Beneath the crust

The Earth’s crust is the only solid part of our planet that humans have seen. This thin, hard outer layer ranges in thickness from 8 kilometres to about 40 kilometres. Scientists have drilled to a depth of about 12 kilometres through the Earth’s crust, but have yet to drill through to the next layer. Without actually seeing what’s in the Earth, how do scientists know what’s inside it?

The Earth’s structure

Scientists gather data from earthquakes all around the world to help them ‘see’ inside the Earth. Earthquakes produce waves that travel through the Earth away from the origin of the earthquake. The waves are called seismic waves. There are a few different types of seismic wave. Each travels at a different speed and behaves differently as it passes through various materials in the Earth. By analysing the waves and their behaviour, scientists have been able to determine what’s inside the Earth.

The Earth’s crust

The Earth’s crust is made up of large pieces called plates. The plates ‘float’ on the semi-solid rocks near the top of the mantle. The Earth’s plates move very slowly, often sliding under, over or against each other. The study of the Earth’s plates is important because most of the world’s earthquakes and volcanic eruptions occur because of the motion of the plates.

Lithosphere

The lithosphere (crust) is the layer that forms the hard, rigid surface of the Earth. There are two types of crust — continental crust and oceanic crust. Continental crust is lighter and thicker than oceanic crust.

Asthenosphere

The asthenosphere is part of the mantle and is made up of rocks that are quite supple. The asthenosphere can be described as a ‘ductile solid’ because it can flow very slowly.

Mantle

The mantle is a 2900 km thick layer that makes up the greatest volume of the planet. It is hotter and denser than the crust — the temperature in the mantle is over 1000°C. The mantle is made mostly of solid rock with some patches of molten rock.

Outer core

The outer core of the Earth is a 2200 km thick layer made mostly of iron. Temperatures of more than 4000°C make the rock in the outer core molten.

Inner core

The inner core is even hotter than the outer core. It is a solid sphere with a radius of about 1200 km. Like the outer core, the inner core is made up mostly of iron. Scientists believe that the inner core is solid because of the huge pressure exerted on it from the other layers.
Two types of crust

There are two types of crust that make up the Earth’s surface: oceanic crust and continental crust. Some of the Earth’s plates are made up of just oceanic crust; others have both oceanic and continental crust.

Oceanic crust is:
- between 6 and 8 kilometres thick
- made mostly of heavy rocks, like basalt
- formed from lava spewing from the mantle through cracks in the Earth’s crust under the oceans
- thinner than continental crust and, as a result, covered by water
- quite young.

Continental crust is:
- between 20 and 70 kilometres thick
- made mostly of less dense, lighter rocks, like granite
- formed from a series of volcanic events, weathering and sedimentation
- very old. Most of the original continental crust formed as the lighter materials rose and separated from the heavier ones during the formation of the Earth.

On the move

The Earth’s plates move at different speeds, but most move between 1 cm and 15 cm per year. The Indo–Australian Plate is moving away from Antarctica and towards Asia at a rate of about 6 cm per year. At this rate, Australia could be a part of Asia in about 40 million years.

REMEMBER
1. List the layers in the Earth that are:
   (a) solid
   (b) molten
   (c) partially molten.
2. What is the main substance found in the Earth’s core?
3. What are seismic waves?
4. Why is the inner core solid, even though it is hotter than the molten outer core?
5. On which plate can Australia be found?

THINK
6. What type of crust — continental or oceanic — would form most of the Pacific Plate? Explain your answer.
7. In the early 1960s, geologists started a project that attempted to drill through the crust and into the asthenosphere at the top of the mantle. Through what type of crust would the scientists most likely have drilled? Explain your answer.

DISCUSS
8. Form groups of three or four. In your group, discuss how Australia’s movement towards Asia could impact on the plants and animals that are currently found on our continent. Think about how:
   • temperature changes would affect the plants and animals
   • new wildlife from Asia entering Australia would affect the plants and animals.

I CAN:
- label and describe the layers in the Earth
- describe the Earth’s crust as consisting of several plates
- describe some differences between oceanic and continental crusts.