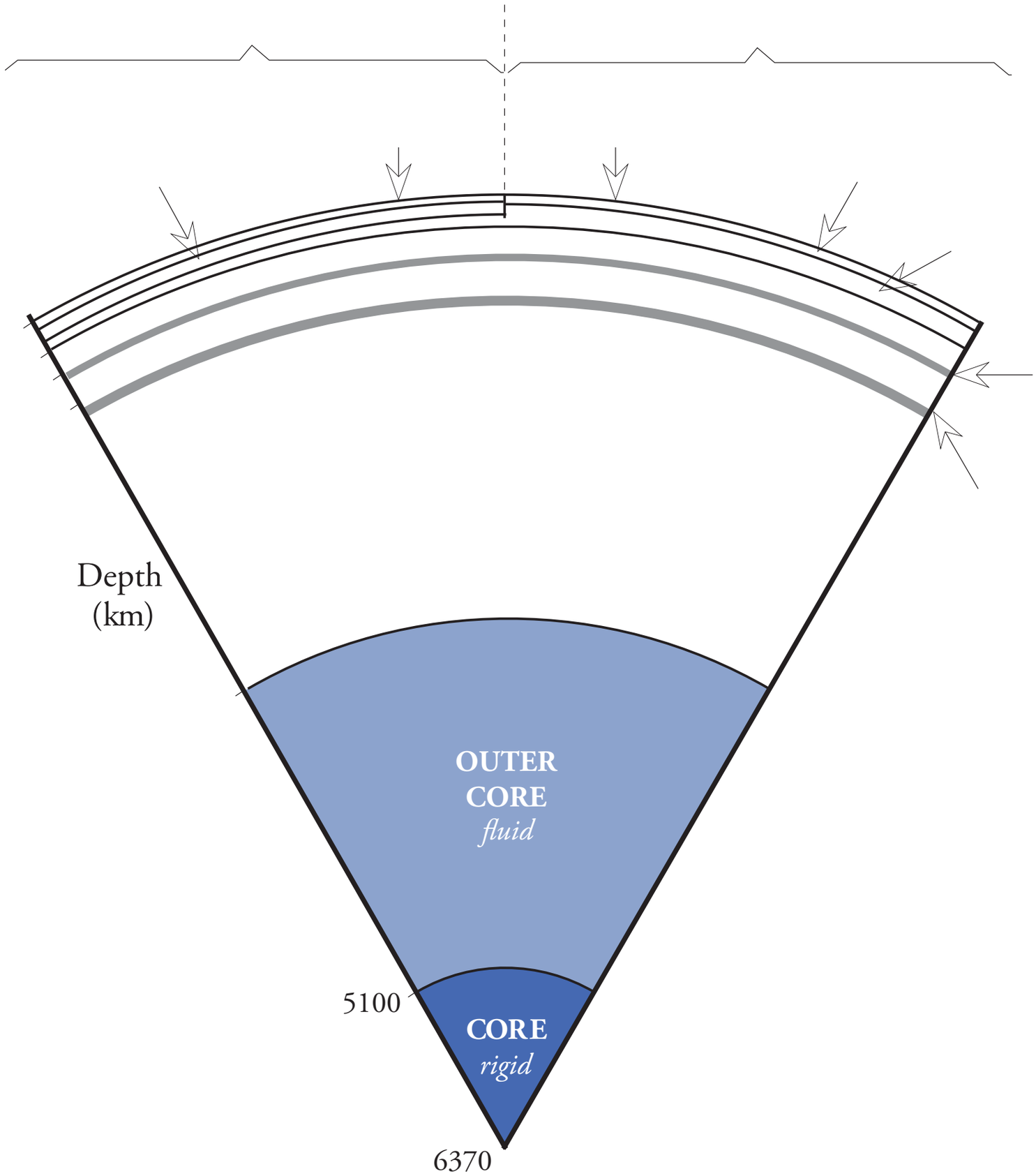
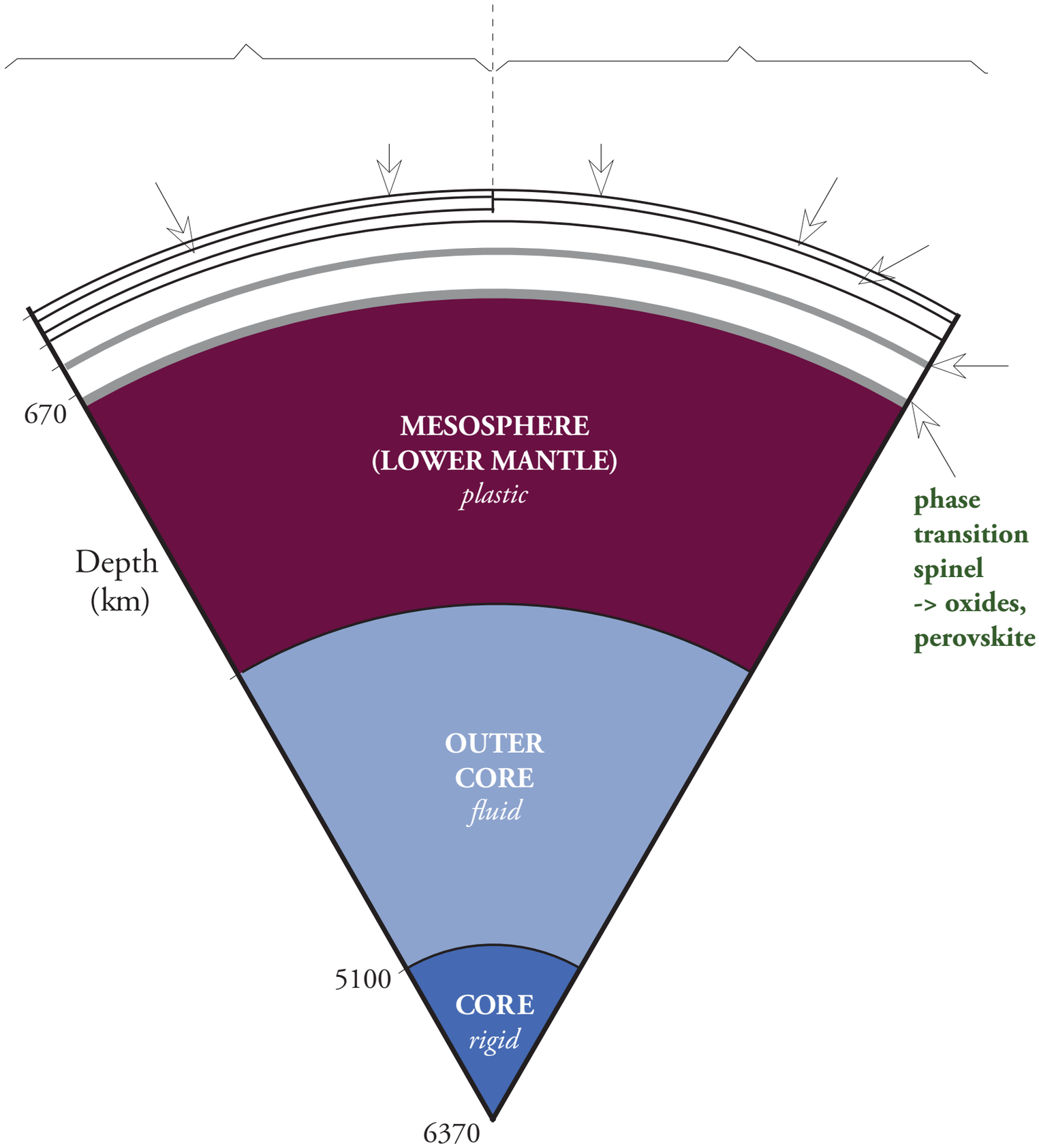
