

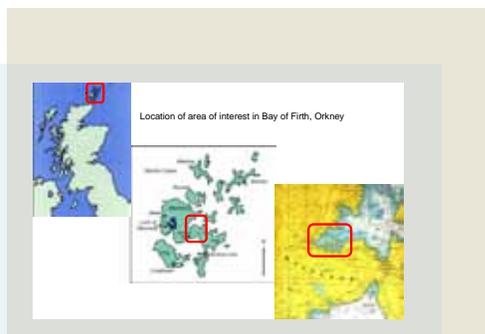
Drowned Stone Age settlement of the Bay of Firth, Orkney, Scotland

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Introduction

This paper presents the results of geophysical survey and diving work in the Bay of Firth, Orkney supported by the NGS/Waite Grant. This work took place in 2009 with the aim of recording and verifying possible submerged prehistoric stone structures on the sea bed.



The archipelago of Orkney comprises a small group of low-lying islands seven miles to the north of mainland Scotland. It is well known for its archaeology which

includes the stone built houses, tombs and monuments that make up the Heart of Neolithic Orkney World Heritage Sites. The archaeology of Orkney is unique both in terms of the range of monuments that have survived and in terms of the diversity of artefactual material that has been uncovered.

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The Neolithic sites of Orkney are about 5000 years old. They include villages such as Skara Brae where stone-built furniture may still be seen.



Skara Brae: Raymond Parks

Tombs such as Maeshowe were built for the occupants of the Neolithic villages



Maeshowe: Sigurd Towrie

Great stone circles were built in order to mark the passing of the year and celebrate festivities



Stones of Stenness: Raymond Parks

There is another, less well known, side to Orkney archaeology, however, and that comprises the submerged landscape around the islands. Work on Holocene sea-level change in Orkney indicates that relative sea-levels only reached their present position some 4000 years ago. This is substantially after the arrival of the first Mesolithic population of Orkney c.10,000 years ago, and nearly two millennia after the development of farming in the islands c.6000 years ago. The considerable changes that have taken place in relative sea-level mean that our understanding of the archaeology of the islands can only be partial while it is based solely on the investigation of sites on land. The quality of the upstanding stone buildings at the many Neolithic villages and other sites across Orkney (eg: Skara Brae, Knap of Howar, Links of Noltland) suggests that submerged sites, if they exist, might be substantial.

Background

Since 2005 the present project has combined the analysis of sediment cores to provide information on Holocene sea-level rise with geophysical survey and diving to investigate the possibility that archaeological sites and landscapes dating to the Neolithic and earlier could have survived inundation in submerged locations with high preservation potential. The Bay of Firth was selected as a case study due to its position at the heart of the archipelago which offers classic sheltered conditions that might be conducive to site survival after submergence. In addition local ethno-archaeological information suggested the presence of stone remains on the seabed in the Bay. This report will outline the techniques used, present the first results relating to both archaeological and palaeo-landscape features, and suggest possible avenues for future research in the area.

Sediment cores may be extracted by hand as here in the Loch of Stenness



Where sediment lies below deeper a small boat is used



Occasionally sediments lie in marshland



The cores are carefully wrapped and removed for analysis



Photos: Rising Tide

Holocene sea-level change in Orkney.

Work to date has focused on extracting sediment cores from four locations around Scapa Flow (the lochs of Stenness and Harray, and Waulkmill Bay in Mainland Orkney, and Echanloch in Burray).

The lochs of Stenness and Harry lie either side of the peninsula whereon the prominent Neolithic sites of the Ring of Bookan, Ring of Brodgar, Stones of Stenness, Ness of Brodgar, and Barnhouse are located. The loch of Stenness is linked to the sea at the Brig o'Waithe, it is saline and has a tidal regime. Harray is separated from Stenness by sluice gates and the water is fresh. The results here provide an interesting context for the World Heritage sites because they indicate that the loch only became flooded by seawater long after the Neolithic monuments were built. At the time of Neolithic activity the loch comprised open reaches of fresh water, surrounded by reed marsh. The sediments in the Loch of Harray suggest a more organic peaty surface prior to the influx of water.

