

REPORT ON A COASTAL ZONE ASSESSMENT SURVEY OF ORKNEY:

BURRAY

FLOTTA

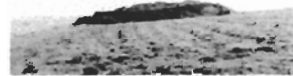
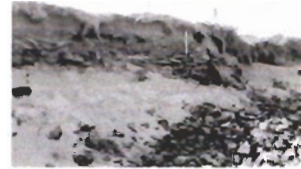
GRAEMSAY

HOY

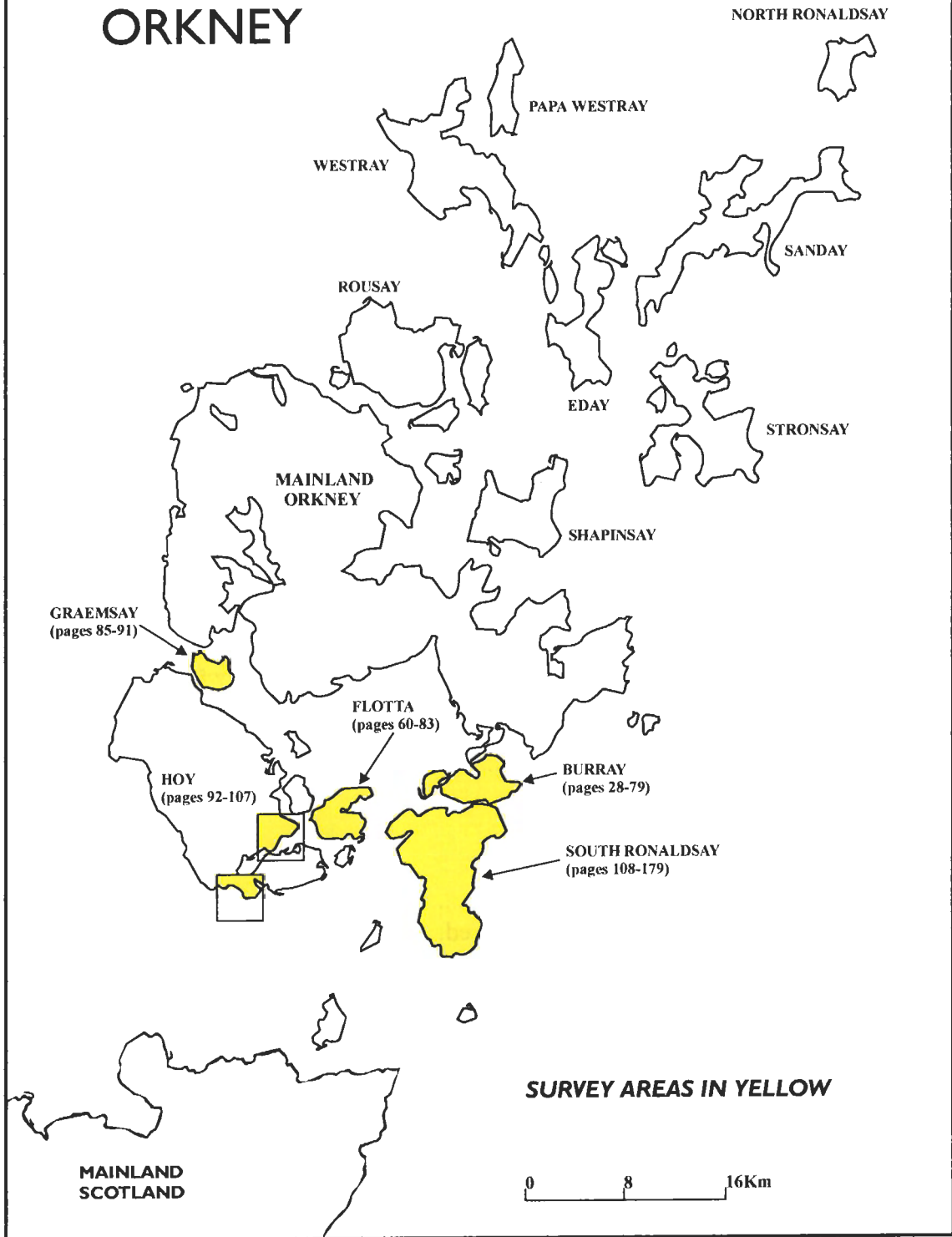
SOUTH RONALDSAY

AUGUST 1997

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ORKNEY



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Hinterland geology and coastal geomorphology
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1.0 INTRODUCTION

This report documents the results of a coastal zone assessment survey carried out in Orkney over four weeks in August 1997. The field survey was carried out by a team of four people, comprising two archaeologists and two geomorphologists. The work was commissioned by the Orkney Archaeological Trust (OAT) and funded with a grant from Historic Scotland (HS). The commission defined the area to be surveyed and work was carried out in accordance with Historic Scotland's Procedure Paper 4: Coastal Assessment Survey (Historic Scotland, 1996).

Survey Area

The survey area comprised the Orcadian islands of Burray, South Ronaldsay, Flotta, Graemsay and parts of Hoy (see location map). Survey was limited to the coastal zone, defined as a 100m wide strip of land adjacent to the coast edge, including the foreshore (inter-tidal zone). No marine survey was undertaken; previously recorded sites located in the marine zone, however, have been included in this report.