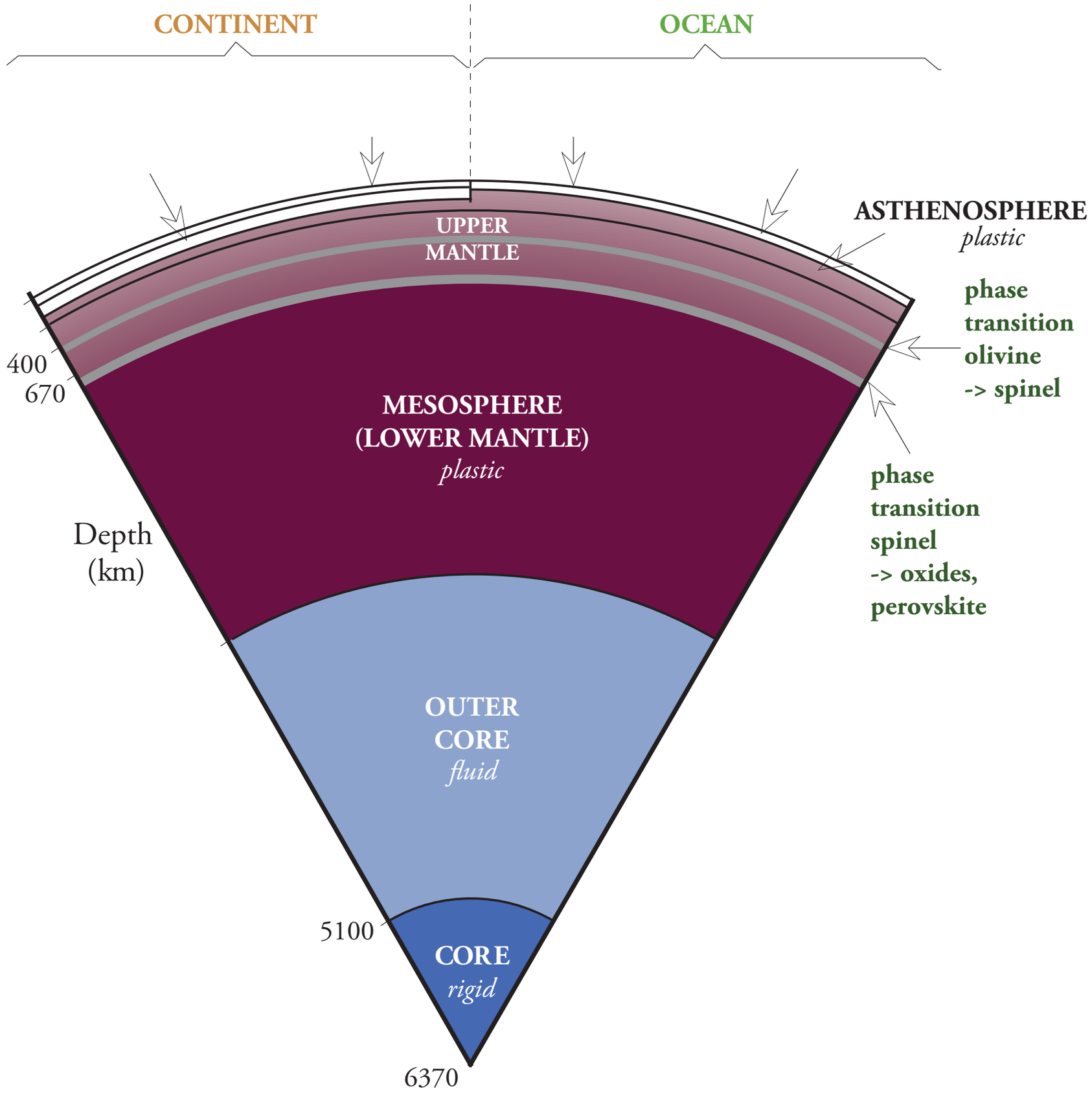
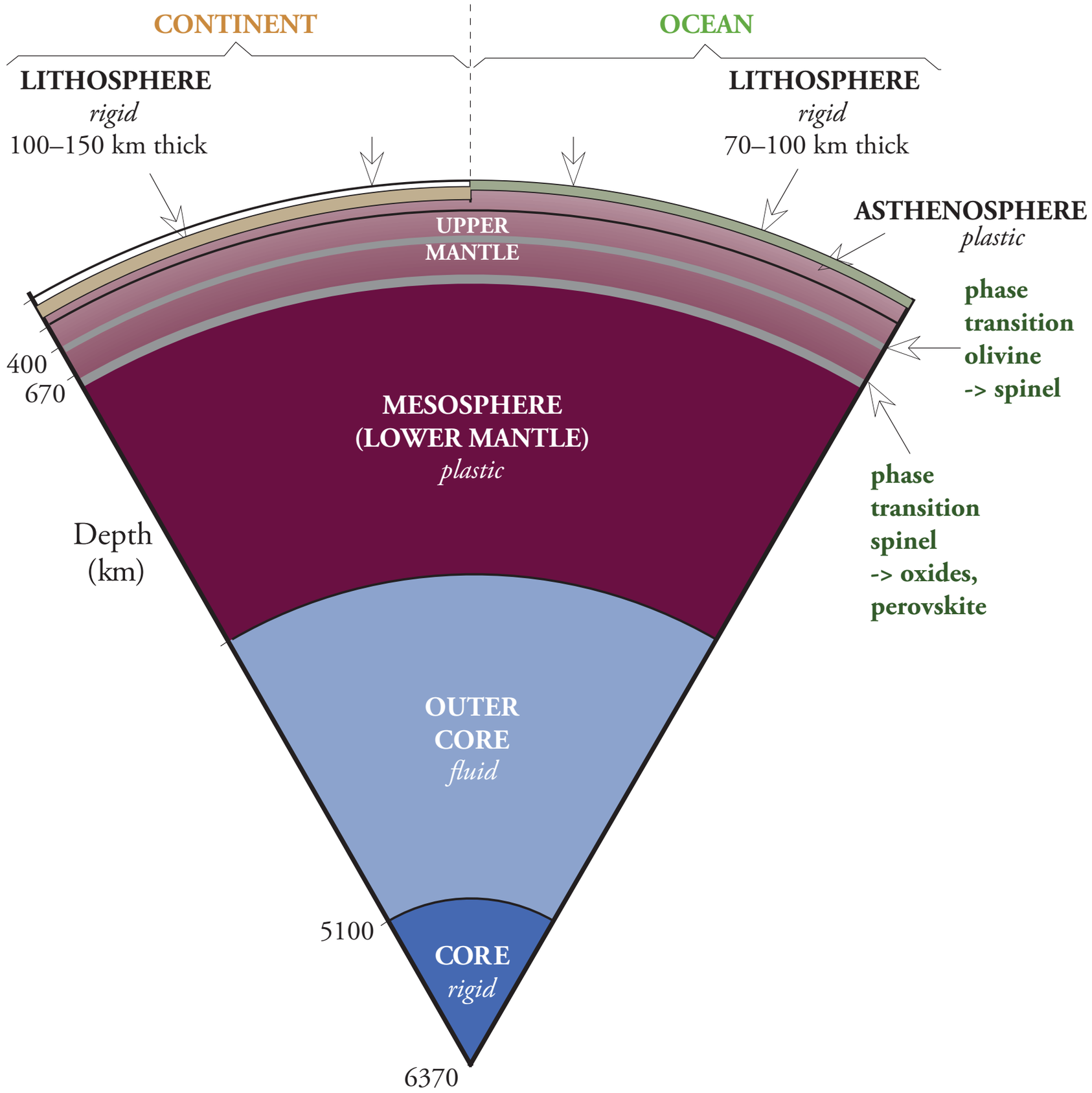

