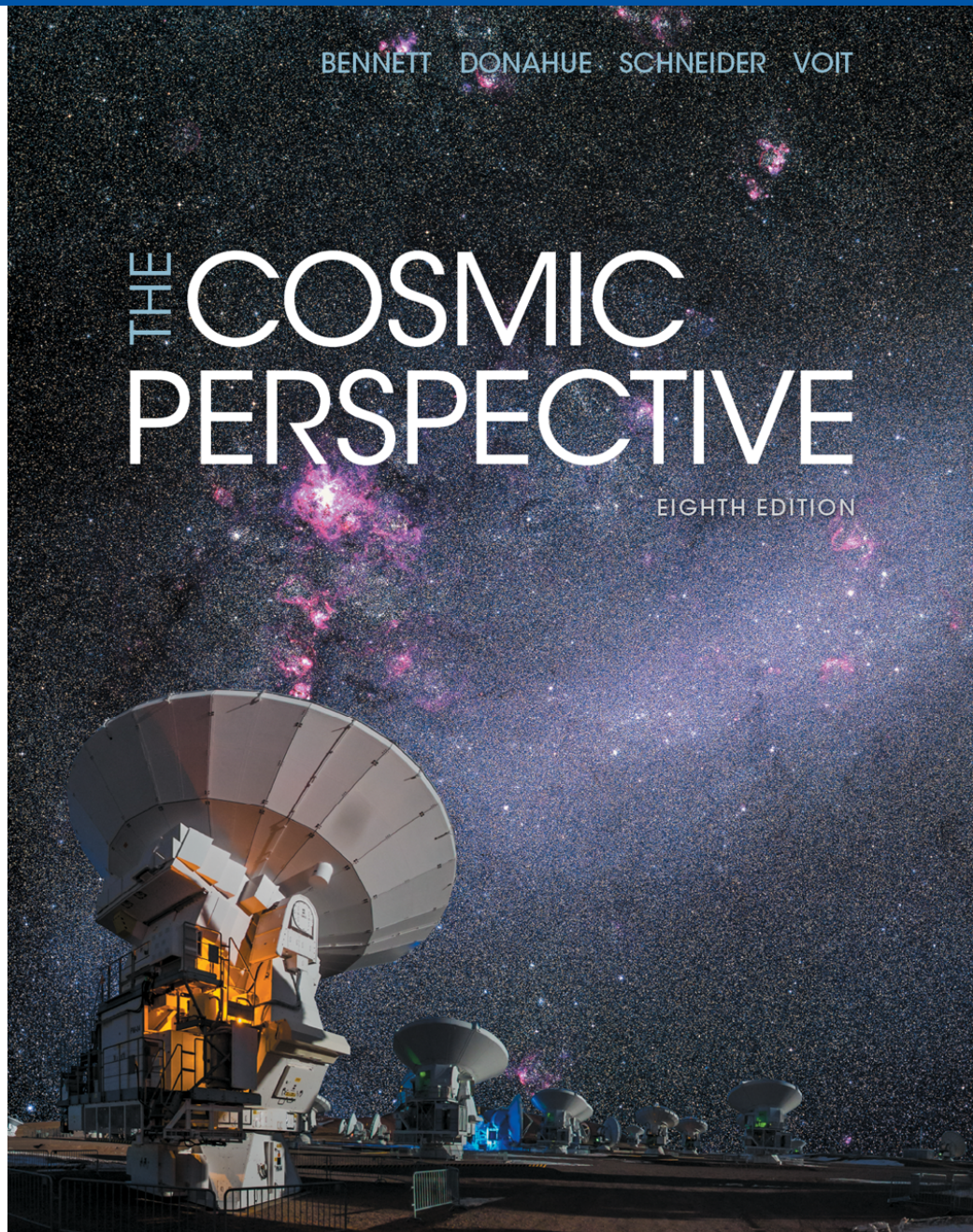
Review Clickers

Chapter 9: Planetary Geology: Earth and the Other Terrestrial Worlds



Which two bodies show evidence of heavy cratering?

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How do we learn about Earth's core, mantle, and crust?

