The Rising Tide

Report on Fieldwork June 2010

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Holm of Grimbister and Damsay lie at the heart of the study area in the Bay of Firth

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Introduction

The Rising Tide is a project into the changing environment of Orkney and its impact on the past settlement of the islands (Wickham-Jones *et al* forthcoming). In particular research is being conducted on the rising relative sea-level since the Early Holocene and the possibility that once-terrestrial sites may be preserved on the seabed.

The second season of field research in 2010 comprised a week of fieldwork in the Bay of Firth from 6th June. The field research team comprised Caroline Wickham Jones (archaeology - Aberdeen University), Sue Dawson (geography - Dundee University), Richard Bates (marine geophysics - University of St Andrews), Nigel Nayling and Martin Bates (diving and archaeology – University of Wales, Lampeter) and Chris Stuart (local shellfish diver). During the field work a visit was made by the Marine Officer for Historic Scotland, Philip Robertson.

The aims of the field research were:

- To ground truth information on specific seafloor targets identified by local divers and to evaluate geophysical targets identified in the of 2008/9 surveys
- To carry out preliminary sampling of the sedimentary records of palaeo-environmental indicators
- to record and examine anthropogenic structures within the intertidal zone
- To investigate local data bases of archive material, in particular aerial photographs

Background

The Bay of Firth lies to the west of Kirkwall and is a protected, shallow bay with water depths of 3-12m. It has been selected for detailed survey because of its sheltered position, geophysical structure, and strong ethno-archaeological record. Within the bay lie two islands, Damsay and Holm of Grimbister. While Holm of Grimbister is joined to the mainland by a tidal causeway Damsay lies further out, to the north-east, but local ethno-archaeological information suggests the presence at one time of a causeway to the west, across a stretch of shallow water and existing skerries.

During 2009, geophysical surveys were conducted in the bay using a SEA SwathPlus High frequency sonar. The sonar recordings were acquired mainly around the island of Damsay. In March 2010 ground truth information was acquired on a number of geophysical targets using a diver-based survey. Analysis of both the geophysics and the diver-based survey revealed a number of potential target types including

- mounds,
- isolated blocks,
- linear features
- complex scatterings

A list of the targets is given in Appendix A.

Methods and Activities

Work in June 2010 combined the use of four interrelated techniques:

- Diver survey (figure 1)
- Palaeo-environmental sampling
- Archaeological field survey along the foreshore
- Archive searches of aerial photographs and old documents including maps.

Figure 1: Divers prepare for work.

Dive Operations

Aim

To evaluate targets provided by local diver information and begin to understand the process for further investigation of scattered stone mounds and features on the seabed.

Objectives

1. Evaluation of new target features (Chris Stuart targets)
2. Line transect evaluation of south shore line
3. Re-evaluation of deep (9m) linear anomalies
4. Spot-drop diving on additional geophysical targets
5. Snorkel transects of near shore line north and west of Damsay
6. Assessment of dive conditions and feasibility for archaeological observation at different times of the year.

The main purpose of dive operations was to place an archaeologist (Nigel Nayling) onto the seafloor in order to evaluate local knowledge and experience in the identification of submerged archaeological stonework.

Methods

Dive operations were conducted from an inflatable rib skippered by Richard Bates who provided logistical support regarding location and drop zones on precise targets (figure 2), together with briefing/de-briefing the divers before/after they were deployed. During the dive survey, the weather conditions remained calm with light winds and a small sea state. The water clarity was much improved from dive operations earlier in the year with visibility in

excess of 8m. The water temperatures also made for longer dive times. Unfortunately, the later time of year also meant that the seaweed, in particular the kelp, had grown significantly and was a particular problem for interpreting the rock-covered features. Dive operations spanned all states of the tide and it was noted that weak currents are experienced in the bay to the north of Damsay and to the south east of the island.

