

1. EARTH

Planet Earth is our big Home. It moves through Space doing a complete turn on its axis (through the north and south poles) each day, giving us daylight and night depending on which part is facing the sun. It also rotates around the Sun once each year, giving us our seasons of winter, spring, summer and autumn. The Sun provides light and heat energy for everything on Earth.

Earth is estimated to be 4,600 million years old (4.6 billion)...a very, very long time! (Humans only evolved about **one** million years ago. If we pretend that 1 million years is a **second**, earth's age of 4,600 million years would be about 1.3 hours).

Earth is almost a **closed system**...almost nothing escapes into space and almost nothing enters from space (except energy from the Sun). Thus everything on Earth **cycles** into different forms and back again. For example **water** vapour from oceans rises to form clouds then falls as snow and rain and flows as rivers back to the oceans.

There is a **crust** of rock covering the earth, like a skin or the shell of an egg. It is thinner under the oceans and thicker under the **continents** (land masses). It is also cracked around the continents which are then referred to as **plates**. Those cracks are where the largest **earthquakes** occur and where the 500 or so currently active **volcanoes** are located.

Under the crust is softer rock and with increasing depth, the pressure and temperature increases until rocks melt to form **molten** rock in the **mantle**. This churns around in the depths of the earth and creates the pressures on the surface which move continental plates often resulting in earthquakes and cracks. If one plate slides under another the resulting molten continental rock bursts through the overlying plate to create volcanoes.

As an example of these movements.....150 million years ago (in the dinosaur period), New Zealand was connected to Australia, Africa, India, Antarctica and South America as a **super-continent** called **Gondwana** (If you look at the shapes of these countries you will see how they fitted together like a giant jigsaw puzzle). Animals (including dinosaurs) and plants (including our podocarps: kahikatea, totara and matai) could spread easily throughout this super-continent. When the land masses broke away, these animals and plants **evolved** separately from the others....some still show clear signs of being related....others have evolved quite differently....and some have survived when their relations on other land masses have become **extinct** (disappeared).

2. ROCK CYCLE

Yes, rocks change in a cycle too, but a very slow one. The molten rock in the mantle under the earth's crust can burst through the crust to form volcanoes and spew out

heavy molten **lava** (e.g. the **basalt rock outcrops** forming the two waterfalls in Drayton valley, as well as other outcrop bluffs there), or blast out molten rock mixed with air to form a very light rock called **pumice** or mixed fine material and stone sized molten rock called **scoria**. The continental plates can also ride up over the neighbouring plate (this is what the Southern Alps are doing) or plunge under (like the sea bed off the West Coast).

The volcanoes and the uplift mountains get **eroded** (worn down) from ice splitting the rock, rocks tumbling onto each other and breaking, rain making rocks slide and grind on each other (making sand), wind blasting them with sand, streams and rivers rolling, breaking and grinding them until at the river mouths only silt, sand and small stones can be seen. When rivers are in flood the silt and sand is carried well off-shore (as can be seen often with the Waimakariri River in north-west windy weather). Currents in the ocean also carry the silt and sand further off-shore. Beyond the continental shelf off-shore, silt and sand settle in deep trenches and as layer after layer builds up, they sink deeper and consolidate as soft **sedimentary** sandstones. As these are buried and altered by pressure and heat, they are transformed into **metamorphic** rocks (like in Fiordland and NWNelson). Eventually these rocks are worn down and **subducted** back into the mantle and become molten rock again.

3. BANKS PENINSULA

This emerged from the ocean as two volcanoes, forming an island off the Canterbury coast. The plains had not yet built up (with shingle eroded off the mountains) and in a warm period the sea level would have been much higher.

The first volcano, 10 million years ago, was centred on Lyttelton Harbour and was three times higher than the Port Hills today. The second volcano, 8 million years ago was centred on Akaroa Harbour and was 200m higher than the Lyttelton one. Both volcanoes ceased erupting 8 million years ago and became **extinct** (not likely to erupt again). They have also eroded down to their present heights and the crater rim has been breached allowing the sea into the main valleys which are now harbours.

