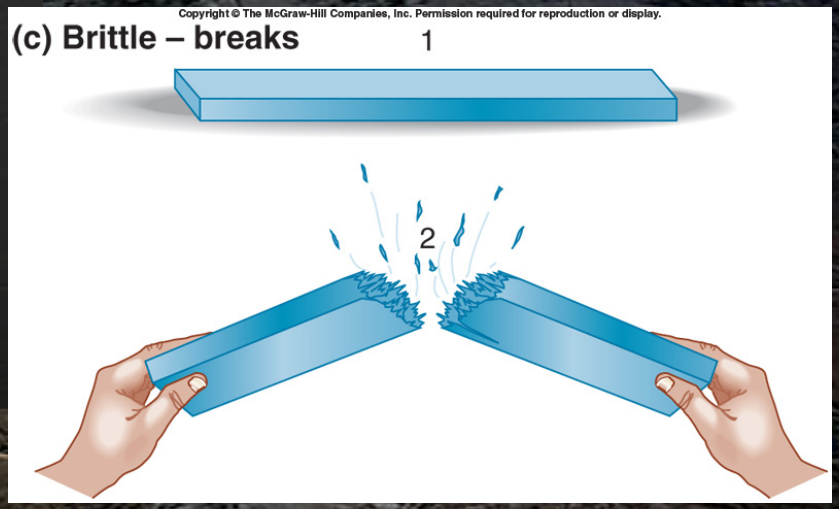
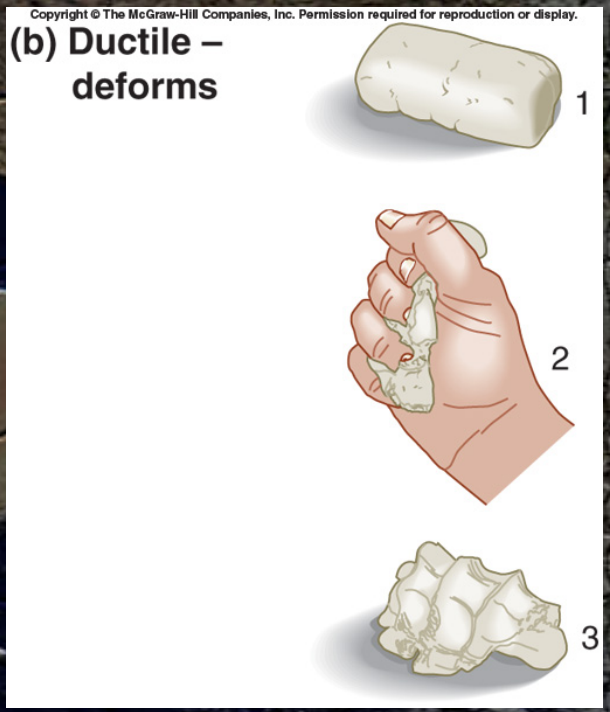
Elastic, Ductile and Brittle Material

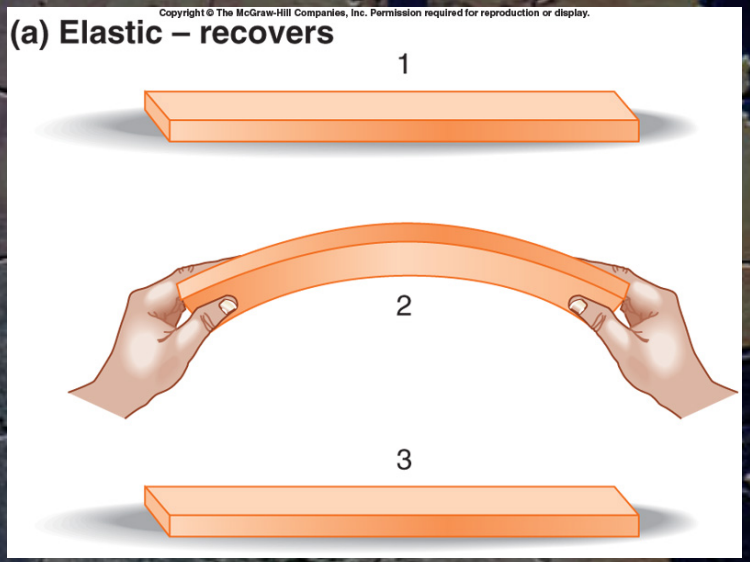
Fig 2.22

Response to Forces

- elastic: recovers
- ductile: deforms
  (e.g. under pressure/heat)
- brittle: breaks



