

**THE ARTIFICIAL ISLETS OF THE CENTRAL INNER HEBRIDES:  
FIRST APPROACHES**

In two volumes  
Volume 1  
The Text

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## **Declaration**

I declare that this thesis has been composed by me and that the work contained within it has been conducted by me.

## **Abstract**

The central aim of this study is the examination of the artificial islets of the central Inner Hebrides in order to understand their structural composition and spatial positioning in the landscape. Another goal is to investigate how the central Inner Hebridean sites compare with other artificial islets in Scotland.

Crannogs have been studied, through survey and excavation, on the mainland of Scotland since the middle of the nineteenth century. Work has been carried out more recently in the Outer Hebrides on sites, commonly known as island duns, which contrast in form with the sites on the mainland. No systematic work has previously been carried out on the artificial islets of the Inner Hebrides although a number of them, such as Loch Ba, on Mull, were referred to in the past. This thesis examines the artificial islets of the Inner Hebrides with emphasis given to a detailed case study of the islands of Mull, Coll, Tiree, and Islay.

Initially, a literature survey is undertaken to establish the number of sites observed in the past and the features that were noted on them. This includes a study of local histories, historical and archaeological journals, placenames and early maps of the area. Field and underwater inspection of the lochs on the islands included a detailed, measured survey of each of the artificial islets, including those not recorded in the early references.

The visible, structural features of the artificial islets of the central Inner Hebrides are then analysed and their recurrent characteristics examined. This exercise shows that progress in the study of artificial islets can be made by applying simple analytical techniques to a sizeable number of artificial islets confined to a specific geographic region. In this case the characteristics of the data examined provide evidence which runs counter to current, widely-held theories concerning the nature, form and utility of artificial islets. Therefore alternative conclusions are proffered.

Another aim of the thesis is to analyze the location and spatial positioning of these artificial islet sites. Techniques are developed to propose how site positioning was employed by the early inhabitants in relation to potential farming and maritime resources.

The final part of this study compares these artificial islets with other crannog/artificial islet sites elsewhere in Scotland. Particular effort is made to see whether there is any discernible difference between Inner Hebridean sites and those on the mainland and in the Outer Hebrides respectively, but conclusions are limited because of the restricted data available.

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## Table of Contents

Declaration.....	i
Abstract.....	ii
Acknowledgements.....	iii
Table of Contents.....	v

### Chapter 1

#### Introduction

General.....	1
Definition of terms.....	3
Context of artificial islets.....	6
Aims of study.....	8
Thesis structure.....	9

### Chapter 2

#### Environment and archaeology in the Inner Hebrides

Introduction.....	12
Location.....	13
Geology and topography.....	14
Holocene sea-level changes.....	17
Climate.....	18
Latter prehistoric environment and vegetation.....	20
Soils.....	29
Summary.....	34

### Chapter 3

#### Scottish crannogs: Background

Introduction.....	37
A critical history of research:.....	37
Initial fieldwork.....	38
The work of Munro and Blundell.....	42
Excavations on Scottish crannogs during the following half century	
Lochend Loch, Coatbridge, Lanarkshire.....	46
Eadarloch, Loch Treig, Inverness-shire.....	47
Milton Loch Crannog I, Stewartry of Kirkcudbright.....	49
Loch Glashan, Argyllshire.....	52
Academic awakening.....	54
Lily Savory.....	54
Gwynne Oakley.....	55
Loch Awe survey.....	57
Loch Tay survey.....	60
Oakbank, Loch Tay, Perthshire.....	60
Landscape with lake dwellings - Ian Morrison.....	64
Lake of Menteith survey.....	68
South-West Scotland survey.....	70
Crannogs and wood signatures.....	73
A reassessment of the crannogs of Loch Awe region.....	73
Popular conceptions.....	74
Conclusions.....	77

## **Chapter 4**

### **Preliminary work:**

#### **A review of the earlier sources on the water bodies and artificial islets of the central Inner Hebrides**

Introduction.....	79
Maps.....	80
Local histories and records .....	84
Modern reports.....	88
Aerial photographs.....	89
Previous archaeological reports.....	90
Place names.....	92
Summary.....	94

## **Chapter 5**

### **Field search:**

#### **Underwater reconnaissance and survey in the central Inner Hebrides**

Aims of survey.....	95
Field search.....	97
Methods and techniques of field survey.....	101
Gazetteer.....	103
Dissemination of data.....	104

## **Chapter 6**

#### **A consideration of surviving structural features of the artificial islets of the central Inner Hebrides**

Introduction.....	106
History of structural analysis of artificial islets.....	107
Preservation of features.....	114
Materials.....	115
Stone.....	115
Wood.....	117
Basal area.....	120
Upper internal area.....	121
Enclosed base area percentage.....	123
Surface features.....	125
Shape.....	126
Distance from shore.....	128
Height.....	129
Depth of water.....	130
Accessibility.....	132
Causeways.....	133
Foundations.....	135
Geology of lochbed.....	135
Slope of lochbed.....	137
Defensiveness.....	138
Summary.....	140

## Chapter 7

### A consideration of the spatial positioning of the artificial islets of the central Inner Hebrides

Introduction.....	143
History of spatial analysis.....	144
History of spatial analysis as applied to artificial islets.....	147
The problems of archaeological data.....	152
Distribution issues in the study of artificial islets.....	153
The advantages of artificial islets.....	155
Advantages of a central Inner Hebrides artificial islet survey.....	158
Limiting factors.....	160
Advancing the techniques of analysis.....	161
Methodology.....	162
Sampling.....	162
Site catchment analysis.....	165
Computing and site catchment analysis.....	167
Methodological limitations.....	169
Arable land.....	173
Altitude.....	184
Bioclimate.....	186
Distance to coast.....	190
Drift geology.....	192
Water supply.....	195
The characteristics of the lochs.....	195
Distance to outlet.....	196
Location within the water bodies.....	197
Shelter.....	199
Depth of water.....	202
Slope of lochbed.....	203
Summary.....	203

## Chapter 8

### Consideration of Mainland artificial islet sites

Introduction.....	207
Limitations of comparison.....	208
Loch Awe.....	208
Loch Tay.....	212
Structural comparisons.....	213
Timber.....	213
Basal dimensions.....	214
Height.....	216
Surface features.....	217
Geology of lochbed.....	220
Accessibility.....	221
Causeways.....	221
Harbours and jetties.....	223
Spatial comparisons.....	225
Arable land, artificial islets and duns.....	225
Arable land and artificial islets.....	226
Summary.....	229

## **Chapter 9**

### **Consideration of artificial islet sites of the Western Isles**

Introduction.....	233
Terminology.....	234
History of research.....	236
Early work.....	236
Limitations of early work.....	237
Later work.....	238
The excavations.....	240
Dun Bharabhat, Cnip, Lewis.....	240
Eilean Domhnuill, Loch Olabhat, North Uist.....	242
Eilean Olabhat, Loch Olabhat, North Uist.....	245
Limits of comparison.....	246
Review of Armit's research in the Western Isles.....	247
Spatial analysis.....	249
Structural comparisons of artificial islets.....	252
Summary.....	254

## **Chapter 10**

### **Conclusions**

Summary.....	256
Contribution of structural analysis.....	257
Methodological contribution of spatial analysis.....	260
Future of research.....	262
Field survey.....	262
Environmental studies.....	264
Excavation.....	265
Closing remarks.....	268

<b>Bibliography</b> .....	269
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**Appendices, Illustrations, Plates and Plans are contained in Volume 2**

# Chapter 1

## Introduction

### General

Since the pioneering synthesis of Robert Munro (1882) it has been appreciated by archaeologists that the inland lochs of Scotland contain a sizeable number of man-made islets. These artificial islets, more commonly known as ‘crannogs’, are some of the best preserved archaeological monuments in Europe and provide the focus for this study. Even though the numbers of known sites and quality of individual site preservation are outstanding, Scotland’s artificial islets remain largely unstudied due to their watery location. In the relatively rare instances where these sites have been excavated, the evidence recovered indicates that they were constructed and inhabited throughout many periods, including the Neolithic, Iron Age, early Christian and medieval, up until the 17th Century. Although this extremely wide ranging chronology has generally discouraged their study by the mainstream period-focused archaeologists, the research potential of artificial islets is immense due to their richness in preserved organic materials which are often not present on dry land sites.

Artificial islets are some of Scotland’s most numerous later prehistoric monuments, with recent estimates of their total number ranging between 338 (Oakley 1973) and 500 (Dixon 1984, 15), and have been recognised as archaeological monuments since Victorian times (Munro 1882). Until recently, however, they have received little serious archaeological attention in comparison with many categories of dry-land sites. This is almost certainly due to their setting within water bodies, which prevented the easy examination of their submerged features until the development of sport diving equipment in the 1960s. Prior to this, only sites situated in lochs which had been drained were intensively investigated; water-bound islets, which were not easily accessible, were most often only inspected from the shore which prevented their measured survey and detailed description. It should be no surprise therefore,

that the information which has been recorded in the archaeological record for these sites over the course of the last century is highly variable in both quality and detail.

It is only recently that detailed survey reports have been produced for individual artificial islets by trained archaeologists. However, this work has been slow to develop, primarily due to the expense incurred in the investigation of submerged sites and the continuing shortage of trained archaeological divers. As yet, the only major underwater surveys of artificial islets have been carried out in two of the large Highland lochs (Hardy, McArdle and Miles 1973; Dixon 1982). These surveys revealed additional examples of this category of site, thereby demonstrating the likelihood that many artificial islets are as yet unidentified and that maps of their distribution are certainly less than complete. The products of the Loch Awe and Loch Tay surveys also form the core data-sets upon which many of the current theories concerning the structural composition and spatial positioning of Scotland's artificial islets are based (Morrison 1985; Dixon 1991; Dixon 1994; Dixon and Andrian 1995).

One of the central aims of this thesis is to improve the corpus of information on Scottish artificial islets through a programme of intensive underwater survey, conducted primarily on an under-researched area (the islands of Coll, Tiree, Mull and Islay; restricted amounts of diving were also undertaken on Lewis). This survey included the underwater examination of lochs not previously recorded as including sites in this category. It thus represents an intensity of underwater survey previously unmatched in Scotland. The results of the field programme are not only significant in themselves, but also because they provide a suite of evidence against which to measure prevailing hypotheses on crannog construction, their settings and economic bases. The new data immediately suggest that these hypotheses appear inapplicable to artificial islet sites in this region.

To make the above point at the outset is not to devalue the research that has already been undertaken, but simply to demonstrate how insubstantial the evidence so far recovered is; and thus how fragile are necessarily the hypotheses that are founded on such partial information. It thus appears axiomatic that research on

artificial islets remains at a stage in which conjecture and refutation can still substantially be founded of systematic, non-destructive, field observation, with the implication that here is a research topic still suitable for small-team research, safety considerations of course eliminating the possibility of solo work.

If the conclusions which end this thesis appear little more sophisticated than those that were in place at the outset of the work, this is a fair reflection of the relatively early stage at which artificial islet research in Scotland still finds itself. It should none the less be underscored that the data-set on which they are based represents, in the writer's opinion, a significant improvement on that available at the outset of this programme. Within the scope of a self-funded doctoral programme, excavation even on a limited scale was not feasible and would not have been ethically responsible, given the many unpredictable outcomes of underwater excavation, more especially with regard to the long-term conservation of organic finds.

### **Definition of terms**

Before proceeding it is necessary first to define a number of terms employed throughout this thesis. Many of these terms have been used in different contexts elsewhere and their precise meanings are often not explicitly presented. Some are labels for particular archaeological site types while others represent geographical regions. Each of the terms is meant to be understood in the context set out below wherever they appear throughout this thesis.

#### **Artificial islets**

At first sight the term 'artificial islet' may seem to be self explanatory, however, certain restrictions are placed on the term here. Artificial islets are defined as: 'any islet which is man-made or partially man-made and deliberately intended to be utilised as an islet, whether in free water or as dry points in a swamp'. This description follows Morrison's (1985, 19) definition of a "crannog" while avoiding the connotative baggage associated with that term. The entirety of this thesis could

easily be devoted to debating the precise definition of the term “crannog” and to considering the types of sites that it should embrace. The debate centres around the assumption that all crannogs are constructed of timber (Dixon 1994, 267; Dixon and Andrian 1995, 27). If this qualification is accepted, then the term is clearly not applicable to the sites examined below.

The term ‘artificial islet’ as used here is also to be taken as distinct from the term ‘artificial island’. This distinction is based upon the size of the sites. All sites with basal areas (defined below) covering under 1800m<sup>2</sup> in extent are considered artificial islets as they, at least theoretically, could have been constructed by an extended family unit over a reasonable period of time. Artificial islets are in a sizeable number of cases, perhaps even usually, crowned by a single structure which occupies the centre of the islet. The size of 1800 m<sup>2</sup> is not significant in and of itself but has been used here because this is the point where a substantial break in size occurs in the distribution. Artificial islets are the monuments which are examined in this thesis.

### **Artificial islands**

Artificial islands follow the same definition as artificial islets except that their basal areas exceed 1800m<sup>2</sup> in extent; they tend to be substantially larger constructions. A considerable amount of labour and origination would have been required to construct these sites and their upper surfaces are normally crowned by the remains of multiple buildings. Each of these factors indicate that large human groups may have constructed and, perhaps, occupied the sites. This classification of archaeological sites based on their size finds parallels in the dry-stone duns and forts of Atlantic Scotland.

A total of six artificial islands were identified in the central Inner Hebrides: Loch Ballygrant (Islay), Loch Lossit (Islay), Loch Finlaggan (Islay), Loch Gorm (Islay), Loch an Eilean (Tiree) and Dun Beag (Tiree). The remains of several buildings were found on each of these sites, with the exception of Dun Beag on which none were visible. Some, such as Eilean Mor in Loch Finlaggan, are known to

have been occupied by large populations in the Medieval Period (Finlaggan Trust 1995). Two of the sites (Dun Beag and Loch Gorm) were surveyed and are included in Appendix A for purposes of comparison. It is beyond the scope of this thesis to consider these sites further here.

### **Central Inner Hebrides**

The central Inner Hebrides are defined as the group of four islands, consisting of: Mull, Coll, Tiree and Islay, set off the West coast of central Scotland (Illustration 1.1). The central Inner Hebrides were deliberately chosen as the study area for detailed survey because they are located off the western fringe of the Scottish mainland between the Western Isles and Ireland; they are therefore positioned at the junction of three artificial islet building provinces.

### **Western Isles**

The Western Isles, commonly known as the Outer Hebrides, are defined as the chain of islands stretching from Lewis in the north to Barra in the south. The definition used here follows that of Armit (1992, 1).

### **Later Prehistory**

The term later prehistory, as used here, follows Armit's definition for the Atlantic Province of "... the 1<sup>st</sup> millennium BC and the 1<sup>st</sup> millennium AD prior to 800 AD, the conventional beginning of the Norse period" (1992, 1). In many respects the term is used here as a point of reference or a heuristic tool with which to discuss a group of archaeological sites, the occupation and construction of which can range in date from the Neolithic through to Victorian times. Radiocarbon determinations have shown that the artificial islets of the central Inner Hebrides fall within this range with individual sites dating to the Early Neolithic, Iron Age and medieval periods. The 'later prehistoric' as defined above falls conveniently near the centre of this range and is thus considered the most appropriate of any of the generic chronological terms. Some have argued that most artificial islets should be considered later prehistoric in date based upon radiocarbon determinations obtained from sites on the mainland (Henderson 1994, 130).

## The context of artificial islets

The artificial islets of Scotland are just one example of the types of lacustrine structures which have been found throughout Europe. Lake-dwellings cover a broad chronological and geographical range and show great diversity in their structural composition. Various types of pile-dwellings have been found in several areas of central Europe; they range geographically from the Late Bronze sites of Cortaillod-Esserts, Cortaillod-Est (Arnold 1986; Egloff 1981), and Auvernier-Nord (Arnold 1981), in Lake Neuchâtel, in Switzerland, to the Neolithic site of Charavines, in Lake Paladru, France (Bocquet *et. al.* 1987, 51-54), and Early and Middle Bronze Age sites in a number of the North Italian lakes, such as Ledro, Mercurago, Barche di Solferino, Lavagnonechiera, Carera and Fiave (Perini 1981; 1984). Although there has been considerable controversy as to whether the Swiss sites were true lake-dwellings built in open water, as Keller proposed in 1866, or were settlements built on the lake-shore (Ruoff 1980, 148; Ruoff 1987, 60), the North Italian sites have been shown to be true lake villages with some degree of certainty (Perini 1987, 80-81; Audouze and Buchsenschutz 1992, 200). Numerous solid based structures, such as the seventh-century BC village of Biskupin, in Poland (Bukowski 1960), have also been found in wetland environments throughout East-Central Europe (Petrequin 1984; Zvelebil 1987).

The type of artificial islets / crannogs which are the subject of this thesis, however, are primarily found in Scotland and Ireland. Like the Scottish sites, the Irish examples have been investigated since the middle of the last century (Wood-Martin 1886) and several were excavated earlier in the present one (Hencken 1936; 1942; 1950; Raftery 1943; O’Riordain and Lucas 1947), prior to the development of modern archaeological standards. Although underwater surveys have been carried out on artificial islets in several Irish lochs (Farrell, Kelly and Gowan 1989; Farrell 1989), the information gathered by these is as yet largely unpublished.

As with the Swiss sites, there has recently been debate as to whether all Irish crannogs were originally surrounded by water or whether they were lake side settlements (Crone 1993, 250-252; Edwards 1990, 36-37; Lynn 1983). There has also been a tendency to attribute most Irish crannogs to the Early Christian Period based upon dendrochronological analysis of six sites in the early 1970s (Baillie 1979) and the wealth of diagnostic finds recovered from the excavated sites of Lagore, Co. Meath, Ballinderry 1, Co. Westmeath, and Ballinderry 2, Co. Offaly (Hencken 1950; 1942; 1936). Based upon this evidence theories have been forwarded suggesting that crannogs spread from Scotland to Ireland in the Early Christian Period (Crone 1993, 250-252; Edwards 1990, 36-37; Lynn 1983). However, recently published excavations, such as Rathtinaun, Co. Sligo (Raftery 1994, 32-35) and Clonfinlough, Co. Offaly (Moloney 1994), have demonstrated that some Irish crannogs predate this period. It would seem wise at this point to wait for the publication of further excavation and survey data before making firm conclusions concerning the Irish sites.

Various types of lacustrine structures have also been found in lowland Britain. The most famous of these are the Iron Age lake villages of Glastonbury and Meare in the Somerset Levels which were excavated in the early part of this century (Bulleid and Gray 1911; Bulleid and Gray 1948). Recent environmental research has shown that the Meare settlement was constructed on the surface of an active raised bog in a relatively dry section of these wetlands, whereas wetter conditions prevailed at the Glastonbury site (Coles 1987, 150). Each of these wetland settlements is substantially larger than the artificial islets investigated here.

Since the end of the last century archaeological remains interpreted as lake-dwellings have been found in low-lying areas of eastern Yorkshire near Costa Beck (Clark 1930), Barmston (Varley 1968), Ulrome and Skipsea (Smith 1911). However the descriptions of these sites seldom note substantial structures and recent research has shown that many of these alleged lake-dwellings were either the misidentified remains of trackways (Van de Noort 1995, 332) or the products of local imagination (Holley and Martlew *forthcoming*). Notices have been published of similarly

ambiguous structures located in Lancashire (Cole 1889), and within the small meres of Suffolk and Norfolk (Munro 1882, 290).

A single crannog has been identified and partially excavated in Llangorse Lake, Wales (Campbell and Lane 1989; Redknap and Lane 1994). This site is thought to have been an Irish import to Wales and is the only known example of its type in the country. Underwater excavations have confirmed that the site was a residence, possibly royal, and have recovered timbers which date it to the 890s AD based upon dendrochronological examination (*ibid.* 202).

### **Aims of the study**

The central aim of this thesis is to examine the artificial islets of the central Inner Hebrides in order to understand their structural composition and spatial positioning in the landscape. Another goal is to investigate how the central Inner Hebridean sites compare with other artificial islets in Scotland. Much of the current thinking concerning the structural composition and spatial positioning of Scotland's artificial islets is based upon information gathered from surveys of large Highland lochs (Hardy, McArdle and Miles 1973; Dixon 1982). The information obtained from the artificial islets of the central Inner Hebrides, therefore, offers a useful contrast to these data-sets and allows the current theories to be examined in an island setting of small lochs.

The first task is to gather a reliable set of data. Although most of the artificial islets of the central Inner Hebrides have been previously identified, a majority had only been examined from the shores of each loch and consequently their descriptions lack detail and accurate measurements. For this reason all of the sites needed to be surveyed in the field using modern techniques and equipment. Intensive field-survey was also required to identify and confirm the surviving distribution of artificial islets.

The second task undertaken was to examine the survey data with the goal of identifying patterns in the islets' measurable characteristics. This analysis is

primarily concerned with the structural composition and spatial location of the artificial islets. For this discussion to be meaningful the achievement of the first aim was a necessary prerequisite.

The third task is to compare the data obtained from central Inner Hebrides with those gathered by previous artificial islet surveys on the Scottish mainland and Western Isles. This allows the validity of theories, concerning the structural composition and spatial positioning of artificial islets, posited for sites located in other landscapes to be appraised in an alternative setting.

### **Thesis structure**

The artificial islets of the central Inner Hebrides are the principal sites examined in this thesis. Chapter 2 provides the environmental background for the central Inner Hebrides concentrating on factors such as the geology, climate, and topography which may have influenced the placement of artificial islets in the area. Previous environmental research in the region is reviewed in an attempt to reconstruct the Later Prehistoric environment and vegetation of the islands.

Chapter 3 examines the history of artificial islet research in Scotland. Artificial islets have received varying degrees of attention since the early days of antiquarian enquiry, however, it is only during the last twenty-five years that these sites have been systematically surveyed in any numbers. This chapter outlines the current theories on the structural composition and spatial positioning of artificial islets and identifies the key data-sets upon which they are based. The validity of the illustrations used to portray artificial islets in popular archaeological publications is also considered, as this iconography is considered significantly to underpin current perceptions.

Various maps, local records, regional histories and aerial photographs are considered in Chapter 4 in order to establish the distribution of artificial islets as recognised in the central Inner Hebrides prior to the execution of the present survey.

The methods and techniques used to identify, measure and describe the artificial islets of the central Inner Hebrides are presented in Chapter 5 along with the means of accessing the survey data.

The visible, structural features of the artificial islets of the central Inner Hebrides are described in Chapter 6 and their recurrent characteristics examined. This review shows that progress in the study of artificial islets can be made by applying simple analytical techniques to a sizeable number of artificial islets confined to a specific geographic region. In this case the characteristics of the data examined provide evidence which runs counter to current, widely-held theories concerning the nature and utility of artificial islets, therefore alternative conclusions are proffered.

Chapter 7 explores the relationships between the spatial positioning of artificial islets within the central Inner Hebrides relative to aspects of the landscape in which they are set. Through such analysis an attempt to elucidate the settlement pattern may be made, while the validity of prevailing theories concerning the spatial positioning of artificial islets can be examined.

The wider context of islet building in Scotland, based upon crannog surveys which were conducted in Loch Awe and Loch Tay, is reviewed in Chapter 8. Particular attention is given to assessing the quality of the data recovered by these surveys. The remainder of this chapter explores the characteristics of the structural details of the artificial islets of the central Inner Hebrides and those of the Loch Awe and Loch Tay distributions.

Another large distribution of artificial islets, those of the Western Isles, is examined in Chapter 9. This chapter outlines the archaeological work which has been carried out on the artificial islets of the Western Isles in order to establish what is known about their nature, structure, chronology, function, and spatial positioning. This information is then compared with that recovered from the artificial islets of the

central Inner Hebrides so that differences in the distributions characteristics can be studied and current theories examined.

Chapter 10 briefly summarises the findings of the preceding chapters and discusses their contribution to artificial islet research. This chapter also highlights several areas, primarily field survey, environmental research and further excavation, which are deserving of further research.

## Chapter 2

### Geography and environment in the central Inner Hebrides

#### Introduction

In order to study the settlement pattern of artificial islets in the central Inner Hebrides it is first necessary to understand the natural environment in which they are set. Environmental factors such as the geology, climate, and topography will all have influenced the placement of settlement sites to some degree. Although these were not the only factors affecting the settlement pattern, the natural environment of the Inner Hebrides would have determined the economic opportunity-cost of living in the area during any period. This set of opportunities and restrictions is not static but has been changing since the central Inner Hebrides were first settled by humans.

This chapter considers the available evidence on the later prehistoric environments of the central Inner Hebrides and how they have changed throughout the last two millennia. This is accomplished through examining and synthesising evidence collected by a wide range of environmental specialists and published in scientific reports (Barber and Brown 1984; Bennett 1989; Edwards and Berridge 1994; Agnew *et al.* 1988; Edwards and Mithen 1995; Storrie 1983; McCullagh 1991; Ritchie and Welfare 1983; Walker and Lowe 1985; 1986; 1987; Lowe and Walker 1986; Hale 1988; Tipping 1994; Wilkins 1984; Gilbertson *et al.* 1995; Pilcher 1974; Boardman 1995; Graham 1952; Hudson and Henderson 1983; Moore 1975; 1993; Stevenson and Birks 1995; Green and Harding 1983; Boyd and Boyd 1990; Birse, Dry and Robinson 1970; 1971). A review of this material indicates that great changes have taken place in the central Inner Hebrides since the last glaciation, in terms of climatic deterioration, soil formation, sea-level change, decline of woodland and expansion of peat and machair deposition. The rate and chronology of these changes is not fully understood, nor is their impact on previous human populations. The role that environmental factors have played in influencing where artificial islets were placed in the central Inner Hebridean landscape will be discussed extensively in later

Both stable and dynamic features of the natural environment of the central Inner Hebrides will be outlined. The features that have not changed since the last glaciation, such as global location, solid geology and topography, will be considered first because they are easily summarised. The more dynamic features of the environment, which are central to the study of the distribution of artificial islets, will then be examined; these include sea-level, climatic, vegetational, pedological and coastal change. Particular attention is given to the vegetational history of the central Inner Hebrides, as this is essential for determining which type of materials were readily available for the construction of artificial islets. The evidence will show that timber was an increasingly scarce commodity in the region from the Neolithic Period onwards and that it is therefore questionable whether the massive quantities of timber needed to construct pile dwellings were readily available.

It will be seen that the later prehistoric inhabitants of the central Inner Hebrides were living in an increasingly inhospitable landscape. Sea-levels were rising and machair was transgressing steadily inland while blanket peat was expanding outwards from inland areas. Later Prehistoric populations would have been caught between these two constraints on the exploitable landscape, and presumably placed under ever-increasing economic strain. In such situations groups must compete for ever-decreasing resources and are thus likely to come into conflict with each other. The artificial islets of the central Inner Hebrides may have been a response to this environmentally driven conflict.

## **Location**

The Inner Hebrides are a chain of some 151 named islands, 27 of which are permanently inhabited at present, of varying topography and size which lie off the west coast of Argyll. This study focuses on four of the major islands of this group: Mull, Coll, Tiree and Islay which are referred to here as the central Inner Hebrides. This group of islands is separated from the Outer Hebrides by the Sea of the Hebrides,

and from the mainland of Scotland, in the form of the Argyll peninsula, by the Sounds of Mull and Jura.

The central Inner Hebrides belong to the Atlantic Province of later Scottish prehistory (initially defined by Piggott 1956, 1 and 15; 1967, 3-5), linked to other areas of western Britain and Ireland by the western seaways (Bowen 1972). These islands occur within a sea area roughly 130 km east-west by 100 km north-south. Mull, the largest of the group, is separated from the mainland by the Sound of Mull which measures only 2km at its narrowest extent. Coll lies 7km west of the north-west tip of Mull and is separated from its neighbour Tiree to the south west by the 1.5km wide Sound of Gunna. Islay, the southern most island of this study, is located 25km west of the Mull of Kintyre and is divided from the Isle of Jura (not considered in this study) by the narrow, 0.8km wide Sound of Islay. The Oa in SW Islay lies some 37 km from northern Ireland, with which it is intermittently intervisible across the North Channel.

### **Geology and Topography**

The geology and topography of the central Inner Hebrides are extremely diverse, varying greatly from island to island. The geological variability of the region is amongst the most complex for a geographical unit of this scale anywhere in Europe, and has played an important role in the development of both soils and landscape. The altitudinal ranges of the islands are considerable and provide a wide range of climatic environments. The geology of the region has been most recently summarised in Fyfe *et al.* (1993), Bowes (1983), Hudson and Henderson (1983), Storrie (1981), Stoker *et al.* (1993), and Boyd and Boyd (1996). The settlement patterns of the central Inner Hebrides may best be appreciated in light of the wide range of alternative landscapes available (e.g. Johnston 1990).

The island of Mull can be conveniently divided into three distinct geomorphological regions: the north, the south and east, and the Ross. The north of Mull, the area north of Loch na Keal and Salen, is composed of horizontal sheets of

tertiary lavas which have eroded to produce a distinctive stepped landscape which is edged by low cliffs. These tertiary lavas only once rise above 425m OD (at Speinne Mor) but produce fertile soils which have attracted a density of settlement since prehistory. The south and east of Mull is dominated by high, rugged mountains, cut by deep glens. The highest of the peaks, at the volcanic centre of the island, Ben More, rises 966 above OD and is the highest peak of tertiary basalts in Britain. This area of the island was covered by free-flowing lavas which hardened into fine-grained basalts near the beginning of the Tertiary Age. The soils in this section of the island are generally less fertile than those in the north, with exception of those on a strip of calcareous glacial drift which covers the glen floor between Loch Spelve and Loch Buie (Macnab 1995, 14-17). The Ross of Mull is also covered by lava flows which slope up from the shores of Loch Scridain and run across the peninsula to form a continuous line of cliffs up to 455m in height which dominate the south coast. The end of the Ross, west of Bunessan, is covered by low, rounded hills of red and pink granite which are occasionally broken by small lochans (Whittow 1977).

Although Coll and Tiree lie just off Mull's west coast, their topography and geology more closely resembles that of the Western Isles than the other Inner Hebridean Isles. These two islands are mainly composed of low lying, under 140m OD, outcrops of Lewisian gneiss, consisting predominantly of grey tonalitic gneisses, together with enclaves of mafic/ultramafic material and supracrustal metasediments (Muir *et al.* 1993, 167). The tectonic evolution and geochemistry of the islands' rock formations have been examined in detail by Drury (1970; 1972; 1972b; 1973) and Whitehouse and Robertson (1995). Extensive tracts of machair cover the west coast of Coll and both completely encircle and cut across the middle of Tiree. The medial section of Tiree is known as "The Reef" and it has been postulated that Late and Post-glacial seas covered the area creating two separate islands (RCAHMS 1980, 3; Mather *et al.* 1975, 4) in the early Holocene between 6,000 and 7,000 years ago (Peacock 1983, 88). Over three-quarters of Tiree lies below the 20m contour and is covered by raised beaches and calcareous soils which give relatively high agricultural

yields. By contrast, Coll is more rugged; its dissected topography never rises above 104m and the island has only small patches of agriculturally productive soils.

Unlike Coll and Tiree, Islay has an extremely complex geological structure which has recently been summarised by Storrie (1981, 18-23; 1997, 15-20) and Newton (1988b). The island is dissected by two upland areas of quartzitic rocks, one in the northeast culminating in Sgarbh Breac (364m), the other in the south-east, reaching 491m in Beinn Bheigir. The upland in the south-east forms the largest area of high ground and terminates at one hundred metre high cliffs overlooking the Sound of Islay. The lower north-eastern upland is bounded by well-developed Quaternary cliffs, shore platforms, and postglacial raised beaches. Between the two uplands lies a central lowland area which is underlain by strongly metamorphosed Precambrian slates and phyllites, with some calcareous quartzose schists, and igneous intrusions. These rocks have been extensively eroded to form "The Glen" which comprises the upper drainage basin of the Laggan River and much of the Sorn basin. Extensive deposits of fairly pure Dalradian limestone, which have been intensively quarried in historical times, are found in this area. The limestone is not strongly dolomitized, and in some places is 95% pure calcium carbonate, which makes it useful as an agricultural fertiliser. These deposits have also provided building material, decorative whitewash and road metal. Veins of minerals in the limestone have also been worked in the Ballygrant area at different times, the most important being lead, copper and silver. These workings have recently been assessed by Cressey (1996). The southeast of Islay is almost free of superficial deposits and differential erosion of the relatively harder intrusives and softer rocks has created a sequence of minor ridges and valleys which terminate seawards in the form of small islets and skerries. The Mull of Oa is surrounded by outcrops of black slates and grey phyllites which form spectacular cliffs that fall sheer into the sea near its south-west end. The southern end of the Rhinns of Islay is made up of rocks assigned to the Lewisian basement complex which are mostly orthogneisses. The remainder of the Rhinns is covered by a series of Torridonian grits, slates and phyllites. The western coast of the Rhinns terminates at cliffs which are occasionally interrupted by stretches of sands and dunes. Basaltic

Tertiary dykes cut across the island while machair is located along the west and south-west coasts. Long stretches of raised beach are located in various parts of the coastal fringe and provide good agriculturally productive soils. Glacial drift has accumulated in many of the glens and forms the basal deposits on which the largest peat bogs have developed (Storrie 1997, 18). These bogs also cover parts of the raised beaches and are bordered by windblown machair along Laggan Bay. The geology and topography of Islay is therefore varied, and gives rise to many different kinds of landscape. The superficial deposits of glacial, fluvoglacial and fluvial materials (especially where these have been derived from limestone) provide soils with reasonable agricultural qualities that are otherwise fairly rare in the Hebrides, and have contributed significantly to the assessment of Islay as the most fertile zone within the medieval Lordship of the Isles (*ibid.* 20).

### **Holocene sea-level changes**

The fluctuations in the relative sea-level in the central Inner Hebrides since the last glaciation are not fully understood. Accumulating evidence suggest that the sequence is extremely complex (Ballantyne and Dawson 1997, 33; Boyd and Boyd 1996, 29; Peacock 1983, 84). The melting of the ice during the Quaternary Period served to raise the sea-levels while the isostatic raising of the land released from the load of the ice sheets counterbalanced this to some extent. The interplay between these two factors has produced raised beaches and other coastal markers at varying heights along the seaboard of Atlantic Scotland, which are to some degree dependant on distance from the centre of uplift, normally situated near Rannoch Moor in the western Grampians. Isostatic uplift has been both greater and more rapid in areas close to the centre of the ice sheet. Thus Mull, which was covered by its own locally nourished ice sheet (Peacock 1983, 85; Sissons 1983), is likely to have experienced greater fluctuations in sea-level than the other Hebridean islands. Isostatic uplift was rapid at first, then progressively slowed throughout the Late Glacial and Holocene and is continuing. The fluctuating sea-levels of the central Inner Hebrides have produced a series of raised beaches which are grouped at heights of around 8m and 30m above present sea-level (Boyd and Boyd 1996, 29; Mather *et al.* 1975, 4) but the

extent to which sea-level change has occurred since the later prehistoric period on the individual islands and the region as a whole is poorly understood. Mather *et al.* (1975, 6) have speculated that most of low-lying Tiree was submerged by late-glacial and early post-glacial seas and have identified, what they argue to be early post-glacial raised beaches between 7 and 9m OD on the islands. However, the fluctuations in post-glacial sea-levels in the area remain poorly understood and more research is required before firm conclusions can be reached. There is currently little information available for sea-level change on Coll and Tiree but if they follow the pattern noted on the Western Isles where negative isostatic uplift has been noted (Peacock 1984, 26; Ritchie 1979, 114) it may be expected that relative sea-levels have risen slightly since later prehistory. Recent research in the Uists indicates that sea-level was at least 5m lower around 8800 BP but had almost reached its present level by 5700 years ago (Ritchie 1979, 114). Thereafter, sea-level continued to rise very slowly and was accompanied by coastline retreat. Sea-level change is discussed again below, as it relates to machair transgression.

## **Climate**

The central Inner Hebrides experience a wet and warm maritime climate because of their geographical location at the eastern edge of the Atlantic Ocean in a predominantly south-westerly air-stream. The rainfall on Coll, Tiree and the Ross of Mull is relatively low, the average rainfall for Tiree in the period 1951-1980 being 1106mm per annum. In contrast, average rainfall on the highlands of Mull and Islay can exceed 2400mm. In total there are approximately 250 rain days per year in the West Highland area, due mainly to predominating eastward moving cyclones (Meteorological Office 1989, 4). Although a majority of the precipitation falls in the winter, warm temperatures limit snowfall to under 20 days a year and generally prevent it from lying (Bibby 1982, 15). The water masses which circulate around the Inner Hebrides are fed from the Gulf Stream and have the smallest range of annual variation in temperature of any sea area around the British Isles. Detailed accounts of the climate of the Inner Hebrides have been provided by Green and Harding (1983) and Boyd and Boyd (1990).

Climatically, Coll and Tiree are classified as having 'warm and moist' climates (as defined by Birse, Dry and Robinson 1970; 1971). Mull and Islay have several climatic regions ranging from 'very cold and wet' on the highlands to 'warm and wet' to 'warm and moist' in the lower coastal regions (*ibid.*). The growing season in the lowland areas, defined by the length of time for which the daily air temperature is above 5.6° c, is approximately 250 days extending up to 269 days on Tiree (Green and Harding 1983, 131); this compares with 245 days in the Western Isles (Boyd and Boyd 1997, 37). The mean annual temperature on Tiree is 9.1°C, only 1°C lower than southern England (Meteorological Office 1989, 19). Tiree has the added advantage of having the highest annual average of hours of sunlight, 1450 per annum, of any area in Britain. In the upland areas of Mull and Islay the growing season is dramatically shorter. Temperature falls by approximately 0.6° C for every 100m above sea level, and when this adiabatic lapse rate is combined with the higher precipitation that is prevalent the result is driving rain and snow. Many of the peaks are snow covered throughout the winter months (Green and Harding 1983, 121-140).

The central Inner Hebridean islands are subjected to some of the highest wind speeds in the world. The full force of winds from the North Atlantic, where mean wind speeds reach 10.3 m/sec in the winter and 5.15 m/sec in the summer, produce waves which batter the coasts (Bibby 1982, 15). Wind exposure can influence the nature and location of settlements and constrains the growth of vegetation, more especially tall communities, in many areas. Along the coasts, vegetation is also inhibited by salt spray, and a combination of wind and shallow soil inhibits the growth of trees. As a result, the islands of Coll and Tiree are now devoid of tree cover and Mull and Islay are wooded only in sheltered areas or where they have been commercially planted.

## Later Prehistoric Environment and Vegetation

The climate of the central Inner Hebrides, and the rest of Britain, has been subject to changes throughout the Holocene and to a lesser extent since later prehistory. Although the degree to which Scotland's climate has altered during this period has recently been debated (Whittington and Edwards 1997, 11-22) it is important to recognise that climatic change, however slight, has occurred. Proxy evidence for climatic change can be found in an analysis of the soil, pollen/floral and faunal history of an area. For present purposes, the characteristics of the later prehistoric climate of the central Inner Hebrides will be examined based on the evidence obtained from soil and pollen studies. Although there are problems with interpreting pollen as a marker for climatic – as opposed to vegetational - change (Whittington and Edwards 1997, 15), palynological studies provide the largest easily accessible corpus of environmental data for Scotland and have been recently used to reconstruct past environments and vegetational histories of the Atlantic province (cf. Fossitt 1996; Edwards and Berridge 1994).

The Neolithic and Bronze Age environment in Britain was generally warm and dry with the Bronze Age marking the optimum for upland farming (Roberts 1989, 149). The climate during these periods was more typically continental, usually referred to as Sub-Boreal. From the detailed examination of pollen diagrams around Britain it has been suggested that the climate began to deteriorate slightly around c.1250 BC and then more rapidly after c.850 BC, reaching its wettest in c.650 BC. Recent environmental evidence indicates that this climatic downturn may have been triggered by the eruption of the Icelandic volcano Hekla in 1159 BC which introduced large amounts tephra into the atmosphere effectively initiating a catastrophe such as a 'nuclear winter' (Cowie and Shepherd 1997, 166). There is some evidence to suggest that after c.400 BC until c.450 AD the climate once again became warmer and drier, perhaps slightly warmer than today, but it is generally assumed that the climate of the Iron Age was less warm and dry than that of the Bronze Age (Turner 1981, 260-1). This climatic downturn seems to have occurred just after the extensive deforestation

of Scotland's indigenous woodlands (Agnew *et al.* 1988, 199; Storrie 1983, 552; Birks and Williams 1983, 269) and contributed to the expansion of blanket-bog and heath on poorly drained, less-fertile soils. An examination of pollen diagrams from across Scotland reveals that woodlands were relatively stable until about 5000 BP (Whittington and Edwards 1997, 16; Tipping 1994) when human activity is suspected to initiate wide-scale deforestation.

An analysis of the environmental evidence from the central Inner Hebrides indicates that the sequence indicated for this area is in broad agreement with the environment of the rest of Britain during pre-history. Although there has been only a limited amount of environmental work done in the islands, a review of this work indicates that tree cover varied from island to island, and was on the decline since the Neolithic.

The excavation and pollen analysis of buried soils carried out by Barber and Brown (1984) at an Sithean, a complex of hut circles and fieldwalls, just east of and above Loch Gorm on Islay, indicated that heathland and rough pasture covered the western part of the island by the Late Neolithic (*ibid.* 184). An examination of the buried soils showed a sequence of land use which alternated between intensive cultivation and periods of peat growth. Podzols were initially cultivated in the second millennium BC and then abandoned and engulfed by peat at an undetermined date in the first millennium AD. During the medieval period cultivation was resumed and continued through to the 18th century AD when the land reverted to grazings. This work is the only detailed published study of buried soils to be carried out in the central Inner Hebrides.

In recent years the palaeoenvironmental history of the Rhinns region of Islay has been intensively studied and the vegetational history of the southern part of it established. A tentative picture of the local environment was first constructed by Bennett (1989) who examined pollen assemblages from Loch Conailbhe and Coultoon Bog. Although the pollen in the first core was degraded and the upper portions of the

second were truncated by peat cutting, Bennett was able to conclude that even warmth-loving hardwoods such as elm (*Ulmus*) and oak (*Quercus*) colonised the island during the Postglacial Period and that it was well wooded until the rapid spread of heathland communities c. 5000 BP. Climatic factors, anthropogenic impacts and increasingly acidic soils conditions were all considered to be contributing factors in this sudden shift.