a) magnetic field studies
b) seismic waves
c) X-ray imaging
d) all of the above

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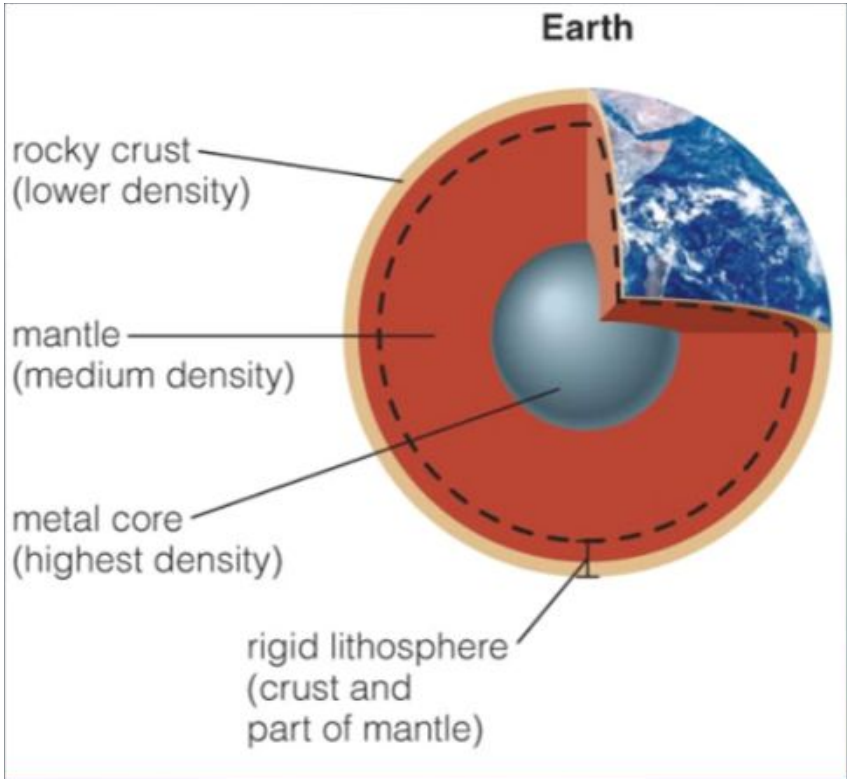

Mantle and core existing!

What is the *lithosphere*?

a) another name for a planet's crust
b) the crust plus the mantle
c) a relatively rigid outer layer of rock that floats on less rigid rock below
d) the boundary between the core and mantle

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Where did Earth's (interior) heat come from?

a) volcanoes
b) accretion and differentiation as Earth formed
c) radioactivity
d) all of the above
e) B and C

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How does an object's rate of cooling vary with size?

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b) A smaller object cools more slowly than a larger object.
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What is necessary for *differentiation* to occur in a planet?

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b) It must be made of a mix of materials of different density.
c) Material inside must be able to flow.
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Do you think *differentiation* is likely to happen in a very small world?

a) yes
b) no

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Credit: European Southern Observatory

Think of planetesimals!

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b) magnetized iron in Earth's crust
c) magnetized iron in Earth's core
d) molten metal circulating inside Earth

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Why are smaller terrestrial bodies such as Mercury or the Moon "geologically dead"?

a) They don't have volcanoes.
b) They cooled off faster than Earth did.
c) They don't have erosion.
d) They were hit by fewer meteorites than Earth.
e) They are made of different materials than Earth.

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Which of the following is an example of *convection*?

a) Heat radiates from a planet into space.
b) Heat travels from atom to atom, from inside a planet to the outside.
c) Hot material inside a planet rises, and cool material sinks towards the center.
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What is true of convection that stresses a planet's crust?

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What are the 4 basic processes that shape planetary surfaces?

a) magnetic fields, impacts, volcanoes, erosion
b) magnetic fields, earthquakes, volcanoes, erosion
c) tectonics, impacts, volcanoes, erosion
d) magnetic fields, impacts, volcanoes, erosion
e) tectonics, impacts, erosion, magnetic fields

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The lunar crater *Tycho* is about 80 km (50 miles) across. It was probably made by

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b) an impactor about 80 km across.
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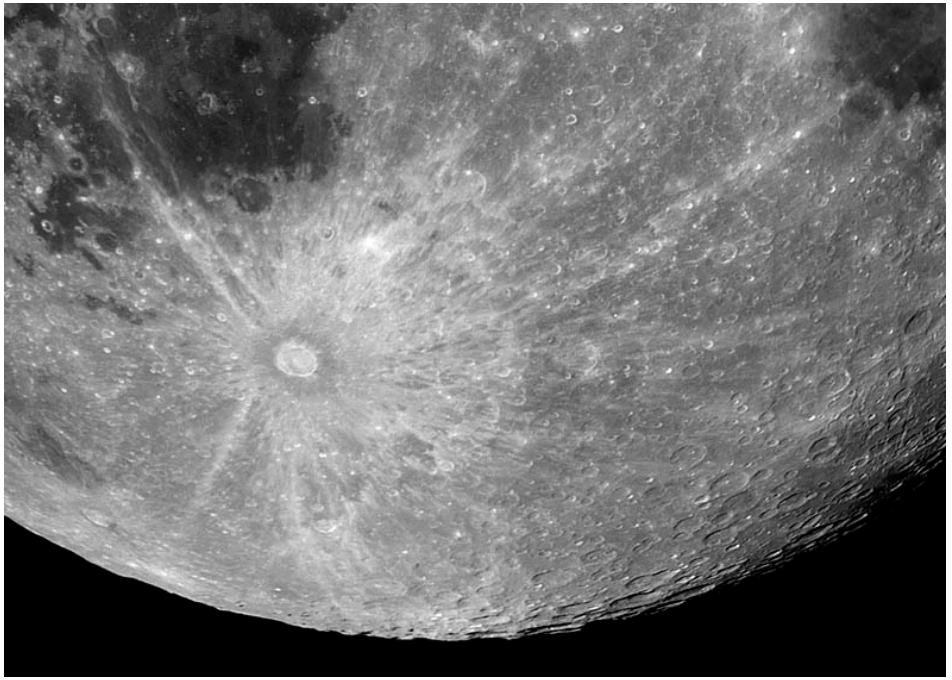