Analysis of the sediments looks for the changes from freshwater to marine microfossils, these can then be dated using radiocarbon assay:

Voy, Stenness: 3090±40BP (Beta 242127) 1440-1270 Cal BC

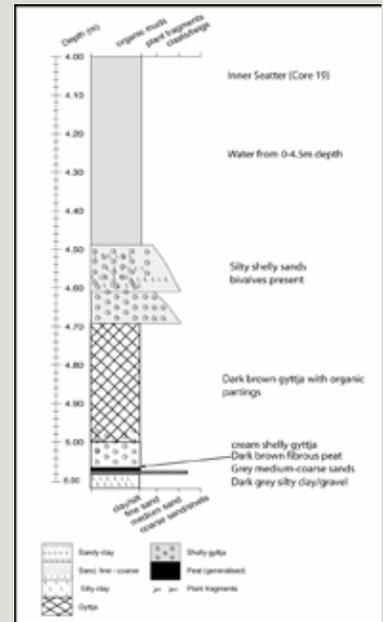
Echnaloch, Burray: 3950±40BP (Beta 242126) 2340-2570 Cal BC

The date for the influx of sea into the Loch of Stenness is supported by the evidence from Echnaloch in Burray, a small fresh water lochan separated from the sea by a stony ayre along which runs the modern road.

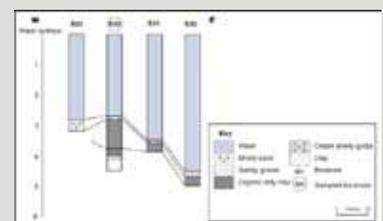
Below: view across the Lochs of Stenness and Harray



Analysis results in a profile of each sediment core:



Information from several cores can then be combined to provide information across the loch



The evidence suggests that the sea only reached present levels around Orkney some 4000 years ago. When people first came to Orkney some 10,000 years ago at the end of the last Ice Age the islands comprised a very different landscape to today. Over time, since then, rising sea-levels have gradually reduced the amount of land available and broken the single landmass into an archipelago of smaller islands. The prehistoric inhabitants of Orkney were no strangers to sea-level rise.

The shoreline around Orkney at the end of the Younger Dryas, c. 11,000 years ago may have been as much as 40m lower. This reconstruction of the shape of the islands at the time is based on available sea-level and palaeo-shoreline data.



A Dawson & R Bates



The coring site at Voy at the head of the Loch of Stenness



The Brig o'Waithe, where sea water flows into the Loch of Stenness



Echnaloch in the island of Burray lies behind a natural barrier



The Bay of Firth viewed from the east

Fieldwork, Bay of Firth

2008 Season

Hydrographic survey work was carried out in the summer of 2008 in the Bay of Firth using a side scan sonar system operated by Fiona Stewart of HighResolution Geoservices and the *Charles-Ann* skippered by Harvey Groat from Stronsay. This survey revealed features considered likely to be related to the submergence of the landscape as well as several positive anomalies that might represent structural remains.

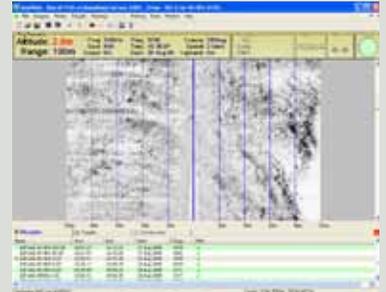
2009 Season

The 2009 field season focussed on shedding further light on various targets selected from the 2008 survey. Work comprised both detailed geophysical survey work using bathymetric side scan sonar and shallow diving.

Geophysics

Geophysical survey examined previously noted targets and suggested others of potential significance.

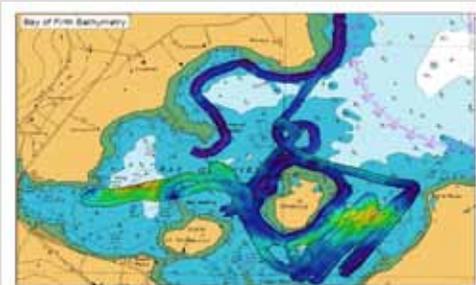
The results of the geophysics comprised a variety of anomalies such as circular features, as well as information on visible inter-tidal structures



