

Geosphere -Mantle and Core-

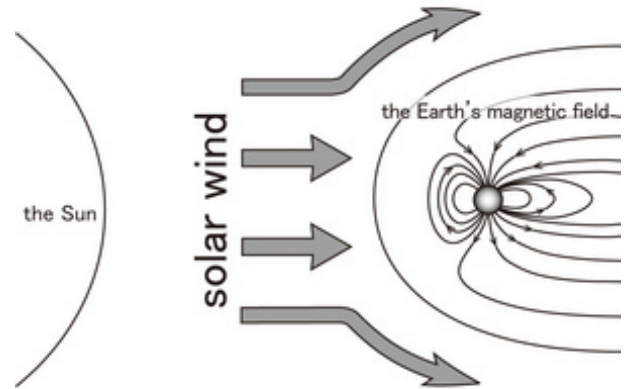
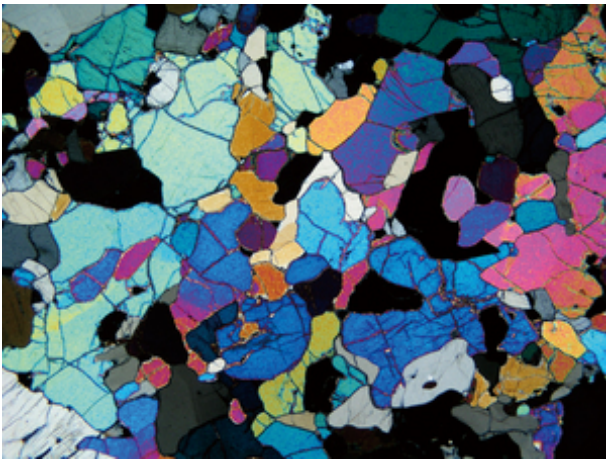
地圏-マントルと核

■Purpose of Exhibition

We would like you to discover which substances make the mantle and the core and how they affect the earth's surface environment by the slow flowing that takes a long time.



■Additional Knowledge



[Mantle]

There is no magma which the rock had been melted under the earth crust. It is made of the rock, "peridotite". Peridotites are rocks including the spinel, the garnet and the plagioclase, as well as the olivine and the pyroxene. A peridotite stone can be changed into the jewel which is named "peridot". It means that there are many jewels in the mantle.

In the much deeper area of the mantle (about 660km deep), although the component is the same as the peridotite, it is turned into different substances (perovskite). This is called "phase transition". It is because the pressure is too high and the alignment of atoms is dense. So, we call the area which the peridotite can survive "the upper mantle". Also we call the below area of the upper mantle "the lower mantle".

It is estimated that there is a dense layer which is called "the D"-layer (D double prime layer)" in the bottom of the mantle (depth 2,700 km). There are two theories. First is that the oceanic plates sank and piled up, and their melting forces upward flow of the mantle. Second is that the perovskite is in the phase transition. It has not been clear which theory is correct.

[Mantle Plume]

"Thermal Convection" occurs when water and air is heated from the bottom and cooled down from above. Likewise, the substance of mantle takes a long time to

do thermal convection (mantle convection).

There are the upward and downward flows of the convention. The "Hot plume" is the upper current with the high temperature. The "Cold plume" is the lower current with the low temperature. The word "plume" is originally from the word "smoke", like smoke that wells up from chimneys. How the plume moves in the mantle is estimated by research (seismic tomography) of which the seismic wave is transmitted in the earth's interior and by computer simulation. The movement of plume is similar to the lava lamps' convention. This current carries the heat to the surface of the earth and produces volcanic activity and plate movement.

[Diamond]

Graphite (carbon) is well known for being a mineral which turns into a different mineral (Phase transition) despite them being the same substances. Have you heard that you could make a diamond if you squashed up charcoal? Diamonds are made only in high pressure places like more than 100 km below the ground.

"Kimberlite" is rock which includes the diamond. The magma of kimberlite occurs in the mantle 100-300 km below the ground and it shoots up at high speed and erupts. If it went up at a low speed, it might be transferred to graphite. The minerals which are made underground tell us what happens underground.

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[Core]

The core is divided into two layers, the inner core and the outer core. Both of them are alloys of nickel and iron. The outer core is liquid and the inner core is solid. When the liquid iron flows, the electricity also flows and magnetic field occurs on the earth (geomagnetism). That's why we know the direction due to the compass. The more important thing is that the magnetic field protects the atmosphere of earth from the direct hit of the plasma current (solar wind) which is blown from the sun. If it were not for the magnetic field, solar wind would take away the atmosphere of earth and there would be no creatures left on our earth. We can say the geomagnetism is the "Barrier of the earth". The flow phenomenon which occurs in the underworld makes our environment in such a way so that creatures can live.

Article by Shoji Nishimoto, curator
