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During Sea-Level Highstands:
A Global Synthesis with implications
for management of future coastal change

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Dynamic controls on grain size distribution on a tropical carbonate beach, Jamaica, W.I.

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Abstract

Jamaica's carbonate beaches are made up of skeletal and non-skeletal grains. The skeletal fraction consists of organisms form the near shore environment and includes fragments of the green alga *Halimeda*, the red alga Amphiroa, echinoderms, mollusc, and foraminifera. The non-skeletal fraction of the sediment consists of clastic, crystalline and amorphous grains (Mitchell et al. 2001; Khan and Mitchell, 2002). On these carbonate beaches sediment size is dependent on the size of the source skeletal elements. For the calcareous alga Halimeda and Amphiroa grain size is related to the size of the segments of the common sand forming species of these organisms. For foraminifera this is the test diameter and for other organisms such as molluscs and echinoids the skeletal elements are largely dependent on the species of the contributing organism. Amongst the non-skeletal grains amorphous grains are generally considered to be alteration products of skeletal grains having had a high residence time in the beach system (Reid and Macintyre, 1998; Perry, 2000). Where as the origin of crystalline grains may be similar; it is not clearly defined.

The relationship between grain type and grain size is therefore important in understanding grain size distribution on carbonate beaches.

The study area is located along the southeastern coast of Jamaica, in the parish of St. Thomas (fig. 1). Thirty (30) samples were collected along a line transect across the beach profile. The most landward sample was collected from the vegetation line at the edge of the berm and the most seaward of the samples 42m from the vegetation line, within the sea grass communities (fig. 2). The samples were dried and impregnated to form blocks from which thin sections were prepared for constituent analysis. Portions of the sample were dry sieved and grain size characteristics calculated by the method of moments.

From grain size analysis (fig. 3) it was observed that samples collected from the backshore had an average grain size 125µm and was well sorted. In contrast the samples from the upper shoreface had an average grain size of 250µm and were poorly sorted. Samples collected from the inshore area showed a decrease in grain size and an increase in sorting. Constituent analysis of these samples showed compositional variations across the beach profile.

Figure 1. Study area located along the southeastern coast of the parish of St. Thomas, Jamaica.

Amorphous and crystalline grains were the major contributors at all sites however the percentage of skeletal grains contributing to the sediment varied across the transect. Samples collected from the backshore area showed few skeletal gains the most abundant of which was the red alga, Amphiroa. An increase in skeletal grains, both in proportion and grain type, was observed in the upper shoreface. These samples although still rich in Amphiroa also contain larger portions of *Halimeda*, foraminifera and mullosc. Samples collected from the inshore area showed a decrease in the diversity of skeletal grains contributing to the sediment as well as a decrease in the average grain size.

Provisional analysis suggests that the concentration of large grain sizes is determined by the presence of large skeletal grains. This is seen in the upper shoreface where larger and less dense grains are concentrated in the high-energy zone. Implications of this are that coarse grain skeletal material is preferentially sorted into high-energy zones while finer material is concentrated in the lower energy zones. This has further Implications for the breakdown rates of skeletal grains. If they are concentrated in high-energy zones they will be more susceptible to undergo abrasion and fracturing.