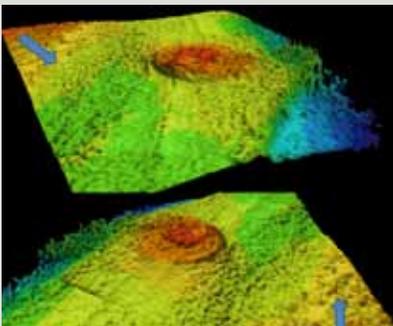
CMax screen during survey work in 2008 with rectilinear anomaly on right hand side



The Charles Ann with survey equipment



2009 survey area



New site identified in 2009



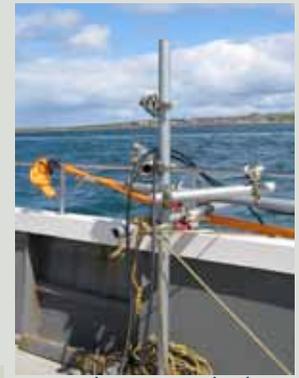
Orkney is a popular destination: the National Geographic Explorer in town



Survey team kitting up the boat

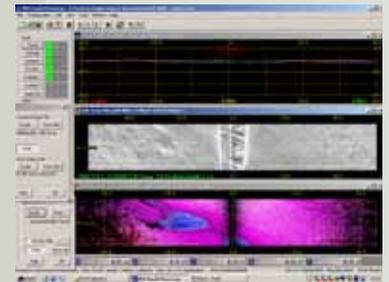
Shallow-Diving

Shallow-dives (less than 10m) were undertaken by SULA Diving on eight targets and five search areas over a three day period. Video camera and still photography was undertaken.

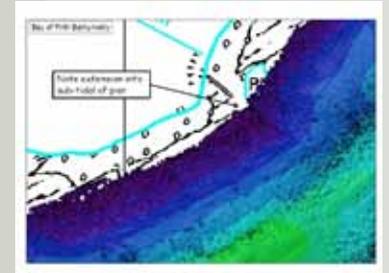


Survey equipment on the boat

	Location	Anomaly	Result
A	59.00.580N 03.04.050W	Bay on W coast of Damsay, clear subsea embayment	Several stone features
B	59.00.3898N 03.04.1596W	Unusual reading on sidescan	Stone feature
C	59.00.2404N 03.04.0032W	Circular feature on sidescan	Stone feature
D	59.00.130N 03.03.300W	Unusual reading on sidescan	Stone feature
E	59.00.339N 03.03.654W	Pier visible at low tide	Pier
F	59.00.720N 03.03.870W	High readings on sidescan	Stone features
G	59.01.2287N 03.04.4063W	Funnel shape on sidescan	Nothing visible, deep sediment
H	59.00.3686N 03.05.5321W	Moorings	Nothing visible, deep sediment
SEARCH AREAS			
	To N of D	Clear Linear features on sidescan	Nothing visible, deep sediment
	Between B – C	Shoreline	Shoreline
	To N of E		Nothing visible
	To E of F		Nothing visible
	In Bay around A		Several stone features



Screen during survey in 2009 showing large circular anomaly



Survey results around old pier

Five main areas of interest (A-E) were highlighted by the diving work



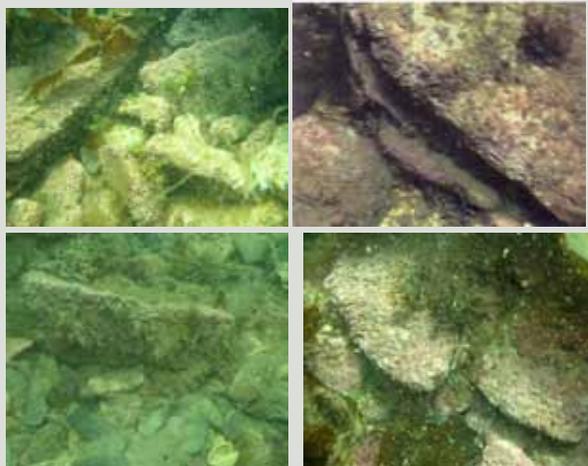
Diver at work

Area A

Area A was located off the modern beach on the west coast of Damsay and is today a shallow embayment. Water depths are between 1 and 3 metres. The area was initially considered to be a possible palaeo-embayment from the side scan imagery. At least two potential features were recorded: material including upright slabs lay immediately underneath the boat as the divers entered the water; and slightly to the north lay a large feature comprising slabs and collapsed stonework with voids. This measured roughly 8m x 2m. There were, in addition, other features of interest.