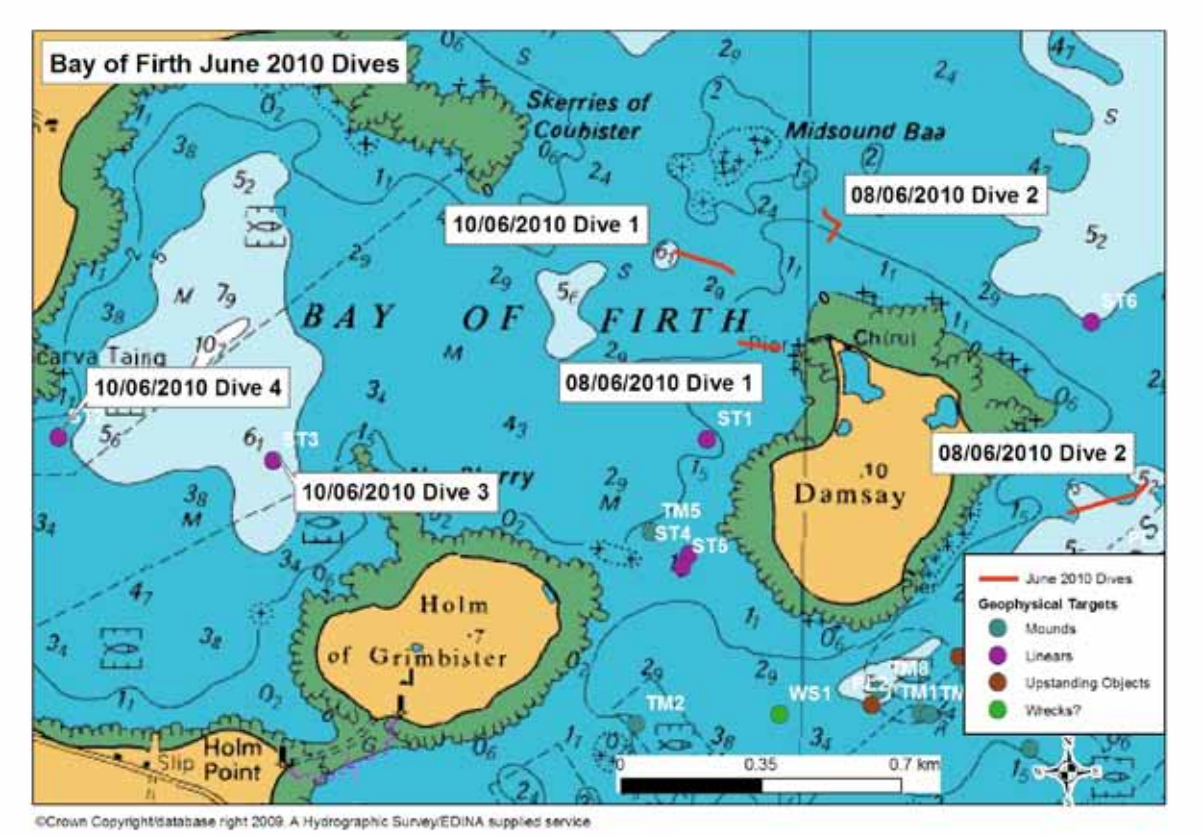

Figure 2: Dive locations June 2010

Activity

A summary of diver observations and an interpretation of the seafloor features follow.

07/03/2010 Dive Day One

Shallow Snorkel, North of Chapel, Damsay

Shallow transects were made in the bay to the west and north of the chapel site on Damsay in water generally less than 2m deep. The objective of these transects was to further ground truth the areas where upstanding stones had been recognised on previous dives and where the large stone "table" feature had been seen. In addition, it provided a safe environment for displaying to other non-diving team members the difficulty in recognising and interpreting submerged archaeology. Along the spit extending north west of Damsay a series of stone uprights were recorded arranged in a 6-7m circular pattern. Each stone was approximately 1m wide by 1m high (figure 3). The most southerly stone stood 0.6m proud of the low water mark in a vertical orientation and displayed a vertical parting similar to some of the smaller stones recorded in the bay to the west of Damsay Chapel. Below low water mark additional isolated large stones appear to continue offshore in arrangements that are not conformably bedded with the surrounding geological formations. Further inspection of this site by Nigel

Nayling and Philip Roberston later in the week confirmed initial observations and we conclude that this area should be prioritised for further investigation.

Figure: 3: stone upright NW of Damsay

The transects to the north of the Chapel site did not re-locate the table stone but in this area abundant seaweed caused difficulties in identification (figure 4).

Figure 4: Chapel mound with diver in foreground

Main Mound to south east of Damsay

The main mound site (TM1) was visited but weed growth at the centre made it difficult to see the stonework.

