Map Sheet NB 39 25/ NB 44 30	Arnish to Ranish	386	The final section of the survey transect runs from Arnish to Ranish and begins with high cliffs extending southwards until the tidal Loch Grimshader is entered by turning west past Druim Dubh. The low rock platform at the front of Grimshader is then followed until low cliff and rock platform is followed south prior to arrival at Ranish.

3.0 PREVIOUS RESEARCH IN THIS STUDY AREA

Previous research on Lewis has generally being carried out since 1989 and half is only recorded as unpublished interim reports. Prior to 1989 the main projects were the RCAHMS survey published in 1928, the work of the National Museum and Historic Scotland during the mid and late 1970s and the work of the Calanais Archaeological Project between 1985 and 1989. Except for the RCAHMS inventory a majority of this early work also remains to be fully published. Much of the work executed has been part of combined discipline studies of archaeology and the palaeo-environment. This has lead to the creation of an extensive settlement record that is supported and placed firmly in context by, detailed environmental data.

Mesolithic occupation in Lewis is still a controversial issue that leads to disagreement amongst archaeologist working in the region. While physical anthropogenic evidence is scarce, a Mesolithic presence is implied through possible woodland clearances, and associated 'fire ecology', in pollen profiles such as those from at Tob nan Leobag and Bharabhat (Edwards *et al.* 1994, p16). However, this is not universal to all the cores taken suggesting that any evidence represents local activity. The only Mesolithic artefactual evidence recorded on Lewis are possible lithics in a midden now lost due to erosion at Traigh na Berie (Lacaille 1937). This lack of anthropogenic evidence can be partially explained by changes in sea level that have lead to the loss of the Mesolithic coastal strip. Additionally the encroachment of peat across most of the islands interior following the Mesolithic during the Neolithic and Bronze ages (Edwards *et al.* 1994, p16) has obscured much of the prehistoric and later settlement evidence.

The activities of early farmers at the beginning of the Neolithic (around 5000 BP in Lewis) had a profound impact on the vegetation. Neolithic society is thought to have been complex and well organised due largely to the legacy of ritual remains such as the Calanais Stones and their associated ritual landscape. The settlement remains of the people who built these monuments are still poorly represented. This again is a function of rising sea level and peat encroachment but is also due to the

repeated use of the thin soils of the coastal strip over the past 4000 years which will have destroyed any remaining evidence of this period (Coles *et al.* 1993).

Bronze Age settlement in Lewis is just as poorly represented as Neolithic settlement with only a small number of sites (between two and five depending on the interpretation of dating evidence) being excavated and attributed to this period (see tables **3.1** and **3.2**). However, the pollen evidence suggests that there was progressive woodland decline during this period and a spread of arable agriculture. Pollen spectra in some cores indicate that the extent of land devoted to pastoralism was increasing (Edwards *et al.* 1994, p19). This suggests that population, contrary to the structural evidence (or rather the lack of it), was on the increase.

The Late Bronze Age / Early Iron Age climatic deterioration is well documented across Britain and the pollen evidence from Lewis shows a sharp rise in *Calluna* and *Erica* pollen and associated heathland/blanket mire genera (Edwards *et al.* 1994, p20). At approximately the same time (c.2500 BP; Armit 1990, p60) the classic Iron Age monumental drystone architecture of the Complex Atlantic Roundhouses appears in the archaeological record.

This is thought to be followed by the wheelhouses and later Iron Age cellular structures (Armit 1992). The durability of these monument types, and the higher population, combined with a research bias in recent years, results in a far greater number and better known distribution of Iron Age sites. To build these monuments in such numbers would require sophisticated social organisation and an economic base with sufficient surplus to feed the carrying out the construction work This would suggest that in the Iron Age the 'whiteland' coastal zone would be a well managed economic landscape, balancing the need for arable and pastoral elements within an increasingly dense settlement framework. Furthermore, as timber would have been in great demand, it is likely that any remaining stands would be managed and driftwood would be collected and utilised (see Boardman 1995 for evidence of driftwood utilisation in the Neolithic and Bronze Age of South Uist).

Much of the structural evidence that would usually be used to quantify settlement activities during these periods has probably been successively obliterated by later periods of agricultural activity in the limited areas of the 'whitelands' (and the continuing peat encroachment). The monumental architecture of later prehistory survives due to the sheer scale of features which are difficult to dismantle and frequently reused. These sites also tend to be located on marginal ground that would not normally be cultivated.