An impact crater simulation

Why do the *lunar highlands* have many more craters than the *lunar maria*?

a) They are on the side of the Moon away from Earth, which was hit by more impacts.
b) Lava flooded the maria, hiding many craters.
c) The less cratered surfaces are younger than those with more craters.
d) all of the above
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d) meteorite impacts

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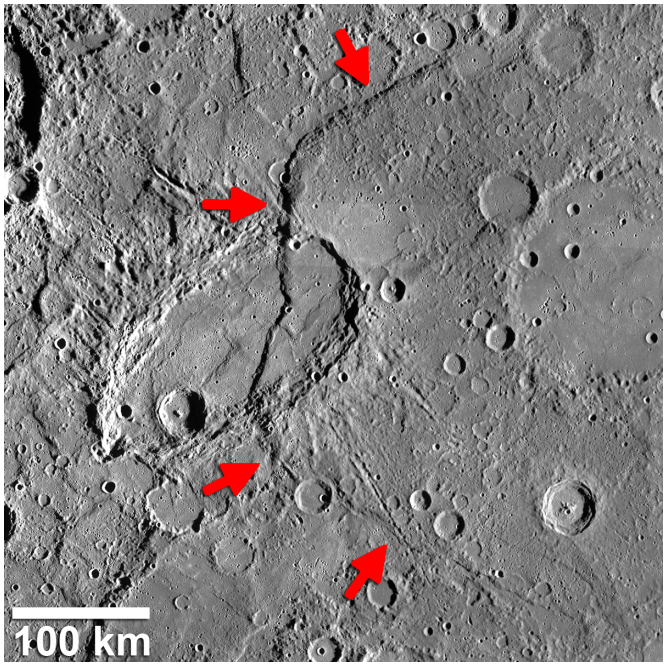

Credit: space.com

Why do we think Mars had more volcanic activity in the past than it does today?

a) Mars was bombarded with more impacts in the past, which fueled more volcanic activity.
b) Mars would have been warmer in the past.
c) Some meteorites from Mars come from relatively young lava.
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"Of over 61,000 meteorites that have been found on Earth, 224 were identified as Martian as of January 2019",
Wikipedia & Meteoritical Bulletin Database

What evidence is there for past liquid water is on Mars?

a) channels that look like dry riverbeds
b) eroded crater rims
c) *Spirit* and *Opportunity* rovers have found mineral evidence of water
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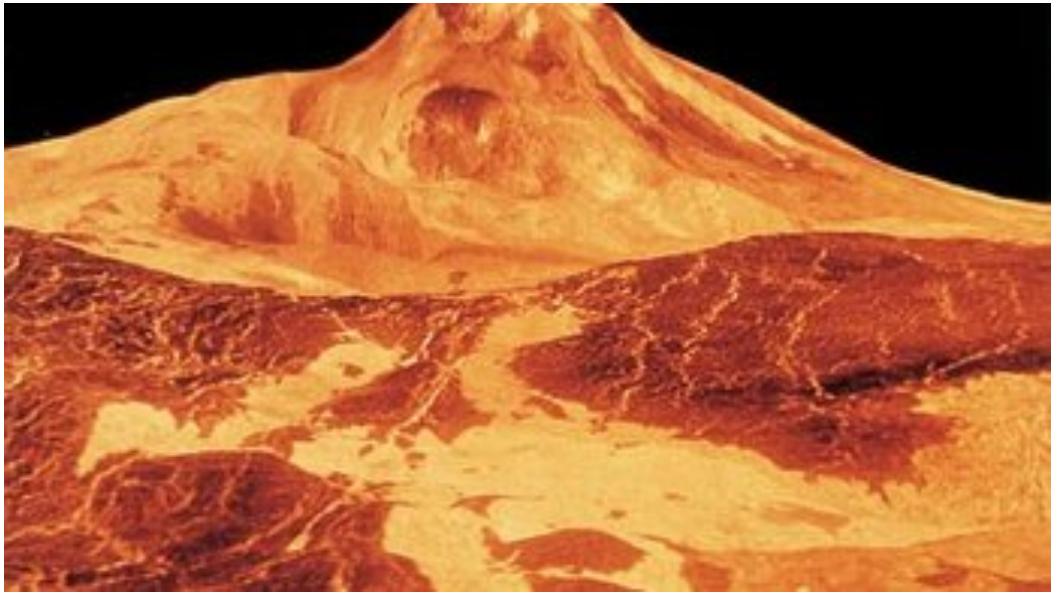

