

Conclusions

The findings of this survey, together with those conducted in previous years, have made positive gains in information, not only in identifying a large number of new sites and areas of archaeological potential, but also in providing a clearer picture of the threats faced by the archaeological resource from coastal erosion and other agents. The results indicate that the coastal zone in Shetland is a particularly rich archaeological resource and may be over- rather than under-representative in terms of the site types found there. The findings also detail the large numbers of sites, many of unknown potential, which are either eroding or at imminent risk of erosion from the sea.

Ultimately, survey is a more coarse process than excavation and relies on a received understanding of what types of sites exist and are likely to be found. Site recognition is also affected by current understanding of the nature of the archaeological resource. It is impossible to interpret the unknown without reference to the known, therefore gaps or weaknesses in the record will be reflected in the ability to conclusively identify new sites. The absence of sites of particular type or date from the survey record cannot be taken as an indication that no such sites exist in the area; only that they could not be recognised by this type of survey. Survey is far less able to pick up new site types or to determine chronologies or particular features of interest. For these reasons, the results of survey at best provide a sketch which can only be refined and enlarged upon through further excavation.

A broad theme which emerged during the course of this work concerns the currently limited state of knowledge about sites of all periods in Shetland. This is due to the paucity of modern excavation and the resultant lack of dating evidence. This was found to be particularly problematic in regard to prehistoric houses and burial monuments and sites of all types within the 14th-18th C date range.

Unlike sites which are threatened by development or land management regimes, there is no provision within the National Planning Policy Guideline (NPPG5/PAN42) for archaeological remains which are being destroyed or threatened with destruction by the sea. Neither is there any dedicated source of funding to pay for either protective measures or for archaeological work on such sites. Furthermore, threatened or damaged coastal sites are not always considered prime candidates for independently funded academic research projects, since the remains are likely to be incomplete or located in areas where it is difficult to provide safe conditions for inexperienced workers. Despite these difficulties, a good many excavations on coastal sites all over Scotland have been

successfully carried out in recent years; most of these being funded or part-funded by Historic Scotland. The results, which are now becoming available, amply illustrate the richness of this resource. The only objection which could be raised is in that site selection has tended to be random, usually focusing on high-status sites which are not representative of the resource as a whole.

Building on from this work, it is to be hoped that the agenda for coastal archaeology in the future will:

- Be guided by a co-ordinated policy which can evaluate the current situation, discern priorities and form an agenda for future work

- Investigate all sources of funding available for the archaeological investigation or protection of coastal sites

- Raise the profile of archaeology within bodies with an interest in coastal heritage and management

- Investigate how coastal archaeology can be integrated into broader management and conservation schemes

- Involve local communities in the care of monuments and provide opportunities for visitors to appreciate the archaeological resource

- Promote a wider general interest in Shetland archaeology and coastal matters in particular

This survey is of limited usefulness, and has a shelf life. Its ultimate value depends on it being integrated within a more comprehensive management framework. To progress beyond this point will require that long term strategies are formulated, and implemented. Mechanisms need to be set in place to facilitate the feedback of new information and to regularly reassess priorities.

Recommendations

Every site recorded within this survey has been assessed to determine if further investigative work is required. The conclusions are given in outline form in the site gazetteers and site descriptions which form the body of this report. In those sections recommendations are given as one of three types: Survey, Monitor or Nil, in accordance with Historic Scotland guidelines.

The term 'Survey' has been used as a general term covering all forms of further archaeological investigation or site protection. This may include topographical survey, section recording, trial trenching and open area excavation.

This section expands upon the specific type of work required where survey or monitoring has been recommended. These sites have been divided into four categories:

- **Category 1:** Urgent action required
- **Category 2:** Assessment required
- **Category 3:** Assessment desirable
- **Category 4:** Monitoring required

The main criteria used to categorise sites were the level of vulnerability to destruction, followed by the degree of archaeological potential.

Category 1 sites are therefore both highly vulnerable and likely to be of high archaeological potential. The sites in this category are listed in order of priority. Within the other categories sites are listed in the order in which they occur on the map sections. **Category 2** sites are vulnerable but either are of lower or unknown archaeological potential. **Category 3** sites may be of low vulnerability/some potential or vulnerable/unknown potential. The monitoring of **Category 4** sites is recommended either to keep a site of known potential under surveillance or to check for new exposures on sites currently considered to be of low or unknown potential.

In a majority of cases, it is difficult to accurately assess archaeological potential from surface examination alone. The most immediate requirement here is for further site assessment. The findings of site assessment can be used to inform future management decisions or may act as a salvage operation if further work is either not possible or desirable. A small proportion of assessed sites may go on to be excavated or protected; the remainder will eventually be destroyed. Assessment in advance of destruction will, at the minimum, provide an enhanced site record with empirical evidence of the nature, date and extent of the remains.

Category 1: Urgent Action Required

South Voxter / Mail (SM22, Map 2)

Description: Human remains, representing in-situ burials, are eroding out of a coastal exposure. The burials lie in stone-lined graves, cut in the sandy subsoil, and covered by turf and topsoil. They are aligned E-W and therefore likely to date to the Christian era. At least two individuals are represented by the in-situ remains, have been truncated by coastal erosion. The lower leg and feet bones are missing from one skeleton, while the other is missing all of the lower limb bones. At least one more individual is represented by loose bones, including fragments of pelvis, tarsal and metatarsals, which were found strewn about on the foreshore.

Potential: The remains visible in section may be associated with human remains which have been found in this general area in the past and which are thought to derive from a burial ground 'of ancient date'. This site is located in the near vicinity to the graveyard at Mail, which has yielded several carved stones and Viking artefacts. This area appears to have been a centre of influence from the Iron Age period onwards.

Threat: The site is being actively eroded by the sea.

Action: The remains currently exposed require immediate salvage excavation. The remainder of the eroding coastal section should be cleaned and examined for traces of further burials. The extent of the remains could be assessed using geophysical survey, followed up by trial trenching or open area excavation. The coastline in this general area should be kept under regular

surveillance in case further remains appear. This work could be carried out in tandem with assessment at site SM20, see Category 2, below.

Broch of Burreland (SM29, Map 3)

Description: The Broch of Burreland stands on a promontory, surrounded by high cliffs, across the sound from Mousa Broch. The approach to the promontory is blocked by a drystone structure of 18th-20th C date which is built over the footings of a larger structure of unknown date. Further on to the promontory, the ill-defined remains of a grass-covered bank extends across the neck. The remains of a large cellular structure are visible in an eroding cliff section to the NW side of the promontory and further structural remains, associated with anthropogenic deposits, are exposed to the NNW side. The broch remains are substantial although the walls are in a poor condition and very vulnerable to collapse. To the exterior of the broch there is a subrectangular enclosure and ten or more structures which may be houses or workshops.