Early historic, and medieval settlement is poorly recorded in the Lewis archaeological record. Settlement of this period is difficult to identify due, in part, to the similarity of its form to activity in the post-medieval an immediate pre-crofting phases. This problem is accentuated by the nature of turf and earth core houses which are largely dismantled every 80-100 years and rebuilt on a slightly different site (Dodgshon 1993).

The first major differentiation in historic structural evidence that is possible, is that seen during the encrofting of the townships as agriculture becomes far more intensive and regularised and site types such as kilns and mills tend to become larger as the communities that are using them become fewer in number and larger in size.

3.1 TABLE OF ARCHAEOLOGICAL SURVEYS WITHIN THE STUDY AREA

SURVEY PROJECT	*AREA SURVEYED*	*SURVEY COVERAGE*	*REFERENCES*
RCAHMS inventory	Lewis and Harris.	Selective survey of Lewis and Harris, with emphasis on prehistoric archaeological remains and built heritage.	RCAHMS 1928
Coastal Erosion Assessment of Lewis and Harris	Certain stretches of coastline in Lewis and Harris.	Selective linear survey of Lewis and Harris, with emphasis on prehistoric archaeological remains and built heritage.	Cowie 1994
Later Prehistoric archaeological survey	Review of Later Prehistoric monuments in the Western Isles.	Selective survey of Later Prehistoric drystone structures.	Armit 1992
CARP	Bhaltos peninsula.	Detailed all-period area survey of Bhaltos Peninsula with an emphasis on. Prehistoric remains.	Armit 1994
West of Lewis Landscape Project (WLLP)	4 kilometre wide strip extending from the Calanais township to 10 kilometres inland.	Detailed all-period area survey with subsequent strategic excavation.	Interim reports: Coles 1993 Coles *et al.* 1994
Garenin Landscape Survey (GLS)	Garenin township and grazings.	Detailed all-period area survey with subsequent strategic excavation.	Interim reports: Burgess *et al.* 1994 Burgess and Gilmour 1995
Uig Landscape	Aird Uig and Uig Sands	Detailed all-period area survey with	Interim reports:

Survey (ULS)		subsequent strategic excavation.	Burgess and Church 1995
Bostadh Beach Project	Islands of Great Bernera and Little Bernera.	Detailed all-period area survey with associated excavations at Bostadh Beach	Interim report: Burgess and Neighbour 1997

3.2 TABLE OF ARCHAEOLOGICAL EXCAVATIONS WITHIN THE STUDY AREA

NAME OF SITE, NGR AND LABEL	*DESCRIPTION*	*REFERENCES*
Tolanais, Baile na Cille NB 045 338	Two cairns (Late Bronze Age) and a boat naust (Medieval)	Interim report: MacLeod 1995a, 1995b
Berero NB 045 344	Possible Medieval house underlying post-Medieval blackhouse.	Interim report: Burgess *et al.* 1996b
An Dunan NB 046 346	Possible Bronze Age utilised natural islet.	Interim report: Burgess *et al.* 1996a
Gob Eirer NB 033 339	Possible Norse Promontory fort.	Interim report: Burgess *et al.* 1996c
Guinnerso NB 035 363	Possible early Prehistoric landscape with associated settlement focus and field systems.	Interim report: Burgess *et al.* 1996d
Cnip II and III NB 097 366	Iron Age metal-working site.	Armit and Dunwell 1992
Cnip I NB 098 366	Iron Age wheelhouse and later structures.	Harding and Armit 1990
Cnip headland NB 099 364	Viking cemetery.	Welander *et al.* 1987; Dunwell *et al.* 1995a
Cnip headland NB 099 365	Cist burial (Beaker).	Dunwell *et al.* 1995b
Cnip headland NB 099 364	Bronze Age kerbed cairns and associated palaeosols.	Close-Brooks 1995
Bostadh NB 137 401	Late Iron Age and Norse settlement.	Interim report: Neighbour and Burgess 1996
Tob nan Leobag NB 219 326	Early Prehistoric sub-peat field system.	Cowie (forth.)
Garenin NB 187 450 NB 1869 4500	Promontory enclosure with possible platform settlements.	Interim report: Burgess and Gilmour 1995

Garenin NB 194 451 NB 1948 4510	Illicit still (post Medieval) with possible prehistoric remains underlying.	Interim report: Burgess and Gilmour 1995
Dalmore NB 216 452 No label	Middens and settlement of Late Neolithic and Early Bronze Age date.	Interim report: Ponting and Ponting 1984 Sharples 1984
Barvas NB 348 518	Multi-phase Beaker settlement with later burials	Interim report: Cowie 1986, 1987 Cowie (forth.)
Barvas NB 348 518	Multi-phase Norse settlement.	Cowie (forth.)
Galson NB 437 594	Iron Age long cist burials and multi-phase settlement.	Stevenson, 1952 Neighbour and Knott (forth.)