Depth
(km)


Depth
(km)
OUTER
CORE
fluid
5100
CORE
rigid
6370


670
MESOSPHERE
(LOWER MANTLE)
plastic
Depth
(km)
phase
transition
spinel
-> oxides,
perovskite
OUTER
CORE
fluid
5100
CORE
rigid
6370

R. Bousquet


CONTINENT
OCEAN
UPPER
MANTLE
ASTHENOSPHERE
plastic
phase
transition
olivine
-> spinel
400
670
MESOSPHERE
(LOWER MANTLE)
plastic
phase
transition
spinel
-> oxides,
perovskite
Depth
(km)
OUTER
CORE
fluid
5100
CORE
rigid
6370


CONTINENT
OCEAN
LITHOSPHERE
rigid
100–150 km thick
LITHOSPHERE
rigid
70–100 km thick
ASTHENOSPHERE
plastic
UPPER
MANTLE
phase
transition
olivine
-> spinel
400
670
MESOSPHERE
(LOWER MANTLE)
plastic
phase
transition
spinel
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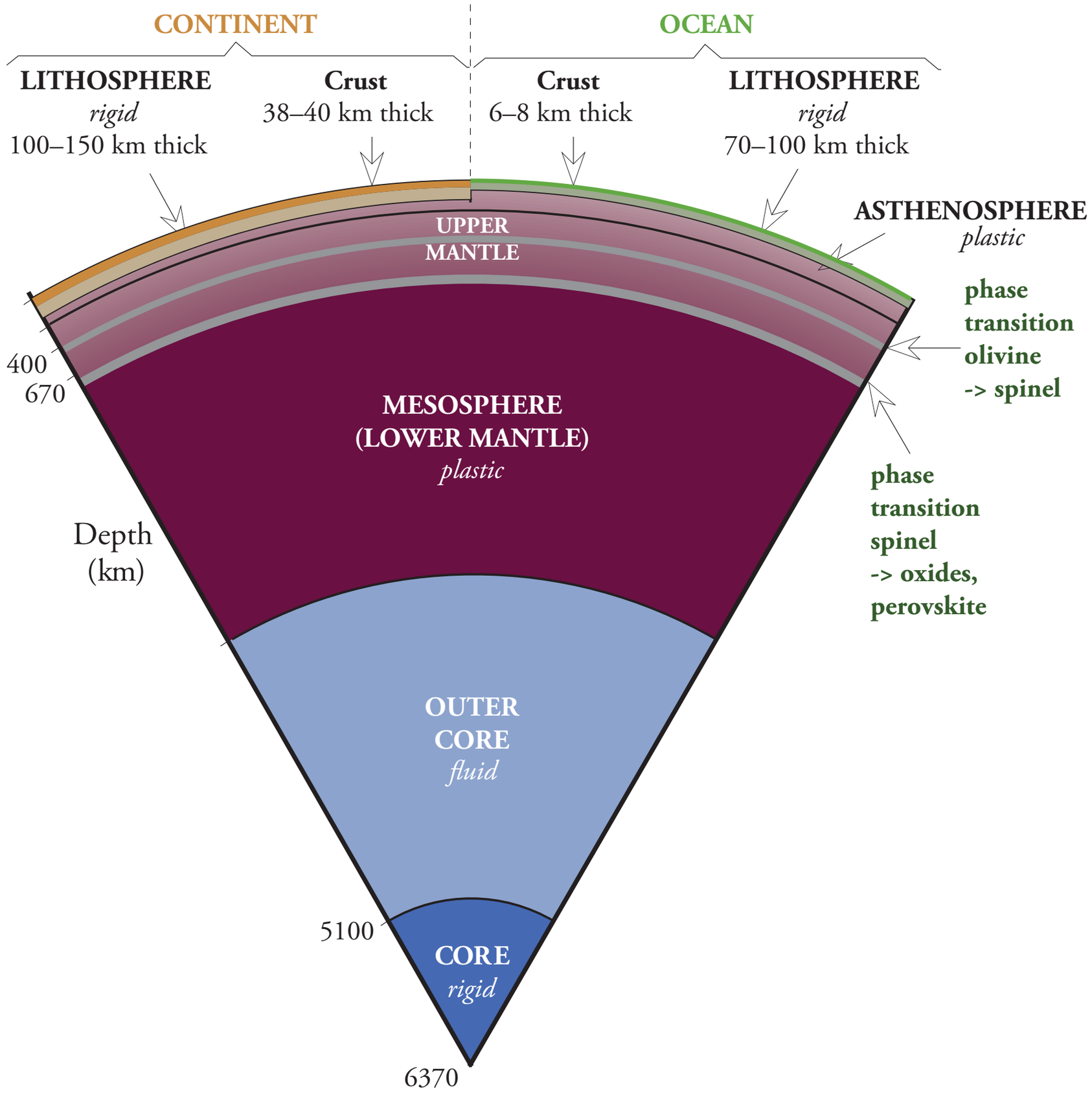
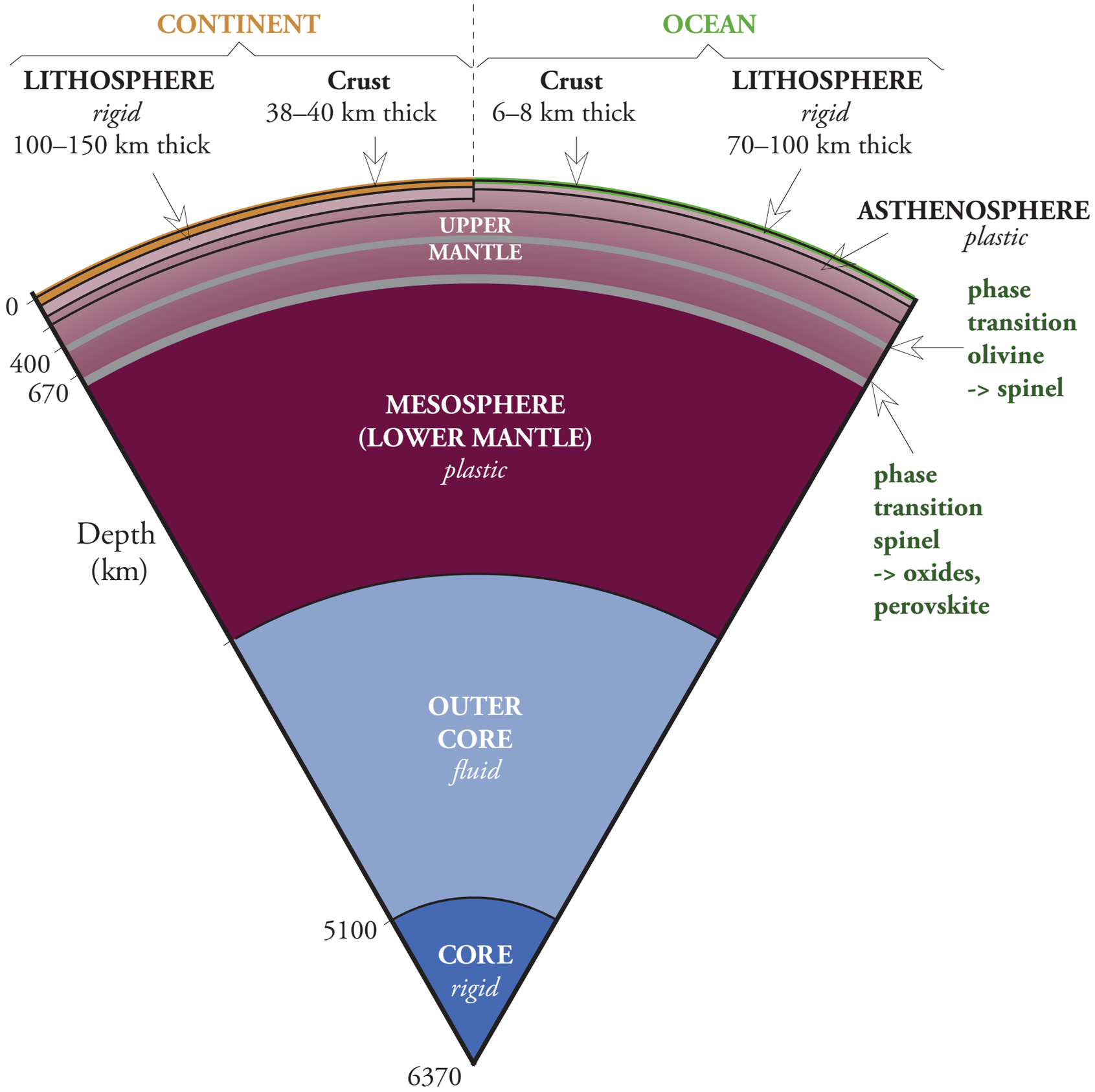
perovskite
Depth
(km)
OUTER
CORE
fluid
5100
CORE
rigid
6370