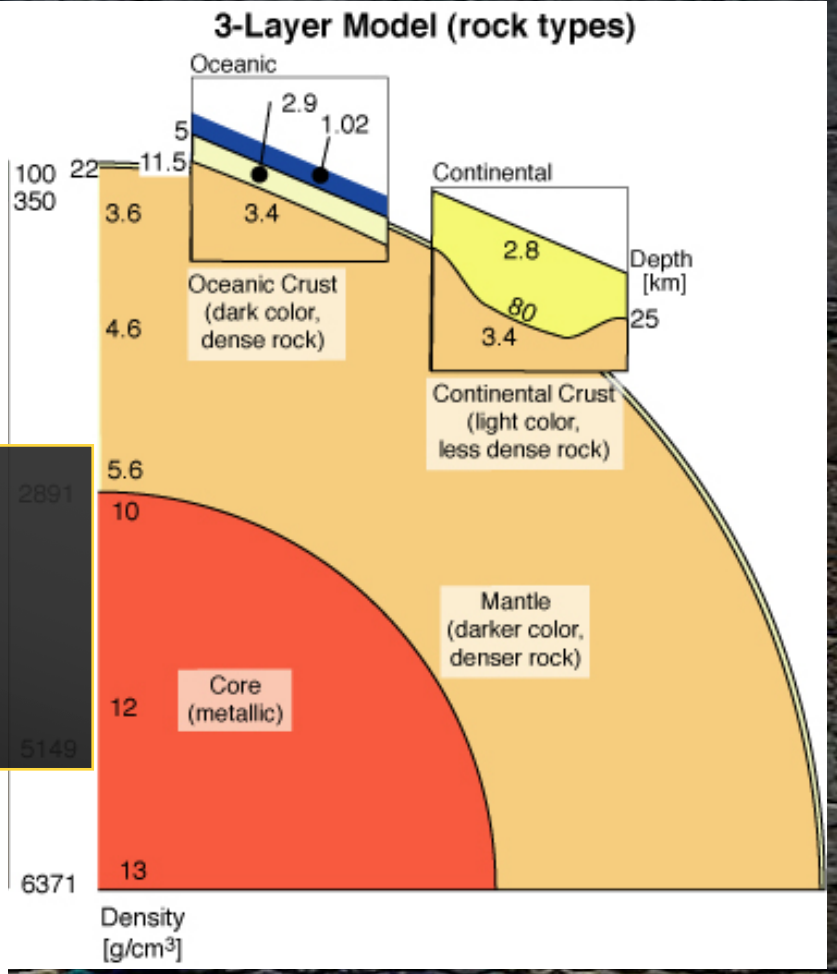




Images: P. Abbott "Natural Disasters"

The Layered Earth – The 3-Layer Model

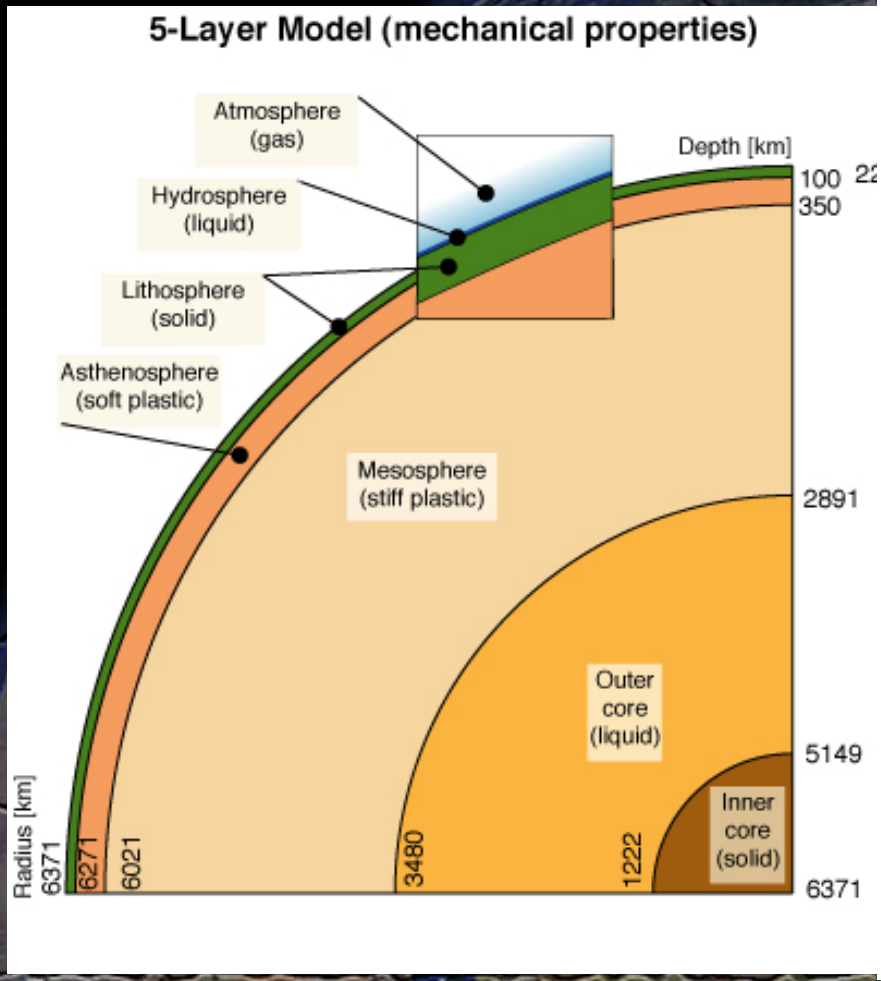
Fig 3.27



MATERIALS:

