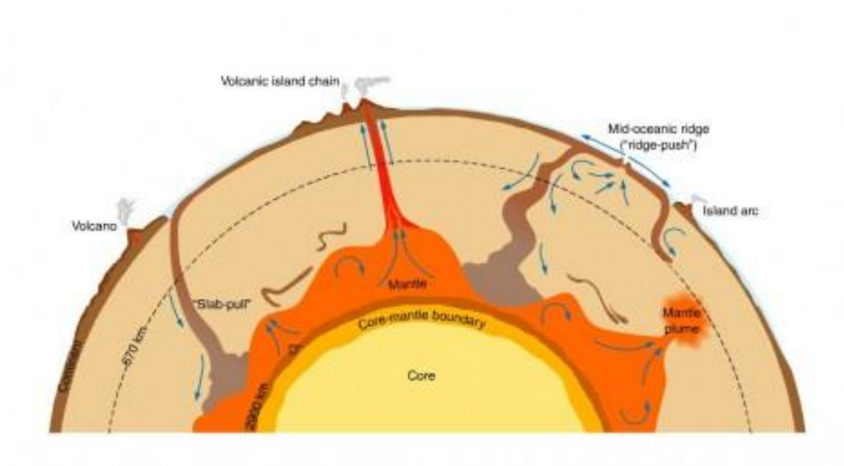
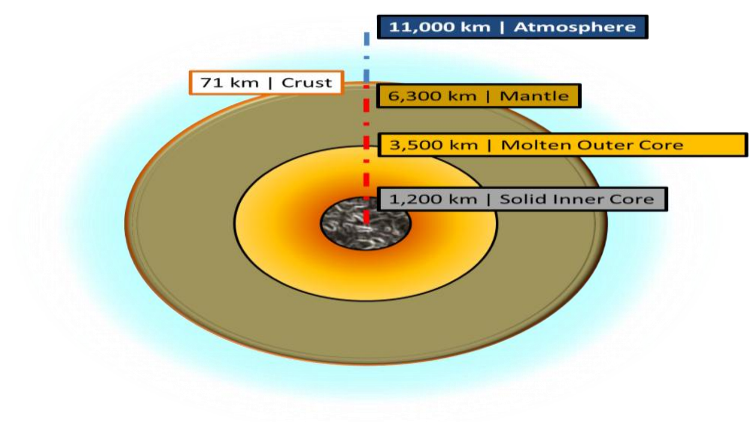
COMPOSITION OF THE EARTH'S MANTLE

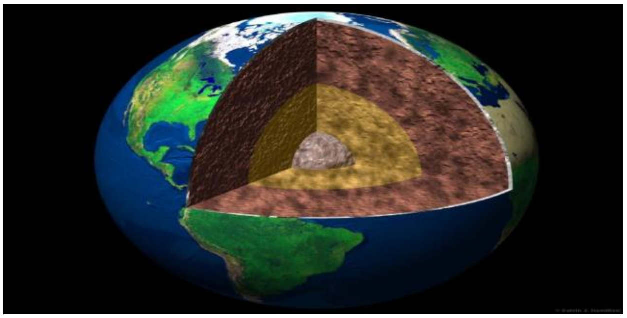


The Earth's mantle is a layer with a thickness of 2,900 km or 1800 miles (46% of the Earth's average radius of 6371 km or 3,960 miles) and extends from the outer core of the Earth at 3500 km radius from the center of the Earth, to the lithosphere that is only less than 200 km (124 miles) thick, so it represents 87% of the total volume of the Earth.



The exact composition of the mantle is not known with certainty, but is determined or inferred by the material coming from volcanic eruptions coming from up to 300 km depth. It is concluded by now that the composition of the mantle is 46% silicon oxide, 38% magnesium oxide, 8% iron oxide and other compounds like “garnet”.

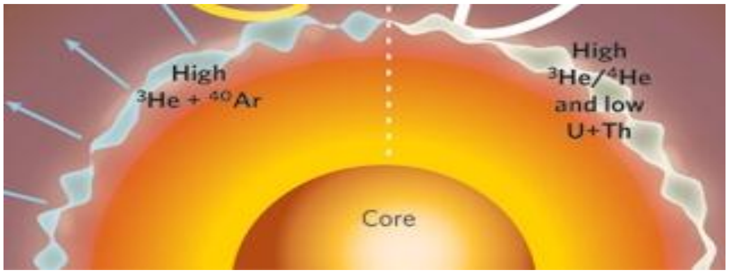
The Earth’s mantle contains a huge amount of water (estimated to be far more than the ocean) in a supercritical fluid state at high temperatures and pressures. The mantle is a type of refractory or thermal insulation, that might act as a semiconductor due to the abundance of the oxides of silicon, as a crystal layer capable of being magnetized and transmitting the magnetic field due largely to the presence of magnesium.