More detailed palynological work has recently been carried out in the Rhinns of Islay as part of the Southern Hebrides Mesolithic Project by Edwards and Berridge (1994) who were able to recover two complete profiles from Loch a'Bhogaidh. This work followed pilot studies by Agnew *et al.* (1988) and allowed the reconstruction of a Holocene vegetational history which extended up to the present. Analysis of the cores showed that an open tundra-like early Holocene and Late Glacial landscape eventually gave way to a wooded period characterised by elm (*Ulmus*), pine (*Pinus*) and oak (*Quercus*). Possible anthropogenic interference is indicated by high quantities of charcoal as early as 12,300 BP (Edwards and Mithen 1995, 360), long before any supporting archaeological evidence is currently available, but also noted during the periods c. 10,320-9910 BP (*ibid.* 355), c. 7550-7310 BP and c. 7000-6500 BP by fluctuations in hazel pollen and rises in levels of charcoal (Edwards and Berridge 1994, 768). Sharp reductions in arboreal taxa did not occur until 3610 BP, at which point a rise in charcoal, the appearance of cereal-type pollen, and the increased mineral content of terrestrial run-off suggest that woodland was removed so that mixed agriculture could be practised. This trend continued from the middle Bronze Age through to the early Iron Age when a rise in *Sphagnum* indicates that soils were becoming impoverished and blanket-peat was spreading within the catchment. Edwards suggests that this was either a result of land-use pressure or perhaps progressive climatic deterioration. After c. 1870 BP the local area is dominated by heath and acidic grassland (Edwards and Berridge 1994, 768).

Environmental evidence from a variety of archaeological sites in other areas of Islay and Jura indicates climatic deterioration, a podzolisation of soils and an increase

in peat and moor-land from c.5000 BC worsening from the mid-second millennium onwards (Storrie 1983, 552). This climatic horizon was verified by environmental studies which were a component of the examination of a Neolithic settlement site at Newton, Islay. Analysis of a dated absolute (concentration) pollen core taken here indicated that woodlands were initially disturbed, possibly by anthropogenic interference, as early as c. 5000 BC but that open woodland predominated until c. 3150 BC when a decrease in elm (*Ulmus*) pollen indicates that woodlands were being cleared in the Sorn Valley. McCullagh also suggested that agricultural activities were taking place at this point. A section of the core radio-carbon dated to  $4215 \pm 70$  BP (GU-1897) (uncalibrated) indicated that by c.2250 BC much of the indigenous forest cover had been cleared and the acidification of soils and slow peat accumulation had both begun, probably at least partially as a result of overgrazing (McCullagh 1991, 40-42).

Evidence that at least a limited amount of timber was found on Islay as late as the Bronze Age was recovered from a settlement excavated by Ritchie and Welfare (1983) in the sand dunes north of Loch Ardnave. Charcoal of alder (*Alnus*), birch (*Betula*), oak (*Quercus*), hazel (*Corylus*), ash (*Fraxinus*), wild cherry (*Prunus avium*), willow (*Salix*) and spruce (*Picea*) was recovered from various floor layers and a hearth, produced uncalibrated radio-carbon determinations ranging from  $3687 \text{ BP} \pm 60$  (GU-1440) to  $3230 \text{ BP} \pm 120$  (GU-1272) (*ibid.* 317). A carbonised piece of hazel (*Corylus avellana*) 85mm in length and 30mm in diameter was recovered from beneath a house wall and displayed features which indicated that it was cut by a metal implement. The piece returned a radiocarbon determination of  $3610 \text{ BP} \pm 85$  (GU-1371) (uncalibrated) and was speculated to be the product of local clearance (*ibid.* 360). Charcoal of alder (*Alnus*), birch (*Betula*), hazel (*Corylus*) and willow (*Salix*) from an upper hearth produced uncalibrated determinations of  $1570 \text{ BP} \pm 65$  (GU-1272) and  $1755 \pm 60$  (GU-1443) showing that at least some timber was still available in the later Iron Age. An analysis of the post holes from the site showed a considerable range of sizes for the contained posts, but indicated that most of the timber was under

190mm in diameter. The excavators considered this to reflect “the difficulty the builders must have had in obtaining timbers of reasonable size” (*ibid.* 308).

Two important conclusions concerning Bronze Age woodland may be inferred from this site. Firstly, all of the timber recovered was relatively small in size, under 25cm in diameter (*ibid.* 308), indicating that it is likely to have come from open-scrub woodland. Large, straight timbers (30cm in diameter and over 5m in length), such as those found in the mainland crannog sites (Ritchie 1942, 38; Piggott 1952, 141; Dixon 1984, 218), were not found at the site and would not be present in such woodlands. Although a majority of the species identified can still be found on Islay today, the presence of spruce, a taxon not native to Scotland, indicates that North American or Scandinavian driftwood was the source of at least some of the timber. Considering the limited amount of timber recovered and the presence of goose barnacle (*Lepas*), a species that attaches itself to floating objects such a timber, in occupation deposits (*ibid.* 356), it is not unreasonable to suggest that much, if not all, of the timber could have been driftwood. In either case the evidence supports the suggestion that timber, though obtainable in small quantities, was scarce in the local area by the Bronze Age.

Environmental evidence from a series of sites on Mull shows that deforestation, and thus inferentially climatic decline, occurred during the same general period as on Islay. An analysis of three pollen cores taken from Glen More, in south central Mull, was carried out by Walker and Lowe (1985). This analysis shows that woodlands of alder (*Alnus*), oak (*Quercus*) and birch (*Betula*) were gradually being replaced by *Calluna* and *Erica* heathland, moors and grasslands during the late Holocene. Throughout most of north-west Scotland this change is thought to have begun around 4000 BP (*ibid.* 606). The extent to which anthropogenic factors facilitated this change in the landscape was left open by Walker and Lowe and most of the observed changes were speculated to be the results of natural processes such as soil deterioration through accelerated leaching, expansion of mires and blanket-bog, and increasingly stormy conditions along the western littoral. However, Walker and

Lowe found cereal, and *Plantago lanceolata* pollen, a weed commonly associated with early cultivation, in the western most pollen profile indicating that agricultural activity may have been practised in the lower reaches of Glen More during the period of woodland decline. (Fossitt (1996, 191) has recently questioned “the use of *Plantago lanceolata* as an indicator of human activity” during the Holocene noting that it occurs in maritime grassland communities in western Lewis from as early as c. 8000 BP). They conclude that the pollen evidence indicates that “the decline of woodland stands through natural processes, and the acceleration of that trend as a consequence of anthropogenic forest clearance from the Neolithic period onwards” (Walker and Lowe 1985, 606).

The following year (1986) Walker and Lowe extended their study to include three sites in western and northern Mull. An analysis of these sites indicated that a similar decline of Holocene woodlands and expansion of heath and grasslands occurred c. 4000 BP. However, at Mishnish and Loch an t’Suidhe some strands of alder (*Alnus*), oak (*Quercus*) and birch (*Betula*) are speculated to have survived much longer, possibly into the Iron Age. The presence of several taxa common to the grazed grassland communities of Mull, strongly suggests that pastoral farming activity was occurring in the area since the end of the Neolithic (Lowe and Walker 1986, 434-35). After analysing a further core from Gribun, western Mull, Walker and Lowe concluded that since c. 4000 BP, anthropogenic factors were responsible for the clearance of woodlands in the lowland areas and coastal localities of Mull while inland woods gradually declined from natural causes (Walker and Lowe 1987, 346). A long (8m) core obtained subsequently, during the excavation of the standing stones at Glen Gorm, displayed a similar vegetational sequence with only limited scrub surviving into the Neolithic, although without the presence of cereal pollen (Hale 1988; Martlew and Ruggles 1996, 122). It has recently been suggested that this period of woodland clearance and agricultural expansion was broadly synchronous throughout much of Scotland (Tipping 1994, 33).

Small clumps of woodland probably survived in the more isolated glens of Mull and Islay throughout the later prehistoric and into the medieval periods but these stands were likely to be small and difficult to access. Adomnan records that when timber (oak) was required for repairs on Iona in the sixth century AD it was imported from near the mouth of the river Seil in Lorn on the mainland (Reeves 1988, 108). The need to go so far afield suggests that timber was not readily available on Mull or the other nearby islands, such as Coll and Tiree, which were routinely visited. By the time of the First *Statistical Account* (1792-96) natural woodland had regenerated on the sheltered east side of Mull and was being exported from Torosay parish to the mainland for iron-smelting (McArthur 1794, 267). The *New Statistical Account* published in 1845 notes that plantations of mixed broadleaf and conifer woods had spread across Mull from Torosay to Fishnish (Clerk 1843, 290), Kilfinichen, Pennycross and Torloisk (Campbell 1843, 305) as the economic value of timber was realised. Today several areas of Mull including Loch Don, Craignure, the heads of Loch na Keal, Loch Tuath and Loch Buie are covered with stands of gnarled oak which can reach up to 10m in height. However, until evidence to the contrary is found, this woodland renewal should be considered a medieval or post-medieval development (Boyd and Boyd 1996b, 54). The First *Statistical Account* for Islay mentions that wood was very scarce on the island and that it had to be imported at a high price (McLiesh 1794, 291). Some woodland was found near Loch Knock in Kildalton parish but this is described as consisting of small timbers (Robertson 1794, 292).

There has been very little palaeoecological evidence recovered from Coll and Tiree, but it has been commonly assumed that the islands were largely treeless during the Holocene (McVean and Ratcliffe, 1962; Birks and Williams 1983; Ball 1983). This absence of tree cover has been attributed to the low lying topography and intense exposure to the salt laden winds of westerly gales prevalent in these islands. During fieldwork for this thesis a series of tree stumps were exhumed from beneath a peat bog on Coll by a local farmer. The stumps were later identified as willow (*Salix*) but their date is still unknown. In the Western Isles, there is some evidence to indicate the

occurrence of willow prior to c.5000 BC (Wilkins 1984, 258) and willow scrub has been recently noted to grow on isolated islands in lochs on the western side of the Western Isles (Glibertson *et al.* 1995, 26). Except for a few small rowan (*Sorbus*) and *Salix* bushes on Coll, no native woodlands exist on the island today and there is no historical record of any. Likewise, on Tiree only a few wind-twisted clumps of sycamores (which are not a component of the native flora), elders, willows and hawthorns can be found in the lee of houses or protected within rock crevices. Recent efforts to grow trees on the machair of Tiree have failed and demonstrate the difficulties of establishing woodland on these wind-swept islands. Trees were quickly killed by salt laden winds after they grew taller than waist-high shielding fence (Boyd and Boyd 1996, 124).

The only detailed environmental evidence for Tiree comes from a charcoal assemblage of birch (*Betula*), hazel (*Corylus*), oak (*Quercus*), alder (*Alnus*), and spruce (*Picea*) and from pollen analysis of buried soils from MacKie's (1974) excavation of Dun Mor Vaul (Pilcher 1974, 204-207). Unfortunately the pollen profile was of limited value because it was constructed of samples from three different parts of the broch and did not represent either a vertical or a dated sequence. Low levels of birch (*Betula*), hazel (*Corylus*) and alder (*Alnus*) pollen were found indicating that only very open woodland may have existed on Tiree. Such small amounts of pollen from individual tree species were present that Pilcher suggests that it is likely to have been wind blown from elsewhere. This explanation has also been supported by Ritchie (1988, 80), who also notes the presence of pollen blown from the Scottish mainland on North Uist. Pilcher concluded "that there was no woodland in the vicinity of Vaul during the Iron-Age" (1974, 206). The charcoal found on the site was considered to derive primarily from driftwood because of the presence of spruce (*Picea*), a tree that is not native to the British Isles. Such driftwood is likely to have come from North America rather than Northern Europe, given the predominant direction of currents in the Atlantic (Boardman 1995, 149; Graham 1952, 135). The pollen analysis also revealed high levels of agricultural activity in the Iron Age on

Tiree and that agriculture had taken place on the island previous to the construction of the broch, probably in the Bronze Age.

Charcoal of oak (*Quercus*), hazel (*Corylus*), elm (*Ulmus*), alder (*Alnus*), willow (*Salix*), and spruce (*Picea*) were also recovered from an Iron Age hut site at Ballevullin, just north of Loch Bhasapoll on Tiree, excavated in 1912 by Henderson Bishop. A report of this site was subsequently published by MacKie, who erroneously assumed that the presence of charcoal indicated that oak and hazel forests were present on Tiree in the Iron Age (1963, 176). This inference was presumably based on the opinion of Brett who states that “Tiree supported an oak forest with hazel shrubs and alder and willow in wetter places” (*ibid.* 182). Brett conceded that the spruce was likely to be driftwood and, besides the presence of the charcoal, no other evidence was put forward to support his theory of significant later prehistoric tree cover. In light of the subsequent pollen analysis at Dun Mor Vaul by Pilcher, Brett’s theory seems to be unsupported.

Recent research in the Western Isles, to which Coll and Tiree are similar in terms of geology, topography, exposure and climate, has shown that open woodlands dominated the landscape there from c. 9000 to 8000 BP (Fossitt 1996, 191). Two periods of subsequent woodland decline have been identified. The first c. 7900 BP has been attributed to a natural disturbance of high magnitude but short duration and initiated the spread of blanket peat (*ibid.* 190). The second major woodland decline occurred c. 5200-400 BP and is also associated with a period of blanket peat expansion. The palynological records indicate that by 2500 BP the Western Isles were “predominantly treeless” (*ibid.* 194) and “dominated by blanket peat” (*ibid.* 193). Whittington and Edwards (1997, 17) agree that the Western Isles were still substantially wooded down to the western shoreline until 5000 BP, when human interference in the landscape became intense. Other research on charcoal recovered from a Neolithic site on Barra suggests that very little mature timber remained on the island by the mid 4th millennium BC (Boardman 1995, 154). If Coll and Tiree have followed a similar sequence of events it is likely that their restricted size would have

facilitated the removal of any woodland then present during the Neolithic. Research is currently underway to establish a more detailed vegetational history of these two islands (Holley and Coles *forthcoming*).

The palynological work of the last two decades has greatly increased our understanding of the vegetational history of the central Inner Hebrides. Although only limited work has been carried out, the results show that the vegetational resources which were available throughout the later Holocene varied from island to island. On Mull and Islay, timber was already becoming a scarce resource during the Neolithic. Coastal areas were quickly cleared, leaving the only woodlands well inland, requiring an increasing effort to obtain wood for construction, heating and other purposes. Until evidence to the contrary is recovered, it can be assumed that Coll and Tiree were treeless since well before the Neolithic. Timber would have had to have been imported to these islands, with driftwood being the only locally available source of wood. By later prehistoric times (c. 2500 BP) the broad vegetational patterns of these islands would have appeared much as they do today and would have been covered by open heath and grasslands, with areas of blanket peat steadily expanding.

### **Soils**

The landscape of the central Inner Hebrides is covered by a complex mixture of soil types. The overwhelmingly dominant soils in quantitative terms are the blanket peats and peaty gleys which cover roughly 57% of the total land area (Hudson and Henderson 1983, 118). Large percentages of the coastal areas of Coll and Tiree are covered by machair. Illustrations 7.1-7.4 show the distribution of modern soil types on the central Inner Hebrides, based on soil cover maps prepared by the Soil Survey of Scotland (Bibby *et al.* 1983). The map indicates that the brown forest soils and the humus-iron podzols, which are conducive to agricultural cultivation and grazing, are confined to small pockets of land; the exception is on Mull, where they cover extensive coastal tracts. These soils form the nucleus of many of the present day farms, and are considered vitally important to Inner Hebridean agriculture (Hudson and Henderson 1983, 115).

The blanket peat and peaty gley soils which cover most of the inland areas of each of the islands considered here, have been the principal inhibitor of agricultural development in the central Inner Hebrides. Most of the dates obtained from basal peat deposits throughout Scotland show that the current peat cover was initiated during the first millennium BC or first millennium AD (Davidson and Carter 1997, 57). Although the factors which led to the formation of this peat are still a matter of some debate (Moore 1975; 1993; Stevenson and Birks 1995), most are linked with the permanent removal of forest. When the trees were felled, microclimates were altered by increasing exposure. A cooler and wetter macroclimate resulted, which increased the leaching of the soil and depressed the activity of soil organisms. This led to the formation of acid mor humus, incomplete decomposition of organic material and peat formation. Leaching of soluble soil materials also led to the formation of iron pan and decreased the drainage capacities of the soils. Both these factors led to the shallower rooting of newly established trees, increasing their susceptibility to windthrow (Moore 1975).

Moore (1993) has argued that human activity was the primary factor in initiating the hydrological changes which led to the development of blanket peat. A combination of direct felling, burning with grazing and trampling of woodlands by domesticated animals all initially promoted local woodland decline. As additional demands were placed on the forest, especially by grazing animals, rates of seed-set and germination were reduced, young saplings were consumed, and woodland did not regenerate. The addition of charcoal to soils from the firing of woodlands or heathlands also increased water retention of affected areas. The inert particles of carbon reduced the porosity of soils causing sandy soils to behave like clay as far as water retention was concerned. Once humans forced the woodland across its tolerance threshold of regeneration natural processes intervened to prohibit new growth by increasing the water retention of soils which facilitated the development of blanket peat. Just across the Sound of Mull, at Achnacree, Soulsby (1976, 282) has attributed the initial decline in soil fertility to "primitive cultivation practices" which

left the ground open to plants conducive to podsol formation. In this instance over-cultivation and subsequent abandonment lead to peat initiation.

The development of blanket peat has produced a highly infertile, acidic, poorly drained soil which supports only a restricted range of vegetation. Resultantly, large areas of the islands are today considered useless for arable agriculture and may only be exploited for rough pasturage and grazing.

Armit (1992, 9) has asserted that, in the Western Isles, the development of peat and peaty soils has been relatively recent, since the latest centuries BC, although recent research indicates that the spread of blanket peat was initiated as early as c. 9100 BP and dominated the landscape by 2500 BP (Fossitt 1996, 193). The limited amount of environmental evidence available for the central Inner Hebrides, indicates that the development of peat occurred there prior to the end of the Neolithic. A core of peat from Islay produced uncalibrated radiocarbon dates of 4095±105 BC (GU-1898) through to 2265±70 BC (GU-1897) indicating the development of blanket peat from the late Neolithic (McCullagh 1989, 38). The work of Walker and Lowe (1986; 1987; 1988) has shown that blanket peat was established on many of the upland regions of Mull well before the Neolithic. By the later prehistoric the peoples of the central Inner Hebrides would have been living in landscapes where large areas of blanket peat were already well established.

It is undoubted that blanket peat has continued to grow and spread throughout prehistory right up to the present day, and now covers many areas of the islands which were relatively "peat free" in the past. This subsequent spread of peat is most visible, for example, on land near the Ledmore artificial islet site on Mull, which was considered arable land in 1770 (J.A. Richmond, unpublished map) but which is now entirely covered with over 0.3m of blanket peat. What is of direct concern to the present study, is that peat growth has encroached into many of the upland lochs of the central Inner Hebrides, changing shorelines, altering water tables, and perhaps obscuring artificial islets. Aerial photographs held at the RCAHMS clearly show

major peat encroachment into lochs over the period 1948-1959. This encroachment is best demonstrated by one section of shoreline in Loch Ba which pushed out by c. 5m during this time period. Other smaller lochs which are naturally less well drained will certainly have shrunk considerably in size since prehistory. It is central to the understanding of later prehistoric settlement patterns of the central Inner Hebrides to recognise that many of the areas now covered with peat may have supported a very different land-surface in the past.

The landscape of Tiree, and to a lesser extent Coll, has also been considerably altered by the development and redeposition of machair. Approximately 30% of Tiree, and 10% of Coll, is covered by the white shell sands which form low-lying dunes and broad, level plains. Proportionately smaller areas on Islay near Ardnave and Laggan are also covered with machair deposits. Machair is highly unstable and is prone to wind erosion where it has not been stabilised by vegetation, or has been exposed by over-grazing and ploughing. The continual shifting of the machair has radically distorted the sand dune landscapes of Tiree since prehistory, and several later prehistoric archaeological sites have been discovered eroding from deflating sand deposits (e.g. Mann 1906; MacKie 1963). Recent research on inter-tidal and submerged organic deposits on Barra and South Uist has shown that shell sands began to transgress into inland areas as long ago as 5-7000 years BP (Ritchie 1979, 114; Gilbertson and Grattan 1995, 8). Sea-level seems to have remained stable between 8800 BP and 5100 BP but rose relatively rapidly thereafter, sweeping machair sands landward and forming the present pattern of inlets, tidal strands, fjords and offshore islands (Ritchie 1979, 111; Ritchie 1985, 175). This submergence and associated coastal retreat has been attributed to an overall rise in the relative level of the Atlantic Ocean, leading to slow long-term subsidence of the land and accelerated coastal erosion. The chronology and rate of this transgression is only partially understood but Armit has asserted that during the later prehistoric even “a relatively small rise in sea level could cause enormous changes in the machair landscape” (1992, 10).

Little work has been done to date on the chronology or rate of transgression of the machair landscapes of Coll and Tiree and, considering that preliminary research in the Western Isles (Gilbertson and Grattan 1995, 8; Gilbertson *et al.* 1995b, 24; Ritchie 1985, 173) has shown that its encroachment is a complex process which may vary from island to island and through time (Angus and Elliott 1992), it is premature to speculate on the exact extent to which this factor has modified these islands' landscapes. A recent field-survey of the machair beaches of Coll and Tiree by Mather *et al.* (1975) has shown that the machair landscapes of the islands have experienced repeated cycles of severe wind erosion and rapid transgression during the past three centuries, possibly in part as a result of the intensive agricultural activity required to support the population increases of the late eighteenth and early nineteenth centuries (*ibid.* 81). Johnston's (1990) research into the historical tax records of Coll and Tiree has support this date and show that sand blow was recorded as a problem at twelve coastal settlements during the period. In some cases (two on Coll and three on Tiree) sand blow was so severe that settlements had to be abandoned (*ibid.* 101). Sand blow was also noted as a problem during this period in the Western Isles by numerous sources summarised by Ritchie (1979, 119).

Both machair transgression and sea-level rise have undoubtedly been active on the islands throughout and since prehistory and would most radically effect Tiree, which is surrounded by a shallow machair shelf. A review of the bathymetry surrounding Tiree (Hydrographic Office 1988; 1991) shows that even a small 1-2m rise in sea-level since the later prehistoric period could have submerged substantial areas of coastline and drowned the potential land bridge to Coll. The bathymetry also shows that the south western end of Coll would have been substantially larger during periods of lower relative sea-level of the order of 2m.

Inland water bodies have also been affected by machair redeposition, which has steadily been pushed back from the coasts, and has partially infilled lochs Bhasapoll and a' Phuill on Tiree, and Cliad on Coll. This phenomenon has also been noted on Lewis (Armit 1992, 10) where it has considerably altered the form and size

of at least two lochs. Ritchie has noted machair deposition on the landward margins of a dozen lochs in the Uists (1979, 113) and has found that the lochs were originally formed when the deposition of machair blocked drainage of the catchments in which they then formed. Although it is unlikely that machair redeposition has masked artificial islets in Lochs Bhasapoll and Cliad, as sites were found in both lochs still standing clear of the water level, this process may have entirely covered any potential sites in Loch a' Phuill, which is now only knee deep.

The agricultural productivity of machair soils is generally quite low for a variety of reasons. The characteristic coarse texture and excessive drainage of the soils increase the likelihood of summer drought and leaves them susceptible to erosion when they are not cloaked by a grass sward. The high alkalinity of the soils generally restricts their arable potential, unless organic materials such as dung, peat, or seaweed are introduced, which increases the yield obtained from them considerably. Coll and Tìree are both fortunate in that more agriculturally productive brown calcareous soils have developed on many of the shell-sand drifts.

## **Summary**

The environmental changes discussed in this chapter have played a significant role in shaping the settlement patterns of the central Inner Hebrides. Although these changes have not generally veiled the perceived distribution of artificial islets, they have radically transformed the landscape within which the sites are set. Ombrogenous peat bog has developed to cover vast inland areas making the identification of dry-land archaeological sites and previous land surfaces difficult, and altering the shape and form of inland lochs. Machair has been continuously shifted by erosion and has been driven farther and farther inland, filling up lochs and mantling lowland areas. To what extent these features had developed by the later prehistoric is unknown, but they have certainly modified the landscape since that time and continue to do so to the present day.

The environmental evidence suggests that most of woodlands had been cleared from the central Inner Hebrides well before later prehistoric times. The woodland decline was probably caused by a combination of anthropogenic clearances, a deteriorating wetter climate, and the subsequent expansion of peat bog. High-intensity low-frequency events such as sudden storm flooding by tsunamis or volcanic eruptions, such as Hekla in Iceland in 1159 BC (Cowie and Shepherd 1997, 166; Baillie and Munro 1988, 346), introducing large amounts tephra into the atmosphere have also negatively affected woodlands during different periods and may have caused a sudden general decline in environmental conditions in Scotland (Dugmore 1989; Bell and Walker 1992, 135), although it may be too early to attribute climatic change to single events (Buckland *et al.* 1997). By the later prehistoric, only the isolated, sheltered inland areas of Mull and Islay would have supported stands of trees while Coll and Tiree would have been treeless. Timber, therefore, would have been a relatively scarce resource on the islands and would have needed to have been imported. This factor must have influenced what type of settlement structures were constructed on the islands, and it seems highly unlikely that the massive quantities of timber required for the construction of a wooden “crannog” could have been easily obtained.

Driftwood has been identified as the major source of locally available timber in the Western Isles throughout the late Holocene but its quantity and frequency of appearance is unknown. Such driftwood is likely to have come from North America rather than Northern Europe, given the predominant direction of currents in the Atlantic (Boardman 1995, 149; Graham 1952, 135). This situation has long been recognised with Pennant noting that part of the mast of H.M.S. Tilbury, a man-of-war burnt off Jamaica, was recovered on the west coast of Scotland (1790, 266) and Beveridge recording that “West Indian shells, beans, and seeds, together with coconuts (even in bunches), bamboo and North American turtles” have been washed ashore on North Uist (1911, 5). Experiments with drift bottles carried out in the 1930s by the Newfoundland Department of Natural Resources conclusively demonstrated that trans-Atlantic currents bring material from the east coast of North

America to the western coast of Scotland (Scott 1951, 152). Although the quantity of this material which was washed up in the central Inner Hebrides during prehistory is unknown, the presence of spruce charcoal in archaeological hearth contexts on both Islay and Tiree suggests that it arrived with sufficient regularity to be used as fuel. Scott doubts that the quantity was ever large enough to allow buildings to be entirely constructed of such wood but that it was available in sufficient quantities to roof structures (*ibid.* 153). The maximum size of driftwood is unknown but Mowat (1996, 114) believes it would have been one of the only locally available sources of timber of sufficient size for the construction of logboats in the Western Islands of Scotland. It is doubtful however that the large quantities of mature, linear timbers required for the construction of pile-dwellings would have regularly arrived on the Hebridean islands by this means.

The evidence examined here indicates that throughout the later prehistoric period the environment of the central Inner Hebrides was becoming increasingly inhospitable. Blanket peat was expanding throughout inland areas, steadily engulfing more agriculturally productive soils and pushing settlements towards the coasts. In contrast to this, relative sea-level was rising and machair was slowly transgressing further inland and engulfing coastal settlements. The climate seems to have continued to deteriorate throughout the region becoming increasingly cooler and wetter. In order to exist in the ever increasingly hostile environment the inhabitants of the central Inner Hebrides would have had to continually adjust their social and economic strategies in response to these restrictions. Conflict is inevitable in such circumstances, when varying groups must compete for ever decreasing resources. The construction of artificial islets may be a response to this increased competition.

## Chapter 3

### Scottish Crannogs: Background

#### **Introduction:**

Crannogs or artificial islets are one of the most chronologically and structurally diverse archaeological site types found in Scotland. Their distribution stretches from Shetland to the Borders and covers nearly every region of the country. Although crannogs may occasionally be found in tidal estuaries (Hale 1992), the majority are located in the fresh-water, inland lochs. Estimates of their numbers range widely and until more of Scotland's lochs have been comprehensively surveyed, they will remain overly tenuous. Oakley (1973) has found that 338 crannogs have been mentioned in previous literature. The National Monuments Record at the Royal Commission on Ancient and Historic Monuments of Scotland has listed 245 sites as crannogs with another 94 categorised as possible crannogs (as of October 1997). Dixon initially estimated there to be 500 (1984, 15) in Scotland but now reckons that their total population may range in the thousands (1996, 7). Despite the frequency of their occurrence, until recently the crannogs of Scotland have received little serious archaeological attention in comparison to many categories of dry-land sites. This situation is slowly changing however, and with the advent of modern diving gear crannogs have suddenly become one of the most exciting and promising archaeological site categories now under investigation.

This chapter will outline the history of crannog studies in Scotland from its development in the 19<sup>th</sup> century to the present day, concentrating on the material gathered by the most recent excavations and surveys. Comparatively little attention will be given to the antiquarian period of research, as this material has been extensively reviewed elsewhere (Oakley 1973; Dixon 1984; Morrison 1985; and Dixon 1991).

## **A critical history of research:**

### **Initial fieldwork**

Crannogs and artificial islets have been studied in Scotland since the 19<sup>th</sup> century and were one of the first types of archaeological sites to be extensively recorded by the devotees of antiquarian interest in the later part of the last century. Crannogs had been noted earlier by the compilers of both the *Old and New Statistical Accounts*, and in studies such as Donald Monro's *Description of the Western Isles of Scotland* (1549) but it was not until the dawn of the antiquarian age and the birth of scientific interest in mankind's past that these sites attracted serious attention. During the middle of the last century it became the vogue amongst the gentry to collect archaeological curiosities, to explore old ruins and occasionally to undertake excavations (Bell 1981). This fashionable interest, like most things in the Victorian period, has been well documented and it is from this that the development of the archaeological study of crannogs in Scotland can be traced.

The first antiquarian notices of crannogs appeared in print shortly after land improvement schemes, primarily on large estates, were initiated throughout Scotland during the last century and many of the country's small lochs were drained in order to create new fields for grazing. The proprietors of many of these estates were often educated men who recognised the interest and the antiquity of the small islets which were occasionally revealed as the lochs were drained. Mid-way through the century substantial curiosity in these islets was generated after Keller published his book on the lake dwellings of Switzerland (1866). The considerable public attention given to the Swiss sites soon lead to more thorough investigations of those in Scotland and notices of their discovery sharply increased in number thereafter (Munro 1882, 16).

Unfortunately many of these early antiquarian notices of crannogs are only cursory in nature and are therefore of limited assistance to the modern researcher as

they were made before appropriate standards for archaeological field-reporting were developed. The precise reasons for their limited usefulness are:

1. With the notable exception of Munro's reports (discussed below), most of the notices recorded only brief descriptions of the crannogs. These lack organised structure, thoroughness and in many cases actual measurements.
2. Most of the crannogs which were extensively described were ones discovered through loch drainage operations. In many cases these sites were examined months after the lochs were drained, when their organic deposits were already well decayed and their natural weight had compressed the islet's organic structural components. The descriptions thus refer to sites which had been considerably altered by natural drying processes subsequent to their emergence from their watery environment.
3. In most cases those sites which were not drained were described from shore, which severely limited the detail of descriptions and precluded obtaining measured distances.
4. Many of the antiquarians also described sites based upon second hand information (often the vague recollections of farmers), which could vary greatly in age. In few instances was this second hand information actually verified in the field.
5. With the exception of the Reverend Odo Blundell (discussed below), none of the early antiquaries utilised diving equipment, so that most underwater features could only be viewed from the loch's surface and then be investigated by probing with poles.

The antiquarian period's primary contribution to crannog studies was the identification of sites, on which many modern distribution maps (e.g. Oakley 1973;

Dixon 1984; Morrison 1985; Henderson 1994) are still substantially based. However, it should be noted that many of these sites have not been checked by professional archaeologists since this period. As a result many of these early reports identify sites as crannogs which are not indeed artificial in nature (as will be seen in the central Inner Hebrides, Chapter 5).

Although the accuracy of antiquarian observations is open to question, a study undertaken by the writer of crannogs noted in the *Proceedings of the Society of Antiquaries of Scotland*, in which the majority of the accounts were published, reveals that many structural features are mentioned repeatedly in connection with crannogs. A large number of these common elements are still used to identify artificial islands and for that reason are summarised below.

1. Many of the crannog descriptions note that the sites were surrounded by wooden piles and/or had wood as a major component of their surviving structure at the time of discovery or recording. Much of this wood was identified as oak, but small amounts of birch and hazel were also described. Some have argued that the antiquarians were not capable of accurately identifying types of wood and were misled by the darkness and other transformations which have affected water-logged timber (Dixon *pers. comm.* 1994). However, it should be remembered that most of the antiquarian investigators were educated and, due to every-day usage of timber, had a familiarity with woods which the average person today does not possess. It can be argued, therefore, that the antiquarian observations are likely to be correct and that the majority of the crannog timbers studied at that time were of oak.
2. In at least half a dozen cases, wooden beams were observed to display evidence of carpentry. A number of authors record timberwork jointed by mortises (Grigor 1863, 332; Stuart 1865, 116, 117, 119, 120, 126, 141; Scott 1868, 16; Wilson 1871, 375).

3. In seven instances, wooden causeways, in the form of parallel lines of upright posts fixed in the loch beds, were observed to connect the crannogs to shore (Mackinlay 1863, 44-45; Stuart 1865, 117, 139; Scott 1868, 16; Campbell 1868, 465; Stuart 1873, 286; Burns Begg 1887, 122).
4. In almost every case crannogs are described as masses of material which had been deposited in water bodies in order to form a solid structure, literally the creation of an island. The antiquarians generally did not perceive the crannogs to be free-standing structures, analogous to pile-dwellings as known by this time about the mouths of the Orinoco and Amazon in South America (Bates 1870, 19-21), Lake Mohrya in Central Africa (Cameron 1877, 63; Gibb 1869, 311) and along the coasts of New Guinea and Borneo (Munro 1882, 4).
5. Almost every crannog noted employed stone in the form of unshaped or roughly-shaped boulders in its construction to some extent.
6. The presence of animal bones and other organic midden material was often noted on, or near the sites (Stuart 1865; Wilson 1874; Love 1875; Burns Begg 1888) suggesting that the sites were once used as domestic structures.
7. Offensive weapons were only found on two of the crannogs: two iron spearheads at Lochlee (Munro 1879, 228), an iron spearhead and three iron arrow points at Buston (Munro 1881, 111).
8. In more than fifteen cases antiquarians have noted that log boats, thought to be made from oak, were found re-used as part of, or near to crannogs (Burnett 1850, 26; Gregor 1863, 177; Stuart 1865, 118, 119, 120, 139, 171; Campbell 1870, 465; Love 1875, 286; Burns Begg 1888, 118).

9. Although direct association between log boats and crannogs can only be established in a few cases, Mowat, in his study of these craft, notes that “the discovery of several logboats built into crannog (sub-) structures justifies an inferred date in the later prehistoric or early historic periods in each case on the assumption that these are redundant boats re-used as beams or infill” (1996, 132). Although the dating of the logboats from their association with the assumed chronological range of crannogs may prove to be questionable, there does seem to be a strong connection between crannogs and primitive water craft.

These generalisations merely summarise the major points found in early notices of crannogs. Further discussion of their contents can be found in studies by Dixon (1984) and Oakley (1973).

The antiquarian perception of what a crannog is can best be summarised by reference to Dixon’s overview, taken from his unpublished Ph.D. (1984):

“... it was generally accepted that a crannog was a basically artificial island usually with a timber and brushwood foundation supporting a house with a log floor and clay or stone hearth, possibly surrounded by a stockade and with a gangway to the shore. Boulders in or on the structure were seen as providing strength for the uprights or acting as a barrier to water erosion” (Dixon 1984, 47).

### **The contribution of Munro and Blundell**

Robert Munro, who is considered by many to be the father of crannog research, was unquestionably the most scientific of the antiquarian researchers. The author of two books, *Ancient Scottish Lake Dwellings or Crannogs* (1882) and *The Lake-Dwellings of Europe* (1890) and at least 15 other articles on crannogs, Munro applied a standard of precision to his research which was unprecedented at the time.

Munro's works have been extensively reviewed elsewhere (Dixon 1984, 37-92) and will only be briefly commented upon here.

Munro's knowledge of crannogs was primarily based upon excavations he carried out in Ayrshire at Lochlee (Illustration 3.1), Buston (Illustration 3.2) and Lochspouts, on sites in drained or partially-drained lochs. These excavations were the first in Scotland to provide plans and sections of crannogs, as well as detailed notes of structural features. Artefacts were also recorded and drawn in some detail. Munro developed theories regarding almost every aspect of crannogs and their dwellers (discussed extensively below in Chapters 6 and 7), which remained relatively unchallenged for almost a century.

Munro thus laid a solid foundation for subsequent studies of crannogs in Scotland, as well as providing a framework for considering these sites alongside comparable structures from elsewhere in Europe (1890). However, recently at least one of the sites that Munro excavated has been shown to be more complex than he thought (Barber and Crone 1993) and many of his theories concerning the structural typology of crannogs have been challenged in Dixon's unpublished work (1984). Munro's principal errors, however, are that he believed that the distribution of crannogs was primarily focussed on SW Scotland, where the majority of his own work took place, and that most crannogs were constructed during, or after, the Roman occupation of Scotland (1905, 164). Subsequent research has shown that each of these assumptions is incorrect.

At the end of the last century Munro was instrumental in provoking an argument known as the "Clyde controversy", which sent the archaeological establishment in Scotland into heated debate. The controversy centred around objects recovered during the excavations of Dumbuck crannog, on the river Clyde, and from the nearby hill-fort of Dumbaie. Several slate objects resembling spearheads, anthropomorphic figures and pendants were discovered at Dumbuck (Bruce 1900). The objects were unique not only because they were the first artefacts of these forms

made of slate discovered in Scotland, but also because many of the objects were decorated with incised lines and linear ornamentation. The objects from Dumbuck found parallels only in material recovered from Dumbuie which was excavated by the same individual (Miller 1896). After examining the objects and the site at Dumbuck, Munro alleged that the slate objects were, “not genuine relics of the people who constructed and inhabited the crannogs” (Munro 1905, 150) but were instead modern forgeries. Munro also disagreed with the excavators interpreting the site as a “Neolithic period pile-structure” (*ibid.* 153) based both on the structural evidence they discovered and upon these finds.

A bitter argument between Munro and the excavators ensued in the newspapers and proceedings of various archaeological societies in which prominent scholars took each side of the issue. The arguments became so complex and drawn-out that Munro published a book entitled *Archaeology and False Antiquities* (1905) outlining the controversy’s progression in chronological order. Munro’s arguments against the validity of the slate objects, based upon their functional utility and paucity at other Scottish sites, are convincing and his opposition had to go as far afield as Australia to cite archaeological parallels (Bruce 1900, 459; Munro 1905, 177). The unique nature of the objects and the lack of worked flints on the site, or any other object which could be traced to the Neolithic, led Munro to question the date the excavators assigned to the site. Munro also argued that the multiple layers of beams and the general depth of timber uncovered on the site precluded the possibility of the site being a pile-structure and ended the debate with the statement that he did not, “know of a true pile-dwelling in Scotland belonging to any period” (*ibid.* 164). Although the original excavators did not offer any additional evidence to support their theories, they stood by their original interpretation of the site and claimed that the slate artefacts were genuine (Bruce 1900).

The inevitable consequences of the Clyde controversy were that the legitimacy of crannog research was called into question and bad feelings developed between archaeologists working on them in Scotland. These factors probably greatly

contributed to the decline of crannog research before and after the First World War and explain why these enigmatic sites were largely ignored by the mainstream of Scottish archaeology for the next seventy years.

A Benedictine Monk named Odo Blundell was one of the few archaeological researchers in Scotland to escape the Clyde controversy unscathed and was the last of the antiquarians to study crannogs. A true innovator, Blundell was one of the first to employ diving dress and a water telescope to investigate crannogs underwater first hand, in Loch Ness (Blundell 1909). Blundell thus produced the first major underwater survey of artificial islands in highland lochs (*ibid.*). This survey was followed by his article "Artificial Islands in the Highland Area" (1913), which was essentially a gazetteer of the crannogs found in the Highlands of Scotland based on his own research. Although this survey greatly increased the number of known sites in the Highlands and Islands, its content should be viewed with some caution. The work was based on questionnaires, asking for information on crannogs, which were circulated to Highland clergy and landowners. Sites were identified as being artificial solely on the opinion of a variety of local people from all across the Highlands. In many cases these people did not provide measurements and could only give vague descriptions of sites which were often only viewed from shore. The accuracy of this survey is also called into question by the fact that many of Blundell's sources had no comparative knowledge of artificial islands upon which to make accurate identifications.

The close of the antiquarian period of research was signalled by the First World War. Blundell left his research to become a chaplain with the British forces and Munro's failing health prevented further organised work. A brief excavation was carried out at Loch Kinellan (Fraser 1917) under Munro's partial supervision but the excavation was too disorganised to add much useful information to what was already known about crannogs.

## **Excavations on Scottish crannogs during the following half century**

After the work of Blundell and Munro, popular archaeological interest in artificial islets waned in Scotland until the 1970s. The intervening period was marked by only four excavations, the most detailed of these occurring at Eadarloch (Inverness-shire) and Milton Loch (Stewartry of Kirkcudbright). These excavations are highly important as they were the first to employ modern techniques of excavation and site recording, thus allowing a detailed picture of each of the sites to be achieved. Many of the theories concerning the structural form of crannogs which are currently being posited are based on these early excavations, particularly the one in Milton Loch. For this reason each of the excavations will be reviewed in detail below.

