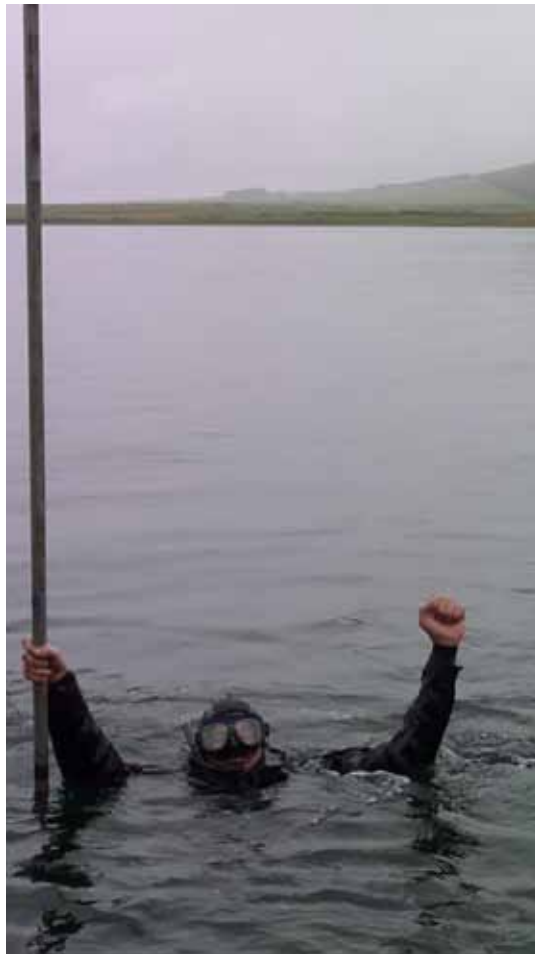


The Rising Tide: Submerged Landscape of Orkney

Interim Report: September 2011

R Bates¹, M Bates², S Dawson³, D Huws⁴, Nigel Nayling⁵ & CR Wickham-Jones⁶



¹ School of Geography and Geosciences, University of St Andrews, crb@st-andrews.ac.uk

² Department of Archaeology and Anthropology, University of Wales, Lampeter, M.BATES@lamp.ac.uk

³ Department of Geography, University of Dundee, s.dawson@dundee.ac.uk

⁴ School of Ocean Sciences, University of Bangor, d.g.huws@bangor.ac.uk

⁵ Department of Archaeology and Anthropology, University of Wales, Lampeter, N.NAYLING@lamp.ac.uk

⁶ Department of Archaeology, University of Aberdeen, c.wickham-jones@abdn.co.uk

Introduction

The Rising Tide is a project into the changing landscape of Orkney and the impact of sea-level rise on the inhabitants of the islands. Previous research has demonstrated that sea-level only reached its present height around 2000BC.

Fieldwork

Work through 2011-2012 has been undertaken under several different project headings and sponsors.

Bay of Firth

Remote sensing took place in the shallower areas of the bay in order to complete the survey across the entire area.



Fig 1: Bay of Firth, initial picture from marine geophysics (satellite image from Google Earth)

Although the results have yet to be processed fully it is interesting to note that a potential feature picked up by RCAHMS also appears on the remote sensing.



This feature lies in shallow water and will repay more detailed investigation

Fig 2: potential circular mound feature revealed on RCAHMS aerial photograph



Sub-bottom survey

Seismic profiling took place in selected parts of the Bay of Firth under the aegis of research undertaken by Richard Hughes and supervised by Dr Dei Huws. Detailed analysis has still to be completed but initial results relate to sediment depths and nature, and to the pre-inundation topography in the inner, Finstown, basin. In addition the makeup of the feature known as the 'Main Mound' to the east of Damsay is also covered.

