

Info series all about.... (available as downloads or a leaflet)

All about ... **Limestone**

Limestone is one of the most common types of rock found on the surface of the Earth. About 10% of the land surface of our planet is made of limestone or similar types of rock, while around 25% of the world's population either live on or take their water from limestones. It is thought that 50% of all our oil and gas reserves are trapped in limestones buried beneath the surface.



Limestone found in New Zealand

The rock limestone is mostly made up of one of two types of mineral - either calcite or aragonite. Both of these are different crystal arrangements of the same chemical compound - calcium carbonate (CaCO₃).

Limestone is a special type of rock for several reasons -

- it is most commonly made by microscopic organisms living in the sea
- it can be dissolved in natural waters - allowing caves, shafts, natural bridges and sculptured rock outcrops to form (like those found in the Waitomo area).
- it is the essential ingredient in making agricultural lime and cement.
- limestone was also used to build the Egyptian pyramids, the Taj Mahal and the Greek Parthenon (all of these are now being slowly dissolved by acids in the atmosphere)

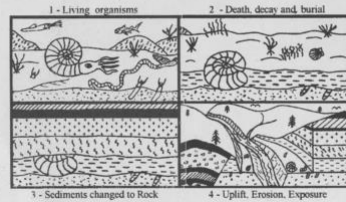
All about ... **FOSSILS**

The term fossil is derived from the Latin word *Fossilis*, which means dug up. Once the word fossil meant any rock with an interesting shape, including stone age tools. Today fossils are regarded as the remains or traces of once living creatures that have been preserved in the rocks.

The most commonly found fossils consist of the hard parts of organisms, such as bones or shells, because the soft parts rot away soon after death. Even the hard parts decompose slowly, and can also be destroyed by fire, scavengers or the weather. If the hard parts are rapidly buried by volcanic ash or *sediments* such as mud and sand, they are protected and may be preserved as fossils. Fossils are common in rocks formed in ancient river mouths and coastal seas, as these were places where there was abundant life and layers of sediment were constantly deposited.

In special circumstances the soft parts of organisms may be fossilised. The whole mammoth found frozen in the Siberian Tundra, and insects trapped in amber (fossil tree sap) are examples of these.

Trace fossils are the tracks and trails of animals that have been preserved, rather than the animals themselves. Trace fossils can be as spectacular as dinosaur footprints, or as unobtrusive as worm burrowings or snail trails on the sea floor.



All about ... **CAVES**

Caves are natural cavities in rock. Several types of cave are found in New Zealand; sea caves, lava caves and solution caves.

Sea Caves

Sea caves are common in rocks along New Zealand's coasts. Waves repeatedly pounding the rock forces water into tiny cracks. The cracks gradually enlarge. Although sea caves can be of impressive size, they are rarely very long.

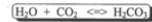
Lava Caves

Lava caves are found in cooled basaltic lava flows. Auckland is built on a field of basaltic volcanoes and has a number of lava caves. Some can be seen on Rangitoto Island, and the largest is the Wiri Lava Cave in South Auckland.

Lava caves begin as open lava canyons, through which lava moves from the vent of the volcano to the advancing toe of the lava flow. Although the lava may be as hot as 1200°C the surface of the flow cools rapidly. A crust forms over the flow, creating a lava tube. If the lava drains out of the tube at the end of the eruption, a lava cave is left behind. Entrances, known as skylights, are created by the partial collapse of the cave roof.

Solution Caves

In New Zealand solution caves are formed in limestone (such as at Waitomo Caves) and in marble (found in the mountains of the Nelson region). The calcium carbonate (CaCO₃) that these rocks are composed of, readily dissolves in acid, allowing solution caves to form. Carbonic acid (H₂CO₃) is produced naturally when carbon dioxide from the atmosphere is dissolved in rain water.



Although this acidic water will dissolve calcium carbonate, it is so weak that it is still fine to drink. When solid calcium carbonate comes into contact with carbonic acid, it is dissolved, forming calcium (Ca²⁺) and bicarbonate (HCO₃⁻) ions in solution.



Soils have much higher concentrations of CO₂ than the atmosphere. They accumulate CO₂ that is released by plant roots, bacteria and fungi. Water percolating through soils absorbs additional CO₂ and becomes more acidic than rain water. However this water quickly becomes saturated with CaCO₃.

All about ... **SPELEOTHEMS**

Caves are unique - because of the dark, because of the quiet, but perhaps most of all because of the strange crystal formations with which caves are decorated. These decorations are called SPELEOTHEMS.

How are speleothems formed?

Speleothems are crystal deposits which form on the ceiling, walls and floor of caves. As rainwater seeps through the soil it absorbs the carbon dioxide (CO₂) given off by plant roots, soil animals and decaying matter. This carbon dioxide makes the water acidic and able to dissolve limestone (calcium carbonate).

The acidic water dissolves some of the limestone as it finds its way through tiny cracks in the rock. When the water reaches the cave, it loses carbon dioxide to the cave air. The water is now less acidic and unable to hold the same amount of limestone. Tiny crystals of calcium carbonate are deposited, slowly decorating the cave with speleothems.



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All about ... **GLOWWORMS**

Glowworms are the larval stage in the life of an insect called the fungus gnat. Just as maggots grow into common houseflies, glowworms grow to become fungus gnats, which are similar to mosquitoes. Although they are most spectacular in caves, glowworms are also quite common outside - they can be found wherever conditions are damp, food is in good supply and there is an overhanging wall. Similar glowworms can also be found in the south-east of Australia. The scientific name of the New Zealand species is *Arachnocampa luminosa*.

The famous light ...

The New Zealand glowworm is one of many creatures that naturally produce light (bioluminescence). The light of the glowworm larvae is given off by small tubes ending around the glowworm's anus, as a byproduct of excretion. A reaction takes place between an enzyme called luciferase and other chemicals, with the blue-green light given off as a result.

The light is used to attract insects lost in the dark, which the glowworm catches and eats. If a glowworm is hungry its light will shine a little brighter and is even more effective! When the female glowworm becomes an adult the light is used to attract males for mating.



All about ... **WETAS**

The weta is one of New Zealand's most infamous creatures. The Maori called them Devils of the Night or Gods of Ugly Things. An early scientist, Sir Walter Buller, once attempted to collect and kill some wetas for studying. One was held underwater for four days but survived; another was still alive after being dropped into near-boiling water; while yet another ate its way out of his handkerchief. But in spite of their fearsome appearance they are quite harmless, and very rarely aggressive.

Wetas are found in several Southern Hemisphere countries apart from New Zealand. The largest species found here are the heaviest insects in the world, weighing up to 70 grams - however, there are over 70 species of weta in New Zealand. Even older than the tuatara, wetas are a very primitive creature. Our wetas have changed very little since New Zealand was isolated from the rest of the world many millions of years ago. In fact some species are very similar now to when they lived with the dinosaurs.

Wetas can be divided into four major groups - cave wetas, tree wetas, ground wetas, and giant wetas.