08/06/2010 Dive Day 2

Dive 1

Dive on spread of stone north west of the Chapel site. This is an area that Chris Stuart and other local divers have consistently identified as one where large stone features and bedded stone or stone walls have been observed. A long traverse was made over the site but the majority of bedded stone appeared to be natural.

Dive 2

Dive north of the chapel site into a large sandy bay NW of Damsay. The site showed some large isolated blocks of stone mainly located on sandy seafloor. The sandy seafloor patches were encountered along the transect between more continuous rock outcrops.

10/10/2010 Dive Day 3

Dive 1

Dive across skerry that extends from north west point of Damsay towards the mainland (figure 5). Local information postulates that this skerry shallow area could once have been a low tide-exposed causeway between Damsay and the mainland. The dive started in the rocky areas and traversed through patches of sand that once more contained large (up to 2m), isolated blocks of stone and clusters of stone blocks.

Figure 5: Skerries of Coubister running out to Damsay at low tide

Dive 2

Dive into deep area (6m) south east of Damsay. Start on isolated scattering of stone in fine sand to soft silt sediment. Scattering 5-10m diameter with stones upto 0.5m size. Along transect singular and isolated pairs of stone encountered 1-1.5m size and upto 0.5m from the seafloor.

Dive 3

Dive on isolated upstanding geophysical anomaly ST3 (figure 6). The anomaly can be clearly seen in the original geophysical data as a large (greater than 0.5m) anomaly standing proud from the seafloor. This was identified as a 1.5m long stone sticking out at an angle to the seafloor in soft sediment. Near this site large 1x1.5m metal plate identified on the seafloor together with hydraulic hose.

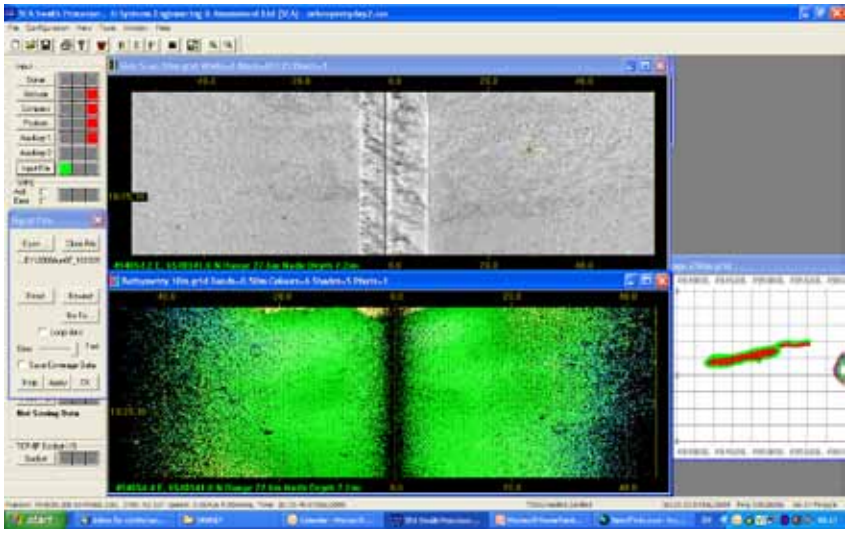

Figure 6: Upstanding Stone indicated by anomaly at ST3

Dive 4

Dive on large upstanding geophysical anomaly ST2 (figure 7). From the geophysical data this anomaly was identified as a mesh cage, 1.5x1.5x1.5m filled with rubble, located in soft silt sediment (figure 8).

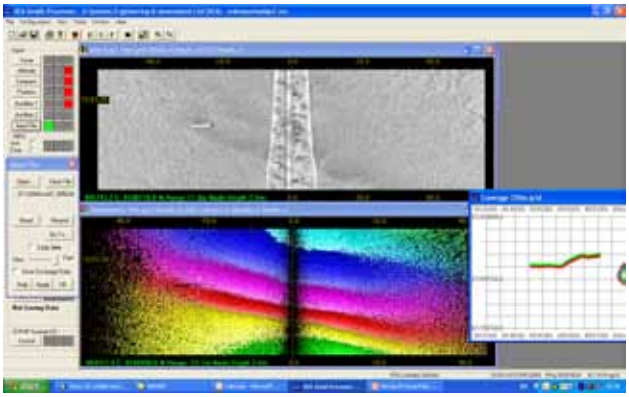

Figure 7: Geophysical anomaly ST2

Figure 8: mesh cage at ST2

Palaeo-environmental Sampling

Aim

To demonstrate the existence of extensive sediment sequences containing a variety of sources of information around the study area both within the intertidal zone and in areas in the immediate vicinity of the shore (i.e. within 1km of present shore).

