FIGURE 24. VERTICAL PHOTOGRAPH SHOWING THE DEVELOPMENT OF SMALL PARABOLIC DUNES FROM BLOWOUTS IN A LARGE RELICT FOREDUNE NORTHWEST OF HUNTER'S CREEK. PHOTOGRAPH COURTESY OF CAR'T'ER HOLT HARVEY FORESTS LTD.

a) Dunes associated with relict foredunes

In many parts of the barrier, small blowout and parabolic dunes have modified foredune ridges (Fig. 24), particularly the high foredunes which would have been exposed to higher wind velocities. Dune orientation indicates that most developed in response to onshore northeasterly winds, and others to offshore winds. The blowout and parabolic dunes are morphologically and stratigraphically continuous with their parent foredunes. The continuity indicates that the blowout and parabolic dunes are similar in age to their parent foredunes.

b) Large parabolic dunes

Large parabolic dunes are present in at least five locations on the barrier (A-E, Fig. 23). They developed either through enlargement of the blowouts of formerly stable (relict) foredune ridges or from wind erosion of bare sand cliffs along receding sections of the harbour shoreline, as at Hunter's Creek. Some dunes (B, Fig. 23) have migrated up to 730 m over otherwise unmodified relict foredunes. We include as large parabolic dunes the noses of parabolic dunes adjacent to Hunter's Creek (E, Fig. 23, Fig. 27); these migrated from former relict foredunes west of the Hunter's Creek shoreline. Both the trailing arms of the parabolic dunes and the relict foredunes from which they were derived have been eroded away by Hunter's Creek.

The oldest parabolic dunes occur near the inner margin of the barrier. A Taupo-sourced rhyolitic tephra, tentatively identified as Stent tephra, is interbedded with dune sand near the Matakana Mill (S, Fig. 23), indicating dune migration probably commenced about 4000 yr BP at that site.

The large parabolic dunes which migrated eastward across the inner part of the Relict Foredune Plain 2-5 km northwest of the entrance to Blue Gum Bay (inset, Fig. 23) have Taupo Lapilli on their arms and were initiated prior to the Taupo eruption. They cross relict foredune ridges on the surface of which are old Maori garden soils (b, inset, Fig. 23), indicating reactivation after human settlement. The eastern parts of two of the larger dunes (a and c, inset, Fig. 23; Fig. 25, see page 45) overlie Kabaroa Tephra, confirming that they were reactivated during the past 600 years. The ash below one (c, inset, Fig. 23) was in a dark peaty soil with Taupo Lapilli. Pollen from the soil did not include Pinus pollen (Appendix 4), which suggests that the dune covered the site prior to European arrival.

Large relict parabolic dunes occur along and harbourward of Long Ridge on the ocean side of the recurved ridges at the former Blue Gum Bay entrance (D, Fig. 23). Their steep slip faces and the absences of soil profile development and a tephra cover from their surfaces strongly suggests they are also post-Kaharoa in age. The extent of these dunes has not been defined, owing to a thick vegetation cover and lack of suitable aerial photographs. It is possible that they are reactivated dunes similar to those 2-5 km northwest of the entrance to Blue Gum Bay, and were originally formed prior to the Taupo eruption.

At the northern end of the barrier, 1 km south of Waikoura Point (A, Fig. 23), undisturbed Kaharoa Tephra lies directly on clean sand in the deflation basin of one of the large parabolic dunes. The lack of a soil profile indicates the ash fell soon after the deflation basin had formed. The age for the parabolic dune is therefore little more than 600 years. Adjacent dunes are likely to be of similar age.

Relict post-Kaharoa transgressive dunes are common in places along the inner barrier northwest of Blue Gum Bay (C, Fig. 23). These younger dunes are generally smaller, have steeper slopes, show little or no soil profile development, and lack surface tephra deposits.

A series of parabolic dunes (E, Fig. 23) is present along Hunter's Creek. Continuing shoreline erosion by Hunter's Creek has exposed sections across the noses of several parabolic dunes. One section shows three phases of aeolian sand deposition separated by poorly formed buried topsoils (Fig. 27, Table 4).

TABLE 4. DESCRIPTION OF SECTION EXPOSED BY EROSION AT HUNTER'S CREEK.

DEPTH (m)	DESCRIPTION
0-0.10	Poorly-developed, discontinuous topsoil on sand.
0.10-1.75	Wind blown sand with poorly-developed buried topsoils on old dune surfaces and occasional shell fragments.
1.75-2.35	Buried topsoil, gardened, with sparse charcoals, shells, Taupo Lapilli, and lumps of Kaharoa Tephra well-mixed through it. Intact shell midden deposits on upper surface.
2.35-3.15	Iron-stained sand.
3.15-4.65	Cross-bedded dune sand with traces of Stent (?) tephra near base.
4.65-6.00	Horizontally-bedded beach sand with bands of heavy minerals.

The dunes had advanced over Maori garden soils formed on relict foredunns. The garden soils contained Taupo Lapilli and pockets of Kaharoa Tephra. A shell midden on the Maori garden soil has a radiocarbon age of 667 ± 36 yr BP (NZ 8125, Table 1).

