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A Global Synthesis with implications
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Singh L. J.*

Submerged Shorelines of Marlborough Sounds, New Zealand: A Record of Late Quaternary Tectonic Subsidence and Sea Level Stillstands

*School of Earth Sciences, Victoria University of Wellington, PO Box 600, Wellington, New Zealand, fax 644 463-5186, E-mail: Les.Singh@vuw.ac.nz

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Abstract

The Marlborough Sounds form a distinctive region of New Zealand distinguished by its intricate coastline of submergence with deep inlets that resemble fiords. The submergence has been attributed to subsidence of the landscape, the postglacial rise in sea level or to a combination of these processes.

To elucidate the Late Quaternary tectonics and sea level history, Pelorus Sound, in the central part of the area, was chosen for study by the use of high resolution Uniboom seismic reflection profiles, archived 3.5 kHz seismic profiles, and shoreline age-elevation data interpreted from piston cores. The marine mud in Pelorus Sound is underlain by about 400 metres of alluvial deposits. Seismic profiles and radiocarbon dates from a core in the axial part of the Sound near Maud Island, indicate that before 12.5 kyr B.P. the area was occupied by a river system that had formed an alluvial plain.

The upper surface of the alluvium comprises a major seismic unconformity with the informal name “Maud Surface”. By c.12 kyr B.P. the area near Maud Island became an estuary as the shoreline progressed southward into the Sound with the rising sea level. The age-elevation data indicate subsidence of the central part of the area at an average rate of 1 m kyr^{-1}. The Sounds region is also tilting approximately northwards towards the centre of the South Wanganui Basin with measured tilt rates increasing from 1.1° Myr^{-1} during the Last Interglacial to 3.9° Myr^{-1} at 12 kyr B.P. with perhaps a 2° rotation towards the north.

The subsidence and tilting were initiated by the migration of the depocentre of the South Wanganui Basin and probably generated by frictional coupling between the subducting Pacific Plate and the overriding Australian Plate (Stern et al., 1992). The subsidence has resulted in the generation of a drowned landscape and features unique for New Zealand where most coasts are undergoing uplift at rates up to 4 m kyr^{-1}. A set of paired, planar features recorded on a seismic profile is interpreted as submerged marine terraces.

They occur on either side of the channel near Maud Island and were probably formed by stillstands or fluctuations in the rising Holocene sea level. Age-elevation data show a correlation of Pelorus Sound sea levels with those for the New Zealand-East Australian region. The marine terrace elevations, when corrected for tectonic subsidence, correlate with proposed stillstand events at eustatic levels of –45 m (10.5 kyr B.P.), -33 m (c.9.5 kyr B.P.), and the –19 to –26 m paracycle at 8.5 kyr B.P (Larcombe et al., 1995, Carter et al., 1986). The presence of the well-defined terraces and their apparent correlation with well-constrained sea level data support the model of an episodic rise of the Postglacial sea level.

The episodic rise model is further supported by the c.12 kyr B.P (C14 age) shoreline which correlates with substantial sediment wedges and stillstands of this age in the New Zealand – East Australian region (Carter et al., 1986). The c.14 ka calendric age of the stillstand event is also the time of the Antarctic Cold Reversal which was possibly the cause of the stillstand or fluctuation in the general rise of the deglacial eustatic sea level at this time (Blunier et al., 1997, Raynaud et al., 2000).

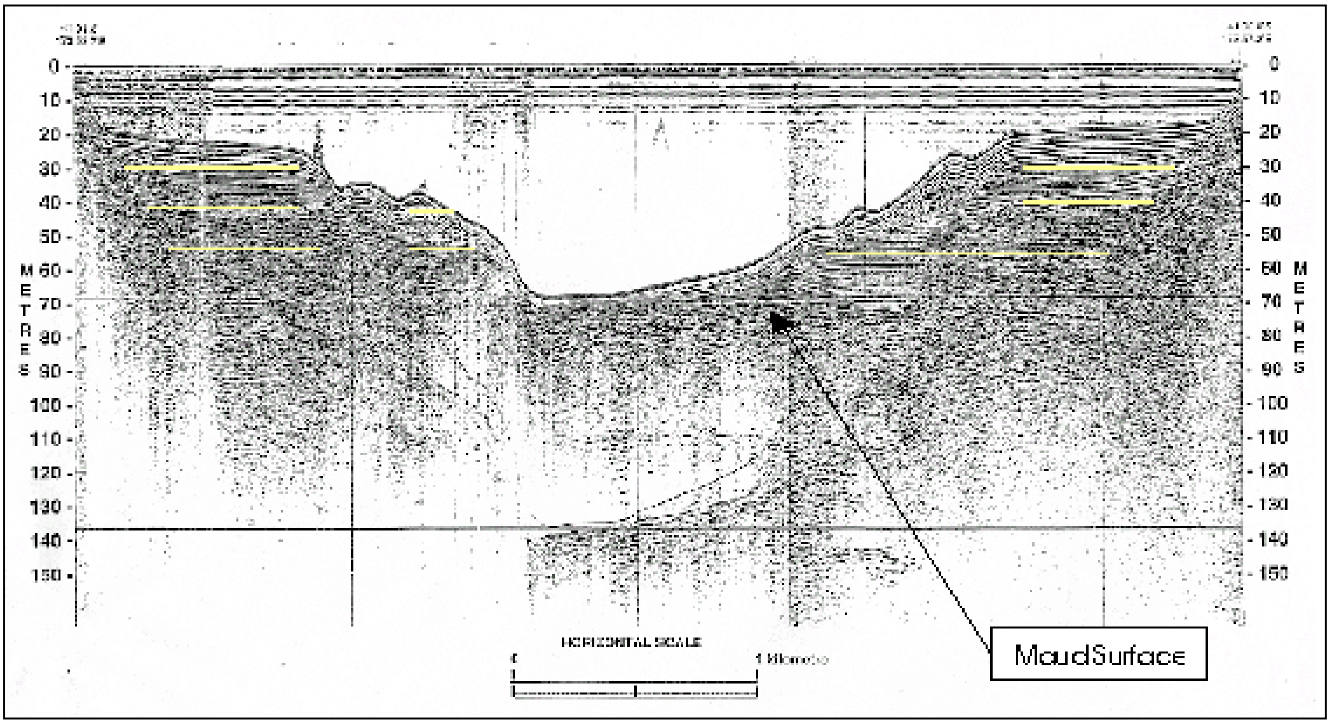

Figure 1. Uniboom seismic profile across Pelorus Sound from Maud Island. Seismic unconformities (heavy lines) indicate the older buried terraces. The unconformity of Maud Surface (12.5 kyr B.P.) is a clear and persistent feature and is underlain by an older unconformity at –110 m. The first multiple of the seafloor intersects the older unconformity. Chevron patterns in the profile above the seafloor are reflections from rocks or from fish.

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