GEOLOGICAL SNAPSHOTS FROM NEW ZEALAND

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Eight members of our Society, including the Chairman and Secretary, were missing from the lecture meeting in April 1999. The reason? They had joined Stonar School's Kiwi Adventure.

1. Christchurch, east coast of South Island: On our very first afternoon in Christchurch, in beautiful, warm sunshine, we walked around the rim of the volcano at Lyttleton Harbour to the north of Banks Peninsula. The great shield shape of the Banks Peninsula was built up by two overlapping volcanoes which erupted on to an island of greywacke. The early eruptions were in the Cretaceous and were of rhyolite and andesite. 12 million years ago, in the Miocene, the Lyttleton Volcano began pouring out basaltic lavas with occasional outbursts of ash and small pebbles. The second great eruption (9·5 Ma) was that of the Akaroa Volcano to the south-east. This eventually overtopped the Lyttleton cone. This was also basaltic. Before the Akaroa eruption, the Lyttleton cone lifted (rising Akaroa magma?) and split open with many fine cracks. Lava rose through these in a swarm of dykes, many of trachyte. We saw these as we walked around the summit of the original Lyttleton Cone.

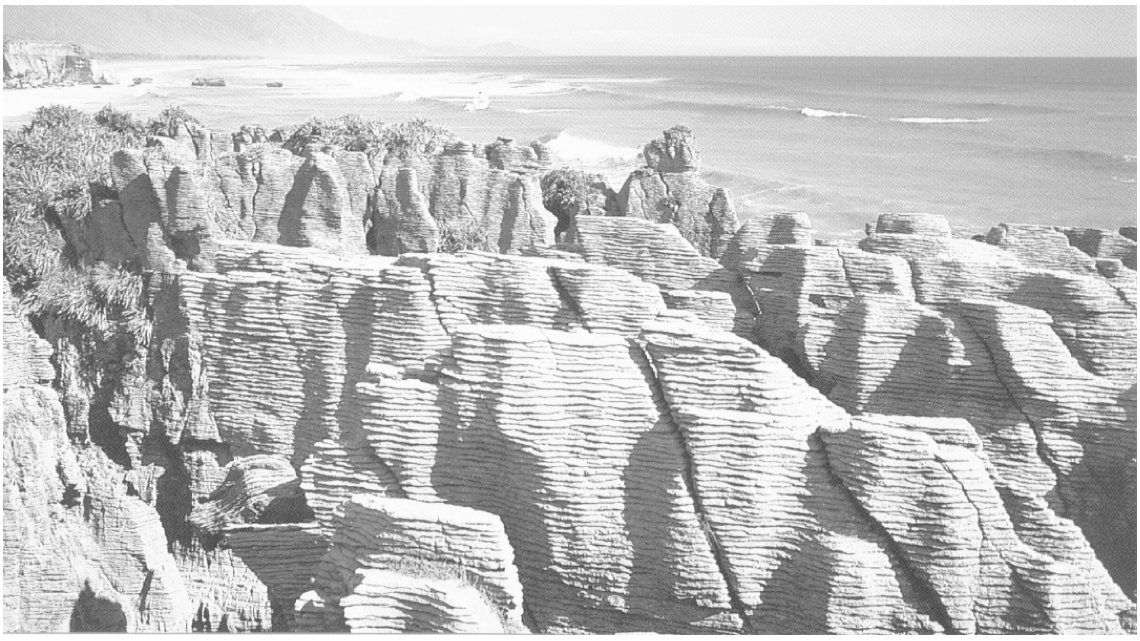
2. The Abel Tasman National Park, north-west coast of South Island: This is the smallest of New Zealand's national parks and protects the coastline and highland between Golden and Tasman Bays. The landforms are mainly granite and it is the breakdown of this rock that gives the sparkling golden sand of the beaches. Once this National Park area was entirely covered with podocarp rainforest on the lowland and beech higher up but it suffered more than a century of land clearance and is only now regenerating. The forest is dense near the coast with a luxuriant understorey of leafy trees and shrubs with many tree ferns. We thought it was like walking through the fern house at Kew Gardens except we were accompanied by the sound of bellbirds.