R. Bousquet


CONTINENT
OCEAN
LITHOSPHERE
rigid
100–150 km thick
Crust
38–40 km thick
Crust
6–8 km thick
LITHOSPHERE
rigid
70–100 km thick
ASTHENOSPHERE
plastic
UPPER
MANTLE
400
670
MESOSPHERE
(LOWER MANTLE)
plastic
phase
transition
olivine
-> spinel
phase
transition
spinel
-> oxides,
perovskite
Depth
(km)
OUTER
CORE
fluid
5100
CORE
rigid
6370

R. Bousquet


CONTINENT
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UPPER
MANTLE
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olivine
-> spinel
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OUTER
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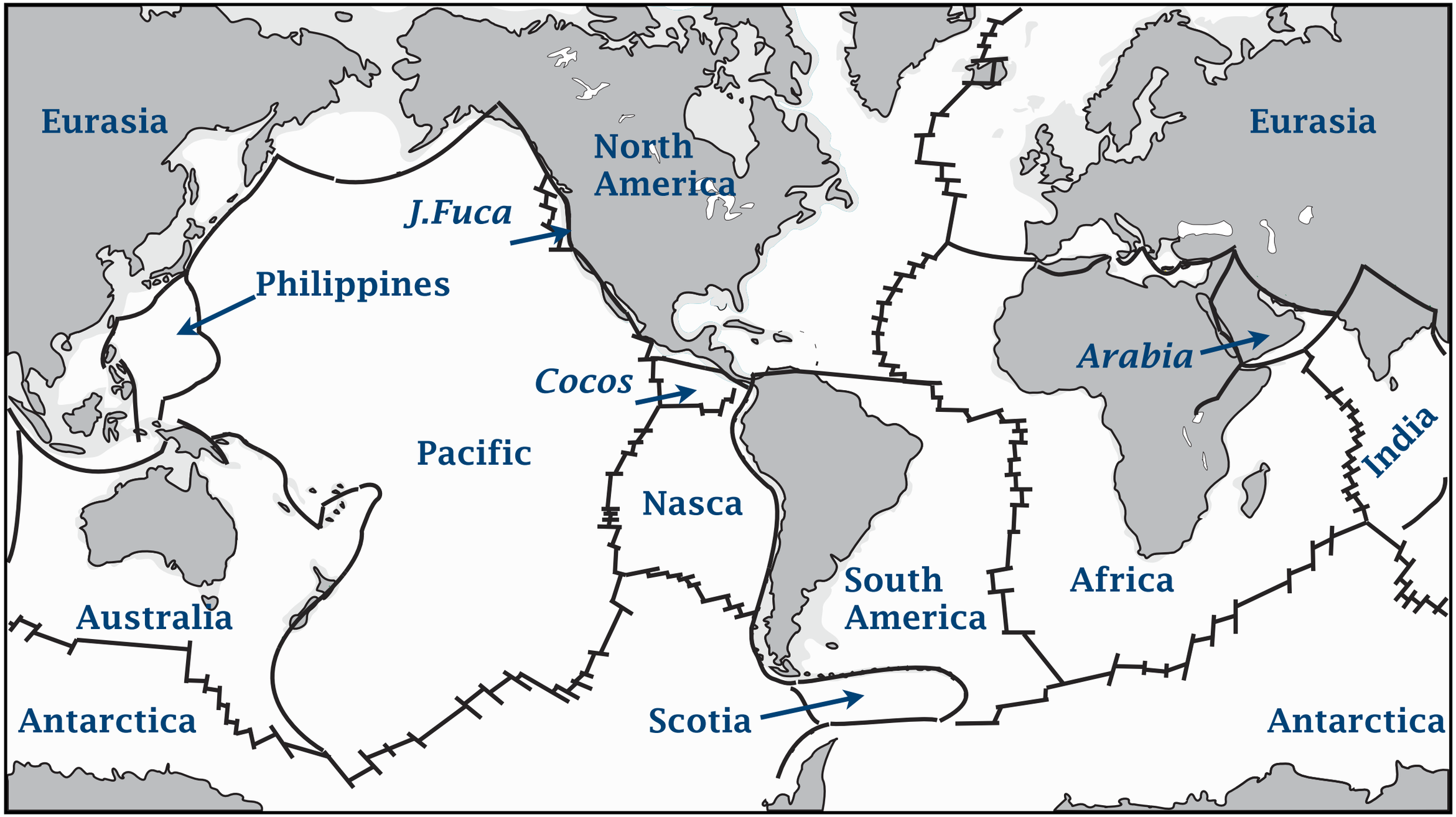
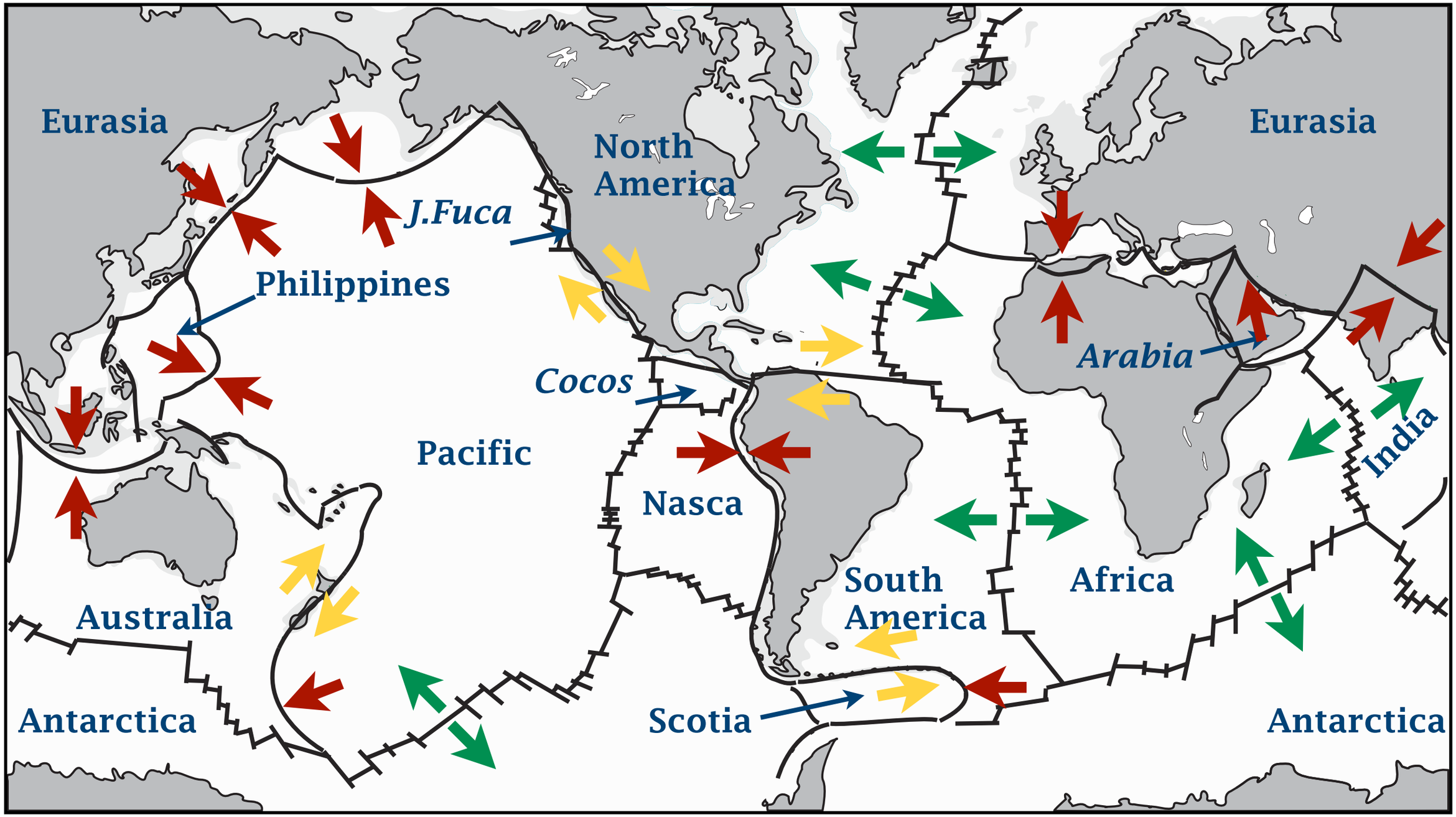
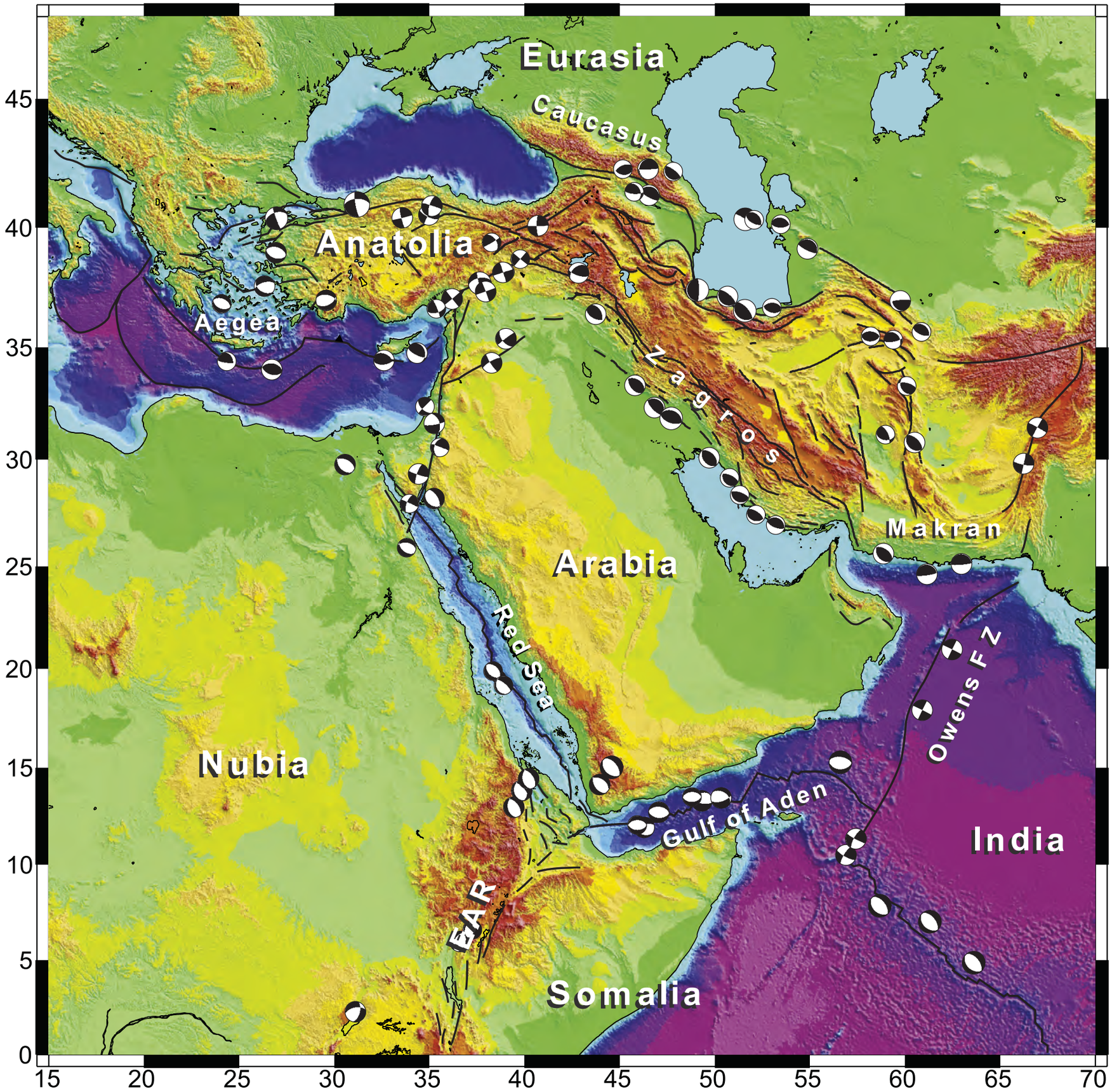
R. Bousquet