Potential: This site has never been formally investigated and although degraded by natural agencies, has not been unduly disturbed by casual exploration. The broch stands up to 4m high and the interior deposits are sealed by a large quantity of rubble. The broch offers a high degree of potential for investigating the manner of construction and nature of the occupation within it and the results of such work would have a wider relevance in relation to later Iron Age studies in Scotland. Of particular interest is the relation of this site with Mousa broch which lies across the Sound. There may also be potential for the investigation of later periods of activity within the broch, since the site appears to have been occupied into the early historic period. The settlement which surrounds this broch, tentatively identified as a Pictish village, also offers much potential for investigation. To date, very few Pictish houses have been excavated anywhere in Scotland and in most cases excavation has been limited to single structures. The settlement is unusual not only in its scale but also in the manner of its layout, which is ordered and appears to respect the broch. A number of the structures appear to be very well preserved and all are readily visible and amenable to excavation. Other areas offering research potential include the possibility that the promontory may have been defended by a block-house type structure.

Threat: The remains are slowly being degraded by animal disturbance and by the advance of a storm beach. To the S side of the promontory there is a steep-sided geo. The sides are eroding and

archaeological deposits are exposed in the upper levels. At the W side of the geo, the remains of a small cellular structure are exposed in a 3m long erosion face. The immediate hinterland of the broch has been denuded of vegetation by salt spray and animal poaching. This threatens to have a destabilising affect on the broch structure, which is in any case quite fragile.

Action: More detailed topographic survey of the entire promontory is urgently required. Better management of the archaeological remains is to be encouraged, particularly the restriction of access onto the promontory by animals. The assessment of the broch, although desirable, may not be practical but nevertheless some effort should be made to consolidate the remains and render them less vulnerable to collapse. The assessment of the surrounding settlement is deserving of the highest priority. This work should be designed to assess the nature, date, extent and condition of the remains. Eroding deposits should be recorded, where possible, and salvage excavation should be carried out in areas where vulnerable deposits/structures are imminently vulnerable to erosion.

Ward of Outrabister (LN27, LN28, LN29, LN30 and LN31, Map 2)

Description: Three houses and two cairns of prehistoric date were identified in this area. House LN2, which is very well preserved, lies on a small terrace below a rocky rise and immediately next to the cliff edge. It is sub-oval in shape and there are up to five recesses or cells defined within the interior, two of which are defined by coursed walls, standing to 0.3m high. This site shows many similarities with other (dated) Bronze Age houses in Shetland. House LN28 lies some 100m to the SW of LN27, and is aligned NE-SW with a seaward (SE) facing entrance. It is sub-circular in plan and measures 10m wide by 8m long. The exterior bank has stone revetting in the area of the entrance. The interior face has a coursed stone revetment which stands 1m above the level of the floor. The interior is sub-divided into five recesses or cells by means of piers of walling which project from the inner wall face. The piers stand to 0.5m high above the level of the floor, and may be more substantial since the original floor surface lies beneath quantities of collapsed walling and turf. Several remnant wall lines radiate outwards from the house. Cairn LN29 measures 3m by 1m and is located on a rocky slope, some 100m to the SW of LN28. It has been damaged by subaerial erosion but it appears to have been originally rectangular or square in plan. House LN30 is located some 15m up slope from the house at LN29 and is largely covered with peat. It measures 10m by 7m and is irregularly sub-oval in plan. The interior is

divided into five alcoves by means of piers which project from the inner wall face. Only the tops of these piers are now visible above the peat. The entrance is formed from a short passage and there may be a porch or courtyard outside. To the W side of the house, discontinuous lines of stones appear to define a field system comprising two or more sub-circular or oval areas. Cairn LN31, a small sub-oval structure, is located on a small level shelf on a sloping hillside

Potential: The sites in this area are all unusually well preserved and houses LN28 and LN30, in particular, do not appear to have been disturbed since their abandonment. It is possible that features will be preserved here that do not survive on other prehistoric sites which have been altered or disturbed. Differences in their form and construction suggest that these houses are not all of contemporary date and thus they offer potential not only to investigate prehistoric settlement but also to learn how it evolved over time. The preservation of probable burial cairns and field systems in the immediate area offers the potential to investigate a range of activities associated with the settlements.

Threat: The sites are threatened by subaerial erosion.

Action: A more detailed topographic survey of each of the sites and the surrounding area is urgently required. The sites should also be individually recorded in their present state. In consideration of the high quality of the remains and potential for further investigation, provision should be made for further assessment or, preferably, excavation in the near future.

Sands of Cumblewick (SM41, Map 4)

Description: A series of consecutive coastal exposures, which occur over an 85m long stretch of coastline, reveal anthropogenic deposits and structural remains indicative of prehistoric settlement. At least one structure can be inferred from the remains. This had walls built, at least partly, of stone and a paved floor. A prehistoric date is further suggested by the types of stone tools which were noted within the exposed deposits. To either side of the structure there are deep buried soils which appear to have been cultivated over a long period of time.

Potential: The remains which are currently visible suggest that there is likely to be a prehistoric settlement preserved below the level of the current ground surface in this area. The date and

extent of the site is not known but from what is visible of one structure, in combination with the fact that there are no surface indications in the hinterland, it would appear most likely that the settlement is of earlier prehistoric date. The deposits noted in the eroding sections comprised deep layers of cultivation soils and anthropogenic soil which contained well preserved inclusions of organic material, including charcoal. Thus, in addition to structural remains, the site may be likely to yield valuable information on past environments and agricultural regimes, which is not typical in the Shetland context.

Threat: The site is being actively eroded by the sea.

Action: The eroding section faces should be cleaned and recorded. Since the exposures are numerous and extensive, analysis of the sections may help to pinpoint the optimum locations for test trenching. Trenching should examine the structural remains and explore a sample of the surrounding hinterland. Geophysical survey may assist in determining the extent of the remains over the wider area. A programme of environmental sampling and analysis should be carried out to assess the potential for further specialist work in the area and to provide material suitable for dating.

Mail (SM24, Map 2)

Description: Deep deposits of cultivation soil, containing inclusions of shell and bone, are visible in an eroding section, although much of the cliff face is now partially covered with rough vegetation and recently dumped refuse. Midden deposits, containing burnt bone, shell and carbonised grain, and artefacts, including steatite vessels and a quernstone, were uncovered in this general area in the last century.

Potential: The remains found in this area in the past, together with the deposits currently visible, are indicative of a settlement. The associated artefacts may belong to any period from the Bronze Age onwards, but the presence of steatite vessels is more suggestive of either a Bronze Age or Viking/Norse date. This site lies in an area known, largely from chance finds, to have been a centre of wealth and influence in the later prehistoric and early historic periods. There has been little work done in the area to date and this site offers the opportunity to examine in-situ remains.

Threat: The site is being slowly eroded by the sea. The remains are also vulnerable to degradation from the use of the area as a dumping ground.

