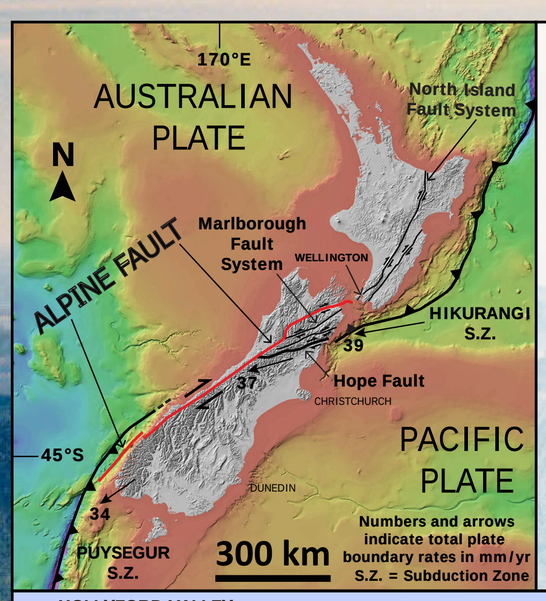
ALPINE FAULT

IN THE HOLLYFORD VALLEY



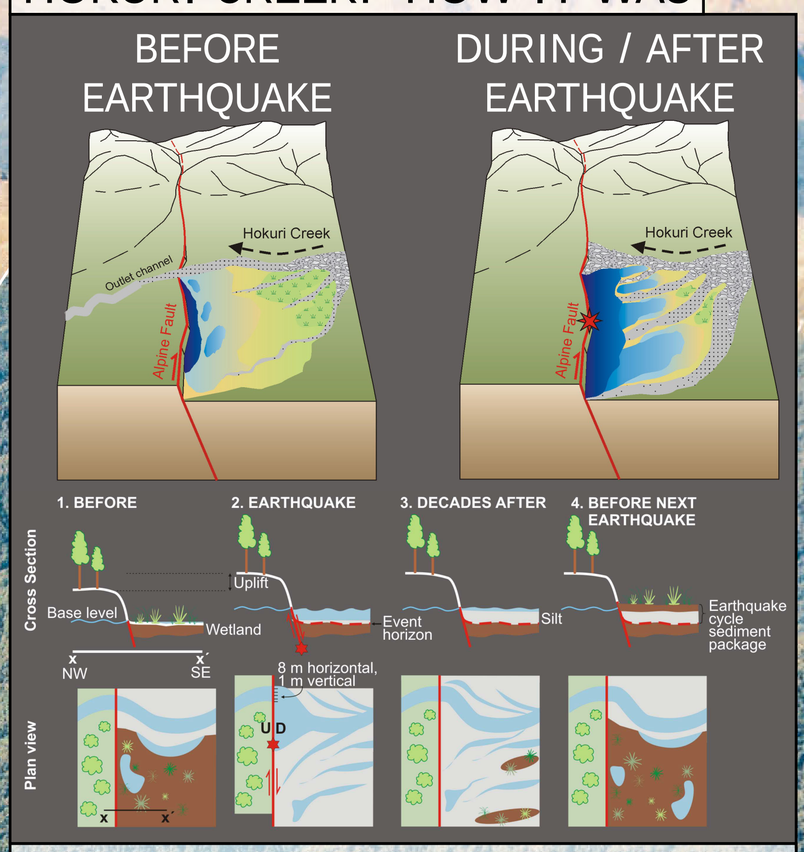
➤ **The Alpine Fault is the 880 km long active fault that traverses the length of the South Island and accommodates about 27 mm/yr of the motion between the Pacific and Australian tectonic plates (or about the rate of human fingernail growth). This motion occurs mostly in infrequent, large magnitude earthquakes, which are a major hazard for NZ.**

➤ **The fault forms one of the longest and straightest lines visible from space. Its motion is mostly horizontal (strike-slip), but a component of vertical motion has formed the Southern Alps.**