Credit: ESA

Suppose Venus rotated as fast as Earth. How would this change its relative levels of volcanism, tectonics, and erosion?

a) All would remain the same – they are independent of rotation.
b) All three would be higher.
c) All three would be lower.
d) Levels of volcanism and tectonics would stay the same, but erosion levels would be higher.
e) Levels of volcanism and tectonics would be higher, and erosion levels would stay the same.

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b) mantle
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As a planet cools, what happens to its lithosphere?

a) Nothing, except it gets colder too.
b) It gets thicker.
c) It gets thinner.
d) It rises to the surface of the planet.
e) It sinks to the center of the planet.

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Where in Earth is conduction the most important heat transport process?

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b) in the mantle
c) in the lithosphere
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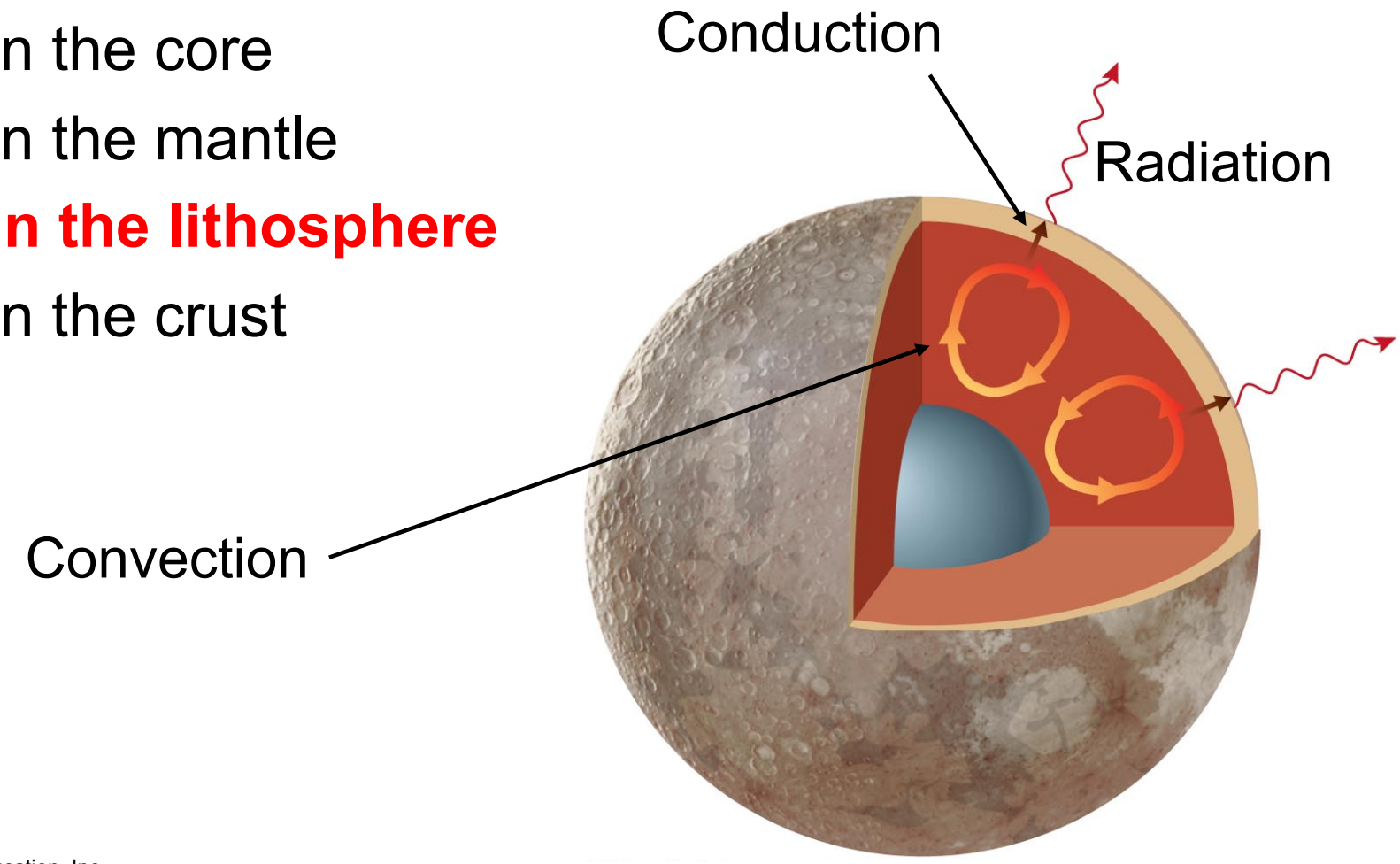

Which of the following is *not* needed for a planet to have a global magnetic field?