- core (metallic)
- mantle (dark, dense rock)
- crust (light, low-density rock)

The Layered Earth – The 5-Layer Model



MECHANICAL PROPERTIES

solid inner core (metallic)

- liquid outer core (metallic)
- viscous mantle
  (similar to stony meteorites)
- weak asthenosphere above 350km depth
- strong lithosphere above 120km (crust + uppermost mantle)

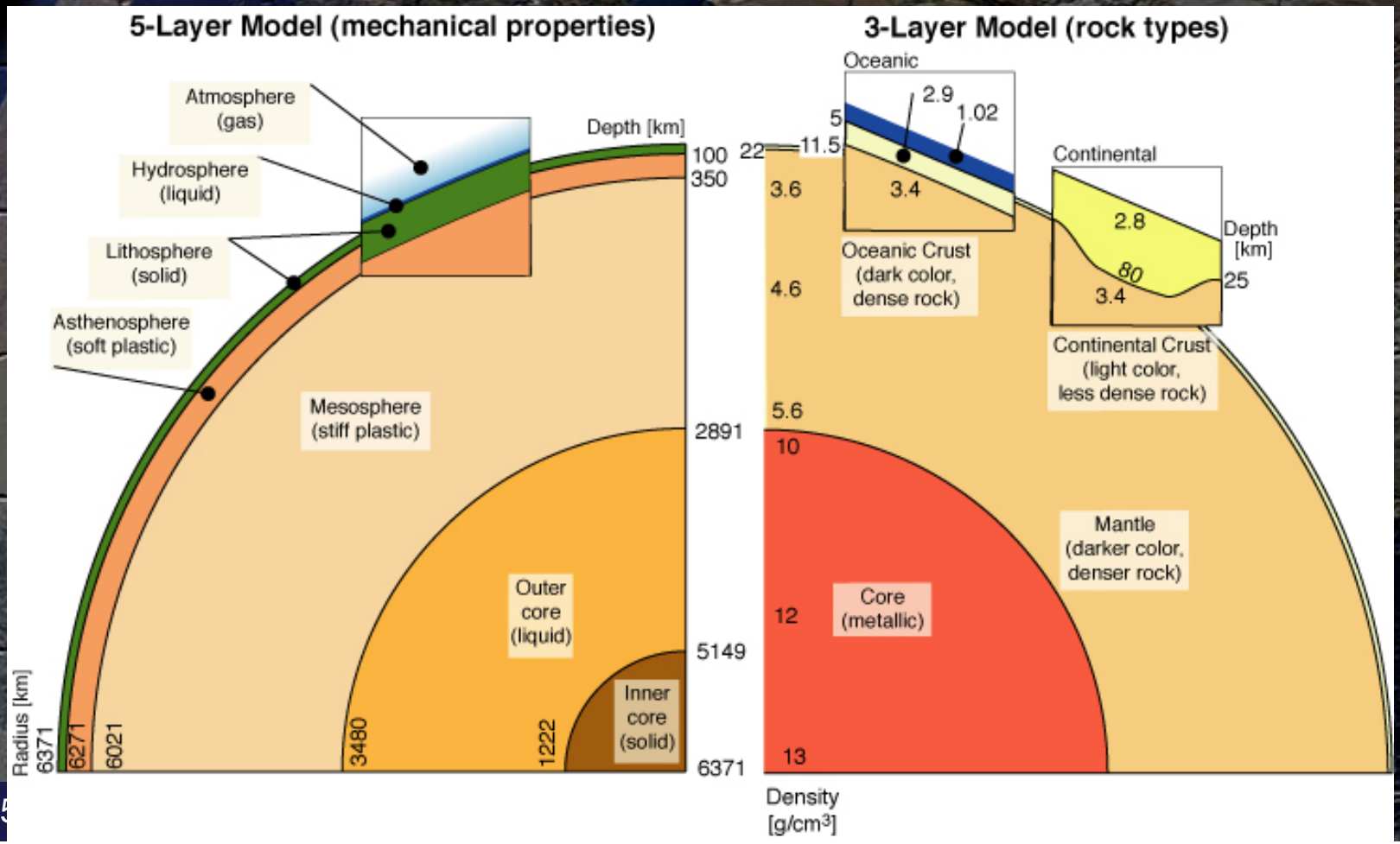
Fig 3.27

The Layered Earth

Fig 3.27

radius: 6371 km
circumference: 40,000 km
CMB: 2891 km depth
IC boundary: 5149 km depth

oceanic crust: 11.5 km thick
continental crust: 30-40 km thick
global average: 25 km thick