Action: The site urgently requires assessment to determine the nature, extent, date and condition of the remains. The eroding sections will need to be cleaned and recorded and trial trenching or limited open area excavation of the hinterland will

Bio Geo, Clevigarth, Kilder Brou Broch (SM89, Map 9)

Description: The remains of a well preserved broch is surrounded by several houses and, unusually, vestiges of a very extensive field system which appears to be of contemporary date. The broch is largely covered by a 4m high mound. The entrance lies to the SW side and the guard cell can be clearly seen. To the S and W sides of the broch there is a broad platform on which the remains of three or more houses are indicated as shallow depressions. Remnants of a field system are located to the N and S sides of the broch. It comprises eight or more oval or subcircular enclosures, the limits of which are outlined by earthfast stones. The enclosures appear to lie symmetrically, in pairs, to either side of a curvilinear boundary. The largest and most visible enclosure covers an area measuring over 200m by 100m. The remains of at least one oval or figure-of-eight shaped house is situated between the enclosures on the S side of the broch. This house is visible as a depression in the ground surface. It measures 5m by 4m and has a stone-revetted internal face. There may be other such houses in the area which were not readily identifiable by this type of survey.

Potential: This site offers considerable opportunity to investigate the hinterland of the broch. This has not been widely attempted at other excavated broch sites thus there is relatively little known about the nature of activities which took place in the wider surroundings of brochs. The field system and associated unenclosed settlement at Kilder Brou Broch are unusually well preserved and deserving of further attention.

Threat: Part of the broch outworks and the remains of a probable structure are eroding over the cliff edge.

Action: A thorough topographic survey should be conducted to record all archaeological sites in the broch hinterland. Ideally, survey should be as extensive as possible to determine the locations of all land boundaries, however distant, which are associated with the field system surrounding the broch. Trial trenching could be employed to assess the potential of subsurface remains associated with past cultivation and land use, both within the enclosures and, for contrast, in the unenclosed areas. The nature and date of the settlement could also be assessed via trial trenching and the eroding deposits should be recorded and salvaged.

Brough Geo, Southvoe Broch (SM81, Map 8)

Description: The broch stands on a broad platform or raised area, surrounded by the remains of at least six other buildings. These structures are not clearly defined and are largely visible as shallow depressions and it is probable that some may originally have been conjoined. There are indications that the settlement was surrounded by a curvilinear enclosure bank.

Potential: This site is uncommon in Shetland in that the broch has a surrounding settlement which may be of contemporary date. Since the majority of remains at this site are stable and are not threatened with coastal erosion in the immediate future, this factor would not justify the excavation of the remains in their entirety. There is, however, potential for investigating the nature and date of one of the satellite structures, which is eroding.

Threat: The broch mound is stable and largely covered with grass except for several small exposures which are located towards the base on the NW side. To the SE exterior of the broch, an oval structure is being eroded by the sea..

Action: The eroding structure should be fully excavated since this is likely to be as cost effective as trial trenching but more likely to provide reliable information. This work could be carried out in combination with limited trial trenching of the broch and one or more of the other structures, including the enclosure bank, to establish if the remains are contemporary in date.

Whilvigarth (SM44, Map 5)

Description: A large grass-covered mound is located 15m from the coast edge. It is situated on a natural rise on sloping, enclosed grassland, close to a modern settlement. It is estimated to measure up to 23m in diameter and it stands up to 3m high. A pile of loose stone to the SW side of the mound includes large fragments of at least four trough querns. Traces of a boundary bank survive, running from the W side of the mound to the coast edge. Although no masonry is exposed, the size of the mound, in combination with its form and the presence of quernstones in the near vicinity, strongly suggest that this may be the site of a broch or substantial house.

Potential: The mound appears to cover the remains of a small broch or structure belonging to a little known class of sites which probably immediately predate or are contemporary with the brochs. Few such sites have been identified or excavated in the Northern Isles in general or Shetland in particular. To date, damage to the site has affected the covering mound but has exposed little of the structure beneath. Thus it is probable that the structure survives relatively intact. The deep overburden of cultivation soils may assist in the preservation of organic remains within deposits associated with the structure and thus there may be an opportunity to investigate matters relating to subsistence and site economy. The boundary bank which runs round the mound is indicative of a field system and there may be further opportunities to investigate land use and management in the hinterland of this site.

Threat: The E and W peripheries of the mound have been flattened out, probably by ploughing, while the centre appears to have been dug into in the past. The mound is vulnerable to human disturbance and subaerial erosion, while the boundary bank is vulnerable to coastal erosion.

Action: More detailed topographical survey is required at this site and should be followed up with trial trenching to establish the nature, date and condition of the remains. A programme of environmental sampling and analysis should be carried out to assess the potential for further specialist work in the area and to provide material suitable for dating.

Stour Hevda (LN25, Map 2)

Description: Two cairns of unknown type and date are located 25m apart towards the tip of a promontory. Cairn (i) is 3m in diameter and comprises of a mounded concentration of loose and apparently formless stone. Cairn (ii) is comprised of a concentration of stone, heaped up over bedrock. It measures approximately 7m in diameter and stands less than 0.5m high. The presence of several orthostats to the periphery of this structure is suggestive of a kerb.

Potential: Neither cairn could be positively identified but it is possible that they may be burial sites.

Threat: Both cairns are largely denuded of vegetation and cairn (ii), which lies 5m from the coast edge, is particularly vulnerable to coastal erosion.

Action: The sites should be assessed to determine their nature and date. The cairns are small in scale and it is likely to be more efficient to carry out full excavation than trial trenching.

Sketta Bay (LN58, Map 5)

Description: A sub-circular structure, which may be a prehistoric house, lies on flat rough grassland immediately adjacent to the coast edge. It is defined by occasional large earthfast stones and measures about 7m by 6m. Stone present in the interior is suggestive of pier divisions. The outline of at least one cell, measuring 2m across, can be discerned. Outside, two walls which may be the remnants of a field system, run off from the exterior of the structure.

Potential: This site, although in a poor state of preservation, offers the opportunity to investigate an isolated prehistoric settlement and field system. While it is unlikely that substantial archaeological deposits are preserved here, assessment is likely at least to furnish information relating to the form, nature and date of the structure. Such information has a wider relevance since few prehistoric houses have, as yet, been excavated or dated in Shetland.

Threat: The site is vulnerable to further coastal and subaerial erosion.

Action: The site could be rapidly assessed through trial trenching, although it may be more worthwhile to carry out open area excavation since deposits are liable to be truncated or discontinuous and may not be comprehensible if viewed in limited exposures. It would also be worthwhile to carry out topographical survey of the immediate hinterland to determine if there are any further settlements or landscape features present.

Category 2: Assessment Required

Grey Stones of Greenmow (SM5, Map 1)

A much reduced prehistoric house is bisected by a modern fence and vulnerable to coastal erosion. The site should be surveyed and assessed to determine its nature, extent and date. Assessment could be carried out via trial trenching, although it may be as cost-efficient to carry out full open area excavation since the remains are not substantial.

Mail (SM20, Map 2)

Two sections of bank, both of which appear to be constructed from earth and stone, form a small enclosure at the tip of a peninsula. They are associated with a mound, the remains of a small cultivated field and the footings of a rectangular structure. The banks may not be of contemporary date and the larger section may be part of a more extensive feature. These remains are worthy of further investigation since they lie close to Mail, where past chance finds have indicated a centre of wealth and importance in the later prehistoric and early historic periods. This survey identified human remains in an eroding section nearby and there are unconfirmed records of an early church and burial ground in this area. The possibility that these remains, and in particular the mound and larger bank may be associated should be investigated through survey and assessment. The remains are extensive and spread out over a wide area and may be best assessed via trial trenching. This work could be combined with assessment at site SM22, see Category 1, above.