The length of coastline walked varies, depending on the scale of map used (Ashmore 1993). In order to gain the most accurate estimate possible, the entire survey area was measured at a scale of 1:10 000, this being the largest scale of map available. When measured at 1:10 000 the distance is **153.20km**. During the preparation of this report it proved inconvenient and unwieldy to use 1:10 000 maps to gauge distances. Instead, the smaller scale 1:25 000 maps were used, this was also convenient because each map section is presented at this scale.

Permission to cross the land was sought from the various landowners by OAT in advance of fieldwork. In all but one instance permission was generously granted on the proviso that crops and young stock were not unduly disturbed. The exception was a strip of land on the east coast of Burray, where commercial sand extraction is taking place (clearly marked on Burray Map 4).

Desk-Based Study

A desk-based review of the known sites and monuments was carried out prior to fieldwork. It was found that, in total, there were 109 previously known sites located within the survey area, of which 17 are protected (either as scheduled ancient monuments or listed buildings). Where possible, each known site was visited in the field and re-examined. In a very few cases it was either not possible to locate a known site or to inspect a site. In such instances the site description given in this report has been taken directly from the NMR record cards; such sites are labelled 'not inspected' or 'not located', as appropriate.

Survey Conditions

In general, the weather conditions under which the survey was carried out were good, with only occasional showers and strong winds. Carrying out a survey in the height of summer, although pleasant for the surveyors, did have some disadvantages in that vegetation was at its most lush and parts of the survey area were under crop. New financial incentives encouraging the cultivation of oats in 1997 saw an increase of land under arable crops (J Gibson, *pers comm*). This phenomenon was noted on South Ronaldsay, in particular. With stock outdoors in the field, caution had to be exercised in entering fields and navigating electric fences. Over most of the survey area there were few sheep to graze the uncultivated strip between the fields and the coast edge and thus the vegetation was frequently overgrown.

Under these conditions, it is probable that site visibility was somewhat reduced; one known site in particular (SR123, South Ronaldsay Map 7) could not be re-located due to overgrown vegetation. This problem was, however, localised and is not considered to have been a major impediment to the survey. The disadvantages of carrying out a survey in summer must be set against those of other times of the year, however. High winds and inclement weather would probably have imposed more restrictions on the speed and scale of the work given that many parts of the coastline are exposed and dangerous under bad conditions.

1.1 AIMS AND METHODS

Built Heritage and Archaeology Survey

The aim of the survey was to characterise the built heritage and archaeology of the coastal zone. Previously known sites were revisited and assessed for change and new sites were located and recorded. All of the sites within the survey area were assessed for vulnerability to erosion. There was no selection criteria; sites of all types and periods within the coastal zone were investigated. A survey of the physical characteristics of the coastal zone was carried out as an integrated part of this work. The results, presented separately, provide a tool for evaluating the implications of coastal erosion on the cultural heritage

The entire coastline of the survey area was walked and observed, where possible, from both the hinterland and foreshore. To investigate the hinterland up to 100m from the coast edge, frequently necessitated the walking of transects perpendicular to the coast at c.20m intervals.

The field record comprised a card system; each site was given a unique identifier made up of an area code and a number (e.g.. HY3 = Hoy, site 3). These identifiers have been kept as the primary site reference within this report, although some site entries have been amalgamated. The dimensions and characteristics of each site were recorded, together with measured sketch plans and a photographic record. Measurements were calculated with a tape for smaller sites; the dimensions of larger sites were estimated by a systematic pacing out of the area. Directions were found using a compass. The sites were located onto a 1:25,000 OS Pathfinder base map, measured, where possible, from fixed features such as field boundaries.

Geology/Geomorphology and Erosion Class Survey

Alan Stapf

The aim of the survey was to characterise the hinterland geology and coastal geomorphology and to classify the erosion status of the coastal zone within the survey area. The survey areas were observed from the hinterland and/or foreshore as conditions allowed. The survey record comprised field notes, a photographic record and annotations made on 1:25000 OS pathfinder base maps. The field records for hinterland geology/coastal geomorphology and erosion class were made separately, although field observation was carried out at the same time.

In assessing the erosion status it is important to note that marine erosion is not the sole agent; subaerial erosion by water and wind also play key roles, especially of the softer drift deposits which contain the majority of archaeological information. Present land use is also of importance, since the erosion of drift deposits can be instigated or aggravated by land use (e.g.. cultivation on steeply sloping land or sand extraction from the hinterland). Therefore

this survey includes information on soils, drainage and land-use, in addition to the geological, geomorphological and erosion data prescribed in the procedural guidelines (Historic Scotland 1996).

1.2 THE REPORT

This report is the product of both field survey and desk-based research. The body of the report was produced by EASE Archaeological Consultants. The gazetteers which accompany the Hinterland Geology & Coastal Geomorphology and Erosion Class maps, along with other (marked) contributions to the text are by A. Stapf. The following notes explain the terminology and shorthand descriptions used throughout the report.