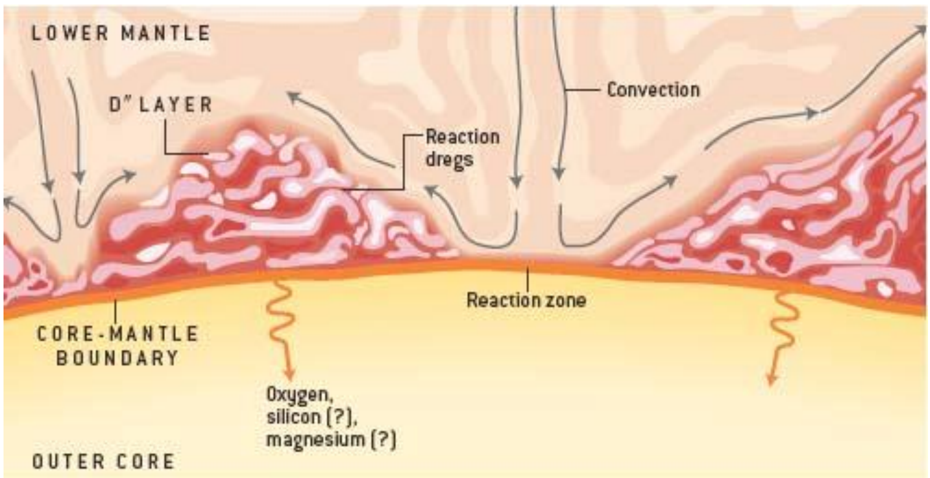
The contact area of the Mantle called “double prime area” or “Gutenberg discontinuity” is the layer that starts at a depth of 2900 km (1800 miles) which is 200 km (124 miles) thick and which surrounds the outer core of the Earth.

The temperature in this zone reaches 5500°K and pressures vary around 2 million atmospheres.

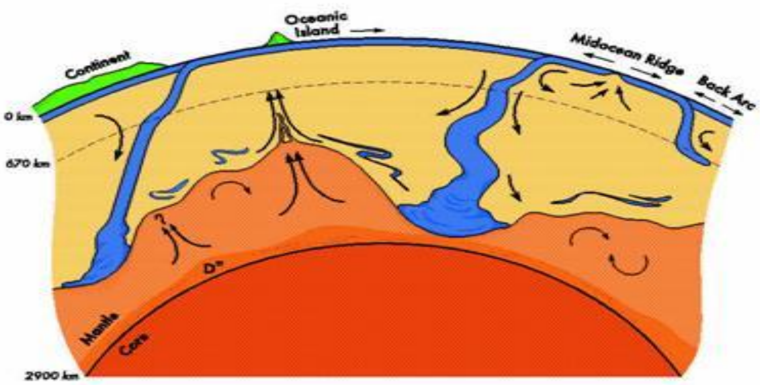
Its chemical composition is different from iron, possibly hydrogen and helium at severe pressure contact with the outer core which fuses with this layer making it anomalous and viscose where a heat transfer process occurs through convection.



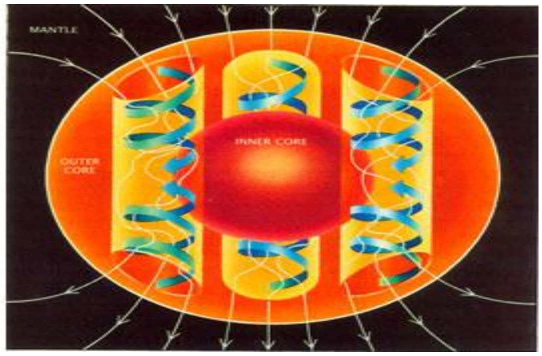
In this area the resistance friction initiates from the rotation of the solid Earth (some crystalline solids) with the fluid outer core in the same sense generating a lot of tension and heat.