Split Apple Rock, Abel Tasman National Park -
isolated block of granite (similar to a tor),
split along a joint, possibly aided by earthquake shock waves

3. The Pororari River, west coast of South Island: The river has carved a gorge in Oligocene Limestone. Here the karstic scenery is completely obscured by the thick vegetation and is totally unlike that of Britain. This is possibly because the soil was not scraped away in the Ice Age. The pebbles here are a great mixture as the Pororari flows over Upper PreCambrian, Cretaceous, Eocene and Oligocene. The Precambrian material includes greywackes, phyllites, schists, hornfels, granitic paragneiss and orthogneiss.

The river flows through the Temperate Rain Forest of the **Paparoa National Park**. The rain forest owes much of its greenness to the heavy rain precipitated when westerly winds blowing over the Tasman Sea are forced to rise over the Southern Alps. It does not rain every day but when it does, falls are heavy with annual rainfall between 2000mm and 6000mm. We were lucky!

4. The Pancake Rocks of Dolomite Point, west coast of South Island: These are Oligocene limestones. They were uplifited and folded in the Pliocene at the end of the Kaikoura orogeny. The layering of the rocks here consists of resistant bands of limestone, separated by thin bands of softer mudstone. Many geologists consider this layered structure to be a secondary process that occurs sometime after deposition, (British Blue Lias?). When the sediments are buried and compacted, grains of calcite are forced against each other under enormous loads. At their points of contact where the pressure is concentrated, the calcite is least stable and begins to pass into solution (pressure solution). These sites of solution gradually merge into one another to form an irregular boundary (stylolite). As the solution of calcite proceeds along this boundary, insoluble minerals scattered throughout the limestone are left as a mudstone residue while the dissolved calcite is carried away in solution. This insoluble material is therefore concentrated as a mudstone seam. This type of layering is called ***stylobedding.*** The pancake effect is caused by modern weathering and marine erosion which picks out the less resistant mudstone and leaves the more resistant limestone. Those of you who saw the BBC's 'Walking with Dinosaurs' will remember that Archaeopteryx was walking around on Pancake Rocks at the beginning of the programme!



Pancake Rocks, Dolomite Point

5. Fox and Franz Josef Glaciers, west coast of South Island: Both are very steep glaciers with the ice descending a long way before it melts. While most of the world's glaciers are in retreat, these two are advancing. Fox gains an average of about 30cm per day. 14,000 years ago it was at today's shoreline. Moraines along the valley floor are a reminder that this whole area was covered by 300m of ice. Because of the glaciers' current rapid advances, the glacial topography is dynamic. Crevasses are constantly opening, lakes form within the glacier and may burst through the sides. It

is therefore dangerous to walk on the glacier and parties are always guided. It was an unforgettable experience!

The mountains here are relatively young and still rising. Sedimentary greywackes have been uplifted along the collision line (the Alpine Fault) of the Indo-Australian and Pacific plates. Massive movements along the fault over the last 3 million years (mountain-building phase called the Kaikoura orogeny) have pushed the Pacific plate over the Indo-Australian, causing as much as 20,000m of uplift. Equally dramatic is the 480km sideways movement that has occurred along the fault. Most of the movement on the fault now is sideways but vertical uplift is raising the mountains about 10mm/yr. However, uplift is counteracted by rapid erosion.

The mountain building process which created the Southern Alps also caused regional metamorphism (late Mesozoic) of the sedimentary greywackes and there is a textbook sequence of high to low grade rocks from the Alpine fault eastwards:-

Garnet to Oligoclase Zone
Biotite Zone
Three bands of increasing grade of Chlorite Zone

Fox Glacier has carved its way through these Zones and we were able to find examples of all except the highest grade, Oligoclase, which occurs further down the valley. Fantastic!

6. Fjordland, south-west of South Island: This is the largest National Park in New Zealand and one of the largest in the world. The rocks are mainly Ordovician but rather inaccessible - the detailed geology is still being investigated. Much of the original rock has been recrystallised to form paragneiss and amphibolite; it is all very complex. We climbed Key Summit (919m) at The Divide en route to the Homer Tunnel. We went through a succession of different vegetation types until we climbed out above the trees into an Alpine Reserve with bogs of sphagnum moss and a great variety of alpine plants. The glacial scenery around was spectacular. The rocks here are described as Plato basaltic volcanics.