There were several **Ice Ages** about 2 million years ago, each one producing glaciers out of the mountain valleys at least as far as the main river gorges and the sea level would have been about 150m lower than today. Between the ice ages, the warmer climate melted the glaciers into retreat and the sea level rose correspondingly. NW Winds blew silt left where the glaciers had been and off the braided river beds, onto the plains as well as the island volcanoes of Banks Peninsula, resulting in the yellow-grey **loess** (fine silt) deposits which still exist on hillsides. With the glaciers retreating and the ice cover reducing in the warmer inter-glacial periods, erosion from the mountains built up and extended the plains until they joined the island volcanoes to create the present peninsula about 14,000 years ago. The loess on the hillsides has eroded faster in recent times, where forest has been removed, land has been

excavated or stormwater has been mismanaged, resulting in more silt in waterways and coastal waters.

4. ENVIRONMENT

The Environment includes both biological and physical elements. There are both **natural** and **cultural** environments, although there are few places on Earth that have not been affected by human (cultural) activity. The Earth and all the living **organisms** (animals and plants) on it and within the physical environment is sometimes called the **biosphere**.

Smaller parts of **the environment** can also be called an environment or a **habitat**, e.g. this Drayton Reserve, or **your Home**. A habitat is the place where particular animals, plants and microbes live.

Within an environment, everything is **connected** (interacting or dependent) sometimes clearly, sometimes not so clearly.

An **ecosystem** is the combination of all the living things that are clearly connected with each other and interacting with the physical environment. Ecosystems are areas which have similar features of topography, soils, moisture, sunshine, vegetation etc. They can be very large areas or very small areas. We have identified 8 different ecosystems in Drayton Reserve.

Ecology is the study of ecosystems, the living and non-living parts and all the connections between them. The word ecology comes from a Greek word "Oikos" meaning "the home", so ecology is the study of the "home" or habitat of the creatures living in a place.

Your home is an environment, a habitat and an ecosystem. You and your family and pets are some of the living organisms within it and are all interacting with each other. Interactions include "give and take". You give help to Mum and Dad with the housework and get provided with meals, a bed and toys etc in return. You depend on each other and care for each other.

But you are also part of the wider natural environment outside your home. You need to learn about the environment and how you are connected with all its parts, what you can take from it and what you need to give it in return. For example, plants give **out oxygen** gas which we need to breathe **in** to stay alive! We breathe **out carbon dioxide** gas which plants need to take **in** to stay alive! **We are dependent on plants and plants are dependent on us!**

Caring for the environment means that it can provide for us all into the future.

Always try to leave the environment better than you found it (even picking up litter helps) and remember that **giving** makes you feel much happier than taking!

5. LIVING ORGANISMS

Life started on earth about 4 billion years ago, with tiny single cell organisms and very slowly evolved into more complex plants and animals like ourselves.

The climate, atmosphere, water and ground conditions were much too harsh for humans (e.g. there were ice ages with salty oceans and low sea levels and hot periods with acidic oceans and high sea levels).

Many organisms died out over time and there were also many **mass extinctions** (when lots of different species died out around the same time). For example, the dinosaurs lasted about 165 million years from 230 million to 65 million years ago. Some organisms have survived through these harsh conditions and are still living today. The following evolved about the dates shown, during the period of the dinosaurs.....gecko(100m), kiwi(130m), tuatara(200m), weta(200m), kahikatea, totara and matai(200m) and giant snails(230m). The following evolved **before** the dinosaurs.....dragonflies and silverfish(300m), springtails(370m), liverworts(400m), tardigrades or moss piglets(530m) and peripatus or velvet worms(550m).

Some are very much newcomers.....e.g. humans(1m)!!

Life forms (organisms) are hugely varied (e.g. elephants to ants!), and occupy every little corner of planet earth (including bacteria in our tummies, in the air and in the soil).

There is still a huge amount that scientists don't know and don't understand and probably never will because life is so complex. This means there will always be lots to study and discover....if you are interested!! (You can learn more about organisms and contribute to our knowledge, by posting pictures of organisms you find onto <http://naturewatch.org.nz>).

Many plants and animals are threatened with extinction because of damage to the environment we humans are doing, either unwittingly or deliberately. We all need to remember that we are part of the environment and connected to all other organisms in some way or other. We should therefore respect, care for and enjoy all life forms, so that they can survive with us and help us and future generations.

THANKS FOR COMING

Come again as often as you like. Did you know that spending a little time regularly in a natural environment like this Reserve, improves your happiness, health and creativity? (yes, scientifically proven!).

If you want to volunteer any time or resources to this long-term community project, contact Dave Bryce 021363498 or email: ecosolutions@xtra.co.nz to go on our mailing list.