Built Heritage and Archaeology: Gazetteer Entries

The gazetteer entries comprise a set of characteristics for each site. The categories are as follows:

<u>CATEGORY</u>	<u>EXAMPLE</u>
Site Code (NMR Number).....	B19 (ND 49 NE 1)
Grid Reference.....	ND 4897 9881
Placename.....	Ayresdale
Site type: protected status (scheduled/listed).....	East Broch of Burray: Scheduled
Date (approximate).....	1st mill BC/1st mill AD
Condition.....	Good
Recommendations.....	Monitor

Built Heritage and Archaeology: Site Description Entries

The site description entries comprise a set of characteristics for each site. The categories are as follows:

<u>CATEGORY</u>	<u>EXAMPLE</u>
Site Code.....	B19
Island: Map Section number.....	Burray: Map 4
Grid Reference.....	ND 4897 9881
Placename.....	Ayresdale
Site type (NMR number):status (HS index no.).....	East Broch of Burray (ND 49 NE1):
.....	Scheduled (HS index 1438,
.....	07ND 489 988)
Date.....	1st mill BC/1st mill AD
Location in relation to coast edge.....	Elements located <10m from coast edge
Description.....	This site was partially excavated.....etc.
Condition.....	Good
Recommendation.....	Monitor

Built Heritage and Archaeology: Site Type

While the categories of site types was not restricted (i.e. types were not selected from a pre-set list), efforts were made to standardise the labels given for this report. For example, ruinous buildings of 19th/20th C date which could be positively identified were divided into categories such as dwelling houses, mills, farm buildings or outbuildings; where their use was not apparent, they were labelled as 'structures'. The use of 'croft' and 'farmstead' and 'smallholding' has been avoided where possible, since it was often not apparent whether the 'structure' was associated with a parcel of land.

Prehistoric sites, and mounds in particular, are frequently difficult to date and characterise from the visible remains. The identification of mounds as chambered cairns, burial mounds or more recent refuse or farm mounds, for example, was made on the basis of previously recorded information, or where this was not available, the *most probable* explanation of the visible remains. In such cases, the true identity of these sites would require further assessment and/or excavation.

The interpretations of WWI and WWII remains are largely based on the works of others (most notably Guy, 1993 and Dorman, 1996). Frequently these site complexes contain many elements which have not been previously recorded and require the attention of a 20th C military specialist to provide a full explanation. This situation may be soon remedied by ongoing RCAHMS survey of these sites. For this report, we have tried to enumerate and provide a general overview of those remains which lie in the coastal zone.

Built Heritage and Archaeology: Dating

The date ranges set out for various site types within this report are based on an overview of similar sites in Orkney (and elsewhere) which have been scientifically dated or historically recorded. These ranges represent a general consensus; it must be noted that there is much debate about the date ranges of specific sites (such as broch, for example). It is also likely that there are many local variations which provide exceptions to the rule; for example, burials in cists, covered by earthen mounds may have continued for longer in Orkney than elsewhere in Scotland.

With some exceptions, it is frequently difficult to ascribe a date to many prehistoric remains when assessment is based on their visible component alone. In the case of mounds, the general rule employed was to separate them into three categories- chambered cairns (4th-3rd millennium BC), burial mounds (3rd-1st millennium BC) and indeterminate. If a mound appeared to be of some vintage (i.e. stabilised turf, rounded, somewhat reduced appearance) and lay within the bounds of acceptable size and shape, it was categorised as a 'burial mound'. Where a mound had all of these aspects, and appeared to also have a more complex underlying structure (large, protruding stones or substantial hollowed areas, for example) it was classed as a chambered cairn. Where there were any suspicions regarding the origin and date of a mound, it was labelled 'indeterminate'.

In this report, abandoned houses or structures are frequently labelled as of 19th/20th C date. This date range indicates that the structure had elements which appeared to be of both 19th and 20th C date. In many cases the fabric of the building may be largely of 19th C date, with later additions of 20th C date. Some of these structures may incorporate earlier elements as well, but this is very difficult to ascertain; the internal features of most structures were subject to rearrangement and features which would point to an earlier date (e.g. hanging lums, box

beds etc.) are likely to have been replaced by what ever was fashionable at the period of the latest occupation. The materials used in the construction of such buildings are usually locally available and seldom give a clue as to date; the frequent repairs required to maintain traditional houses in Orkney means that construction techniques also generally date to the period of the latest occupancy.

Built Heritage and Archaeology: Condition

The condition of each site entry was assessed under the following criteria:

Good: This label was applied where a site exhibited either high potential or had sufficient visible elements surviving to properly characterise it. An archaeological site was considered to be in 'good' condition where it was undisturbed or only slightly disturbed and retained obvious archaeological potential. Further work at such sites could reasonable be expected to provide information regarding date, nature, extent and complexity. Buildings (especially the large category of 19th/20th C structures) were considered 'good' where there were multiple site elements represented and survived in a reasonable enough condition to provide information regarding their construction, development and use.