Earth's Outermost Shells

Fig 3.28

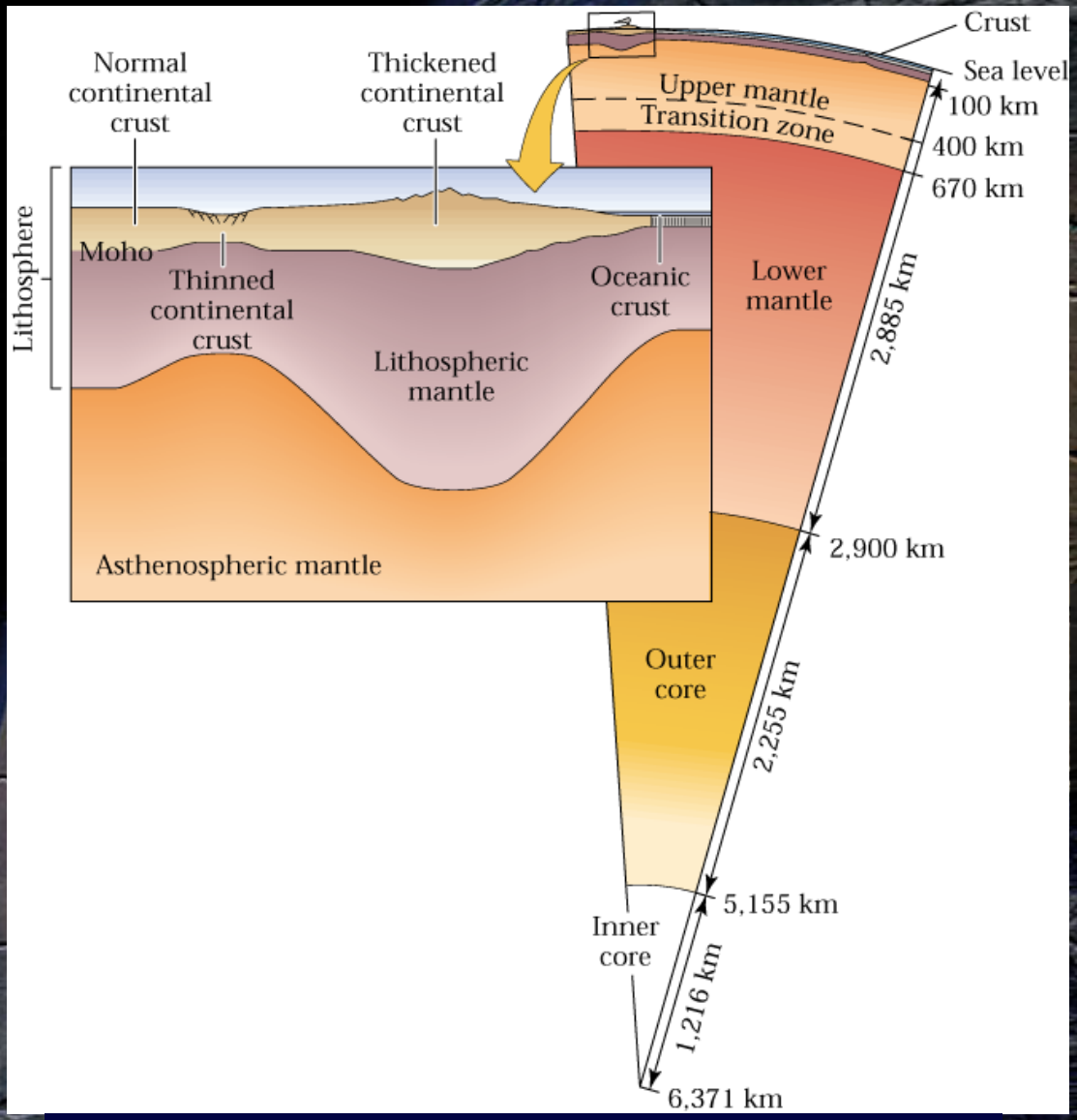


Image: S. Marshak "Earth, Portrait of a Planet"

Lithosphere

- from Greek "lithos" (rock)
- crust + uppermost mantle
- cool and strong but brittle
- zone of Eqs/volcanoes