Cumlewick Ness (SM38, Map 4)

The remains of a possible chambered cairn are exposed in a peat cutting on a flat-topped rise. The site requires assessment to determine its nature, date and extent. This could best be achieved through a programme of trial trenching combined with a peat-probing survey.

Cumlewick Ness (SM39, Map 4)

A concentration of earthfast stone may represent the remains of a cairn. The site requires assessment to determine its nature, date and extent. This could best be achieved through a programme of trial trenching

Channerwick (SM47, Map 5)

Midden deposits, which may be associated with 18th-20th C structures in the immediate hinterland, are currently being eroded from a coastal section. The midden covers a layer of buried soil which may be of much earlier date. The deposits should be assessed via a programme of section recording and sampling.

Blovid (SM62, Map 7)

Four possible burial mounds are located close together on a small promontory and are vulnerable to coastal erosion. Work required at this site includes measured topographical survey and site assessment via trial trenching or, preferably, sample excavation of one or more of the mounds.

Blovid, Helm's Geo (SM64, Map 7)

This broch is known as Southpund or Levenwick broch lies close to the coast edge. The remains of a later wheelhouse are contained inside. The site has suffered storm damage in the past and is covered by a large amount of collapsed rubble. The broch is surrounded by ramparts and there are several smaller buildings located to its exterior. The site was partially investigated in the last century but further assessment of the defences and immediate broch hinterland is required. At a minimum, the site should be sufficiently cleared of rubble to permit a detailed site plan to be made. The condition, nature and date of the structures which lie to the broch exterior could be assessed by a programme of trial trenching, preferably integrated with the open excavation of a limited number of larger trenches. The provision for open excavation is recommended because the remains are likely to be complex and may be more readily understood if investigated in this manner.

Troswick (SM77, Map 8)

This site comprises two structures, three or more small cairns and the remains of an extensive field system, all of probable prehistoric date. The site is scheduled but some elements are vulnerable to coastal erosion. The site requires assessment to determine the nature, condition and date of the remains. The first requirement will be to produce a detailed site plan. This might be followed by a programme of trial trenching, designed to investigate the structures, field system and wider landscape.

Green Face (SM92, Map 9)

Two grassy mounds, of unknown date and type, are surrounded by an enclosure. More detailed topographical survey and assessment is required. This should be designed to determine the nature, condition and date of the mounds and may be best achieved via a programme of trial trenching. This could be further enhanced through the geophysical survey of the immediate hinterland area.

Haa Ness (WH76 and WH77, Map 1)

Two possible cairns lie 12m apart, close to the coast edge. Each comprises of a pile of loose stone among which there are several earthfast orthostats. The structures are already very degraded and are vulnerable to further coastal erosion. While it is unlikely that substantial archaeological deposits survive at either site, it may be possible to characterise the structures more fully if their ground plans can be determined. Assessment here will require topographic survey, the structured removal of the loose stone overburden, followed by exploratory trial trenching of the interiors and immediate hinterland area.

Ayre of Breiwick (WH6, Map 1)

A concentration of earthfast rubble, which includes both orthostats and edge-set stones, appears to be part of a structure. The site lies close to the coast edge and is vulnerable to coastal erosion. The nature and date of this site cannot be determined from the surface remains alone and further assessment is required. A limited programme of trial trenching would establish the nature and condition of the remains, at the minimum, and may recover sufficient material for dating purposes.

Guttald (WH8, Map 2)

A possible chambered cairn is defined by a pile of loose rubble associated with several orthostatic stones. The outline of a narrow passage and small chamber can be tentatively identified. The site lies on a small rise and is very reduced and vulnerable to further subaerial erosion. The site has not been previously recorded and therefore a detailed site plan is required. Assessment should aim to establish the ground plan of the structure and to determine if there are any associated deposits present. This could best be achieved by the structured removal of the loose stone overburden, followed by limited trial trenching in the interior and immediate hinterland area.

Hamara Neap (WH22, Map 3)

A substantial curvilinear earthen bank forms a sub-oval enclosure which backs on to the coast edge. Assessment of the remains via trial trenching should establish the nature and possibly the date of the enclosure and may uncover evidence for associated remains or cultivation soils.

Gairdie Geo (WH24, Map 3)

A large oval enclosure, which may be of prehistoric date, backs on to the coast edge. The remains of old wall lines lie in the immediate area and it is probable that there are further remains present but obscured by deep peat deposits. Assessment should aim to investigate the enclosure and its wider landscape via a programme of trial trenching on the known sites and peat probing to locate remains which are currently obscured.

Milsie Geo (WH25, Map 4)

Intermittent earthfast stones outline a semi-circular enclosure which backs on to the coast edge. The enclosure is partially covered by peat and may be of early date. Assessment of this site to establish nature, date and any associations with other sites (not currently visible) could best be achieved via a combined programme of peat probing and trial trenching.

Ha Clett (WH26, Map 4)

Two conjoined structures appear to be the remains of a house and enclosure of prehistoric date. Both are partially obscured by peat deposits. The nature, date, extent and condition of the sites should be established through a combined programme of peat probing and trial trenching.

Ward of Hoorin (WH36, Map 4)

Among an extensive concentration of stone which protrudes through peat, the remains of at least one possible house and three enclosures, of probable prehistoric date, can be identified. Some elements lie close to the coast edge and are vulnerable to coastal erosion. Further remains are likely to survive beneath the peat in the surrounding area. Assessment should seek to establish the nature, date and condition of the structures which are currently visible and should also investigate the probability that further remains are present in the area. This could best be achieved by a combined programme of peat probing and trial trenching.

Vai Voe (WH40, Map 5)

A probable house, and field system, of possible Viking/Norse date, is partially obscured by peat. The house lies close to the coast edge and is vulnerable to coastal erosion. The site requires assessment to determine the nature, date and extent of the remains and to investigate the probability that further remains are preserved beneath the peat. It is recommended that a combined programme of peat probing and trial trenching be carried out at this site.

Kirk Ness (WH51, Map 5)

Fragments of earthen bank, possibly representing the remains of an enclosure, lie close to the coast edge and are vulnerable to coastal erosion. A mound stands nearby and appears to be associated. The nature, date and condition of the remains needs to be assessed. This could be achieved through a programme of trial trenching and more detailed topographic survey.

Suther Ness, The Cumble (WH56, Map 5)

A scheduled structure variously identified as a prehistoric or Viking/Norse period house lies close to the coast edge and is actively eroding. Assessment is required to determine the nature, date and condition of the surviving remains. The most appropriate method to achieve this will be limited open area excavation to examine a sample of the site remains.

Suther Ness (WH57, Map 5)

A stone setting, tentatively identified as a Viking burial site, was previously identified in this area. The site was not relocated during this work and assessment of the area is required to determine if it or any part of it still survives. If it can be found, the site should be excavated in its entirety since it may not survive much longer and it offers the opportunity to examine a site type which is under-represented among the Shetland excavation record. If the interpretation of this site can

be confirmed, it is recommended that more detailed topographical and possibly geophysical survey is carried out in the general area to investigate the possibility that further burials or associated remains may be present.

