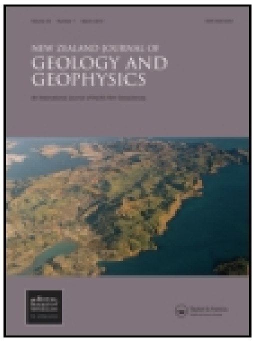

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Note

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Abstract Thirty-eight samples collected from the southern North Island west coast, between Paekakariki and Otaki (i.e. Kapiti coast) were analysed by mechanical sieving to determine if chronologically distinct dunes exhibited characteristic sedimentary parameters. Slight differences do appear to occur but the contrasts are of insufficient magnitude to be used alone as a diagnostic feature. The study indicates a strong environmental uniformity has been in existence for over 6000 years notwithstanding large changes in the quantity of sediments available for dune building and the input of volcanic material.

Keywords Quaternary; sand dunes; sediments; Kapiti coast

OBJECTIVES

The depositional chronology of the sand-dune sequence of the Kapiti coast has been discussed by several authors (Adkin 1910, 1919, 1951; Cotton 1918; Te Punga 1962; Fleming 1953, 1972; and Gibb 1978), and much emphasis has been placed upon morphological criteria. The sedimentary characteristics of the dunes have been investigated by Oliver (1948) who commented only that the material exhibited good sorting and small grain size, a point also noted by Smith (1982). Gibb (1977) has shown that the present-day beach sands are likewise well sorted and fine grained although he noted variations along the beach. The present study seeks to provide more sedimentological data on the dune system and in particular to determine whether a particular phase of dune building can be identified from the physical characteristics of its sediments.

TECHNIQUES

This note is based upon the analysis of 38 samples collected in three bands normal to the shore in the south, centre, and north of the area. All samples were taken from deep within the dune, usually more than 2 m below the surface. Each sample was then analysed using standard sieving procedures, with nested sieves of $^1/_4\ \phi$ intervals for 9 min, and the data plotted using Folk & Ward (1957) parameters. These are detailed in Tables 1 and 2.

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Table 1 Grain-size analyses of sand-dune samples from the Kapiti (west) coast, southern North Island, using Folk & Ward (1957) parameters.

Grid reference*	Mean size	Sorting	Skewness	Kurtosis
Southern area				
N156 509619	2.72	0.35	–0. 34	1.46
N156 511622	2.00	1.02	–0. 63	0.81
N156 509619 (Fig. 1A)	1.73	0.67	0. 04	0.85
N156 509619	2.30	0.62	–0. 40	0.86
N156 510618 (Fig. 1D)	2.71	0.29	–0. 23	1.24
N156 512625	2.12	0.87	–0. 53	0.67
N156 512625	2.57	0.44	–0. 40	1.24
N156 513629	2.70	0.24	0. 26	1.86
N156 511615	2.90	0.21	0. 03	1.09
N156 512615	2.91	0.20	0. 02	1.11
N156 517648	2.69	0.38	–0. 04	1.50
N156 520642	2.73	0.25	0. 32	1.20
N156 520642 (Fig. 1E)	2.75	0.31	–0. 21	1.51
N156 522 642	2.64	0.35	0.050	1.95
N156 525643 (Fig. 1G)	2.84	0.21	–0. 05	1.10
N156 530640	2.84	0.20	–0. 03	1.11
N156 530640	2.72	0.24	0. 34	1.55
Central area				
N156 519692	2.74	0.27	0. 27	1.11
N156 519693 (Fig. 1B)	2.77	0.24	–0. 16	1.12
N156 529715	2.72	0.23	–0. 09	1.03
N156 542700	2.71	0.24	–0. 05	1.05
N156 551690	2.74	0.21	–0. 02	1.02
N156 563698 (Fig. 1H)	2.98	0.21	0. 03	0.99
Northern area				
N156 589772	2.76	0.24	–0. 13	1.08
N156 589772	1.85	0.43	0. 26	1.23
N156 589770	2.77	0.25	–0. 19	1.14
N156 613818	2.70	0.30	–0. 22	1.22
N156 624841	1.95	0.41	0. 16	1.00
N156 625841 (Fig. 1C)	1.97	0.46	0. 08	1.05
N156 624831	2.59	0.38	–0. 05	1.23
N156 631838 (Fig. 1F)	2.77	0.27	–0. 11	1.05
N156 631838	2.66	0.36	0. 02	1.31
N156 631838	2.84	0.26	0. 16	0.68
N156 632838	2.82	0.28	0. 25	0.74
N156 632837	2.65	0.35	0. 02	1.30
N156 632837 (Fig. 1I)	2.78	0.25	–0. 15	1.10
N156 642835	2.70	0.35	0. 27	0.19
N156 643834	2.00	0.52	0. 27	0.94

*Grid references taken from N. Z. topographical map series NZMS 1, sheet N156 & pt N157—Kapiti.