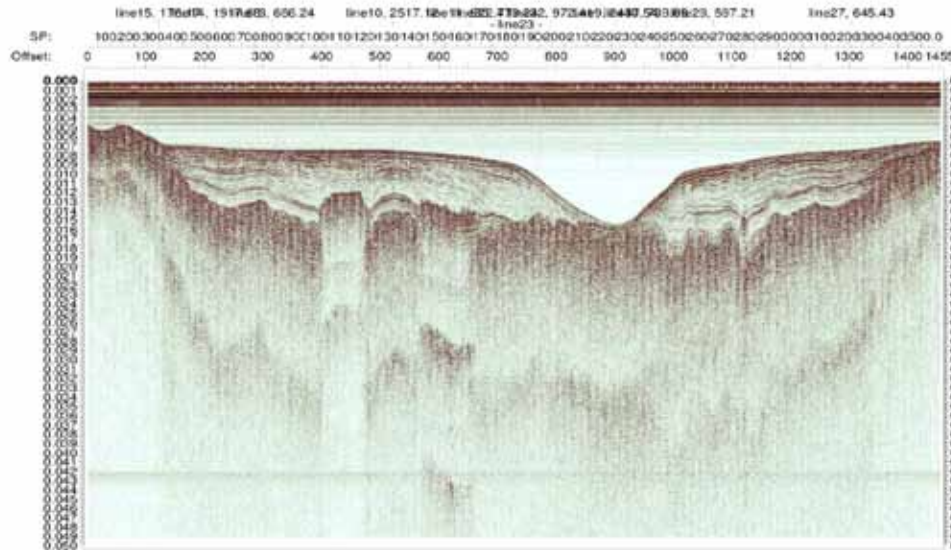


Fig 3: Seismic section across the Finstown Basin

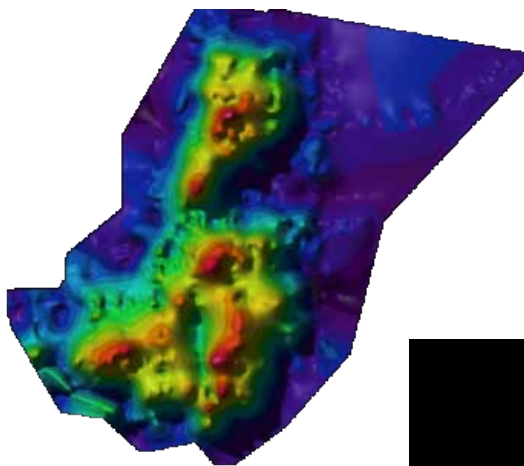
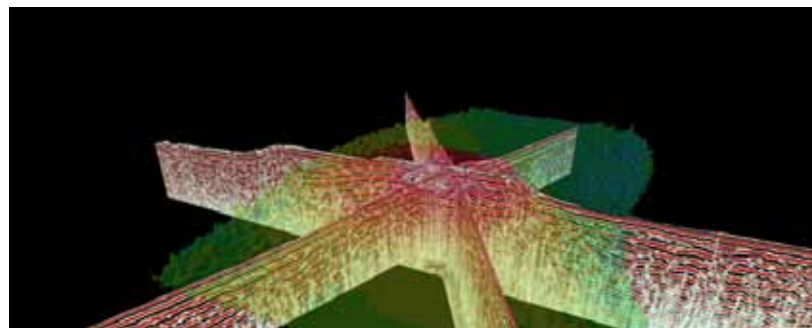


Fig 4: Sediment thickness in the Finstown Basin

Fig 5: Profiles across the Main Mound.



Sponsor: University of Bangor

Core Sampling

Sediment cores have been extracted from the Finstown Basin in order to characterize and date general environmental changes in the Bay of Firth including the record of inundation as relative sea-levels rose. In addition the sediments were also examined in proximity to the Main Mound.



Fig 6: Cores from the Bay of Firth

Fig 7: Coring in the Bay of Firth

The possibility of further work to extract deeper cores with the use of a vibrocore will be examined.

Sponsor: Historic Scotland

Loch of Stenness

Geophysical survey

Work has started using remote sensing to examine the bed of the Loch of Stenness with a view to assessing the possibility that existing earthwork sites on the loch shore might have left a trace on the loch bed. In addition, the possibility of submerged features in the proximity of the Ness of Brodgar, Ring of Brodgar, and Stones of Stenness will be examined.



Fig 8: using the Zego for geophysical sensing in shallow waters.