### **Lochend Loch, Coatbridge, Lanarkshire**

The excavation of Lochend crannog, Coatbridge, Lanarkshire occurred in 1932 but is perhaps best placed in the antiquarian tradition. The site was discovered when the loch was drained and deepened as part of a park enhancement scheme. The excavation was carried out by local workmen under the supervision of Mr. Ludovic Mann and was reported by James Monteith (1937). The site was oval in shape (Illustration 3.3), measuring 90 by 120 feet (27.5m by 36.5m), and located 70 yards (64m) from the former edge of the loch. Excavation revealed occupational debris, such as a large quantity of worked wood, pottery, animal bones, spindle whorls, a jet bracelet, a large cache of hazel nuts and two rotary quern stones. Burnt timbers, charcoal (of oak and birch) and fire-cracked rock were also found throughout the site, indicating that it had once been burned. Fragments of two human skeletons were recovered, one of which had been burned within the main structure. The substructure of the islet was reported to be built of alternating horizontal layers of timbers, clay, small branches and ferns. Monteith indicated that at least one timber floor level remained intact at the time of excavation. Although the excavator reached no conclusions as to the chronology, economy or history of the site, several of the site's features indicate that it served as a dwelling.

### **Eadarloch, Loch Treig, Inverness-shire**

A site at Eadarloch, Loch Treig, western Inverness-shire, was excavated and recorded by Professor James Ritchie of Edinburgh University in 1933 after it was exposed during loch drainage operations preceding the construction of a hydroelectric dam for the British Aluminium Company in Fort William (Ritchie 1942, 8-78). Ritchie recorded many of the local traditions regarding the use and origin of the islet and speculated that it was used as a temporary refuge, probably against wolves. The crannog site was planned roughly; and scaled cross-sectional plans were produced. This attention to detail and thoroughness allows a relatively complete picture of the site to be gained.

Ritchie makes several observations regarding Eadarloch crannog's siting and construction which deserve special mention. They are noted here to show how well the site compares with material and features found on other excavated sites.

1. The centre of the crannog was situated 128 feet (39m) from the nearest shore (Ritchie 1942, 11).
2. The crannog was surrounded by water over 7 feet (2.13m) in depth prior to drainage (*ibid.*).
3. The crannog was described as "a great oval heap of rounded stones and boulders". The stone mound stood 8 to 10 feet (2.5-3m) high and had a basal area measuring 40 by 60 feet (12m by 18.3m) (*ibid.* 20). The upper platform measured 16 by 33 feet (4.9m by 10m) (*ibid.* 21).
4. The upper structure of the crannog consisted of a horizontal timber gridwork. The timber used was pine or birch, up to 31 feet (9.45m) in length. Individual timbers displayed little sign of tapering, suggesting that they were cut in a well grown forest (*ibid.* 30). Timbers were joined together by square half-checks through which dowel-pegs were driven (*ibid.* 30). These checks were believed to be have been cut by an iron tool and the dowel holes burned through, rather than augered out. Dowels were squared into octagonal-shaped pegs (*ibid.* 32). The timber structure

was held in place by slender birch posts 6 inches (15cm) in diameter, inserted into the lake bed, with the bark still on them. (*ibid.* 33).

5. The upper timber framework rested upon alternating layers of heather mixed with bracken, brushwood, timber and earth and stone packing (*ibid.* 35). The layers of brushwood were considered to have prevented the crannog from sinking into the lacustrine mud (*ibid.* 52).
6. The islet was accessed by a timber landing stage (*ibid.* 47).

In Ritchie's report of the Eadarloch excavation he made many observations about the form and structural composition of the crannog which departed from Munro's views, the latter formed, as has been noted, primarily around his first-hand experience of Ayrshire examples. He hypothesised from the differences in the scale of the sites that the crannogs excavated by Munro in the South West of Scotland were akin to "lake villages" (this term was left undefined, although the obvious candidates for him to have had in mind were those of Somerset examined by Bulleid and Gray 1911; 1948) while the crannogs located in the Highlands, such as Eadarloch, should, in his view, be considered as "lake-hutments" (*ibid.* 9). Ritchie's primary departure from conventional thinking, however, was that he believed the Eadarloch site to be rectangular rather than circular or oval in shape, and from this he inferred that the building set upon it was also rectangular in plan (Illustration 3.4).

An unpublished investigation of the site by Dixon in 1983 revealed that the Eadarloch crannog had not been fully excavated and a substantial mound still remained (Dixon 1984, 54). Dixon has stated (*pers. comm.* 1993) that the site, as it survives after Ritchie's work, is clearly oval and not rectangular in shape. Dixon's 1983 investigation also reported that "a ridge of stone is clear now" (1985, 54), between the site and shore, "and cursory examination established the existence of substantial, parallel, horizontal beams running along the ridge close to the surface" (*ibid.*) This feature, presumed by Dixon to be a causeway, was not reported in Ritchie's investigation.

Ritchie further distanced himself from established thought by disagreeing with the sinking raft method which Munro had proposed for crannog construction, whereby components of the timber substructure were floated from shore to be sunk by depositing stones and earth on them. Instead, he suggested that at Eadarloch the crannog builders lowered the water-level of the loch by deepening its outlet, allowing the superstructure to be built in the dry. This would also have allowed materials to be transported easily to the site by floating them on the remaining shallow water. The outflow from the loch was later dammed up and the water-level returned to its former depth. While this theory is certainly possible, there is no evidence to suggest that such an elaborate scheme was employed. In order to prove such a theory it would be necessary to excavate the loch's outlet in order to establish whether it had been subject to human interference.

Ritchie concluded that the site was constructed "at a period in closer contact with the construction of crannogs of Romano-British times, and the modifications and improvements which they introduced into the design suggest that they lived at the end of or soon after those times" (Ritchie 1942, 74). However, at least one phase of the site is suggested to occur between the Mediaeval Period and the sixteenth century; based upon documentary evidence, a Mary Queen of Scots coin, and other artefacts found on the site. Use of the site during this period, however, need not preclude earlier beginnings for the construction, for which there is some evidence (*ibid.*).

### **Milton Loch Crannog I, Stewartry of Kirkcudbright**

Milton Loch Crannog, Kirkcudbrightshire, was excavated in 1952 by C. M. Piggott. Rescue work was considered appropriate as it was believed that the surviving remains were suffering from exposure to wind and fluctuating water-levels. It was one of two crannogs in the loch; the other example has not been investigated. This was the first excavation to have been carried out conforming to modern standards of archaeology.

Piggott identified several key features of the crannog's structure which are worth reiterating, as they give a fairly clear picture of the site's construction.

1. The crannog was initially described as "a round stone-covered island some 35 feet (10.7m) across" (1952, 136). The stones were later described as "small" and "weathered" (*ibid.* 136).
2. Stumps of vertical piles protruded through the stones, suggesting a substantial timber frame-work, incorporating piles fixed into the lake-bed.
3. The crannog was connected to the shore by a wooden causeway described as having been defined by "two approximately parallel lines of upright posts" (*ibid.* 136) 100 feet (30.5m) in length.
4. Removal of the stone covering from the crannog revealed that the site was primarily constructed of timber. A floor level of parallel timbers, identified as alder and birch, was observed between the end of the causeway and the interior of the structure. Beneath this level was another horizontal layer of "large logs" which were laid both radially and concentrically in relation to the centre of the site. The foundations of the site were described as being built on the "raft principle" (*ibid.* 141).
5. A large piece of timber with square mortises cut into it was discovered directly aligned with the causeway and was positioned some 9 feet (2.8m) towards the centre of the islet. This feature was interpreted as a threshold to a structure which occupied the centre of the site (*ibid.* 137).
6. The centre of the crannog was dominated by a hearth of large stones and clay, 12 feet (3.7m) across.
7. Several sections of decayed wattling were found lying horizontally (*ibid.* fig. 3) and interpreted as the remains of internal dividing walls.
8. Attached to the crannog was a horseshoe-shaped, mound of stones, interpreted as a breakwater, which was edged on its external margin by vertical piles.

Several artefacts were also found during the excavation. A wooden plough stilt and head were found beneath the foundations of the crannog superstructure and a

rotary quern, a spindle-whorl, and two wooden gorges were found at other locations on the site. Each of these artefacts was interpreted as showing that the crannog dwellers engaged in agricultural activities. Several seeds and fragments of food refuse were found, indicating that domestic occupation occurred on the site. A bronze loop was also found and identified as a Roman-period find of Pannonian type by its distinctive features. It was upon this find that Piggott initially dated the crannog to the second century A.D., the Pannonian auxiliaries posted in North Britain at that time (*ibid.* 146).

Piggott's excavation was hampered by a host of problems and many of the conclusions that she reached were later proved to be incorrect. Rising water levels in the loch severely restricted the excavation of the site, preventing investigation of the foundations, harbour area and causeway. The results and conclusions of this excavation are therefore of reduced usefulness because it left large areas of the crannog unexplored. The dating of the site was subsequently found to be in error fifteen years later when a radio carbon date of 400+100 BC uncalibrated (K-1394. Lerche 1969) was obtained for the plough. A further date was later supplied for one of the vertical piles, (490+100 BC uncalibrated; K-2027; Guido 1974) confirming this early date, and eliminating the possibility that the ard was already old when it was incorporated in the substructure of the crannog. In light of this radiocarbon evidence it seems that the site at Milton Loch had at least two periods of occupation, or that there was at least recourse to it several centuries after its original construction.

The nature of the structure in Milton Loch has been confused by the accounts published by subsequent commentators. These have introduced significant variations in the interpretation of the findings as presented in the site report but without justifying the changes. Thus Piggott clearly states that the foundations of the site were built upon the "raft principle" (*ibid.* 141), where layers of structural material were deposited directly onto the loch bed. Despite this, both the artist's reconstruction of the site (*ibid.* fig. 5) (Illustration 3.5) and a picture of a scale model reconstruction (*ibid.* plate XV: by Jack and Margaret Scott; now in the Kelvingrove Museum,



Glasgow) (Illustration 3.6) show the crannog as a free-standing pile structure. The plans of the site (Illustration 3.7 and 3.8), however, render this possibility extremely unlikely as there were an insufficient number of piles encountered in the interior of the crannog at the time of excavation (*ibid.* fig. 7, fig. 6) to have supported a raised platform. The presence of several layers of horizontal timbers and the lack of evidence of jointing, dowels or ties indicating that these were connected to the vertical piles, also undermines this theory. It seems clear then that artist and model-makers stretched the archaeological evidence to fit their own preconceptions of crannogs, rather than depicting the structure indicated by the excavation's findings. This incorrect artistic impression of the site has had far-reaching consequences; indeed it is largely responsible for the idea that all crannogs are pile-dwellings as depicted in modern, popular publications (e.g. Ross 1991, 103; Hesketh 1988, 11; Reid 1993; Feachem 1963, 189; MacSween and Sharp 1989, 19; and Armit 1997, 34).

### **Loch Glashan, Argyllshire**

In April of 1960, a crannog was discovered in Loch Glashan, Mid Argyll, after loch levels were lowered for work on a hydro-electric scheme. The crannog was excavated in July of the same year by Mr. J.G. Scott who published a brief excavation report and notice in *Discovery and Excavation in Scotland* (1960, 8-9). The RCAHMS later published additional plans (RCAHMS 1988, 205-208) (Illustration 3.9) but the full details of the excavation have never been reported.

The DES report, although brief, contains several notable details about the structure of the site. The surviving top of the crannog was found to be 9 feet (2.7m) below the surface of the loch, implying that the loch must have been subject to fluctuations in water-level or that the structure had sunk into the mud which was reported to surround it. The crannog was sited near an abrupt slope in the loch-bed giving it easy access to open water. Initial observations of the crannog include that it was "a low mound, largely covered with stones, about 55 ft. (16.8m) long and 35 ft. (10.7m) wide" (Scott 1960, 8). The stones were found to form a thin, superficial scatter, except in the NW sector where their depth of 3 feet (1m). was interpreted as

indicating the foundations for a circular hut. The site was observed to be composed mainly of brushwood, laid directly onto the lochbed, on top of which layers of horizontal logs, identified as oak and silver birch, were placed. Several of the logs had “roughly trimmed” (*sic.* RCAHMS 1988, 207) flattened tops which the excavators interpreted as being the remains of a floor level of a building measuring 15 ft. (4.5m) by 24 ft. (7.5m). “Sockets cut into the timbers of the sub-floor” (*ibid.*) were thought to indicate the positions of the uprights of the building. At one end of the building the logs were overlaid with slabs of stone, this feature being interpreted as a hearth. A few vertical piles were found edging the perimeter of the side of the site facing open water. The Loch Glashan crannog was dated to the period between 500 A.D. and 850 A.D. based on finds (discussed below) recovered from the brushwood foundations. High water-levels prevented excavation into the basal layers of the site.

The RCAHMS report (1988, 205-208) on the site was produced in co-operation with J.G. Scott and is more complete than the one found in DES. The RCAHMS records that the crannog is 40m from the old shoreline, 0.9m in height, and 11m by 16m in size. These measurements are larger than Scott's but the RCAHMS reports that up to a third of the site may have subsided into deeper water making it hard to estimate the original size.

Apparently the site was divided into six sectors by Scott, of which four were excavated. The RCAHMS reports that an almost complete vessel of E-ware was recovered during excavation, and has dated the site between the later 6th and 8th centuries AD, by this find. A logboat was also discovered 950m NNE of the crannog.

Other artefacts recovered from the site include: a trough, four bowls, a paddle, a scoop, numerous pegs and pins, various pieces of clothing made from scrap leather, a small iron axe head, a bronze penannular brooch, and up to sixteen rotary quern stones. The wooden artefacts were recently studied by Caroline Earwood (1990, 79-94) as part of a project on the manufacture and use of wood artefacts from prehistoric and early historic Britain and Ireland. Earwood's study shows that a large majority of

the artefacts were of domestic type. Several troughs and dishes were examined and a bowl fragment showed evidence of turning. A spatula and several dozen pegs and pins, believed to be used in securing mortise holes, were also identified. Several fragments of wooden handles, probably for chisels, gouges, or awls, were found to have similarities to handles found on first millennium AD crannogs in Ireland. Earwood concluded that there was a striking parallel between the Loch Glashan artefacts and those found in Ireland indicating the “exchange of ideas and techniques if not of people and goods” (*ibid.* 92).

Earwood noted that her study was limited by several factors. Many of the artefacts recorded in the original finds lists had been lost or had suffered as a result of poor conservation. None of the wood species were identified before conservation and as a result they can not now be identified without severely disfiguring them. In almost every case the conservation processes has obscured tool marks which would have given clues to the method of manufacturing the artefacts.

### **Academic Awakening**

After a half century, during which only emergency excavations of crannogs were conducted, academic interest in crannogs was rekindled. Sport diving became popular in the late 60s and suddenly sites which were previously beyond the reach of the archaeologist became accessible to the adventurous. By the early 70s the antiquarian notices of crannogs were beginning to be reviewed and major underwater field-surveys initiated. This level of activity in the research of crannogs was to continue for another two decades and would establish that crannogs were a vital part of the archaeological landscape of Scotland.

### **Lily Savory**

The first dissertation to be submitted for a degree, on the subject of crannogs, was written by Lily Savory in 1973 for a M.A. in archaeology at the University of Edinburgh. This work was confined to the Solway-Clyde province in the south west

of Scotland and reviewed the large body of work produced by Munro and the other antiquarians. Savory did not attempt any fieldwork herself. Instead, old site plans and descriptions were reworked and outlined in clear form (Savory 1973, appendix I) and an extensive study was made of the artefacts recovered from Solway-Clyde sites. (Savory 1973, 23-52)

Savory amassed an extensive site gazetteer upon which many of her general observations were based. Her findings confirmed that crannogs were deliberately built even when natural islands were available (*ibid.* 5). A majority of sites in the province were situated in small lochs which were not subject to strong currents or wave action (*ibid.* 6). She further noted that wood played a primary role in the construction of all the crannogs and that, “purely stone-built crannogs” (*ibid.* 6) did not exist in the region. A study was also made of relative distances from shore and the depths of water surrounding the crannogs (*ibid.* 7).

Although the findings of Savory's work were limited, progress had been made in clarifying the work of Munro and the other antiquarians. Her study of small finds is somewhat less useful as antiquarians seldom recorded the context of the artefacts. The finds therefore, at best, can only partially indicate the economy and approximate period of occupation or reoccupation of their respective sites.

### **Gwynne Oakley**

A comprehensive study of Scottish Crannogs was submitted by Gwynne Oakley, in 1973, for a M. Phil degree in Archaeology at Newcastle University. This work was the first to attempt to compile all of the previous literary accounts of crannogs in Scotland and to provide a thorough history of research. The result of this exercise was an extensive and detailed site gazetteer which included 338 sites. As discussed below in Chapter 5, most modern distribution maps of crannogs are still based on Oakley's gazetteer. English and Irish crannogs, including their artefacts, were also reviewed and compared with the Scottish material.

Before proceeding to analysis, Oakley subdivided the Scottish crannogs into three groups: 159 certain crannogs, 81 probable and 98 possible. This system of grading has persisted to the present day and is used in the RCAHMS Inventories. The accuracy of Oakley's system, however, is questionable. Oakley does not indicate what criteria the sites had to meet to be included into each of the respective groups. Another limiting factor in this subdivision is the detail and accuracy of the antiquarian accounts, upon which a large part Oakley's study is based. Some of the accounts are little more than two or three sentences which lack detail and simply state, "something that 'somebody' thinks is a crannog exists at X". Without additional field investigation, notices such as these cannot be relied upon and will significantly bias data, as is shown to be the case below (Chapter 5).

Oakley broke other new ground by compiling a data-base of all of the excavated crannogs' structural material and associated artefacts. The analysis of this data is summarised and discussed here. In the Western Isles, 26 suspected crannogs have brochs, duns or similar dry-stone structures built on them. On the mainland, 50 crannogs have stone buildings or castles on them, 27 of which were supposedly occupied in the medieval period or later. Structurally, 80 sites have provided evidence for horizontal timbers and 69 have vertical piles. To some extent, 43 crannogs had been excavated at the time the data-base was compiled; but only 23 have yielded finds which provide an indication of the date of the occupation of these sites. Surface dimensions were available for 109 sites, 72 of which fit into the 20 foot to 80 foot (6.3m to 24.5m) diameter range.

Artefacts recovered from the excavated sites encompass a wide range of domestic items. The artefacts most commonly found were quern stones, 29 of which were found on 9 different sites. Nine sites also produced a total of 12 spindle whorls; and 14 hammer stones were found on 8 sites. Other artefacts commonly found on sites included: worked flints, whetstones, iron tools, and a wide range of pottery types.

The value of Oakley's work is limited by several factors. First, the work is exclusively a desk-top exercise: Oakley did not visit any of the 338 crannog sites and thus can only be as reliable as the information upon which her work is based. Much of the material which Oakley compiled is presented as raw numbers with no indication of their statistical significance. For instance, 50 crannogs are stated to have stone buildings on them, however it is not clear if that is 50 of the 159 certain crannogs, 240 (including probable) crannogs, or 338 (including possible) crannogs. The set of comparanda must be defined before the raw numbers will obtain significance.

Oakley's conclusions are varied and interesting. She theorised that crannog-like structures were first developed in the Neolithic in response to the changing climate. As the climate became colder and wetter in the Late Bronze Age, crannogs were utilised as a defensive response to the resultant competition for resources. The size of most crannogs suggests that they were occupied by a single family unit, probably farmers who controlled the decreasing grain supply. Excavated sites indicated that occupation of them was intermittent across the centuries and that many sites were subsequently rebuilt with new features, such mortise beams and stone (*ibid.* 112-113). These theories were innovative for the time and have subsequently been supported as regards the early use of this portion of the environment for constructions by excavations in the Western Isles (Armit 1988; 1989; and 1996).

### **Loch Awe Survey**

The first modern underwater survey of crannogs was carried out in Loch Awe in September and October of 1972 under the direction C. McArdle, Drs Duncan McArdle and Ian Morrison. This survey was produced with the help of Naval Air Command divers, the University of Edinburgh and the University of Liverpool Sub-Aqua Clubs, who checked possible sites indicated through the study of aerial photographs, Ordnance Survey maps, and literary notices. Over sixty possible sites were investigated with twenty proving to be man-made. This exercise pioneered the techniques used in modern underwater surveys and the methods for recording the underwater features of crannogs. Besides being the first large-scale underwater survey

of its type, this expedition was the first to attempt to identify a "total-cull" of the crannog sites located in a large loch (Hardy, McArdle and Miles 1973).

Sites identified by the survey were found to vary greatly in size and shape and displayed a variety of features including causeways, harbours, jetties and middens. Structural timbers were found to project from 9 of the confirmed sites and several small finds such as rotary and saddle quern stones, pierced weights, a round chipped stone disc, and a fragment of bronze sheet were also discovered. Timbers were sampled from two of the sites (Inistrynich and Ederline Boathouse) with the intention of obtaining radiocarbon dates for each; however, only the sample from Ederline was eventually dated and this produced a determination of 370 BC  $\pm$  45 uncalibrated (UB 2415) (Morrison 1981, 347). Morrison noted that crannogs were found at many varying positions throughout the loch but that almost all were near "reasonable agricultural land" (Morrison 1973, 19).

One of the primary goals of the 1972 survey was to produce a corpus of field-survey data with which to compare the crannogs in Loch Awe to others throughout Scotland. Without such an index of site attributes McArdle and McArdle postulated that it would be impossible to devise a rational programme for deploying the inevitably limited resources for excavation and that, "without a broad knowledge of the areas in question, excavations on any sites are "shots in the dark", since it will not be known whether these are typical or not, or belong to an exceptional type" (McArdle and McArdle 1973, 9). The variables to be measured by the survey included: variation in size, shape, type, depth of surrounding water, and the frequency of external features such as harbours, jetties, and causeways (McArdle and McArdle 1973a; McArdle and McArdle 1973b; and McArdle and McArdle 1973c).

Although each of these variables was assessed, the results of the survey were reported in a summary format which generally did not include specific measurements for each of the individual sites. This is because overly detailed survey of the crannogs was not considered to be as important as identifying each of sites which few

archaeologists believed existed at the time (Dr. D McArdle *pers. comm.* 1997). In appendix 3 of the 1973 report (Hardy, McArdle and Miles 1973) Morrison included charts which listed the individual heights and water-levels (in feet) surrounding the crannogs as well as the measurements of their major and minor axes. Archaeological site plans were furnished for only 6 of the 20 crannogs discussed in the original report. Specific measurements for each site were also excluded from subsequent publications (McArdle and McArdle 1973b; 1973c) and archaeological site plans were not publicly available for all of the sites in Loch Awe until the publication of Morrison's book in 1985. It is unfortunate that many of the measurements taken by the 1973 survey have never been published but all of the original field-notes and data still exist and may soon be publicly available (Dr. D. McArdle *pers. comm.* 1997). The RCAHMS have included the Loch Awe crannogs in subsequent Inventories for the area (RCAHMS 1975; 1988) but have not re-inspected the sites and have relied upon information gathered by the 1972 survey (Hardy, McArdle and Miles 1973; McArdle and McArdle 1973b). Even though the Loch Awe sites were only surveyed once there are major inconsistencies in the data reported within and between the various publications (see Chapter 8 below).

Although the Loch Awe survey failed to produce in published form the database of structural and spatial variables that it set out to achieve, it had an appreciable impact on Scottish archaeology. The survey established that large scale, organised, underwater surveys could be carried out with the same precision as dry-land surveys. It also demonstrated the need for modern underwater survey of highland lochs. Fifteen sites which were previously "unknown" were discovered, whilst many other potential crannogs hypothesised in earlier sources were definitively eliminated, thus significantly changing the archaeological distribution and perceived settlement pattern for that area. Perhaps the most important result of this survey was the reawakening of enthusiasm for crannog research.

### **Loch Tay Survey**

The second large-scale underwater crannog survey was carried out in Loch Tay by T.N. Dixon in May of 1979. This survey had the same aims as the one in Loch Awe and employed many of the techniques which were developed there. A team consisting of members of the Department of Archaeology and the Sub-aqua Club of Edinburgh University, located and planned seventeen crannog sites. Five of the crannogs were found to be visible year round in the prevailing water regime, five others were visible only in the summer during low water, while seven of the crannogs were permanently submerged (Dixon 1982). Like the crannogs in Loch Awe, the sites in Loch Tay were found to be of various shapes, sizes, and were spread widely along the entire margins of the loch.

This survey further advanced the methods and techniques developed in Loch Awe and proved beyond question that large-scale underwater surveys are both possible and certainly needed. This project produced additional proof that some highland lochs also have high concentrations of crannog sites.

### **Oakbank, Loch Tay, Perthshire**

Shortly after the completion of the Loch Tay survey, Dixon began the underwater excavation of one of the fully submerged crannogs on the north shore of the loch near Fearnan, named Oakbank. This site was chosen because it was close to village amenities and because it displayed substantial amounts of well preserved organic material on its surface. Underwater excavation quickly revealed that the site had a substantial organic component and was (apparently) primarily a timber-built construction.

In 1984 Dixon submitted the interim results of the Oakbank excavation along with a critique of crannog research for a Ph.D. in archaeology at Edinburgh University. The first part of the thesis traced the history of crannog research in Scotland and extensively discussed the work and theories of Munro and Blundell.

Dixon then went on to argue for the feasibility, viability and value of excavating a crannog underwater, based upon the Oakbank excavation.

The archaeological value of the Oakbank excavation is beyond question and a fairly detailed picture of the site structure can be gained from Dixon's 1984 account, although relatively little of the structural detail that has been excavated has yet been published. The site was initially described as an oval mound of boulders, measuring approximately 20m by 25m at its base, lying 30m offshore to which it was joined by two rows of oak piles. A small stone-covered feature, 7m in diameter, was attached to the west side of the site and piles were observed protruding from the lochbed between the two mounds.

Upon excavation the boulders that covered the site were attributed to two groups in terms of their position: a 3m wide band around the periphery of the mound and a layer, in places only one stone deep, capping the top of the site (Dixon 1984, 194). Though initially the peripheral band of boulders was thought to have been placed to help protect the piles from water action, excavation revealed that the stones overlay substantial deposits of organic materials, including the tops of eroded vertical piles. This led Dixon to conclude that, "it may be reasonably argued that the first phases of construction of Oakbank Crannog involved a free-standing timber structure without boulders around the foundations" (*ibid.* 196). The function and chronology of each of the boulder coverings is still a matter of debate (*ibid.* 194-197; Morrison 1985, 37-42; Dixon 1995, 66) which has yet to be adequately explained.

After the boulders covering the upper parts of the site were removed, a layer of small stones underlain by a thin layer of grit and silt was encountered. Directly beneath these layers was a thick organic deposit within which both vertical and horizontal timbers were embedded (Dixon 1984, 194) i.e. some of the vertical timbers are embedded in a "man-made" deposit and not into the lake bed. The organic deposit was found to rest upon the silts of the loch bed. Some of the vertical piling was found to penetrate the loch bed while others were only partly inserted through the organic

mound. This variation in pile depths was used by Dixon to suggest different phases of construction on the site (*ibid.*).

The mound of organic materials was found to be a complex mixture of vegetable debris and timbers which were remarkably well preserved. Dixon noted that the mound consisted of, “substantial proportions of bracken stems and fronds and other ferns, twigs and small branches with a wide variety and high concentrations of seeds, straw, excreta, insect parts and puparia” (*ibid.* 205). This material initially gave the impression of being one heterogeneous mass but excavation revealed that it was in fact a series of compacted layers, in some cases less than 1 cm in thickness. Distinct deposits of high concentrations of woodworking debris and sawdust were also found on certain parts of the site. However, generally strata, “blended irregularly one into another” (*ibid.* 206) and, “no single stratified deposit could be followed for a significant distance in any direction” (*ibid.*). It is curious to note the presence of materials such as fern leaves, straw and sawdust in these deposits. Such materials float on water and are not likely to be present directly beneath the site if they were dropped from the type of pile-structure which Dixon claims once occupied the mound.

Within the excavated areas, the remains of 25 internal structures have been suggested by Dixon. Most of these are identified by either post alignments or horizontal features, however, the movement of the piling and periodic repairs on the site have confused the interpretation of these structures (Sands 1994, 40). Sections of flooring, formed from unworked roundwood lengths laid parallel to each other, are clearly defined in several areas on the site but so far the manner in which the flooring was attached to the uprights has not been discovered (*ibid.* 41). A common floor of thin branches was found farther down in the organic matrix and Dixon suggests that this, “may represent a foundation layer for the upper floors and not a living floor surface” (Dixon 1984, 210).

The stratigraphy at Oakbank clearly shows that there were multiple phases of occupation on the site accompanied by major episodes of rebuilding. Dixon initially

postulated, “that at least four building phases occurred” (*ibid.* 260) but more recently has suggested that “there may have been as many as five or six major stages of construction” (Dixon 1989, 47-48). The first structure on the site was theorised to be, “a free-standing pile structure” (Dixon 1984, 218), represented by the large uprights which were driven deeply into the loch bed. The floor area of this stage would have been suspended over the water and presumably attached to the piles. The final phase of activity on the site has been conjectured to occur after a period of abandonment during which the layers of silt and gravel accumulated. The structure was probably no longer free standing at this stage and the boulders were deposited upon the mass of organic material in order to raise the surface of the site to a functional height above water level (*ibid.* 256). Intermediate phases have been inferred from piles driven into the organic deposits to varying depths but as yet the number and nature of these remain unclear.

The various phases of Oakbank have been dated between 800 BC and 300 BC, on the basis of calibrated radiocarbon dates, suggesting that the site was initially constructed in the late Bronze Age. Radiocarbon determinations were initially obtained for two of the exposed piles (Dixon 1981b), with further dates being provided for stakes recovered near the surface of the site (Dixon 1984). In recent years five dates have been obtained from material recovered outside the main mound all of which are broadly contemporary with the earlier determinations (Sands 1994, 45-46). The exact chronology of the individual phases remain unclear, however, Sands notes that only 25% of the site has been excavated (1994, 36) and that the excavation has only reached the base of the structure in section Y-Q.

Despite Oakbank’s archaeological importance and ongoing excavation very little information has been published on the site subsequent to the submission of Dixon’s unpublished thesis in 1984. Sands has recently published an overview of the site as part of his study on the tool-marked timbers recovered from Oakbank (Sands 1997); this account is meantime the only major paper ever published on the excavation’s findings. Dixon has published a string of articles publicising the

excavations of Oakbank crannog (Dixon 1985; 1989; 1991; 1994; 1995; 1996; Dixon and Andrian 1995; 1996) but these contain little hard data and merely restate hypotheses that he had formed by 1984. Although excavation is known to have continued on the site up until 1992 (Dixon 1994, 268), Dixon has not yet published a substantive excavation report. This situation generally prevents criticism of Dixon's interpretation of various features on the site as there are few known facts to debate.

Despite this lack of published structural information, Dixon's interpretation of the structural form of the Oakbank site (as now represented too in a reconstruction in Loch Tay) can still be debated. Considering that very little of the site's first phase deposits have been excavated (Sands *pers. comm.* 1997) and that no jointed structures have thus far been observed, there is very little evidence to suggest that the first structure on the site was a free-standing pile-dwelling. The later phases of the site almost certainly rested directly upon the mass of horizontally-bedded organic material and thus ultimately on the lochbed, as is suggested by the intact floor levels. There is little evidence to suggest that earlier phases of the site were any different. If Oakbank was a free-standing structure it is hard to envision how deposits of sawdust and wood chips from its floor were incorporated into the organic mound, as such materials would float away on the surface of the water, not sink (and this apparently uniquely, for there is no published evidence for organic debris accumulating elsewhere on the loch bed in the vicinity) alongside the piles. The water-level during any period of the site's occupation has not been established, and so any estimate of the site's height, or the suggestion that it was free-standing seems to be overly speculative. Dixon's theories regarding the structure and placement of artificial islets will be examined further in Chapter 6 and Chapter 7.

### ***Landscape with Lake Dwellings - Ian Morrison***

The first modern published work which traced the history of crannog research and reintroduced artificial islets to the archaeological community at large was Ian Morrison's *Landscape with Lake Dwellings* (1985). This work is still considered to be the handbook of modern crannog researchers and it covers the history of research,

techniques of underwater excavation, and many of the major theories concerning the spatial location and use of crannogs. Morrison intended the book to be a general introduction to crannogs but, due to a lack of other major publications, it has become the modern definitive work on the subject. It is for this reason that many of Morrison's theories will be reviewed in detail below.

Although Morrison devotes large sections of his book to the history of research and the techniques of investigation used to survey and excavate crannogs, his definition of a crannog and general theories concerning their structure and placement in the landscape are the primary contribution of the work. Most recent crannog researchers (e. g. Barber and Crone 1993; Henderson 1994; Sands 1997) have accepted Morrison's definition of crannogs *verbatim*. This definition has two components.

1. "Central to the concept of the crannog is the idea that it was in essence a site deliberately intended to be utilised as an island, whether in free water or as a dry point in a swamp" (Morrison 1985, 19).
2. "The word also implies an islet that is in some measure man-made" (*ibid.*).

Although the notion that all artificial islands should be termed crannogs has recently been challenged (Henderson 1994, 130-136; Delgado 1997, 117), additional fieldwork and excavation will be needed before at the national scale the sites can be separated into definitive groups and more descriptive terms applied. Morrison's definition of the key characteristics of a crannog has been accepted here, although the term 'artificial islet' has been chosen as more adequately describing these sites.

Definitions aside, Morrison departed from past researchers by disagreeing with the lowland-highland division of artificial islands, posited by Ritchie (1942, 9) and supported by Piggott (1962, 147), which separated the country into primarily (Lowland) timber and (Highland) stone-built provinces. Morrison noted that, "many stony mounds in Highland lochs contain substantial timber components" (1985, 20)

and that Oakbank crannog demonstrates, “that some sites, which now appear as stone mounds, may originally have been built as essentially wooden structures” (*ibid.*). While this theory has been supported by the Oakbank and Loch Treig excavations, it should be remembered that in proportional terms very few Highland crannogs have been excavated. As Morrison concedes (*ibid.* 37), there is certainly a wealth of evidence (see Chapter 9) to suggest that artificial islets in the Western Isles are primarily stone-built constructions and differ structurally to the above-mentioned mainland sites; however, until more sites undergo underwater inspection and are surveyed it is too early to plot variations in crannog constructional materials even across the mainland of Scotland.

The purposes of the stone coverings of crannogs that are so frequently encountered (and are noted above in the cases of both Milton Loch I and Oakbank) have baffled researchers from the beginning. Morrison has postulated that many crannogs were originally timber built constructions and that, as they decayed, stone was added to their basal materials to support the weakening structures (1985, 39). The surviving stone mounds, therefore, in this model, do not represent surfaces which were intended for direct habitation; however, exactly how the addition of loose stone would support weakening vertical timbers in this scenario is unclear. From an engineering point of view the additional stone would only reinforce the bases of the piles and not protect their air/water interface where the maximum levels of decay are likely to occur. Even if this point is overlooked, this theory assumes that timber was the primary source of building material during the period that artificial islets were in use. This is an assumption which is not justified by survey evidence, nor indeed from earlier observations, that many crannogs are capped by massive perimeter walling and displayed the remains of stone building foundations.

Despite this oversight, Morrison is one of the few crannog researchers who has searched public records and archives for information regarding crannogs. As a result of this search he concluded that the historical definition of the word “crannog” is uncertain. The word has traditionally been used in many different contexts to mean

a variety of different things (*ibid.* 26). Morrison was unable to find any comprehensive descriptions of crannogs but found notes indicating that they were inhabited up until the 17th century A.D. (*ibid.* 29).

Morrison was the first researcher to apply spatial analysis techniques to crannog sites. Analysis of the positions of crannogs in the landscape led Morrison to theorise that crannogs were used as farm steadings, or stores for produce (*ibid.* 21). This theory is supported by the bones of domestic livestock, the dung, and other indications that the Oakbank structure had functioned partially as a byre; and by the recovery of wooden ploughs, or ards, at two crannog excavations. Morrison found additional evidence supporting this theory during his Loch Awe survey, where 17 of the 20 crannog sites were found to be located next to what he defined as, 'patches of agriculturally viable soil'. This association between good agricultural soil and crannogs has also been recorded in later surveys (Henderson 1994).

Morrison argued that in order to truly understand crannogs one would have to analyse their place in the environmental landscape. He believed that physical factors such as water depth, the consistency and solidity of the subjacent lochbed, and shelter from the wind and wave-fetch, influenced the placement of crannogs. He also saw that it would require a large data-base to securely establish any of these connections. His 1985 book therefore sought to draw attention to these issues and, "to develop a policy for the systematic acquisition of dates; and to lay a foundation for more sophisticated analysis of distributions" (1985, 58). Perhaps the greatest benefit of Morrison's book is that it issues a call for more research to be carried out on crannogs. The following excerpt is quoted here at length because it is still an accurate assessment of what is required before significant advances can be made in crannog research:

"In the present state of knowledge, it seems more useful to record a larger number of sites in a relatively simple but consistent fashion: that is, to secure basic but dependable portraits of these otherwise largely

invisible antiquities. It is necessary to establish their degree of variability, by documenting their size range, their characteristic shapes and types of appendages, and their relationship to the terrain” (Morrison 1985, 88).

This was the basic tenet which drove both the Loch Awe and Loch Tay surveys and underpinned the work reported here. It should also be a primary concern of future surveys of artificial islets.

### **Lake of Menteith Survey**

To contrast the surveys of the large Highland lochs (Loch Tay and Loch Awe), a survey of a small lowland loch was carried out by Jon Henderson in 1993. The results of this survey were submitted for an M.A. dissertation in Archaeology, at the University of Edinburgh in 1994. This survey was the first in Scotland to incorporate extensive fieldwalking, of the Lake of Menteith drainage catchment, in order to establish how crannogs relate to surrounding land features and other archaeological site types. A total of four crannog sites, only two of which were previously known, were identified and surveyed using the most up-to-date remote sensing and surveying equipment. Access to such advanced equipment allowed Henderson to produce three-dimensional site plans and contour surveys which display an unprecedented level of detail and accuracy.

Henderson’s survey of this small lowland loch confirms several of Morrison’s theories concerning the spatial positioning of crannogs. Three of the four crannogs Henderson surveyed were sited on natural rises in the loch bed (Henderson 1994, 149). Each of the sites were located immediately adjacent to potentially arable farm land (as described by the *Soil Survey of Scotland*). Adjacent to the section of the loch which was too deep to accommodate a crannog site, a presumptively contemporary land site was found. From these similarities Henderson concluded that Morrison’s theories on siting were equally relevant to lowland crannogs (*ibid.* 164).

Beyond supporting Morrison's theories, Henderson developed several hypotheses of his own concerning the nature and definition of crannogs. Chapter 5 of Henderson's study is devoted to challenging the current chronology of crannog sites. Traditionally, crannog occupation is thought to range from the Neolithic to the 17th century (Morrison 1985; Dixon 1982; 1991). Henderson attempts to limit this range and argues that Scottish crannogs, "mainly represent Later Prehistoric activity" (Henderson 1994, 127). This statement was based upon the high proportion of later prehistoric radiocarbon dates available for crannogs at that time. The dangers of suggesting sweeping chronologies based on such a small sample are obvious and, as discussed in Chapter 6 of this thesis, recent evidence has confirmed the extensions of isotopic and artefact-based chronologies for crannogs well into the Medieval Period.

Henderson further indicated that the chronology of most crannog sites can be determined by a combination of surface survey evidence and size (*ibid.* 132-3). He argued that large sites (over 50m in diameter), such as Priory Island in Loch Tay, should not be given the same label as smaller sites (under 10 m in diameter), such as Milton Boathouse crannog in Loch Tay. Sites (excluding island duns) which have drystone structures on their surface, or which are rectilinear in plan are likely to yield later historic dates. Henderson concedes that many sites are likely to be multiple period constructions but insists on the validity of categorisation by surface remains. As discussed elsewhere (Holley and Ralston 1995), these assumptions are open to debate and recent survey evidence in the central Inner Hebrides would suggest that chronological predictions cannot be made based upon a site's size or surface remains.

As a whole, the value of Henderson's work is in its innovative approach to the survey and assessment of the placement of crannogs. The applications of new technologies in remote sensing and survey, combined with dry-land field-walking gives a much more complete picture of these lowland sites and their contexts than others which have been recently added to the archaeological record. This exercise also clearly displays the appropriateness and potential of new technologies which can be applied to underwater survey (also see Henderson and Burgess 1996).

### **South-West Scotland Survey**

Environmental archaeology has recently become one of the favoured areas of archaeological study. Research projects which show that they are environmentally sensitive and promote certain environmental opinions often receive large grants. This avenue of funding was successfully tapped by Barber and Crone (1993; 1993b) in order to research the effects that 20th-century environmental changes had on crannog sites. The study was limited to south-west Scotland and consisted of an investigative field-survey of known sites which determined their state of preservation. Coring and limited excavation were utilised to retrieve information on the mechanisms and rates of organic decay.

A total of 58 suspected crannog sites were visited by Barber and Crone's survey and categorised according to their likelihood of being a crannog: 33 sites were 'confidently' identified as crannogs, i.e. those sites which had previously been examined, excavated, or yielded artefacts; 9 sites were identified as 'possible' crannogs, i.e. sites which had been labelled as crannogs in the past but which have no supporting evidence; and 16 were labelled as 'unlikely' crannogs, those sites which had been described as crannogs in the past but which show no evidence whatsoever, structural or otherwise, of being crannogs (Barber and Crone 1993, 526).

Unfortunately Barber and Crone's survey was only able to directly examine a small proportion of the crannogs in the region, due to their watery setting. Only 16 (33%) of the 48 'certain' and 'possible' crannogs inspected were actually visited by the authors. An additional 6 (21%) of these sites were inspected underwater by the Scottish Trust for Underwater Archaeology; however, the other 22 (46%) were only, "examined from the adjacent shoreline" (*ibid.* 526). It is hard for the present author, in the light of the experience that is hereafter the focus of research, to understand how a site can be classified with certainty when it has not actually been inspected. Considering that most of these sites were over 20m from the shore and either, "partly or wholly underwater" (*ibid.*), it is unclear how their true nature was determined.

