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Previously undocumented widespread subduction on the western side of the Alpine Fault, New Zealand

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There is limited knowledge concerning the environmental after-effects of Alpine Fault-related ruptures on the West Coast of the South Island, New Zealand. In particular, with the prevailing perception of the Alpine Fault as predominantly strike-slip (~10 m horizontal displacement on the western/seaward side and 4 m vertical on the eastern/landward side) any minor vertical land displacement on the western/seaward side and associated tsunami inundation are seldom considered as possible after-effects of its activity.

A recent study of drowned forests, subsided soils, exposed tree stumps and sedimentary evidence from coastal lagoons and beaches along an 80 km stretch of West Coast coastline between Saltwater Lagoon and Hunts Beach indicate multiple subsidence (and uplift) events. At least seven recognisable co-seismic subsidence events appear to have taken place from ~5000 years BP to AD 1650, with as many as three co-seismic uplift events between ~6500 years BP and AD 1826. Radiocarbon dating of drowned trees revealed the presence of multiple tree age cohorts, some overlain by tsunami and/or slope failure deposits. The overall trend is one of subduction, with rates varying along the coast from as low as 0.05 mm/yr in the north to as high as 0.6 mm/yr in the south.

The recognition of co-seismic subsidence events in this area may help explain a geomorphological conundrum where coastal wetlands and lagoons are maintained in a region where substantial sediment supply to the coast should cause infilling and progradation. However, the presence of a raised bench dated to AD 1826 surrounding at least two lagoons (0.77 masl: Saltwater Lagoon, 0.50 masl: Okarito Lagoon) and identifiable around the periphery of several other coastal wetlands, together with earlier uplift events around 1800 years BP and possibly 6500 years BP, adds to the regional evidence for recent co-seismic uplift, as well as demonstrating the complexity of tectonics in the area. A tectonic case for a



fault roughly parallel to and seaward of the Alpine Fault is proposed – and traced in the landscape – to help at least partially explain the subsidence and uplift along the coast.

Figure 1: Drowned forest in Saltwater Lagoon, West Coast, New Zealand. At least three co-seismic subsidence events are recorded at

this site. Unfortunately dendrochronology is currently unable to tie in the youngest drowned forest to existing chronologies [Photo: J. Goff].

