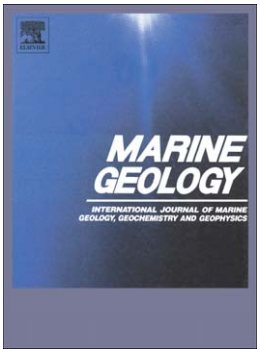

Pebble and cobble transport on a steep, mega-tidal, mixed sand and gravel beach

Nina Stark, Alex E. Hay

PII: S0025-3227(16)30277-8
DOI: doi: 10.1016/j.margeo.2016.10.012
Reference: MARGO 5530

To appear in: *Marine Geology*

Received date: 31 March 2016
Revised date: 19 October 2016
Accepted date: 28 October 2016

Please cite this article as: Stark, Nina, Hay, Alex E., Pebble and cobble transport on a steep, mega-tidal, mixed sand and gravel beach, *Marine Geology* (2016), doi: 10.1016/j.margeo.2016.10.012

Pebble and cobble transport on a steep, mega-tidal, mixed sand and gravel beach

Nina Stark[a], Alex E. Hay[b]

[a] *Virginia Tech, Department of Civil and Environmental Engineering, 200 Patton Hall, Blacksburg, VA 24061, USA*
[b] *Dalhousie University, Department of Oceanography, 1355 Oxford Street, Halifax, Nova Scotia B3H 4R2, Canada*

Abstract

Natural tracer pebbles and cobbles were deployed on a steep (slope: 0.1) mixed sand and gravel mega-tidal beach located at the head of the Bay of Fundy. Two experiments were carried out to investigate the response of natural pebble- and cobble-sized material, both to energetic wave conditions during individual storm events, and to tidal-only forcing conditions between storms. Net displacement of different tracer sizes was the focus of the first experiment, while the effect of different shapes was tested in the second. The pebbles and cobbles were painted in fluorescent colors, labeled, and their positions measured at low tide over periods of 10-12 days. The tracers were emplaced at mid-tide level on the beach face at low water, and later recovered and re-deployed on successive low tides. Net travel distance and direction were measured upon recovery. Hydrodynamic forcing conditions and local morphology at mid-tide level on the beach face were monitored continuously during the experiments. In the first experiment, recovery rates were 100% during calm and moderate wave conditions ($H_s \leq 0.5\,\mathrm{m}$), but decreased significantly in more energetic wave forcing (H_s up to 1 m). Recovery rates were lower for smaller tracers. During a three day wind-wave event, net displacements of up to 48 m were measured. Comparable net displacements were observed for all tracers. Maximum displacements were 39 m onshore, 42 m offshore, and 46 m alongshore. In calm conditions, maximum displacements were less than 1 m, indicating that the bottom stresses due to tidal currents alone are too low to cause significant tracer displacement on time scales of weeks, despite the high tidal range. In the second experiment, recovery rates were lower, due to more energetic wave forcing: significant wave