An Investigation of factors influencing drumlin erosion in Mahone Bay, Nova Scotia

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The processes that influence the erosion of drowned drumlins in Atlantic Canada are not particularly well understood. Consequently management strategies and engineering practices focussed on mitigating erosion have had limited success and in some cases have resulted in shoreline modifications that have significant ecological and social impacts. This study focuses on determining the relative importance of the sedimentological, geomorphological, and physical parameters that contribute to headward erosion of seven drowned drumlin islands in Mahone Bay, southwestern Nova Scotia. The islands being studied are palimpsest drumlins formed during Wisconsinan ice advance from 30 ky to 17 ky BP. Sea level rise following deglaciation and recent and gradual subsidence associated with foreland bulge migration has exposed these islands to marine influence (drowned drumlins). A 60 year long historical airphoto survey established long term erosion rates of up to 0.46 m/yr and determined the orientation of eroding surfaces, transportation corridors, and subsequent deposits. A suite of marine physical parameters (bathymetry, fetch, swell) were studied to constrain energy transfer processes. Site investigation involved documenting the sedimentology and stratigraphy of eroding surfaces as well as hydrological conditions (water table elevation, permeability) that might contribute to headland instability. The results of this study indicate that the erosion rates are the result of a combination of complex interacting factors. Sandy and clay rich lodgement tills are more prone to mass wasting than coarse grained ablation tills that contain a greater number of cobble to boulder clasts. Multiple tills and layering within tills also produce hydrological anisotropy and contribute

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to the activation of glide planes along which mass wasting occurs. Hydrogeologically triggered rotational and translational failure occurs in response to oversteepening. The consequent exposure of underconsolidated sediment to wave activity expedites erosion. Most rapidly eroding headlands are exposed to both maximum storm fetch and ocean swells. Wave energy input can be considered as the limiting factor when determining the locations of highest rates of erosion.