Asthenosphere

- from Greek "asthenes" (weak)
- uppermost mantle
- warm, soft, ductile

Earth's Outermost Shells

Fig 3.28

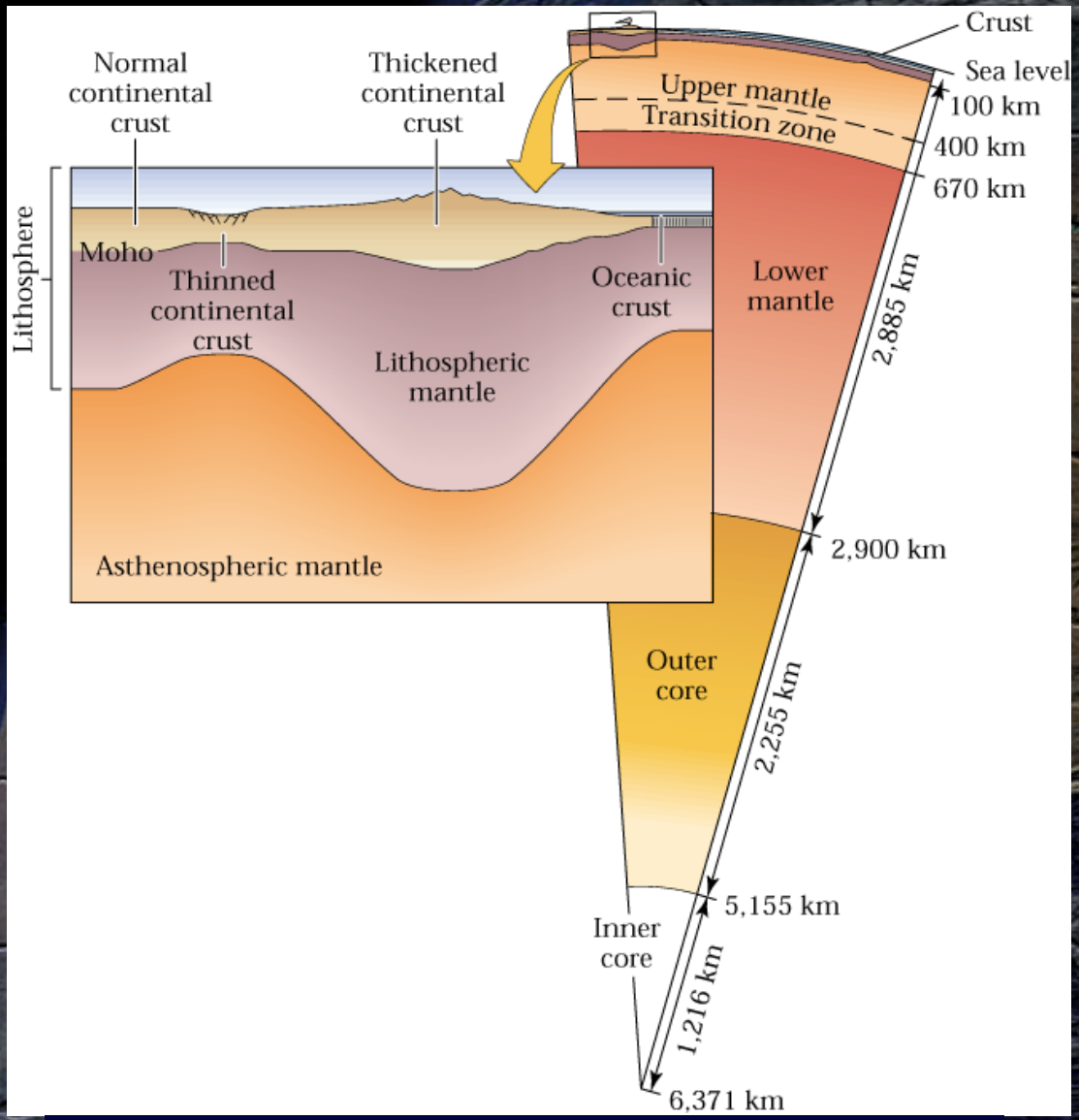


Image: S. Marshak "Earth, Portrait of a Planet"