Neither of the principal investigators were divers (Dixon *pers. comm.* 1994), so submerged features would not have been encountered in their survey. It is axiomatic, as a result of the surveys outlined above, that accurate field survey on submerged crannog sites requires sub-aqua equipment. This perspective also applies to 5 (31%) of the 16 'unlikely' crannogs eliminated during this survey upon, what appears to be, an inadequate fieldwork methodology. Present knowledge of the real distributions of crannogs in Scotland's water bodies is so partial that to definitively eliminate sites without actually inspecting them seems unjustifiable.

The primary value of Barber and Crone's survey was the subsequent re-excavation of Buiston crannog, undertaken to assess the quality of the preservation of organic materials on the site. The crannog had previously been excavated by Munro and had been described as a unitary structure (1882, 205). Barber and Crone, however, discovered that the site experienced at least 3 distinct periods of activity. Radiocarbon dates from timbers sampled at each level produced calibrated dates of AD 10-120 (GU-3000), AD 310-440 (GU-3004), and AD 605-665 (GU-2636) (Barber and Crone 1993, 529). This is the first published site to reveal three distinct phases of activity. Post-excavation studies are still in course; and it is possible that dendrochronological studies will further refine this chronological sequence. It will be interesting to see if future excavations reveal other sites with multi-period activity. The full excavation report of this site has yet to be published.

The effects of 20th century environmental changes on crannogs were only minimally discussed by Barber and Crone in the 1993 publication. According to them, organic deposits survived on only 2 of the 17 drained crannogs. Sites still submerged in lochs were reported to be subjected to accelerated biodegradation due to nitrate run-off from surrounding field systems, a problem also encountered by Dixon (1994, 272) in work on Loch Leven. Underwater investigation indicates that the shallow water around sites is heavily infested with animal and plant life and that exposed timbers are being tunnelled into and destroyed by mollusca (Barber and Crone 1993, 527-528).

The environmental aspects of Barber and Crone's survey, like other projects which rely on particular results for continuation of their funding, should be justifiably subject to close scrutiny. It should be remembered that underwater environmental conditions are known for only 6 of the 28 sites inspected. The condition of the remaining 22 sites, observed from shore, could only be speculated upon. Crannogs which now reside on dry land would certainly decay due to exposure to air. It has not been shown how 20th-century environmental changes have accelerated this natural decay. It is acknowledged that some sites have certainly suffered from 20th century environmental changes, however, all archaeological sites suffer from these changes to some degree. The case has not been made conclusively that crannogs suffer disproportionately to other archaeological site types.

Crone also published a paper entitled "Crannogs and chronologies" (Crone 1993). This work examines all of the then published radiocarbon dates for crannogs in Scotland, from which Crone postulated that there are three distinct phases of crannog activity in this country. Sixty-five percent of the dates she examined fell into the period 850 BC to AD 200, three dates fell into the period 4th to 7th century, and one date fell into the Medieval Period. The substantial periods between these dates led Crone to state that "crannogs were a site type resorted to over the centuries when a given set of circumstances prevailed" (1993, 248). In the case of Buiston crannog, Crone directly equated phases of crannog activity with historically documented, "periods of great political upheaval in southern Scotland" (*ibid.*). The remainder of this work rehearses the theory which suggests that crannogs originated in Scotland and spread to Ireland in the Early Christian Period. This diffusionist theory is also based upon radiocarbon dates and has particular flaws, such as the non random sampling of sites and the uncertainty of several sites' chronologies, which Crone goes on to discuss (*ibid.* 151-152).

### **Crannogs and wood signatures**

The next significant contribution to crannog research was made by Robert Sands who examined the worked timbers of Oakbank crannog (Loch Tay) for a Ph.D. in archaeology at Edinburgh University in 1994. This work was published in 1997. The excellent preservation of the timbers at Oakbank allowed Sands successfully to identify marks left on them by prehistoric tools. These marks are called signatures and Sands developed a system of recovering and cataloguing signatures from piles throughout the site. After creating a data base of approximately 300 signatures it was possible to identify individual axes and their blade widths which had been used to work various timbers. This allowed Sands to begin to identify individual building phases on the site, based upon the axes used to work the wood. Sands also produced a detailed overview of the excavations at the Oakbank site (1994, 35-53; 1997, 33-43).

Through an examination of the worked wood recovered from Oakbank, Sands was able to reach several conclusions regarding the technology of the crannog dwellers and the chronology of the site. Wooden artefacts throughout the site showed a high degree of competency in wood-working but little extra effort seems to have been expended in their production. This suggests that, “once the functional criteria had been fulfilled the object was finished” (1994, 63). Evidence was found to indicate that axes, knives, gouges/chisels, hole-boring tools and awls had been used on the site. It was also concluded that, “some of the tools being used at Oakbank were probably made of iron” (*ibid.* 182) but that most of the signatures indicated Bronze Age axe widths (*ibid.* 172). Perhaps the most significant contribution of this study was that it made major advances in developing a technique with which to date periods of construction on timber crannogs.

### **A reassessment of the crannogs of Loch Awe region**

In 1995, the economy of the islet dwellers of the Loch Awe region was reassessed by Aileen Halley as part of an M.A. in Archaeology at Edinburgh University. This work sought to establish that the crannog dwellers of Loch Awe had,

“a varied and wide economy, exploiting many natural resources” (Halley 1995, I). Another goal was to demonstrate the relationship between crannogs and other site types on shore.

Unfortunately, this study was based on the McArdle’s original survey and Morrison’s subsequent book, and did not draw upon any new archaeological information. Consequently, the study could only point out the obvious resources that the crannog dwellers might have exploited, without offering any substantive proof that this exploitation took place. This lack of archaeological data also negated Halley’s attempt to establish links between crannogs and other site types on shore. Halley did produce an impressive contour survey of a crannog in Loch Ederline but failed to assess it. Although this study had noble goals, the lack of direct archaeological evidence prevented it from offering anything other than speculation.

### **Popular Conceptions**

This chapter has examined the history of crannog research from its beginnings in the 19<sup>th</sup> century to the present day by presenting the theories developed by archaeologists specialising in the study of crannogs and the data upon which these theories rest. Most of this data has been produced by field-surveys of varying quality and a proportionately small number of excavations, each of which have been discussed above. The publication of this research has been largely confined to journals of academic societies and has only rarely filtered through to the public first-hand in the works of Munro (1882; 1890) and Morrison (1985). It is interesting then to note how crannogs are perceived by the archaeological community at large and how they are presented to the general public through popular publications, as such sources are undoubtedly influential in conditioning further research on this subject.

Munro’s work initially shaped the popular perception of crannogs. Both he (1882) and Anderson (1883, 263) describe crannogs as being primarily timber constructions but admit that artificial islets in the Highlands and Islands could be

constructed entirely of stone (Anderson 1883, 263; Munro 1882, 242). This point is generally over-looked by subsequent authors ( e.g. Delgado 1997, 117; Sykes, 1997, 79; Orm 1997, 88-89; Reid 1993, 39; Ritchie and Ritchie 1991, 110-115; Hesketh 1988, 11; Feachem 1963, 187). Although Anderson did not speculate on the form of crannogs (1883, 263), Munro, based upon the descriptive notices of the crannogs of Ireland (1882, 5-11) and his excavations at Lochlee, Lochspouts, and Buiston (1882), theorised that, “all wooden islands were constructed after one uniform plan”, which was based upon, “the highest mechanical principles that the circumstances could admit” (*ibid.* 261). This theorised plan works thus: a crannog was built by floating circular rafts of timber over the desired site, at which point additional layers of logs, stones and gravel were deposited on it until the whole mass grounded on the loch bed. Piles were then inserted through prepared holes in the timbers of the raft, thereby firmly fixing the structure in place. This process was repeated until the surface of the structure reached the desired height above water-level when, “a prepared pavement of oak-beams was constructed” (1882, 262) and enclosed by a wooden fence.

This model of a crannog’s structure is consistently presented in general syntheses on Scottish prehistory (Childe 1935, 211; Piggott 1958, 183; Feachem 1963, 187; Chadwick 1971, 126; Cunliffe 1974, 215 3edn 1991; Laing 1977, 37; MacSween and Sharp 1989, 38; Ritchie and Ritchie 1991, 110; Oram 1997, 88), all of which draw their descriptions primarily from Munro’s work. Despite the stress in this hypothesis on horizontal timberwork as the primary constituent of the substructures of artificial islands, it is remarkable that a fundamentally different model has, in fact, won overwhelming acceptance amongst archaeological illustrators.

Although crannogs generally continued to be described as solid based structures by archaeologists, subsequent to the Milton Loch excavation artistic impressions of crannogs almost exclusively depicted them as pile-dwellings. In some cases mounds of stone are shown beneath the piles (Reid 1993, cover; Hesketh 1988, 21) or the text accompanying the illustrations indicates that the piles surround a mound of organic material (MacSween and Sharp 1989, 19) but unless the

illustrations are examined closely, these features are not readily apparent. In other instances crannogs are shown strictly as pile-dwellings (Feachem 1963, 189; Dyer 1990, 144; Ross 1991, 103; Bewley 1994, 122; Armit 1997, 34; Delgado 1997, 117). Morrison's book enforces this image, depicting crannogs as pile-dwellings in twelve instances (1985, figs. 2.1, 2.2, 3.16, 3.17, 3.18, and 4.2). This image has dominated popular archaeological publications to such an extent that the construction of such structures has recently been described in the following terms: "the foundations were built by adding boulders to a natural rocky outcrop in a lake, which were then filled in with loose stones. From that base a wooden stilt house was constructed" (Sykes 1997, 79), even though it clearly would have been impossible for engineering reasons to erect a timber pile-dwelling directly on top of a bedrock lochbed or on a mound of stones accumulated on this surface.

The imagery used to present Scottish crannogs to the wider archaeological community and the general public has radically changed in recent years. The concept of pile-dwellings which now frequents popular publications is, in fact, based upon artistic licence, not archaeological evidence, and is directly traceable to the Milton Loch excavation report (Piggott 1952-3). Dixon's interpretation of the partially excavated Oakbank site (Loch Tay) as, "a free-standing pile structure" (1984, 218; 1994, 268; Dixon and Andrian 1995, 27; 1996) and the recent reconstruction in Loch Tay (Dixon and Andrian 1996; Andrian 1997) have contributed greatly to perpetuating this image, even though the evidence for a pile-structure at Oakbank, as briefly discussed above, is tenuous at best.

The evidence meantime published from the Oakbank excavation does not support the theory that the site was a pile-dwelling. Plans which have been published showing an overview of the site (Dixon 1981, figure 1; Dixon 1982b, figure 2; Dixon 1982, figure 4; Dixon and Andrian 1992, figure 1; Dixon 1995, figure 3; Sands 1997, figure 11) (see Illustrations 3.10– 3.14) do not depict piles other than towards the margins of the site. The detailed plans of sections excavated on the interior of the site (Dixon 1981, figure 2; Dixon 1982b, figure 3; Dixon 1995, figure 4) (see Illustrations

3.15– 3.17) show very few uprights near the centre of the site with most vertical piles measuring under 20cm in diameter. Plans of the excavated portions of Oakbank included in Dixon's unpublished thesis. (1984, figures 23, 24 and 25) also show a similar paucity of vertical timbers. If these plans are compared with those of known pile-dwellings on the continent, such as Fiave in Northern Italy (Perini 1981; 1984) (see Illustration 3.18), it is clear that the vertical timbers of Oakbank are both far less densely distributed and that they are placed with less regularity. Both of these factors seriously undermine the interpretation of Oakbank as a pile-dwelling as the vertical elements required to support such a structure are lacking in sufficient numbers in the published evidence.

## **Conclusions**

This chapter has shown that it remains premature to make generalisations concerning crannogs based upon the information gathered over the last hundred years. This is a consequence of the poor quality of both a number of the published excavations and of the knowledge-base that underpins the distribution maps of these sites. It is only recently that detailed survey reports have been produced for individual crannogs by trained archaeologists. Previously many sites were merely identified from shore and labelled crannogs by non-specialists. Chapter 5 will demonstrate that many sites identified in this manner prove, on closer inspection, not to be artificial in nature but in fact natural features. Unfortunately modern distribution maps of crannogs still incorporate this unverified data. The lack of major underwater surveys of Scottish lochs have inevitably left the perceived distribution of crannogs incomplete, and if the Loch Awe and Loch Tay surveys are typical there are undoubtedly many sites which are as yet unidentified, as well as others in the record which will, in due course, be expunged from it.

The almost total lack of published, up-to-date evidence recovered by modern excavations employing scientific techniques has also seriously retarded the study of these enigmatic sites. Theories over a decade old, based upon single excavations, and

unverifiable assertions have been incorporated into recent textbooks. Any attempt at critical appraisal runs up against the problem that only five sites have been excavated in the last 50 years (only the earliest two of these have been fully published, while two others are currently still being excavated or written up). However important these excavations may be individually, they are hardly a representative sample of a population of over 500 artificial islets. This point is highlighted by recent research (Hale 1996) which suggests that artificial islets in tidal estuaries may have substantially different structures to those found in inland lochs. Therefore it is obviously too early to be making either sweeping generalisations concerning the structural form of crannogs, or hard-line definitions of regional variation in their form on the mainland, or indeed on the off-shore island chains. Clearly at this point restrictive definitions such as, "crannogs may be categorised as artificial islands originally built of timber, utilising driven piles to create a platform above the water supporting a house or settlement" (Dixon 1994, 267; Dixon and Andrian 1995, 27) can be described as merely unquantified perspectives, unless their purpose is to exclude most of the shadowy-known artificial islets of Scotland from consideration as crannogs.

This is the stage at which the comprehensive field-survey of a large number of artificial islets is needed to assist future research. Only through examining a collection of detailed site reports can reliable comments upon the structure of artificial islets be made. This chapter has shown that the current theories regarding the structural form and spatial positioning of artificial islets rests upon a body of data which is both very selective and highly variable in quality. Even amongst modern surveys, the detail of the site-specific data of artificial islets is limited and in some cases ambiguous. What appears desperately needed is further detailed and measured survey of numbers of artificial islets, in order to test the validity of the hypotheses that have been advanced to date. The remainder of this thesis will attempt to accomplish these goals.

## Chapter 4

### Preliminary work:

#### A review of the earlier sources on the water bodies and artificial islets of the central Inner Hebrides

##### Introduction

Dixon has stated that, "Field survey of crannogs in any loch should be preceded by an examination of available reference material" (1984, 146), echoing standard practice for any reconnaissance, for which initial desk-based work is appropriate. In the case of the study area here considered, the central Inner Hebrides, this material includes maps, local records and histories and aerial photographs. Although it is acknowledged that these sources may give valuable clues as to the location of artificial islets, they are often documents prepared primarily with other purposes in mind and must be considered incomplete; they cannot therefore be used to establish the total population of sites. Other sources such as the RCAHMS Inventories (1980; 1984), card-based files (principally the Ordnance Survey Archaeology Division records which form a significant component of the National Monuments Record for Scotland) and *Discovery and Excavation in Scotland* were also consulted before field work was undertaken; however, even these sources are unlikely to be sufficient to recover the total distribution of sites. As Morrison rightly points out, although cartographic and literary evidence "can yield some intriguing insights, these are often oblique and incomplete" (1985, 30). Ultimately, underwater survey in the field is the only sure method of identifying sites.

The degree to which reference material is useful in identifying artificial islets varies. This chapter will demonstrate that each of the sources examined below unsurprisingly gives an incomplete picture of the numbers and characteristics of sites which must in each instance be examined in the field. Dixon used reference material, particularly Murry and Pullar's (1910) bathymetric map of Loch Tay, to limit the areas of Loch Tay which were searched in the early 80s to "areas shallow and flat enough to support crannogs" (1984, 148) but, as will be seen below, this was not

possible in the central Inner Hebrides due to the relative frequency of reported sites and the shallowness of a majority of the lochs.

Reference material, in particular estate maps (discussed below), was also found to be helpful in identifying the pre-drainage distribution of lochs in the central Inner Hebrides and which sections of the islands had historically been considered arable land (discussed in Chapter 7).

## **Maps**

In general, maps of the central Inner Hebrides produced prior to those of the Ordnance Survey were of limited value in locating potential artificial islets, or for that matter, the lochs in which they are located. The early maps of Scotland were compiled by a variety of people each with their own conventions and biases, who were seldom attuned to recognising ancient archaeological sites. The primary problem was that most of the cartographers had never visited the central Inner Hebrides, nor even Scotland, and consequently based their maps on second, or even third-hand accounts (Moore 1991). This resulted in the mis-spelling of place-names, improper orientation of land-masses and a general lack of detail (e.g. Islay is rotated 90° to the east on Martin's map (1703) and Scott's (1799) while Coll and Tiree are given a linear east-west orientation on Tiddeman's map (1730)). The Inner Hebridean islands were seldom drawn to scale and in many cases were not even correct in terms of their general shape. For example Mull appears as an oval shaped island on Martin's map of 1703 and the Ross of Mull is dramatically shortened on Cowley (1734), Dorrett (1750) and Scott (1799). Islay is also poorly depicted on Tiddeman (1730), Cowley (1734), Hogg (1786) and Thomson (1824). No attempt was made in such sources actually to depict the form of the small lochs which dot the islands, assuming that they were displayed at all (e.g. there are no inland lochs on any of the central Inner Hebrides on Martin (1703) and Tiddeman (1730); or Mull on Johnson (1710); or Coll and Tiree on Cowley (1734) and Dorrett's (1750) maps). As a result, it cannot be assumed that the maps are accurate depictions of what was actually visible in the

lochs at the time of their printing, therefore much of the material has little relevance to this study.

Some of the more useful early maps of the central Inner Hebrides were included in volume five of John Blaeu's *Atlas Novus* first published in 1654. This important cartographic work was based on an earlier survey of Scotland conducted by Timothy Pont between 1583 and 1596. There is some debate over exactly why Pont assembled the information but it is generally accepted that he travelled widely throughout Scotland, assembling over 20,000 named places, and that many of the maps were based on first hand observations (Stone 1991, 5). In instances where Pont could not visit a place it is believed that he relied on information gained from local informants (Stone 1989, 13). It is assumed that Pont died around 1612 and that his manuscripts passed through several hands before being published by Blaeu of Amsterdam forty years later. While they may not in the meantime have been amended, Stone (1989) has shown that Blaeu's engravers made many modifications to Pont's original maps, including removing some of the detail and mis-spelling or deleting place-names. Pont seldomly included antiquities (the mapping of the Castles in Loch an Eilean (Tiree) and Loch Gorm (Islay) are an exception) on his maps and generally concentrated on contemporary settlements. Although this limits the value of the maps to the prehistorian, Pont's attention to detail helps to reconstruct the Inner Hebridean landscape as it looked at the end of the sixteenth century and these are still regarded as the most accurate maps of their time. Pont's general map of the Hebrides (Blaeu 1654, map CI) depicts each of the central Inner Hebrides in relatively accurate positions but many of the place names are hard to follow because of the phonetic spelling of Gaelic and errors introduced by Blaeu's engravers (Stone 1991, 83). The small scale maps of the series were taken directly from Pont's manuscripts (Stone 1989, 17) and include separate plates of Mull and Islay, which contain a considerable amount of detail including many of the island's inland lochs.

The map of Mull, which also includes Coll and Tiree, shows each of the islands' major lochs and depicts small islets, which were later found to be artificial, in

Lochs Poit na H-I, Sgubain and Ba (Blaeu 1654, map CII; Stone 1991, 87). Each of the major lochs on Tiree are also depicted but only two islets, the Castle in Loch an Eilean (see Appendix A) and one in Loch Kirkaboll, were noted. Coll is somewhat less adequately depicted and is missing many of its small inland waters. An islet marked with a habitation symbol is located in Loch Cliad and another small unnamed loch contains what are presumably three small natural islets. The map of Islay (Blaeu 1654, map CII) is among the less accurate in the series and it is apparent that Pont had some difficulty with drawing the outline of the island, particularly the large sea-lochs of Indall and Laggan (Stone 1991, 85). The medieval Castle in Loch Gorm is depicted along with two small unnamed islets in the same loch. Two other islets with habitation symbols on them are located in two small unnamed lochs near the east coast of Islay, next to Jura. One of these islets is most likely Council Island in Loch Finlaggan and the other the artificial island in Loch Ballygrant, both which display the remains of later mediaeval buildings on their surfaces (but which are not considered here due to their large size). Small unnamed islets are also located in Lochs Skerolfay (Skerrols), Laggan (Finlaggan ?), Knochrynefa (Allallaidh ?, Appendix A) and in an unnamed loch near the south-west end of Islay.

At least eight of the early maps of Scotland show small unnamed islets in up to six of Islay's lochs but these lochs can seldom be unambiguously identified. Cowley (1734), Dorret (1750), Hogg (1786), and Scott (1799), for example, all show the Castle Island in Loch Gorm and other small islets in unnamed lochs, possibly Allallaidh, Finlaggan, Lossit, or Staoisha. (These same cartographers also show two unnamed islets in Loch Ba on Mull.) The castle in Loch Gorm is also displayed on Mercator's map of 1595, reprinted by the Royal Scottish Geographical Society (1973, map 7), and in Abraham Ortelius's *Scotiae Tabula* in 1573 (MacLeod 1989, 29). Finlaggan (Islay) is displayed on Bishop Leslie's map of 1578 (RSGS 1936, plate V) and on Martin Martin's map of 1703. While each of these maps are interesting in their own right, they were not particularly helpful in identifying the distribution of artificial islets in the central Inner Hebrides.

Estate maps were also generally unhelpful in identifying artificial islets but were useful in identifying how the landscape had evolved in the last two hundred years. A series of maps commissioned by the Duke of Argyll near the middle of the 16<sup>th</sup> century for his estates on Mull and in Morven (Richmond 1770), were helpful in reconstructing which land was considered suitable for arable cultivation in the recent past. Given their intended purposes, it is perhaps unremarkable that they did not include any of the island's artificial islets. Other estate maps, such as *The Plan of the Estates of Aros and Tobermory property of Farquhar Campbell Esq.* of 1849, *The Plan of the Estate of Jarvisfield property of Lachlan Macquarie* of 1826, and *The Plans of Loch Buy* of 1848, held in the Tobermory museum on Mull, were likewise used by the writer to estimate land-use during the early parts of the last century.

The accuracy of cartographic material was notably improved with the publication of the Ordnance Survey 6" to 1 mile maps, the first edition of which for the relevant areas appeared in 1882. These were the first widely published maps which were based on accurately measured first-hand field observations and included an unprecedented amount of detail, including several types of archaeological monuments. Unfortunately, the Ordnance Survey's survey work was carried out in 1878 after most of the lochs in the Hebridean Islands had been drained in the course of agricultural improvement or for other purposes and therefore they cannot be used to establish the extent or the distribution of the islands' pre-drainage waterbodies. Although a few of the artificial islets are depicted as named islets, such as Eilean Ban (Mull), Eilean nan Cinneachan (Coll), Eilean Anlaimh (Coll), Eilean Mhuirell (Islay), Eilean Aird na Brathan (Tiree), only the site at Breachacha (Coll) was labelled on the maps as an antiquity. Each of the other artificial islets, except the two on Mull which are permanently submerged, and thus not depicted, are shown as small unnamed islets. Although the sites were not recognised as antiquities, the maps do show that water-levels in many of the surviving lochs have not substantially changed in the last 120 years.

The Ordnance Survey added crannogs to its maps as they were revised in the 1970s, following renewed visits to the areas concerned by the field surveyors of the Survey's Archaeological Division. Both the current 1:25,000 and 1:50,000 series maps display the location of fifteen of the thirty central Inner Hebridean artificial islets and label them as archaeological features. This discrepancy is probably due to the fact submerged archaeological features are seldomly included on OS maps (Harley 1975, 147) and small archaeological sites, such as artificial islets, are only labelled if they do not interfere with the cartographic clarity of modern features (*ibid.* 149). All of the remaining sites, except the three which are permanently submerged, are visible as small islets on the 1:25,000 series maps.

Another useful source of cartographic information is Murray and Pullar's *Bathymetrical Survey of Scottish Fresh Water Lochs*, published in 1910. Unfortunately only two of the central Inner Hebridean lochs were included in this pioneering study. Loch Ba (*ibid.* III, plate LXVI) and Loch Frisa (*ibid.* III, plate LXVII), both on Mull, were surveyed by John Hewitt and James Murray in 1904 at a scale of 3": 1 mile. Small islets, which were later found to be artificial and are still above water today, were depicted in both lochs, again providing a clear indication that in these cases water-levels have not substantially changed in the last century. As these are the largest lochs in the study area, the bathymetric maps were very useful in establishing which sections of the water bodies were too deep to contain artificial islets and thus considerably limited the area which needed to be searched during the field survey by divers.

### **Local histories and records**

Local histories and records were extremely useful in identifying the location of many of the artificial islets in this study and are noted where appropriate in the individual site reports (Appendix A). Local histories were also useful in determining which lochs had been drained or artificially created in the last hundred years.

Some of the earliest accounts of the central Inner Hebrides are recorded in the *Statistical Accounts of Scotland*. Unfortunately, the archaeological content of these volumes is limited for the areas here considered and the artificial islets in the central Inner Hebrides are not noted in the relevant antiquities sections either in the *Old Statistical Account* of the end of the eighteenth century, nor in its early Victorian successor. The castles in Eilean Loch on Tiree (McCull 1794, 392) and Loch Gorm on Islay (McLiesh, 1794, 391) are the only man-made structures noted in the islands' lochs.

Almost every archaeological site then known on Coll and Tiree was inspected and identified at the turn of the century by the antiquarian Erskine Beveridge who visited the islands with his friend Angus MacIntyre, during the summers of the years between 1896 and 1901. Beveridge published a gazetteer of his archaeological survey in 1903 which included the findings of his limited excavations. This volume includes excellent photographs of four of the artificial islets (these photographs show water-levels similar to those encountered during the survey undertaken for the present research and also indicate that the characteristics of these lochs' catchments have not been altered since Edwardian times (see Chapter 6)). Beveridge labelled the artificial islets with various terms such as 'island duns', 'loch duns' or 'marsh duns' but classified all under the general heading of artificial islets (*ibid.* 4). The antiquarian correctly identified all of the artificial islets on Tiree and all but one, in Loch na Cloiche, on Coll which were confirmed during the work reported here. If anything Beveridge's enthusiasm got the better of him on Coll (a fact which he explicitly recognises in the introduction to his book) where he identified seven sites as artificial islets when they are in fact natural features. The investigation of all such claimed sites, whatever their degree of likelihood, was pursued during the fieldwork for this project, as will be explained below. The fact that Beveridge overestimated the real number of artificial islets on Coll was probably due to the fact that he could only gain access to the sites in Loch Cliad and Loch Cinneachan and had to inspect the others from shore (*ibid.* 19). Beveridge's accounts of the sites are thus not very detailed but were extremely helpful in identifying lochs which needed to be thoroughly inspected. They

also raised the possibility, encountered on other underwater surveys of artificial islets elsewhere in Scotland, that diving and close inspection might significantly increase the tally of confirmed sites.

Several other references to artificial islets of Coll and Tiree were found in various publications. In *Blackwood's Magazine*, Ross (1882) for example described a potential lake-village located between Feall and Crossapol Bays on Coll. This site, which would be exceptional in the Hebrides in terms of its scale, was not confirmed by the present survey and on field inspection it is doubtful if the area where the site was supposed to lie ever supported a loch: none is shown at this position on any of the maps consulted, and there are topographic reasons why this area could not be covered with a waterbody (see Appendix A). Notices of some of the artificial islets of Coll and Tiree were included in Blundell's inventory (as previously remarked, collated from questionnaire survey and not based on his personal inspection) of artificial islands in the highland area (1913) and also in an early guidebook to the islands published by Macdougall and Cameron (1937). Both of these accounts, however, primarily relied on information supplied by Beveridge and added little to what was already known about the sites. Macdougall and Cameron (1937, 18) suspected an additional artificial islet near Arnabost on Coll, but cited no definitive evidence; the location was again checked as part of the fieldwork for the present survey, but nothing conceivably corresponding to an artificial islet was apparent. MacDonald's (1973) guide to Tiree only notes Island House in Loch an Eilean (see Appendix A).

Several of the central Inner Hebrides artificial islets are noted in the Argyll County Council's *List of Ancient Monuments and Historic Buildings* of 1915. The Duke of Argyll reported that there was a crannog in Loch Assapol (Mull) (*ibid.* 2) while Mr. Melles of Gruline House noted that there were possibly three sites in Loch Ba (Mull) (*ibid.* 3). Numerous, but unspecified, prehistoric forts and lake dwellings were recorded for Coll (*ibid.* 4), while on Islay artificial islets were thought to be "in nearly all of the lochs in Kilchoman parish" (*ibid.* 24).

Several accounts and general guide books have been published about the history of the island of Mull (MacLean 1923; 1925; MacCormick 1923; Hannan 1926; Macnab 1970; 1995) each of which includes notices of the island's artificial islets. The artificial islets of Mull were first brought to public notice in 1870 by Mr. F. Campbell who discovered an artificial islet after draining a loch just south of Tobermory. An account of his discovery was published (Campbell 1870) and generated considerable interest in the artificial islets of Mull. Subsequent authors such as MacLean and MacCormick were sensitised to the monuments and identify artificial islets in Lochs Assapol and Sguabain. Blundell (1913, 290-291) also included Mull in his survey of the Highlands and islands and mentioned artificial islets in Lochs Assapol, Ba and Pottee. More recent histories of Mull have been less useful in identifying artificial islets, however, Macnab discovered Eilean Ban in Loch Frisa as late as 1970.

The artificial islets of Mull and Islay were also noted by the Register of the Privy Council of Scotland in 1608, who demanded that Angus McConeill of Dunnyaig (Islay) and Hector McClayne of Duart (Mull) surrender "the haill houssis of defence strongholdis and cranokis in the Yllis pertaining to thame and their foirsaidis sal be delyverit to his Maiestie" (Morrison 1985, 23).

More than thirty guide books and general histories have been published, most near the beginning of the last century, on the history of Islay. A bibliography of these works, many of which are held in the British Museum or the National Library of Scotland, has been published by the Islay Archaeological Survey Group (1961). A cursory examination of this material showed that it did not contain references to Islay's artificial islets but a more detailed examination, especially of the material held in London, may reveal otherwise.

## Modern reports

The freshwater lochs of the central Inner Hebrides are frequented by many different user-groups, some of which may come into contact with, and thus may be able to identify, artificial islets. Such user-groups include fishermen, gillies, sailors, wind-surfers, shepherds, other scientific fieldworkers and scuba divers. Dixon found such sources helpful in locating artificial islets on Loch Tay, which is a water body intensively exploited by the leisure industry (1984, 154). Unsurprisingly, very few of the remote central Inner Hebridean lochs are utilised in this way. Fishing is popular throughout the region but this is primarily done from shore and boats are only available on the largest lochs on Mull and Islay. Local fishermen were found to be generally unaware of the archaeological nature of many of the artificial islets and assumed them to be piles of stones of undetermined origin. Due to their inaccessibility, limited size and shallowness, the central Inner Hebridean lochs are not generally used for sailing or windsurfing. Local shepherds were useful in identifying which of the more remote lochs contained potential sites but in all cases had only viewed such sites from shore. Although a variety of natural scientists have conducted research in the freshwater lochs of the central Inner Hebrides (Maitland and Holden 1983), a review of this literature shows that none have noted the presence of artificial islets. After consulting local sources, it appears very likely that the scuba divers of the present survey were the first to explore all but two of the central Inner Hebridean inland waterbodies. The exceptions are Loch Finlaggan on Islay (examined by Dixon for Channel 4's *Time Team* programme in 1995 (Time Team 1995, 9; National Museums of Scotland 1994, 8)) and Loch Frisa on Mull (used for a zero visibility BSAC training course in 1972 (Ken Knott *pers. comm.* 1994)). In the latter instance, the dive was not concerned with archaeological issues.

## **Aerial photographs**

Aerial photography is a remote sensing method that has been used successfully by previous surveys (Henderson 1993, 20; Dixon 1984, 155; Morrison 1985, 85; Hale 1992) to detect artificial islets both underwater and in the inter-tidal zone. The methodological difficulties of using aerial photographs to reliably identify archaeological sites, however, are well recognised in the technical literature (Wilson 1975; Taylor 1975; Wilson 1982) and these are especially acute in the case of the recognition of submerged features.

The full range of publicly-accessible aerial photographs, both oblique and vertical, relating to the central Inner Hebrides was consulted at NMRS/RCAHMS in Edinburgh (see Appendix K) and found to be of limited value. None of the available imagery, including the oblique photographs taken by the Commission's own fliers, was taken with the express aim of recording submerged sites. In many of the available photographs, the lochs' surfaces are obscured by reflected sunlight, clouds or by wind generated waves. The murkiness of the peaty water encountered in many of the lochs meant that only sites which substantially broke the water's surface were visible. When islets were detected, little detail other than their position could be recorded, as most of the photographs were taken at a 1:10,000 or greater scale. Natural bedrock islets litter many of the central Inner Hebridean lochs and it was impossible to differentiate between these and artificially created sites on the available imagery. Other biological features such as reed beds, algal rings and peat islets, many of which were not consistent from photograph to photograph, further confused the expected distribution of artificial islets. In this area then, an inspection of the aerial photographs produced little relevant information and falsely swelled the number of sites which needed to be inspected in the field. Sites examined as a result of misidentifications on aerial photographs are listed briefly in Appendix A.

## Previous archaeological reports

A majority of the later prehistoric archaeological sites on Islay were identified and roughly surveyed by the now defunct Islay Archaeological Survey Group in the late 1950s and early 1960s. This group of amateur archaeologists correctly identified five of the nine artificial islets now known on Islay and published their findings in a *Gazetteer* (Cliona 1960). Three of Islay's artificial islets were also mentioned in early issues of *Discovery and Excavation in Scotland* (Lamont 1959; Newall 1960; Davies 1959).

The Royal Commission on Ancient and Historic Monuments of Scotland surveyed, fieldwalked and described the vast majority of the archaeological sites of the central Inner Hebrides, including the artificial islets, during the late 1970s and early 1980s and published their findings in two of the Argyll *Inventories*. In *Volume 3* (1980) the Royal Commission recorded a total of fourteen artificial islets, classified as crannogs and related structures, and lists three possible sites on Mull, Coll and Tiree. In the Islay *Inventory* (1984) the Royal Commission began to differentiate amongst artificial islets, listing four as 'islet dwellings', one as a 'fortified islet', two as 'possible crannogs', one as a 'possible fortified islet' and one as a 'possible islet dwelling'. It is not clear on what basis the various terms were applied but all the sites were grouped under the broad heading of crannogs.

The card files (this is the National Monuments Record) kept by the Royal Commission in Edinburgh were also a useful source of information in locating potential sites and referencing the site surveyor's notes. Many of the suspected or rumoured artificial islets mentioned in earlier sources were however never confirmed by the Commission's investigators because any remains present at the proposed locations were fully submerged; these fieldworkers however made accurate notes of their locations. The investigators' notes were invaluable when inspecting the individual sites, not only for locating specific features but also for assessing how the sites had changed over the last twenty years.

The Royal Commission's survey of artificial islets was limited by the inability of investigators to access many of the sites. The officers were not furnished with scuba diving equipment and boats were seldom available; and so only drained sites or those connected to the shore by causeways could be inspected at first hand. This meant that a majority of the sites had to be examined from the lochs' shores and measurements of the visible structures approximated. Little could be noted about the underwater portions of the sites and suspected submerged causeways could rarely be confirmed. In one of the few instances where the Commission's investigators were able to procure a boat, they could do little but float over the top of the suspected site (Loch Assapol, Mull), the inspecting officer later commenting that "exact measurements were quite impossible...the wind was blowing us all about the loch...it was a very harrowing experience" (Graham Ritchie *pers. comm.* 1993).

The distribution map of Scotland's crannogs included in Oakley's (1973) study (Illustration 4.1) shows a total of twenty artificial islets in the central Inner Hebrides. This distribution was compiled from a literary review of the published sources, primarily *DES* and *PSAS*, without any of the sites being inspected by Oakley herself. The present survey examined all of the sites in Oakley's distribution and found that three of these sites were natural features (see Appendix A) and one was a duplication. As a result, Oakley's data-set contains 14 sites fewer than the total distribution recovered by this survey, thus under-reporting the total distribution of artificial islets in the survey region by almost 100%. A distribution map of Scotland's crannogs published by Dixon (1984, 218) is almost an identical copy of Oakley's, updated to include the sites recently discovered by the Loch Tay (Dixon 1982) and Loch Awe (Hardy, McArdle and Miles 1973) underwater surveys (Illustration 4.1). Morrison's distribution map of crannogs (1985, 10) is based on Dixon's and once again few of the sites were ever checked in the field (Morrison *pers. comm.* 1996). As late as 1994 Henderson (1994, figure 5.1) was still using a distribution map based on Oakley's showing the same twenty crannogs in the central Inner Hebrides (Illustration 4.1). Harding (1997, 119) has also recently published a distribution map of the forts,

brochs, duns and crannogs of Argyll which only depicts 53% (16) of the population of artificial islets in the central Inner Hebrides.

It is remarkable that twenty-five years after Oakley's map was first compiled it remains the fundamental source used for displaying the distribution of Scotland's crannogs / artificial islets. Recent surveys have added data to the map but a majority of the other sites depicted have never been inspected by divers. In fact the central Inner Hebridean sites included in Oakley's survey were only viewed from shore (which naturally limits the security of the information) by what are arguably non experts in artificial islet identification. Considering that in the central Inner Hebrides Oakley misidentified 20% (4) (50% of these were natural features, see Appendix A, Loch Kinnabus and Loch Ghille Caluim) of the sites and missed 46% (14) (although 57% (8) of these were not previously reported), her distribution should be viewed as far from complete and, if the central Inner Hebrides are typical, it includes many sites which are natural features.

### **Place names**

The place names of the central Inner Hebridean lochs were investigated to establish if they indicated which lochs contained artificial islets. This approach, though an enlightening exercise in linguistics, was not useful in identifying archaeological sites. The place names of the central Inner Hebrides have been examined recently by Macquarrie (1982), Ferguson and Perrons (1988), Johnston (1990), Findlay and Turner (1994) and Young (1997). An examination of these sources shows that many of the place names have been anglicised by the Ordnance Survey or otherwise changed in recent history and thus translations of the meaning of the names are not always historically reliable. For this reason local sources were consulted wherever possible: Mrs. M. Douglass on Mull, Mr. H. McKinnon on Coll and Dr. J. Holliday on Tiree to verify the original spellings and meanings of the lochs names. Lastly, Mr. Ian Fraser, director of the Scottish Place Names Survey at Edinburgh University, was consulted to render final judgement on the meanings of the lochs' place names.

An examination of Appendix C shows that the place names of the central Inner Hebridean fresh water lochs are a mixture of Gaelic and Norse. Most of the names are associated with farms near the lochs, rivers which drain into them, descriptions of the landscape surrounding the lochs, or derive from personal names; they are seldomly descriptions of the lochs themselves. Only three of the lochs names were found to be potentially associated with the artificial islets: Loch an Duin ('Loch of the Dun') on Coll and Loch Barradail ('Loch of the fortress in the valley') and – much less certainly potentially associated with a man-made structure in or near it - Loch an Fhir Mhoir ('Loch of the big man') on Islay. The place names of Loch an Duin and Loch Barradail are likely to refer directly to the artificial islets known within these lochs, as there are no other archaeological features likely to have produced these names near these lochs, while Loch an Fhir Mhoir may refer to the social status of the person occupying or controlling the loch. The reason that Loch an Fhir Mhoir was so named is not locally known and it was not until the present survey identified the potential islet broch near its centre that the possible origins of the name were realised. Mr. Fraser agreed with the author that this place name was most likely associated with the loch due to the presence of the artificial islet within it.

Seven of the artificial islets in the central Inner Hebrides are named in map or documentary sources consulted for this survey. Eilean Mhic Conuill (Tiree), Eilean Anlaimh (Coll), Dun Anlaimh (Coll), Caisteal Eoghainn a' Chinn Bhig (Mull) and Eilean Mhuireill (Islay) are all named after people. Each of these islets is crowned by walling which is likely to be medieval in date and it is possible that these personal names originally date from this period. The two remaining islets are named with descriptive terms: Eilean Ban (Mull) meaning 'fair island' and Eilean Aird na Brathan (Tiree) meaning 'millstone promontory' (this site is located next to the stream which powered Tiree's mill).

## Summary

The artificial islets of the central Inner Hebrides were found to be well documented by each of the sources considered in this chapter. All of the sites confirmed by this survey, except Ledmore on Mull, were either previously identified, or had been suspected to be, an artificial islet by at least one published source. While this intensity of coverage is a testament to the thoroughness of the field workers, amateur and professional, of the past, it should also be noted that over twenty of the sites listed as artificial islets in these same publications were discovered to be natural features or duplications. This is the first intensive underwater survey project which discounts almost as many sites as it has been able to confirm and may have implications for any attempt to 'guesstimate' the total surviving number of artificial islets in Scottish inland waters. The reason that so many of the sites were incorrectly identified is undoubtedly because most of the sites were never inspected at close range and were only examined from the shores of the lochs. With the exception of the sites which were located in lochs which had subsequently been drained, almost all of the measurements previously published for the sites were approximations and did not take into account the submerged portions of the islets. Thus, although in total almost all the sites recognised and confirmed by the survey detailed in succeeding chapters were already known in archaeological sources or related literature, there were also substantial numbers of 'probable' or 'possible' sites that can now be either definitively eliminated or considered at best as very unlikely. Whether overestimates, as in the case of Beveridge's consideration of Coll, or underestimates, as in the case of Oakley's consideration of the region, no individual source had previously identified all of the artificial islets of the central Inner Hebrides.

## **Chapter 5**

### **Field search: Underwater reconnaissance and survey in the central Inner Hebrides**

Following the examination of the historical sources and cartographic material pertaining to the artificial islets of the central Inner Hebrides (Chapter 4), it is clear that many of the problems related to the presence, form, structural characteristics and landscape positions of these sites could only be addressed by examining the sites in the field. As mentioned above, each of the artificial islets examined here had not been previously inspected by divers and only a few had been viewed other than purely cursorily from shore. Only in cases where the lochs in which the islets were once located had been drained, or in instances where the RCAHMS investigators had been able to obtain access, were detailed accounts available for the sites. In the latter case, these accounts could not include consideration of the submerged portions of these sites. Furthermore, experience elsewhere in Scottish water bodies strongly intimated that underwater survey might well reveal additional sites of this type that had previously escaped detection.