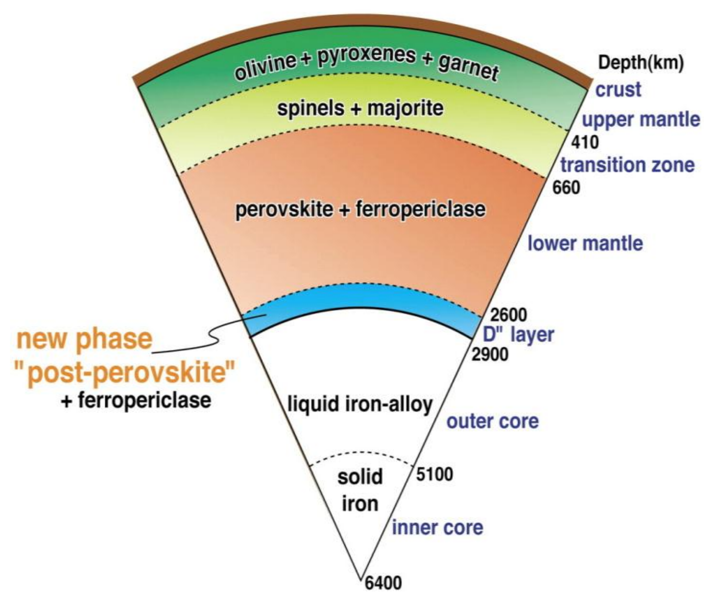
The “lower mesosphere” or “lower mantle” extends from 2900 km (1800 miles) where the “Gutenberg discontinuity” ends (with temperatures up to 5500 ° K) to 700 km depth (430 miles with temperatures of 3300 ° K). It is believed it is composed of “garnet peridotite” with an average density of 5.5 tons/m3.



This area is generally complex because at these temperatures, the atoms are ionized, and electrons will be seeking ions for binding, separation and making connections with high frequency, generating a strong electric current, but which in turn is measured by the resistance generated by the presence of silicate and magnesium oxides.



At a depth of 1800 km (1100 miles), after an irregular strip of 8 km thick, secondary seismic waves begin to appear, this line indicates that the material is stiffer and less plastic (initiating the formation of magma), abounding silicates, oxides of magnesium and iron. The density of this area is about 4.6 tons/m3 and the temperature is 1400°K. From 1500 km (900 miles) to 1200 km (750 miles) depth small gradients of seismic wave propagation occurs, the temperature is 1300 ° K

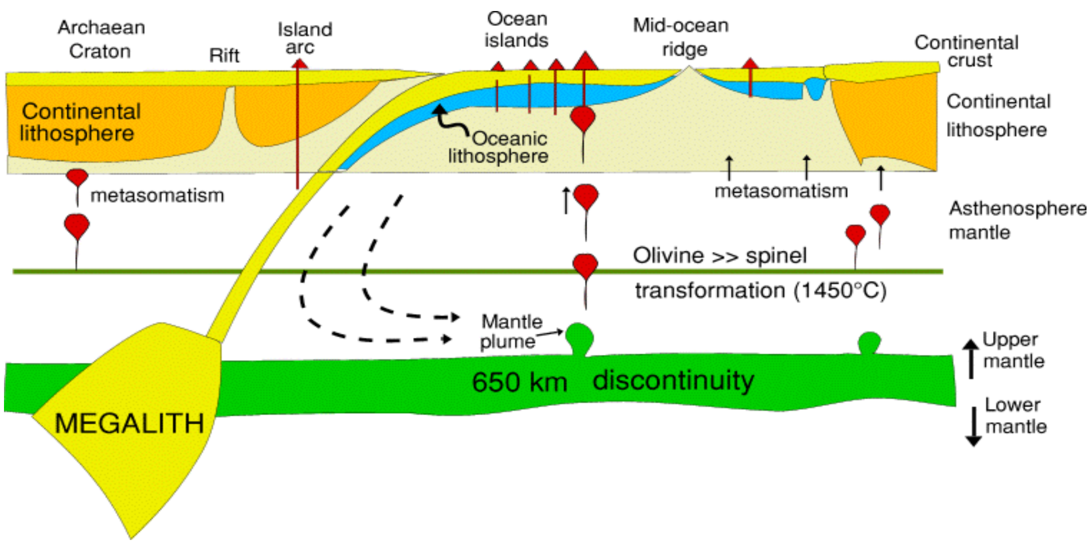


At a depth of 1000 km (620 miles) silicon closed structures in the mantle are transformed. The material becomes rigid and convection currents are created where magma occurs.

At a depth of 900 km (560 miles) depth in the “Repetti Discontinuity” a dense olivine layer begins to transform into “spinels”, giving rise to geological faults.