The most recent dune advance is probably at the southeastern end of the section where two parabolic dunes have advanced from the present shoreline to beyond the Purakau shoreline (Fig. 26, see page 45). They cut through a Maori garden soil and their basins have been deflated almost to present sea level. A shell midden in the Maori garden soil has a radiocarbon age of 677 ± 29 yr BP (NZ8187, Table 1).

c) Dunes of the coastal strip and Southeastern End of the barrier

Relict, largely parabolic, dunes form a narrow continuous strip near the ocean coast. This extends along much of the barrier's length and obscures the former relict foredune topography. The strip is mostly 100-200 m wide with its seaward limit within 100 m of the foredune. However, it widens to the southeast to include most of the southeastern part of the barrier which has a generally low, hummocky topography. The parabolic dunes near the ocean coast are more numerous and extensive than the other two groups.

These dunes show little or no soil profile development. Limited foredune development seaward of them suggests a relatively young age. They overlie Kaharoa Tephra at three locations (K, Fig. 23) but nowhere does the tephra overlie the dunes. They therefore appear to postdate the Kaharoa Eruption and may have originated following damage to the foredune vegetation, possibly due to human activity or volcanic ash. Historical records provide no conclusive evidence that these dunes were active at the time of early European settlement on the island, but it should be noted that Cockayne (1909), in his study of active dunefields in New Zealand, referred to a strip of dunes adjacent to the Bay of Plenty coast extending from Tauranga Harbour to beyond Opotiki.

2.2.7 Backbarrier flats

Backbarrier flats supporting swamp forest are common at the heads of Hunter's Creek, Blue Gum Bay, and the inner margin of the northwestern part of the

barrier (Fig. 7). Their boundary with the backbarrier washover slope is poorly defined. The flats have extremely low relief compared to the rest of the barrier and are up to 750 m wide. In the northwestern part of the barrier they incorporate former estuarine channels.

The backbarrier flats developed along the sheltered harbour shoreline of the barrier and originated as estuarine flats which ceased to be inundated by tides as the harbour shore prograded. They are commonly fringed by a zone of active estuarine flats with a well-developed vegetation succession e.g., at the northwestern end of Blue Gum Bay. In contrast to sediment derived directly from the ocean beach, sediment of the backbarrier flat and active intertidal flats contains a small proportion of fine mud.

Sedimentation rates on estuarine flats are enhanced by salt marsh vegetation, such as that described by Beadel (1989x), which gives greater protection from harbour waves by lowering energy levels (White 1979). Accretion rates tend to decrease with time as the surface elevation approaches that of the highest spring tide (Pethick 1981). Accretion above this level results mainly from the accumulation of organic platter and airfall tephra.

Kaharoa Tephra and sea-rafted Taupo Pumice are present at the northwestern margin of the flats along Blue Gum Bay. Kaharoa Tephra only was observed on the flats at the northwestern end of the barrier but field investigations were limited. Nevertheless, our impression is that the greater part of these flats are young.

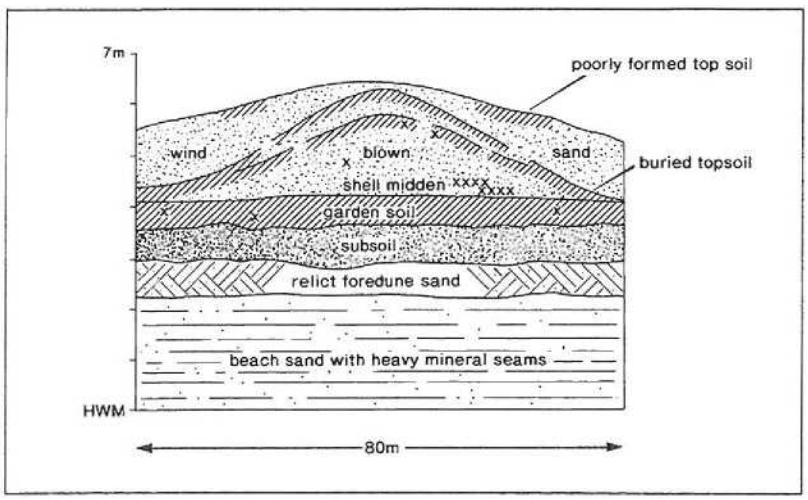

FIGURE 27. STRATIGRAPHY OF DUNES EXPOSED IN AN ESTUARINE CLIFF ADJACENT TO HUNTER'S CREEK. GARDEN SOIL ON RELICT FOREDUNE SAND IS OVERLAIN BY THREE LAYERS OF DUNE SAND ASSOCIATED WITH PARABOLIC DUNE ADVANCES. THE PARABOLIC DUNE SAND LAYERS ARE SEPARATED BY BURIED SOILS.

FIGURE 5 PHOTO OF THE LOWEST PLEISTOCENE TERRACF ON MATAKANA CORE. BLUE GUM BAY AT TOP LEFT. THE INTERGALACIAL. COASTAL PLAIN WITH TRACES OF THE ORIGINAL RIDGE/SWALE TOPOGRAPHY AT CENTRE, AND THE. OUTER MARGIN OF AN OLDER PLEISTOCENE TERRACE AT BOTTOM RIGHT. VIEW TO THE EAST.

FIGURE 6. PLEISTOCENE PARABOLIC DUNE (CENTRE OF PHOTO) ADJACENT TO BLUE GUM BAY (FIG. 4). VIEW TO THE NORTHWEST.

FIGURE 25. THE NOSE OF A PARABOLIC DUNE (c, INSET, FIG. 23) WHICH HAS MIGRATED ACROSS THE RELICT FOREDUNE PLAIN NORTH OF B LUE GUM BAY.

FIGURE 26. PARABOLIC DUNES WHICH HAVE MIGRATED FROM HUNTER'S CREEK (CENTRE LEFT) ACROSS THE PURAKAU SHORELINE. VIEW TO THE NORTH.