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Wind impact on black sand properties in beach-dune system, Patea Beach, Taranaki Peninsula, New Zealand

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The aim of the study was to analyse the impact of different grains weight (resulted from their mineralogy/density and size) on grain size distribution and mineralogical composition of aeolian sand deposited in different zones of beach-dune system. We studied black sand composed of titanomagnetite, magnetite, pyroxene and other heavy minerals occurring at the coast of Patea Beach, Taranaki Penninsula, New Zealand. Sand samples were collected along shore normal transect from lower and upper swash zones, upper beach with shadow dunes formed behind pingao and lower and upper part of climbing dunes. Applied methods included determination of: (i) mineralogical composition by microscope analysis, powder X-ray diffraction, and energy-dispersive X-ray spectroscopy analysis, (ii) grain size distribution by sieve analysis, (iii) grain shape by Morphologi 3G particle shape analyser, and (iv) grain microtexture by SEM. Additionally, grains of the greatest density (more than 5 g/cm^3), i.e. titanomagnetite have been selected from each sieve by means of magnet to analyse the impact of different mineral densities on aeolian sand texture. We found that titanomagnetite and magnetite made up over 95% of grains in the upper swash and shadow dune sand, whereas the lower swash zone sand was composed of more than 80% of grains of lower densities (mainly pyroxene and amphibole of densities slightly above 3 g/cm^3). Sand building climbing dune was composed of smaller grains of titanomagnetite and coarser pyroxene grains. Main size of titanomagnetite grains equalled 0.15 mm and of other grains $\sim$ 0.21 mm. Titanomagnetite grains are spherical and well rounded, other grains are of low sphericity and are mostly subangular and subrounded. The results show that the short wind transport between swash zone and upper beach did not affect the sand properties whereas the impact of aeolian transport on sand building climbing dunes was evident and expressed by significant change in mineralogical composition and grain size distribution.