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b) convection in the conducting fluid
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a) Infrared
b) Radio
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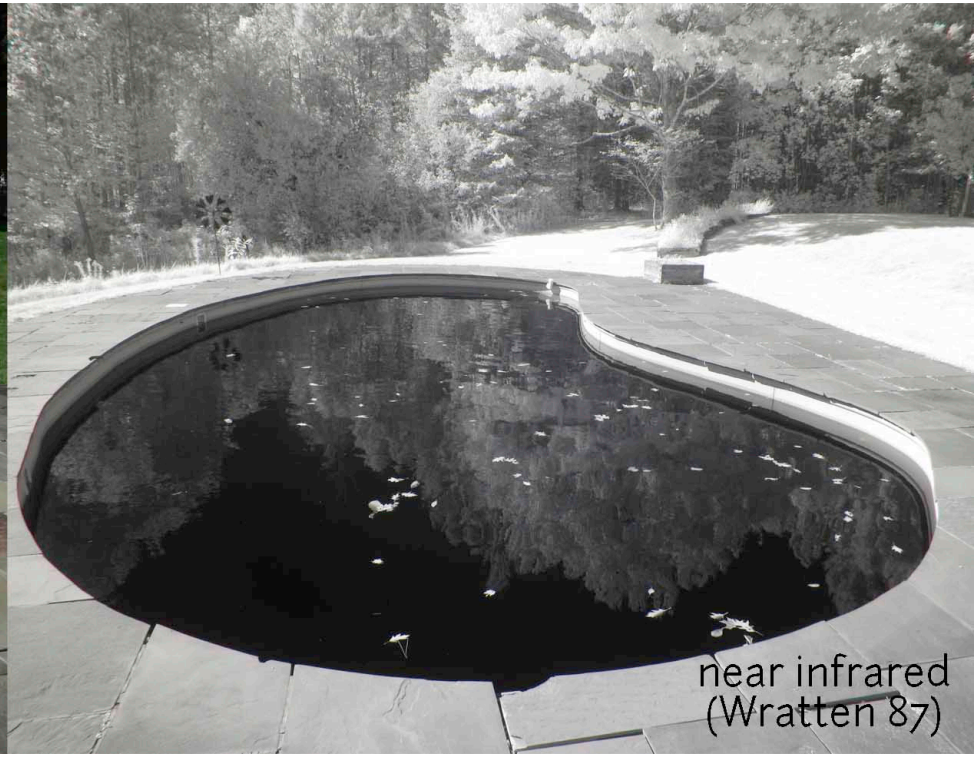
Credit: photovideoedu

Water in infrared



Credit: publiclab.org

Which of the following worlds have the thinnest lithospheres?

a) Earth and the Moon
b) Venus and the Moon
c) Mercury and Venus
d) Earth and Mars
e) Earth and Venus

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Which of the terrestrial worlds has the strongest magnetic field?

a) Mars
b) Earth
c) Venus
d) the Moon
e) Mercury

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a) Mars
b) Earth (by far)
c) Venus
d) the Moon
e) Mercury

Why does Earth has the strongest magnetic field of all terrestrial worlds?

a) It is the only one that has a metallic core.
b) It rotates much faster than any other terrestrial world.
c) It is the only one that has both a partially molten metallic core and reasonably rapid rotation.
d) It is by far the largest terrestrial world.
e) It is the most volcanically active world.

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The surface area-to-volume ratio means that

a) a planet with larger radius cools faster
b) a planet with a larger radius cools slower
c) the cooling rate is directly proportional to the radius of the planet
d) the cooling rate is inversely proportional to the radius of the planet
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Area of a sphere: $S = 4\pi r^2$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

$$Ratio = \frac{S}{V} = \frac{3}{r}$$

The cooling rate of larger worlds is smaller (slower)