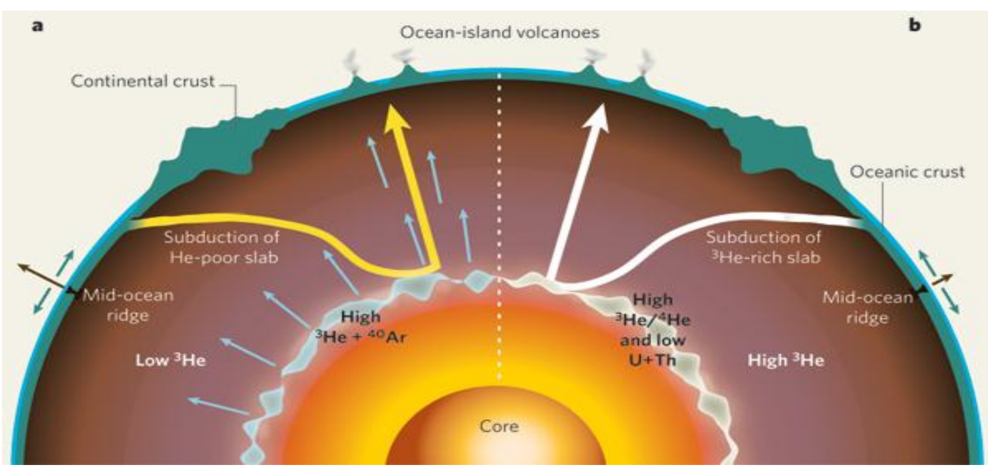
At a depth of 700 km (430 miles) the pressure reaches around 500 000 atmospheres and dense olivine magnesium perovskite is completely transformed in ringwoodite spinels (gamma) and wadseleite (beta) with garnet.

In subduction zones of plate tectonics, earthquakes have been detected at this depth.



At a depth of 650 km (400 miles) the “upper mesosphere” or “upper mantle” starts. The temperature reaches 1200°K and begins a hydrated irregular “transition zone” with a thickness from 220 km (125 miles) to 400 km (250 miles) defined as a fuzzy region with a highly seismic velocity, being thicker in the continents areas than in the ocean areas.

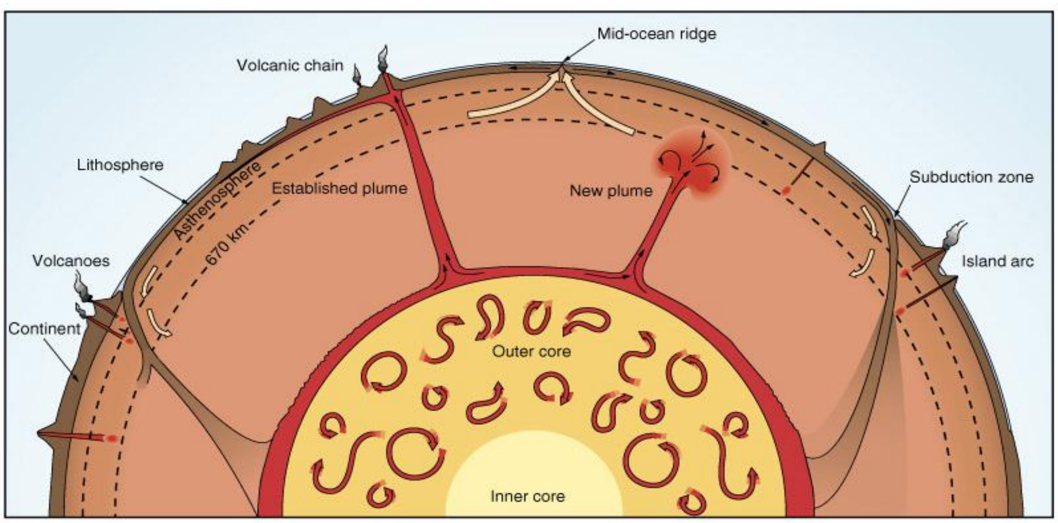
In this “transition zone” occurs convection generated by the subduction of tectonic plates that sends cold water from the ocean to the top of this area of dehydrated magnesium oxide, cooling and suddenly energizing water which will try to escape to through the lithosphere by convection opening micro cracks and possibly causing seismicity at these depths.