An underwater field survey of the freshwater lochs of the central Inner Hebrides was thus begun in the spring of 1994 and continued until the end of the summer of 1996. Multiple field seasons were required due to the logistics of access to the central Inner Hebridean islands, the dispersal of their water bodies, the limited availability of equipment, and the need to assimilate the data that was accumulated. The chronic lack of trained archaeological divers, discussed below, available to assist in the project, not least so that it could fulfil rigorous safety requirements, was also a significant controlling factor.

#### **Aims of survey**

The aims of the survey generally followed those of Dixon (1984, 143), which were developed from those of McArdle and McArdle (1973, 8). These were expanded where necessary to take into account the unique nature of the central Inner

Hebridean sites and, in terms of a complementary land-based component, to make a more detailed assessment of the landscape surrounding each site. A significant factor relating to the approach taken is that the methodologies that had been developed previously had been targeted primarily at lochs occupying heavily glaciated troughs, in which the locations of crannogs and similar sites are forcibly restricted to the shallow waters marginal to these water bodies.

The first aim was to locate and determine the position and form of every surviving artificial islet in the freshwater lochs of the central Inner Hebrides. To achieve this, all sites referred to in earlier sources, whether confirmed or merely possible, were checked, and as many other water bodies that matched criteria which suggested they could have accommodated sites of the type, as could be examined within the constraints of access arrangements, safety considerations and time and financial resources. (For a list of lochs inspected see Appendix B)

Once identified each site was examined for features such as: jetties, harbours, causeways, stepping stones, middens, surface walling and building foundations, which had been identified at other crannog sites in Scotland. Detailed plans and photographs, where possible, were then produced of each site.

The third basic aim was to establish if any of the sites contained visible organic deposits or features and, if so, to note their form, position and state of preservation. If organic materials were discovered and their removal would not overly disturb the site, samples were taken for environmental examination in order to establish a relative chronology for each site by way of vegetation studies, dendrochronology or radiocarbon assessment. The survey was to be as non-intrusive as possible and, beyond the limited amount of organic sampling undertaken, a strict policy of non-disturbance was followed.

The fourth aim was to record the artificial islets' relationships to topographical and geographical elements of the immediate and surrounding landscape. Underwater survey concentrated on the geology, slope, depth and

consistency of the loch bed directly adjacent to each site and between the site and the nearest shore. The site's position in the loch, distance to closest shore and distance to the nearest inlets and outlets were also noted. The landscape surrounding each loch was also studied to determine whether each site was sheltered from the prevailing winds and whether it was positioned near areas of agriculturally productive soils.

The fifth basic aim was to field-walk each of the lochs' catchments where artificial islets were found, in order to establish the presence and characteristics of other field remains in these areas and from this to deduce if the artificial islet sites held consistent relationships with other archaeological monuments or field systems.

### **Field search**

The methods used to identify artificial islets in the central Inner Hebridean lochs varied substantially from those employed by previous surveyors of crannogs on the Scottish mainland. Unlike the large, deep Highland lochs of Awe and Tay, a majority of the central Inner Hebridean lochs are under 0.25km<sup>2</sup> in surface area (Maitland and Holden 1983, 232) and are a maximum of 10m in depth. The shallowness of the water meant that artificial islets could potentially be found at any position within most lochs, and were not forcibly restricted to marginal locations where relatively shallower water is normally encountered. Thus, although the water bodies were smaller than the large highland lochs, comparable areas of loch bed had to be searched. The McArdules (1973) and Dixon (1982) were able to restrict their field-searches to the shallow (under 10m) margins of the mainland lochs, whereas nearly all areas of the central Inner Hebridean lochs had to be inspected.

The topography of the central Inner Hebrides was a major inhibitor to the survey of the artificial islets. Many of the lochs that needed to be inspected were located substantial distances from any type of road which meant that all of the equipment required for the survey had to be physically carried to the site. For this reason the equipment taken to the lochs was kept to a minimum and air tanks and weightbelts were only imported if required. The distances travelled on foot often

exceeded 2km, each way, and were complicated by the ruggedness of the terrain. Peat bogs had to be crossed, mountains climbed and ravines negotiated. Each of these factors increased the amount of time it took to get to and from each loch and normally limited survey work to one site per day. Additional time was spent field-walking the catchments of each of the lochs surveyed, but generally no archaeological remains were observed. Where other sites were encountered, these are noted in Appendix A.

Unlike previous surveys, boats or inflatables were seldom used to inspect potential sites in the central Inner Hebrides. This was largely due to the small size and remote location of most of the lochs. It would have been extremely inconvenient to import boats to each of the lochs inspected and very few have easily accessible launches. For this reason boats were only used in the large Lochs of Ba and Frisa on Mull. A small 3.5m Zodiac™ inflatable, loaned by Ian Morrison of Edinburgh University, and a 4 hp Yamaha outboard engine, borrowed from the Archaeology Department of Edinburgh University, were used to enhance the effectiveness of the survey of these two large lochs. The boat was used as a platform for a Humming Bird™ *Wide 3D Vision* echo-sounder which allowed large areas of the loch bed to be quickly and systematically searched. This technique had previously been successfully used by Henderson (1994, 34) to identify artificial islets in low visibility conditions in the Lake of Menteith. The echo-sounder used by this survey gave a 50m wide three dimensional image of the loch bed which allowed artificial islets to be clearly distinguished: however, only the site at Gruline in Loch Ba on Mull (Appendix A) was initially discovered using the echo-sounder. The speed and efficiency of the survey of these large lochs could have been dramatically improved if both a larger boat and a more powerful engine had been available.

The primary method of locating artificial islets in the central Inner Hebrides was, by necessity, inspection by divers. Most lochs were small enough that they could be searched by a pair of divers within half an hour once the divers were in the water and the shallowness of the water bodies meant that only snorkels were needed to access most areas of lochbed. In at least 50% of the cases the lochs were shallow

enough to be inspected by wading and large areas could quickly be covered by this method. Water visibility largely determined the intensity of the search patterns, and in some lochs the water was so peaty that survey had to be conducted by feel. These lochs necessarily took considerable time to search whereas if the visibility was good large areas could be quickly covered in looser patterns of survey traverses. Mud and heavy silt also hampered field-searches by reducing visibility and covering potential features. In two instances (Lochs an Sgalain (Mull) and Muchairt (Islay), divers had to inspect lochs by swimming through very thin mud, the consistency of quicksand, in nil visibility. This situation was potentially dangerous and particularly close contact had to be kept between the divers and shore personnel at all times. It is obviously impossible to guarantee that all the sites existing in these conditions were recovered. (A note on all the lochs inspected is included as Appendix B)

Most of the artificial islets noted by the various sources discussed in the previous chapter were easily relocated. All but three of the central Inner Hebridean artificial islets could be visually sighted from shore as small overgrown islets, boulder covered platforms or circular patches of reeds. Only three of the artificial islets were found to be submerged all year round (Loch Assapol (Mull), Gruline (Mull) and Eilean Mhic Conuill (Tiree) and these were quickly identified by snorkelling in their general area as indicated by earlier sources. All the sites or potential sites noted by previous sources were located and several new sites identified. Only a single artificial islet, Ledmore (Mull) (Appendix A), was discovered in the central Inner Hebrides which had not been mentioned or suspected previously by the sources consulted in Chapter 4.

Once an artificial islet was located, several circuits were made around the site in order to establish its shape, to inspect it for underwater features, and clearly to define its outer edge at the interface with the loch bed deposits. Specific attention was given to the geological characteristics of the loch bed immediately adjacent to the base of the artificial islet and the immediate surrounding lochbed. Once all of the islet's visible features had been located and noted each site was planned and photographed. The whole process from initial identification to departing the site

usually took from 3 to 5 hours depending on the complexity of the remains encountered and the scale of the catchment to be walked over.

It is believed that the strategy employed during the present survey was sufficient to recover the total surviving distribution of artificial islets in the fresh water lochs of the central Inner Hebrides that is susceptible to discovery using the techniques that were employed. (Island sites, located in salt-water tidal areas, which are occasionally referred to as crannogs, such as Eilean Amalaig, Loch Spelve (Mull) (RCAHMS 1980, No. 240) and Dun an Dunan, Salum Bay (Tiree) (RCAHMS 1980, No. 172), were not inspected as they were beyond the scope of this thesis.) It is of course possible that some sites may be buried beneath sediments or that they have sunk into unconsolidated areas of loch bed, leaving no visible trace of their existence, these sites are presently unrecoverable. Over 80% of the freshwater lochs of the central Inner Hebrides were inspected by divers (see Appendix B), an intensity of coverage which is unparalleled in any other area of Scotland. The catchments immediately surrounding the shores of these lochs, including any likely promontories, were also inspected in order to identify any sites which had not been previously recognised as artificial islets. The author is therefore fairly confident in stating that all visible remains of artificial islets were identified. The factors which may prevent the total surviving distribution of artificial islets from being realised are discussed extensively in Chapter 7.

Potential sites, either those noted in earlier sources or those identified for the first time during this programme, had to meet several criteria before they were accepted as artificial islets. Although there are at present no strict criteria for the identification of artificial islets in the field in print, previous surveys have included sites within this category based on the appearance of two or more identifiably man-made features. Such features can include: mounds of stone with steeply banked limits, wooden piles projecting from mounds of stone or directly from the lochbed, the presence of stone walling, building foundations, causeways, or jetties, or the occurrence of midden deposits and artefacts on the lochbed or associated directly with structural evidence. Each of these features was considered by the present survey

but the primary criterion used in verifying a site was that the islet was at least partly artificial. In almost every case examined in the central Inner Hebrides this trait was clearly distinguishable. Artificial islets differed substantially in form, shape, and size from natural mounds of stone attributable to geomorphological phenomena; and natural islets rarely showed any sign of human activity. The potential complication encountered in some lochs used by substantial sea-craft – the dumping overboard of ballast, as in Loch Ness (Morrison 1985, 17) – is irrelevant in the present context.

### **Methods and techniques of field survey**

The methods and techniques used in the central Inner Hebridean survey were based on those developed in the Loch Awe (McArdle and McArdle 1973, 8-13) and Loch Tay (Dixon 1984, 160-164) surveys. New methods introduced by Henderson (1994) in surveying artificial islets in the Lake of Mentieth were also employed.

Survey in most of the Hebridean lochs was carried out using standard snorkelling equipment consisting of a dry suit, gloves, hood, mask, snorkel, fins and light (4 kg) weightbelt. Dry-suits were preferred over wet-suits so that divers could avoid hypothermia in the exposed, windswept Hebridean landscape. As has been noted, the divers also had to conduct a survey, complete records and take photographs out of the water on the artificial islets themselves. Water conducts heat four times faster than air and after several hours in the water a diver's core temperature can lower considerably. This situation is exacerbated if the diver comes out of the water wet and is then exposed to strong winds. As already mentioned, most of the lochs inspected by this survey were considerable distances from any road so caution had to be exercised wherever possible. For the examination of sites located in deeper water, the standard dive kit of a single 12 litre air cylinder, demand valve and octopus, depth gauge, air pressure gauge, and inflatable buoyancy jacket were used. Safety was maintained by diving in pairs on every occasion and by having a person on shore always ready to assist the divers.

The speed and accuracy with which sites could be surveyed was dramatically improved over those achieved during past surveys by using an electronic distance measurer. Although Dixon has criticised the benefits of EDMs and digital data (1984, 163), other recent studies have confirmed the value of using this technology in order to electronically survey crannog sites (Henderson and Burgess 1996). It is inconceivable that this survey could have been carried out to the same standard using the antiquated method of compass bearings and measuring tapes championed by Dixon (1984, 161). Just the process of recording measurements on paper in the field introduces the risk of error and requires an extra person to log the data if timescales for the making of a record for each site are not substantially to increase: in the conditions outlined above in which many of the surveys for this project had to be undertaken, the latter option would not have been feasible.

The present survey utilised a Leica™ Wild T1000 total station which has an attached data logger and removable data card. This equipment allowed detailed point data to be taken and recorded instantly and then imported directly to computer-based drawing packages such as *Autosketch*™ without further data entry. Although the accuracy of the data is only as good as the surveyor, and the outline of the features of many of these sites are to some degree subjective, in so far as measurements are wholly dependent on where the surveyor places the target, the equipment is capable of recording with mm accuracy. This level of accuracy is unnecessary for the planning of sites of the kinds recorded here, but the speed at which sites can be surveyed with an EDM and the consequent reduction of time that divers have to be in the water completely justifies its use.

A team of three people was found to be an adequate number for surveying a site. One person operated the EDM from shore and acted as a lifeguard, while the other two surveyed the site. Each site was surveyed by one diver placing a reflective prism, on top of an extendible pole, on the point being taken while the other diver kept in contact with the EDM operator through the use of walkie-talkies. This method followed that used by Morrison (1985, 90) and was found to be fast and

efficient. Moreover, constant verbal contact and the absence of tapes in which divers could have become entangled provided a high level of safety.

Unlike previous surveys, this survey was required to meet several new safety guidelines. Each of the fieldworkers, including the EDM operator, had to be British Sub Aqua Club qualified divers. This proved problematic as there is currently a shortage of divers who are also trained archaeological field surveyors. Fortunately Mr. Ian W. Morrison, a British Sub Aqua Club instructor, kindly donated his time to train volunteer fieldworkers in basic diving skills. Without his help it would have been impossible to carry out this survey. The author, as the leader of the survey, was required to hold a higher level of certification than the other members of the team, under British Sub Aqua Club rules, and underwent training in order to qualify as an advanced diver. Assembling the necessary trained personnel was not a simple task but led to the formation of a qualified team which was able to carry out initial loch surveys and participate in detailed surveys, thereby producing work of superior quality. Full acknowledgement of the participants is included in the introductory pages to this dissertation, but it should be underscored here that, unlike a land-based survey programme, where there are still many roles that can be fulfilled by the solitary fieldworker undertaking doctoral research, solo work in underwater archaeology is indefensible.

### **Gazetteer - (see Appendix A)**

A total of thirty artificial islets were located and confirmed in the freshwater lochs of the central Inner Hebrides and planned (see Illustration 5.1). Of this number only three are permanently underwater, the remainder appearing as small islets which break the loch's surface.

The names assigned to the islets in the gazetteer generally follow the method described by Dixon (1984, 164) and are most often those used by the Ordnance Survey on their latest maps. Submerged sites or those with no name previously given to them are normally called after the loch in which they are situated. If multiple

unnamed sites were found in a loch, as in Loch Ba and Loch Frisa on Mull, sites were named after the nearest habitation on shore.

Each site report in the gazetteer includes a review of the material published on the site and whether it had previously been identified as an artificial islet. This is followed by a detailed description of the location and conditions found in each loch as well as a general overview of the surrounding topography. Each site is then described and specific features and measurements noted. There are considerably more measurements reported here than is usually the case in past surveys, to allow as complete a picture as possible of each site to emerge and to provide a more solid basis from which future surveyors may be able to assess long-term change on such sites. The particular features and potential chronology of each site is then discussed along with the site's relationship to the surrounding landscape. Each site report concludes with the date that the artificial islet was actually surveyed.

### **Dissemination of data**

One of the primary problems with surveys of artificial islets in the past has been that a majority of the information that they gathered has never been published and is thus not publicly available. It is very difficult to question researchers' conclusions if the data on which they are basing their conclusions is not available for consultation. For this reason it was decided to publish the central Inner Hebridean artificial islet survey data as it was gathered. Brief notes containing relevant measurements and descriptions were published for each individual site in *Discovery and Excavation in Scotland* during the years 1996, 1995 and 1994, immediately after the sites were surveyed.

An Internet World Wide Web site was also constructed by the author so that the survey data could be distributed to an international audience. The web site contains site reports and pictures of each of the artificial islets surveyed in the central Inner Hebrides and is registered with major Internet search engines such as *Yahoo*, *Alta Vista*, *Webcrawler*, *Excite* and *Lycos*, under the word "crannog". There are

many advantages of placing information on the Internet. Information can be accessed any time of the day, world-wide, all year round, from any computer connected to the World Wide Web. During the first month the site was registered, over 200 users visited the site and the site continues to be regularly consulted by users world-wide. Users have provided a considerable amount of feedback, some of which is incorporated into the discussion section of this thesis, and many have requested additional information. The Internet site has been cited by archaeology students in Scotland, England, Russia, Sweden, Poland, Croatia, the United States, Canada and Australia in university reports and was recently included in the electronic version of an introductory archaeology book published by K.T. Green (1995). It is hoped that this site can remain open into the future. This type of access to the information is certainly beneficial to crannog studies as a whole and will allow others unable to visit the sites to draw their own conclusions.

Crannogs On the Web can be found at:

<http://129.215.101.50/arch/postgrad/Holley/homepage.html>

## Chapter 6

### A consideration of surviving structural features of the artificial islets of the central Inner Hebrides

#### Introduction

The purpose of this chapter is to explore relationships between the structural details of the artificial islets of the central Inner Hebrides. The data employed have been presented in Appendix A. Although the field-survey that was undertaken provides limited information on internal structural details, it does allow a more general analysis of the visible, recurrent features, of what are assumed on the basis of the available evidence to be primarily stone-built structures. This chapter will demonstrate that this approach can give insights into the nature and utility of artificial islets, and provides evidence which runs counter to the theories of Dixon (1984) and Morrison (1985) regarding the function of artificial islets.

Although the analysis of field-survey data has well-recognised limitations, it has been used to examine large distributions of unexcavated monuments throughout Atlantic Scotland, primarily brochs (Armit 1990; Martlew 1982; Fojut 1982), and has proved to be a useful device by which to discuss prevailing theories heuristically. While Dixon has criticised this approach stating that, “the comparison of crannog habitation area sizes based only on evidence of survey is highly speculative since the mounds as they now stand may not be representative of their earlier form” (1984, 186), the advantages of this approach are perceived to outweigh its weaknesses for this set of unexcavated sites. Additionally, Dixon’s remark was framed primarily in terms of the essentially timber-built structures which he examined; it may be postulated that the correlation between present form and initial useable surface area may be subject to fewer vagaries in the case of stone-built constructions. This technique’s primary strength is that it may be used to rehearse previous theories without destroying monuments through excavation and is infinitely repeatable as more data become available. Unless techniques such as this, which examine large groups of

data, are employed it is unclear how relevant and useful discussion of these monuments may be stimulated without excavation, and on what basis, other than immediate threats to them, sites might be selected for excavation.

Excavation data from all the sites considered here is meantime lacking and, given the nature of the environments in which they are set, is likely to remain so. Unless funds are identified to mount a programme of research excavation, it seems unlikely that such interventions will occur, the sites being unlikely to be faced by the kinds of catastrophic threat that have underpinned excavation work on artificial islets elsewhere in Scotland (Barber and Crone 1993). Whilst the central Inner Hebridean sites are unlikely to be wholly stable, and are of course subject to currents, acidification and eutrophication (cf Cressey 1996) the degree of this menace is perceived to be small compared to that occurring in other regions of Scotland.

This review will show that progress in the study of artificial islets can be made by applying simple analytical techniques to a sizeable number of artificial islets confined to a specific geographic region. The application of a regional approach will be useful in examining what are essentially a chronologically disparate collection of sites that are a response to the common logistically based material constraints which would have been encountered in the region throughout the past three millennia.

### **History of structural analysis of artificial islets**

Prior to this study, the structural analysis of artificial islets has primarily been limited to single sites. Most researchers have viewed artificial islets at the micro scale, i.e. only considering the site under excavation, to the detriment of a regional approach. Furthermore, most researchers have only excavated a single artificial islet site during their career and the total number of sites which have been excavated is small. This section will outline the history of the structural analysis of artificial islets in Scotland. (Full discussion of the work and general theories of each author noted here may be found in Chapter 3).

As the director of the excavation of three artificial islets, Robert Munro had an extensive first-hand knowledge of the structure of Scotland's artificial islets. His analysis of the structure of these sites, however, was confined to a few comments on how the islets were constructed and what materials were used. Munro was not an advocate of the theory that all artificial islets were pile-dwellings and theorised that the beds of many of the lochs were too soft and yielding to support true pile-dwellings (1886, 469). Towards the end of his career he stated that he did not, "know of a true pile-dwelling in Scotland belonging to any period" (1905, 164). Based upon the descriptive notices of the artificial islets of Ireland (see Munro 1882, 5-11) and his excavations at Lochlee, Lochspouts, and Buston, Munro theorised that, "all wooden islands were constructed after one uniform plan", which was based on, "the highest mechanical principles that the circumstances could admit" (1882, 261). This theorised plan works thus: an artificial islet was built by floating circular rafts of timber over the desired site, at which point additional layers of logs, stones and gravel were deposited on it until the whole mass grounded on the lochbed. Piles were then inserted through prepared holes in the timbers of the raft, thereby firmly fixing the structure in place. This process was repeated until the surface of the structure reached the desired height above water-level when, "a prepared pavement of oak-beams was constructed" (1882, 262), and enclosed by a wooden fence.

Although this hypothesis relates to artificial islets with significant timber components, Munro also noted that, "it cannot be assumed that the crannog-builders made wood a *sine qua non* in the structure of islands" (1882,242). Munro concedes that artificial islets situated on consolidated lochbed deposits, such as those found in the glacial and rock-cut basins of the larger Scottish lochs, could be entirely composed of stone (1882, 242).

A lowland - highland division of artificial islets based on size was suggested by J. Ritchie, the next major contributor to the structural analysis of artificial islets, in 1942. After his excavation of a site in Loch Treig, Inverness-shire, he hypothesised

from the differences in the scale of the sites that the artificial islets excavated by Munro in the south-west of Scotland were akin to “lake villages” (this term was left undefined) while the crannogs located in the Highlands should be considered as “lake-hutments” (Ritchie 1942, 9). Although these terms have never won favour in the Scottish context, they represent the first explicit statement of the variation in size amongst Scottish artificial islets; and that variability in size may indicate differing functions or use by communities of different types.

He further argued that there were four main types of “lake-dwellings” present throughout Scotland and Europe, which could be categorised by their structural details. Excavation had revealed that each, “was essentially built about a skeleton of wood”, but Ritchie theorised that, “the character of the skeleton as well as the purpose it served have varied from country to country and perhaps also from time to time” (1942, 25). The first and oldest type of structure, located predominantly in Central Europe and utilised during the Neolithic and Bronze Ages’ was a free standing, timber pile-structure on which was set a level platform designed to stand several feet proud of the water-level. The second type of artificial islet was also composed of timbers. In this case, however, the timber was stacked in a rectangular fashion, like a log cabin (Ger. *Kastenbau*), until it was above water-level and then a wooden platform was placed on it. This type of structure was held in place by posts which were driven into the lochbed at the corners of the structure. Ritchie believed that this model was in use during the Early Iron Age in Northern Germany and France and was very probably based on near-contemporary excavations on the Continent, as in the fortifications at Biskupin in Poland and at the late Urnfield Swiss site of Zug-Sumpf (see Ruoff 1987, 71; Audouze and Buchsenschutz 1992, 53-54, 67-70). A third type of structure, common to Central Europe, was termed “fascine islands” (Keller 1866) and was constructed by dumping brushwood, branches, and the stems of small trees on the lochbed and then driving piles through the mass to keep it in place. The fourth type of structure as described by Ritchie follows Munro’s model and is a matrix of timbers held in place by heaps of stone and timber piles (Ritchie 1942, 25). It was this last type of structure that Ritchie perceived to be most common to

Scotland and Ireland and that he had encountered in his excavations at Loch Treig. It should be noted that Ritchie did not cite parallels for all four of his structural typologies, nor did he consider the practicalities of engineering such structures.

However, Ritchie disagreed with Munro's theory that rafts of timber were sunk over the desired site and posited instead that that water-levels were temporarily lowered in the lochs so that the islets could be constructed in the dry. Ritchie's interpretation of the site at Loch Treig is unique in that it is the only artificial islet thus far excavated in Scotland where the shape has been interpreted as rectangular subsequent to its excavation.

The first sizeable data-set concerning the structural features of artificial islets was gathered by McArdle and McArdle during their 1973 underwater survey in Loch Awe, Argyll. This survey was designed to measure the 'variation in size, shape, type, depth of water around the artificial islet, and the frequency of external features such as harbours, jetties, and causeways' (Morrison 1973; McArdle and McArdle 1973a; McArdle and McArdle 1973b). The limitations of this data-set have been discussed below in Chapter 8. Although the 1973 survey recorded a wealth of information concerning the structural features of the artificial islets in Loch Awe, most of the data was tabulated and summarised rather than analysed in detail on a site-by-site basis, thereby unfortunately diminishing the value of this key data-set as a source for comparanda for the central Inner Hebridean sites. It is unfortunate that many of the measurements taken by the 1973 survey have never been published, although all of the original field-notes and data still exist (McArdle *pers. comm.* 1997).

McArdle and McArdle made only two generalisations concerning the structural features of the artificial islets they examined. They noted that, "all the man-made mounds were composed of regular-sized stone which a man could comfortably lift, usually with an open structure, (i.e. no sand or gravel mixed in between)" (McArdle and McArdle 1973a, 10). Secondly, they recorded that timbers were located on 9 of the 20 artificial islet sites they visited and the presence of this material

led the authors to conclude that, “we can now confidently state that most crannogs are wooden structures with merely a facing of stone to prevent erosion” (McArdle and McArdle 1973a, 10).

A further structural analysis, based on underwater survey, of a sizeable population of artificial islets was carried out by Dixon in Loch Tay (1982; 1984). He compared (1984) the structure and form of the artificial islets he surveyed with those in Loch Awe (Hardy, McArdle and Miles 1973). Dixon’s consideration of structural information takes the form of brief notes on various structural aspects of artificial islets. Both these data-sets and Dixon’s findings are discussed extensively in Chapter 3 and will only briefly be commented on here.

Dixon highlighted several structural features in the Loch Awe and Loch Tay artificial islet groups which he thought significant. These features he considered could be used as a basis for the structural analysis of artificial islets in other geographical regions. In Loch Awe, 14 (70%) sites were built on bedrock or natural mounds, whereas in Loch Tay none were. The diameters of artificial islets in both lochs were found to range from 7m to 30m and the ratio of basal area to upper internal area also displayed a significant range (Dixon 1984,179). Timbers were found at 16 of 37 sites, including vertically-set piles at 6 examples (*ibid.* 181-182). No harbours or jetties were found associated with artificial islets in Loch Tay, but 9 were discovered in Loch Awe. Although these findings are summary, they were the first which were based on a comparatively large sample of sites from two distinct geographical provinces.

Throughout Dixon’s Ph.D. thesis he argues against Munro’s theory that some artificial islets could be entirely constructed of stone and that, “the structure of crannogs can no longer be seen as a simple matter of either timber or stone” (*ibid.* 253). The prevailing theme throughout the thesis is that artificial islets were originally “true pile-dwellings” which were always constructed of wood and usually crowned with a, “timber house, surrounded by a wooden walkway and possibly a stockade”

(*ibid.* 2). Although Dixon notes that stone is present at many of the sites he considered he dismisses it as, “a later method of rebuilding earlier sites which had become derelict” (*ibid.* 259), and insists that, “although many of the later sites were substantially stone-built, for most of the time the artificial islets supported timber structures” (*ibid.* 11). After partially excavating Oakbank crannog in Perthshire, Dixon concluded that, “stone-built mounds may not be a distinctive type of structure”, and that, “it is probable that many, if not all, of the stone mounds mark the organic remains of earlier timber framed sites” (*ibid.* 259).

Although Dixon’s perception that stone was never the predominant initial building material of these sites would have seriously limited where and what type of structures could be built, he insists that dumped stone was a later addition to the sites he had examined (Dixon and Andrian 1995, 27) and claims that, “it is questionable whether a crannog built entirely of boulders would have been functional given the difficulties of constructing a timber dwelling on it” (Dixon 1984, 259). This remark is underpinned by the assumption, not justified by Dixon’s work nor indeed earlier observations, that timber structures dependent on the lacustrine equivalent of earthfast posts, represented the sole method of building construction during the period artificial islets were in use. The foundations of stone-built structures are commonly found on artificial islets, especially in the Western Isles of Scotland (see Chapter 9), which have been shown to date to the later prehistoric period (Harding and Armit 1990) and earlier (Armit 1987). Stone has been the only locally available source of building material in many parts of Atlantic Scotland, where a majority of all domestic architecture has traditionally been stone-built, throughout the past three millennia. The difficulties which would need to be overcome to construct pile-dwellings on bedrock would be extreme, if not impossible, but Dixon states that, “it is noticeable in later surveys that crannogs may be constructed near to bedrock but do not utilise it” (*ibid.* 42). However, this statement does not agree with the findings of the Loch Awe survey which showed that fourteen artificial islets were built on bedrock or natural mounds.

In recent years Dixon has revised his views on the structural role of stone on artificial islets and admits that some sites in the Western Isles and other “barren environments” may be composed of stone (Dixon and Andrian 1996). He has categorised these sites separately from crannogs, labelling them as either island brochs, island duns or stone mounds while noting that, “they may have fulfilled the same function as crannogs” (Dixon 1994, 268; Dixon and Andrian 1995, 27). These distinctions in terminology are not particularly useful for describing sites that exist in various states of preservation, however, and their usage to describe land sites in this region has recently been challenged (Armit 1992).

Morrison (1985) reviewed available structural evidence and constructional information in his synthesis. He disagreed with the lowland-highland division of artificial islets, posited by Ritchie and supported by Piggott (1962, 147), which separated the country into primarily (Lowland) timber and (Highland) stone-built provinces. Morrison noted that, “...many stoney mounds in Highland lochs contain substantial timber components...”, and that Oakbank crannog demonstrates, “...that some sites, which now appear as stone mounds, may originally have been built as essentially wooden structures” (1985, 20). Morrison made two other observations regarding the structure of the artificial islets of Scotland without citing any specific proof. He believed that the stony tops of most artificial islets, “do not represent a surface intended for direct inhabitation” (1985, 40), and speculated that the artificial islet dwellers economised on constructional effort and tested the characteristics of the lochbed before building a site (1985, 42). Whilst some of this may have been achieved by probing from canoes or other surface craft, in other instances it may have proved essential to insert test piles in order to test the load bearing qualities of the lochbed.

This section has shown that the previous approaches to the structural analysis of artificial islets have been brief and fragmentary. Past studies have tended to over-generalise findings and have arguably not realised the full potential of the available data. The unwillingness of modern researchers to accept that varying materials and different constructional methods may have been used to construct artificial islets in

different geographical regions of Scotland is not supported by the data and seems to rely too heavily on the results of restricted programmes of excavation. Although this situation is beginning to change as more survey data becomes available, the popular perception that artificial islets are occupied by exclusively timber built structures remains (see Harding 1997, 137; Oram 1997, 88; Delgado 1997, 117). The remainder of this chapter will demonstrate that the analysis of the structural features of artificial islets can yield a wealth of information, much of which contradicts previous theories which have been based largely on speculation, or on the incorporation of comparanda of dubious value from outside Scotland.

### **Preservation of features**

Almost every structural feature which can be analysed is prone to have been affected by a host of factors which have impacted on the artificial islets since their construction. In some respects, artificial islets are likely to be some of the most intact field monuments in Scotland. Many factors, such as subsequent stone robbing or erosion through agricultural practices, which have had devastating effects on land sites, do not apply to artificial islets due to their inaccessible, partially submerged nature. However, their setting does not wholly protect artificial islets from subsequent change and thus the secure identification of the presence or absence of most structural features as the result of a single underwater survey makes the drawing of firm conclusions less than certain.

Fieldwork is much less useful as a guide to the details of the structural configuration of artificial islets, for which excavation of all examples would be necessary, than to their position in the landscape, as will be demonstrated in Chapter 7. Nevertheless, the structural data which can be measured in the field give important clues as to the function and nature of the artificial islets of the central Inner Hebrides, as well as, at the most basic level, providing confirmation that some sites, previously only viewed remotely from the shore, are indeed wholly or partly artificial.

The remainder of this chapter will examine the structural features of artificial islets individually. Two standard indices are employed throughout. These are defined as follows:

$$\text{Mean} = \frac{\sum \text{measurement}}{\text{number of sites}}$$

$$\text{Standard Deviation} = \frac{\sum (\text{Mean-measurement})^2}{\text{number of sites}}$$

## **Materials**

### **Stone**

The artificial islets of this study are primarily composed of large quantities of stone. In a largely treeless environment as, despite the accumulating palynological evidence for some woodland cover in the Western Isles in earlier prehistory (Fossitt 1996; Gilbertson *et al.* 1995; Edwards and Whittington 1997) the exposed and windswept islands of Coll and Tiree will have proffered in later prehistory, this is hardly surprising. Morrison had already noted that the builders of the artificial islets in the Western and Northern Isles used materials that were readily at hand (1985, 37). This view is wholly supported from observations made doing fieldwork in the central Inner Hebrides. With the possible exception of the sites on Tiree which survive as comparatively slight structures, an average of 600m<sup>3</sup> of stone (see Appendix D) would have been needed to construct each of the artificial islets located in this study area.

The exact source of this stone is unknown, but several recurrently-observed characteristics may be noted. At least 80% of the stone may be described as unshaped (i.e. showing no evidence of tooling) and of a size that can easily be carried by a man. The lack of sharp angular edges suggests that the stone was not being quarried from

rock-faces but instead was being collected from across the landscape. It may also be noted that up to 95% of the stone is not so well-rounded that it is likely to have come from the sea shore or river-beds. There is no evidence to suggest that any of the stone was obtained from other than the local setting of the sites. In every case the stone appears to have come from the island on which the artificial islets are sited, and probably within maximally 1km or 2km of the artificial islet's site. This suggests that the builders of the artificial islets were opportunists who collected the stone from their immediate surroundings, incidentally thereby improving land for cultivation or pasture, in a manner already noted through cairn construction in other sectors of the Scottish landscape.

Calculations based upon the size of the stone mounds encountered in the surveys reported here suggest an average volume of stone of  $600 \text{ m}^3$ , implying c. 1,500 tonnes of stone was needed to construct the average artificial islet; the sheer volume implies that the original builders probably collected stone from various sources. The bases of these calculations is included in Appendix D. A large proportion of the stone was probably harvested from around the margins of the lochs. Every loch inspected by this survey, surprisingly even the ones inundated by peat, was noted to be ringed by spreads of stone which were exposed or only partially submerged. Most of this stone was similar in size to that used on the artificial islets and its proximity would have required a minimum of effort to transport to the site. Additional stone could have been collected on Mull and Islay from the areas of scree along the steeper hillside slopes in the vicinity of lochs such as Frisa, Ba, Allallaidh and Bharradail. Glacial moraines, which are present in the valley bottoms and margins and hence near the lochs, would have also provided an easily accessible source of stone that would have required a minimum of transport. On Coll and Tiree, stone was probably collected primarily from the edges of the lochs or occasionally found lying loose in the landscape as erratics because these islands do not have scree slopes and were not as heavily glaciated during the Devensian, due to their exposed position in the Atlantic.

Roughly-shaped stone was found on 11 (38%) of the artificial islets surveyed. These stones were not finely dressed, but had simply been struck to form at least one relatively regular face. In most cases these stones were used as perimeter walling with a flat side facing outwards, or in 6 cases to line the inside of subrectangular buildings on the summit of the artificial islet. All of the shaped stone was easily liftable and of the same geological types as unworked stone. As a total percentage of stone visible on a site, shaped stone made up less than 1%; it was never identified on sites lacking either perimeter walling or internal built constructions. It is clear that stone was shaped only when it was needed for a specialised function, such as wall building, when less-regular, unmodified, stone would not suffice.

### **Wood**

Timber was found as a visible component at only four sites in the study area. At two of these sites, Loch na Meal (Mull)(a nineteenth century record, described below) and Loch nan Deala (Islay), wood only appears to have been used in the construction of causeways (see comments on causeways below). As discussed above, there is a wealth of evidence to suggest that the primary material used in the construction of artificial islets in the central Inner Hebrides was stone, although the superstructures of islets composed entirely of organic material may not have survived.

The function of the single pieces of wood found at two of the sites on Mull is unknown. Both pieces of timber were found protruding from the base of the stone rubble on their respective islets, a location which tends to indicate that the wood was serving a structural purpose related to the initial establishment of the sites concerned; however, without excavation, this view is only speculative. It is unlikely that the timbers were driven into the sites through the stone coverings at a later time, so in each case the timbers can be considered original even if they are not an integral part of the islets' superstructure.

The identified timbers were derived from two species, alder (*Alnus*) and oak (*Quercus*). The alder timber, found at Eilean Ban, was 0.20m in width and over 6.00m in length. This timber may have been worked as it was split in half longitudinally, although no other signs of woodworking were noted in survey; the timber remains *in situ*. As previously reported (Holley and Ralston 1995), a sample of this timber returned a radiocarbon determination of 2200±70 B.P. (Beta-78832, calibrated at 2σ to 395-45 BC). The oak timber was found at the Ledmore site, also in Loch Frisa. Only 0.50m of this timber was visible protruding through the base of the stone spread and it appeared to have suffered from erosion, very probably attributable to water movement within this section of the loch. It was approximately 0.04m in diameter and produced a radiocarbon date of 700±50 B.P. (Beta-78833), calibrated at 2σ to AD 1250-1395. This date represents a *terminus post quem* as the portion of the timber sampled is likely to be heartwood.

Although no other samples of wood were encountered during the underwater surveys, these accounts are not the only records of timber having been recovered from central Inner Hebridean artificial islets. A large quantity of wood was noted when the artificial islet in Loch na Meal, on Mull, was discovered in the 1870s, during the partial draining of the loch. Campbell observed at that time that the artificial islet was approached by “a stone causeway laid upon oak trees” (1870, 465) next to which was found the remains of three dug out canoes of “black oak”. It is important to note that this artificial islet was described as being, “formed of a quantity of loose stones, on the only rock near the surface of the water in the whole loch” (Campbell 1870, 465). From these observations, it is evident that the oak timbers did not play any role in the structure of the artificial islet itself and served only as a footing for its causeway. It is unfortunate that all of this timber is now lost.

The only piece of timber recovered from an artificial islet on Islay was also found in association with a causeway. At the site in Loch nan Deala, a 0.8m long and 0.40m wide timber was discovered protruding from the top of a stone causeway, c. 3.00m from the edge of the artificial islet. This timber was firmly embedded in the

stone rubble and appeared to be part of the causeway structure. The timber was sampled and discovered to be *Quercus* (oak) and produced a radiocarbon determination of  $6060 \pm 70$  BP (Beta-099284), calibrated at  $2\sigma$  to 5205-4800 BC. Although such an early date is not outside the realm of possibility for the site, a more likely explanation of its origin is that the timber is a piece of bog oak which was used by the islet's builders. If this is the case, the timber cannot be used to date the construction of the islet but may provide a *terminus post quem* for activity on the site. If however, the timber is contemporary with the islets construction, it would challenge the chronology traditionally ascribed to artificial islets and would require the typology of Hebridean early prehistoric habitation sites to be rethought. Only excavation will determine the exact context of this timber and the chronology of the rest of the site.

A review of the soil and pollen evidence presented in Chapter 2 of this thesis indicates that by the Iron Age only scattered strands of alder, oak and birch were growing on Mull and Islay; and it is thus a reasonable assumption that timber would have been a scarce resource in the central Inner Hebrides. In what absolute quantities timber would have been available is impossible to judge from the palynological evidence; none the less, in an environment where constructional timber was clearly not plentifully available, it seems unlikely that the large amounts needed to construct an artificial islet (upwards of 600 tonnes: the basis of this calculation is included in Appendix D) could easily be obtained.

The environmental evidence from Coll and Tiree suggests that no trees have grown there since the Mesolithic; only scrub woodland may have survived later into prehistory. Any timber that was needed would have had to have been imported or collected as driftwood. In order to build an artificial islet of approximately the same volume as the average site considered in this study, a massive amount (between 500 and 600 tonnes minimum to equal  $600\text{m}^3$ ) of timber would have had to have been imported to the islands from the mainland and then transported, in most cases over 3km, inland. As reviewed in Chapter 3, a majority of the timber recovered from artificial islets in Scotland is oak. This timber is extremely heavy when green,

weighing between 1033 and 1841 kg/m<sup>3</sup> (see Appendix D), and will not float in water unless it is seasoned (Gregory 1997). This means that unseasoned oak timbers could not have been floated out to the islands but would have had to have been carried by boats. The maritime technology exploited throughout the central Inner Hebrides during the later prehistoric is unknown but Gregory thinks that small skin covered craft (coracles) were widely used for sea travel (*pers. comm.* 1997). Only limited amounts of timber could be carried in such craft and it is questionable whether the long straight timbers which would have been required to build a pile-dwelling could have been transported by such a vessel. Clearly, very little timber if any would have been used in the construction of artificial islets on Coll and Tiree if stone provided a satisfactory building material. The use of timber on these islands would have been highly impractical, due to the cost in time and energy needed to obtain it, and largely unnecessary given the accessibility of stone.

### **Basal area**

This is defined as the physical area of lochbed which is covered by the artificial islet. The basal area of an artificial islet is in many cases one of the few variables which can be measured reliably from field observations. Some under-representations in size may occur due to heavy silting and peat growth around the peripheries of some sites but it is reasonable to assume that most sites are not substantially larger than the dimensions stated in this account. In fact, the size of some basal areas may be over-estimated in cases where sites are situated atop natural features such as bedrock outcrops and natural ridges of sand or gravel. It is often difficult to differentiate with any precision where the basal portion of an artificial islet begins and a natural feature ends. The basal area has been used here to demonstrate the broad size range of artificial islet sites in the study area. This statistic was preferred over the calculation of external diameters due to the fact that approximately half the sites in the study area have an elliptical shape, producing two axes which can vary greatly in length; in this sample up to 233%. The question of shape is considered separately below. Illustration 6.1 graphs the basal areas of artificial islets.