3.3 PALAEO-ENVIRONMENT, GEOMORPHOLOGY AND EROSION ASSESSMENT

A survey of this nature not only needs to assess the past research in archaeological survey and excavation but must also consider the past research into the palaeo-environment evidence. The study area contains many sites of palaeo-environment interest, which has cast light on the character and development of the regional landscape and have also provided important evidence on the glacial configuration of Scotland during the Quaternary (Sutherland 1992, p413).

3.3.1 Solid geology

This constitutes the rock platform which form the cliffs of Lewis and provides the basic material, by in-situ weathering or glacial erosion and deposition, for the subsoil on which the archaeological sites rest. The metamorphic Gneisses and related rocks of Lewis are amongst the oldest in Britain, with some formations dating back to 2800 million years (Edwards *et al.* 1994, p4). Figure **2** shows the almost exclusive coverage of basement rock of Lewisian gneiss in the region. However, the Butt of Lewis and an area north and east of Stornoway are underlain by softer Metasediments and Triassic sediments which affect the long term erosion of the respective coastlines in relation to the rest of Lewis.

This solid geology gives Lewis a subdued and undulating landscape with occasional upland areas such as the igneous complex in South Harris; a landscape deal for the development of widespread blanket peat (Moore 1993).

3.3.2 Quaternary evidence

The drift geology is much more ephemeral and represents a palimpsest of evidence common to Atlantic Scotland due to scouring and deposition through repeated glaciation. However 'snap-shots' of evidence occur across Lewis and Harris and these are summarised in Table **3.4**. This evidence is summarised from the syntheses of the physical evidence from the Quaternary provided

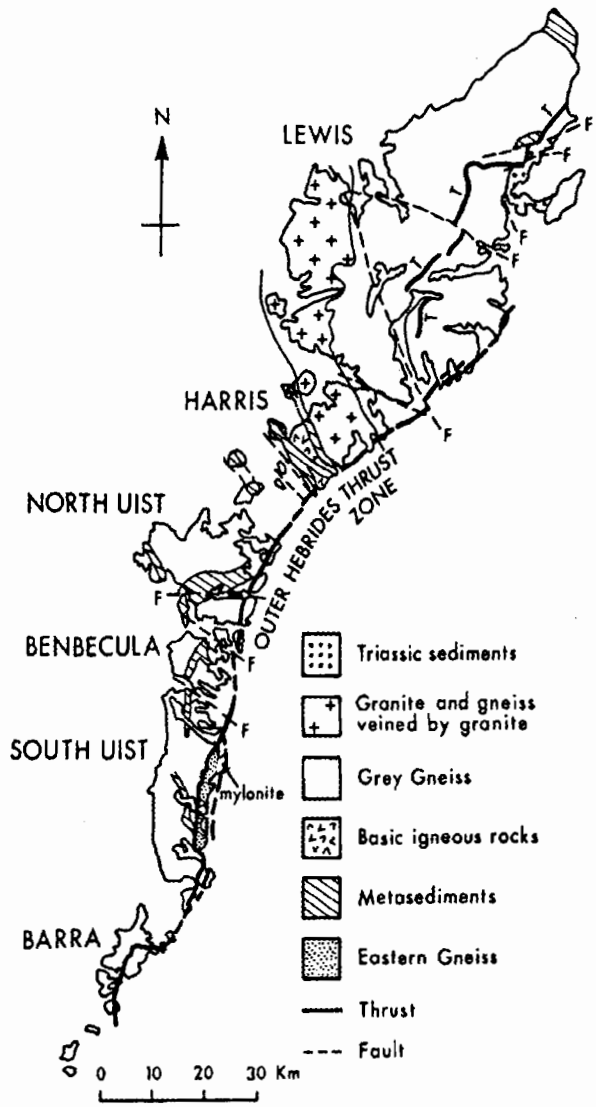

Figure 2: The Geology of Lewis, (Source: Pankhurst and Mullin 1994, p15)

by Peacock (1984) and Sutherland (1992) which highlight a number of key sites and areas, such as Uig Sands, north-west Lewis and Tolsta Head. The implications of this evidence will be examined in the erosion and geomorphic summaries attached to the relevant map sheets in section 5 and certain areas of particular importance will be examined in detail in section 6.

