

## How The Mountains At Arthur's Pass Were Formed

Scientists have an alternative story of the forming of the earth and the mountains. The mountains we see at Arthur's Pass today started forming 200 million years ago. Long ago layers of **mud, sand, and gravel** settled on the sea-bed. These layers of sediment built up over thousands of years. The resulting **pressure** from the weight of the accumulated **layers of sediment**, combined with a **chemical reaction** like mixing concrete, compressed the lower layers and formed rock. You can often see the layers of material as **strata** in the rocks around Arthur's Pass. (See Photo Gallery).

- Layers of sand become **sandstone (greywacke)**
- Layers of mud become **mudstone (argillite)**
- Layers of gravel become **conglomerate**

These types of rock make up the mountains at Arthur's Pass.

This process still continues as rivers carrying small pieces of sand, mud, and gravel flow into the sea and deposit this sediment on the shore and sea-bed. The Bealey River and its tributaries carry debris from the mountains into the Waimakariri River which flows across the plains to the sea. You can see **ripples** caused by **water action** on the sand preserved in some **sedimentary rocks** (see Photo Gallery). Shell fish that die on the sea-bed have their shells preserved as **fossils** in the rocks, showing that these rocks were formed under the sea (see Photo Gallery). Some fossils can be found in the rocks of Arthur's Pass region. Some examples are displayed in the Visitor Information Centre at Arthur's Pass.

**Heat and pressure** deep under the earth's surface can change the sedimentary rocks. **Metamorphism** is the way in which heat and pressure changes sedimentary rocks into **schists**. Some schists have white **quartz veins** where a mineral has been **metamorphosed** (changed). If you look at the rocks at Arthur's Pass when you go for a walk you will see rocks with quartz veins in them.

The earth's crust consists of plates of rock material. Two plates colliding results in **folding and buckling of strata** (layers). This process is called **Plate Tectonics**. Two plates meet along a **fault-line**. **Earthquakes** are common along fault-lines. The Australian plate and the Pacific plate meet along New Zealand's **Alpine fault-line**. If you go over Arthur's Pass and down the Otira Gorge you can see the Alpine fault-line. If you cross the Alpine fault-line to the west you are in Australia, geologically speaking.

Continued movement of plates causes **uplift** and pushes the layers of rock up into mountains. The mountains show the folding and buckling that the strata of rock has been subjected to by these enormous pressures. The mountains of Arthur's Pass are the result of this **process of uplift, buckling and folding** of the rock **layers**.

## Erosion

**The mountains of the Southern Alps began to form 30 million years ago, and the process is still occurring.**

The process of mountain uplift is being balanced by **erosion**. When you come to Arthur's Pass you will see many examples of erosion, such as **scree**s.

**Wind, rain and snow** beat at the mountain, slowly wearing it away. When water seeps into the cracks in the rocks and freezes during a heavy **frost**, the rocks may split and shatter. The loose material is carried away either in rivers, by the wind as dust, or slides down the mountain side as **scree slides** or **slips**. Three main processes form a **scree slide**. These are slips during heavy flooding, glacier recession leaving unstable valley walls and shattering of rocks by frost.

No plants grow on new scree slides. After a while small plants find pockets of soil and **colonize** the scree slide. After many years bigger plants grow and finally forest is established. This is called **plant succession** (refer to ecology section). The sides of the Bealey Valley are now covered in forest, but were once bare shingle slopes.

**Heavy rain** results in dirty, swollen, fast flowing rivers. These rivers are dirty because of the mud and shingle they are carrying from the mountain. Melting snow will increase the amount of water. Flooding rivers accelerate the erosive process, and slips often result.

**Earthquakes** have a major erosive impact on the mountains. One mountain at Arthur's Pass is called Falling Mountain. It was named when the 1929 earthquake caused a large landslide to take away half the peak.

The natural cycle of erosion is often accelerated by careless human intrusion. For example, the track to Temple Basin.

Rivers carry the debris from the mountains back to the sea. The Canterbury Plains are **alluvial plains** made from the gravel eroded out from the Southern Alps. The sediment is finally carried to the sea by rivers like the Waimakariri. It settles on the sea-bed in layers ready for the **cycle of rocks** to begin again.