Fair: This label was applied to sites considered to have some potential or where limited elements remained and the site could be generally characterised. Archaeological sites of this type were generally somewhat disturbed but retained some potential; a sufficient part of the site remains that it could be more fully characterised via excavation. Standing buildings were considered 'fair' when, although ruinous or disturbed, sufficient of the site remained that it could be generally characterised.

Poor: Sites described as 'poor' have visible elements which are very disturbed and offer little potential for further characterisation. This assumption was made on the basis of the evidence available at the time of this survey and it must be noted that, without recourse to full assessment, the true potential of many sites can only be estimated.

Built Heritage and Archaeology: Recommendations

Recommendations for further work were assessed under the following criteria:

Survey: Where no previous survey was carried out, or, where changes have occurred since the last survey and further work is now necessary.

Monitor: Where there has been little or no change since the last survey or where indeterminate or limited remains are visible and further remains may become exposed in the future.

Nil: Where there has been no change since the site was last surveyed or where a site belongs to a type which is common and is unlikely to represent the best example of its type.

Hinterland Geology and Coastal Geomorphology: Gazetteer Entries

The gazetteer entries comprise a set of characteristics for each coastal unit. The categories are as follows:

CATEGORY

EXAMPLE

Label_Placename.....4 Greenvale
Grid Reference (to centre of coastline stretch)..ND 465 972
Length of Unit.....1.50 Km
Foreshore Type.....Rock platform with a 50-60% cobble cover
Coast Edge Type.....Coast edge rising to >5m after 300m
Hinterland Type.....Drift-rock interface visible...etc.
Description.....At least one old groyne.....etc.

Erosion Class: Gazetteer Entries

The gazetteer entries comprise a set of characteristics for each coastal unit. The categories are as follows:

CATEGORY

EXAMPLE

Label_Placename.....6 Newhouse
Grid Reference (to centre of coastline stretch).....ND 467 970
Length of Unit.....1.40 Km
Erosion Class at time of visit.....Stable
Description.....There are a few areas ofetc.

Erosion Classes

The following definitions have been used:

Eroding: Where more than 70% of the coastline is actively eroding.

Eroding to Stable: Where there are both active erosion and stable areas with 30-70% of either one.

Stable: The section is more than 70% stable. Usually any erosion is limited and local with any variation specified in the accompanying text.

Accreting to Stable: Where there are both accreting and stable areas with 30-70% of either one.

Accreting: The section has accretion over more than 70% of it's length.

Accreting/Eroding: There are both accreting and eroding processes taking place and may have as much or little as 20-80% of each process. The erosion and accretion may not be linearly arranged along the coastline, e.g.. at Ayre of Cara there is erosion of the coastal edge and deposition of sands along the foreshore.

1.3 BACKGROUND TO SURVEY

The Orkney Islands

The Orkney islands lie off the north-east coast of Scotland, separated by the Pentland Firth, which at its narrowest point, is 10 km wide. There are about 90 islands (including very small rocky outposts) of which some 14 are inhabited. The largest island, Mainland, lies to the centre of the archipelago. The two main towns on Orkney, Kirkwall and Stromness, are situated on Mainland. Kirkwall, lies to the east and is the administrative centre, while Stromness, to the west, is the port for travel to the Scottish mainland. Communications within the islands are good, with daily ferry crossings and a regular air service. The economy is based primarily on agriculture (mainly dairy and beef production); fishing and tourism are also important. It has been estimated that 3-4% of Orkney is under arable, with barley, oats, potatoes and turnips being the major crops. About 45% of Orkney is under grass: improved grassland, for grazing, silage and hay, makes up the major part, and less than 1% of the total grassland area is unimproved (Charter, 1995, 9, 17). There are several industries serving the North Sea oil fields, including an oil terminal on the island of Flotta.

The islands visited by this survey surround the waters of Scapa Flow, lying to the south of the Orkney archipelago. While Scapa Flow has dangerous currents and can be treacherously stormy, it has, by dint of being almost completely encircled by islands, provided sheltered harbours for centuries; it served during both world wars as the base of the British Home Fleet. To the east side of Scapa Flow lie the islands of Burray and South Ronaldsay; since the end of the second world war these have been joined to Mainland Orkney by a series of causeways (the 'Churchill Barriers'). The west side of Scapa Flow is defined by the islands of Flotta, Graemsay and Hoy

Orkney in Earlier Times

(Site codes, in **bold** text, refer to examples of site types found within this survey).

The Orkney Islands became cut off from mainland Scotland around 11,000 BC. The first settlers, who arrived around 4000 BC, came by boat from the north coast of Scotland. Evidence for settled farming communities was found at the settlement at Knap of Howar on Papa Westray and dated to about 3500 BC (Ritchie, 1983, Ashmore, 1996, 45). The remains of early prehistoric settlements and burial monuments are widespread throughout the islands; their survival due in part to the fact that they were built in stone rather than wood. It would appear that there was little natural woodland left on Orkney by about 2600 BC (Davidson and Jones, 1985, 35). Orkney flagstones provided an excellent building material, however, and were used with a high degree of mastery and sophistication, particularly in the construction of tombs.

