Background Information- Grade 3 “How Do Waves Make the Beach?”

*(Please note; the following information is intended for your interest and optional preparation only. It is not required for your participation as a chaperone)*

Beaches are shaped by many things, among them, the rising and falling of the tides, the crashing waves and the wind blowing along the shore. Changes in sand grain size distribution on the Waihe’e Coastal Refuge coastline is a result of the wave energy levels on the beach. The general trend is to find coarser sand as you move from the waterline up onto the beach. This is because incoming waves have more power as they move forward, up the beach, even though this power is short-lived. In contrast, the return of the water seaward had less power and, therefore, can only carry smaller grains. Larger grains are moved forward by the crashing waves and left there as the weaker return flow cannot carry them back to the sea.

We see this phenomenon happening on a longer time scale too. Only the high energy waves produced by storms can carry sediment above the berm (the uppermost zone on the beach), where normal tides do not reach. The **berm** is also more susceptible to having the finer sediments blown away by the wind. This is because it spends more time as dry, loose sand. The sand in the **swash zone** (where waves wash over the sandin each tidal cycle), on the other hand, is more frequently wet. The water’s cohesiveness holds the sand grains together, so the finer grains are less able to be moved by the wind. So even on a small scale, the wind and waves control changes in shoreline shape.

The distribution of the grain size is called sorting. Well-sorted sand will have sand grains that are all close to the same size. Poorly-sorted sand will have a wide variety of grain sizes together. The size of a sand grain is one component that determines how easily sand will be moved by wind and/or waves. Smaller grains can be moved with less energy than larger grains, but the density of the material that makes up the grain is also an important factor. The lighter colored grains are less dense minerals – quartz and feldspar. The darker grains are more dense, iron bearing minerals – garnet, magnetite, ilmenite, epidote and hornblende. After a windy or stormy day, you’ll see the darker sands in a thin layer on the beach. Many people may mistake these dark grains for an oil spill, but these dark, dense grains are what is left behind when the lighter, less dense grains were moved away by the wind and waves.
Finally,the shape of the sand grains helps us determine how old the grains are and how much wind and wave energy they have been exposed to. Newly eroded grains that have not been exposed to much energy in the environment will have sharp angles. As the grains are exposed to energy over time, those angles are worn away and the grains become more round in appearance.
The sorting methods explored in the Grade 3 activities are :

1. Particle size sorting between **swash zone** and **wrack line** (line of debris transported on the largest incoming waves) using a tray with particle size indicated in mm.(Quantitative)
2. Particle color sorting using a **part to whole** sorting on a pie chart template. (Qualitative)

(see Waihe’e Resources, Grade 3 Student Activity Sheet 2017)