Eurasia
North America
J.Fuca
Philippines
Eurasia
Arabia
Cocos
India
Pacific
Nasca
South America
Africa
Australia
Antarctica
Scotia
Antarctica


Eurasia
North America
Eurasia
J.Fuca
Philippines
Arabia
Cocos
India
Pacific
Nasca
South America
Africa
Australia
Antarctica
Scotia
Antarctica

Topographie des Ozeanboden



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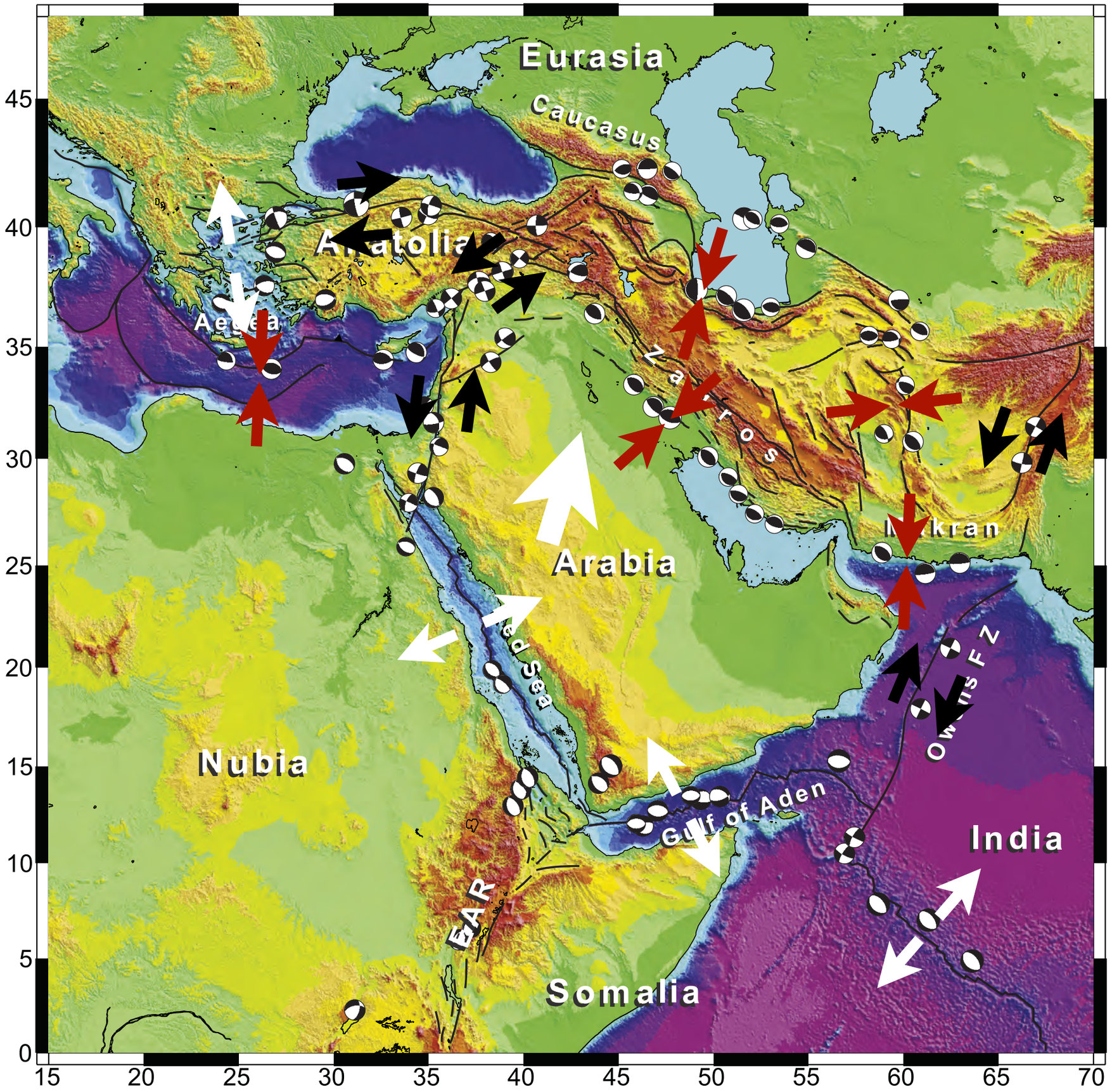
Topographie des Ozeanboden