SOUTHERN AREA

Three phases of dune building are clearly represented in the area between Paekakariki and Raumati South. Contemporary embryo/foredunes occur south of the Whareroa Stream in the Queen Elizabeth Park. Behind these are bold rugged dunes of the Taupo Pumice Dunesand phase, and further inland are the more subdued dunes of the Foxton Dunesand phase. The sedimentary characteristics of these dunes are shown graphically in Fig. 1. The embryo dunes (Fig. 1A) show a lack of peakedness and a relatively wide size-range expressed in a sorting coefficient of 0.66. The mean grain size of 2.29 ϕ indicates a relatively coarse, though still fine, sand. This sample clearly differs from all the others, suggesting the dominance of some local source material derived via the Whareroa Stream and the beach.

Morphological and mineralogical contrasts are usually sufficient to distinguish between the Taupo and Foxton dunes. There is some suggestion from the grain-size parameters that the Foxton dunes have a more peaked pattern (Fig. 1D, G) but variation within both groups makes identification difficult and highlights the problem of sampling sand dunes effectively. Although both the Taupo and Foxton dunes consist of several dune ridges, the density of sampling used failed to reveal any intradune ridge contrasts.

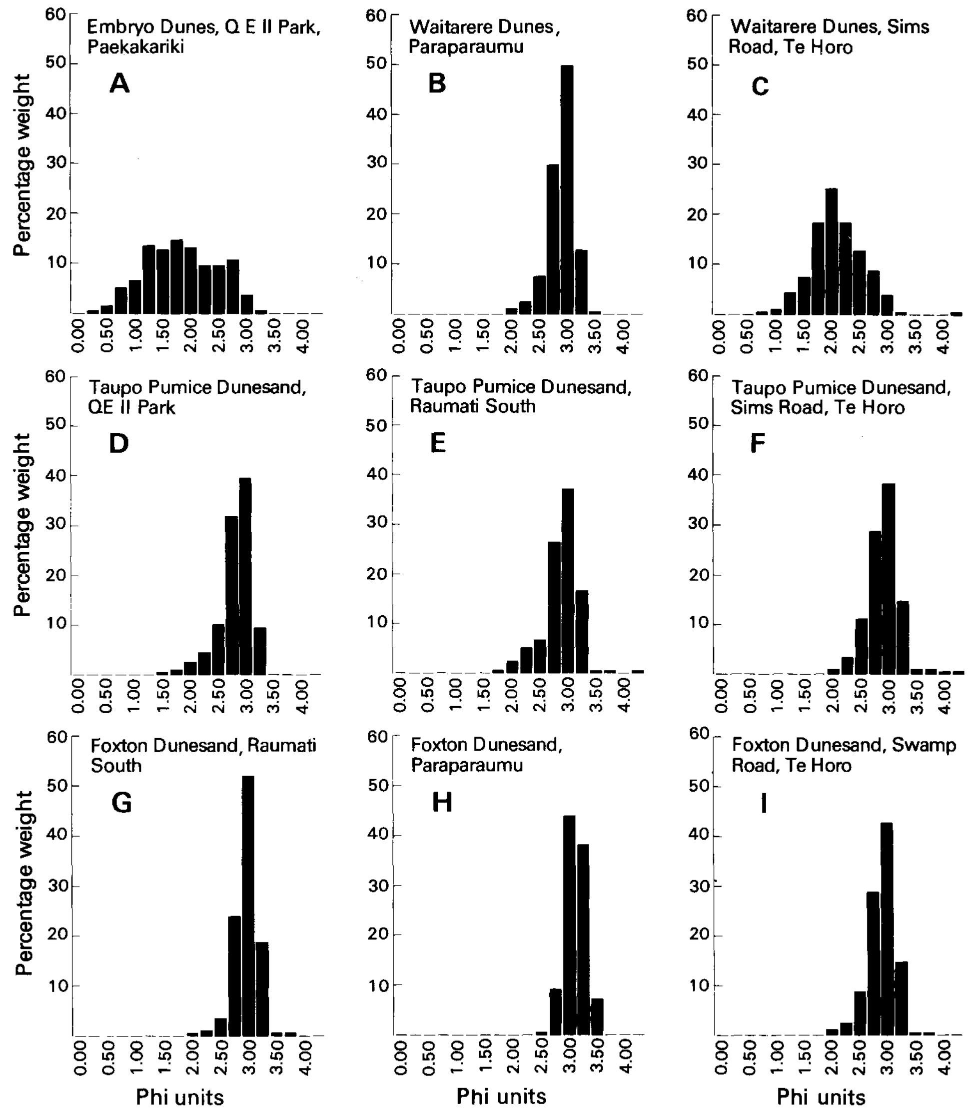
CENTRAL AREA

The sand dune area from Paraparaumu Beach inland to Paraparaumu shows a remarkably uniform sedimentary environment. Apart from embryo dunes at the coast, at least three other dune-building phases have been identified—the Waitarere, Taupo, and Foxton phases. The grain size of these dunes is similar (Fig. 1B, E, H). They are very well sorted (sorting coefficient between 0.20 and 0.31), fine-grained sediments. This uniformity is further emphasised by the similarity between the parameters of skewness and kurtosis.

Table 2 Grain-size analysis of sand-dune samples from the Kapiti coast, showing percent weight in each ϕ class limit.

Class limits (ϕ):	−0.50	−0.25	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	Rest
Southern area																				
N156 509619	0.34	0.09	0.17	0.13	0.31	0.65	0.48	0.80	0.57	0.91	2.36	4.15	8.41	26.06	39.03	14.00	0.30	0.16	0.03	0.04
N156 511622	3.49	1.07	1.26	1.53	3.14	6.52	4.40	5.80	3.52	3.79	4.42	4.59	8.11	23.05	20.67	4.18	0.19	0.13	0.02	0.03
N156 509619 (Fig. 1A)	0.00	0.89	0.20	0.46	1.52	4.90	6.28	13.53	12.32	14.35	12.99	9.34	9.57	10.38	3.46	0.43	0.05	0.03	0.00	0.00
N156 509619	0.00	0.00	0.03	0.06	0.21	1.29	2.16	4.76	5.50	7.44	9.95	9.31	11.41	22.29	20.86	4.24	0.10	0.26	0.06	0.01
N156 510618 (Fig. 1D)	0.00	0.00	0.00	0.02	0.03	0.10	0.09	0.17	0.32	0.85	2.48	4.42	10.01	31.81	39.60	9.68	0.21	0.09	0.02	0.02
N156 512625	0.09	0.09	0.31	0.78	2.58	6.70	5.95	7.66	5.40	5.83	5.59	4.32	5.25	14.50	27.43	7.10	0.16	0.07	0.02	0.06
N156 512625	0.00	0.02	0.07	0.09	0.14	0.28	0.39	1.49	1.85	3.18	5.35	7.06	11.13	26.65	34.05	7.75	0.21	0.13	0.04	0.02
N156 513629	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.04	0.14	0.49	1.64	2.15	8.35	62.53	10.72	12.88	0.65	0.23	0.03	0.02
N156 511615	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.04	0.03	0.18	0.50	2.22	17.62	50.67	25.49	1.19	0.76	0.33	0.84
N156 512615	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.28	1.67	15.94	53.83	26.30	0.80	0.54	0.15	0.33
N156 517648	0.00	0.01	0.00	0.01	0.04	0.08	0.08	0.12	0.44	2.49	5.66	2.57	10.09	44.65	14.74	16.82	1.36	0.63	0.12	0.01