The earliest known tombs comprise a passage and one or more chambers. These 'chambered tombs' were built from stone and covered over with an earthen mound (Davidson and Henshall, 1989). They were used over many generations as communal burial places and ossuaries (see **SR87**, **SR57**, **SR132**). The earliest settlements, such as Knap of Howar, and slightly later, Skara Brae and Barnhouse on Mainland comprised structures of stone with internal features such as hearths, cupboard recesses, pits and sleeping compartments, although there is much variety in their individual detail. The quantities of domestic midden material which was found surrounding these structures yielded valuable information on the diet and economy of the early farmers. They grew barley and wheat, raised cattle, sheep and pigs and

utilised natural resources such as fish, shellfish, seabirds, seals and whales. Pottery was made from local clay and tools from animal bone and stone of various types.

By about 2000 BC burial in chambered tombs had come to an end and, cremation, followed by burial in individual graves became the dominant burial rite. Cremated remains were deposited in a pot or receptacle or, frequently, directly into a stone-lined cist or pit. The cist could be covered by an earthen mound, cut into a pre-existing burial mound or natural knoll or covered over without a mound. Numerous clusters of such burial mounds survive in Orkney (see **SR76**, **SR77**), in contrast to the paucity of known settlements of this period.

Around 1500 BC new types of structures, known as burnt mounds, began to appear. In their simplest form, burnt mounds are formed from heaps of fire-cracked stone, often, but not always, found in association with a stone-lined water trough (see **HY1**, **HY9**). This form of burnt mound is thought to have served as an open-air cooking place, where a water-filled tank was heated by the addition of roasting-hot stones. Modern experiments have shown that it is possible to bring the water to boil and cook even large joints of meat in this manner. Some 'burnt mounds' are more structurally complex, however, and may have served as domestic buildings. The burnt mound at Liddel, South Ronaldsay is the best example of this type (Hedges, 1975).

Settlements of the first millennium BC and early centuries of the first millennium AD are numerous in Orkney, although evidence for burial at this time is more scarce. The most visible site type of this period is the broch tower (see **B19**, **HY8**), which represents the culmination of a development toward substantial domestic structures. The round houses which preceded brochs are typified by excavated sites at Howe (Ballin-Smith, 1994) and Bu (Hedges, 1987), both on Mainland. Within the area of this survey, the settlement at Little Howe on South Ronaldsay (**SR12**) may be of similar date and type. The round houses, as the broch which came later, had solid walls and are thought to have been occupied by extended family groups. The interiors of these structures demonstrate clear divisions of space; often they have a central 'communal area' surrounding a large hearth and more private peripheral areas. The economy which sustained this type of settlement remained largely agricultural but with an increasing trend toward specialised craft production. The brochs, because of their complexity and the effort required to construct them, are thought by some to have served as the homes of the local elite's; this is indicated at sites such as Gurness (Mainland), where a group of smaller houses have been built outside the broch, possibly forming a 'village' community.

Other structures dating to this period include souterrains (See **SR142**), which as the name suggests, are underground passage, often but not always, associated with above-ground settlements. The common explanation is that souterrains were used as storage places, but they may have served a variety of purposes. Promontory forts are an under-investigated class of monument, thought to date to this period. In its simplest form, the promontory fort consists of a set of bank and ditch defences built across a neck of land, restricting access onto the promontory (see **SR97**, **SR68**). In some cases, the remains of structures are visible behind the defences, although some of these may be associated with monastic settlements of later date.

During the later prehistoric and early historic periods, Orcadian society was much influenced by outside influences. The adoption of Pictish art styles, metalworking traditions and new house styles reveal that by about 500 AD, Orkney had come within the Pictish cultural and administrative sphere of influence. Carved symbol stones (see **SR138**, **SR144**), of which eight

have been found in Orkney, are the most recognisable type of 'Pictish' artefact. The provenance of most of these stones is unknown, and, as in the case of the stone found built into the window sill at St. Peter's Church in South Ronaldsay (**SR138**), many were been re-used in later times. Houses of this period were frequently built into the rubble of earlier buildings, particularly brochs, and were not as substantial or ostentatious as their predecessors. The house excavated at Buckquoy (Mainland) comprised a group of cells arranged around a central area, forming a figure-of eight plan (Ritchie, 1977). A more complex development, comprising multiple cellular structures, was revealed at Howe, also on mainland (Ballin Smith, 1994, 91-117). Post-broch 'Pictish' settlements may be represented within the survey area at **HY8** and **SR127**.

In the seventh and eighth centuries AD Christianity spread through Pictland, also reaching Orkney. Few sites of this period have been excavated; the archaeological evidence is limited to a few isolated finds, such as carved cross slabs and metal hand bells. The early buildings on the Brough of Birsay, previously seen as a pre-Norse monastery, have been reassessed and are now thought to represent a secular, rather than religious, settlement (Morris, 1996, 57-62). Studies have indicated the survival of possible eremitic refuges on isolated promontories and stack sites (Lamb 1980). The rectangular buildings noted at Castle of Burwick (see **SR72**) and Harra Brough (see **SR152**) may be such sites. Putative early church sites, as indicated by dedications to Irish saints and local traditions, are known within the area of this survey on Graemsay (**G34**, **G32**) and South Ronaldsay (**SR153**, **SR145**).