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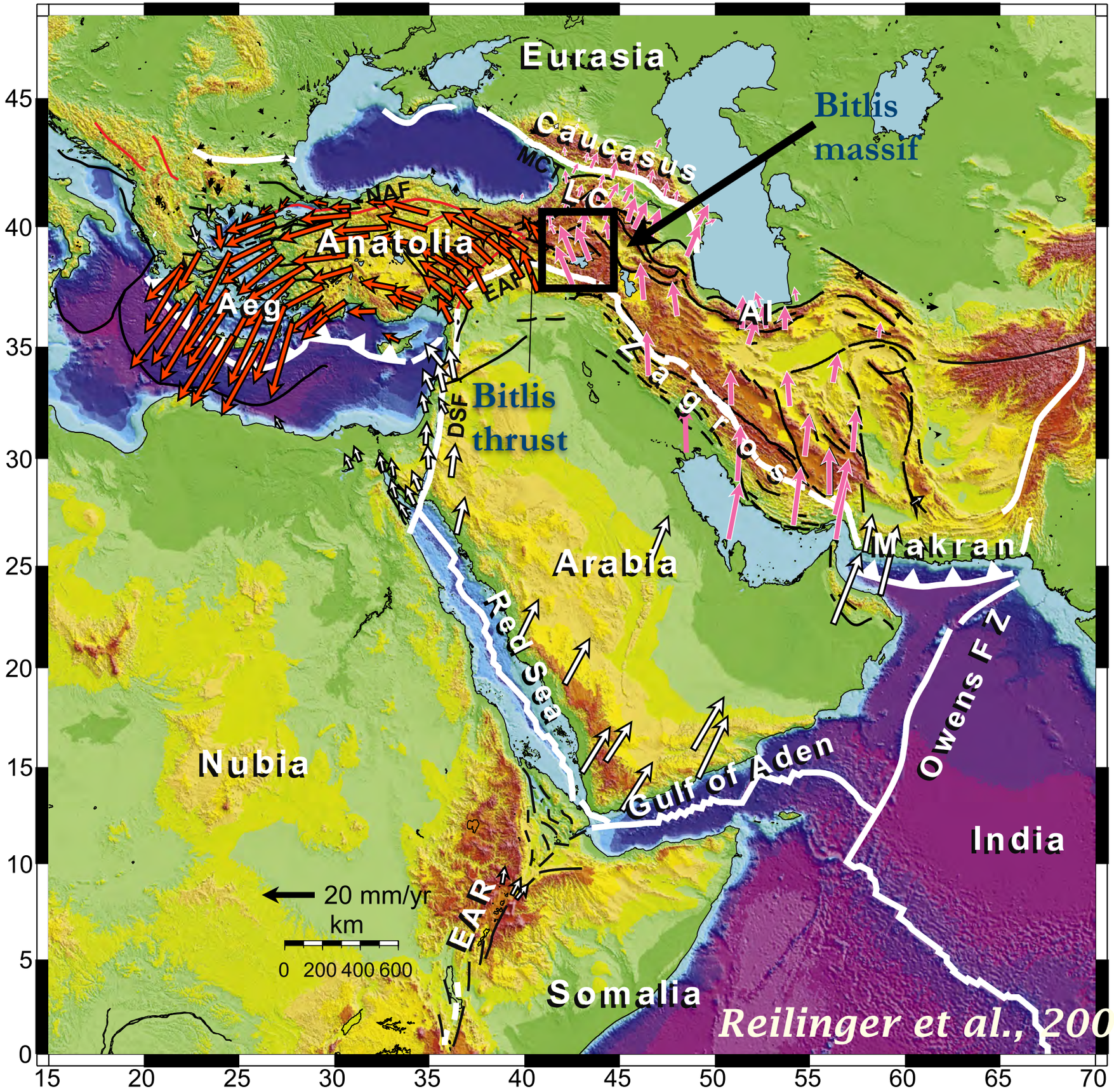
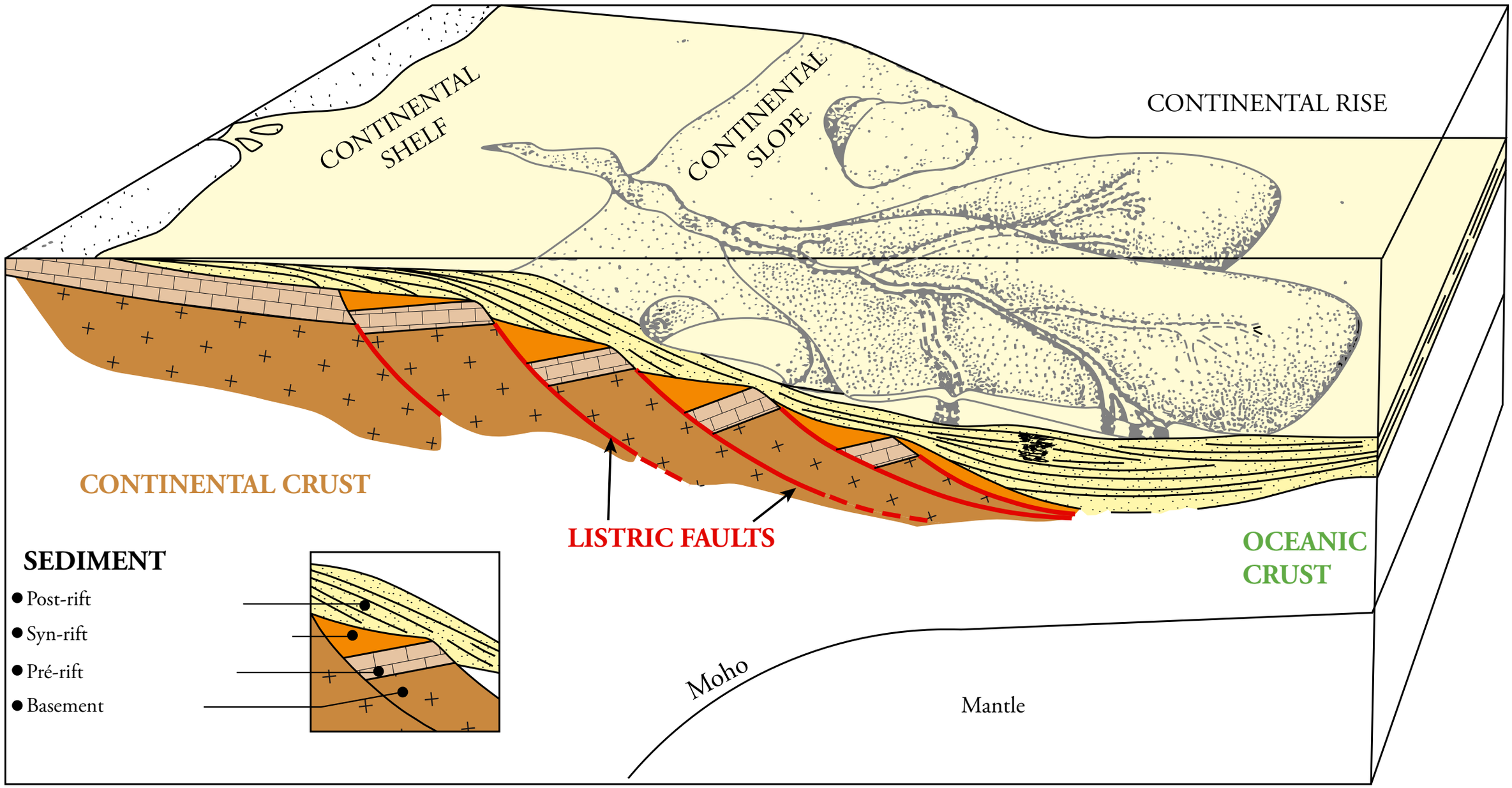
Introduction