Quaternary glaciation produced a landscape of complex relief with rocky outcrops, small hollows (now filled by peat and water), extensive till deposits and erosion and meltwater features related to glacio-fluvial action. Many of these features constitute the drift geology within the coastal zone and represent softer erosion focuses overlying the hard Gneiss rock platform and cliff.

3.3.3 Holocene environment

The environmental evidence for the early part of the Holocene is based on pollen profiles from locations around the island, over half of which are covered by the survey transect. The earliest core taken was that from Little Loch Roag by Birks and Madsen (1979). The most important aspect of this profile was the apparent low levels of arboreal pollen. The authors concluded that Lewis was predominantly open grassland and heath in the Holocene with only occasional stands of birch and hazel scrub; the arboreal component was accounted for by windblown mainland pollen.

There are a number of reasons to challenge this. Firstly, there is clear evidence of widespread tree stumps under and within the peat in areas supposedly devoid of trees (see Wilkins 1984) and the proposed mainland source for the arboreal pollen is questionable since the predominant wind direction is straight from the Atlantic (Armit 1992, p14). There is also evidence from other pollen sites which suggest differing conclusions. For example, the profiles from Tob nan Leobag (Bohncke 1988), Loch Bharabhat and Loch na Beinne Beig (Edwards *et al.* 1994) suggest that tree cover was more extensive than that proposed from Little Loch Roag. Significant stands, predominantly *Betula* with secondary species of *Pinus*, *Quercus*, *Alnus* and *Corylus,* seem to have existed in the first half of the Holocene. This cover is reduced only by the first significant anthropogenic impact, the Neolithic clearances. Recent studies of pollen from Loch Ruadh Guinnerso produced results more analogous to the those seen at Little Loch Roag suggesting local variations across the island (Flitcroft 1997)

Following the introduction of widespread settlement and agriculture, the second half of the Holocene in Lewis has seen a much more open landscape. The pollen spectra indicate periodic minor fluxes in

arboreal pollen (which represents local increases in tree cover). The existence of cereal pollen of *Hordeum* type at Loch Bharabhat (Edwards *et al.* 1994, p19) suggests agricultural activity.

So the 'whitelands' zone in the second half of the Holocene could well have sustained areas of tree cover dotted around an arable and pastoral mosaic. This would certainly be a managed environment and landscape but an important control on its spatial extent would be sea level change.

Lewisian sea level change in the Holocene is dominated by of submergence. This differs with other areas in Atlantic Scotland, such as Oban, which display relative sea level fall resulting from glacial induced isostacy outstripping eustacy. The Western Isles has less pronounced isostacy due to smaller ice volumes and hence the sea level has risen quicker than the land. Ritchie (1985) investigated 21 sites in the intertidal zone which led him to conclude that submergence has been dominant in the Uists since the Post Glacial period. It is reasonable to expect a similar pattern in Lewis as a comparable balance is struck between isostacy and eustacy. He suggested that the rise may have been in the order of 5 metres at around 5100 BP, and a steady rise since then of up to 2 metres. This would seriously affect the ability to locate evidence of previous coastal settlement due to the submergence of relatively fertile land and the associated archaeology. This sea level rise is also implicit to the activation of the machair development models that Ritchie proposed (1966, 1979).

3.4 TABLE OF QUATERNARY EVIDENCE IN LEWIS

SITE	*FEATURE*	*ENVIRONMENT*	*DIRECT DATING*	*CORRELATION*	*REFERENCES*
Harris mountains (for example).	Glacial and periglacial erosion/ deposition features.	Local glaciation in upland areas.	None	Loch Lomond Readvance	Geikie 1878 von Weymarn 1974, 1979
Uig and Glen Valtos (for example).	Eskers, kames and glaciofluvial meltwater features.	Deglaciation	None	Late Devensian / post Glacial	Peacock 1984
Galson beach and Tolsta Head	Glacial till and lodgement till.	Glacial	Radiocarbon and amino acid dates from shell.	Late Devensian	Sutherland and Walker 1984