Earthquakes primarily happen due to

a) Tectonics
b) Volcanism
c) Erosion
d) Impact cratering

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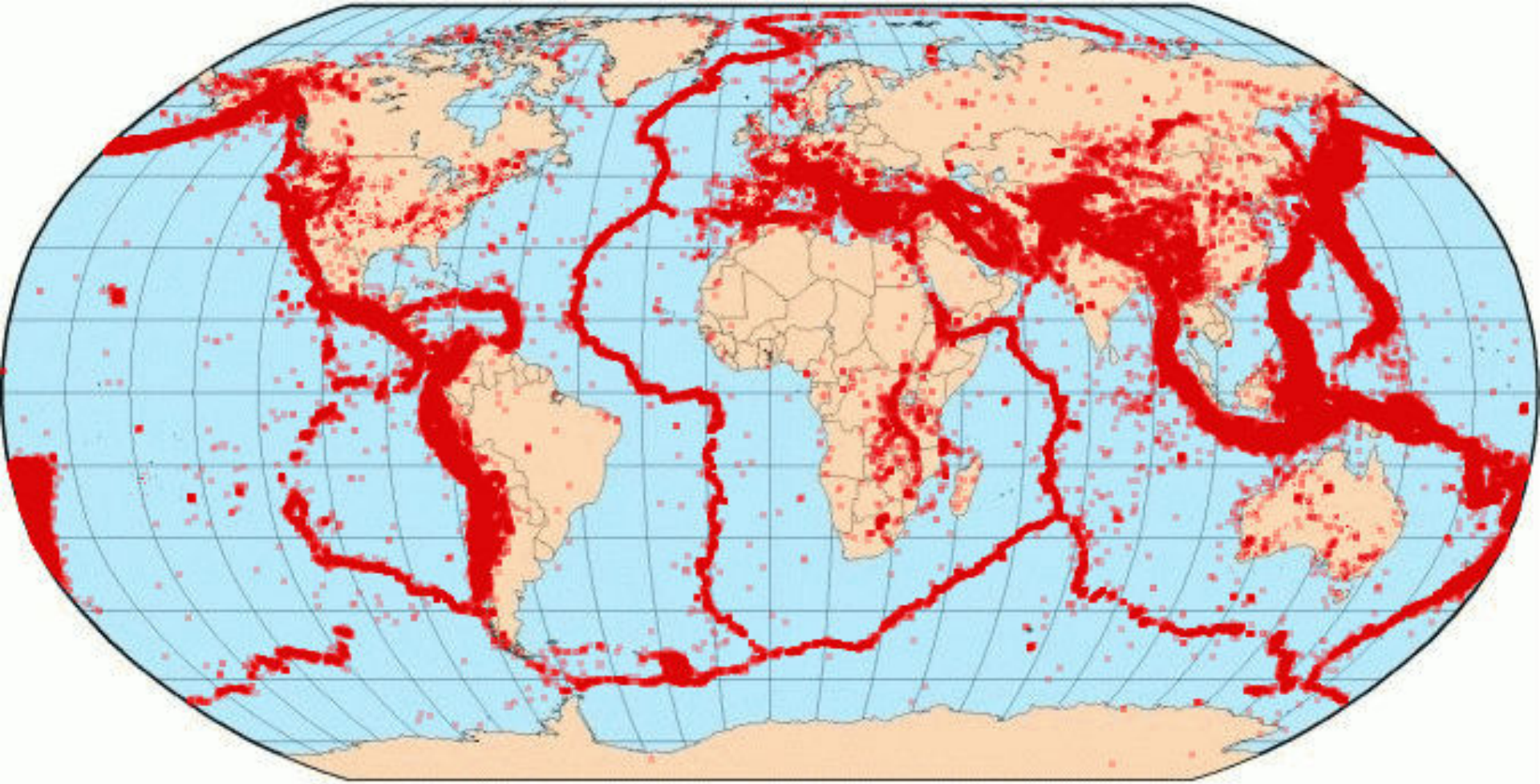
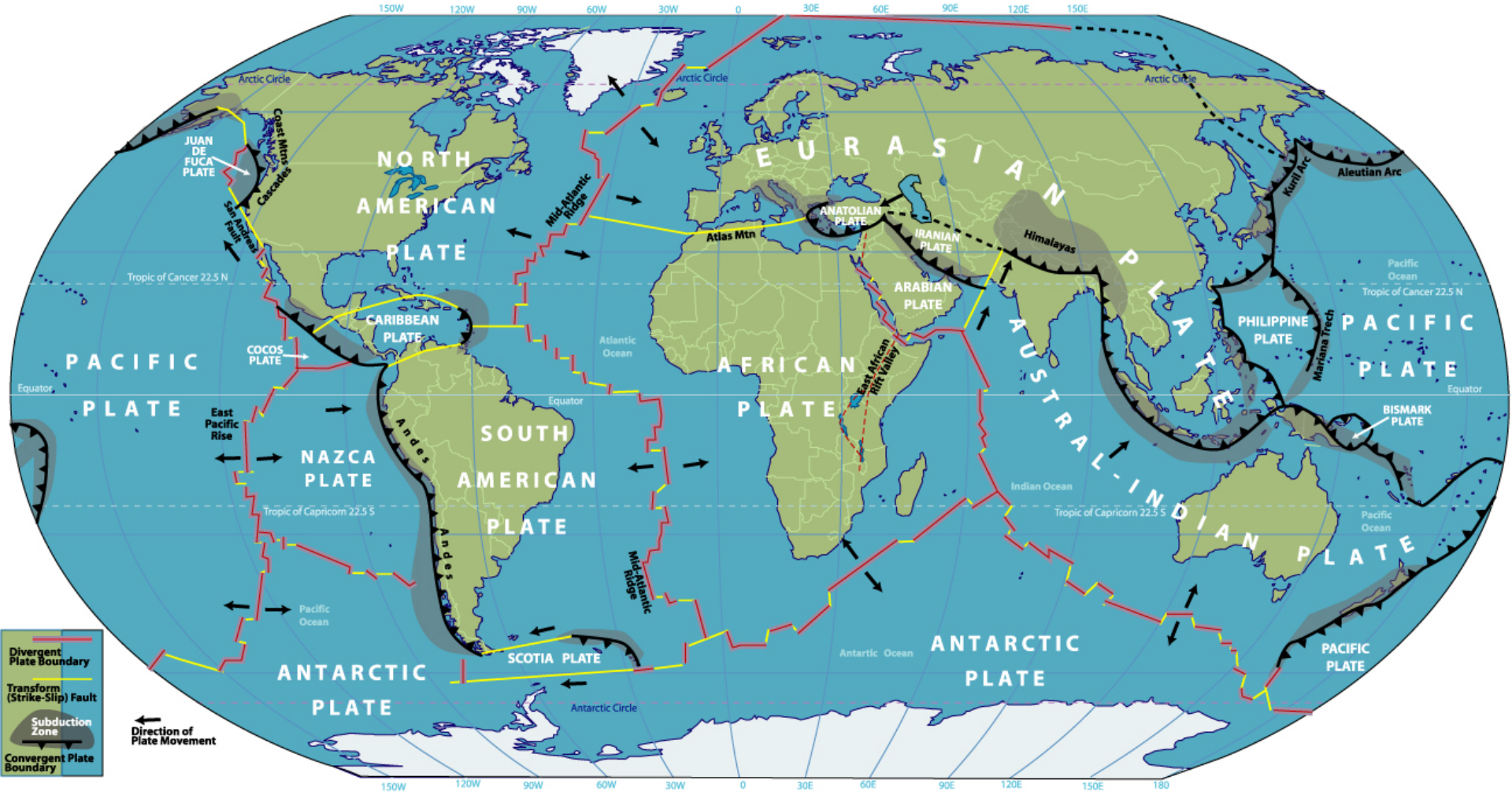
Earthquakes and tectonic plates