N156 520642	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.35	0.98	10.44	57.63	13.34	14.82	1.54	0.68	0.06	0.00
N156 520642 (Fig. 1E)	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.09	0.43	2.32	5.11	10.51	25.81	37.31	16.35	0.61	0.48	0.19	0.61
N156 522642	0.00	0.02	0.00	0.00	0.00	0.01	0.04	0.00	0.13	0.47	4.29	6.25	14.69	48.87	10.76	9.11	1.91	2.21	1.14	0.00
N156 525643 (Fig. 1G)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.30	0.96	3.60	23.35	51.84	18.47	0.69	0.43	0.12	0.14
N156 530640	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.30	1.85	25.64	53.65	16.89	0.67	0.43	0.13	0.25
N156 530640	0.00	0.04	0.00	0.04	0.00	0.01	0.01	0.02	0.04	0.07	0.47	1.05	8.64	62.77	11.36	11.92	1.73	1.33	0.42	0.00
Central area																				
N156 519692	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.10	0.39	1.46	2.37	8.85	54.03	12.75	18.58	1.05	0.25	0.02	0.00
N156 519693 (Fig. 1B)	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.05	0.08	0.17	0.85	2.62	7.39	29.65	45.95	12.50	0.38	0.19	0.02	0.01
N156 529715	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.19	1.18	3.71	10.78	39.06	38.97	5.68	0.13	0.07	0.01	0.03
N156 542700	0.02	0.00	0.00	0.01	0.01	0.02	0.01	0.03	0.04	0.11	0.82	3.54	12.20	37.81	37.25	6.69	0.31	0.35	0.18	0.51
N156 551690	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.22	1.29	7.85	40.48	41.56	7.08	0.30	0.36	0.21	0.54
N156 563698 (Fig. 1H)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.70	9.53	43.69	38.43	6.98	0.23	0.20	0.13
Northern area																				
N156 589772	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.03	0.05	0.10	0.68	2.52	9.19	31.62	43.07	11.67	0.50	0.33	0.01	0.11
N156 589772	0.00	0.03	0.00	0.18	0.18	0.51	0.29	3.57	12.51	28.96	25.32	11.66	6.55	4.71	3.64	1.39	0.18	0.03	0.03	0.18
N156 589770	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.05	0.07	0.24	1.39	2.96	7.69	27.19	46.08	13.40	0.38	0.16	0.11	0.14
N156 613818	0.00	0.00	0.00	0.00	0.02	0.04	0.03	0.05	0.13	0.63	2.78	5.34	10.95	30.85	38.45	9.32	0.56	0.42	0.14	0.20
N156 624841	0.00	0.00	0.00	0.01	0.06	0.16	0.87	2.08	6.66	21.43	30.85	14.19	13.87	7.36	1.18	0.94	0.11	0.11	0.03	0.00
N156 625841 (Fig. 1C)	0.00	0.00	0.00	0.00	0.06	0.46	0.98	4.39	7.30	17.83	24.86	17.96	12.46	8.39	3.98	0.70	0.10	0.10	0.10	0.26
N156 624831	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.12	0.89	7.12	9.04	18.56	37.43	12.45	12.61	0.95	0.59	0.08	0.00
N156 631838 (Fig. 1F)	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.08	0.78	3.43	11.15	28.41	38.82	14.59	0.86	0.83	0.29	0.57
N156 631838	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.11	1.02	4.40	5.66	15.72	42.87	11.98	15.72	1.29	0.87	0.18	0.00
N156 631838	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.01	0.01	0.03	0.25	0.70	4.09	39.78	20.99	29.59	2.57	1.66	0.16	0.00
N156 632838	0.00	2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.20	0.52	3.78	43.26	15.51	29.84	2.88	1.62	0.18	0.00
N156 632837	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.26	0.88	8.59	6.03	17.53	42.33	13.71	13.66	1.08	0.70	0.08	0.00
N156 632837 (Fig. 1I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.20	1.06	2.55	8.27	28.54	43.25	14.70	0.60	0.48	0.09	0.17
N156 642835	0.00	0.00	0.00	0.01	0.07	0.19	1.11	2.68	9.61	21.56	24.00	9.11	12.07	11.64	2.86	3.10	0.67	0.83	0.41	0.00
N156 643834	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.12	0.24	1.05	3.83	6.67	11.06	24.41	35.47	14.17	1.15	1.06	0.26	0.40