Oceanic Lithosphere

- crust thin but dense

Continental Lithosphere

- crust thick, less dense
- old continents have roots

Isostasy

Fig 3.29

2 counteracting forces

- gravity
- buoyancy

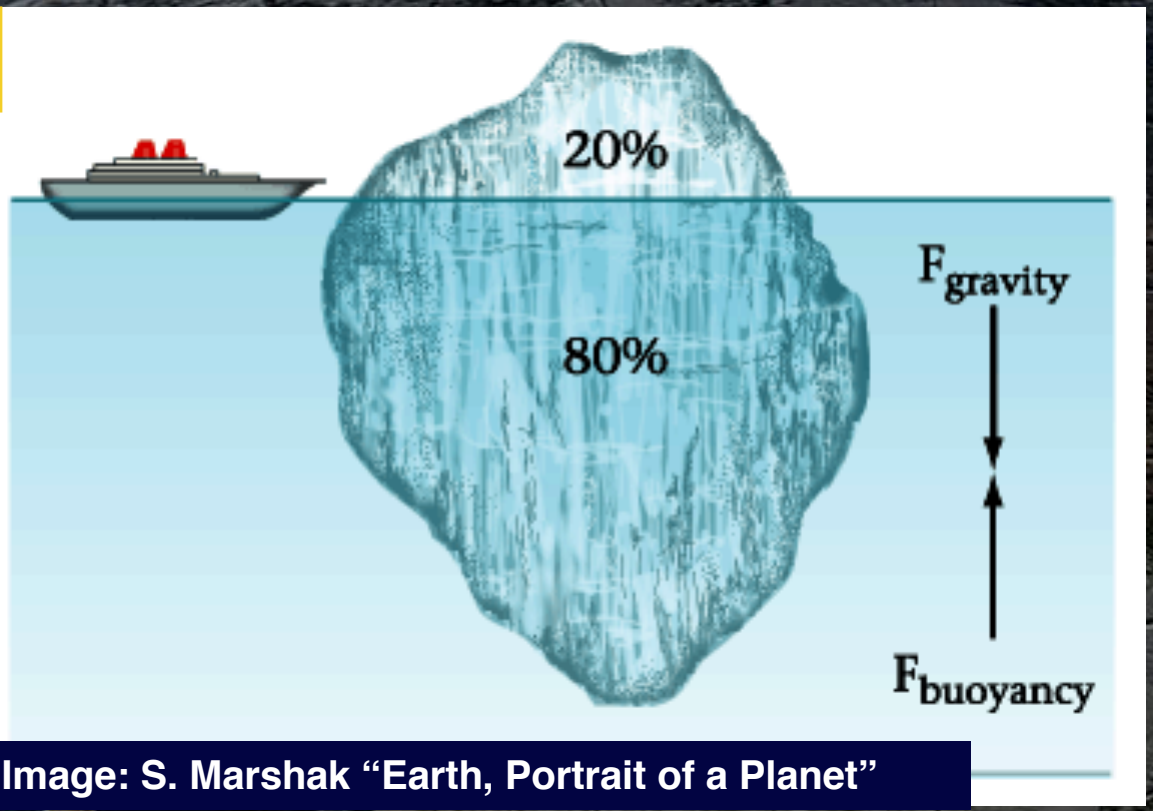


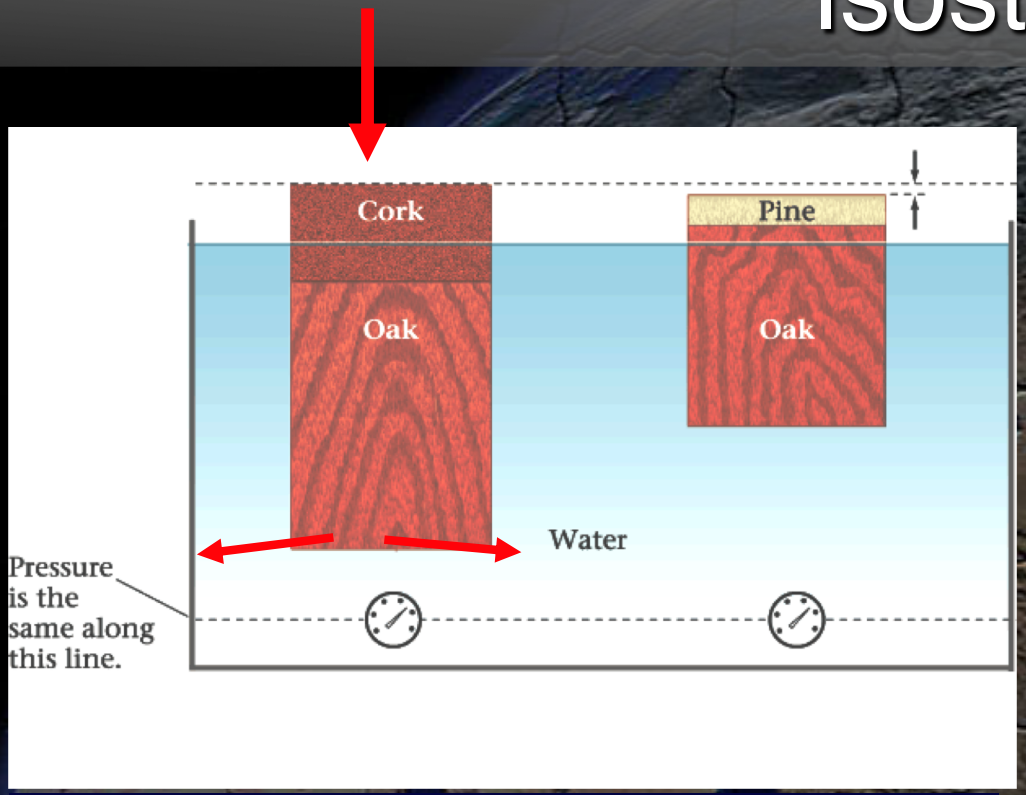
Image: S. Marshak "Earth, Portrait of a Planet"

isostatic equilibrium

- forces are balanced
- body floats

➢ rigid lithosphere floats on soft asthenosphere
➢ asthenosphere reacts to imbalance (flows)