Source: dlindquist.com

Map of earthquakes since 1973

Earthquakes and tectonic plates



Source: hohomaps.com

Tectonic plate boundaries

What drives the motion of the tectonic plates on Earth?

a) convection cells in the mantle
b) lava flows in trenches along the sea floor
c) the Coriolis force
d) Earth's magnetic field
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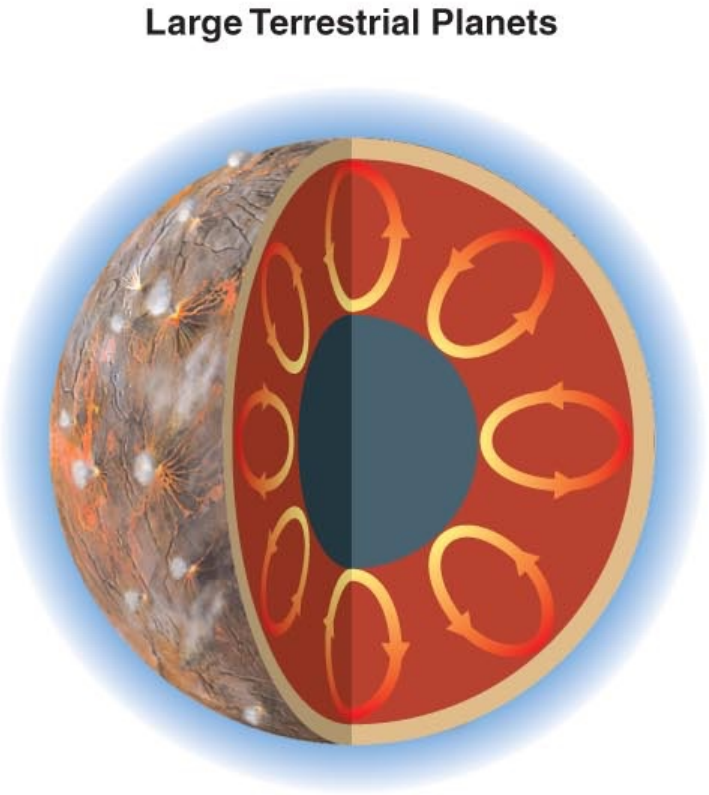