Objectives

To determine whether or not questions regarding sea-level change, vegetation patterns and palaeohydrology could be addressed with future field and laboratory work.

Methods

Four sites were targeted for investigation as indicated in figure 9 and Table 1:

1. The blanket bog on the south side of the bay (Site 1, figure 9).
2. The blanket bog associated with the Burn of Redland to the north of the bay (Site 2, figures 10 & 11).
3. The small (partially infilled) lake (Loch of Brockan) to the north of the bay (Site 3, figures 12 & 13).
4. An exposure of intertidal organic sediments on the west shore of Ferry Point (Trench 1, figure 14).

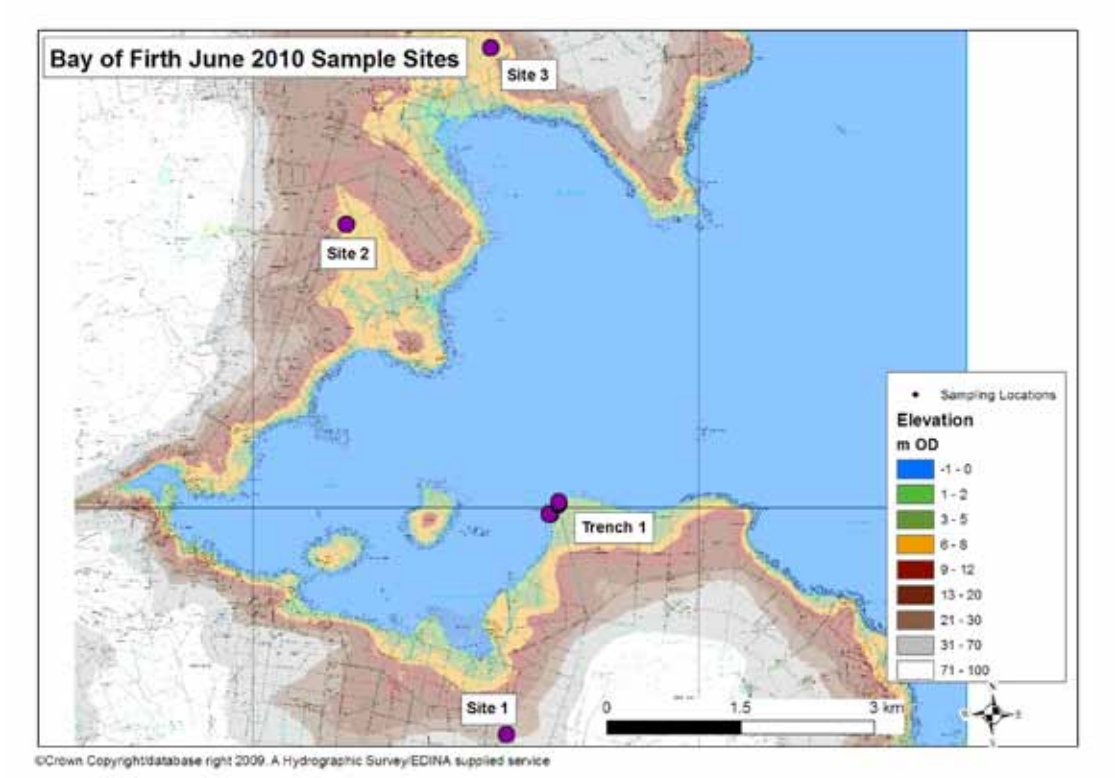

Figure 9: Sample sites around the Bay of Firth

Sediment samples were obtained from each for further analysis and initial descriptions of the stratigraphy are given below.

Site	Lat	Long	Ht (mOD)
S1	1011139.9	339685.1	35.7
S2	1017183.4	338044.4	8.8
S3	1019166.3	339664.5	5.8
Trench 1	1013934.0	340333.2	1.0

Table 1 – locations for core samples and trench

Activity

Site 1. The site lies on the south side of the bay within an area of blanket bog at Hardhill at an elevation of approximately 35m O.D. (Plate 1). This site had previously been prospected using a gouge auger in March 2010 (Bates et al 2010) and a position was fixed for a single borehole on the basis of this survey. The core sample was acquired with a Russian/'D' Section auger. The stratigraphy is described (for this and other cores) from top (surface) to base of the core:

> Stratigraphy: At the surface a 2m layer of peat (variably humified and fresh) overlay a further 0.6m of peat with charcoal flecks. The basal 0.21m of the sequence consisted of dark brown organic silts with charcoal flecks over an inpenetratable substrate.