The Viking settlement of Orkney appears to have begun during the latter part of the 8th C, although earlier contact is likely. The details of this take-over are unclear, but it appears that by the 9th C Orkney was controlled by Earls, related to the ruling families of Norway. Viking settlements were often built over the ruins of earlier, native houses, such as at Buckquoy (Ritchie, 1977); as befitting competent seafarers, they were generally located close to the sea. In plan, Viking houses were oblong or rectangular, with a long central hearth, benches against the walls and were often supplied with a series of drains. Generally, the walls were built of stone, although wood may have been imported from Scandinavia for flooring and roofs. The settlers were farmers and there was little difference between their farming methods and those of their neighbours. The *Orkneyinga Saga* (Taylor, 1938), written c.1200 by an unknown author, tells of life at this time, and of how farmers would go travelling and raiding to far off place once the agricultural work had been done for the year.

The first Vikings to settler in Orkney were pagan, burying their dead with grave goods, often in boat-shaped graves and, sometimes, in actual boats. Within several generations, in what is known as the Norse period, they had been christianised and begun to build small churches to serve individual estates. The bishopric of Orkney and Shetland was established in 11th C and settled at Birsay by 1160. Orcadian Norsemen made pilgrimages and went on crusades to the Holy Lands. These travels took them as far afield as Jerusalem, where the Church of the Holy Sepulchre provide the inspiration for the round church built at Orphir (Mainland) in the first half of the 12th C. The construction of the great cathedral of St. Magnus in Kirkwall, dedicated to Earl Magnus who was murdered on the island of Egilsay, begun in 1137, was not to be completed until 15th C. After the murder of the last Norse earl of Orkney in 1231, the title passed to the son of the earl of Angus, a Scot who pledged allegiance to the Norwegian crown. This begun a period which saw the power and influence of Scottish Earls grow in Orkney, with concomitant changes in custom. Orkney was finally annexed by the Scottish

Crown in 1481 The turbulent power struggles associated with these changes saw the construction of several castles and fortified houses in Orkney.

The most hated of the Scottish Earls, the Stewarts, were responsible for the construction of two fine palaces at Kirkwall and Birsay in the late 16th and early 17th C. Few buildings of this period have survived; within the area of this survey only the site of a mansion dating to 1633 (**SR147**) and a meal store in Burray village (**B28,37**). This was a time of growth in North Sea fishing and trade with German and Dutch merchants of the Hanseatic League. Villages, such as St. Margaret's Hope (see **SR120**) and Burray Village (see **B28,37**) began to develop. Farming continued to be the mainstay of the economy, with new improvements becoming fashionable and well-appointed farm buildings were constructed (see **G3**). The Orcadian kelp industry, beginning in the late 17th C, was to be of great economic importance to the islands. By the mid-18th C kelp was worth up to £10,000 per year to Orkney, although the effort required to collect the raw sea weed and later process it in kilns was such that farming and fishing tasks suffered from neglect (Fenton 1978, 61). The probable remains of a kelp-working area are noted within the area of this survey at Kirkhouse Point on South Ronaldsay (see **SR101,102**) and Fulzie Geo on Graemsay (see **G10**). Herring became an increasingly important commodity by the 16th C; by the 19th C trade was booming. The evidence can be seen in the remains of many jetties, slipways, harbours, noosts and storehouses dating to this period. The threat to this trading link with northern Europe posed by American privateers in the early 19th C was taken seriously. A battery with two martello towers (see **HY 22**) was constructed to guard the anchorage at Longhope on Hoy. A series of light houses (see **G2, G12**) were built in the mid-19th C to guide shipping around the often treacherous water surrounding the islands.

The ruins of many 19th C farmsteads and houses are scattered throughout the islands, testifying to population decline and the changeover to larger farms which had begun by the 20th C. While some traditional houses and farm buildings of 19th C date are still occupied and even restored (see **SR10**), although many more lie in a state of considerable decay. The remnants of structures associated with 19th C farming include ranges of buildings comprising both house and outbuildings (**B7**), large mill buildings (**B32**) and smaller click (horizontal) mills (**G5**), enclosures (**H7**), planticrues (**H9**) and even refuse pits (**B1**). The presence of boat noosts, or shelters, close to 19th C habitations indicates the importance of sea, not only for fishing but also for transport in the days before metalled roads were built. The islands, although individual, were interdependent, and linked, rather than separated by the sea. This interdependence is evident, for example, in the exchange of fuel from areas with good peat supplies to those with little or none. By the end of the 18th C, Graemsay was supplied with peat from Hoy or Walls, while Burray furnished some of South Ronaldsay's requirements (Fenton, 1978, 212).