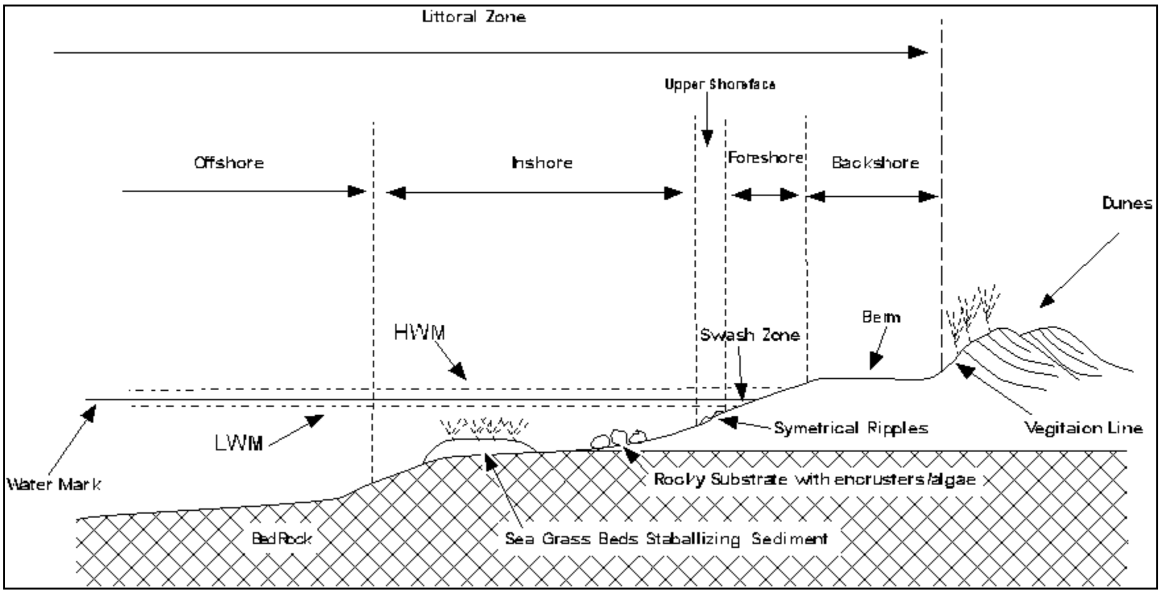

Figure 2. Diagram of the beach profile.

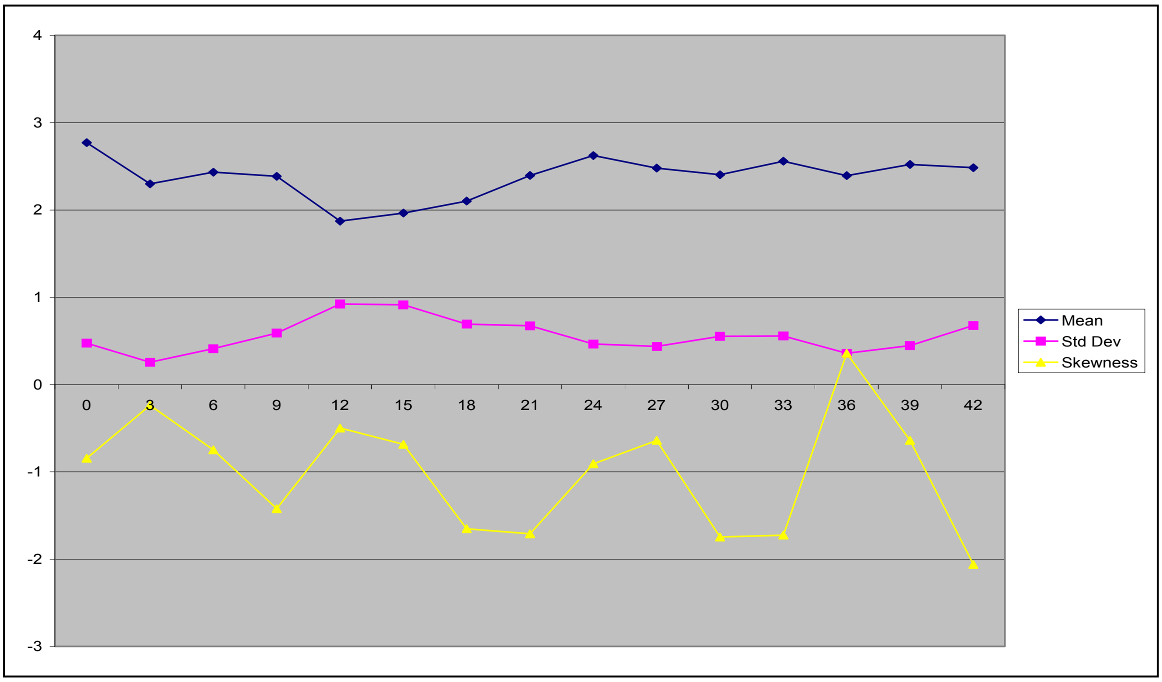

Table 1. Graph of the grain size (Φ) vs. distance (m).

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