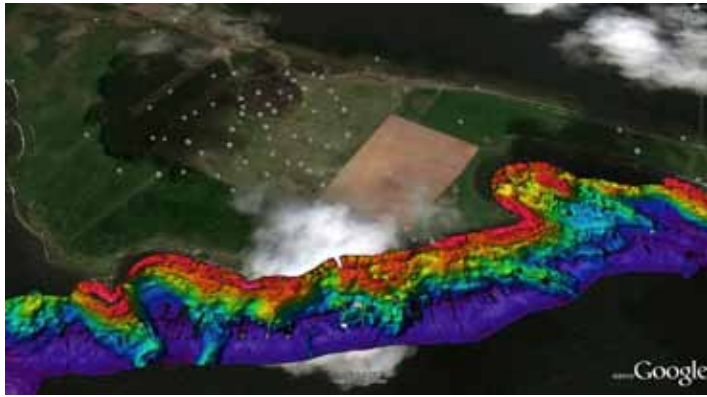


Fig 9: preliminary sensing in proximity to the Ring of Brodgar

Geophysical survey has also been undertaken at Unston using electro-magnetic and electrical sectioning equipment. This work has been part of the approach to a seamless survey around Stenness

Sponsors: Royal Archaeological Institute & Society of Antiquaries of London

Hoy and Hoxa

Sediment Analysis

Analysis of sediment cores extracted from Mill Bay, Hoy, and Dam of Hoxa, South Ronaldsay has been undertaken.



Fig 10: Location of Mill Bay in Hoy and Dam of Hoxa, South Ronaldsay

At Mill Bay the presence of intertidal peat rich in plant microfossils (particularly Alder, *Alnus*, and Birch, *Betula*) reflects more extensive tree cover in the middle Holocene. Diatoms preserved within the sediments exhibit the onset of brackish and marine conditions as sea-level rose to present levels. Material sent for radiocarbon dating should help to date the transition to marine conditions.



Fig 11: Coring at Mill Bay

The site at Dam of Hoxa is an Oyce site where a barrier beach has cut off a series of small lochans which were once connected to the sea. Microfossils within a core sampled from the smallest lochan reflect this with freshwater diatom flora overlying brackish and brackish-marine diatoms. Samples have been prepared and sent for dating analysis to assess the time at which the sea reached the present and allowed the development of the Oyce.



Fig 12: Coring at Dam of Hoxa

Sponsor: Scapa Flow Landscape Partnership

Radiocarbon Dating

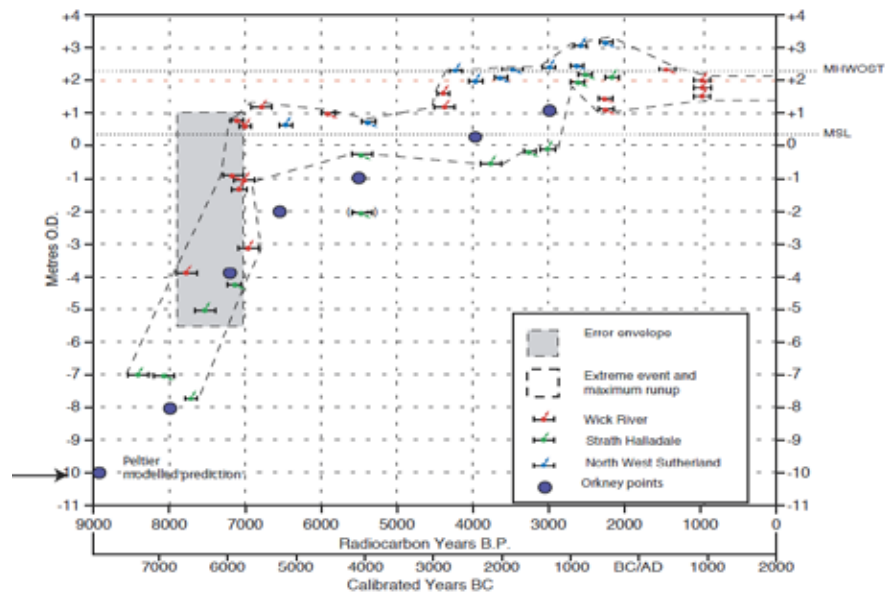
Dates have been obtained from samples taken from cores in the Loch of Stenness, Seatter Embayment and Loch of Harray, Stoneyhill area (Table1). These dates provide information relating to the environmental history of the two lochs, including the date of present inundation in the Loch of Harray, the presence of deposits from the Storegga Tsunami in the Loch of Stenness and the Late Glacial environment of both lochs. As such they complement dates already obtained from Voy in the Loch of Stenness and Echna Loch in Burray.