Reilinger et al., 2006

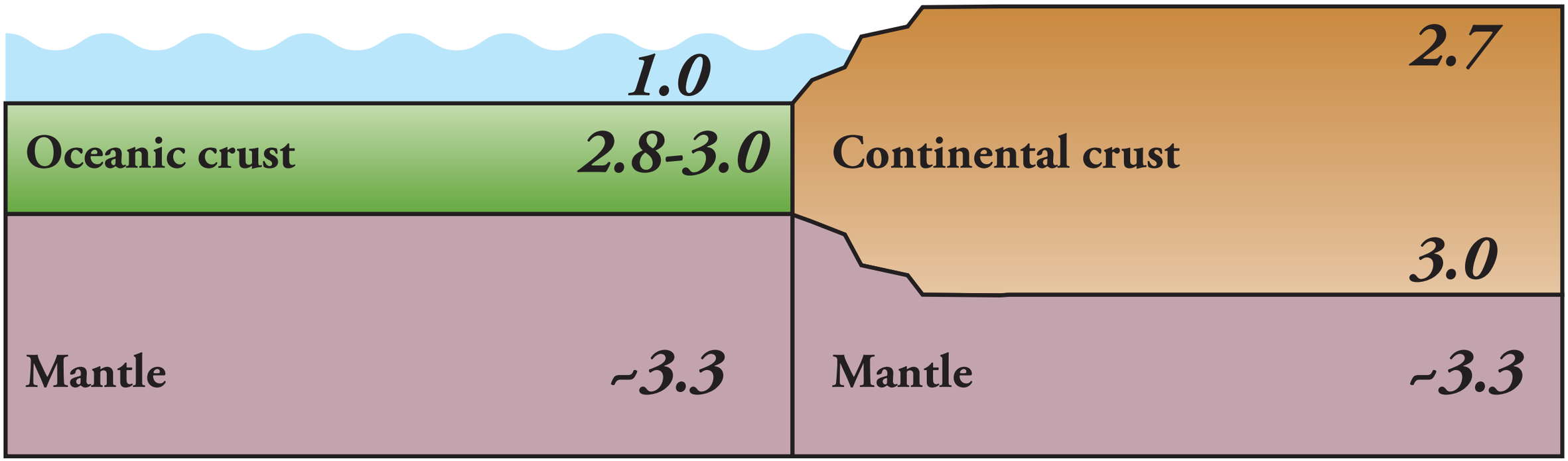

CONTINENTAL SHELF
CONTINENTAL SLOPE
CONTINENTAL RISE
CONTINENTAL CRUST
LISTRIC FAULTS
OCEANIC CRUST
SEDIMENT
Post-rift
Syn-rift
Pré-rift
Basement
Moho
Mantle

R. Bousquet

- ✓ *Warum gibt es Wasser in den Ozean und selten auf den Kontinenten?*
- ✓ *Wie wird die Wärme in der Erde transportiert ?*
- ✓ *Wo gibt es in der Erde keine S-Wellen? Warum?*
- ✓ *Was sagt die Raleigh Nummer (Ra) ?...*

✓ *Warum gibt es Wasser in den Ozean und selten auf den Kontinenten?*

Isostasie:



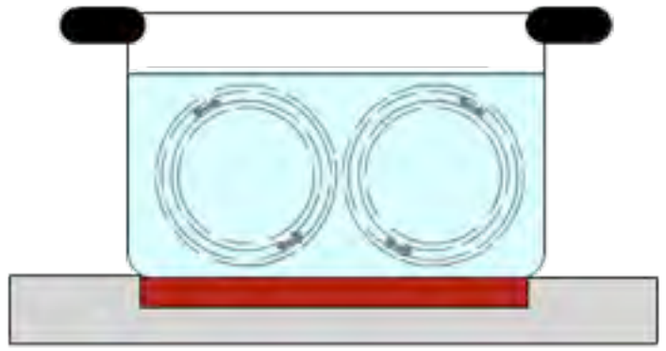
Der Transport der Wärme

Conduction

Crystal lattice interaction:
Heat ↑ => Vibrations of atoms ↑
Transfer of kinetic Energy

Convection

The heat is transferred by relative motion of portions of the heated body. (Fluids, Ice, Mantle rocks...)



✓ *Was sagt die Raleigh Nummer (Ra) ?...*

Whether or not convection takes place depends on the Rayleigh number, Ra

$$Ra = \frac{\rho_0 \cdot g_0 \cdot \alpha \cdot \Delta T \cdot d^3}{\kappa \cdot \eta} = \frac{\rho_0 \cdot g_0 \cdot \alpha \cdot \Delta T \cdot d}{\kappa \cdot \eta / d^2}$$

✓ *Was sagt die Raleigh Nummer (Ra) ?...*

$$Ra = \frac{buoyant\ pressure}{viscous\ pressure}$$

The higher value of Ra, the more likely for the buoyant movement of fluid to overcome viscous "resistance".

How can we tell if the mantle will actually convect? We see that the Rayleigh number is the ratio of buoyant pressure, tending to encourage flow, and viscous pressure, tending to resist flow. Obviously, there are Rayleigh numbers so low that viscous pressure wins and convection does not take place. And there are Rayleigh numbers so high that convection takes place readily. T ***here is obviously a value of Ra, called the critical Rayleigh number,*** *Rac, which is the boundary between these two regimes. That is, when Ra = Rac, then convection is just barely possible.*
The first thing one wants to ask when examining a natural system is the following: Does Ra exceed Rac? The critical Rayleigh number for convection in planets is about 1000.
The determination of mantle viscosity from glacial rebound data allowed an accurate estimate of the Rayleigh number of the Earth's mantle (other factors in Ra were much better known). The mantle was found to be unstable to convection. The same is true for the mantles of the other terrestrial planets. ***For the Earth's mantle, Ra is at least 100,000 times critical!!***