Tolsta Head	Peat layer	Interstadial - open landscape (flora of cool maritime).	Radiocarbon dating 27 333 ± 240 bp (SRR 87)	Mid Devensian	von Weymarn and Edwards 1973
Galson Beach	Raised gravel beach.	?	None	early Devensian (?)	Baden Powell and Elton 1937 von Weyman 1974, 1979
Toa Galson	Solifluction deposit.	Periglacial	None	early Devensian (?)	Sutherland and Walker 1984
Toa Galson	Possible interglacial peat	Maritime grassland changing to acid heathland.	None	Ipswichian (??)	Sutherland and Walker 1984 Peacock 1984
North Lewis coastline	Till deposited on rock platform.	Glacial	None	pre Devensian / Wolstonian (??)	Sutherland and Walker 1984
North Lewis coastline	Formation of a raised rock platform and marine cliff with subsequent period of erosion.	?	None	pre Devensian / Wolstonian (??)	Godard 1965 McCann 1968 von Weymarn 1974

Note: This table represents a stylised stratigraphy extrapolated from a number of sites, with the earliest event (the raised rock platform) at the base of the table. The question marks after some correlation entries signifies the degree of uncertainty of correlation; this becomes more marked the further back in time you go.

3.5 *THE IMPLICATIONS OF PREVIOUS RESEARCH FOR THIS STUDY*

A well researched and detailed background thus exists from which the coastal erosion threat to both archaeological and palaeo-environment sites can be assessed. The palaeo-environment sites not only give time depth to the development of the landscape but also provide detailed descriptions and analysis of the structure and character of the stratified matrix in which the threatened archaeology is located. The character of the archaeology itself is also well documented with most periods represented by at least some excavated remains. Hence, a reasoned approach to the response and management of the coastal erosion threat should be possible, especially by utilising the previous archaeological survey in 1978 (Cowie 1994) and the coastal erosion survey undertaken by HR Wallington (Ramsay and Brampton 1995), coupled with the results of this survey.

4.0 SURVEY METHODOLOGY

The survey methodology employed here has its roots in the work carried out Roger Mercer in Caithness (Mercer 1980, 1981 and 1985) and Kirkpatrick Fleming (Mercer 1997) and by CB Burgess and C Burgess in Portugal during the late 1980's (CB Burgess 1987). The method employed on these surveys was one of total recording of all feature including sites in use within the recent past (cut off dates varying between 1900 and 1957). This recording was carried out on pro-forma sheets to ensure consistency.

These principles were carried forward to surveys carried out by the authors at Calanais (Coles *et. al.* 1995), Garenin (Burgess 1995 and Burgess and Gilmour 1996), Aird Uig (Burgess and Church 1996) and Bernera (Burgess and Neighbour 1997). Experience gained during these surveys was combined with experience gained in the use of **Penmap** for terrestrial survey and GIS recording lead the authors to propose the use of a completely computerised field recording system for this assessment.

4.1 METHODOLOGY

This survey has been carried out in three phases following the standard pattern of linear and area surveys carried out using current archaeological methods. These phases are sequential and reliant on the completion of the preceding phase before the commencement of the next.

The phases employed were, background research (desk based assessment), fieldwork and reporting. Due to the extended period of time over which this survey was carried out an additional stage of background research was included. This occurred during the reporting phase and allowed the constant updating of the National Monuments Record to be taken into account and to record any Scheduled Ancient Monuments added during the 11 months since the first desk based assessment.

4.2 PHASE 1: BACKGROUND RESEARCH (DESK BASED ASSESSMENT)

For the purpose of this study the authors carried a desk based assessment that consulted the National Monuments Record, Historic Scotland's map room and the National Map Library prior to the execution of the fieldwork phase of the project. At the National Monuments Record (RCAHMS, NMRS) the authors examined the Ordnance Survey record cards, map sheets and the NMRS

database through the **Artimis** GIS system. The **Artimis** data was generated on the basis of a search set to note all sites with 500 metres of a centre line path based on the Ordnance Survey 1:25000 survey of the coastline of Lewis. A computer disk containing all of the information obtained through **Artimis** was provided by NMRS.

A small sample of aerial photographs were examined at this time at the Aerial Photographic Unit (RCAHMS APU) but due to the short time between the receipt of grants and the execution of the survey no time was available for a complete examination of all available photographs. Those photographs viewed were of poor quality with intermittent cloud cover, and coverage in general is less complete for the Western Isles, than elsewhere in Scotland.