An immediately noticeable feature of the distribution of basal areas is the wide range encountered, from 191m<sup>2</sup> at Loch na Bualie (Tiree) to 1774m<sup>2</sup> at Loch Ardnave (Islay). The external basal area correlates approximately with the size range of upper internal areas (see below), but displays no apparent correlation with any other variables such as depth of water, the composition of the lochbed, or the height of the artificial islets. This wide variation in size is therefore more likely to be linked with the variance in intended use of the artificial islets and/or the types of structures intended to have been placed upon them rather than topographical and geographical factors and constraints related to their specific position in the landscape.

The basal area distribution is skewed to the left, and thus to the smaller end of the size-range, with 45% of the sites falling between 191m<sup>2</sup> and 390m<sup>2</sup> in size. The mean basal size increases with distance from the Scottish mainland; Mull's mean is 428m<sup>2</sup>, Coll's 453m<sup>2</sup>, Tiree's 616m<sup>2</sup>, and Islay's 890m<sup>2</sup>, producing an overall mean of 605m<sup>2</sup> and standard deviation of  $\pm 378\text{m}^2$ .

### **Upper internal area**

The upper internal area, defined as the area of the islet which was intended to stand proud of the water-level and serve as a dry area to be exploited by the islets' builders, is one of the most difficult variables to measure in the field. Variation in loch levels through time, especially small ones, as is perceived to be the case in this data-set, can confuse the boundaries of the upper internal area by placing them near the air-water interface where the shallowness and constant movement of the water often combine with parallax to make the measurement overly subjective. For this reason the internal areas defined in the field were checked against the surveyed profiles of the sites and adjusted to take account of the main break in slope. Another problem inherent in accurately defining the internal area is that it is impossible, in most cases, to estimate how much the site has settled since it was abandoned. Although Dixon has criticised the calculation of this figure as overly speculative (1984, 186), clearly the

measurements offered here furnish a somewhat crude index of actual internal areas but they do provide an approximate order of size and hence of internal space.

Unsurprisingly, the characteristics of the distribution of the upper internal areas (Illustration 6.2) demonstrates similarities to those of the basal area, in that it also covers a wide size range, from 40m<sup>2</sup> at Loch na Buaile (Tiree) to 584m<sup>2</sup> at Loch Bharradail (Islay). These measurements are again useful in highlighting the differences in scale across the set of artificial islets. While the ratio of range between the smallest and largest basal area is 1:9, the corresponding ratio of range of upper internal areas is almost 1:15. This wider variation in the size of upper internal areas may indicate a need for structures of widely varying sizes or it may be the observed result of varying efficiencies of construction (as discussed below) and possibly the differential impact of subsequent settling. The distribution of upper internal area displays no clear correlation with any other variables such as depth of water, composition of lochbed, or the height of the internal areas above the lochbed. It is assumed that each of these factors would have affected the size of the upper internal area by increasing the amount of work needed to enlarge the site's upper platform.

This lack of apparent correlation would lead one to conclude that the size of the internal area is dictated primarily by the needs of the builders of the artificial islets. While this assumption may seem obvious, it contradicts the theories of Morrison (1985, 60-62) who has linked sizes to other geographic variables, such as water depth, slope of lochbed, and consistency of lochbed. For the central Inner Hebrides then, it may be argued that the size of the upper internal area is related to the intended utility of the artificial islets rather than topographical constraints of the kinds posited in previous work.

An examination of Illustration 6.2 shows that the distribution of upper internal areas is again skewed to the left, and thus to the smaller end of the size range, with a mean of 208.7m<sup>2</sup> and standard deviation of  $\pm 111$ m<sup>2</sup>. This skew shows an overwhelming preference (83%) for areas under 320m<sup>2</sup>. This restricted size

(comparable with that [375 m<sup>2</sup>] used by the RCAHMS for the definition of duns) imposes physical restrictions on the community sizes that could have made use of these artificial islets. In most instances the surface of the islets are only large enough to accommodate one or perhaps two structures such as would be used by a single family group. It can be further argued that such small areas would not be economical for use exclusively as animal byres, as both Morrison (1985, 21 and 70) and Dixon (1984, 171) have suggested, unless the animals were very small or there were very few of them. Another factor which would preclude the artificial islets from being used as byres is that large animals would have no way of accessing the sites (as argued below).

### **Enclosed basal area percentage**

The enclosed basal percentage represents the proportion of overall basal area compared to the upper internal area. Measurements are only approximate and therefore the precision of this statistic is limited since it is difficult to estimate the upper internal areas, and also, as has been noted, the basal portions of some sites may be slightly covered by silt. The use of this variable is considered to provide a crude index as to the efficiency of the constructional methods used by the artificial islet builders. It seems reasonable to assume that the islet builders would aim to maximise the useable area by building as efficiently as possible, which would entail the artificial islet having as near-vertical sides as would be consistent with stability. It follows that this variable should be as close to a 1 to 1 ratio as conditions and available materials would permit, realising that this ratio could only be achieved with coursed or faced walling. After the range of ratios was examined (Illustration 6.3) it became clear this hypothesis was not always fulfilled. Basal area to upper internal area ratios varied greatly ranging from 1:1.42 at Loch an Duin (Coll), to 1:11.3, at Loch Fada (Coll). This wide range should, however, be tempered by the fact that the four largest sites (Loch Fada (Coll), Loch Urbhaig (Coll), Loch Ardnave (Islay) and Eilean Mhuirell (Islay)) were situated atop natural features such as bedrock outcrops, and natural ridges of gravel. Such natural features may have the effect of distorting the

distribution of basal sizes and if these sites are excluded from consideration the upper limit of the ratio would only extend to 1:4.78 at Loch na Buaille (Tiree).

The distribution of basal area to upper internal area ratios shown in Illustration 6.3 is skewed to the left as expected. It is a reasonable assumption that both the height of the islet and depth of water surrounding the site (each discussed separately below) would have impacted on the efficiency of construction, as measured by this statistic, since materials were probably dropped onto the lochbed from the surface of the water. This method of depositing stone would almost certainly preclude vertical slopes and the greater the distance the materials had to be dropped the less control the builders would have had over their final position and thus efficiency of construction. The mean of 3.6 and large standard deviation of  $\pm 2.35$ , inclusive of the wide range, seems to indicate a lack of efficiency in the artificial islets' construction. Alternatively, it may also indicate that the wide shelving margins were deliberately created, perhaps to diminish wave impact or make landing by boats less easy for the uninitiated. However, when the large sites resting on natural features are excluded (because their basal areas may tend towards the large side) the mean drops to 2.76 and standard deviation to  $\pm 0.93$ .

While one should be cautious about drawing conclusions from such approximate measurements, some general observations can be made. Assuming that the artificial islets have not settled outward to any significant degree, which seems reasonable considering that 65% of the sites are built atop consolidated areas of lochbed that prevent their outward collapse, and subsequent interference by man is perceived to be minimal as most of the sites are not easily accessible, it seems likely that upper internal areas were surrounded from the outset by extensive sloping surfaces of stone substructure. This characteristic, and the large basal areas that are also encountered, may have been necessary to distribute the weight of the islet over a wider area of lochbed and thus to minimise the settling of the islet into softer silts. This hypothesis is supported by the fact that the artificial islets with the most steeply-sloping sides below the water table are those located on bedrock outcrops. A large

basal area would also have had the additional effect of creating an underwater hazard for boats approaching the islet and would also have contributed to breaking up waves, although wave action is not a significant problem at most of the sites in the study area, because of the limited fetch present attributable to their small size.

During field-survey, it was noted that traversing the sloping areas of submerged stone which surrounded the visible portions of the artificial islets was very difficult and treacherous. The uneven surfaces of the stone spreads are covered by slippery algal growth making it very difficult to obtain firm footing. If care is not taken it is easy to slip into the many pits and slanted crevices amongst the stones. In consideration of this, it may be suggested that the large areas of sloping stone were deliberately created as defensive features which inhibited humans from accessing the sites. The presence of this feature also suggests that the artificial islets were never intended to be used as animal byres because the uneven nature of the surrounding stone spreads would have acted as a natural cattle grid preventing large animals from accessing the islets. The regular occurrence of relatively gently sloping shelves marginal to the artificial islets may therefore have functional explanations which run counter to the initial hypothesis of building efficiency, which was propounded at the beginning of this section.

### **Surface features**

As can be seen from the site descriptions, most of the artificial islets of the central Inner Hebrides can be described as oval or circular mounds of stone. Both Morrison (1985, 39 and 55) and Dixon (1984, 180) believe that stone was a later addition to most of the artificial islets, forming a carapace over a mound constructed of organic materials. Both state that artificial islets are timber built structures and that the stone which now covers most sites was only a minor structural component. The function of this carapace has never been explained. McArdle and McArdle also believed that artificial islets were primarily timber structures and that the stone found on most sites was merely a facing to prevent erosion (1973a, 10).

The surface evidence from the artificial islets of the central Inner Hebrides would seem to, at least partially, contradict this view. It can be argued that the present stone surface was contemporary with at least one phase of occupation on 70% of the sites surveyed, because structural remains which were intended to be above the water-level were found at this level. Various types of walling were found on the surface of 65% of the sites. An element of perimeter walling was identified on 50% of the sites and in 35% of these cases this perimeter walling was over 1.5m in height. The remains of building foundations were observed at 45% of the central Inner Hebridean sites. In 5 cases (17%), of which 2 are on Coll and 3 on Islay, the plans of these structures seem to have been sub-rectangular. Based on this evidence, it is reasonable to assume that an occupation level exists at, or near, the present-day surface of at least 70% of the sites surveyed.

If this is the case, it can also be assumed that water-levels have not significantly changed since the sites were last occupied, as a majority of sites and their walling are still above water-level. Although both Morrison (1985, 61) and Dixon (1984, 259) have challenged this perspective drawing on the evidence from Lochs Tay and Awe, where artificial islet surfaces occur both below and above present loch levels, it corresponds with Munro's (1882, 275) observations of smaller lochs and will be given further consideration below.

## **Shape**

Using the measurements obtained by survey, the artificial islets of the central Inner Hebrides may be divided into two forms on the basis of their shape. One is approximately circular, while the other is markedly elliptical. None of the islets in this study was found to be rectangular, a possibility that was considered because Ritchie (1942) hypothesised that the site he excavated in Loch Treig, Inverness-shire, was rectangular. The degree of circularity of each artificial islet was determined by comparing the N-S and E-W axes of the upper internal area. If each of the axes was

found to be within 1.00m of the mean of both axis, the structure was described as circular. By this method, 59% of the artificial islets were found to be circular: the remaining 41%, where this condition is not satisfied, are elliptical. The ratio of lengths of the two perpendicular axis of elliptical islets ranged from 1:1.21 at Breachacha (Coll) to 1:2.33 at Loch Cliad #2 (Coll) showing a wide (100%) variation in the sites' lengths and widths.

The orientations of the long axes of the elliptical artificial islets were compared to the long axis of the lochs in which they were located, in order to check whether the islets were positioned so as to be perpendicular or parallel to the closest shore (Appendix E). Only three of the twelve elliptical structures studied were discovered to be perpendicular to the nearest shore. This shows a preference for exposing the longest axis to the closest shore, indicating that minimisation of the area which could be attacked from nearby land was not a major factor in the orientation of the elliptical artificial islets; rather it may have been considered more vital to present the most important prospect of the site to figures approaching it overland, or alternatively practical considerations like the perceived impact of wave action may have predicated this.

The orientation of the elliptical islets may, however, be associated with natural features on the lochbed. It is notable that 7 of the 12 elliptically shaped islets were sited atop bedrock outcrops with a further islet sited on a gravel ridge. In each of these cases ( $8/12 = 67\%$ ) the islet's shape conformed to that of the natural feature and the boundaries did not significantly deviate from this. It is readily apparent that the builders of the islets were not prepared to spend the extra energy required to change the shape of the natural feature, if an islet of the desired size could be constructed on its surface. This may indicate that the islets' builders were trying to build as economically as possible, or that final shape was relatively unimportant to them. This suggests that the shape of the elliptical islets may have more to do with topographical constraints than deliberate human criteria, such as minimisation of exposure to shore.

## **Distance from shore**

The distance of an artificial islet from the nearest shore is a somewhat subjective measurement which is based on an assumed water-level at the time of occupation and minimal peat encroachment. For the purposes of this study the water-level was generally assumed to be the same as that present at the time of survey. In the case of drained or partially drained lochs, water-levels were reconstructed based upon historical sources and local topographies whenever possible. Although these measurements are admittedly approximate, they serve to show a broad range of relative distances to shore being chosen by the artificial islets' builders.

The most obvious feature (Illustration 6.4) is the fairly even distribution of sites over a wide (70m) range of distances from present-day shorelines, varying between 10.5m at Loch Bharradail (Islay) to 82m at Eilean Mhic Connill (Tiree). The mean distance from shore in the study area was 43.6m and the standard deviation is  $\pm 20.4$ m. A reasonable hypothesis would be to propose that the distance from the shore would correlate with depth of water, with sites being set in shallow water found farther from shore but this was not the case. A cursory examination of the data (Appendix E) shows that the distance from the shore has no apparent correlation with any other variable in this study. Where islets are built atop natural features, such as bedrock and gravel ridges, it is presumed that the builders had no control over this variable as the natural feature's location determined the site's relative distance from shore. Although there may have been several natural features for the builders to choose from in the larger lochs, the majority of the lochs in this study are small (under 0.25km<sup>2</sup> in area (Maitland and Holden 1983, 232)) and contained only limited areas of consolidated lochbed suitable for the placement of an artificial islet. At almost half the sites in this study the distance from the shore was not a variable which could be influenced by the site's builders. Sites which were built on silts or sand could presumably be placed wherever the builders desired them but these sites were also spread over a wide range of distances.

This lack of preference for particular distances is puzzling. It may be speculated that either the distance from the shore was unimportant, or that a restricted distance (of 20m) accomplished what aims the builders desired. If extra distance from the shore was only considered a bonus by the original builders, the critical threshold is likely to be masked by the range of available figures. Another possibility is that where the original builders were faced with a real choice, the distance from the shore is a site specific variable and was determined by the individual needs of the islets' builders such as the perceived threat from the shore, ease of access, or some other unknown criteria.

## **Height**

The height of an artificial islet is defined here as the distance from the lowest point of the basal portion of the islet to the highest point of its surface, not including walling on the upper internal area. The relationship between the original, and the measurable, height of an artificial islet is dependent on many factors. Islets which have been built on silty or unstable lochbeds may have sunk into the lochbed over time, leaving only their upper portions now visible. Although not relevant to the majority of examples considered in this study, artificial islets in large lochs may have been spread over time by wave action. The height of some of the artificial islets may be enhanced by the sites having being placed atop natural features such as bedrock outcrops, and ridges of sand or gravel. In such instances the observed heights minimally represent those intended by their original constructors and in these cases, it is often difficult to assess where the artificial part of the islet begins and where the natural feature ends. For the above reasons the true height of artificial islets must remain subject to a measure of uncertainty, although the figures available from survey (allowing for a constant water-level, or its successful estimation in the case of drained water bodies) represent minima.

The heights discussed here were those recorded at the time of survey. Although the upper internal areas of most of the sites were believed to have been

found, in a few instances the basal portions of the islets were covered by sediments which prevented the true bottom of the man-made portions of the islets from being observed. Where possible the sediments were probed in order to determine the height of the islet. It is hoped that this technique was adequate to recover approximate measurements of height.

The most obvious feature of Illustration 6.5 is the wide variation in the artificial islets' heights, which range from c. 0.80m in Loch na Buaille (Tiree) to c. 5.50m at Loch Fada (Coll). An inspection of Illustration 6.5 shows that the height distribution is skewed to the left with 55% of the sites falling in the 1.10m to 2.00m range. It can therefore be stated that this height range satisfied the needs of a significant proportion of the artificial islets' builders. When the fact that the five tallest artificial islets are to a large degree composed of bedrock and thus their final height above the lochbed is only partially influenced by man the preference for the 1.1m to 2m range may be regarded as even more significant, because the height of the taller islets is not artificial.

While caution should be exercised in drawing conclusions from the analysis of such approximate measurements, some general observations can be proffered. Assuming that a majority of the artificial islets did not sink into the sediments (as argued above) and that the surfaces of the artificial islets are currently as initially built, it seems that the builders in most cases did not require structures over 2m in total height. This would leave little room to compensate for seasonal fluctuations in water-level, as Dixon has stated is the case in Loch Tay (Dixon *pers. comm.* 1993), suggesting that this was not a concern of the islets builders in the environments of the central Inner Hebrides.

### **Depth of water**

The depth of water surrounding artificial islets is another variable which potentially has varied through time, both long-term and in some instances as a result

potentially of annual fluctuations. Most of the central Inner Hebridean lochs were found to be shallow, under 10m in depth, which did not limit where artificial islets were placed (see Chapter 2 and Chapter 5). For the purposes of this study water-levels recorded at the time of survey have been used. As argued above in the 'surface features' section, it is reasonable to assume that these water-levels roughly correlate with those found at the artificial islets at the time of their occupation. The depth of water discussed here is the average depth of water immediately surrounding the sites (taken as the mean of the depth measurements surrounding the basal portion of the site), or if greater, the maximum depth of water between the sites and the closest shore. Illustration 6.6 shows the depth of water surrounding the artificial islets in the form of a bar graph.

Although there is a fairly wide range of depths represented in Illustration 6.6, from 0.30m at Loch Ardnave (Islay) to 4.00m+ at Eilean Ban (Mull), the distribution is clearly skewed to the left and thus towards shallower water. Just under 52% of the sites are surrounded by less than 1.5m of water. The mean water depth falls just above 1.94m with a standard deviation of  $\pm 1.12$ m. After the compaction of silt is taken into consideration, this would mean that roughly 60% of the sites were surrounded by water deeper than a man could reasonably wade through.

The depth of water surrounding a site may give some indication of the importance of defence to the builders of these artificial islets. It is reasonable to assume that if their builders perceived the primary threat to be human assault, they would have placed their sites in water sufficiently deep to act as a deterrent. If the builders were more concerned with accessing these sites, it would follow that they would either be placed in shallow water which could be easily waded through without major inconvenience or that they would be accessed by causeways. The artificial islets of this study appear to be sited where the trade-off between ease of access and defence was evenly balanced. It is surprising that there is no observable connection between water depth and the sites' distance from the shore. This may be due to the geomorphology of the individual lochbeds or an attempt to situate the sites' far

enough away from shore that they were less vulnerable to missile attacks, such as fire arrows. No remains of dug-out canoes were noted by the survey but boat noosts (discussed below) were present on several of the artificial islets surrounded by deeper water. This may suggest that the sites were placed so that only those with the proper means could approach them.

## **Accessibility**

For the purposes of this study the accessibility of an artificial islet was determined by how it could be approached from the loch shore. Water depth was a crucial variable in determining the accessibility of the islets and when combined with an assessment of the nature of the lochbed an estimate can be made as to whether a site could be reached by wading from the shore. It was found (see Appendix E) that 5 or 17% of the sites could be reached by wading. A further 13 or 45% of the sites were accessed from the shore by means of a causeway. The remaining 38% of sites were determined to be in water too deep to wade across and could therefore only be approached by swimming or by the use of a boat or raft. In no instance was there any surviving indication of a wooden platform or bridge.

It was found that water depth generally correlated with the presence of a causeway. Sites which could be reached by wading, were found in water between 0.5m and 1.5m in depth; causeways were absent in these cases. In almost every case where a site was accessed by a causeway the stretch of water which was crossed was between 1.5m and 2m in depth. The two exceptions to this observation are the sites in Loch Fhir Mhoir (Islay) and Loch Allallaidh (Islay) (where the water surrounding the sites was 4m in depth) but in each of these cases the causeway is believed to be sited on top of a natural feature which almost attained the surface of the water. Sites located in water over 2m in depth were considered inaccessible by wading and were not generally accessed by causeways.

The relationship between water depth and accessibility may correspond with the builders' perceived need for security. Sites where security was not an issue were placed in shallow water, whereas sites where security was a concern were located in deeper water. In cases where relatively easy access to the site was balanced with security, causeways (often of some complexity, as discussed below) were built. Sites where security was paramount simply did not allow for easy access from the shore.

## Causeways

Defensive features were encountered in 8 of the 13 causeways which accessed the artificial islets in the study area. Bends were the most common feature and were incorporated into 6 of the causeways, normally near their centre. The angle of the bends ranged from 5° at Eilean Anlaimh (Coll) to 78° at Loch an Duin (Coll). Beveridge (1903, 23) has suggested that in order for bends to be maximally effective the surface of the causeways was probably covered with several inches of water. During the survey it was noted that the surfaces of all the causeways were at least 0.5m lower than the surfaces of the sites' upper platforms and that most (8 of 13) were below water-level. Of the 5 which were above water-level 4 were located in lochs which had been partially drained. The evidence from the central Inner Hebrides then would seem to support Beveridge's theory.

Three other types of defensive features were incorporated into the causeways of the central Inner Hebrides, but each was found at only a single site:

- The causeway to Dun Anlaimh in Loch Cinneachan (Coll), had a large stone near its centre which tilted down at a 40° angle when weight was placed on it. This "trap" effectively "threw" the author into the loch on three separate occasions and was an extremely effective means of inhibiting access to the site. After the trap was sprung the stone pivoted back into place and was once again indistinguishable from the surrounding stones. Due to the size and delicate positioning of this stone there is no doubt that it was deliberately placed. Such a feature would serve as a warning

device to the inhabitants of the artificial islet through the commotion caused as the intruder is displaced.

- The defence of the causeway at Loch Cliad #2 (Coll) was enhanced by a large stone barrier, measuring c. 1.00m in height and width and c. 2.00m in length, placed across the islet end of the causeway.
- In Loch Allalaidh, on Islay, a stone wall was built half way along the causeway. This wall extended out into the water 10m either side of the causeway and further inhibited access to a site which was surrounded by water 4m in depth. Similar flanking walls have been noted at artificial islet sites in the Western Isles by Armit at Eilean Domhnuill (North Uist) and Dun Loch an Duna, Bragar (Lewis) (Armit 1996, 46-47, 124; 1988, 13).

In discussing the defensive nature of a causeway, practical considerations may indicate the nature of the threat to the islet dwellers. If Beveridge's theory that causeways were meant to be submerged is accepted (and the data would seem to suggest this), it can be argued from their relative heights that the surface of the causeway could not be submerged by more than 0.5m otherwise the upper platform of the islet would also be submerged. In the light of day the causeway would be visible through such a shallow covering of water. However, at night even a very shallow covering of water would make the causeway effectively invisible. It could be argued then that the artificial islets' dwellers were primarily concerned to ward off attack at night.

Sites in the study area, with the exception of Eilean Mhuirell (Islay) which had no obvious means of access also had no evidence to suggest the existence of boat noosts. If boats or rafts were used to reach the deeper-water sites this may indicate that they were either small and light, or had shallow draughts so that they could be pulled up onto the rocks of the islets.

## **Foundations**

### **Geology of lochbed**

The nature and consistency of the lochbed undoubtedly played an important role in determining where artificial islets were situated within individual lochs and perhaps also in excluding certain lochs from consideration for use as locations. In Loch Awe, Morrison (1985, 61) found that there was a positive relationship between artificial islets and natural features such as bedrock outcrops and natural rises in the lochbed. This correlation was also noted by Henderson (1994, 149) in the siting of three artificial islets in the Lake of Mentieth. The nature of the lochbed is in most cases a fairly straightforward variable to determine. Areas of the lochbed surrounding the basal portion of the artificial islets were inspected and in some cases natural features such as bedrock could clearly be seen protruding though, or forming part of the surface of the artificial islets.

However, the conditions noted by this survey are not necessarily those found directly beneath the artificial islets themselves, since these points were obviously not available for inspection. Without excavation the true nature of the lochbed beneath the artificial islets can only be assumed. It is considered that the principal effect of this limitation would be the under-representation of bedrock and gravel foundations in lochs which have been subject to subsequent heavy silting. The artificial islets of this study (assuming that they do not have a natural core) are composed of a large mass of stones that weighs, on average, 1500 tonnes but which can range between 350 and 6300 tonnes (see Appendix D). It is highly probable that many of the sites which are surrounded by silts have a bedrock core upon which they rest. Otherwise the sites would just sink into the silts and disappear.

For the purposes of this study the materials of the lochbed have been characterised according to the following categories: bedrock, silts, sand, gravel, and combinations thereof. These were the materials encountered at the time of survey.

Bedrock seems to be one of the most commonly sought after foundations, with 11 or 38% of the sites being situated on it. All of the sites which were over 2.7m in height were situated on bedrock. A large proportion of the sites, 10 or 35%, were also built on silts of varying texture. As noted above, this number is probably high and represents conditions around the sites at the present time, rather than the true original nature of the foundation; sediment inwash since the period that the sites were in use is very likely, and Cressey has recorded levels of sediment deposition of up to 2.8mm per year at four of the lochs on Islay (Cressey 1996, 182, 218 and 242). Two (7%) sites were built on gravel while another six (21%) were built on very firm sand. In the case of both these latter materials, the lochbed was very firm and difficult to probe with a ranging rod, although this does not preclude a measure of deposition or compaction since the site was in use.

Several points may be noted on the basis of the geological characteristics of these settings. In 65% or more of the cases, the builders sought out areas of firm lochbed on which to build their islets. It would seem, therefore, that the connection between artificial islets and bedrock outcrops observed by Morrison and Henderson also holds true for the central Inner Hebrides. The positioning of a majority of the sites over firm areas of lochbed indicates that most of the artificial islets could not have been pile-dwellings because it would have been impossible with the technology then available to have sunk piles into bedrock, gravel or hard packed sand.

Although it is feasible that some of the artificial islets could have had wooden substructures, the only way of anchoring the islets to impenetrable lochbeds would have been by depositing vast quantities of stone on them, as has been hypothesised by Munro (1882, 261). In a region where timber was likely always to have been a scarce commodity during the currency of the construction of artificial islets, it is far more probable that the artificial islets of the central Inner Hebrides were primarily stone-built structures which were constructed by off-loading gathered stones from the surface directly on the lochbed. This would also explain why very few timbers were recovered from the sites, compared to the results from Lochs Awe and Tay.

## **Slope of lochbed**

Morrison has noted that artificial islets were not constructed on steeply sloping sections of lochbed because such positions were unlikely to hold the weight of an artificial islet without, “sliding away into the depths” (Morrison 1985, 61). This variable was also considered important by Dixon who observed that the artificial islets in Loch Tay were sited only in areas of lochbed which had, “a flat bottom” (1984, 159 and 175). The slope of the lochbed was not a primary factor in the positioning of artificial islets in the central Inner Hebrides due to the fact that so few of the lochs involved are of any size or depth. Most of the lochs in the study area are small, under 0.25km<sup>2</sup> in area (Maitland and Holden 1983, 232), and were found by this survey to have, shallow (between 3m and 5m in maximum depth), relatively flat lochbeds. The only notable exceptions to these dimensions in depth and size were found in Loch Ba and Loch Frisa, both of which are on Mull, where depths of over 120ft have been recorded (Murray and Pullar 1910). The centres of 3 other lochs, all on Islay, were found to be of moderate (30ft to 50ft) depth by Cressey (1995) but in each case the margins of the lochs’ beds, where the artificial islets were likely to have been built, were relatively shallow (3m to 5m in depth) and level.

At only 3 of the 29 sites does it appear that the topography of the lochbed affected the type and size of the artificial islet which could be constructed. In Loch Frisa (Mull), the site of Eilean Ban was situated on the top of a steep sided bedrock outcrop which was surrounded by water c. 4.00m in depth. In Loch Ba (Mull), the Knock site was situated on a natural ridge of bedrock and gravel which was also surrounded by water of a similar depth. In Loch Allalaidh (Islay) the sides of the site dropped away sharply to over 4.00m in depth and it is therefore probable that the artificial islet has a natural core, not visible at the time of survey. In each of these cases the artificial islets utilised the entire surface area of the natural feature without extending it significantly outward. These three sites, some of the largest in the sample, were constrained in size by the slope and form of the lochbed. Steep underwater

slopes were not found near any of the other artificial islets in this study, so that the slope of the lochbed was not a significant variable in the siting of most of the artificial islets.

## **Defensiveness**

This section seeks to highlight the combinations of structural features of the artificial islets which may be considered defensive in nature, in order to determine if defence was a major consideration on the part of their builders. The defensiveness of an artificial islet may be based upon: the thickness and height of perimeter walling; the ease of access to a site from the water's edge; and its distance from shore. The second factor is somewhat subjective as walling rarely survives to any height. However, the original height of walling can often be posited from consideration of its surviving width. This section can only analyse the features which are visible in the field and does not attempt a full reconstruction of the defensive capability of the artificial islets. There is ample evidence to suggest that the artificial islets of the central Inner Hebrides were primarily built of stone and so this section assumes that any perimeter walling was also composed of stone and therefore likely to have been observed by survey.

A simple method was devised to determine the defensibility of each of the artificial islets and follows that used by Fojut for brochs (1982, 54). This is based largely on common sense and should be viewed simply as a heuristic device with which to discuss the data. Whether these same factors were considered defensive features by the islets' builders is open to speculation. However, by combining these factors, this approach may give a rough indication of the value of defence to the builders of the sites. Each characteristic (summarised in Illustration 6.8) was assessed on a presence or absence, and degree of presence basis and awarded a point value of either nil, 1, or 2. The presence of perimeter walling on a site earned a score of 1 with an additional point being given if the walling was over 1.00 m in thickness or height. The site's distance from shore was assessed by awarding 1 point to sites located over

20.00m from shore with an additional point awarded if the site was over 40.00m from the shore. Accessibility was assessed by awarding 1 point if the site could be approached by wading from the shore or was accessed by a causeway, and 2 points if the site was surrounded by water too deep to wade across.

Based upon the scoring of these criteria the distribution of the defensiveness of the artificial islets can be assessed. An inspection of Illustration 6.7 shows that the defensiveness of the artificial islets of the central Inner Hebrides falls across a wide range of values. The mean of the distribution is 3.86, with a standard deviation of  $\pm 1.72$ . This suggests that, in considering the whole data-set, ease of access to, and the defence of, the artificial islets were equally important but with considerable internal variation. Only 20% of the sites can be considered highly defensive, and only 20% relatively indefensible. Distance from the mainland seems to correlate inversely with the average defensiveness of the artificial islets, with a mean on Mull of 4.7, Islay 4.11, Coll 3.3 and Tiree 3.0. It is curious to note that the sites which are considered to be the most defensible, Eilean Ban (Mull), Eoghan (Mull) and Eilean Mhuirell (Islay), are also the lochs furthest inland on their respective islands.

## Summary

The primary contribution of the above analyses and survey has been to demonstrate methods for measuring the variability of artificial islets from data derived from surface inspection, including underwater survey, and in illustrating the type of conclusions which can be drawn from this information. The simple analyses carried out above have a number of implications for the interpretation of the function and utility of artificial islets in the central Inner Hebrides. The results of these analyses may be summarised as follows:

- There is ample evidence to suggest that the majority of artificial islets in the central Inner Hebrides are entirely composed of stone and that timber only played a minor role in the construction of these islets. This observation contradicts both Morrison's (1985, 39) and Dixon's (1984, 180) theories that stone was inevitably a later addition to sites. Though many of the sites examined here do display evidence for multi-period activity their position on consolidated areas of lochbed and lack of observed timbers indicates the limitations of the uses of timber as a structural component.
- The overall view gained from the analysis of the structural features of the artificial islets of the central Inner Hebrides is one of conflicting efficiencies. The builders of the islets clearly used materials which were readily at hand and easily transportable (i.e. medium sized stone) and utilised natural features such as bedrock outcrops or gravel ridges when available. Little effort was made to modify constructional materials unless they were needed for a specialised feature such as a wall. At the same time materials were not deposited on the lochbed in the most efficient manner, if economy of effort were the uppermost consideration. The relatively profligate use of stone would have greatly increased the amount of work needed to construct the islets, although it may have conferred defensive advantages and helped minimise the impact, generally slight, of wave fetch.

- The wide range of sizes of these structures reflects considerable differences in the scale of construction both in terms of materials and time.
- If the islets are presumed to be sites for habitation, the capacity of individual sites for the accommodation of people displays considerable variability. Whether this indicates that accommodation was intended for varying populations or whether space was used differently and involved a different range of functions on different sites is not clear.
- Although both Morrison (1985, 21) and Dixon (1984, 171) have suggested artificial islets were used as byres for livestock, the uneven nature of the stone covering the exterior of the islets suggests that they were not, as animals would have had no simple way of accessing the sites. The small size of the majority of the sites would also indicate that their use as animal byres would have been restricted. On small islands such as Coll and Tiree, which were devoid of natural predators and from which large animals could not be removed easily on the hoof, it is questionable whether corrals of this level of security would have been needed.
- An assessment of the defensive characteristics of these artificial islets suggests that ease of access was considered as important as defence across the data-set, but that some sites had considerably higher inbuilt defensive features than others.
- The presence of perimeter walling and building foundations on 70% of the sites suggests that the present surfaces of a large majority of the sites are those of the latest occupation. This observation contradicts the belief held by both Morrison (1985, 55) and Dixon (1984, 180) that the present surfaces of artificial islets were not associated with any phase of occupation, primarily because timber structures could not be placed on them, and suggests that all artificial islets were not occupied by timber roundhouses but that a majority of sites in this region of Scotland were crowned by stone-built structures. Whether these stone structures

were associated with the first phase of activity on the sites or are later additions is unknown.

- An evaluation of the causeways' heights and relative water-levels suggests that the artificial islets' inhabitants may have been concerned with attack at night rather than day. However, the nature of the threat still remains unclear.
- The relationship between the water-levels observed at the time of survey and the perimeter walling found on the artificial islets suggests that water-levels in the central Inner Hebridean lochs have not significantly fluctuated since the islets were last occupied. This last finding agrees with Munro's observations in the SW of Scotland.

## Chapter 7

### A consideration of the spatial positioning of the artificial islets of the central Inner Hebrides

#### Introduction

The purpose of this chapter is to explore the relationships between the spatial positioning of artificial islets within the central Inner Hebrides relative to aspects of the landscape in which they are set. In previous studies (Dixon 1984; Morrison 1985; Henderson 1994), consideration of the spatial positioning of artificial islets has been based on relatively casual observations of the surrounding landscape by researchers and present hypotheses largely rest on conjecture. As yet, no attempt has been made to quantify the relationship between artificial islets and the wide range of environmental data which has been available in cartographic and other sources for some time. This chapter will seek to employ a more scientific approach to the study of the landscape surrounding artificial islets which is based on detailed information gathered from a variety of sources. Through such analysis an attempt to elucidate the settlement pattern may be made, while the validity of prevailing theories (Dixon 1984; Morrison 1985) concerning the spatial positioning of artificial islets can be examined.

Although the techniques of spatial analyses of the environmental data discussed here have well-recognised limitations, such an approach has been used to examine large distributions of unexcavated monuments throughout Atlantic Scotland, primarily brochs (Armit 1990; Martlew 1982; Fojut 1982), and has proved to be a useful device by which to discuss prevailing theories heuristically. While Morrison has criticised the application of this approach to distributions of artificial islets, stating that "it is over-optimistic to embark on ambitious quantitative analyses of distributions, until the basic characteristics of the data have been thoroughly explored" (1985, 59), until such an analysis has been made Morrison's own theories regarding the spatial positioning of artificial islets can only rest upon conjectures. These will have been based on a limited range of direct observations and are seemingly exempt

from review. The validity of this approach will be evidenced throughout the following chapter and it will be shown that this type of analysis presents a useful way to examine prevailing theories without destroying monuments through excavation. An additional advantage of this type of approach is that it is extremely economic and infinitely repeatable as more data becomes available. Unless techniques such as this, which examine large groups of data, are employed it is unclear how relevant and useful discussion of artificial islets may be stimulated at this time. Furthermore, unless the risk of catastrophic degradation of particular sites is to be the sole means of determining which sites should in future undergo fuller examination, these techniques may have a contribution to make in helping determine the 'typical' from the 'atypical' artificial islet.

The notation of spatial proximity and its analysis has long been one of the favoured tools of archaeological interpretation. Spatial information is most often observed on a micro scale during the excavation of single sites, when great emphasis is placed on the relationship between an object and its surroundings. This information is often used to help to determine the chronological and sometimes cultural relationships of both structures and artefacts, although it is recognised that spatial proximity, sometimes termed "horizontal stratigraphy", does not necessarily imply a secure relationship amongst the elements being considered. Spatial information may also be analysed on a macro scale, across a geographical region, for much the same purpose. It is the latter procedure which this thesis seeks to employ.

### **History of spatial analysis**

The growth of spatial awareness and the development of its analysis in archaeology has a long and complex history which has already been traced (Hodder and Orton 1976; Martlew 1981, 2-10; Ralston 1976) and therefore is only briefly noted here. Spatial archaeological data has been presented on a macro scale since the middle of the last century (Grinsell 1971) but the significance of the interrelationship of this data has only begun to be realised since the beginning of this century

(Crawford 1912, 1922). Soon thereafter work combining geological and geomorphological information with archaeological data was carried out by Fox, who concluded in the fourth edition of *The Personality of Britain* that “the structure of Britain has exerted a powerful influence on her prehistory” (1943, 87). Although this work was restricted to generalisations by lack of specific data, it displayed the potential for gaining information from spatial relationships and awoke the archaeological establishment to a new method of analysis. A geographer reviewing the fourth edition of this work described its publication as “a minor earthquake corresponding to number 6 of the Rossi-Forel scale - ‘General awakening of those asleep. General ringing of bells.....some startled people leave their dwellings’” (Taylor 1975).

The first major work in Scotland which explicitly linked archaeological data and spatial correlations was carried out by V. Gordon Childe (1942). He used not only geographical but also ethno-historical data to compare the distribution of chambered cairns on Rousay, Orkney, to the distribution of more recent farmsteads and townships (representing units of agricultural exploitation), and churches (representing population centres). In this case-study, Childe noted that “churches or the sites thereof correspond to each group of cairns” (1942, 141) and that cairns were often on the edge of then-cultivated land. It was also remarked that most of the cairns were situated near water sources such as springs or burns. Childe’s work was influential in developing the application of concepts that would later be formulated into spatial analysis because it was one of the first applications to be carried out at a manageable scale and based on detailed evidence. Furthermore, Childe acknowledged that this kind of approach is limited by the following assumptions:

- The inventory of existing archaeological sites must be complete.
- Few (preferably no) sites must have been destroyed.
- Few sites can be misidentified.
- All the sites are assumed to be contemporary.
- Conclusions based on sites in one region need not apply elsewhere.

These points are still recognised as being significant today and are appropriate to any investigation of prehistoric settlement patterns.

Another work which was influential in developing spatial awareness in Scotland was Fairhurst's paper on "The Geography of Scotland in Prehistoric Times" (1953). This pioneering study correctly identified the dynamic nature of the environmental changes (such as isostatic uplift, woodland development, and the formation of blanket peat) which have affected Scotland since the last glaciation in order to reconstruct the landscapes of the past. The appreciation of these changes is a testament to the vision of Fairhurst and recent environmental archaeological research has generally confirmed his initial observations. The main aim of Fairhurst's work, however, was to investigate the relationship between Iron Age settlement sites and the physical features of the Scottish landscape. This was accomplished by analysing the distribution of the altitudes above sea-level of all Iron Age settlement sites (forts, crannogs, earth houses and brochs). Two basic regional variations were observed in the data. On the Atlantic seaboard of Scotland, Iron Age settlement was confined to below 500' while towards the East coast, they avoided the lowlands and were located in the 400' to 1,100' range. These two distinct distributions were theorised to be the result of Iron Age man's response to the agricultural attractiveness of various soils. In the West raised beaches were favoured over the poorly drained soils and peat bog of the rugged and rocky uplands whilst in the East the drier soils of upland slopes were preferred over the thick woodlands of lower altitudes. Fairhurst did not at that stage recognise the huge impact of subsequent cultivation and other activities on the reduction of the lowland Iron Age settlement evidence in eastern Scotland. Though somewhat generalised, this study reinforced the concept that characteristics of the physical landscape influenced prehistoric settlement and posed questions which would be taken up by future researchers.

In recent years the stone-built structures of Atlantic Scotland have received considerable attention by advocates of locational and spatial analysis. As Armit has

noted, this has probably been due to the excellent preservation of monumental stone structures and “the relative absence of destructive later land-use” (1992, 109). The completeness of the data-set in this region makes it one of the few areas in Britain where Childe’s first assumption can even begin to be approached.

Most of the recent spatial work carried out in Atlantic Scotland has been concerned with the assessment of the distribution pattern of brochs, or as more recently defined “complex Atlantic Roundhouses” (Armit 1990). In 1977 Heisler developed a system of quantifying land carrying capacity, based on 19th century accounts, in order to reconstruct the social organisation of Iron Age Caithness; but the assumptions which underpinned this model seem, in retrospect, overly deterministic. A more reasonable approach to the brochs of this area, employing improved locational and spatial techniques, was produced shortly thereafter by Martlew (1981). In more recent years the problem of defining the geographical limits of study has been overcome by analysing distributions of monuments on the Northern and Western Isles, as was initially used by Childe, and taken forward by Renfrew on Arran (1990, 146-151). Here, the coastline sets the boundaries, and thus edge effects produced by arbitrarily subdividing larger land masses are avoided. A study by (Fojut 1982) sought to rationalise the locational patterning of brochs in Shetland using many of the same techniques as Martlew. Another work which effectively employed spatial analysis was Armit’s (1990) *Later Prehistory of the Western Isles*. Armit utilised a wide range of basic spatial assessment techniques on a variety of monumental habitation structures in order to reconstruct an Iron Age chronology for the islands. This work is extensively reviewed in Chapter 9 of this thesis.

### **History of spatial analysis as applied to artificial islets**

From the very beginnings of artificial islet research in Scotland, spatial analysis was employed in at least rudimentary forms. Most of this analysis has been done essentially in an impressionistic way, meaning that artificial islet distributions were plotted on a map and then hypotheses were advanced, leading to suggestions that

artificial islets were located near particular types of land. This section will examine the adequacy of the spatial analysis work which has been carried out on artificial islets in the past, and will demonstrate the need for the application of a more organised, quantitative and comprehensive approach.