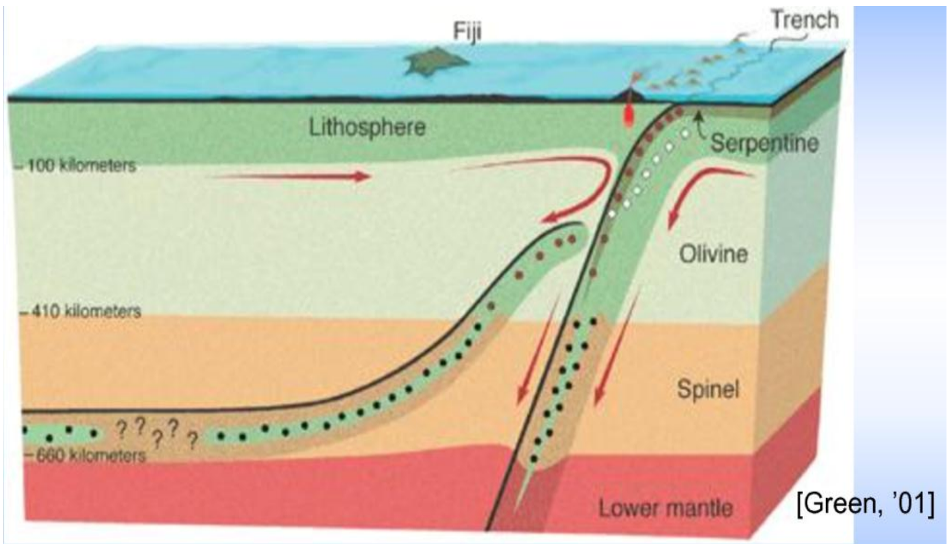
In this area the thermal flux is 0.5 µcal / cm ² sec consisting mainly in olivine, pyroxene, spinal structure minerals, and unstable garnet minerals with magmatic formation with seismic velocities between 7.6 and 8.6 km / s

From a depth of 400 km (250 miles) to 200 km (120 miles) it is formed a basaltic plastic rock layer with low viscosity, with low capability of generating faults and low seismic velocity because it has a magmatic consistency at 600 ° C.

At 200 km depth rigid tectonic plates of the crust are formed which occurs most often in the "subduction zones". The olivine rock becomes ductile, moving elastic deformation rates measured in centimeters per year linear distances of thousands of kilometers and can break causing faults.

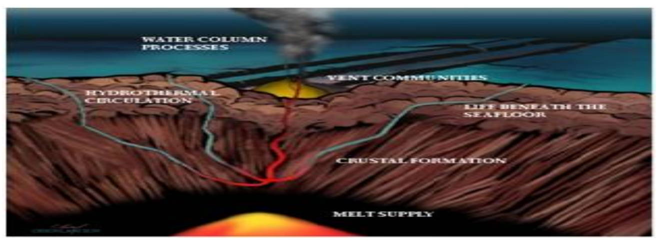


Some tectonic plates converge with other, sinking below each other with an average rate of 2-8 centimeters per year. In subduction zones, the rise of these molten materials and the introduction of large amounts of water in the mantle cause the emergence of island arcs (Netherlands or Japan) and volcanic chains like the Sierras and Cordilleras (Mountain chains).

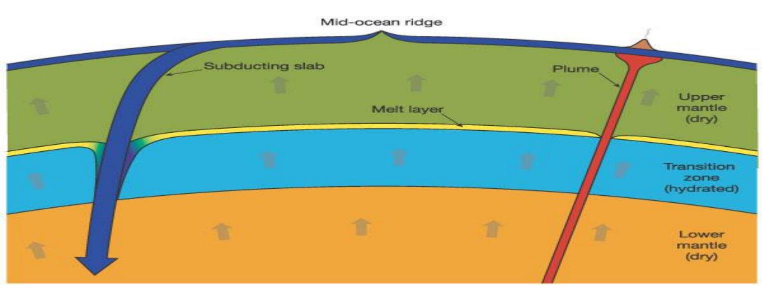


Below 50 km (30 miles), there are no occurrences of seismicity, which means there is a plastic and viscous layer by its chemical composition (which mostly might be silicate solids with localized regions of fusion). In this area there are consolidated basaltic magmas originated by partial melting of rocks from the mantle forming this layer.

The magma is composed of 60% olivine, 30% ortho and 10% clinopyroxene and spinel, garnet and plagioclase. In this layer convection currents occur on which the lithosphere (and plate tectonics) are based, which at contact becomes very hot and where there is a large pressure which occurs by convection of magma to the surface. Most earthquakes occur above this area.



At a depth of 35 km it is again the surface of the mantle or “lithospheric mantle” which marks the beginning of the “lithosphere” and seismicity. It is hotter beneath the oceans by the absence of a thick crust with a density of 5.5 tons/m3. It is manly composed by oxygen, magnesium, silicon, iron, calcium and aluminum.



Source: http://www.artinaid.com/2013/04/composition-of-the-earths-mantle/