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

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Quaternary coastal morphology and sea level changes

Project 437

Gehrels R.[*], Newman S.[*], Kirby J.[*]

Late Holocene sea-level changes in western Iceland

[*]Department of Geography, University of Plymouth, Plymouth, U.K.,
E-mail: wrgehrels@plymouth.ac.uk, swnewman@plymouth.ac.uk, Jason.Kirby@atkinsglobal.com

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Abstract

Holocene sea-level studies from Iceland are rare (Pirazzoli, 1991) and the few that have been published concentrate on the millennial-scale postglacial isostatic history of the coastline (e.g., Simonarson and Leifsdottir, 2002).

This study is a first attempt to reconstruct Late Holocene sea-level changes at high resolution. Iceland is of interest in this respect as it is positioned near the northern "pole" of the North Atlantic Oscillation (NAO). The influence of this climatic phenomenon on sea level is clear from monthly tide-gauge records. This study aims to determine the influence of the NAO on sea level at longer (decadal-centennial) time scales during the past 2000 years. At the time of the submission of this abstract we are still awaiting dating results (AMS ^{14}C and ^{210}Pb) and this report is therefore preliminary.

The Viðarholmi salt marsh (according to Ingolfsson (1994) known as "Melabakkar") is the largest salt marsh in Iceland, situated on the Haffjord. This part of western Iceland is the only area in Iceland where extensive salt marshes are found that are suitable for sea-level work. No previous work has been conducted here.

The stratigraphy of the salt marsh was documented with detailed descriptions of 10 exposed sections and numerous reconnaissance cores. We use salt-marsh foraminifera as sea-level indicators and collected 83 samples from the surface of the marsh to investigate their modern vertical distribution. All sample sites were surveyed and linked to a geodetic benchmark.

The marshes in this part of western Iceland are dominated by *Puccinellia maritima*. The stratigraphy of the marshes is exposed along eroding creekbanks. The salt-marsh sediments consist of peat, up to 1.6 m thick, overlying either mudflat sediments or volcanic bedrock. We found one distinct tephra layer in the middle of the sequence and several embedded pumice layers embedded (Figure 1). We also uncovered a bone, which was identified as the leg (wrist) bone of a 4-5 year old horse (*Equus cavallus*). This finding is significant as large mammals only appeared in Iceland following the Viking settlement around 870 AD. The bone was dated to 335±28 BP.

We collected a series of six basal samples to correct for auto-compaction of the peat sequence. In salt marshes further to the north we found large areas where freshwater peat with rooted stumps of birch was overlain by salt-marsh peat, 0.5-1.5 m thick. This sequence is a clear indication of the transgressive nature of this coastline.Three surface transects of foraminifera have been counted. Transect 1 shows a zoned foraminiferal distribution, with agglutinated foraminifera (*Jadammina macrescens*, *Trochammina* spp.) dominating the upper part of the transect and calcareous species present in high numbers along the bottom part. In the two other transects (not shown) this zonation was not apparent.

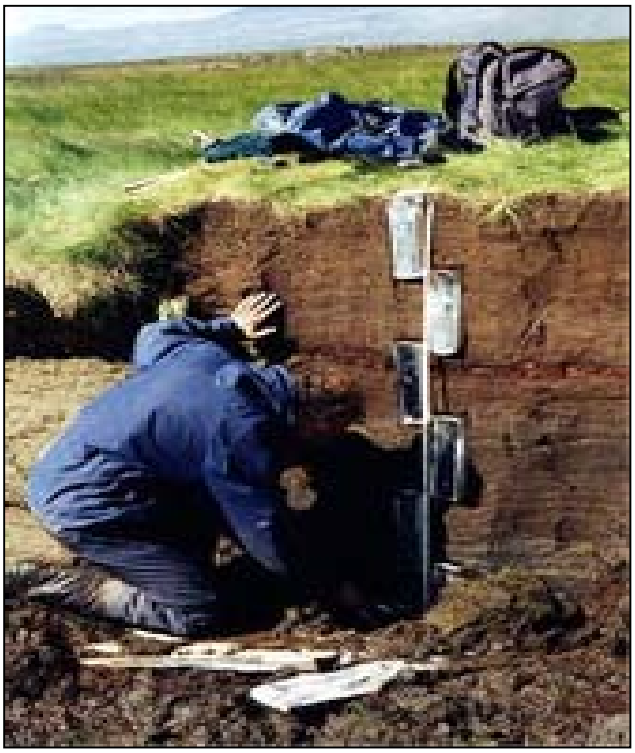

Figure 1. Sampling in Viðarholmi salt marsh, western Iceland. A pumice layer (sampled by the third tin from the top) and Landnám tephra (the white layer sampled by the fourth tin) are visible.

A transfer function based on the surfical foraminifera can be used to calculate former sea-level positions with a precision of 0.18 m. We sampled one stratigraphic section in detail using monolith tins. Tephra analyses were conducted on the sediments and it was established that the main tephra layer that is visible in the stratigraphy of the Viđarholmi salt marsh (Figure 1) is the Landnám (settlement) layer, dating to ~870 AD. The source of pumice layers was determined to be the Reykjanes peninsula. The fossil counts of foraminifera yielded high numbers of *Jadammina macrescens*, indicating that the sediments in this section were formed in the upper part of the salt marsh.

A few calcareous foraminifera appear in the upper three samples, probably washed in from the creek or the result of ice rafting. Several fluctuations of sea level appear to have been captured within the record denoted by large scale reductions followed by swift increases in test numbers.

Agglutinated species *Paratrochammina (Lepidoparatrochammina) haynesi, Trochammina ochracea,* and *Trochammina* spp., are present through the record, but only *Jadammina macrescens*, the most terrestrial of all foraminifera, remains during these apparent declines. Further analyses are in progress.

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