Ness of Setter/Ward of Setter (LN5, LN6 and LN7, Map 1)

The remains of three houses and two boundary banks of probable prehistoric date are located on a sloping hillside and are vulnerable to subaerial erosion. The sites require assessment in the form of trial trenching or limited open area excavation to determine their nature, date and condition. Topographical survey of the wider area is also recommended to investigate the possibility that other remains of early date may be present in the hinterland.

Marafield Dale (LN8, Map 1)

A probable oval house is partially exposed in an overgrown peat cutting. The site requires assessment to determine its nature, condition and date. This could be achieved through trial trenching. Since the peat in this area is at least 0.5m deep there may be further archaeological remains surviving in the surrounding area; this could be investigated through a peat probing survey.

Feorwick (LN21, Map 2)

A substantial stone structure lies on a small rise close to the coast edge. It is partially overlain by a later rectangular enclosure. The interior is filled with rubble, amongst which there are quern fragments. The structure would appear to be one of a class of little known sites which probably immediately predate or are contemporary with the brochs. The site requires assessment to conclusively establish its nature and date. This may be achieved by trial trenching but it is more likely that limited open area excavation will provide more positive results. The site hinterland is covered by deep peat deposits and the possibility that there are further remains in the area could be investigated through a peat probing survey.

Taing of Kelswick (LN40, Map 3)

A sub-circular stone structure which may have most recently been used as a sheep crue, may preserve the ground plan and some features of an earlier, possibly prehistoric, house. There is some suggestion that the structure may be surrounded by an enclosure. The site lies close to the coast edge and is vulnerable to coastal erosion. Assessment is required to determine the nature, date and condition of the remains. Trial trenching or limited open area excavation are likely to be the most suitable methods to apply here.

East Lunna Voe (LN45, Map 3)

A long, low mound and associated curvilinear bank have been tentatively identified as a Viking/Norse period burial. The remains lie on a sloping hillside and is vulnerable to subaerial erosion. This site is located close to the Chapel Knowe at Lunna, thought to be the site of an early monastery; several Viking period burials have been identified in the area. Open area excavation of the entire site is likely to be the most appropriate action at this site since the mound is not very substantial. If the identification is confirmed, it may be worthwhile to consider topographical survey of the wider hinterland area.

Category 3: Assessment Desirable

Ravi Geo (SM9, Map 1): stable burnt mound

Helli Ness (SM10, Map 1): boundary bank of indeterminate date

Taing of Helliness (SM12, Map 1): 18th-20th C structures of indeterminate type

Vins Geo, No Ness (SM33, Map 4): 18th-20th C mill

Northpunds (SM48, Map 5): structural remains of indeterminate date & type

The Noup (SM57, Map 6): mound of indeterminate date & type

Munglie Mint (SM58, Map 6): structure of indeterminate date & type

Bassie Sound (SM66, Map 7): possible horizontal mill

Burn of Breigeo (SM68, Map 7): possible burnt mound

Virdi Field (SM69, Map 7): field system of indeterminate date

Drooping Point (SM72, Map 7): possible prehistoric houses

Taingi Geo (SM83, Map 8): field system and mounds, indeterminate date & type

Eastshore (SM93, Map 9): structure, enclosure and field system, indeterminate date & type

Sandwick (WH75, Map 1): eroding, possible buried anthropogenic deposits of unknown type & date

Veeda Stack (WH11, Map 2): Structural remains of unknown date and type

The Gairdie, Isbister (WH17, Map 3): prehistoric house and field system

Kirk Ness (WH48, Map 5): mound of indeterminate date & type

Kirk Ness (WH50, Map 5): indeterminate remains

Brough Head (WH58, Map 6): mound of indeterminate date & type

Brough Head (WH59, Map 6): mound of indeterminate date & type

Outer North Point (WH62, Map 6): structural remains of indeterminate date & type

Ness of Setter (LN4, Map 1): structural remains of indeterminate date & type

The Vadills (LN12, Map 1): indeterminate remains

Land Taing (LN23, Map 2): indeterminate remains

Ward of Outrabister (LN26, Map 2): structural remains of indeterminate date & type

Lunna Ness (LN34, Map 3): possible cairn of indeterminate date & type

Grut Wick (LN36, Map 3): cairn of indeterminate date & type

Whale Geo (LN38, Map 3): field system of indeterminate date

Loomi Shun (LN43, Map 3): cairn of indeterminate date & type

Lunna (LN44, Map 3): boundary bank of indeterminate date

Catta Ness (LN52, Map 5): horizontal mill

Category 4: Monitoring Required

Clodie Knowe Broch (SM16, Map 1): broch mound

Skirvi Geo (SM95, Map 1): structural remains, indeterminate

North Voxter (SM98, Map 1): findspot of runic inscriptions

Mail (SM99, Map 2): burial ground, findspot of carved stones

Mail (SM21, Map 2): church, manse, findspot

Mail (SM100, Map 2): site of broch and findspot of gaming piece

Sandwick (SM110, Map 4): site of chapel

Sandwick graveyard (SM36, Map 4): mound, indeterminate

Whilvigarth (SM43, Map 5): structural remains, indeterminate

Netherton (SM51, Map 6): structural remains, indeterminate

Levenwick graveyard (SM52, Map 6): mound, indeterminate

Netherton (SM53, Map 6): structural remains and noost

Ramlee Geo (SM111, Map 7): site of human burials

Burn of the Rait (SM112, Map 7): site of human burials

Stack of the Brough, Dalsetter (SM106, Map 8): Dalsetter Broch

Lambhoga Head (SM87, Map 8): possible promontory fort

Eastshore (SM94, Map 9): East Shore Broch

Sandwick (WH74, Map 1): structures, burnt mounds and field system

Isbister (WH21, Map 3): site of burnt mound

Standing Stones of Yoxie, Pettigarths Field (WH19, Map 3): house and field system

Benie Hoose, Pettigarths Field (WH20, Map 3): house and field system

Kirk Knowe, Inner Holm of Skaw (WH31, Map 4): site of chapel and burial ground

Skaw (WH33, Map 4): structures, noosts and field system

Skaw Voe (WH34, Map 4): standing stones

Mutter Knowe (WH35, Map 4): burnt mound

Vai Voe (WH42, Map 5): house and quern stones

Suther Ness (WH54, Map 5): mound, indeterminate

Suther Ness (WH55, Map 5): orthostat

Skelder Taing to Grame's Ness (LN1, Map 1): peat cuttings

Outrabister (LN77, Map 2): structural remains, indeterminate

Lunna Ness (LN78, Map 2): chambered cairn

Vidlin (LN49, Map 5): site of broch

Kirkabister (LN68, Map 5): site of chapel and burial ground

Catta Ness (LN55, Map 5): indeterminate remains

Introduction

Aims and Methods

The aim of this part of the survey was to examine and describe coastal geomorphology and erosion along the coastlines of Whalsay, South Mainland and Lunnasting in Shetland. The survey was conducted by the author in October 1998. The survey was carried out from the hinterland and/or foreshore as conditions allowed and all areas within the given remit were examined.