In this century, the seas around Orkney, specifically Scapa Flow, have played a part in the defence of Britain by providing a safe anchorage for the Royal Naval Home Fleet. In 1912 a scheme was put forward for the defence of Scapa Flow by the Home Ports Defence Committee, after some disagreement the responsibility for this work fell from the army to the navy. Within days of the outbreak of WWI, nothing had yet been done and the navy set about the hasty erection of temporary coastal batteries at Hoxa Head (**SR24**) and Stanger Head (**F12,13**). A command centre and refuelling base was established at Lyness on Hoy (see **HY14, 31, 32**). The lack of protection around Scapa Flow, however, made Admiral Jellicoe wary of anchoring there for more than a short visit. Defences were enhanced by 1915 with

additional guns, blockship barriers (**B30, B33, G17**), booms and anti-submarine barriers (**G31, G37, HY17**), controlled minefields and hydrophone listening stations. In fact, Scapa Flow saw little action throughout the war. When hostilities came to an end and the lengthy peace negotiations begun, 74 ships of the German Imperial Navy's High Seas Fleet, which had not surrendered, were interned in Scapa Flow. On 21 June 1919, with the British fleet away on exercises at sea, the German commander gave orders to scuttle the entire fleet, and despite British efforts to thwart the plan, 52 ships went to the sea bed. Most were later salvaged, but the remains of several still lie there.

With the prospects of another war looming, plans for improving the defence of Scapa Flow were formulated, but were not put into practice until 1938, when the construction of permanent coastal batteries at Hoxa Head and Stanger Head got underway. The sinking of HMS Royal Oak in Scapa Flow in October 1939 by a German submarine, which had got past the blockship barriers, provided the impetus for the construction of permanent defences, the Churchill barriers (**B13, B27**), which cut off the eastern entrances to Scapa. A new administrative body, Orkney and Shetland Defences, saw to the construction of more coastal batteries (**G13, F14,15**) as well as anti-aircraft batteries (**B21**), booms, minefields etc. There were three coastal Regiments stationed in Orkney, based at Stromness, Kirkwall and on Flotta (**F16, 17, 18**). Scapa, was therefore, very well-defended by the middle years of the war, and was never threatened.

Survey Area: Previous Archaeological Work

The islands in this survey have been previously investigated by Ordnance Survey (1900 6" map) and by the RCAHMS in the 1920's for the purposes of creating an inventory of archaeological sites and monuments (RCAHMS 1946, vol 2). There have been follow up visits by both OS and RCAHMS surveyors and a new survey of parts of Hoy was carried out in the 1980's (RCAHMS 1989). The chambered cairns of Orkney have been reassessed as a group in recent times (Davidson and Henshall 1989). The WWI and II military remains have been recorded (Guy 1993) and are currently being surveyed by RCAHMS as a contribution to the Defence of Britain Project.

Within the survey area, only two sites, Isbister Chambered Cairn (Hedges 1983, see SR87) on South Ronaldsay and a cist burial at Sandside, Graemsay (Hedges 1978, see G35) have been archaeologically excavated in modern times. Less well-documented investigations were carried out in the 19th C by Petrie at Little Howe settlement (SR12), Muckle Howe broch (SR127) and the alleged site of St. Colm's chapel (SR153) and by Farrer at East Broch of Burray (Farrer 1859, see B34) and West Broch of Burray (see B34). There are many sites, mounds in particular, which have been investigated in the past (e.g. SR77), either by landowners or antiquarians, for which no record is available. The site descriptions (**4.1 APPENDIX I**) incorporate the relevant portions of all earlier records for sites which have been previously recorded.

Physical Background to Survey Area: Geology

Alan Stapf

Geologically the Orkney Islands are quite similar to the flags and sandstones of Caithness. This is reflected in the subdued topography of all islands except Western Hoy, West Mainland, Rousay and Westray. Old Red Sandstones are the major underlying geological unit on all the surveyed areas except North Graemsay, where the Granite Schist Complex makes up an igneous and metamorphic basement complex.

The Old Red Sandstones are a laminated succession of hard and soft layers which repeat as cyclic units (cyclothems) and have been grouped into chronological groups. The three main groups found in the survey areas are (oldest first):-

- . *Stromness Flags* which tend to be grey siltstone and sandstones.
- . *Rousay Flags* which are very similar to Stromness Flags but have more pronounced weathering and some purplish, soft limestone, fishbed layers.
- . *Eday Beds* are yellow or red sandstones and marls, some derived from volcanic sediments.

The Eday beds are more readily eroded than the Stromness and Rousay Flags as some of the intervening deposits are soft and so erosion can undermine the tougher, upper layers.

Most of the beds are close to the horizontal or have shallow angles of dip.

Physical Background to Survey Area: Geomorphology

The topography has been further softened by the deposition of till during and towards the end of the ice age. There are relatively few places where thick layers of till are evident in section over the survey area. During the last glaciation, local ice glaciers were only supported on North West Hoy with the majority of the ice flowing across Orkney from the south-east.

The islands have been sinking since the ice age due to isostatic uplift of mainland Scotland with the loss of ice and a consequent down warping of peripheral land masses such as Orkney. Added to this there have been eustatic changes in sea level i.e.. sea level rises. A post glacial shoreline of -4m, South Orkney, to -6m, North Orkney, approximately 6,500 BP has been derived by Smith et al (1996); and a 2m rise in mean sea level change since 6,000 BP has been approximated by Lambeck (1991), the latter based on a mathematical model.