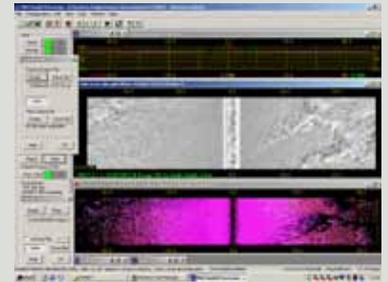
Area B & C

Areas B & C were located on the south-western shore of Damsay. Two targets were located (previously identified by side scan in 2008); these comprised mounded features of angular slabs including apparently coursed stone, collapse, and voids. A sweep was carried out along the shore at high tide in c 3 m of water depth just outside of the intertidal zone, but yielded nothing.



Stonework from Areas B & C

The side scan revealed a strong anomaly at Area A, probably resulting from a combination of palaeo-shoreline and archaeological features



The archaeological features at Area A comprised upright stone slabs, as well as walling and apparent negative features or voids.



Area D

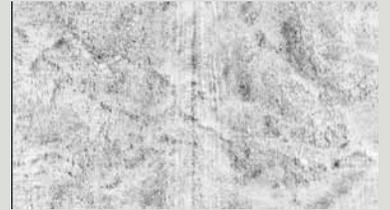
This area lies in c10m of water depth to the E of Damsay. The original target comprised an area of clear linear anomalies identified on the original sidescan survey of September 2008. These anomalies showed clearly in the 2009 survey. In addition the sidescan of 09, suggested an isolated circular feature in this area. At the drop zone, to the S of this area the divers located a small stone feature in 9m of water (high tide) made up of horizontal flagstones together with small upright slabs. This stood proud of the fine particulate muddy substrate which extended over a wide area to the north.

Area E

Area E was centred round the remains of a former pier visible at low tide on the east coast of Damsay. The pier was located, and no other features were recorded. A coastal sweep to the north of pier did not yield any further results.



The original side scan image in Area D lay in an area of slightly deeper water and comprised clear linear anomalies in a rectilinear pattern reminiscent of a field system.



Area D side scan image: scale 200m across image.



Area D, stonework on the seabed



Area E: old pier structure

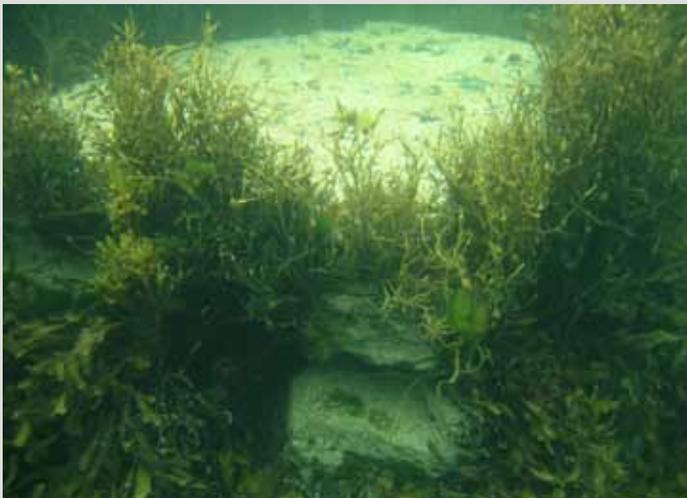
The island of Damsay around which many of the sites occur



Area F

Area F lay off the north shore of Damsay, to the N of the site of St Mary's Chapel. The side scan revealed some strong anomalies in this area. A feature comprising flat slabs with some semi uprights, and coursed stonework was located at the drop zone. Nearby, lay a large structure of

This massive stone structure was recorded at Area F



massive blocks. A sweep to the east along the shore yielded nothing.

Area G

Area G lay to the W towards the Rendal shore and was investigated to locate a funnel shaped anomaly. The seabed comprised soft muddy substrate and no feature was located.

Area H

Area H was chosen to investigate a linear series of anomalies towards the mouth of Finstown harbour. The seabed comprised soft muddy substrate and no features were located, but the presence of a single mooring suggested that these anomalies represent moorings.