The appearance of the sequence indicates that pollen and plant marcofossils are likely to be well preserved. The presence of charcoal attests to burning though whether of

anthropogenic or natural origin cannot at present be determined. The presence of silt at the base of the sequence indicates a degree of colluvial activity downslope at the site. Eight individual cores were retained for further investigation.

Site 2. The site lies on the north side of the bay close to the stream exiting from the Dale of Redland. Ground surface elevations here are approximately 15m O.D. Rapid survey of a single transect from the bog edge into the middle of the bog was undertaken by gouge auger. A single core sample was acquired with a Russian/'D' Section auger at this site (figures 10 &11).

Figure 10: Coring at the Burn of Redland

Stratigraphy: Surface to 3.3m of peat was found to overlie a grey silty-clay of unknown origin (possibly glacial till).

Figure 11: Core from Burn of Redland

The appearance of the sequence indicates that pollen and plant marcofossils are likely to be well preserved. Nine individual cores were retained for further investigation.

Site 3. The site lies on the north side of the bay at an elevation of 5.8m O.D (figure 12). It comprises a small partially infilled lake (the Loch of Brockan). Rapid survey of the peat bog to the eastern and northern side of the lake was undertaken using gouge auger. A single core sample was acquired with a Russian/'D' Section auger (figure 13).

Figure 12: Loch of Brockan from the NW

Figure 13: Loch of Brockan core.

Stratigraphy: Surface to 1.6m of peat was found here overlying 1.7m of calcareous lake or marl sediments (Figure 3B). Downwards these sediments become finer grained and softer, molluscs disappear and organic flecks appear towards the base.

The appearance of the sequence indicates that pollen and plant macrofossils are likely to preserve well in the peat. Shells are very well preserved within the lake marls and it is likely that ostracods also survive. Nine individual cores were retained for further investigation.
A traverse of the lake shore identified a number of unusual features that extended into the shallow lake that may be of anthropogenic origin. Considerable potential is recognised here for deeper and more complex sediment sequences. The relatively sheltered location would also suggest this to be an area where further anthropogenic remains could be found. This location should be prioritised for more detailed work.

Site 4 The site lies on the eastern shore of the bay at Ferry Point. It comprises a deposit of silty organic sediment on the foreshore below the present cobble and shingle beach, immediately seaward of a small, shallow lochan. The sequence extends c. 100m laterally across the beach and c. 15m east to west, just to the low water mark. To investigate the stratigraphy and obtain monolith samples of the sediments a trench was dug, roughly east-west down the beach from high water to the low tide mark (figure 14). At the deepest (upper) section the trench was c. 1m deep. Unfortunately after recording of the section a storm powered tide infilled the trench so that samples were eventually cut from a smaller trench dug immediately to the south of the original (stratigraphy in the smaller trench was observed to be identical to that of the main trench).

Figure 14: Trench section, Ferry Point

Figure 15: Excavation of the trench at Ferry Point

Figure 16: Stratigraphy at Ferry Point

Stratigraphy (figures 15 & 16):.A grey fine silt underlies the modern storm beach and extends to 2m across the intertidal zone. Below this a slightly sandy brown organic silt is widespread to c 30cm depth. A thin unit of fine grey banded sands underlies the organic deposit at the upper section of the trench extending 4m along the section. A unit of dark brown organic silt grading to a greyish-brown fine sandy silt comprises the majority of the sediment to 1m depth. The base of the sequence comprises blue-grey clay, gravel and cobble matrix. Along the top of this deposit organic intraclasts of wood (alder and ash) were noted. The blue-grey clay becomes less stoney and thicker to seaward.

Figure 17: Monoliths in position, Ferry Point

The sequence of organic silts and sands suggests the potential to reconstruct the evolution of the Ferry Point coastal stretch. The nature of the sediment suggests that it should contain a variety of palaeoenvironmentlal indicators including diatoms, pollen and (Chironomid) beetle remains to allow a comprehensive assessment of the environment immediately east of the geophysical and dive targets. Material for further analyses and radiocarbon dates were collected in two overlapping monolith tins which span the stratigraphy from top to base at the most easterly exposure of the trench (figure 17).