The Historic Scotland Map Room was consulted for a record of all relevant Scheduled Ancient Monuments, and the National Map Library was consulted to examine copies of the First Edition 6" Ordnance Survey. Copies of these maps were kindly lent to the project by Mary McLeod for day to day use.

4.3 PHASE 2: FIELDWORK

4.3.1 Summary field methodology

Utilising the data gathered during the desk based assessment three field teams examined stretches of the coast line divided into arbitrary administrative parcels of between 5 and 10 linear kilometres. Teams consisted of two people (occasionally 3 people) equipped with a pen based portable computer (PC. Compaq Concerto 486 SL 33Mhz, 12Mb RAM.) into which details of all cultural heritage features, palaeo-enviroment features and details of erosion and geomorphology were recorded. **Penmap** software was used to record the data onto scaled background maps using its GIS system to manage the data. Record forms were programmed for the project by the authors and altered and refined on the basis of the first weeks experiences in the field.

One team member was tasked to examine the foreshore and the eroding face and the other to examine the hinterland and the eroding face. No partial sampling strategy was employed, instead 100% of the survey area, consisting of the foreshore and a hinter land of between 50-200, metres was examined. The surveyed hinterland tended to increase in area when no access was available to the foreshore and eroding face (*i.e.* where terrain was dominated by high sea cliffs). Sites recorded were located to an

accuracy, suitable for mapping on a 1:25000, of 20 metres (a radius of 10 metres) by means of either compass resection or handheld navigational GPS.

Field survey commenced in the south-west at Aird Drollageo and all three teams operated within 15 kilometres of each other, heading first north to the Butt of Lewis and the south down the east coast to Stornoway and Ranish in the south-east. Several parcels were omitted during this first examination because the distance between pick up points (*i.e.* nearest roads) was deemed to be to great for completion in one day. These stretches included the Scaliscro Inn to the Bernera Bridge (17 kilometres) and the stretch between Port of Ness and New Tolsta (11 kilometres).

Information gathered on computer was backed up daily to prevent any data loss. During the 8 weeks of the survey only one case of a fatal computer crash (*i.e.* a single days work lost) occurred leading to a section having to be re-examined.

An addition element of desk based assessment was carried out in the Library in Stornoway. This work was aimed at recording all data held in Stornoway Library concerning buildings in and around the Stornoway Harbour area and was carried out before that parcel of the study area was examined.

4.3.2 Recording criteria

For the purposes of this survey a 'cultural heritage site' was taken to be any man made feature constructed before 1950 (1950 being the present of before present). This instruction was tempered so that currently occupied structures were only recorded if they were deemed "to be of particular interest" by the field team. While some guidance was given on what was "of particular interest" this allowed an element of supervisor discretion. The information gathered under this ambiguity in the otherwise rigorous recording criteria (discussed in section 4.3.3), tended to be consistent between the teams. One outstanding example may be seen in Stornoway where more than 100 17th, 18th and 19th century buildings were recorded, all of which are still occupied or used as commercial premises.

Geomorphic information was also recorded, (depicted on the maps and in the gazetteers in section 5), on the ground as the information was first entered into the GIS. Criteria for recording the start of a new cell were very simple; whenever a field team deemed that the erosion class had changed, or alternatively, the foreshore geomorphology, hinterland geomorphology or geomorphic modifier had changed then a new cell was recorded. The resultant cells range in size from between 100 metres and

10000 metres in length and are representative of all changes in the geomorphology within the study area.

4.3.3 Development of Penmap GIS system

The **Penmap** GIS system used to record the data collected during this survey has been used by the authors for both excavation and terrestrial survey since the start of the Garenin Landscape Survey in 1994. The authors have, in concert with Mr S Gilmour and Mr J Henderson, been in the process of developing site based GIS recording of information that ranges from Small Finds and Soil Sample details to Photographic and Drawing logs on sites across Scotland (Burgess, Henderson and Gilmour 1996). The basic principles employed in the use of these GIS incorporate a pro-forma basis obtained by using as many 'pick lists' as possible to standardise descriptions. This has however, always been tempered with the use of free text fields to allow additional description to be added to a record.

The results gained have the advantage of being consistent, with more complete forms (fewer fields are ignored and not filled in), while at the same time details and irregularities in the data are picked up in the free text fields.

These principles were applied to the recording forms for this assessment, with the aim of reducing the inconsistencies that have plagued earlier surveys recorded on paper. The problem of inconstency arises both between staff when more than one team is operating, and also on an individuals forms, when similar sites may be described differently on separate occasions.