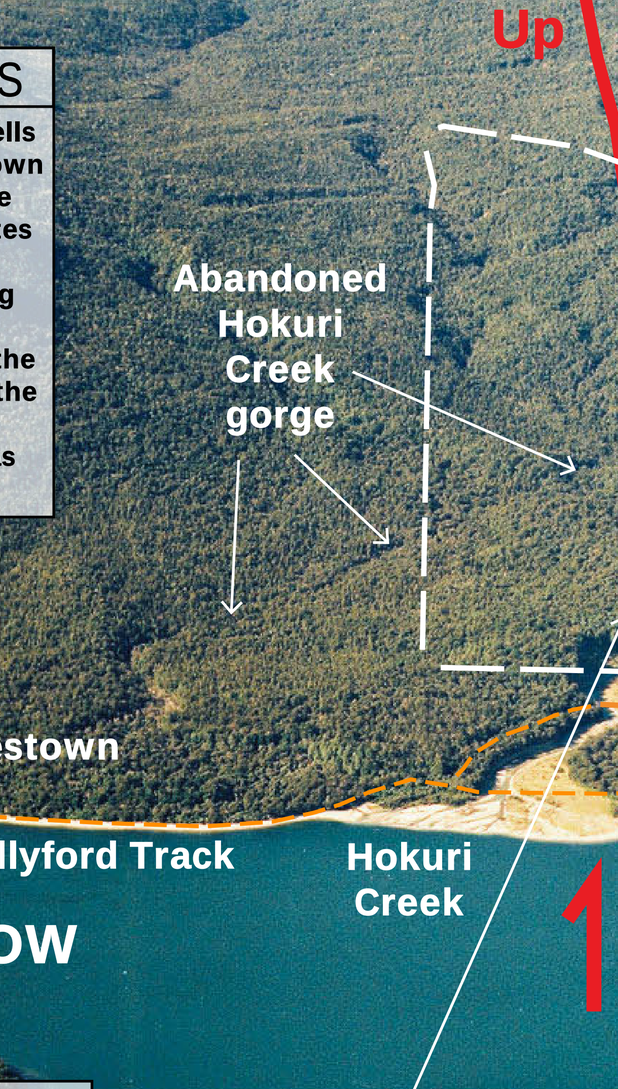
JAMESTOWN SHELLS

A deposit of sub-tidal marine shells found behind the site of Jamestown has been radiocarbon dated to be about 6500 years old and indicates the lower Hollyford valley was a marine fjord at the time. By using the modern elevation of the site, the past elevation derived from the shell species' living depths, and the deposit's age, a local Australian plate uplift rate of 1-2 mm/yr has been determined.

