Late Holocene palaeoseismicity and associated land / sea level changes in the greater Anchorage area

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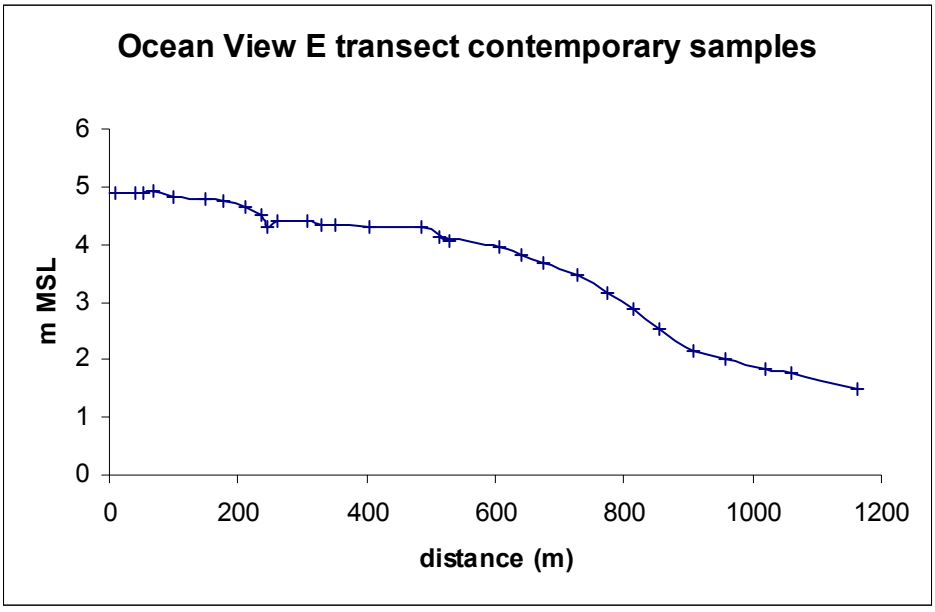
1. Investigations undertaken

All activity for the period 1st March to 30th September 2002 comprises field investigations. Laboratory analyses will commence from October 2002 when Hamilton moves full time onto the project. The first fieldwork occurred in April (Hamilton and Shennan, with Combellick for part of the time), in order to obtain contemporary samples and observations of sedimentation processes during late winter / early spring conditions, the same time of year as the 1964 earthquake. We also retrieved the first set of sediment transplant experiments (see below) that we had set up in 2001 in anticipation of the project taking place. Field investigations during the summer (Hamilton and Shennan, with Combellick and Horton for part of the time) involved additional contemporary samples, GPS and tidal observations, sampling of exposed sections, coring transects, retrieval of further sediment transplant experiment and setting up a further one.

2. Results

We now have sufficient contemporary surface samples from three sites, Ocean View at Anchorage, Girdwood and Kenai to form the basis for quantitative diatom transfer functions, taking into account the tidal range differences between the sites. Figure 1 illustrates the gradual transition of contemporary samples from high marsh through to tidal flat at Ocean View. The transition from vegetated marsh to mud flat occurs between 330 – 400m along the transect.

Figure 1



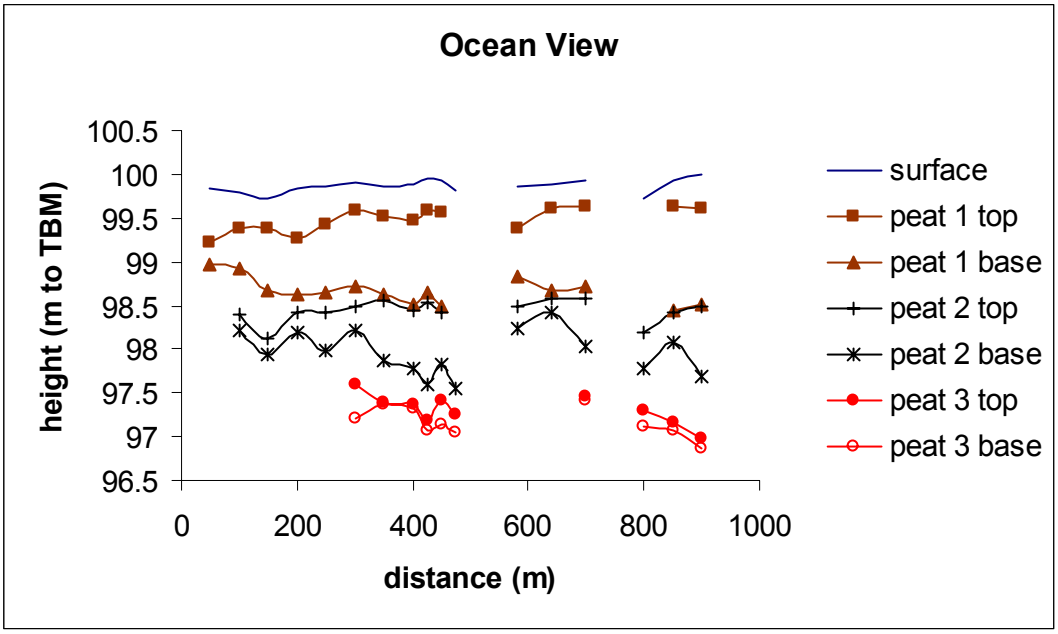
Our other contemporary sampling strategy focuses upon the effects of sea ice and frozen tidal flats. We have collected samples from ice blocks transported onto the marsh surface and from sections sediment rich ice that developed above the frozen tidal flat surface. Analysis of the diatom content of these sediments and their consequences for the quantitative diatom transfer functions will be used to define the final field sampling for 2003.

So far we have recovered 3 blocks of vegetated marsh sediment that we had transplanted into the mudflat zone in order to simulate the instantaneous change in height relative to the tidal fame that results from coseismic submergence. Two were recovered after 11 months and one after 16 months. Each shows ~2-3cm of sediment accumulation since burial (figure 2). We shall soon commence laboratory analyses of these and the control samples in order to identify the magnitude of any diatom mixing down profile following submergence. We have set out a further experiment using raised bog peat to simulate the most extreme magnitude of marsh burial.

Figure 2

Transects of cores and sampling of sediment sections is complete, with samples from both the 1964 peat layer and the preceding late Holocene peat layer stored at Durham awaiting laboratory analysis. The Girdwood samples can be directly correlated with those reported by Combellick. Figure 3 summarises the new results from the new site at Ocean View, Anchorage, showing the lateral consistency of 3 peat layers intercalated with predominantly silt layers (Height relative to temporary survey mark, 100.00 = ~4.8m above mean sea level)

Figure 3



3. Non-technical Summary

This project has undertaken new field investigations and subsequent laboratory procedures in order to: (1) analyse the evidence of late Holocene ground displacements in the greater Anchorage area associated with past subduction zone earthquakes; and (2) improve the vertical resolution of geological estimates of land-level changes from Holocene earthquakes. The project builds strongly on previous experience gained by the principal investigators whilst researching late Holocene earthquake and relative sea-level behaviour in the more intensively studied Cascadia subduction zone and developing microfossil-based transfer functions to quantify land- and sea-level change.