For the purposes of this survey fields that were given 'pick lists' included:

- Structural element
- Artefactual element
- Orientation
- Location
- Aspect
- Period

The 'Structural element' and 'Artefactual Element' fields were also given an 'Other' option (see appendix 9) and a second field for free text. Contrary to the expectations of the authors this field was

not abused by the consistent use of "Other"field. Instead teams chose another option where possible and recorded additional information in the free text field.

Further advantages were also gained in using this system including the removal of the data entry stage in the handling and analysis of the site information. This is normally where paper forms are transcribed to a computer, and is often a time when errors creep into the data and further inconsistencies are applied to descriptions. The system also allows for basic database searches to be made on the information in its raw state. While these searches are not as advanced as those carried out with a more advanced GIS system such as **ARTIMIS**, the data can be interegated so that questions such as '*all monuments of type X, located on cliff edges*' can be made.

Information gathered in the GIS was easily exported to a database (either Corel's Paradox or Micro Soft Access) where it could be interrogated, edited, sorted and re-numbered. **Penmap's** GIS system also allows export to other major GIS packages using the **ARCINFO DXF** and **ERSI** Shape file formats.

The results of this survey are stored in six GIS databases for each map sheet:

- Point monuments
- Linear monuments
- Area monuments
- Point palaeo-environment
- Linear palaeo-environment
- Geomorphology

The archaeology and palaeo-environment records were split into point, linear and area monuments for administration reasons within the GIS system. For this report the six GIS databases have been amalgamated into three tables for presentation in section 5. These tables are Cultural heritage, Palaeo-environment and Geomorphology.

4.3.4 Health and safety

Health and safety is a major consideration on any archaeological project. The risks for an assessment such as this may be considered to be higher than usual, with tides, sinking sands and muds and unstable cliffs to deal with. While health and safety under any circumstance tends to be a matter of

common sense the teams on this survey were equipped to deal with un-expected eventualities. Each team was suitably attired and carried the following safety equipment:

- One red parachute flare
- One red smoke flare
- A CB radio
- Two survival bags
- A compass
- Paper maps for navigation

Teams where also issued with specific collection times and travel plans so that if they were more than 30 minutes late the alarm could be raised and a search started. Any work bellow the high tide line was timed to coincide with low tides and all teams were required to know the tide time for their parcels. This proved to be particularly important during this study due to extreme spring tides up to 2 metres higher than the mean.

4.3.5 The project team

The field work was undertaken using three survey teams consisting of a survey supervisor and one or two students from the University of Edinburgh. The overall Project Director was C Burgess, the team was lead in the field by M Church with the assistance of Mary MacLeod and Nevenka Vesligaj. All four key personnel have a good knowledge of the archaeology of Lewis, with the authors being directly involved with much of the recent research undertaken by the Calanais Archaeological Research Project. The initial desk based assessment was executed by the authors and Nevenka Vesligaj who also copy-edited the text. Dr. Geraint Coles, Simon Gilmour and Professor Dennis Harding, edited and provided guidance and interpretation for the geomorphic and archaeological data. Patrick Ashmore managed the project for Historic Scotland.

4.4 PHASE 3: REPORTING AND PUBLICATION

Upon completion of the fieldwork phase of the project collation and preparation began for the production of this report. This phase also involved a second stage of desk based assessment initiated to update the records of the original desk based assessment. The report has been prepared using the guidelines laid out in Historic Scotland's *Archaeology Procedure Paper 4. Coastal Zone Survey* (1996). Once this report is accepted it is the intention of the authors to reproduce parts of the

information in an academic paper and possibly publish the bulk of the text as a monograph in the proposed Calanais Monograph Series.

4.5 PHASE 4: INITIATION OF FURTHER RESEARCH PROJECTS

A further phase exists in most research based projects, that is the initiation of further research based upon the results from the present study. In the case of this assessment this may involve the closer examination of particular groups of features that are representative of the sites recorded. Other additional research may also involve extending the survey to the other islands in the Western Isles (particularly Harris) and the implementation of monitoring schemes for the areas already surveyed.

5.0 SURVEY RESULTS

5.1 FORMAT OF MAPS AND GAZETTEERS

Following this section are the results of the 1996 Coastal Erosion Assessment (Lewis). Each section of the coastline is split into two subsections. The first set of data consists of the cultural heritage and palaeo-environment data which is recorded on one map and is accompanied by two gazetteers in table form and a brief discussion and analysis of the cultural heritage gazetteer.