Assuming that we know the initial isotopic fraction of potassium-40 in a rock and its half-life (1.25 bn years), a finding of ¼ of the initial fraction in that rock means that the rock is

a) 1.25 bn years old
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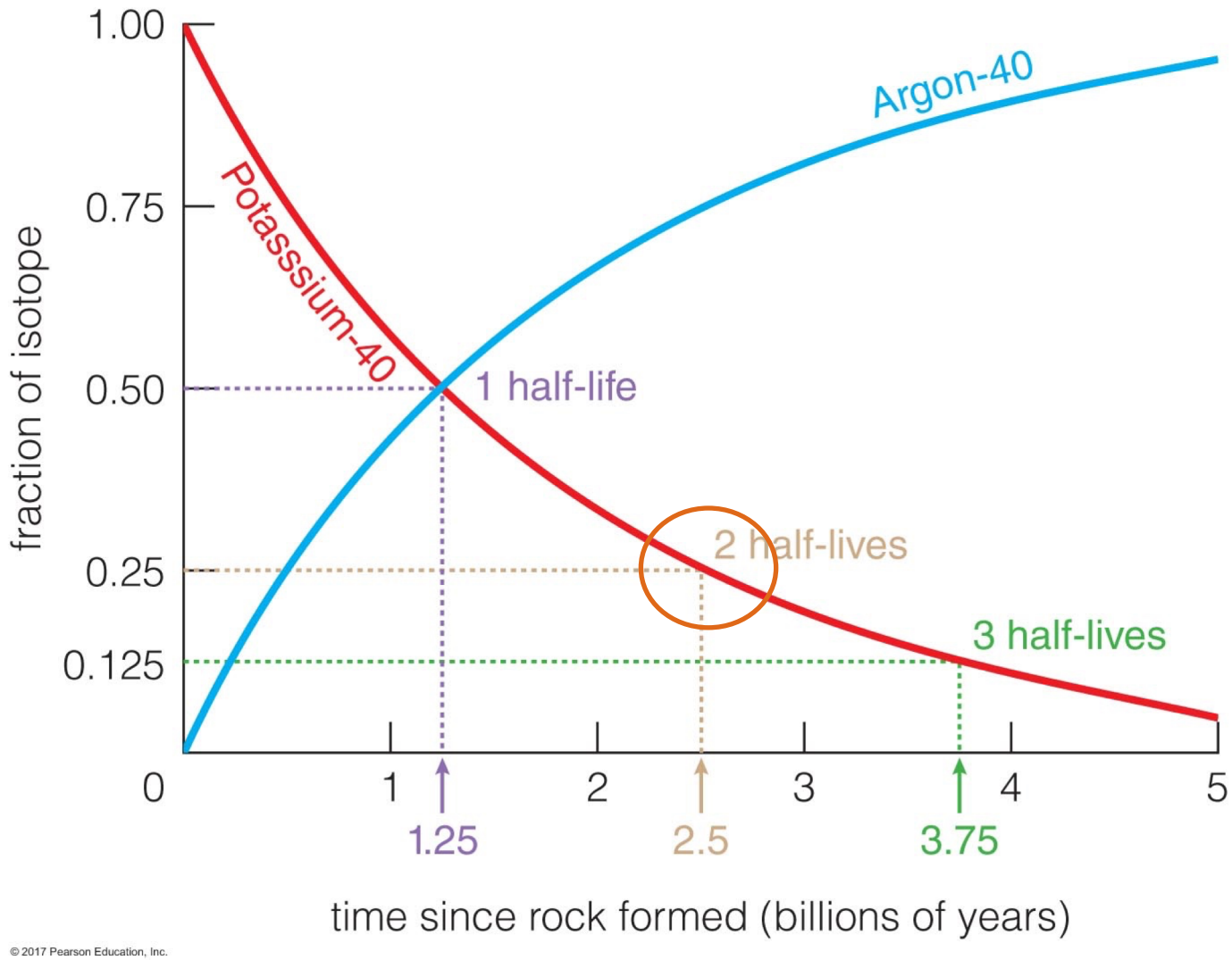
Radiometric dating



Why are there fewer large impact craters on the Earth's seafloor than on the continents?

a) Seafloor crust is younger than continental crust, so it has had less time in which to suffer impacts.
b) The oceans slow large impactors and prevent them from making craters.
c) Erosion erases impact craters must faster on the ocean bottom than on land.
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