Isostasy



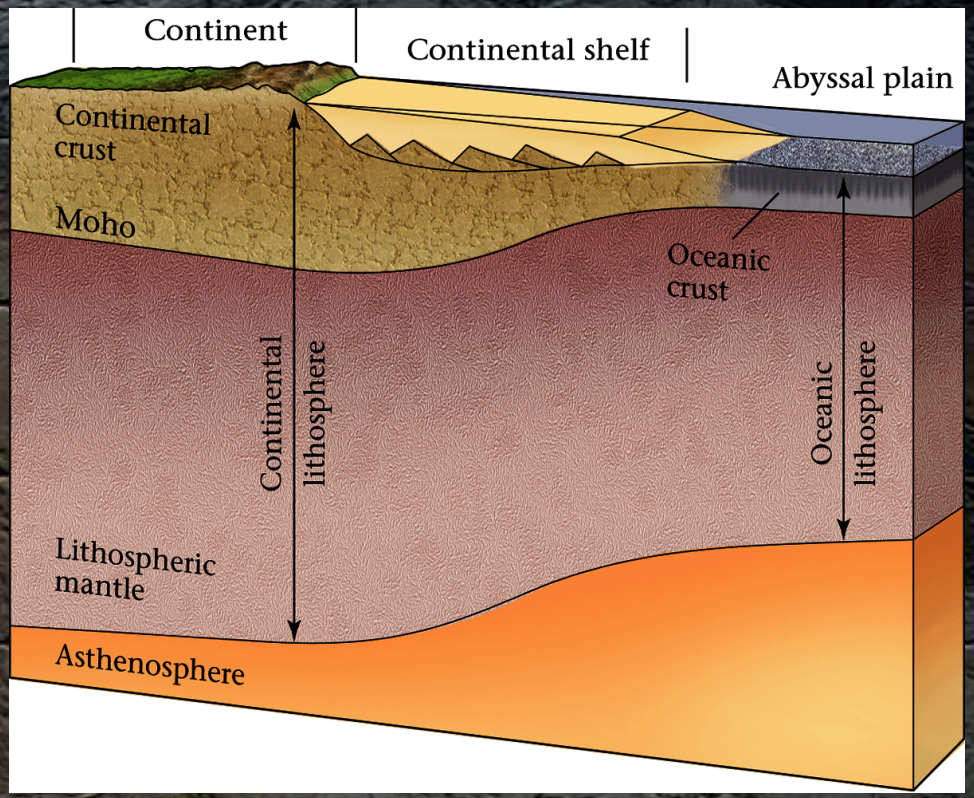


Image: S. Marshak "Earth, Portrait of a Planet"

- rigid lithosphere floats on soft asthenosphere
- oceanic denser than continental lithosphere
- continents have deep roots
- asthenosphere reacts to imbalance (flows)