The survey included an examination of soils, drift type, drainage and land use since marine erosion, although the most important cause, is not the sole agent of coastal erosion. Subaerial erosion by water and wind play key roles; especially within areas of softer drift deposits which contain the majority of archaeological remains.

Present land use is also of importance, in that erosion of drift deposits can be instigated or aggravated by land use. This may result, for example, from cultivation on steeply sloping land, sand extraction from the foreshore or hinterland, or overstocking.

The Survey and Report: Hinterland Geology, Coastal Geomorphology and Erosion Class

Hinterland Geology and Coastal Geomorphology: Gazetteer Entries

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

<u>CATEGORY</u>	<u>EXAMPLE</u>
Label - Placename	1 Vidlin Ness
Grid Reference (to centre of area)	HU 480 662
Length of unit	1.2km
Foreshore Type	Rock platform with intermittent cobble cover.
Coast Edge Type	Coast edge is <5m.
Hinterland Type	The drift/rock interface is visible
Description	Some cobble cover lies within small coves...

Erosion Class: Gazetteer Entries

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

<u>CATEGORY</u>	<u>EXAMPLE</u>
Label - Placename	6 Ward of Burriland
Grid Reference (to centre of area)	HU 445 236
Length of Unit	0.23km
Erosion Class at time of visit	Eroding to Stable
Description	The coast edge has minor erosion...

Erosion Classes

The following definitions have been used:

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

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

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

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

Accreting: A section with accretion over more than 70% of its length.

Accreting/Eroding: There are both accreting and eroding processes taking place and may vary from 20% to 80% of each process. The erosion and accretion may not be arranged in a linear fashion along the coastline; there may be erosion of the coastal edge and deposition of sands along the foreshore.

The Geology of the Survey Area

Geologically the Shetland Islands are made up of igneous and metamorphic rock in the north and west, with sandstones along the south western fringes. The general trend of faults and folds is NNE to SSW and the underlying geology is generally reflected in the overall topography. While there are substantial hills within the sandstone areas, these are subdued and rolling in comparison to the higher and more craggy ranges of the metamorphic and igneous areas.

The island of Whalsay is almost entirely made up of metamorphic rock of the Scatsta division, but has few crags or high hills. In contrast, the Lunnasting peninsula across the water on Mainland has a much more rugged topography with high, craggy hills. Here, the geology is also of the metamorphic Scatsta division but it also contains a trough of metamorphosed limestone.

The south eastern fringes of Mainland have hills which are well rounded where there is sandstone, (Old Red Sandstone), with higher, steeper and more craggy hills making up the metamorphic Clift Hills division. The coastal edge within the sandstone areas contains some dramatic cliff lines, where the rock breaks cleanly along the characteristic sandstone joints.

The Old Red Sandstones, which are a laminated succession of sediments, tend to fracture in jointed blocks in a catastrophic manner whereas the metamorphic rocks are generally weathered along softer folds and weaknesses in a slower, constant process as compared to the sandstone.

The Geomorphology of the Survey Area

In many places within the survey area the topography has been softened by the deposition of till. This occurred predominantly during and towards the end of the last ice age. During this last glaciation there was probably only one main local glacier to the north of Mainland, with flows running to the north west and north east. The latter flows would have abutted the regional major glaciation dominated by the westerly flowing Scandinavian ice sheet. The Scandinavian ice sheet appears to have run in a westerly direction across the south of Mainland as there is no evidence that Shetland supported a glacier in the south to hinder the flow of ice. Many of the voes themselves may have been deepened slightly by ice movements; within Lunna Ness terracing effects along hillsides may have been sculpted by ice movement.

Further gelifluction or colluvial deposits have also built up at slope bottoms since the last glacial retreat and in some areas deep deposits of peat have accumulated. There are relatively few places where deep layers of till are evident in section over the survey area. Most of the deeper tills are located on the south west side of Lunna Ness and in localised hollows which now make up the shallower bays.

Apart from till the other main drift deposits are blown sand and peat. Within the survey area peat is much more widespread than blown sand. The sand lies at specific points, notably Sand Wick on Whalsay and within Leven Wick on Mainland. Peat was more commonly found around Lunna Ness, notably the west side, the north east side Whalsay and the remote exposed peninsulas of south east Mainland.

Sea Level Change

The islands have been submerging since the last ice age due to an isostatic uplift of mainland Scotland, with the loss of ice, and a consequent down warping of peripheral land masses such as Orkney and especially Shetland. Added to this there have been eustatic changes in sea level ie. sea level rises. A post glacial shoreline of -9 metres, approximately 5,500 BP has been estimated by Hoppe, (1996) who analysed submerged peat around south Shetland, and a massive 30 metre rise in mean sea level change since 7,000 BP has been approximated by Lambeck (1991), using a mathematical model. If the submergence was consistent over time, which is unlikely, this would equate to approximately 1.64 and 4.29 mm / year change in sea level. However the sea level changes have lessened from the initial upsurge after the last glaciation.

Evidence of submergence within the survey area can be seen in peat layers found at high water mark at localised points on the eastern side of Whalsay. No peat deposits were observed below HWM, however.

No raised beaches were found within the survey area, nor have any been documented. The absence of raised beaches is perhaps verification that the islands are submerging. There are a large number of bars, tombolas and ayres within Shetland, but there are only two or three substantial ones within the survey area. The majority appear to be quite stable and, in some cases, accreting. Steers (1973) notes that the bars may be accreting at a pace which is equal to the submergence of the islands.

Soils and Land Use

The natural soils tend to be peat, peaty gleys or peaty podzols with rankers over rocky areas. There is very little cultivation around the coast, but where present, there is modification of the soils to a more uniform cultivated horizon. The more freely draining and improved soils tend to lie over thick drift deposits. Consequently most cultivable soils lie within coves and shallow dips. An exception to this is the area to the south west of Lunna Ness which has deep tills but is presently uncultivated. Most of the cultivable land is down to grass.

The majority of coastline and hinterland is unfenced and left open for rough grazing. In some areas, most notably along the west coast of Lunna Ness, the stocking rate is extremely low. In areas with more

abundant drift deposits there is evidence that fence lines have been relocated further back from the coast edge as erosion has advanced.

Susceptibility to Erosion

Most of the coastal rock platforms of Shetland are steeply shelving or have an almost non-existent rock platform. The intertidal rock platforms tend to be steep and to form a narrow foreshore beach. This does not dissipate wave energy as would a long shallow platform and consequently there is little moderation of the high energy waves. In the few areas where long shallow rock platforms do exist, they tend to support storm beaches, such as at Tros Wick on Mainland. In more sheltered positions they may support sedimented bays, such as those at Voe and Aith Voe; the latter having a more estuarine environment.

Another crucial factor in determining vulnerability to erosion is the levels to which the coastline is exposed to the long reaches of storm waves. There is little long-term information on wind speed and direction, the two main factors affecting wave size. Wright (1976) in a review of meteorological data found that between 1920 and 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 1.5 m for 10% of the year and 0.5 m for 75% of the year on the south and western facing coasts (Draper, 1991).