The remains in Area F included upright slabs and walling



Muddy substrate at Area G



Mooring at Area H

Discussion

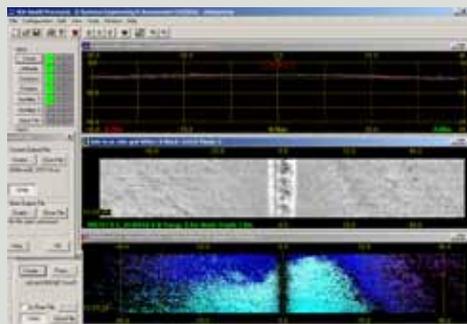
The variation in the features observed suggests that a variety of structural remains survive on the seabed of the Bay of Firth. The material comprises local flagstones, the native building material of Orkney from the Neolithic onwards. In addition, the enhanced geophysical survey recorded other features that are likely to represent parts of the palaeo-shoreline relating to periods when relative sea-level was lower than today.

The seabed around the island of Damsay is relatively uniform with shallow angles from the present shoreline running into the sub-tidal area and deeper. In general it is free from large stones, covered in many areas by sediment of differing types and small stones. In some places a considerable depth of soft sediment was recorded. Whilst many of the smaller stones may relate to erosion of beach material in the intertidal zone, the vertical stone slabs and apparent traces of coursed and collapsed stonework are unlikely to be natural. The recorded features were all clearly visible, and all differ markedly from the seabed around them. Where it is visible, the sandstone geology of the area lies in parallel beds, dipping to seaward. Many of the uprights lay at right angles to this natural bedding, also ruling out a natural origin.

In most places the seabed around the Bay of Firth contrasted greatly with the areas of stone structure recorded above.



Block-like features on the sea bed



Conclusions

The survey work carried out in the Bay of Firth in 2009 demonstrates that stone built structures have survived in at least five locations on the seabed in the bay. Thick kelp hindered identification of the size and shape of the features, and at this stage it is not possible to determine their age or nature. Nevertheless, the sea-level history of the area and the nature of the archaeological remains on land suggest that at least some of these sites are Neolithic in origin and therefore of considerable importance for our understanding of the early settlement of Orkney and indeed for archaeology in the UK. It is possible that the remains at Area F relate to the eroding chapel on Damsay, but further work is needed to clarify this. Work on submerged prehistoric remains around the UK is in its infancy and the sites in the Bay of Firth have great potential for the understanding, management and interpretation of this new heritage resource.

Implications

- The survival of archaeological material on the seabed confirms that the record of sites on land is not complete.
- Further study of the Bay of Firth is needed in order to categorise and date the identified sites and to assess their preservation.
- This study examined only some of the targets identified in 2008, further work is necessary to look for other sites and to provide an overall geographical context for the ancient landscape.
- In order to understand Prehistoric Orkney properly it is necessary to understand the submerged landscape of Orkney and the sites that have survived here.
- Current research suggests that the sea around Orkney only reached its present position about 4000 years ago; it is therefore possible that some seabed sites may date back to the Neolithic period and beyond.
- Current understanding of seabed archaeology is poor, further survey work is needed. To date this is the only project of its kind in Scotland.
- The management of the seabed must include measures for the study, management (and, where appropriate, conservation) of submerged archaeological sites and landscapes.
- The visibility of the features suggests that there is potential to extend the recreational dive interest of Orkney with the addition of a submerged prehistory dive trail.

Further Work in the Bay of Firth

A considerable programme of work is required in order to identify and understand the sites recorded in 2009 and to put them into a wider geographical and archaeological context. This work should include:

1. Photogrammetry/planning to obtain an accurate record of the configuration, shape and size of individual features;
2. ROV footage to clarify the visual record;
3. Inter-tidal examination of the island of Damsay for visible archaeological remains;
4. Detailed bathymetry of the Bay of Firth to assist in the identification of palaeo-landscape and archaeological features;
5. Sub-bottom profile work in order to examine the linear anomalies in Area D which seem to lie below a capping of soft sediment;
6. Further shallow diving on other targets in the Bay;
7. Inshore and coastal coring:
 - a. sediment analysis related to former sea-levels;
 - b. dates related to former sea-levels;
 - c. environmental analysis related to the palaeo-landscape;
8. Academic interpretation and Reporting;
9. Public interpretation and Access.

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