HOKURI CREEK: HOW IT WAS

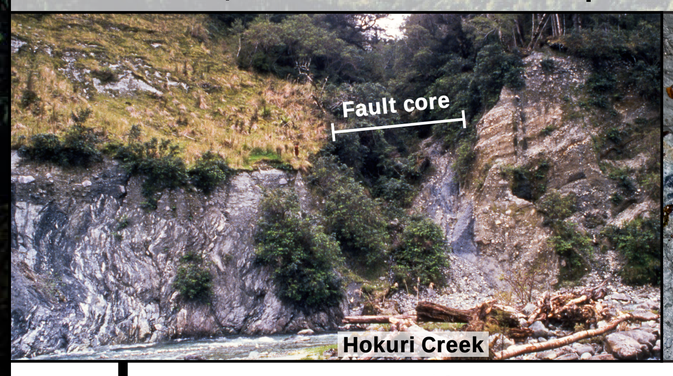


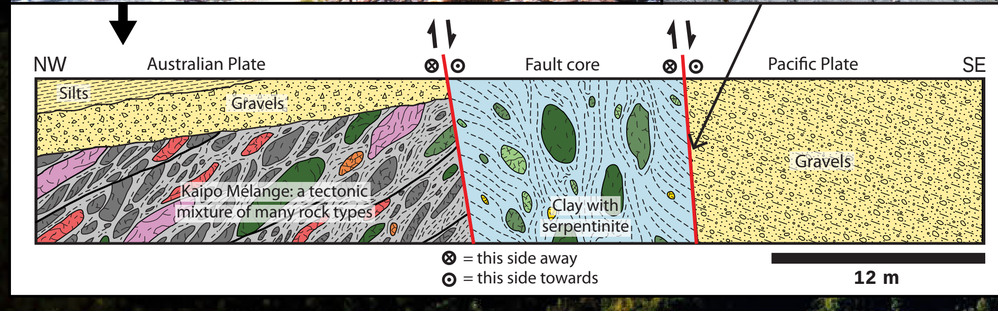
➤ **Each large earthquake that ruptures the surface at Hokuri Creek offsets the two sides of the fault about 8 metres horizontally and 1 metre vertically. When this happened in the past, it dammed the narrow gorge outlet of Hokuri Creek and flooded its wetland upstream. Silt then gradually filled in the ponded area. When the water became shallow enough, the wetland took over again and peat was deposited. This cycle repeated after every earthquake to build up a sequence of alternating peat-silt sedimentary layers. By radiocarbon dating organic matter at the top of a peat unit and at the bottom of the silt unit above, the age of a past earthquake can be estimated.**



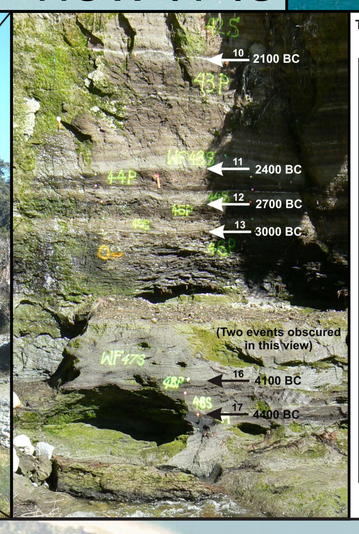
FAULT ZONE EXPOSURE

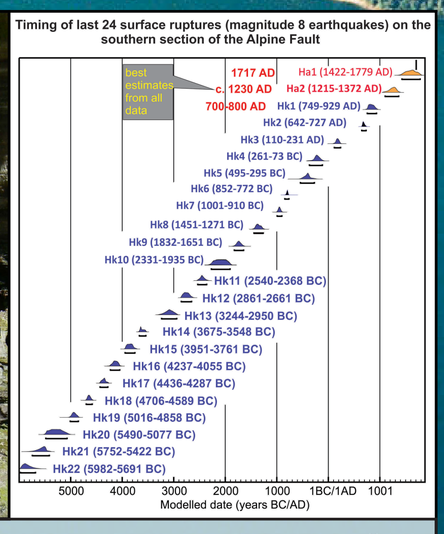
➤ **Hokuri Creek is one of the few places in the world where a plate boundary fault is so spectacularly exposed. A great example can be seen 350 meters upstream of the Hokuri Creek walkwire on the true right of the creek. Most fault movement occurs on the sides and within a 12 meter-wide zone of blue clay formed by alteration of serpentine at depth. The main clay mineral present is saponite, one of the frictionally weakest minerals known. The margins of the clay-rich zone (the "fault core") have scratch marks formed by the two sides sliding against each other during major earthquakes. The scratches, or "slickenlines," are sub-horizontal, consistent with overall Alpine Fault movement here.**





HOKURI CREEK: HOW IT IS





➤ **Fortunately, in the last 1000 years the gorge was abandoned and Hokuri Creek cut a more direct route to Lake McKerrow southwest along the Alpine Fault, which spectacularly exposed the Hokuri pond-wetland sediments. Careful dating has identified 22 major earthquake events here. Together with two more recent earthquake events recorded at Haast, Hokuri Creek reveals an 8000 year record of 24 large (M 7.0-8.0) earthquakes on the southern onshore Alpine Fault. These earthquakes occur at relatively regular intervals (typically about 329 ± 68 years). The last earthquake occurred in 1717 AD, so there is now a 30% probability of a major Alpine Fault earthquake in the next 50 years.**

Prepared by Nicolas Barth (OU) and Ursula Cochran (GNS) [2012]

Background photo by L. Homer (GNS Science). Some content from: Berryman et al., 2012, Major earthquakes occur regularly on an isolated plate boundary fault: Science, v. 336, p. 1690-1693.

For more information on the Alpine Fault see the GNS Science and University of Otago- Geology Department websites.

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