Currents are also likely to affect erosion by removing eroded material from the base of the coastal edge. In this respect there is little build up of talus material below cliff lines around Shetland. Where there is talus it comes from a recent rock fall.

Types of Erosion

Marine Erosion: The sea is the main agent of erosion within the survey area. Landslip can occur after cliff faces have been mechanically undercut or coast edges have been scoured. The sea is also directly responsible for erosion through the cutting of geos and coves into the coastal edge. This can instigate a consequent separation of landmass which may later erode to form sea arches and stacks. If the wave height, speed and direction are constant along the coast, then the rate of erosion is moderated by the

rock platform gradient and the depth of the cove. A more shallow rock platform tends to dissipate the wave energy before the waves hit the coastal edge. In this case the dominant form is a forward breaking wave. If, however, the cove is deep and narrow there will be a funnelling affect of the waves, which concentrates the energy; this is the case within Channer Wick, South Mainland.

Marine erosion is also manifested in landward migrating storm beaches. Since the gradual landward migration of the coast is difficult to perceive, this type of erosion is not always obvious and a cursory or single examination may suggest that there is, in fact, an accretion of shingle. If a storm beach lies on a steeply rising foreshore, then the waves are more likely to throw the cobbles against the base of the cliff or coastal edge, thus increasing the erosive power of the waves.

Marine erosion also takes place along the hinterland of exposed coastal edges and headlands where wave throw and splash, along with following water run-off, results in the denudation of the soil and drift deposits. This is especially evident within Boats Noost or Point of Tangpool on South Mainland, but is also found in localised areas mainly along the eastern facing coasts.

Subaerial Erosion: The coastlines within the survey area are also affected by subaerial erosion, caused by rain water and wind. The affects of rain water can be manifested as soil creep, peat flow, land slip and water erosion, such as rill and gully formation or stream erosion caused by run-off. Active gully erosion was not found in the survey area, however. It was found that surface water run-off was the greatest cause of subaerial erosion. Surface run-off increases where infiltration of water into the soil or drainage is impeded. Cattle poaching and smearing of the soil impedes infiltration, whereas the vegetation cover enhances it as well as slowing down the water run-off velocity. Sub-aerial erosion tends to be locally confined but can aid or instigate localised sea erosion. In some areas, most notably on the west side of Whalsay, this is the primary cause of soil and drift erosion.

Wind erosion is usually manifested in soft drift deposits where wind blow can lead to deflation troughs and scouring of sand dunes. In this survey, there were few areas where sand drift was evident and of these there was only minor erosion due to wind activity.

Other types of Erosion: Biological agents of erosion in this survey area are limited to animals such as sheep and cattle and to human disturbance. Erosion caused by such agencies can be controlled by management policies. Land use practices and management can both aggravate and alleviate sub-aerial erosion but they are unlikely to have much impact upon marine erosion without large resource input.

Chemical erosion by salt spray is a rather more protracted process and has not been alluded to in this survey other than in combination with observable weathering processes of rocks and the denudation of stabilising vegetation.

Accretion

Within the survey area coastal accretion was found to be limited and very localised. Sand is usually the major accreting material. This is due to the strong variable winds and particle size. If sands are deposited on the foreshore by the sea they can be easily blown onto the hinterland and subsequently stabilised by vegetation. The major proportion of source material comes from deeper sea bottom sediments, although coastal edge erosion may contribute to some sandy sediments. In rainy temperate to rainy marine climatic zones, sand makes up one half and two thirds of bottom sediments respectively, (Hanson, 1988).

Cobble and 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 storm beaches are eroding the shoreline by migrating landwards. In most cases there is evidence to support this view, such as the presence of dying or decaying vegetation beneath an advancing front of cobbles.

Discussion

Hinterland Geology and Coastal Geomorphology

Overall, the geomorphological features concur with a mass of evidence that the sea level has been and is still rising due to the relative down-warping of the islands and global increases in sea level since the last glaciation. Although no submerged peat was found to lie below the HWM in this 1998 survey, peat at a depth of 8.6 to 8.9 metres below HWM was located within Symbister harbour which lies within the survey area of Whalsay (Mykura, 1976). A complete absence of raised beaches may also be interpreted as a drowned landscape.

The majority of the coasts surveyed have a foreshore made up of rock platform with a clear and distinctive coastal edge. Most storm beaches tend to face north east, east or south east. This is not surprising as the coastal survey was predominantly carried out on the east side of Shetland and where coasts did face west were sheltered from the south westerly storm reaches. The higher energy storm beaches lie at Hoga, Tros Wick and Point of Tangpool on South Mainland.

There are only a few sandy beaches within the survey area with two having small hinterlands of a sandy nature, these are Sand Wick on Whalsay and Leven Wick on South Mainland. Other sandy beaches such as at Sand Wick and Hos Wick on South Mainland are extremely limited. A sandy hinterland underlies a grassed area on a small peninsula by South Voxter and within Leven Wick.

Cobbles were fairly widespread around the more sheltered coves and generally absent from the majority of exposed coastline. Where cobbles are found they tend to lie along the upper foreshore. One of the more unique environments within Shetland is the almost estuarine feature of Aith Voe on Mainland where there are both alluvial and marine sediments.

Buried soils and accumulations of good fertile soils, likely to be anthropogenic in origin were noted at a few localised points along the south and west sides of Whalsay, the east side of Vidlin Voe, and within the southerly facing voes and wicks of South Mainland; all are presently being eroded by marine action. Those of possible archaeological interest lie within Sand Wick on Whalsay and within Leven Wick on South Mainland. The buried sediments within Channer Wick are perhaps more important within the fields of pedology and geology, although a section of buried soil and midden below a derelict croft to the north east side may be of archaeological interest .

Erosion

In general, the findings of the survey indicate that the main erosive power of the sea appears to be generated from the south and westerly directions. Added to this, the low lying and softer geological areas are more at risk from erosion than the tougher geological units and higher coastlines. More specifically it appears that the protection a coast edge receives from the buttressing effect by the extension of a rock platform over 2m above the high water mark is more exponential than linear in effect.

Table 1: Individual Section Erosion Class Distances (km)

	E	E/S	S	A/S	A	A/E
Whalsay						
Map 1	1.02	0.97	4.87			
Map 2		0.88	2.50			
Map 3		2.33	2.94			
Map 4		2.11	2.85			
Map 5	0.14	1.98	4.06			
Map 6		0.75	1.67			
Total (km)	1.16	9.02	18.89	0	0	0
Proportion %	3.99	31.03	64.98	0.00	0.00	0.00
Lunnasting						
Map 1	2.26	1.13	3.78			0.12
Map 2	0.82	0.96	7.73			
Map 3	0.62	1.34	3.35			
Map 4	0.26	0.50	2.60			
Map 5		1.34	5.36	0.10		
Total (km)	3.96	5.27	22.82	0.1	0	0.12
Proportion %	12.27	16.33	70.72	0.31	0.00	0.37
S Mainland						
Map 1	0.33	2.87	5.90	0.19		
Map 2		1.08	3.24			
Map 3	0.45	0.87	3.47	0.07		
Map 4	0.36	2.46	6.70			
Map 5	1.25	0.51	3.54			
Map 6	0.22	1.62	2.14			
Map 7		1.11	2.40			0.83
Map 8		2.11	3.90	0.10		0.11
Map 9	0.28	1.99	1.67			
Total (km)	2.89	14.62	32.96	0.36	0	0.94
Proportion	5.58	28.24	63.67	0.70	0.00	1.82

More specifically, the survey indicates that while there are local points of erosion, the majority of the coastline is stable. The next most common class was that of *eroding to stable*, with the *eroding* class in third position. The main agent of erosion was found to be marine action; this dominates the *eroding* class. Within the *eroding to stable* class perhaps only half of the erosion is due to marine action with the remainder caused by sub-aerial erosion. Thus, it can be calculated that perhaps less than 30% of the erosion encountered is due to subaerial agents, (Less than 5% of the total coastline erosion). There is

Shetland Coastal Survey 1998: Geology, Geomorphology & Erosion Class

very little accretion along the coastal edge within the surveyed area, with the most significant areas found around the ayres of Lunna Ness and the storm beaches of South Mainland.