If the submergence was consistent over time, which is unlikely, this would equate to 0.67 and 0.33mm / year change in sea level for the respective researchers. More specifically, Emmery and Aubrey (1985) have estimated that at present there is 2 to 4mm/year change in sea level at the specific locations of: Enloch Bay and North Links on Burray, and Herston Head, Widewall Bay, Newark and Manse Bay on South Ronaldsay.

Apart from till, the other main drift deposits are peat and blown sand. The blown sand is localised within the survey area to the Links and Ayre of Cara on Burray, Newark Bay on South Ronaldsay and Melberry Dunes on Hoy.

No raised beaches were seen in the survey area although Steers, 1973, alluded to a possible dead cliff (i.e. relict cliff) at Windwick, South Ronaldsay. A topographical unit which did resemble a raised beach was seen on the north western corner of Graemsay, but no sediments could be seen to substantiate this and it is more likely that the natural boundary between the basement complex and Stromness Flags has given the area a raised platform appearance.

Soils and Land Use within Survey Area

The natural soils tend to be peat, peaty gleys or peaty podzols, however cultivation has modified the soils into more uniform cultivated horizons. The more freely draining and improved soils are cultivatable, i.e. they could be cultivated by mechanical means, although most are down to grass. A few of the less exposed areas are under cultivation with barley and oats the dominant arable crop. In most places the fields are fenced to the very edge of the coastline with much evidence that the fence lines have been relocated further back from the coast line as erosion has advanced.

Susceptibility to Erosion within Survey Area

The coast lines most susceptible to erosion are the low < 5m edges with soft drift materials, tills and peats, or the relatively softer geological cyclothem such as the marls and sandstones of the Eday Beds. Most rock platforms which lie facing into Scapa Flow are quite wide and shallow as compared to those facing the open seas to the south-westerly and easterly coasts. Here the intertidal rock platforms tend to be steep and so forms a much narrower beach which is not capable of dissipating the wave's energy as does a long shallow platform. Another main factor is the exposure of the coast to the long reaches of storm waves. There is little long-term information on wind speeds and direction, two factors affecting of wave size, although Wright, (1976), reviewed meteorological data and found that between 1920-1974 there was an increase in north westerly and northerly winds at the expense of westerly and south westerly winds. However the winds are still predominantly westerly or southerly, Borne 1997, with wave height exceeding 1.5m for 10% of the year and 0.5m for 75% of the year on the south and western facing coasts of South Ronaldsay (Draper 1991).

Types of Erosion within Survey Area

The sea is the main agent of erosion in the survey area and leads to landslip after mechanical undercutting of the cliff face or scouring of the coast edge. Separation of a landmass leading to sea arches and stacks can be instigated by the cutting of geos and coves. Here the sea is directly responsible for erosion. If the wave height, speed and direction are constant along the coast then the rate of erosion is also moderated by the rock platform gradient and the depth of the cove. A deeper cove and a longer, more shallow rock platform tend to dissipate the waves energy before hitting the coastal edge.

Marine erosion also takes place as a storm beach gradually migrates landwards. This type of erosion is not always obvious and a cursory look or a snap-shot in time may lead one to assume an accretion of shingle as one cannot see the gradual landward migration of the coast. Chemical erosion by salt spray is rather more insidious and has not been alluded to in this survey other than in combination with observable weathering processes of rocks.

Subaerial erosion is the other main eroding agent and is mainly due to rain water and wind. With rain water the affects are seen as soil creep, peat flow, land slip and water erosion, i.e.. rill and gully formation or stream erosion. No definite gully erosion was seen in the survey.

This tends to be locally confined yet aids sea erosion. It is quite likely that in some areas this is the primary cause of drift erosion e.g. Grim Ness, South Ronaldsay.

Wind erosion is usually manifested in soft drift deposits, mainly sand in this case, where wind blow may lead to deflation troughs and scouring of sand dunes as is apparent at Melberry Dunes, Hoy.

Other eroding agents are biological. In this survey the agents are limited to animal, (rabbit, sheep, cattle, etc.) and human disturbance all of which can be controlled by management policies.

Land use practices and management tend to aggravate or alleviate subaerial erosion but appear to have little effect on sea erosion without large resource input.

Accretion within Survey Area

Within the survey accretion was found to be limited and localised. Sand is the major accreting material because of its size. After deposition on the foreshore it can be easily blown onto the hinterland and subsequently stabilised by vegetation. Although cliff erosion may contribute to the sediments the major proportion of source material comes from sea bottom sediments. Under rainy temperate to rainy marine climatic zones sand makes up almost a half to two thirds of bottom sediments respectively, (Hanson, 1988). Large areas of sea bottom sand sediments have been located a few miles to the south west of Orkney, (I.G.S.1977).

Shingle storm beaches may or may not be accreting, in nearly all cases there appears to be erosion co-existing with the accretion. Generally it is suggested that they are eroding the shoreline. Ayres may also be accreting and may be symptomatic of longshore drift of sediments, notably shingle in relatively sheltered waters. Overall these are probably stable or accreting at a very slow rate.