Munro (1882, 262-3, 249) used a deterministic stance based on locational characteristics in the very loosest sense of the term when he postulated that Highland artificial islets were constructed of stone while lowland sites were constructed of timber. Although this statement has been challenged (Dixon 1984, 3; Morrison 1985, 20) and is perhaps too simplistic for such a wide geographical area, recent surveys seem generally to confirm that the lowland artificial islets are in fact primarily constructed of wood (Crone and Barber 1993) while the artificial islets of the "Western Islands" are largely composed of stone (Armit 1990; Holley and Pickard 1995).

Changing scale, Dixon (1984, 170-175) has made a brief attempt to analyse the spatial positioning of artificial islets located in Loch Tay, but this analysis seems to have been essentially qualitative and impressionistic. A number of monument categories including cup-marked rocks, standing stones, bronze-age cists, cairns, hut circles and ring forts were noted to be located near artificial islets but Dixon states that "in no case is there established either physical or temporal association with crannogs" (1984, 170). Exactly how contemporaneity or direct association could be demonstrated between such a wide range of funerary, ritual and domestic structures without excavation is not discussed by the author. However, Dixon (1984, 171) states that most of these monuments are regarded as Bronze Age constructions, which curiously correlates with the Late-Bronze Age date for Oakbank crannog (Dixon 1984, appendix H). It is questionable, however, whether all of the monuments considered date to this period (Ashmore 1996, 31 and 59); available radiocarbon dates for ring-forts, for example, rather suggest them to be first millennium AD constructions, some representing substantial domestic buildings in their own right.

In addition to commenting on the position of artificial islets relative to each other, Dixon also analysed the positions of the artificial islets in the loch with reference to topographic features both above and below water. From this data-set, it was determined that most of the artificial islets in Loch Tay were situated next to gently sloping land onshore indicating “that suitable land for cultivation was a major factor influencing the choice of site for the crannog builders” (Dixon 1984, 173). Caution should be exercised when determining what land was used for simply from consideration of the degree of its slope. This characteristic seems to have been the sole criterion used in arriving at a judgement of the land’s agricultural quality. Soil type, and perhaps criteria like wetness, stoniness and shallowness (Davidson and Carter 1997, 52) - although these are not wholly independent variables - should also be considered when defining what is cultivable land.

It was also concluded that conditions on the lochbed affected the positioning of the artificial islets on Loch Tay. Dixon states “an essential factor in location was the availability of a suitable flat area of lochbed on which to build the structure” (1984, 175). The distribution of known artificial islets indicated that steeply sloping areas were generally avoided and sites were normally situated where the water was 3m - 5m in depth. The four sites which were located on exceptional slopes or in shallow water were dismissed as being located in areas of considerable later silting or erosion. No comment was made as to whether all the areas of the lake margin which matched the criteria inferred for deliberate selection were utilised.

The fullest spatial analysis of artificial islets has been carried out by Morrison in *Landscape with Lake Dwellings* (1985), although this approach was not fully comprehensive, being largely based on observations made on Loch Awe. This study was intended to be an introduction to artificial islets but many of its spatial findings have been incorporated into popular archaeological presentations and thought without question (e.g. MacSween and Sharp 1989, 38; Dyer 1990, 144; Ross 1991, 70; Reid 1993, 39; Bewley 1994, 122; Armit 1997, 34-35; Sykes 1997, 7). Although this work considers artificial islets throughout all of Scotland, its spatial analysis focuses

uniquely on the examples in Loch Awe (Argyll). This large Highland loch has several geological and geomorphological characteristics which limit the areas on which artificial islets could be placed. Morrison indicates that water depth, the nature and slope of the lochbed, and shelter from prevailing wind and waves all played a part in defining where artificial islets could feasibly have been erected (1985, 59). After these areas were defined, he postulates that the immediate access to onshore arable land determined the choice of which of the suitable areas would actually hold an artificial islet site. This hypothesis is based on the fact that 17 of the 20 artificial islets in Loch Awe are located next to, what he defined as, land of arable potential, and only 3 were found near to areas perceived to be unsuitable for agriculture (1985, 74).

This perceived relationship between artificial islets and potentially arable land, has led Morrison to develop a further theory, in this instance regarding the relationship between artificial islets and one of the classes of neighbouring enclosed, dry-land sites, the duns. This hypothesis is based on the following observations on the Loch Awe distribution:

- No duns were found in close proximity to artificial islets.
- However like artificial islets, duns were found near potentially arable land.
- In areas where duns were found the geomorphological conditions of the lochbed physically did not allow for the construction of an artificial islet.

Thus, Morrison postulates that, “in some periods at least, those who required a secure base adjacent to their farmland might elect to build either a dun or a crannog” (1985, 75) depending upon the topography and available materials. This theory of course assumes that artificial islets and duns were being constructed during the same general time-frame and that an either / or choice was being made. This assumption may not hold true in every case, as radiocarbon dates (see Crone 1993; Henderson 1994) indicate that artificial islets were constructed over a long time frame whereas many of the Argyll duns are largely perceived to be 1<sup>st</sup> mill AD in date (Nieke 1984) (although

the heterogeneous nature of these sites have recently been questioned (see Harding 1997)).

Although Morrison's analysis is the most extensive to date, it is limited by his reluctance to employ the full range of available spatial and locational analysis techniques. One of the most powerful tools, site catchment analysis, was dismissed because it, "would have serious limitations when dealing with lifestyles so intimately involved with access by water" (1985, 71), due to the fact that little was known at that time about prehistoric boat types. Although this situation has been remedied in recent years (there are now two studies which examine in detail Scottish prehistoric boat types (Mowat 1997; Gregory 1997)) it is arguable whether this lack of data totally negates the usefulness of site catchment analysis. As shall be shown below, these problems can be overcome with a reasonable degree of certainty and site catchment analysis is a useful device with which to discuss many of Morrison's basic findings, which are not in themselves influenced unduly by assumptions about extensive travel by water.

The major factors which undermined the findings of Morrison's work were that he did not provide any specific data to support his spatial analysis and relied upon impressionistic observations rather than quantified assessments. This approach has been criticised elsewhere (Martlew 1981, 14; Clarke 1977, 5) and does not realise the full potential of available data.

The first artificial islet survey to incorporate the systematic fieldwalking of the drainage catchment of a loch was carried out by John Henderson (1994). Although Henderson was not able to firmly "establish either physical or temporal association between them (crannogs) and sites on land" (1994, 103), he did note several correlations between the presence of artificial islets and topographic features. Underwater investigation revealed that three of the four artificial islets considered in his study of the Lake of Menteith (Stirlingshire) were located on top of natural hummocks on the lochbed, suggesting that these features were both known, and

deliberately sought out by the artificial islet builders. This association had also been noted by Morrison (1985, 61), who had, however, not been able to quantify its significance in the case of Loch Awe. Furthermore, after compiling information from Soil and Land Utilisation maps, Henderson concluded that “there is a clear correlation between the occurrence of arable land use and crannog sites” (1994, 151) and furthermore that “areas of poor land have no crannogs adjacent to them” (151). These findings closely resemble those of Morrison, which is remarkable in light of the fact that Henderson’s study was based on the distribution of artificial islets in a small, shallow, lowland loch, a very different setting from Loch Awe.

This section has shown that the spatial and locational analysis which has been carried out on the artificial islets of Scotland in the past has been limited, in almost all cases to examples within a single water body. So far this analysis has generally been impressionistic, and has not employed more rigorous quantitative methods. This approach is inadequate (Martlew 1981, 6; Grimes 1945; Clarke 1977, 5) and does not make use of the full range of available data. The next section will show, that although there are some problems in attempting a more rigorous analysis of the archaeological data furnished by artificial islets, these problems can be overcome, so that the full potential of the data can begin to be realised.

### **The problems of archaeological data**

The problems with the archaeological distribution maps used in spatial analysis have been discussed by Martlew (1981, 11). Most distribution maps are biased because they only represent the sites which have survived and thus only part of the total data-set. Martlew has outlined the seven primary factors which limit the recovery of archaeological data:

- Sites can be affected or destroyed by natural processes such as erosion and deposition.
- Subsequent settlement can rob or completely destroy sites.

- Recent land-use, such as deep ploughing or forestry plantation, can selectively alter or indeed eliminate surviving evidence.
- The location and intensity of archaeological fieldwork can influence the recovery of data in favour of areas intensively studied. Other areas may be less well represented.
- Modern administrative boundaries can affect how sites are recorded and classified.
- Sites may be misidentified.

Each of these factors singly or in combination serves potentially to confuse and distort the available archaeological data. In severe cases, the conclusion that, “not enough sites survive to show the regularity of the original lattice, so any interpretation of the economic relationships between the remainder, or the exploitation strategies employed by them, will be far wide of the mark” (Martlew 1981, 12), is wholly justifiable.

### **Distribution issues in the study of artificial islets**

The problems which affect artificial islet distribution are distinctly different from those of land sites. The size of the loch in which an artificial islet is placed is probably the prime factor determining how the site can be lost from the archaeological record. Small lochs, defined as those under 0.25km<sup>2</sup> in area, are prone to be substantially affected by peat growth or silting. Peat growth can occur rapidly and quickly engulfs sites which are close to shore. Lochs which suffer from peat growth around their margins moreover almost always have zero water visibility. This means that underwater surveys have to be carried out by feel rather than sight. Surveying in these conditions can be very claustrophobic and potentially dangerous, and so such lochs are not always fully searched for sites. Therefore, it is eminently reasonable for underwater survey not to locate instances of artificial islets in lochs having the foregoing characteristics.

It has been pointed out by Dixon (1984, 158) that silting also hinders the identification of artificial islet sites. Silting can completely cover a site or radically

change the contour of the lochbed in its vicinity, so as to hinder its identification. An artificial islet discovered in Loch na Meal, on Mull, was covered with four feet of silt, and was only identified after the loch was drained (Campbell 1870). Even sites which are only partially silted over are difficult to identify because their edges are smoothed, giving them the appearance of small piles of stone. Both peat growth and silting can also dramatically limit the effectiveness of echo-sounding equipment by smoothing the slope of the sides of the site, making it impossible to distinguish from a natural feature.

Large lochs are also prone to silting but sites in such water bodies are more often under threat from human interference. In large lochs, artificial islets could be destroyed when channels for shipping are created or harbour works are expanded. It is hoped that the "obstructions" posed by artificial islets would have been reported, but the possibility certainly exists that they were not. The construction and operation of hydro-electric and other dams may also seriously affect artificial islets. Artificial islets in Eadarloch, Loch Treig (Ritchie 1942) and Loch Glashan (Scott 1960) were discovered when lochs were temporarily drained during dam construction. It is likely that hydro-electric dams create powerful currents - and certainly modify the natural pattern of currents within a dammed loch, which could erode away artificial islet sites. This proposition is confirmed by Ritchie who noted that 8 years after the construction of the dam at Loch Treig, a "great disturbance of the bottom deposits of the loch, due to the currents set up by the powerful inrush of water" (1942, 10) occurred, severely impacting the artificial islet he had previously excavated there.

Artificial islets which were built on unconsolidated areas of lochbed could conceivably sink into soft sediments, leaving no visible trace of their existence. Considering the amount of stone found at least superficially on so many artificial islets this possibility should occasion no surprise.

## The advantages of artificial islets

The general problems of site survival and detection which Martlew has outlined as distorting the perceived distributions of archaeological sites, only slightly affect artificial islet distributions. None the less, they are worth discussing individually.

(a) Artificial islets are less prone to erosion than land sites due to their submerged state. Even sites which are exposed to strong underwater currents, such as Eilean Ban (Mull) seem to be relatively unaffected. This may largely be due to the fact that most sites that have survived in the study area are primarily composed of stone. Sites which have an air-water interface may suffer from the effects of wave erosion, but this effect probably only minimally alters the margins of the sites in most circumstances, where wave-fetch is relatively restricted. A good example of artificial islets' resistance to erosion can be found in the Beaully Firth where four intertidal sites have withstood the constant effects of tidal erosion for nearly 2000 years (A. Hale *pers. comm.* 1996). These sites, albeit set on a relatively low-energy marine estuary, are still readily identifiable and display tool marked timbers on their exposed surfaces.

Technically, sea level changes should not affect the distribution of artificial islet sites. Sites which have been completely submerged in the sea are still readily recoverable if searched for, although this is probably more true of those in relatively sheltered estuarine locations such as the Beaully Firth and the inner Clyde estuary.

(b) activities associated with subsequent settlements rarely affect artificial islet sites. In Scotland, more recent settlements are generally not built over lochs, although some have been completely drained as part of urban expansion (e.g. Nor' Loch or Canonmills Loch in Edinburgh (Gillon 1990, 75)) and there is no reason to believe that people went to the effort of completely robbing a submerged site of stone. The Western Isles may offer examples of stone being re-used on other islet sites, such as Armit has postulated to be the case on a series of three artificial islets in Loch an

Dana, Shader (1990, 50), but earlier sites were generally not completely destroyed and are thus still identifiable through fieldwork.

(c) Logically, subsequent land use does not generally affect the distribution of artificial islet sites. It may, however, affect the preservation of organic materials within the sites. Modern high nitrate fertilisers used on surrounding farm land can run off into the lochs and lead to an unprecedented level of bacterial activity. It has not yet been conclusively determined if this activity substantially threatens artificial islet sites, but expectations are that it will (Barber 1994). Dixon has claimed that timbers taken from six crannogs in the south-west of Scotland “were visibly suffering attack from a wide range of micro-organisms” (Dixon 1995, 31) but this has yet to be confirmed by a laboratory study. The rising levels of other pollutants and the general acidification of loch waters may constitute a threat to artificial islets on the mainland (Dixon 1994, 272) but such pollution problems are not perceived to be serious in the inland waters of the central Inner Hebrides (Maitland and Holden 1983, 231). Only a single Loch (a’ Chinn Uacraich on Benbecula) has been found to be eutrophic in the Western Isles although algal blooms caused by agricultural fertilizers and waterfowl excrement have been recently noted in the shallow machair lochs of the southern Outer Hebrides and Tiree (Boyd and Boyd 1996, 174).

(d) The location and intensity of fieldwork has undoubtedly influenced the known distribution of artificial islets throughout Scotland. In the antiquarian period, Munro concentrated his research on western Scotland south of the Clyde to the virtual exclusion of the rest of Scotland. This initially skewed the distribution maps to favour that area. It was not until Blundell’s work in the Highlands that artificial islets were identified as a wide spread phenomenon. The Loch Awe and Loch Tay surveys dramatically increased known sites in those water bodies by 50% (12 to 18) and 300% (5 to 20) respectively. Other large lochs, which have few or no recorded sites, will very probably produce large numbers of sites when they are properly surveyed by adequately-equipped underwater teams. Around 400 artificial islets have been mentioned in previous literature (Dixon 1996) and it is considered likely that many

sites are as yet unidentified. This problem has begun to be addressed by students of Edinburgh University's Department of Archaeology, who over the course of the last 10 years have surveyed, and in some instances excavated, over 50 artificial islets (Armit 1987; Holley 1994; 1995; 1996; Henderson 1994; Halley 1995; Hale 1994; 1996; CFA 1994; Church and Burgess 1995) confirming or identifying 19 new sites located in various regions of Scotland. During the same time period, only 7 possible artificial islets, none of which were examined closely (i.e. they were viewed from shore), have been reported in *DES* by other fieldworkers.

(e) Modern administrative boundaries have had little effect on the perceived distribution of artificial islets. Almost none of the artificial islets recorded have been found by government personnel, either local, regional or national, and as yet no regional council has been willing to expend the resources necessary to systematically explore inland water bodies in order to add a significant number of sites in these locations to the archaeological record. The Royal Commission has identified many artificial islets in the various sections of Scotland that they have surveyed for their *Inventories*, but officers were hampered by the inability to record submerged sites. Other sites which only partially broke the water were listed as probable or possible artificial islets, with little attempt being made to seek confirmation. For example, sites such as Loch na Cloiche (NM26SW29) and Loch Urbhaig (NM25NW17) both on Coll were only observed from shore. Artificial islets are probably unique in their inclusion in the *Inventories* as monuments without being inspected directly by the Commission's investigators.

(f) Artificial islet sites are hardly ever misidentified as other archaeological site types. This situation would only occur where former lochs were drained and the true nature of the artificial islets was not recognised. In this case the sites could potentially be introduced to the archaeological record as cairns, although on close inspection the two monument types are readily distinguishable. The majority of loch drainage schemes in Scotland occurred during the height of antiquarian interest in artificial islets. It is therefore likely that most artificial islets were properly identified. Other

factors which also contribute to misidentification of artificial islets, specifically in the central Inner Hebrides, are discussed below.

Under particular sets of conditions, it is a possibility that certain archaeological site types may be misidentified as artificial islets. In cases where lochs water-levels have substantially risen, or where impeded drainage has led to the creation of water bodies since prehistory, cairns of various types may now be located within water bodies and can thus be misidentified as artificial islets. Though not likely to be common, these circumstances may be present in the data-set discussed here, as there is some evidence to indicate that the artificial islet in Loch Ardnave (Islay) (Appendix A) may in fact be a burial cairn on the summit of a slight undulation which is surrounded by low-lying ground which later flooded as drainage towards Loch Gruinart became impeded. It is also possible that ornamental islets created to improve the scenery of 18th century estates in the quest for the picturesque may be misidentified as earlier structures. Although excavation would quickly identify such false antiquities (see CFA 1994) an assessment by survey alone may be somewhat less effective, especially in cases where peat has subsequently partially covered the sites.

### **Advantages of a central Inner Hebrides artificial islet survey**

Few of the potential problems with artificial islet distributions outlined above are likely to affect the artificial islet distribution of the central Inner Hebrides. In this respect the artificial islets of the central Inner Hebrides are an ideal sample to be used for spatial analysis. Most of the lochs involved are small and not subject to shipping, harbour, jetty, or other construction works; nor to other major human interference. The small size of the lochs also prevents the likelihood of severe erosion or, depending on the scale and characteristics of their catchments, substantial sediment deposition as waves seldom reach great heights, and the catchments from which sediment can inwash are of relatively restricted scale. A majority (over 80%) of the lochs considered to be of sufficient size to accommodate artificial islets in the central Inner Hebrides were checked for sites, and so neither differential intensity of

fieldwork nor modern administrative boundaries should affect the number of sites observed and recorded in this study.

Loch drainage schemes should also have had little effect on the perceived artificial islet distribution. A review of the published literature and cartographic material shows that very few lochs have been drained in the survey area. On Mull only one loch, Loch na Meal, is known to have been drained, however, this did result in the discovery of an artificial islet. Extensive areas of Coll have been partially drained, but in almost every case where this activity affected more substantial water bodies, artificial islets were found at the time of drainage and noted in the literature. Areas known to have been drained were fieldwalked and, apart from the possible site of Bally Hough, no evidence was found which would suggest the possibility of an artificial islet in any of the sectors considered. In light of the fact that for the past two centuries, Tiree, most of Coll and parts of Mull were owned by the House of Argyll, which showed an interest in archaeology very early on (Mitchell 1897) and reported several archaeological sites to the Argyll County Council (1915), it can be reasoned that if such sites were found they would have been reported. Several lochs on Tiree have been completely drained and, despite the foregoing view, were found by this survey to contain archaeological sites of questionable function and chronology. These sites are discussed in Appendix A. Portions of the wetlands of Tiree were drained as recently as ten years ago (Boyd and Boyd 1996b, 51) but no new artificial islets were reported at that time. Extensive areas of Islay have been drained since the early 1800s (Storrie 1981, 98; Macdonald 1811, 21) but only one artificial islet (Loch nan Deala) has been discovered as a result of such projects. It is presumed that drainage works were generally confined to boggy ground and both the relevant parts of the *Old* and *New Statistical Accounts* and general literature do not mention that lochs of any size were drained.

## **Limiting factors**

The artificial islet distribution encountered in the central Inner Hebrides will therefore be restricted by two primary factors which cause limitations on the ability to notice and reconnoitre sites. Firstly, peat growth may have totally obscured sites located in upland lochs. Vertical aerial photographs held in NMRS at the RCAHMS clearly show major peat encroachment into lochs over the period 1948-1959. This encroachment is best demonstrated by one section of shoreline in Loch Ba (Mull) which pushed out by 5m during this time period. Other smaller lochs which are less well drained will certainly have shrunk in size since prehistoric times. A certain amount of silting has also obscured certain areas of nearly all of Mull's and Islay's lochs, and to a lesser extent those of Coll and Tiree. It has been demonstrated by Campbell (1870) in Loch na Meal, on Mull, that an artificial islet site can be entirely covered by, in this case 4 feet of, silt. A combination of these two factors forms the most serious limitation on the distribution of artificial islets on Mull and Islay, and it is undeniable that sites in their lochs may remain unidentified after the underwater survey programme reported here. It is considered unlikely in these contexts that artificial islets will be identified as other site types, but it is possible that a heavily silted or peat-covered site could have been disregarded as a natural feature.

It is felt that the survey work carried out during this study was sufficiently thorough to identify all surviving sites not afflicted by the aforementioned problems in the sample area. It is also reasonable to assume that the quality of site survival is extremely good, because most areas of the central Inner Hebrides have not been intensively exploited by man in the historic period. Each of these conditions must hold true if detailed analysis is to be attempted.

## Advancing the techniques of analysis

The spatial and locational analysis of artificial islets was a topic the author intended to address from the outset of this study. However, after only a few weeks of background research, it was apparent that others had been calling for this approach to be taken. Morrison has defined one of the first steps forward in artificial islet studies in the following terms: “it is necessary to establish their degree of variability, by documenting their size range, their characteristic shapes and types of appendages, and their relationships to the terrain” (1985, 88). He further states, “there would seem to be much to be said for taking an holistic view, and considering the study of the environment, economic and settlement information that artificial islets can yield as an extension of the study of the landscape into the water” (*ibid.* 100). It is clear that Morrison considers the organised analysis of spatial data as one of the key procedures necessary to enable modern students to reconstruct the reasoning behind distributions of artificial islets.

Other researchers who have utilised spatial analysis techniques in the interpretation of archaeological data, have also argued that these techniques merit being applied and tested on more site types. Martlew has argued that, “it is now the responsibility of those engaged in research to evaluate these methods of analysis” (1981, 7), and that, “more work is needed in this promising area ... to establish a sound theoretical framework and iron out procedural difficulties” (1981, 42). Fojut has added that, “a study of comparative situations”, is needed, “to ascertain the general applicability of the approach” (Fojut 1982, 59).

It is clear that the application of spatial analysis to distributions of artificial islets should confer three primary benefits:

- The methods and techniques which have previously been developed for various archaeological data-sets can be tested on a new site type.

- New techniques will be developed, specifically to analyse sites placed in very specific landscape facets, i.e. small inland water bodies.
- The initial logic behind the placement of artificial islets can start to be realised.

## **Methodology**

A variety of methods have been used to analyse the spatial positioning and environmental characteristics of archaeological sites. Among the broch populations of the Atlantic west of Scotland, for example, Theissen polygons and carrying capacity have been the most popular (Martlew 1982; Armit 1990; Fojut 1982; Heisler 1977). Other mathematically complex methods are also available (see Hodder and Orton 1976; Shennan 1988) as well as the powerful tools contained within geographic information systems (GIS) (Fortheringham and Rogerson 1994; Worboys 1994). This section will discuss the appropriateness of the application of these methods to the distribution of artificial islets in the central Inner Hebrides. It will be contended that only the most basic analysis can be forwarded with reliability due to the wide chronological range of these sites. The data does not fulfil the criteria necessary for the application of the more sophisticated of these tests, thus it would be incorrect and misleading to use them.

## **Sampling**

Probabilistic sampling is used to determine the normal distribution of a data-set so that the observed data can be checked against a truly random sample. The principles of this method are best illustrated with an example. Let us assume that 30 archaeological sites of a given type have been found on an island. If we wanted to assess the sites' relationship to the types of soils that cover the island we would calculate the areas covered by each soil type and then note the number of archaeological sites which fell on each type: this is the observed data. We would then choose 30 random points on the island, assuming that the archaeological sites could,

theoretically at least, be placed anywhere, and note how many fell on each soil type: these are the expected data. If we then compare the expected data to the observed data we can often tell if the archaeological sites were placed at random or if the variable that we were assessing, in this case soil type, potentially influenced where the sites were placed. Statistical tests can then be employed to tell us the significance of the deviation between the two data-sets. This is of course a simplified example of sampling theory: more detailed discussions can be found in Shennan (1988, 49-53).

It was not necessary or appropriate to utilise sampling procedures to check the data-set discussed here. By definition artificial islets may only be located in water bodies and thus can only be constructed in restricted areas of the insular landscapes. This fact considerably enhances the effectiveness of techniques of spatial analysis by allowing the total population of potential artificial islet sites to be realised with a comparatively high degree of confidence. This fairly finite population can then be used to reconstruct the expected distribution of artificial islets rather than basing this expected distribution on a number of points chosen at random, which is normally the case on land sites. In other words, artificial islets could only have been constructed in the extremely limited areas enclosed by the lochs' shores and not at random points anywhere in the landscape. This allows us to define where artificial islets could potentially be constructed with a degree of confidence not normally attainable in spatial studies.

The potential number of artificial islet locations will of course be largely determined by the size and depth of the available water bodies. The majority of the lochs in the study area are shallow and quite small, averaging under 0.25km<sup>2</sup> in area (Maitland and Holden 1983, table 1), and it is not unreasonable to suggest, based upon the placement of artificial islets in similar environments (Beveridge 1911; RCAHMS 1928), that each could have contained a maximum of one artificial islet. In the larger lochs, such as Loch Awe and Loch Tay, there is of course a wide range of potential locations which are spread across a large geographic area and in these instances some sort of limited sampling within the loch may be appropriate.

The establishment of the total population of the potential artificial islet sites within the study area was relatively straight forward. At least 80% of the lochs were physically inspected by divers and found to contain shallow areas suitable for building artificial islets. If Morrison's estimate of 5m is accepted for the average height of an artificial islet above the lochbed, nearly any sector within a majority of the lochs in the central Inner Hebrides could have theoretically been the location of an artificial islet. As discussed in Chapter 6, the nature of the geology of the lochbeds could also have limited where artificial islets were feasibly placed, but this factor could not be assessed in every area of every lochbed within the time constraints allowed. It will be assumed here that each loch contains at least one area of lochbed which could support the weight of an artificial islet and was also of sufficient size. Although proof is formally lacking, this is in fact probably the case (based upon observation made during the underwater field-survey of lochs undertaken here). On this basis, each of the small lochs in the study area was considered as the potential site of an artificial islet. For modelling purposes and consistency the centre of each loch was chosen to represent the exact spatial position of the potential site, although it is realised that other areas within the lochs would have been more likely to have been chosen. This determination should simply be viewed as a heuristic device which will introduce the least amount of error into the theoretical distribution,  $\pm 200\text{m}$  for each position would be a reasonable estimate, and is thus preferred over any other point chosen at random.

As has already been noted, an assessment of the potential artificial islet locations within large lochs is somewhat more problematic. The water depth encountered further from shore in large lochs normally confines artificial islets to their margins but within these areas there is considerable latitude for the placement of the islets. Six large lochs, over 1km in length, were identified in the study area, two of which contained multiple examples of artificial islets; the other four contained only single sites. In these cases, after areas of substantial water depth were ruled out, for the model the potential positions of the artificial islets were chosen 45m, the mean distance the artificial islets in all the lochs in the study area were found from shore,

from each end of the loch in question. If lochs were over 2km long an additional theoretical potential position was added for every 2km of its length. This was also the unit selected as the artificial islet's theoretical catchment diameter, as will be discussed below. This method, and the measurements selected to underpin it, are admittedly heuristic, but only needed to be employed at three lochs in the study area.

The total theoretical population of potential artificial islet sites was thus recreated with, what can be argued to be, a reasonable degree of confidence.

### **Site catchment analysis**

The method chosen here to explore the relationship between the artificial islets of the central Inner Hebrides and the elements of the landscape in which they are set was site catchment analysis. Although other methods of analysis are also available many of these were deemed inappropriate, as will be discussed below, due to the wide chronological range of the artificial islets and the significant lack of excavation data across the study region.

Site catchment analysis has traditionally been used to examine the territories associated with archaeological sites on the basis of the minimax principle borrowed from geography. The general theory, associated assumptions, and criticisms of this type of analysis have been extensively reviewed elsewhere (Hodder and Orton 1976, 230-236; Vita-Finzi and Higgs 1970; and in a Scottish context by Martlew 1981, 8-10) and thus will only briefly be discussed here. Site catchment analysis rests on the assumption that, "human populations do not exploit their surroundings at random" (Jarman 1972, 706). It is contended that the areas surrounding a site will be exploited in a way which will give a maximum return for a minimum of effort: "there are norms that characterise the limits or thresholds beyond which exploitation of a resource is unprofitable and unlikely to take place in the long run" (*ibid.* 706). Distance is normally taken to be an indicator of these thresholds, with the units of measurement determined by the distance which can be walked in a given period of time. In most

instances the most important land, in which the greatest human investment is made, is likely to lie within 1km of the site, with a one hour threshold set for agricultural communities (Higgs 1975, 223). It is assumed that most cultures value arable land and, “the main area exploited for food will be close to the site being considered” (Hodder and Orton 1976, 230). The practicalities of this idea have been explored by Chisholm (1968) who has demonstrated a ten to fifteen percent fall in the productivity of peasant economies for every kilometre that farmland lies from a settlement.

Although there are a number of problems associated with this type of approach (Hodder and Orton 1976, 233) the most fundamental is that some exploitation strategies may not accord with the minimax theory, or any rationalised strategy which modern thinking might suggest (Martlew 1981, 9). Site catchment analysis assumes that the value of resources were recognised and does not allow for ignorance, aesthetic preferences, prejudices or taboos which may have influenced the decision making of prehistoric societies and thereby influenced where sites were located. A further implicit assumption of many applications is that, whilst soils may have altered significantly in the immediate areas of sites since they were occupied, their *relative* importance will not have changed. Whilst phenomenological and other postmodern approaches may seek to disentangle non-tangible human criteria of the kinds rehearsed above, they can rarely hope to be grasped unambiguously through archaeological approaches, so that there will always be an element of uncertainty when examining any pattern of settlement sites.

The form of site catchment analysis employed here generally follows Fojut (1980) but has been modified to account for the unique setting of artificial islets. A circular area 1km in radius was chosen to represent the hypothetical catchment of each artificial islet, based on the significance of this measurement to agricultural communities, noted above. Although there is considerable comparative ethnographic evidence to back the validity of this measurement (Higgs 1975; Chisholm 1968), it is used here simply as a heuristic measurement, by which elements of the landscape immediately surrounding the artificial islets may be assessed. This is not to say that

areas beyond this distance were not exploited or utilised by the artificial islet dwellers. This unit of measurement is certainly adequate to test Morrison and Dixon's suppositions that artificial islets are almost always situated immediately adjacent to arable land, yet is sufficiently broad to assess whether other factors potentially influenced where the islets were placed. The relationship of the artificial islets of the central Inner Hebrides to arable land, as well as several other potential resources / factors will be examined below.

### **Computing and site catchment analysis**

Recent developments have greatly increased the value of the computer as a tool for carrying out site catchment analysis. The phenomenal growth of micro-processor speeds and memory sizes have led to the development of affordable PCs which are capable of carrying out complex calculations and processing large quantities of data, at speeds which would have been unimaginable only five years ago. This explosion in the capabilities of hardware has been matched by the equally impressive development of powerful, user-friendly software. This section will briefly discuss the capabilities and advantages of such systems, and will outline considerations that are necessary in employing this new technology to carry out site catchment analysis on data-sets such as that assembled here.

One of the primary drawbacks of site catchment analysis is that it requires a considerable amount of information, normally in the form of distribution maps, to be measured and calculated. This can be very time consuming and presents procedural difficulties, when trying to calculate exact areas, for those who are not adept at trigonometry. Fortunately for the archaeologist, the development of PC based mapping software has removed many of these problems. Map based information can quickly be scanned or digitally entered into software packages which allow the data to be manipulated in a myriad of different ways.

The software employed here is Autosketch for Windows™ by Autodesk®. Although this is not currently the most advanced mapping package available, the advantages of this software are many:

- It is affordable (under £200).
- It allows easy entry of data, either through a scanner, digitising pad or directly from a total station.
- It is user-friendly and does not require specialist programming knowledge to operate.
- It allows user-defined areas to be calculated instantly, to within 1mm accuracy.
- Although not a Geographic Information System (GIS) proper, this package allows all data to be exported to more complex GIS systems.
- It allows for the permanent storage of data so that the conclusions reached here can be re-examined as more data becomes available.

Although computer software is a useful tool which can dramatically reduce the amount of work required to carry out site catchment analysis, several factors limit the effectiveness of this tool. Computer-based digital maps will only ever be as good as the data used to construct them. The processing technology has currently far outpaced the quality of the data collected in the field. Distribution maps of any variable which can be measured and thus mapped are only ever approximations of the true conditions in the field; and a certain degree of error resulting from necessary generalisation is always present in any map. Many of the variables which were employed during this study, such as soil type, drift geology and bioclimate, were only published on large scale maps i.e. 1:650,000 for the study area; the need for a consistent information base across the set of islands considered, greatly restricted the

accuracy – in terms of degree of definition of the data. Although this problem is beginning to be addressed, for instance the OS 1:50000 maps of Great Britain are now available in digitised form, the cost of acquiring such detailed data is prohibitive to the individual researcher. In the absence of more detailed data, that which is currently available must be used while acknowledging that, as the data-set improves, interpretations may change and analyses will certainly become more subtle.

Ultimately site catchment analysis will be carried out using fully functional software but at this time such an exercise is not practical. The GIS systems currently available, such as ARC/INFO, are not user-friendly and require knowledge of specialist programming languages in order to construct and manipulate the databases. Within Edinburgh University it takes approximately three years to absorb the knowledge required to construct a GIS (B. Giddings *pers. comm.* 1995) so such systems are for the moment beyond the reach of non specialised users. Even if such knowledge was not required, in this particular case the quality of the various field data in the central Inner Hebrides is not sufficiently detailed to warrant the use of such a system. For these reasons, the software employed here was considered adequate to assess the site catchments of the artificial islets of the central Inner Hebrides.

### **Methodological limitations**

Although there are several other techniques which may be used to examine the spatial positioning of prehistoric monuments, many of these are not appropriate for use on artificial islets. The primary problems are that the data-set examined here is too small to employ the more rigorous statistical tests, such as  $\chi^2$ , while the wide chronological range of artificial islets means that they fail to meet the basic criterion (that of contemporaneity of the sample sites) of many forms of analysis. A short discussion of the forms of analysis not employed in this thesis is given here so that the problems that would be encountered in using such approaches to examine the distribution of artificial islets can be realised.

One of the favoured forms of discussing the distribution of later prehistoric monuments, primarily brochs, in the Atlantic West of Scotland has been an examination of the monuments' potential carrying capacity (Heisler 1977; Fojut 1980). Most of these studies have attempted to elucidate prehistoric populations based on yields reported in the *Statistical Accounts of Scotland* or complex reconstructions of potential agricultural resources. This type of approach is largely hypothetical and the figures which are arrived at have been fairly criticised as relying on "a hazardous series of leaps from specific values to generalised values to generalised mean values" (Martlew 1981, 27). Carrying capacity analysis also relies on a whole host of assumptions concerning the production, storage and consumption of agricultural produce and can only indicate the maximum number of individuals a landscape will support, although as seen below even this parameter is questionable. The most significant of the assumptions is that all agricultural resources were maximally exploited. The extent that these resources were utilised is in fact unknown and this assumption does not allow for ignorance, prejudices or taboos which may have limited how prehistoric societies exploited their landscape. Another basic assumption is that the structures being studied (in this case artificial islets) are contemporary and that they are the only ones being inhabited in the landscape. This assumption does not account for the possibility that structures of other classes may also have been inhabited and that less monumental structures composed of organic material may not even be recognised by conventional archaeological approaches. If the distribution sets are not reasonably complete, the value of this type of analysis is necessarily much reduced.

The basic assumptions of carrying capacity analysis exclude it from being a viable method of examining the distribution of artificial islets in the central Inner Hebrides. Very few land sites and none of the artificial islets have been excavated in the region. Thus, any reconstruction of how or even what resources were exploited would rely almost exclusively on speculation. The extent to which maritime resources were utilised is also unknown but some studies (Heisler 1977) have suggested that the nutritional value of these resources could have equalled those produced on land. The

inhabitants of the central Inner Hebrides had obviously mastered maritime technology to some degree and fishing from shore or from boats was at least feasible; additionally a wide range of resources could have been collected, more particularly from the inter-tidal zone. Just north of Loch Ardnave (Islay), for example, Ritchie and Welfare (1983) excavated the remains of a Bronze Age house and found that a wide range of maritime resources were present in accompanying midden deposits. A large percentage of the deposits consisted of limpet and crab shells but bones of seal and whale were also present (*ibid.* 320). The excavators note that the whole range of marine resources that would have been available were not exploited and the remains of fish, sea-urchins, cuttlefish and lobsters were not present (*ibid.* 357). This may indicate that the value of the resources were not recognised, that only the inter-tidal zone was being exploited, or that the midden deposits are witness to dietary preferences. This example illustrates the problem that even if certain resources were exploited the degree and extent of the exploitation remains open to question. Until more data is recovered from the study area by way of quantified data from modern excavations it seems overly speculative to estimate even maximum populations for the central Inner Hebrides.

The varying chronology of the artificial islets of the central Inner Hebrides not only exempts them from an analysis of their carrying capacity it also excludes them from techniques such as Thiessen polygon analysis. Cunliffe (1978, figure 13:23) has shown that the problem of contemporaneity is crucial to this approach. As discussed elsewhere, the artificial islets of Scotland display a wide chronological range (Barber and Crone 1993; Henderson 1994) and the artificial islets of the central Inner Hebrides are no exception. The radio carbon determinations from timbers recovered from three of the artificial islets in the study area indicated periods of activity ranging from the Neolithic through to the Medieval period. Any of the artificial islets in this study could potentially date to any of these periods; it is therefore not justifiable to suppress the chronological dimension as would be entailed in applying the technique, since the assumption that they were at some stage all in contemporary use cannot be sustained. The chronological relationships between artificial islets and land-based sites

is also not understood, in the absence of sufficient isotopic determinations or other pointers to their timespans. The wide chronological range of artificial islets means that they could be associated with land sites of almost any period. This uncertainty means that the total population of settlement sites of any period in the central Inner Hebrides can seldom be realised and therefore it is not possible to reconstruct the polygons which Thiessen polygon analysis and carrying capacity models are based.

With so few artificial islets adequately excavated analysis at this level of detail seems premature. Not only is chronology problematic, but the function of artificial islets is theoretically open to a wide range of possible explanations, not all of which are likely to have been mutually exclusive. Although most of the artificial islets which have been excavated are apparently domestic settlements, Morrison (1985) has suggested a wide range of possible functions for such sites and recent research has indicated that some may have been used as processing centres (A. Hale *pers. comm.* 1997). Until the function of a representative proportion of artificial islets is firmly clarified by excavation it is pointless drawing territorial polygons around sites.

This lack of appropriate data is not likely to be resolved in the near future unless extensive programs of excavation are implemented. As this is unlikely, these spatial techniques will remain inappropriate to analyse artificial islet distributions and the presence of these enigmatic sites will always undermine the distribution of later prehistoric dwellings from being recovered with confidence.

The remainder of this chapter will discuss relationships between the artificial islets of the central Inner Hebrides and measurable factors which may have influenced where the islets were placed in the landscape. Each of the variables examined below is discussed on an island by island basis, because of the range of variation in the physical and environmental landscapes represented. To group all of the artificial islets together and analyse the total distribution would potentially mask the variation of opportunities afforded at each of the Hebridean islands and would be potentially misleading as the total range of choices are not always present on each island. For present purposes,

therefore, each island is considered as an independent laboratory in which the factors can be examined.

Descriptive statistics will be used extensively throughout the following discussion and are given alongside actual numbers so that the total data-set can easily be reconstructed and checked. Regional surveys of artificial islets in the past have failed in many cases to provide the raw numbers that underpin their analytical components; and much of the detailed data has subsequently become inaccessible. Though somewhat tedious, the data is noted in the main text to avoid repeating this situation and to allow this data-set to be easily compared with others.

### **Arable land**

The presence of good arable land is considered by many modern researchers to be one of the prime factors in influencing where artificial islets were situated in the landscape. The connection between artificial islets and arable land was first observed during the Loch Awe survey where 17 of the 20 sites were found to lie adjacent to patches of land of arable potential. Morrison is so confident of the importance of this variable that he has hypothesised that immediate access to arable land was the primary consideration in the placement of many of the artificial islets throughout Scotland (1985, 74). In the Loch Awe basin, Morrison went so far as to suggest that, “those who required a secure base adjacent to their farmland might elect to build either a dun or a crannog” (*ibid.* 75). Dixon has also hypothesised that land suitable for cultivation was a major factor influencing the placement of crannogs in Loch Tay (1984, 173) stating that, “they (crannogs) were deliberately sited off areas of cultivable land” (*ibid.* 12). The results of recent artificial islet surveys such as Henderson’s in the Lake of Menteith (1994, 151) have generally supported the association between artificial islets and arable land while other research has shown that later prehistoric dwellings such as brochs may also be positioned close to arable land (Fojut 1980, 29; Heisler 1977).

While this theory seems to be reasonable and is widely supported by those working in the field, the association between artificial islets and arable land remains a tenuous one which has not been systematically examined and which furthermore relies exclusively on the individual researcher's interpretation of what constitutes arable land. Morrison has defined arable land in the Loch Awe basin as: "land that was either being actively worked up to the 1930s as arable, or was then classified as good quality meadowland" (1985, 74). However, he offers no distribution maps indicating where arable land is located in relation to specific artificial islet sites as evidence for this claim. Considerations such as the soil types involved or the amount of area covered by arable soils were left undefined in the published treatment of the data. The only specific proof Morrison offers to link artificial islets with arable land is the haphazard association of artificial islets and the pre-improvement land divisions on the north side of Loch Tay (1985, 78). Dixon has been even more vague in his definition of arable land, describing it simply as: "areas of lesser slope" (1984, 173), and notes that all but one of the sites in Loch Tay were located next to land which was under cultivation in 1983. Once again no particular soil characteristics or estimates of adjacent shoreline area covered by arable land were identified.