Sample Data	Measured Radiocarbon Age	$^{13}\text{C}/^{12}\text{C}$ Ratio	Conventional Radiocarbon Age(*)
Beta - 302850 SAMPLE : L HARRAY 1 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes 2 SIGMA CALIBRATION : Cal BC 2190 to 2180 (Cal BP 4140 to 4120) AND Cal BC 2140 to 2010 (Cal BP 4100 to 3960) Cal BC 2000 to 1980 (Cal BP 3950 to 3930)	3730 +/- 30 BP	-27.3 o/oo	3690 +/- 30 BP
Beta - 302851 SAMPLE : L HARRAY 2 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes 2 SIGMA CALIBRATION : Cal BC 15080 to 14780 (Cal BP 17030 to 16730)	14140 +/- 60 BP	-24.5 o/oo	14150 +/- 60 BP
Beta - 302852 SAMPLE : SEATTER 22 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes 2 SIGMA CALIBRATION : Cal BC 7030 to 6650 (Cal BP 8980 to 8600)	7940 +/- 40 BP	-26.7 o/oo	7910 +/- 40 BP
Beta - 302853 SAMPLE : SEATTER 23 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes 2 SIGMA CALIBRATION : Cal BC 11460 to 11300 (Cal BP 13420 to 13260)	11510 +/- 50 BP	-26.5 o/oo	11490 +/- 50 BP

Table 1:
Radiocarbon determinations from Beta Analytic.

Existing dates have been incorporated into a preliminary sea-level curve for Orkney, to be published as part of the JAS submission (below).

Fig 13: preliminary sea-level curve for Orkney



Samples have also been sent for radiocarbon assay from the deposits at Mill Bay and Dam of Hoxa.

Sponsor: University of Aberdeen and Scapa Flow Landscape Project.

Modelling settlement on the submerged landscape of Orkney

In September 2011 work starts on a two year project to assess the archaeological potential of the submerged landscape of Orkney. Information derived from the modeling of existing archaeological sites in similar topographical and environmental areas will be combined with information on the submerged topography and tidal, wave, and current energy in order to predict likely areas for settlement at key periods (Mesolithic and Early Neolithic), and those locations where archaeology might survive.