Isostasy, Ice Loading and Postglacial Rebound

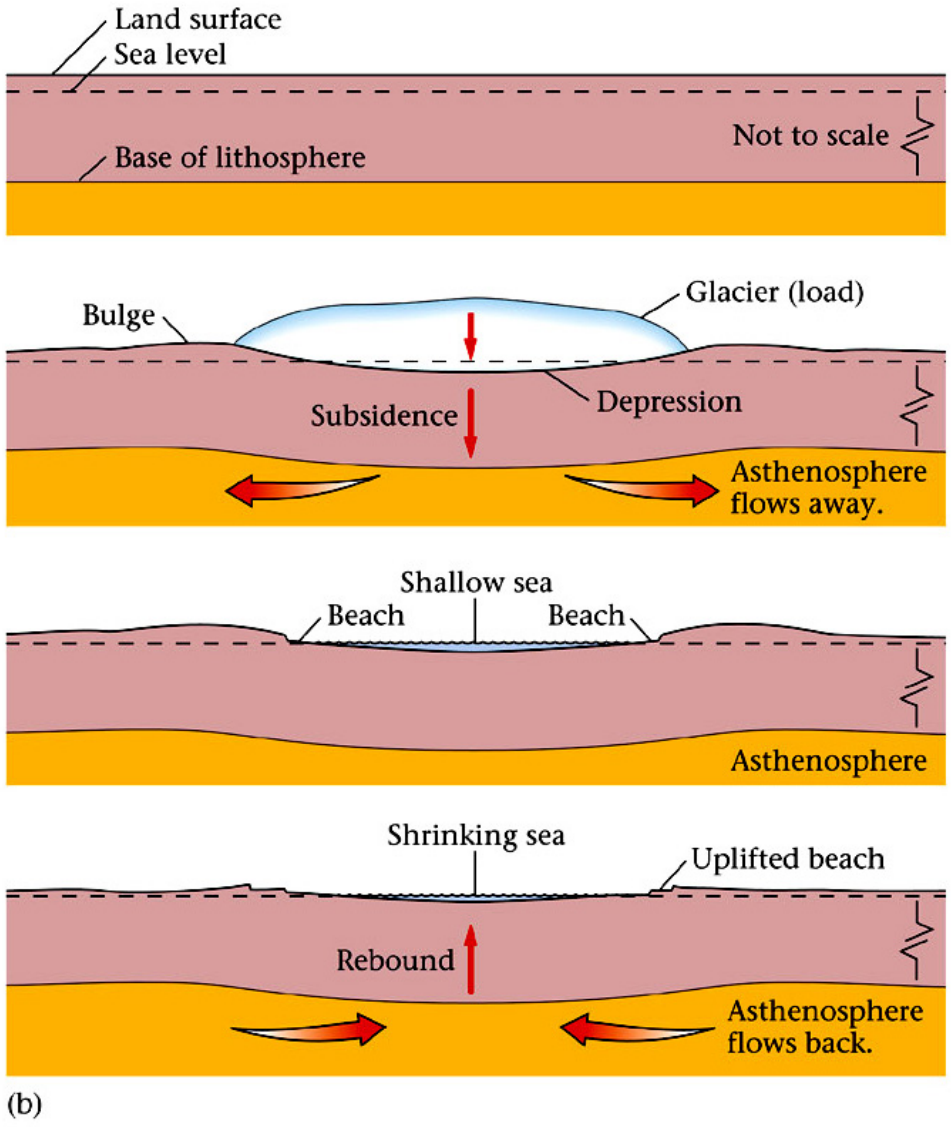


Fig 3.31a

Ice Age

- ice pushes down
- asth. flows away
- lith. sinks

Postglacial Rebound

- ice melts
- water flows away
- less weight
- asth. returns
- lith. rises

Image: S. Marshak "Earth, Portrait of a Planet"

Isostasy, Ice Loading and Postglacial Rebound

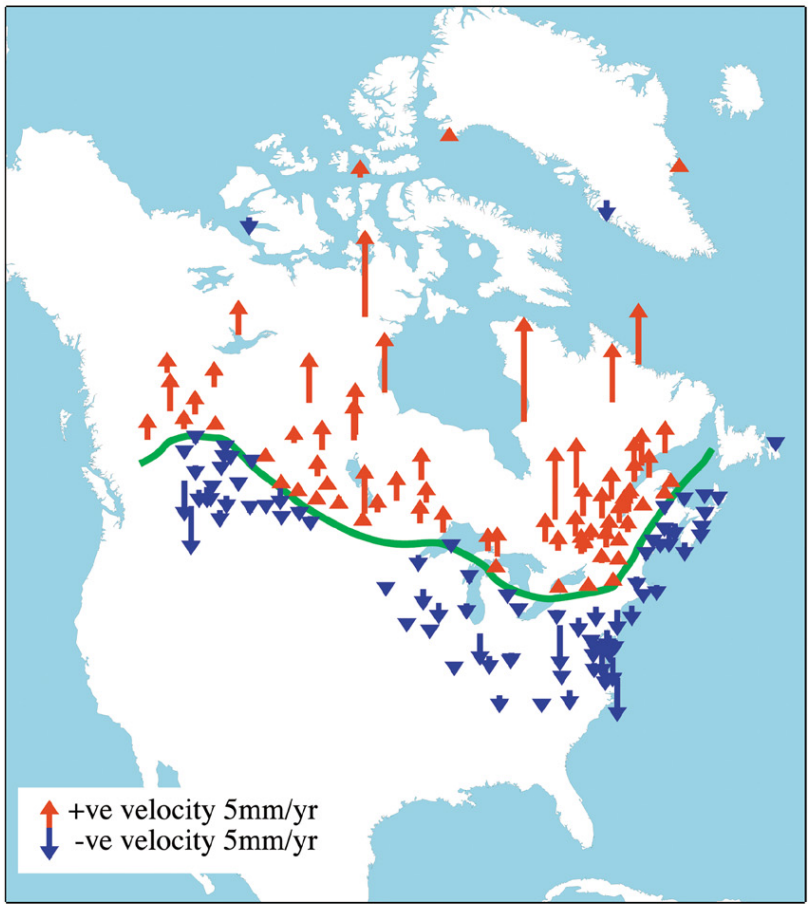


FIGURE 22.33

Earth: Portrait of a Planet, 2nd Edition

- 10,000 years after last ice age
- postglacial rebound: up to 2 cm/year