Fig. 1 Histograms of selected samples based on the proportion of sand retained on sieves stacked at $^{1}/_{4}$ ϕ intervals.



NORTHERN AREA

Although not forming the largest dunes, this area has a sequence of dune deposition that is most complete and morphologically most distinct expecially between the coast and Te Horo. Again the dominant feature of the sediments across the whole sequence is their degree of sorting and their fine grain size. The Taupo dunes and Foxton dunes have remarkably similar physical characteristics, a condition which applies also to the younger Motuiti dunes which are well developed here.

All three members show a peakedness in the 2.75–3.25 range and a sorting coefficient of between 0.25 and 0.35, while skewness ranges only from –0.11 to –0.26 and kurtosis from 1.05 to 1.19 (Fig. 1F, I). The pattern is slightly different in the sample taken from the Waitarere dunes (Fig. 1C), which is less peaked, slightly coarser, and less well sorted, perhaps indicating the input of a larger proportion of locally derived sediments. Other samples taken from these youngest dunes show that the variation within this phase is more marked than in the older dunes.

CONCLUSIONS

Sample analysis confirms the findings of Oliver (1948) that the sediments throughout the area are dominated by fine grained, well sorted sands. Variations within this grouping do occur (1) locally within a particular dune, (2) normal to the shore, and (3) parallel to the shore. The present study was designed to ascertain if variations normal to the shore were sufficiently distinctive to allow dune sequences to be distinguished where the more easily obtained evidence from morphology, pedology, and mineralogy has, for some reason, become obscured. I conclude that, although this is a useful means of distinguishing recent dunes from older phases of depostion in some locations, this particular analysis is not especially helpful in distinguishing between the older dune-building phases or between dune-building periods within a particular phase. Minor differences between samples do occur but they tend to be of a scale insufficient to build a chronology in the absence of supporting material.

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