Whalsay is the least affected area, with under 4% of coastal edge classed as definitely eroding, although almost one third of the coastline has some localised erosion. Lunna Ness has the greatest proportion of stable coastline (over 70%). This area also has the greatest proportion of definitely eroding coastline, however, most of which lies to the south west where the coast edge is largely made up of till. A relatively small part of the coastline of South Mainland was found to be definitely eroding, although there is localised erosion over almost one third of the coastal edge.

Given that the 1997 coastal survey of the Northmavine demonstrated that almost 24% of the coastal edge was definitely eroding and perhaps 40% eroding to some degree, the results of this survey may appear surprising in that only 7% of coastal edge is definitely eroding with less than 20% in some state of erosion. There are two good explanations, firstly most of the coastline observed in this survey is sheltered from the south westerly storms and, secondly, there are less drift deposits close to the coastal edge or within the hinterland than were found in the Northmavine survey area.

Table 2: Erosion Class Distances (km)

	E	E/S	S	A/S	A	A/E	
Whalsay	1.16	9.02	18.89	0	0	0	29.07
Lunnasting	3.96	5.27	22.82	0.1	0	0.12	32.27
S Mainland	2.89	14.62	32.96	0.36	0	0.94	51.77
Total (km)	8.01	28.91	74.67	0.46	-	1.06	113.11
Proportion %	7.08	25.56	66.02	0.41	-	0.94	

Table 3: Erosion Class Proportions (%)

	E	E/S	S	A/S	A	A/E
Whalsay	3.99	31.03	64.98	0.00	0.00	0.00
Lunnasting	12.27	16.33	70.72	0.31	0.00	0.37
S Mainland	5.58	28.24	63.67	0.70	0.00	1.82
Total Survey	7.08	25.56	66.02	0.41	-	0.94

E = Eroding E/S = Eroding to Stable S = Stable
 A = Accreting A/S = Accreting to Stable A/E Accreting and Eroding

The predominant geology of the survey area, metamorphic and igneous rock, is more resistant to erosion than are the sandstones found in parts of South Mainland. Where the coast edge is made up of rock which is at least over 2m above the high water mark there is very limited erosion. The coastlines found to be most susceptible to erosion were those with edges less than 5m in height and where there are soft drift materials, such as tills and sands, close to or below the high water mark. The depth of soft sediment does not appear to lessen the erosion, although the volume of material present is likely to have an affect on the rate at which it is being eroded. The tills which lie on rock 2m or more above the HWM suffer negligible erosion as compared with tills lying along the upper foreshore. The deep tills, sometimes along with underlying saprolite, are generally found in low lying areas. This is the result of past glacial erosion of the higher ground and subsequent deposition within low troughs or basins. The deeper tills, therefore, tend to be found along the lower lying sections of coastline. This topography is characterised by gentle slopes as this type of medium is also susceptible to sub-aerial erosion.

The amount of coastline which appears to be gaining land by accretion is negligible, forming only 1%, and such areas mostly lie within sheltered voes. There was little sand accretion, with only scant evidence for sand accumulation within Sand Wick on Whalsay and Leven Wick, South Mainland. Most accretion was from storm beach material, as at Hoga on South Mainland, or from the build up of shingle around ayres, such as at Hamnavoe on Lunna Ness and the small ayre within Vidlin Voe. Overall the ayres within this survey area were found probably to be stable or accreting at a very slow rate and as Steers (1973) has noted, they may be indicative of a slowly submerging landscape. Storm beaches such as within Tros Wick may only be accreting cobbles and boulders within the hinterland at the expense of material loss from the foreshore or coastal edge, but there is not sufficient information to determine this at the present time. The ayres at Vidlin Voe and Hamnavoe appear to be accreting shingle. The ayre at Hamnavoe has a coastal edge of perhaps 0.12 km although along the length of the ayre accretion may be as much as 0.87 km. .

Only in one localised area, at Lambhoga Head, South Mainland, is there evidence of talus accumulation below cliffs. The talus has not yet been removed by the sea and only here does sub-aerial erosion exceed marine erosion. This is likely to be a temporary state due to recent landslip. A point worthy of note concerns offshore currents and their role in removing talus and other foreshore deposits. Although the information is conveyed as local knowledge, it appears that a large amount of sand has been removed from Aith Wick, South Mainland, along with a small part of the coastal edge during a severe storm at the beginning of the century. More sand has since been removed in subsequent years. This would indicate that there are strong currents which are liable to change relatively suddenly.

Recommendations

There is, as yet no national policy for coastal management within the United Kingdom and there is, therefore, potential for a conflict of interest between the interests of agriculture, nature, archaeological conservation, leisure and amenities. A holistic coastal management policy is not only desirable but could be established and invoked on a local level within Shetland.

There is little that can be done to negate marine erosion of the coastal edge unless huge resources are committed to local problems. However, sea defences such as those around the bay of Symbister on Whalsay can slow down the rate of marine erosion. Sub-aerial erosion can be tackled at a more economical level than can marine erosion. It is likely that land management practices may be implicated in the instigation of sub-aerial erosion. Various practical remedies could be implemented to ameliorate or arrest this problem. These may include the creation of small grassed headlands between the coast and cultivated fields, as has already been established along the coast between Sand Lodge and Robie's Geo on South Mainland. Practices which denude the soil of vegetation on the more sloping areas for protracted lengths of time are likely to give rise to erosion. Thus, the avoidance of overstocking, particularly in wet conditions, together with the reduction or judicious timing of cultivations is likely to be beneficial in counteracting erosion. Subaerial erosion can also be cut down by limiting surface water run-off. This can be achieved by reducing poaching and disturbance of the sediments and increasing infiltration and natural drainage by encouraging vegetation. These practices are founded in good management and husbandry techniques and should, therefore, be promoted in a coastal management policy. It is estimated that their implementation could reduce sub-aerial erosion by as much as 50%

There is currently very little data available about rates of erosion. To assist in the appraisal of an efficient management policy it is recommended that further survey be carried out, particularly in the more vulnerable and archaeologically sensitive areas, so that changes in erosion patterns can be monitored over a longer timescale.

