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TECHNICAL COMMUNICATION

Gravel on Beaches on Hilton Head Island, South Carolina—Relation Between "Specific Surfaces" (Surface Area Divided by the Weight of the Gravel) and the Location of the Gravel Pieces in the Uprush Zone

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ABSTRACT

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This note describes the results of field observations of gravel geometries as they occur on a sandy beach of medium exposure, on Hilton Head Island, South Carolina. It is noted that "specific surface" = area of grain surfaces divided by grain weight, is related to the elevation in the profile, determined by the uprush. Scaling grain size down to sand size this may be useful for evaluation of material for beach nourishment. The most stable grains are those of compact shape, *i.e.* with the smallest specific surface.

ADDITIONAL INDEX WORDS: *Rock and gravel geometries, grain size, specific surface of grains, beach material.*

On the Hilton Head Island beaches, *e.g.* at Sea Pines, there are three different kinds of "rock-geometries" of small size gravel washed up by the wave uprush. Uppermost, in the highest uprush-zone, there are flat pieces (chips). Lower in the uprush zone marrow, oblong pieces occur (arrows). In the lower-most position prismatic, rectangular or cubic pieces occur.

CAUSE

Let us consider three typical pieces. Their weights are equal, but their surface areas are different: flat, oblong and prismatic-compact. In addition, a sphere is considered, still maintaining the same specific gravity of 2.65 of granite and one cubic of heavy weight material of specific gravity 5.0 (Ilmenite-Magnetite). The specific surface is computed for the different geometries as shown in Table 1.

The situation on the beach is that the flat pieces of gravel "floundered up," easily lifted up by the wave uprush. The oblong pieces were rolled up on contact with the beach surface and, therefore, did not climb as high as the flat pieces. The cube-prismatic pieces were more difficult to move and stayed lowest in the uprush zone. They "gave up" earliest! From the actual size (weight) of the rocks the magnitude of the uprush, thereby the wave action, may be deduced!

NOURISHMENT

It is obvious that spheroidal materials are the most stable particularly if they are in heavy

minerals. They will move least. Borrow material for nourishment often has too many "flat" pieces (feldspar, mica, shell fragments, laminated sandstone *et cet.*). More emphasis should probably be put in grain-geometries. And grain size analyses should be by "specific surface," not by sieve-analyses. Settling-tube testing is, of course, better. The heavily worn grains in Danish meltwater deposits have proven to be excellent for nourishment.

The character of our present analyses may have to be adjusted to parameters which are better reasoned, hydraulically speaking.

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Table 1. *Computation of specific surfaces for various gemetries.*

Geometry or other features	Weight (grams)	Surface Area (cm^2)	Specific Surface (Area/ Weight)
Flat pieces 3 x 2.3 x 0.4 cm	7.4	18	2.5
Oblong pieces 4 x 1 x 0.7 cm	7.4	14	2.0
Prismatic Cubic 1.4 x 1.35 x 1.35 cm	7.4	11	1.5
Ball — Sphere D = 1.7 cm	7.4	9.3	1.2
Heavy mineral Cube, specific gravity about 5 (ilmenite, magnetite or similar) 1.15 x 1.15 x 1.15 cm	7.4	8	0.9