Archaeological field survey

Aim

To characterise the anthropogenic structures of the intertidal zone

Objectives

1. To identify the nature of the original features
2. To understand the impact of marine and sub-aerial erosion on the taphonomic history of the feature.

Understanding these processes is particularly important in order to compile the information necessary for the recognition of potential features in the marine zone.

Method

Short stretches of shore on both the east and the west sides of the bay were examined. The comprehensive survey and recording of the intertidal zone was not a fieldwork objective at this stage; nevertheless, three significant features were observed:

1. Structure 1. Ferry Point east (Plate 4A/B).
2. Structure 2. Ferry Point west (Plate 5A/B).
3. Structure 3. Burness, north of the Point of Backaquoy (Plate 6A/B)

Activity

Structure 1. Ferry Point east (Figure 18). This structure was first located in March 2010 and was examined in further detail. The structure comprises a decayed wall that previously traversed the beach. Today it is preserved as an upstanding feature at low water mark. Across much of the mid and high beach the former presence of the wall is only indicated by the distribution of large stone flags resting amongst a generally finer grained beach gravel and cobble mass.

Figure 18: Wall at Ferry Point

Structure 2. Ferry Point west (Figure 19). This structure was discovered during the excavation of the trench across the beach at palaeo-environmental site 4 (above). The structure comprises a series of large blocks and flat slabs arranged in a pattern displaying structured order as well as the presence of packing stones of smaller size. Initially located by the presence of a single upright stone, this feature was very difficult to observe without extensive clearing of the kelp growing across it. In general the larger stones that comprised the structure were clearly differentiated in size from the surrounding beach material at that point. Close inspection also revealed some order to their arrangement, though many stones had moved from likely original positions. It is possible that this represents the remains of a small jetty and it may be linked to a past function as the location of the jetty at Ferry Point.

Figure 19: Jetty at Ferry Point

Structure 3. Burness, north of the Point of Backaquoy (figure 20). This structure consists of stone flags distributed in a platform like distribution at the end of a short causeway of similar flags running out from the low cliffs to the west. Within the central part of this feature a small section of stone walling was noted. Presently it is clear that the local farmer uses this hard as a location for the dumping of rubbish, nevertheless, the structure may be of older (as yet uncertain) antiquity.

Figure 20: Structure at Burness

Documentary work

Aim

To retrieve information pertinent to the history of the Bay of Firth from existing historical records and documents

Objectives

- To assess the impact of developments within the Bay of Firth on the seabed and possible surviving archaeology
- To retrieve old bathymetrical and topographic information that might have a bearing on changes in sedimentation and land forms
- To collate information on past activities within and around the bay.

Methods

Three potential sources of information were examined. Documents relating to the Bay of Firth held within the Orkney Archive, Orkney Library were searched and old maps examined. Aerial photographs held within the office of SNH in Kirkwall were scrutinized.

Activities

Documents

Documents relating to the Bay of Firth Oyster fisheries were examined; information relating to stocking, seabed conditions and management, and harvesting techniques was recorded. The various Statistical Accounts of Scotland were examined together with other general accounts of bathymetry, and seabed topography. Over dredging of the oyster fishery in the 1840s was noted by several sources, and may have had an impact on site survival, though it

is worth noting that the fishery extended out as far as the Quanterness Skerry with much activity seemingly in the outer part of the bay.

Maps

The original Admiralty bathymetrical survey undertaken by Thomas of the HMS Mastiff in 1839/40 was digitised for future reference (figure 21).

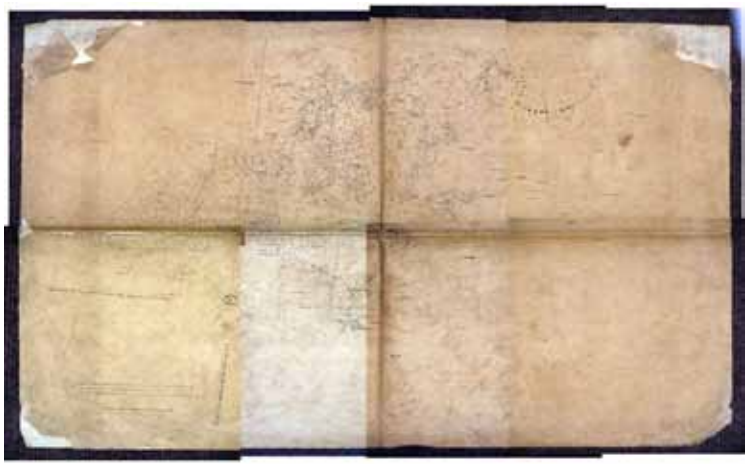

Figure 21: Thomas' survey of the Bay of Firth

Photographs

Aerial photographs were examined but showed little pertinent detail except for the potential of the bay for targeted photography at low water (in hand with RCAHMS).

