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Ground-penetrating radar (GPR) stratigraphy of late-Pleistocene relict foredunes on a coastal barrier: Matakana Island, New Zealand

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Matakana Island, North Island, New Zealand, forms a c. 24 km long barrier island between the Bay of Plenty and Tauranga Harbour, which it encloses. The island is of two distinct parts, with the larger seaward part comprising a Holocene sand barrier, extending parallel to the shoreline, and a harbourward (Pleistocene) part, adjoining the centre of the Holocene barrier. The Pleistocene section of the barrier consists of three terraces at 10, 40 and 70 m above sea level, although the precise process-origin and significance of the features are unknown. We focus on the relatively flat lowest (1.0-1.5 km wide) terrace, as oblique aerial photography indicates the presence of subdued ridges (amplitude 1 m) trending NW-SE, parallel to the current coastline. An investigation of this lower terrace using a 100 MHz pulseEKKO ground penetrating radar (GPR) along a 1 km SW-NE profile normal to the axis of the subdued ridges was undertaken. Following topographic correction, the profile revealed a continuous undulating reflector at 8-12 m depth, which corresponds with the low ridges visible on the surface. The ridge-and-swale nature of the reflector, coupled with the surface topography indicates it represents a relict foredune plain, mainly below present-day sea level. The age of the relict foredune plain is intriguing, with a maximum age of 780,000 due to the absence of Te Puna Ignimbrite, which is present on the higher terraces. Published maps indicate the lowest terrace is covered by lacustrine beds of the Matua Subgroup (minimum age c. 220,000 yr), yet it is difficult to reconcile the survival of ridge-and-swale foredune morphology under several metres of lacustrine deposits, suggesting that a tephra origin for the coverbeds is more likely. Nevertheless, the presence of a Pleistocene foredune plain slightly below present-day sea level indicates no significant long-term uplift, and possibly minor subsidence in this sector of the North Island.