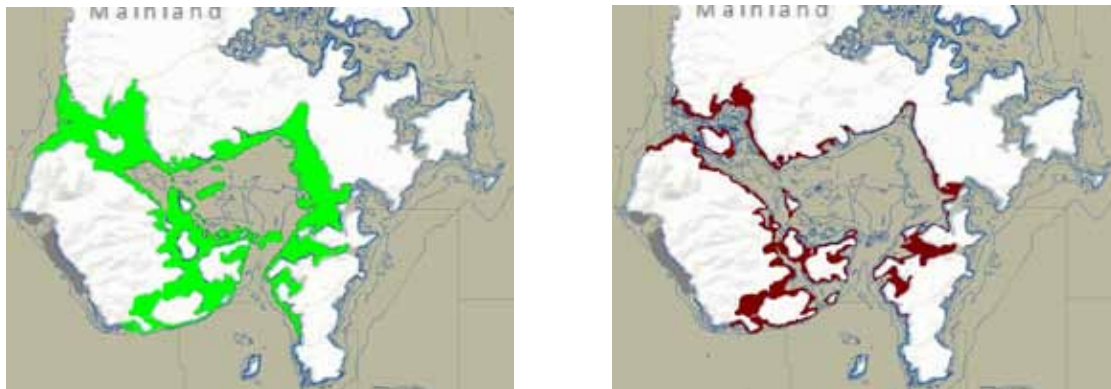
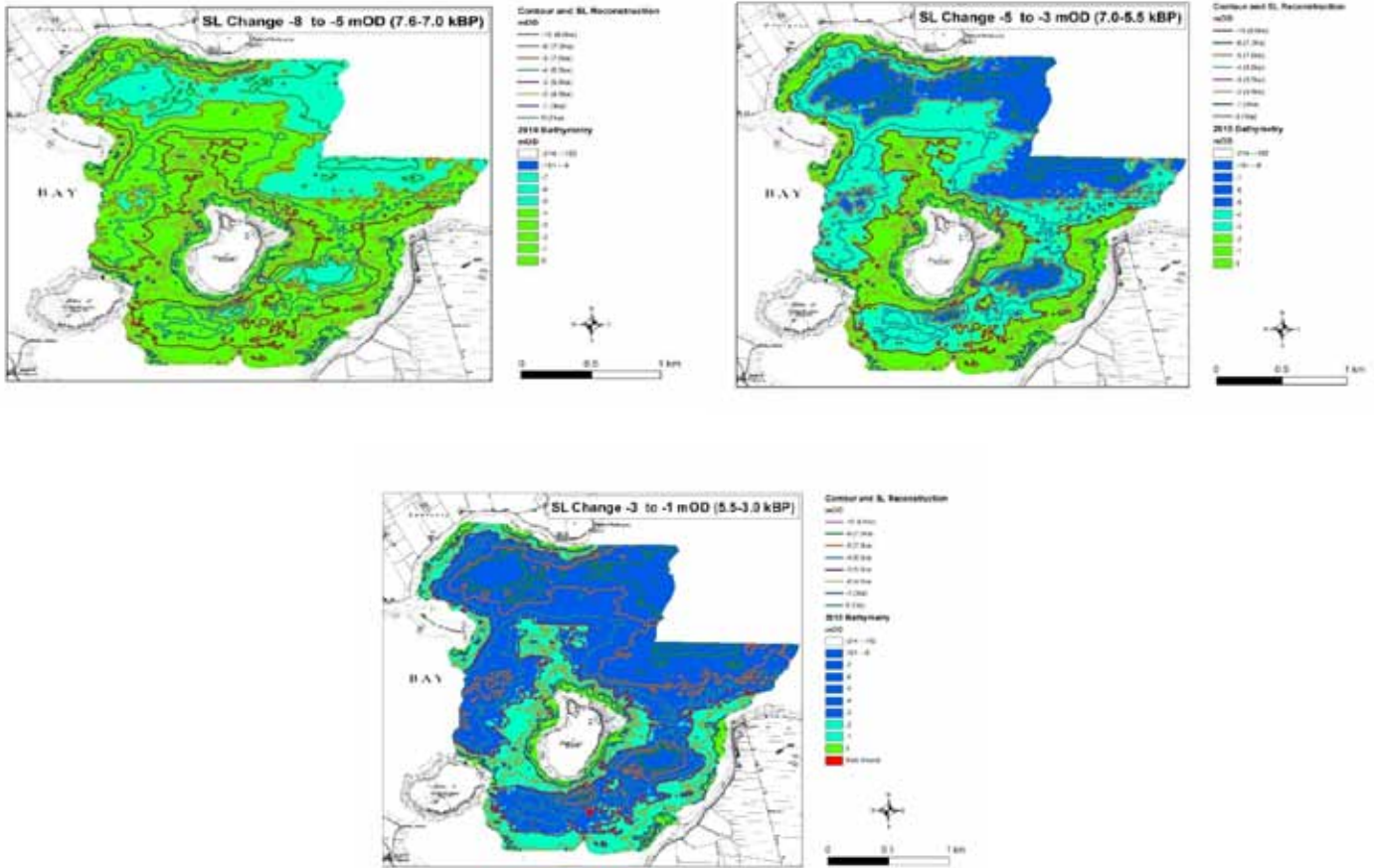


Fig 14: Hypothetical reconstructions of Scapa Flow to show the different shape of the Bay in the Early Mesolithic and Early Neolithic.