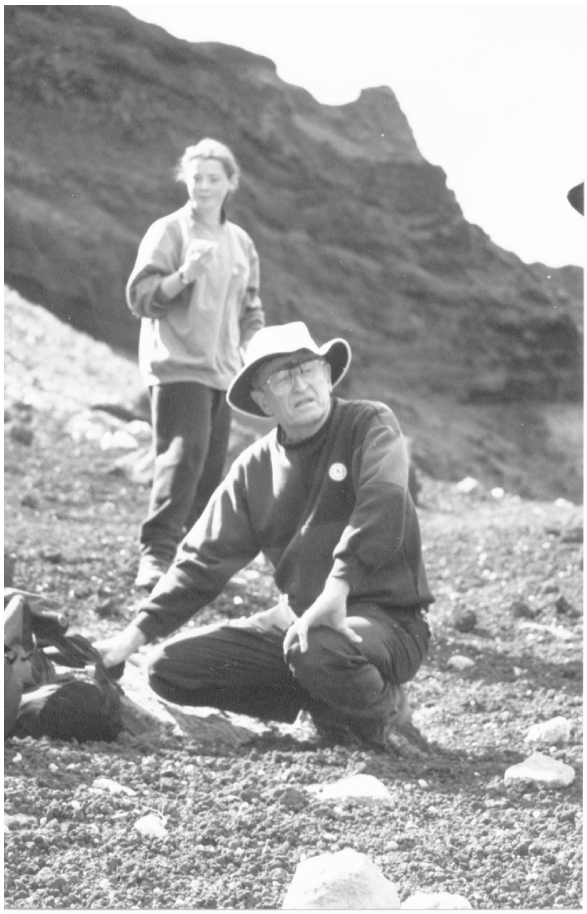
7. Milford Sound, Fjordland: This fjord is often described as one of the scenic wonders of the world. This part of New Zealand is a fragment of the broken-up continent of Gondwana, whose

Mitre Peak (1694m), Milford Sound

original beech forests still survive all around the South Pacific. The land is rising here by about 2mm per year. Granulite has been brought to the surface from over 30km depth.
The sea in the Sound fills a glacial valley more than 300m deep that ends towards the open ocean with an underwater terminal moraine reaching within 100m of the surface.

A layer of freshwater covers the fjord surface to a depth of about 3m. This prevents the growth of seaweeds and algae. The freshwater carries minute particles of vegetation which reduce the amount of sunlight reaching below. Because of the reduced light, normally deep-water flora and fauna can exist here at much shallower depths than normal. In the underwater observatory at 5 - 20m below the surface, we saw black corals, tube anemones, sea pens and brachiopods. At sea level crested penguins and fur seals are frequently seen.

8. Flight from Queenstown, South Island to Rotorua, North Island: We saw **Mount Cook** and the **Southern Alps** and then the sharp divide between the mountains and the **Canterbury Plains** with huge braided streams. From Christchurch north, we could see all the islands in **Marlborough Sound** with the classic volcanic cone shape of **Mount Taranaki** (Egmont) in the distance. We then flew over the active volcanic vents of **Ruapehu, Ngauruhoe and Tongariro.** They were covered in snow and smoking! We had an excellent view of the mountains here; apparently our pilot wanted to check the ski slopes. Next we saw the huge **Lake Taupo** which occupies the caldera of this volcano, reputed to be the largest rhyolitic volcano in the world.



Our Chairman, John, 'selling' volcanic bombs at Tarawera with one of our student members, Kathryn Hyde-Bales

9. Rotorua, North Island: Some of the tents in the grounds of our chalets were advertised as 'heated' i.e. they are on hot ground. There was a geyser in the garden and the sand by the edge of the lake was hot a few cms down! There was a natural hot tub and the barbecue in the garden was geothermally powered; you just lift the lid. Rotorua is actually in a crater, the rim of which can be seen around the town. Three rhyolite cones (Kakapiko, Haparingo and Maurangi) have developed in the crater.

10. Tarawera Volcano: On 10th June 1886, this volcano caused the largest eruption in New Zealand since European settlement occurred here. An almost continuous rift was blasted for 17km across the mountain top through Lake Rotomahana into the Waimangu valley area. We travelled up to the crater of Tarawera on a journey which can only be described as worse than anything at Alton Towers. Having struggled to the top of the volcano and admired the alternating basaltic and rhyolitic scoria (differentiation or what!), we threw caution to the wind and did a scree-run down. Most of us came down feet-first but there's always one who has to be different!

I have left out so much - this is just a taster. If you can, go to New Zealand. Our trip was -

AWESOME!!!