The second set of data includes erosion data and geomorphic data on two maps. These maps reference one gazetteer and are discussed and analysed in two brief texts.

5.2 LOCATIONS OF MAP SECTIONS

The following map displays the location of each map sheet with reference to the page each map section starts on, following it is a table that contains brief descriptions of each of the map sections.

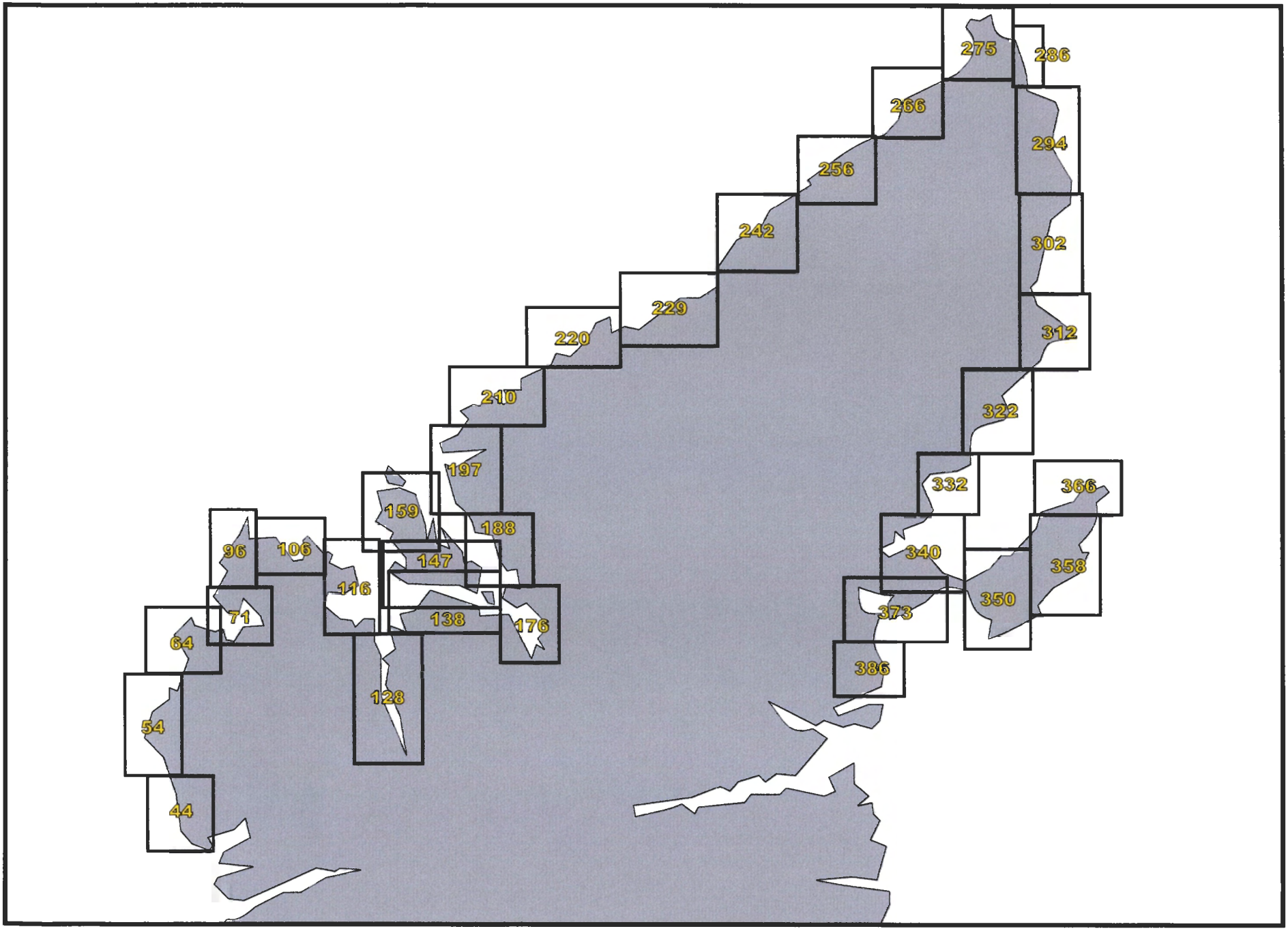

Figure 1: Page location of map sheets