Fig 15: Detailed reconstructions of the Bay of Firth to show gradual inundation by the sea between 7,500BP and 3,000BP. The varying extent of the intertidal area (turquoise) is notable.



Sponsor: Leverhulme Research Awards

Archive work: Bay of Firth Oyster Fishery

Following interest expressed at the MASTS Meeting in Stromness in October 2010, the detailed archive relating to the Bay of Firth Oyster Fishery is under examination and potential archaeological features on the shore at Black Taing have been recorded.



Fig 16: Location of the Bay of Firth Oyster Fishery, satellite image from GoogleEarth.

Liaison

Local snorkelers Penny Martin and Chris Werb of Underwater Orkney

(<http://underwaterorkney.co.uk/>) are interested in the potential for snorkeling in the Bay of Firth and collecting information on the submerged archaeology.

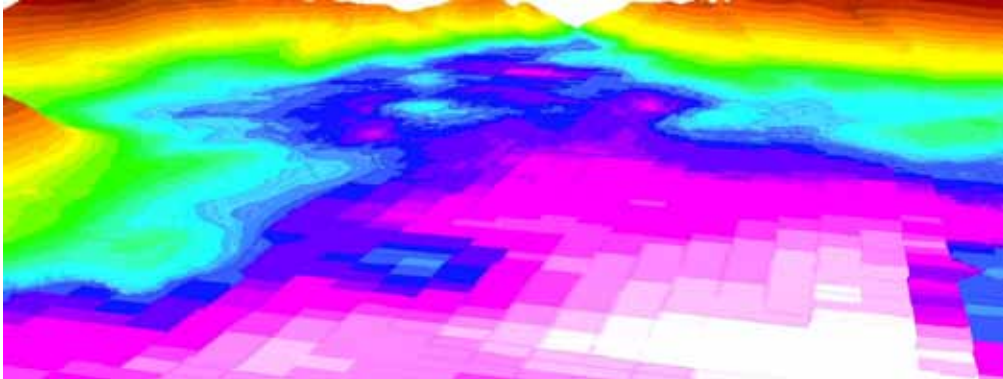


Fig 17: seamless reconstruction of the Bay of Firth

Lectures

- Lecture, Mesolithic in Europe Conference 2010, Sept 2010, Santander, Spain. (300)
- Seminar, MASTS, Heriott Watt, Stromness, October 2011 (40)
- Lecture, Edinburgh University Student Archaeology Society, February 2011. (50)
- Seminar, Dundee University, March 2011 (25)
- Lecture, Sanday Soulka, May 2011 (50)
- Seminar, National Museum of Norway, June 2011 (30)
- Lecture, Spirit of Adventure, August 2011 (100)
- Lecture and associated workshop, Hoy Kirk, Sept 2011 Orkney Science Festival (60)
- Lecture, Cromarty Hall, St Margaret's Hope, S Ronaldsay, Sept 2011 Orkney Science Festival (40)

Publications

- Bates, M.R., Bates, C. R., Dawson, S., Nayling, N., and Wickham-Jones, C.R. A multi-disciplinary approach to the archaeological investigation of a bedrock dominated shallow marine landscape: an example from the Bay of Firth, Orkney, UK Submitted to *Journal of Archaeological Science* (response awaited)
- Dawson S, Wickham-Jones CR and Dawson AG Late Holocene sea-level change and coastal evolution in Orkney, Scotland. New dates being added to text before submission to *Holocene*.



Future work

- Update of Website
- Detailed processing of geophysical survey
- Completion of Loch of Stenness survey
- Land geophysical survey of possible Loch of Stenness sites
- Detailed processing of seismic survey
- Detailed reconnaissance of Main Mound by divers
- Preliminary analysis of sediment cores from Bay of Firth
- Further coring in Bay of Firth
- Preparation of display boards in relation to Scapa Flow Landscape work
- Modeling of archaeological sites on seabed
- Preparation of brief publication on Main Mound
- Investigation of possible sites in Mill Bay, Hoy

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Brian Cordingley & Heather Bond
Karen Walker
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http://www.st-andrews.ac.uk/tzp/rising_tides.html