Discussion

Diving work continues to reveal the complexity of the stone component of the seabed. Potential for the recognition of anthropogenic features seems to be highest where pockets of sedimentation occur thus providing a contrast with upstanding stonework or tumble. Elsewhere the removal of pre-existing land-surface sediment during or after submergence means that possibly only rock cut features would survive from prehistory and they are likely to be difficult to recognise even if associated with anthropogenic stone collapse. Nevertheless, areas of potential feature survival have been isolated, as have stone formations for which no natural explanation can easily be assigned. The two in combination mean that the archaeological potential of the Bay remains high, while the use of geophysical techniques together with a suite of other work including diving as a sound method to explore this type of archaeology has been verified.

In addition, the examination of intertidal features as an important step to assist in the recognition of submerged stonework is recognised. In all three cases undertaken in June 2010, collapsed structural material was observed when isolated features were compared against a background of lithologies that were apparently different. Without a wide field of view individual features would not have been located so easily. In the case of one feature considerable clearance of kelp was necessary before identification of an anthropogenic origin was made. These have important implications for the development of a strategy linked to underwater observations, not least because of the greater abundance of kelp underwater and the restricted visual depth afforded underwater.

Around the Bay, the palaeo-environmental sampling indicates that extensive and well preserved records documenting local and regional landscape development does exist within

the catchment area. These sources of information already appear (without further analysis) to contain a record of changing conditions on the valley sides as well as change in palaeo-hydrology associated with the Loch of Brockan. The probable presence of ostracods as well as other proxy environmental data may provide information suitable for detailed site environmental reconstructions as well as providing the narrative background for the archaeological history of the area. Material suitable for radiocarbon dating will be extracted in order to build a chronological framework for this history.

Archival work has perhaps only touched upon the potential material relating to the Bay. Nevertheless, the value of compiling information on past management practices and mapping exercises has been validated.

Conclusions

The fieldwork undertaken in June 2010 extended information relating to previously identified geophysical targets, as well as evaluating the information supplied by local divers. In practice a combination of adverse weather and local circumstance means that some local information, such as the potential of the south shore could not be covered. A brief fieldwork season like this is of necessity limited so that much of the record of the Bay, including many geophysical targets and previously recorded potential features, remains to be examined.

Preliminary sampling of the sedimentary record around the Bay was particularly successful, providing an initial idea of changing environmental conditions as well as good quality core material for future detailed work and dating. Shoreline survey in two trial zones has had very positive results, producing information that provides a valuable part of the history of the use of the Bay in its own right, as well as an important analogue for the survival and nature of potential anthropogenic stonework underwater. The local archives were also shown to contain material pertinent to understanding of the evolution and history of the Bay.

In summary it is the combination of method that has resulted in the success of the project to date. No single technique can be isolated as valuable above the others. Transition Zone Prehistory as practised by the Rising Tide Project incorporates a seamless archaeology in both a geographical sense, running from hill to seabed, and in a methodological sense, making use of a range of tools from archive to wetsuit.

Recommendations for future work and management

With regard to future work, experience to date suggests that while increased weed growth during the summer months may limit the close visibility of potential stonework, this disadvantage may well be outweighed by warmer water and air temperatures, as well as improved long range visibility due to clear overhead light.

As a result of work to date the following priorities may be identified:

- Acquire more complete swath bathymetry around Damsay and out into deeper water, with the longer term aim of complete coverage of the Bay
- Analyse and date the sediment cores taken in June 2010
- Walk and document in pictures the whole shore for inclusion in a GIS record – recording archaeology, rock formations, and organic sediments
- Detailed survey of eroding and intertidal archaeology and rock formations around the bay in order to generate a list of examples of the type of patterns that might occur on the seabed.
- Review aerial photographs held elsewhere such as RCAHMS and OIC HER
- Work with RCAHMS over the inclusion of the Bay into a programme of future air photography
- Build archive of local memories, stories, scientific papers etc
- Collate further information relating to previous shellfish farming in the Bay
- Continued liaison with local people regarding active shellfish collection and other activity in the Bay
- Liaison regarding the long term tourist potential of the project
- Liaison with Historic Scotland, Scottish Natural Heritage, RCAHMS, Orkney College

Reference

Bates R, Bates M, Dawson S, Nayling N, Wickham-Jones CR 2010 *The Rising Tide: Report on fieldwork March 2010*

Acknowledgements

Thanks are owed to Chris Stuart, Phil Robertson of Historic Scotland, the staff of Orkney Library and Archive, Kate Thompson and Scottish Natural Heritage, and Willie Thomson.

Funders

Fieldwork in June 2010 was funded by The Crown Estate.

Previous funders include:

Historic Scotland
Orkney Islands Council
Orkney Archaeological Trust
NGS/Waitt Grants
The Russell Trust
Private donations

Appendix A: List of Geophysical targets

PL1	3	59.0060423	-3.0520697	parallel linear tracks - end	497009	6540726
PL2	3	59.0026875	-3.0634315	rt angle stone wall? SE Damsay	496356	6540353
PL3	3	59.0037939	-3.0596734	rt angle stone wall? SE Damsay	496572	6540476
PL3	3	59.0203975	-3.0629416	line of stakes on 133526	496386	6542325
PL3	3	59.0204336	-3.0626456	line of stakes on 133526	496403	654329
PL3	3	59.0204876	-3.0623670	line of stakes on 133526	496419	6542335
PL3	3	59.0205508	-3.0618098	line of stakes on 133526	496451	6542342
PL3	3	59.0205419	-3.0614963	line of stakes on 133526	496469	6542341
PL3	3	59.0205510	-3.0612177	line of stakes on 133526	496485	6542342
ST1	2	59.0085840	-3.0707545	Ring structure W of Damsay	495936	6541010
ST2	2	59.0083859	-3.0989235	Boulder NW Holm on 095024	494318	6540990
ST3	2	59.0079527	-3.0895906	Boulder NW of Holm on 101929	494854	6540941
ST4	2	59.0059882	-3.0714978	<3m dia, <1m high stone?? W of Damsay on 094249	495893	6540721
ST5	2	59.0057186	-3.0717584	Boulder W of Damsay on 093511	495878	6540691
ST5	2	59.0055859	-3.0480476	Boulder far E of Damsay on 124606	497240	6540675
ST6	2	59.0113311	-3.0541671	large block NE of Damsay on 125655	496889	6541315
TM1	1	59.0025269	-3.0613075	Main Mound Centre	496478	6540335
TM1	1	59.0025001	-3.0609419	Main Mound Edge	496499	6540332
TM2	1	59.0021792	-3.0736658	Mound and Stones SW Damsay on 150726	495768	6540297
TM3	1	59.0082319	-3.0560599	large mound E of Damsay + line of stones on 084513	496780	6540970
TM4	1	59.0017657	-3.0565542	low mound S of Damsay on 150726	496751	6540250
TM5	1	59.0064812	-3.0731527	small mound west of Damsay	495798	6540776
TM6	1	59.0055652	-3.0549240	upright to E Damsay plus mounds to the east of this	496845	6540673
TM8	1	59.0030379	-3.0631188	Mound S of Damsay on 154830	496374	6540392
WS1	4	59.0024520	-3.0674172	wreck or aircraft?	496127	6540327
F		59.0120035	-3.0645062	Diver -high readings on SS, Stone feature	496295	6541390
A		59.0009678	-3.0675076	bay on W coast of Damsay, several stone features	496122	6540162

Appendix B: Outreach

Lectures since March 2010

Coleraine, Centre for Maritime Archaeology	Seminar	SD & CWJ
Orkney Archaeology Society conference	Lecture	CWJ
Dublin, University College, Dept of Archaeology	Seminar	CWJ
Submission to *Mesolithic in Europe* Conference Santander September		all
Submission to MASTS December 2010		all

Publications

Paper on initial sediment dates being finalised
Paper on Methodology in preparation for submission to *Journal of Archaeological Science*

Website

http://www.st-andrews.ac.uk/tzp/