Henderson (1994) has offered the most convincing assessment of the association between artificial islets and arable land, based on specific evidence. He utilised maps published by the Land Utilisation Survey of Britain and the Soil Survey of Scotland to demonstrate that the artificial islets of the Lake of Menteith were situated next to arable land and avoided land of lesser agricultural value (1994, 151). While these maps have several drawbacks, discussed below, which he did not recognise, they at least offered an assessment based on pedological criteria of what constitutes arable land at the present time (allowing for higher limits for viability resulting from mechanised farming) rather than seemingly arbitrary assessment.

Armit has argued that it is, "highly misleading to attempt to assess the later prehistoric settlement distributions for their relationship to land of varying quality in the area today" (1992, 115) in the Western Isles, because peat growth, the leaching of

soils, machair development and the effects of climatic change have altered the character of the landscape. Although the landscapes of the central Inner Hebrides has experienced similar changes since later prehistoric times, as demonstrated in Chapter 2 of this thesis, it can be argued that the climatic changes have been relatively even overall, and that the relative ranking in terms of agricultural viability in the landscape have been preserved. For instance, with a rise of sea-level, absolute distance to the coast may change but in most cases the artificial islets retain their relative order of distance from the sea. Similarly, when analysing soils it is assumed that the most favourable areas have remained so, even if they become less or more favourable than before in absolute terms. Therefore, the analysis of the landscape characteristics is not wholly inappropriate, especially if the methods of analysis concentrate on orders rather than specific values (Fojut 1980).

The problem of determining what was arable land, however, limits this type of analysis to generalisations as only broad patterns of soil distribution can be identified with certainty in the landscape. Before specific conclusions can be drawn it would be necessary to reconstruct the history of the soils in the central Inner Hebrides. This is obviously beyond the scope of a single thesis, but is a promising area for further research and is one which would help to answer a variety of questions from many different disciplines. To date little research has been done on the soils of the central Inner Hebrides and, as discussed in Chapter 2, it is not clear whether climatic change or anthropogenic activities (or a combination of them) led to the development of the blanket peat which now covers most of the island chain. It is probable that both factors have contributed to the degradation of soils, but not necessarily evenly either in time or in space. Anthropogenic interference, primarily in the form of over cultivation of soils, or poor soil conservation practices, may have significantly hastened soil degradation and encouraged soil compaction which hampered drainage in specific areas thus inducing peat accumulation (Whittington and Edwards 1997, 19). Unlike climatic change, this type of interference would not have applied evenly to every area of the islands and could significantly disturb the ranking of the soils which have developed to the present day. It is conceivable that areas of good soils could

have been over cultivated or have had their hydrology altered to the point where peat engulfed them. It is generally accepted (see Chapter 2) that the environmental conditions which support arable agriculture have been in decline in the central Inner Hebrides since later prehistoric times. It can therefore be assumed that the soils which covered the islands in later prehistory were at least as productive as those of the present. In the absence of research into the soil histories of the central Inner Hebrides, this thesis can only assess the relationship of artificial islets to the present soil cover, acknowledging that the areas of arable land were likely to be greater in the past.

There are two sources of error which are likely to contribute to the over estimation of arable soils. The loch drainage schemes of the 18th and 19th centuries, already discussed in the context of the recovery of artificial islets, obviously created large areas of arable land which would not have been available to the prehistoric inhabitants of the central Inner Hebrides. This problem, though acute, especially near lochs which have been only partially drained, can not easily be remedied with reliability and must be acknowledged as a source of potential error in the data. The establishment of population centres may have also contributed to the development of arable soils. Fojut has suggested that settlements may have polarised patterns of land use resulting in the situation where the land surrounding the settlements “tends to receive more attention than peripheral land, so will be manured and gradually improved” (1980, 30). Evidence of manuring is widely attested throughout Scotland (Cowie and Shepherd 1997, 162) so this suggestion has serious implications on the observed pattern of arable soils surrounding any settlement type and implies that some arable soils were created or improved by human endeavour.

There is evidence within the central Inner Hebrides to support the suggestion that arable soils may be created through anthropogenic actions. At An Sithean on Islay, Barber and Brown (1984, 184) recorded a sequence of land use which alternated between intensive cultivation and periods of peat growth. Podzols were initially cultivated in the second millennium BC and then presumably abandoned and engulfed by peat. During the medieval period cultivation was resumed and continued

through to the 18th century AD when the land reverted to grazings. This example proves that land which has been engulfed by peat can be reclaimed and arable soils developed if the necessary resources are expended. Although this situation is likely to inflate the estimates of arable land used here, without detailed soil analysis there is no way to determine the degree to which, or the chronological periods during which arable soils were created. The situation can only be noted here as a possible source of error, to what extent unknown, which invites future research.

The locations and extents of arable land may be derived from the Soil Survey of Scotland *Soil* map series which cover all of Scotland including the central Inner Hebrides and has been published at both 1:250000 and 1:50000 scale. These maps display soils which have been categorised by type, association, parent materials, landforms and list the types of vegetation communities the soils will support.

Data on arable land may also be derived from two other published sources: the Soil Survey of Scotland *Land Capability* map series and the Royal Air Force's 1946 coverage of Britain by air photography, the earliest broad-scale aerial survey of Britain. However there are inherent problems with employing either of these sources and therefore they have not been utilised here. The chief disadvantage of the *Land Capability* series, for the archaeologist, is that the classifications are based upon the land's suitability for modern mechanised agricultural regimes and not on the vegetation the soils will actually support. The result of this is that flat land is rated highly (because it is easy to cultivate using mechanical means) and valley side slopes are rated poorly (because they largely may only be cultivated by hand). Such criteria do not recognise the agricultural technology of the Later Prehistoric period, which may have relied heavily in some localities on hand dug field systems (Armit and Ralston 1997, 190) and are thus irrelevant to a study of what was considered arable land in that period. Even to this day, modern farm machinery is not widely used to plough or harvest in the Hebrides (Boyd and Boyd 1996, 49) and so the productivity of the land may be under-recognised. Aerial photographs have the methodological disadvantage that the measurement of arable land is a lengthy optical process which

requires a specialist's eye to differentiate between the varying print tones that characterise the numerous land classifications (Fojut 1980, 28 and 52). Another drawback of aerial photography is that it can only mirror the condition of the landscape of when the photograph was taken, in this case 1946, by which time the extent of arable land was primarily determined by mechanisation and by the needs of wartime food production. For these reasons the present study relied upon soil type as the sole criterion for determining its landscape classifications in terms of suitability for agriculture.

For the purposes of this study the soils of the central Inner Hebrides were grouped into three categories: arable, grazing and peat moor. The necessary amalgamations were based upon soil types and the corresponding types of vegetation communities they did or could support. These classifications were simplified from the Soil Surveys Soils maps and represent the relative value in agricultural terms of each soil type. It should be stressed however that these classifications are organised relatively within the study areas: that even the most fertile soils of the central Inner Hebrides are not particularly productive when compared with soils found in other parts of Scotland.

There is obviously great variability in the productivity of each of the broad categories set out here: for instance some tracts of arable land may be relatively productive while others also included under this broad heading are only marginally so. The productivity of any piece of land is also influenced by weather and how the land is worked. Although there is a separate category for grazing land, it is probable that much of the potentially arable land was used as high-yield grazings and even some of the peat moors could be utilised as rough grazings in the summer. It is also possible that some areas of low capability could have been used to produce arable crops if over the course of several years enough effort was spent to fertilise and improve small fields. It is beyond the scope of this thesis to reconstruct in detail how the landscape of the central Inner Hebrides was exploited in later prehistory; the goal here is to establish the relative qualities of the landscape's potential so that the artificial islets

relationship to these qualities can be checked and the theories posed by Morrison (and supported by others) tested in broad-scale terms.

Illustrations 7.1-7.4 show the soils of the central Inner Hebrides as they are classified here. Each of the individual soils which have been regarded as arable, grazing and peat-moor are outlined by type in Appendix F. Using this criterion, 20% of the soils of the central Inner Hebrides were found to be arable, 15% supported grazing and 65% were covered by peat-moor or fresh-water lochs. The areas covered by each of the agriculturally productive soils and their corresponding percentage of land ratio are tabulated below for each of the four islands.

	Total Area	Arable	%	Grazing	%
Coll	7809	857	11	1133	15
Islay	62941	9939	16	14996	24
Mull	89767	19116	21	7886	9
Tiree	8881	3567	40	1295	15

• Units in Hectares

The areas of the central Inner Hebrides calculated (both in real area and % of land surface covered) to be covered by agriculturally productive soils are indexed in the table above. If populations chose which island to occupy uniquely based upon agricultural potential, Tiree and Islay would have been more favourable than either Coll or Mull as they have higher percentages of potentially agricultural land.

The type of soils which are in close proximity (within 1km) to the fresh-water lochs of the central Inner Hebrides produced a different range of choices for the builders of artificial islets. The area covered by each of the agriculturally preferable soils which occur within a 1km radius of the fresh-water lochs is tabulated below.

	Arable	% of total Arable	Grazing	% of total Grazing
Coll	197	23	184	16
Islay	1496	15	3376	22.5
Mull	1691	9	582	7
Tiree	1190	33	303	23

• Units in Hectares

The table above shows that a high percentage of all the arable land on Coll and Tiree is located within close proximity to the islands fresh-water lochs. Although on Islay and Mull the percentage of the islands total arable land which falls within 1km of the lochs is low, the real area extent of such soils in the catchments is relatively high.

Of the 30 sites used in this study, 24 (80%) were found to lie within 1km of arable land. In 18 (60%) of the cases arable soils covered over 20% of the area within 1km of the site. These values were checked against the distribution of arable land near all lochs. The relationship of the soils of the central Inner Hebrides to the lochs are assessed on an island by island basis below.

A review of Illustration 7.5 (also see Appendix G, Table 2) will show that it is not particularly useful to analyse the relationship between the soils and the artificial islets of Tiree (Illustration 7.2), as all of the lochs on Tiree have arable soils within their 1km catchments, and thus in this regard would have been suitable for artificial islet construction. It was also observed that there was not a significant relationship between the artificial islets and soils suitable for grazing as this distribution also closely matched the distribution of all of the lochs. These findings should not be surprising as 40% of the surface of Tiree is covered with arable soils and a higher percentage of these soils are located within 1km of Tiree's lochs than on any of the other Hebridean islands in this study.

The island of Coll (Illustration 7.1) displays a very different picture. Illustration 7.6 (also see Appendix G, Table 1) shows that 67% of the artificial islets there are situated within 1km of arable land, whereas only 23% of the total population of lochs on that island are so located. This finding is highly significant and demonstrates a strong association between artificial islets and arable soils. In real terms, only two of the lochs located near arable land as here classified were not chosen for artificial islets. It is curious that each of these lochs is shallow, under 1m in depth, and perhaps that factor in itself was sufficient to exclude them from being chosen. Land suitable for grazing was found near only three lochs on Coll, one of

which contained an artificial islet, and thus was not considered to be a contributing factor in the locational choices of sites for artificial islets.

Artificial islets were also found to be associated with arable soils on Mull (Illustration 7.3). Of the 38 lochs on Mull, 25 (66%) were found to be situated near arable soils whereas 7 (88%) of the 8 artificial islets were located near arable soils. This correspondence, displayed in Illustration 7.7, though not as marked as that on Coll, is sufficiently significant to suggest that a relationship exists between arable land and artificial islets here. A review of Appendix G, Table 3 shows that the association between artificial islets and arable soils is further strengthened by the relatively large quantity of arable soils found within 1km of the sites. In each case significant percentages of the land area surrounding the lochs containing artificial islets were covered by arable soils, ranging from 21.6% at Loch Poit na h-I to 60.4% at Ledmore (Loch Frisa). The mean percentage of the arable land within 1km of the artificial islets on Mull was 34.5% with a standard deviation of  $\pm 14.7\%$ . The percentage of grazing soils surrounding the artificial islets was found closely to match the percentage of grazing soils surrounding all of the lochs on the island (Illustration 7.7) and was again deemed not significant in the original selection of the sites.

Illustration 7.8 shows that on Islay (Illustration 7.4) there also appears to be a correlation between the location of artificial islets and arable soils (see Appendix G, Table 4). Of the 62 potential artificial islet sites on Islay, 29 (47%) were found to be positioned near arable soils whereas 7 (78%) of the 9 definite artificial islets were situated near arable soils. Once again it can be observed that the builders, or those who controlled them, showed a strong preference for situating their sites in lochs near arable land and this trend seems, on the evidence rehearsed above, to be consistent throughout the central Inner Hebrides. It is notable that the larger artificial islands in Lochs Gorm, Finlaggan, Lossit and Bally Grant (not included in this study) are also located within 1km of concentrations of arable soils. As remarked on the other Hebridean islands in this study, the distribution of grazing soils surrounding artificial

islets (Illustration 7.8) did not significantly differ from that surrounding the total population of lochs.

The picture which emerges from an analysis of the relationship between the soils and the artificial islets is thus consistent throughout the study area. On each island a significant proportion of the definite artificial islets were located near arable soils. Illustration 7.9 compares the soil cover of the central Inner Hebrides with both the total number of positions where artificial islets could be placed and with the artificial islets' actual positions. The graph shows that 80% of the artificial islets were located next to arable land whereas only 52% of the total population of potential artificial islet sites were. Although this preference is not overwhelming, it indicates a trend which needs to be explained.

The normal method of testing trends in archaeological data is by applying statistical tests which quantify the significance of the difference between an observed and an expected data-set. The chi-squared test is perhaps the most popular of these statistical tests and has been widely used by archaeologists. Unfortunately the data-set discussed here is too small (Sheenan 1988, 69) to employ this test on each of the variables examined below. However, it can be used to examine the relationship between the artificial islets and arable soils. The intricacies and methodology of the chi-squared test have been discussed extensively elsewhere (Hodder and Orton 1976; Sheenan 1988) and will, therefore, not be reiterated here.

The chi-squared test examines the probability of whether or not a correlation exists between observed and expected data by formulating the null hypothesis which states that any relationship between the variables has occurred by chance and then allows this to be accepted or rejected. The test does not indicate the cause or strength of the relationship, merely the odds of it occurring by chance. This theory is perhaps best exemplified by working through the problem here.

The object of the exercise is to determine the probability of a correlational relationship between the artificial islets and arable soils. This is accomplished by determining the percentage of the possible artificial islet sites in the study area which have arable soils within their 1 km catchments. In this case 52% do. This percentage is then multiplied by the number of artificial islets (30) and gives the number of sites (15.6) “expected” to be located near arable soils. It logically follows therefore, that 48% (14.4) of the sites do not contain arable soils in their 1km catchments. This data represents the numbers of sites we would expect to find near each soil type if they were equally attractive to the artificial islets’ builders and forms the basis of the null hypothesis: that artificial islets are randomly distributed near each of the soil types. At this point the actual number of artificial islets which are located within 1km of each of the relevant soils is tallied: in this case 24 islets are near arable soils, while only 6 are not; these numbers represent the “observed” data. The difference between the two data-sets is then calculated using the following formula:

$$\chi^2 = \sum \frac{(O-E)^2}{E} \quad \Sigma = \text{Sum of} \quad \begin{array}{l} O = \text{Observed frequency} \\ E = \text{Expected frequency} \end{array}$$

Which in this case =

$$= \frac{(24-15.6)^2}{15.6} + \frac{(6-14.4)^2}{14.4} \quad \begin{array}{l} df = k-1 \\ df = \text{Degree of freedom} \\ k = \text{Number of categories} \end{array}$$

$$= 4.52 + 4.9$$

$$= 9.42$$

The degree of freedom is then calculated by subtracting 1 from the number of categories (i.e. islets situated near arable and non arable soils), in this case 2. This number is then compared to those in a published table and if its value exceeds the critical value of a chosen level of significance a statistically-demonstrable correlation has been identified, and the null hypothesis can be rejected. In this case the degree of freedom is one, so our result of 9.42 is significant at the 0.005 level. This result means that if the artificial islets were distributed randomly throughout the lochs, such a pattern of observed association would have less than a one in five hundred chance of occurring. This correlation is extremely strong and should be explained.

The strong association which the chi-squared test has shown to exist between the artificial islets of the central Inner Hebrides and areas of arable soils may be explained in several ways:

- The association may be entirely coincidental and is the 1 in 500 chance occurrence. This however has been set into perspective by the degrees of freedom and is an unlikely, though ever-present, explanation.
- The artificial islets are directly linked to distributions of arable soils in a causal fashion, suggesting that the builders were deliberately constructing the islets next to arable land. This explanation is the most attractive and confirms Morrison's theory.
- Both the artificial islets and the distribution of arable land are causally linked to a third, unknown factor which has not been considered. This explanation is difficult to assess at this point and requires the consideration of more data.

There are a number of other factors which may have influenced where artificial islets were placed in the landscape and some of these undoubtedly influence, or co-vary with, land quality. These factors will be discussed individually below.

### **Altitude**

Due to the low lying topography of Coll and Tiree, altitude would have only been a consideration of the artificial islet builders on Mull and Islay. On Tiree all fresh-water bodies are located at approximately the same height, 5m OD. On Coll all lochs, with the exception of Loch Boidheach located at 75m OD, are located under 35m OD. The range of altitudes of the lochs containing artificial islets was found to be almost identical to the range displayed by the total population of lochs on the island,

suggesting that the artificial islet builders did not find such small differences in altitude to be a significant factor in their choice of location.

The more diverse topographies of Mull and Islay, however, provided the builders of the artificial islets with a much wider range of altitudes to choose from. On Islay the altitudes of lochs range from 15m at Loch Gorm to 405m at Loch Beinn Bhan and have a mean height of 101m OD and standard deviation of  $\pm 87$ m OD. Illustration 7.10 compares the altitudes of artificial islets to those of all potential sites on Islay in the form of a bar graph. It is immediately noticeable that distribution of artificial islets altitudes is positively skewed to the left with 8 (89%) of the artificial islets located below 100m OD. In fact the only artificial islet located at a relatively high altitude is the heavily fortified islet in Loch Allalaidh, which lies at 225m OD. The distribution of all the potential artificial islet sites on Islay is also skewed to the left with 64% of the lochs located under 100m OD. The difference between the observed 89% and the expected 64% (as estimated from the chi-squared test) is not overly significant but the artificial islets' mean altitude of 64m OD and standard deviation of  $\pm 43$ m OD (almost half that of the total population of potential sites), would also seem to indicate a preference for lower altitudes on the part of the artificial islet builders.

The lochs of Mull are also located across a wide range of altitudes from 10m OD at Loch Assapol to 350m at Loch Fraing. Illustration 7.11 displays a similar range of altitudes to that discussed above for Islay, with 58% of Mull's potential artificial islet sites located below 100m, producing an almost identical mean of 102m and standard deviation of  $\pm 85$ m. The builders' preference for low altitudes was also noted on Mull where 88% (7) of the artificial islets were located below 100m OD. Once again only a single artificial islet, Caisteal Eoghainn a' Chinn Bhig in Loch Sguabain, lay outwith the group; it also is distinguishable by being heavily fortified.

Although caution should be exercised in drawing conclusions from such a small number of sites, it is remarkable that each of the artificial islets located at high

altitude also displays the most highly defensive features encountered in this study (see Chapter 6). These sites mountainous locations and relatively substantial distances from arable land may indicate that they were constructed for a special purpose, for example as refuges.

The artificial islets general avoidance of higher altitudes may suggest that the builders were trying to minimise their exposure to the harsher environmental conditions prevalent there. Areas of high altitude are generally not situated near arable lands in the central Inner Hebrides and the lower temperatures and higher rainfall encountered in such areas would have restricted the growing season there considerably. Clearly such areas would not have been favourable to arable agriculture. The climatic conditions and other environmental factors which surround the positions of artificial islets are examined further below.

## **Bioclimate**

Bioclimatic maps were first developed as tools for ecological research where the influence of 'total climate' was a variable which needed to be quantified as it affected biological situations. For the archaeologist bioclimatic maps provide a convenient summary of the relationship between present-day climatic criteria and vegetation. The bioclimatic sub-regions of Scotland, including the central Inner Hebrides, have been established by Birse, Dry and Robinson (1970; 1971) and published by the Soil Survey of Scotland. These maps have been used in earlier studies (Fojut 1980, 34) to assess the relationship between archaeological sites and zones of mild climate which are conducive to arable agriculture. Bioclimatic maps are employed here to establish whether climate influenced where artificial islets were placed in the central Inner Hebrides, the assumption being that whilst the zones that are determined by this approach may have changed their absolute parameters, their relative ranking will not have changed significantly through time.

The bioclimatic map of Scotland produced by Birse, Dry and Robinson (1971) is based upon several criteria. The major contributing factors to classification of zones are:

- Accumulated temperature.....mean of daily temperatures
  - Potential water deficit.....difference between evaporation and precipitation
  - Thermal zonation.....amount of heat available for plant growth,  
length of growing season, latitude and altitude
- influenced by:
- Oceanicity.....extent to which water surrounds area
  - Exposure.....mean of daily wind speeds

The finer divisions within classes were also based on the limits of major soil groups, the physiognomy of the vegetation and the distribution limits of certain plant species.

The value of Birse, Dry and Robinson's bioclimatic map to the archaeologist is tempered by two factors. Firstly the maps are published at the 1:625,000 scale which is not particularly useful when trying to determine the relationship of exact site locations to specific boundaries. At such a reduced scale a significant proportion of detail is lost and boundaries can only be drawn in the general area with a fairly low degree of accuracy. Acknowledging this, it is obvious that errors should be anticipated in the data produced, and that sites located near the borders of zones may be misclassified, although normally only by  $\pm$  one category. Furthermore, after the map was digitised and enlarged by the present author, the coast lines of the individual islands in the central Inner Hebrides were found to deviate substantially from those portrayed on the OS 1:50,000 map series, so misrepresentations of area, especially near the coasts, should be expected although on what scale is unknown.

The second factor which limits the usefulness of Birse, Dry and Robinson's bioclimatic map to the archaeologist is that an assessment of the present (1970) soil cover and vegetation of Scotland was used to develop the individual climatic categories. As discussed in the arable soils section above, there is a strong likelihood that both the soils and the vegetation of the central Inner Hebrides have been significantly altered since later prehistory. The specific climatic attributes of each area

then are not overly significant, as these may be assumed to have changed since prehistory, but should be interpreted as markers which rank the generalised climate in the landscape. As with the section on arable soils, we are operating on the assumption that the most favourable areas of climate have remained so, even if they become less or more favourable than before in absolute terms.

Illustrations 7.12 to 7.14 are reproductions based on data contained in Birse, Dry and Robinson's (1971) bioclimate map and, though enlarged here, are based on information originally displayed at 1:650,000 scale. All of the central Inner Hebrides fall, as might be expected, into the Hyperoceanic sector, meaning that the Atlantic Ocean is the major influencing factor on the climate of the region. It only stands to reason then that most of the area has a warm humid climate, although the more mountainous areas of Mull and Islay are dominated by the cold and wet Perhumid Orohemiarctic climates. Illustrations 7.15 to 7.17 shows that the fresh-water lochs of the central Inner Hebrides were found in almost every climatic zone, giving the artificial islet builders a wide range of local climates from which to select. The classes and the number of lochs found in each area are:

Class	Description	Number of lochs
H3T1	Humid Northern Temperate (Damp, warm temperature)	56
H2T1	Very humid Northern Temperate (Very damp, warm temperature)	17
H2B3	Very humid Hemiboreal and Orohemiboreal (Very damp, fairly warm temperature)	23
H1T1	Extremely humid Northern Temperate (Wet, warm temperature)	5
H1B3	Extremely humid Hemiboreal and Orohemiboreal (Wet, fairly warm temperature)	12
H1B2	Extremely humid Southern Boreal and Lower Oroboral (Wet, moderate temperature)	3
H1B1	Extremely humid Upper Oroboral (Wet, cool temperature)	6
PB3	Perhumid Hemiboreal and Orohemiboreal (Very Wet, fairly warm temperature)	7
PB1&2	Perhumid Southern Boreal and Lower Oroboral (Very Wet, cool temperature)	5
PA3	Perhumid Orohemiarctic	1

	(Very Wet, cold temperature)	
PT1	Perhumid Northern Temperate	6
	(Very Wet, warm temperature)	

As with altitude, the number and range of bioclimatic zones vary from island to island. On the island of Tiree (Illustration 7.12) all but one of the lochs are located in the H3T1 zone, so bioclimate cannot be considered on the available data as a significant variable in determining where artificial islets were placed there. Coll (Illustration 7.12) also has a restricted range of bioclimatic zones (3), but lochs were found to be located in each of these zones. Illustration 7.15 shows the distribution of lochs based on bioclimatic zones in the form of a bar graph. An inspection of the graph shows that the constructors favoured the slightly wetter conditions of H2T1 (very humid Northern Temperate) over the dryer H3T1 (humid Northern Temperate) by a 2:1 ratio, while totally avoiding the colder and more extreme H2B3. This preference for the warm, slightly wetter areas may be due to the fact that most of the arable soils on Coll are composed of, or are underlain by, shell-sands (*machair*) which tend not to retain moisture and are thus susceptible to summer drought.

The potential locations of the artificial islets of Mull (Illustration 7.13) are spread throughout several climatic zones ranging from the dry and warm H3T1 (Humid Northern Temperate) to the cold and very wet PB1 and PB2 (Perhumid Southern Boreal and Lower Oroboral). As shown in Illustration 7.16, the distribution curve of artificial islets closely matches that of the entire population of potential sites with only the cold wet climates being avoided. In fact Illustration 7.16 would seem to indicate that climate was not a particularly important variable to the artificial islets' builders, as long as sites were placed in fairly warm areas.

Like those on Mull, the potential locations of the artificial islets of Islay (Illustration 7.14) are also spread throughout several climatic zones; however, 84% of the potential sites are located in the three warmest and driest climates. Unsurprisingly 8 (89%) of the 9 artificial islets are also located in these mild climates, with only the site in Loch Allallaidh located in the wet, moderate temperatures of H1B2. An examination of Illustration 7.17 shows that the original builders favoured the warmest

climates of H3T1 and H2T1 and avoided the cold, wet climates of H1B1 and PA3. Although the distribution of artificial islets does not appear closely comparable with the total distribution of lochs, the deviations in the data were found to be fairly insignificant.

### **Distance to coast**

The distance between the coast and various archaeological monuments throughout Atlantic Scotland (e.g. Fojut 1980, 39; Armit 1990, 226) has been analysed in order to establish if this factor influenced where sites were placed in the landscape. It is commonly assumed that the prehistoric inhabitants of Scotland's islands utilised maritime technology (as discussed in Chapter 3 dugouts have been found associated with a great number of artificial islets throughout Scotland) in order to traverse near-shore waters. The degree to which this technology was mastered or exploited is unknown but it is reasonable to assume that travel by sea would have been easier and faster in many circumstances than displacements overland. Theoretically at least, travel by sea would have been the best way to reach the more remote island communities especially those in areas of the Western Isles which are perforated by networks of long sea inlets or finger lochs. Traditionally, an archaeological site's distance to the coast has been used to assess how accessible it was (from the sea) or to establish the importance of maritime resources and that is what the variable is likely to represent here. Armit (1990, 226) has also linked this variable to coastal distributions of arable soils in the Western Isles; however this condition was not prevalent in the central Inner Hebrides and is thus unlikely to be a significant influence.

The measurement of distance between each potential artificial islet site and the coast is a simple process of measuring the straight-line distance from a point in the loch to the high water-line on the coast. The more complex measurements of littorality curves employed by Fojut (1980, 39) and Armit (1990, 226) to calculate the probable distance of random points to the coast were deemed inappropriate due to the

fact that the total distribution of the central Inner Hebridean lochs was known and could be measured directly. The varying shape and size of the central Inner Hebrides prevents a discussion of the specific distances from being overly meaningful as the scale of distances varies widely from island to island. For this reason each of the island's distributions will be discussed individually below.

The artificial islets of Coll are evenly distributed throughout the available range of distances from the coast. Distances ranged from 0.2km at Breachacha to 2.2km at Loch na Cloiche and produced a mean of 1.46km. Illustration 7.18 shows that the distribution of distances from the coast of artificial islets closely matches that of the entire population of potential sites without significant deviation. This indicates that distances to the coast were relatively unimportant to the builders of artificial islets possibly because the distances which had to be traversed were in all cases small (under 2km).

The artificial islets of Tiree are distributed over an even narrower range of distances from the coast, from 0.56km at Loch na Gile to 1.54km at Eilean Aird nam Brathan in Loch Bhasapoll. Illustration 7.19 shows that 3 (75%) of the 4 artificial islets are located between 1km and 1.5km from the coast compared with 47% of the total population of lochs. The builders of the artificial islets would seem to have preferred to locate at middle distances from the coast; however, when dealing with such a small number of sites, the statistical importance of the result is much reduced and this preference may be more apparent than real.

The artificial islets of both Mull and Islay are distributed over a much wider range of distances from the coastal edge than those of the islands considered above. On Mull, the distances from the coast of the artificial islets produce a mean of 3.0km and range from 1.2km at Gruline in Loch Ba to 6.3km at Caisteal Eoghainn a Chinn Big in Loch Sgubain. Illustration 7.20 shows that 62.5% of the artificial islets are located in the 1km to 2km range, compared with 29% of the total population of potential artificial sites. It is noteworthy that the 2 artificial islets located the farthest

from the coast are the massively fortified islets of Eilean Ban (Loch Frisa) and Caisteal Eoghainn a Chinn Big (Loch Sgubain), reinforcing the other indications that these were sites with special functions.

The artificial islets of Islay are spread across a somewhat smaller range of distances to the coast from 0.4km at Loch Ardnave to 4.5km at Eilean Mhuirell in Loch Finlaggan and produce a mean of 2.3km. Illustration 7.21 shows that the artificial islets are fairly evenly spread across the range with the largest concentration (33%) at the 1km to 2km range but on the whole there is not a significant deviation between the known artificial islets and the total population of potential artificial islet sites. It appears that only the lochs located over 5km from the sea were entirely avoided.

### **Drift geology**

The Quaternary cover of the central Inner Hebrides was considered to be a factor which potentially influenced where artificial islets were placed in the landscape. This perspective was based upon the assumption that building stone was obtained from these deposits. As discussed in Chapter 6, it is unclear exactly where the 1900 tonnes of stone which was required to construct the average artificial islet was obtained. The lack of sharp angular edges suggests that the stone was not being quarried from rock-faces or other exposures, consequently an assessment of subsurface geology would not prove useful in addressing the question of source. Likewise 95% of the stone is not so well-rounded that it is likely to have come from the sea-shore or river-beds, so that this obvious source is also ruled out as a major contributor of this material. It is thus reasonable to assess whether artificial islets are regularly located near areas of suitable Quaternary cover which could have provided surface stone with the characteristics that have been noted in their constructions.

For the purposes of this study, the Quaternary cover of the central Inner Hebrides was derived from the 1:625000 Quaternary Map of the United Kingdom –

North (1977) published by the Institute of Geological Sciences. Although more detailed studies of the area are available (Walker, Grey and Lowe 1985; 1992; Dawson 1983), this map provides a useful overview of the region and displays the basic quaternary divisions. However, as with the bioclimatic maps, it should be remembered that the requirement for generalisation will condition the amount of detail that can be recorded, and the accuracy of the specific boundaries is limited to approximately  $\pm 200\text{m}$  by the large scale of the map.

Illustrations 7.22 to 7.24 show that there are two distinct regions of Quaternary cover present in the central Inner Hebrides. Coll and Tiree are dominated by areas of blown sand and raised beaches with small pockets of peat and alluvium. The larger islands of Mull and Islay, however, are primarily covered by boulder clay and morainic drift with extensive tracts of peat, and small pockets of blown sand, raised beaches and alluvium. The deposits that concern us here are the boulder clay and moranic drift which are characterised by large quantities of loose stone (Lea 1977, 27; Whitten and Brooks 1972, 135); instances of these on Islay have been described as, “plentifully charged with well-rounded and striated boulders” (Wilkinson 1907, 69), a description which can be applied to such deposits throughout the central Inner Hebrides (Peacock 1983, 84). To a lesser extent, areas of raised beach can also provide stone of varying size and shape (Whitten and Brooks 1972, 378; Catt 1986, 208). It should be cautioned however that most of the raised beaches in the study area are covered with arable soils which would have been far more valuable to the islets’ builders than the stone found there, although surface stone perhaps removed prior to cultivation and that dislodged during agricultural activities may locally have been significant. A direct relationship between raised beaches and artificial islets is considered none the less far more likely to be due to the presence of arable soils than building stone. The relationship of the distance of these Quaternary deposits to the potential positions of the artificial islets of the central Inner Hebrides is discussed below.

Raised beach deposits are the only form of Quaternary cover which may have provided building stone for artificial islets on Coll and Tiree. The distances of each of the lochs to raised beach deposits on these islands are recorded in Appendix G, Table 5. On Tiree (Illustration 7.22) 75% (i.e. 3 of 4) of the artificial islets are surrounded by raised beach deposits, compared to 53% of the total population of potential sites. The remainder of the population of potential sites are fairly evenly distributed between 0.3km and 2.1km from raised beach deposits. Although all of the artificial islets are located less than 1km from deposits of this type, this distribution is not significantly different from the total population of potential sites (Illustration 7.26). On Coll (Illustration 7.22) the situation is similar. Although it is noticeable that each of the lochs surrounded by raised beach deposits contains an artificial islet, the sites are found throughout a wide range of distances, from 0.4km at Breachacha to 2.6km at Eilean Anlaimh. Illustration 7.26 shows that on the whole the distribution of artificial islets does not significantly deviate from the total population of lochs.

On Mull (Illustration 7.23) deposits of boulder clay and moranic drift are the predominate varieties of Quaternary cover which the builders could have exploited for building stone. These deposits are clustered near the centre of the island and potential artificial islet sites (i.e. lochs), in some cases are up to 7.8km from them. Illustration 7.27 shows that the total population of lochs is distributed across a wide range of distances from boulder clay deposits. The majority of the artificial islets tend to be located within 2km of deposits which could have furnished suitable stone in quantity: however, two of the sites are removed by substantial distances (over 4.5km) and the overall distribution does not significantly deviate from the total population of lochs. In their cases, stone may have been gathered from the shores of the lochs.

The relative abundance of boulder clay and moranic drift, which covers most of Islay, (Illustration 7.24) would have minimised the effect that this variable had on the distribution of artificial islets as all areas of the island are fairly close to surface spreads of this resource. Almost 60% of the potential artificial islet sites on the island are surrounded by deposits of boulder clay or raised beach (Illustration 7.28) and only

three are located more than 1km from them. The distribution of artificial islets displays similar characteristics with 45% of the sites surrounded by boulder clay and all of the sites located within 1km of it.

The analysis above shows that overall the presence of Quaternary cover was not an important factor in the placement of artificial islets in the study area. On each of the islands, the distribution of artificial islets closely matched the distribution of all potential artificial sites with only a slight preference noticed for areas immediately surrounded by boulder clay. There are several reasons why this variable may have been given only minimal consideration by the islet builders. A large proportion of the stone used in the islets was probably harvested from around the margins of the lochs. Every loch inspected by this survey, surprisingly even the ones inundated by peat, was noted to be ringed by spreads of stone which were exposed or only partially submerged. Most of this stone was similar in size to that used on the artificial islets and its proximity would have required a minimum of effort to transport to the site. On islands such as Mull it is questionable whether it would have been economical or indeed feasible to transport stone over the distances involved if suitable stone could be found around the lochs' margins. On the other islands the distances to Quaternary deposits are relatively small, such that the lochs' exact distance to the resource may have been insignificant.

### **Water supply**

By definition artificial islets are surrounded by fresh-water so an assessment of the sites relationship to a fresh-water supply, often a significant factor for dry-land sites, was not appropriate.

### **The characteristics of the lochs**

Just as the geography surrounding the lochs determined which water bodies artificial islets were placed in, the physical characteristics of the lochs were likely to

determine where the artificial islets were placed within each loch. The artificial islets builders were faced with a unique set of conditions at each loch which effectively limited where the islets could be placed. Although within the study area these limitations are perceived to be of minimal significance in the selection of sites, because of their small size, restricted catchments and shallowness; in other areas of Scotland, such as the large and deep Highland lochs infilling glaciated troughs, these conditions greatly restrict where islets are placed. The significance of these characteristics are fairly static as they generally do not vary over time. Each of the factors related to the lochs themselves which are likely to have influenced where artificial islets were placed within these water bodies is discussed separately below.

### **Distance to outlet**

One of the factors which could have potentially influenced where artificial islets were placed in the lochs was the location of the lochs' outlet. This factor was considered to be of importance because control of the lochs' outlet could determine water-levels within the water bodies. One of the easiest ways for human aggressors to drive the inhabitants off the islets would have been to obstruct the loch's outlet until the rising water effectively flooded them out. In the study area the water-levels would have had to have been raised between 0.75m and 2.5m depending on the height of the islet. As a result the relative height of some islets may be seen as a response to this type of threat. This theory of course assumes that a sufficient amount of water is entering the loch, at a fast enough rate, to accomplish this aim, and that the water body is not overly large, which is generally the case in the study area.

Natural outlets were found at only 23 of the lochs which contained artificial islets. If the large lochs, for which it would take a considerable amount of time for water-levels to rise sufficiently to pose a threat to the inhabitants of artificial islets are excluded, this number drops to 15. The distribution of the distances between the artificial islets and the lochs' outlets are shown in Illustration 7.29. What is immediately apparent is the wide range of the distribution from 20m at Loch

Bharradail (Islay) to 700m at Loch Laingadail (Islay). What is also clear is that the artificial islets are not positioned overly close to the outlets and in fact seem to prefer the 200-299m range. This data indicates therefore that immediate access to the lochs' outlets were not important to the builders of the artificial islets, as it would have been impossible for defenders at this range to have exercised remote control over, for example, attempts by aggressors to dam up outlets.

There may be several reasons for the apparent lack of significance of this variable. It may be that in most cases the lochs' catchments were indeed too small to provide enough water to effectively raise water-levels to the point where the islets were covered (which was in some cases up to 2.5m above the normal water-levels). Based upon the same principle it may be speculated that the builders of the artificial islets were primarily concerned with attack during the summer months when dryer conditions would prevent such flooding. Alternatively, the builders of the islets may have not even considered this type of siege warfare a threat but were only interested in making their settlement difficult enough to access to discourage the average brigand from bothering.

### **Location within the water bodies**

The cardinal position and relative position of the artificial islets within the lochs were investigated in order to assess if the builders of the islets favoured specific settings within the water bodies. These variables were straightforward to measure and consisted of the cardinal position of the site (within the bounds of the loch i.e. N, S, E, W) followed by a descriptive tag of end (placed at the end of a loch with a single long axis), side (placed the side of a loch with a single long axis, i.e. next to one of the long shores) or middle (approximately equidistant from any shore). Obviously sites placed near the middle of the lochs do not favour a particular cardinal position. A review of Appendix G, Table 5 shows that 18 (60%) of the artificial islets were located in the ends of the lochs, 7 (23%) on the sides and only 5 (17%) in the middle. This distribution is certainly influenced by the fact that water of sufficient depth to

prohibit the construction of artificial islets is normally found near the centre of lochs. However, as discussed below, it may also be a reflection of the desire on the part of the builders of artificial islets to locate the islets in the most sheltered part of the lochs, the ends, rather than the more exposed sides and middle, where in the bigger lochs at least fetch would have been sufficient to produce wave action.

The artificial islets' cardinal positions within the lochs were initially established in order to reconstruct the degree to which the sites were exposed to prevailing winds and thus waves but other more speculative conclusions may be inferred from the data. Illustration 7.30 shows that the northern sections of the lochs were favoured as sites for artificial islets over other areas with 15 (50%) of the artificial islets located there, while only 2 were located in the eastern, 4 in the southern and 4 in the western sections. As discussed below, this preference is most likely influenced by the islet builders desire to be sheltered from the prevailing westerly and south-westerly winds, but other benefits would also be enjoyed from such positions. A northern position in a loch would maximise the amount of sunlight that reached a site, thus making it warmer, by taking advantage of the clear line of sight to the southern horizon provided by the level water body. Additional sunlight would also reflect off the water perhaps further warming the site. Sites located in such positions would also have the advantage of having the sun behind them and thus in the eyes of any potential attackers from shore, although this advantage would be of limited value during the daily and seasonal cycles and may be overly speculative.

The artificial islet's position within the loch has an explicit relationship with the direction in which the land nearest to it was exposed to sunlight. If it is assumed that the islets' builders desired to have immediate access to arable land on shore, the optimisation of exposure of nearby land to sunlight may be an important factor in the islets' placement. The catchment of most lochs is to some degree bowl-shaped by nature with land to the north of the lochs generally sloping towards the south (i.e. the loch shore), and vice versa. Theoretically, all other things being equal, the land to the north of the lochs should be favoured over that to the south, as it would receive more

sunlight and less shade, hence encouraging the development of arable crops. The data examined here appears to support this hypothesis with the northern sections of the lochs being the most favoured location for the islets.

This analysis can be further refined by looking at more specific data. The direction of the shore (relative to the site) which appears to provide access to the artificial islet (as suggested by the presence of a causeway, or closest proximity) is recorded in Appendix G, Table 5. A review of this data shows that 11 (37%) of the islets are located next to the north shores of their lochs, 7 (23%) to the east shores, 8 (27%) to the west shores and only 4 (13%) to the south shores. This distribution supports the theory that the islets' builders were constructing their islets next to land which was oriented to receive the maximum amount of sunlight and warmth, while generally avoiding the shaded northern facing slopes. It is curious to note that in 2 (50%) of the cases where artificial islets are placed next to the south shores of the lochs (Loch Corr (Islay) and Loch Laingeadail (Islay)), the lochs are located in fairly level landscapes which offer unimpeded exposure to sunlight in all areas.

### **Shelter**

Morrison has theorised that, "hazards presented by wave attack were certainly a factor in selecting locations for crannogs" (1985, 62). After conducting a detailed study of wind directions and wave fetch he concluded that 'three-quarters of the crannogs in Loch Awe are placed in locations that afford shelter from the prevailing south-westerly winds' (1985, 62). In large lochs, such as Loch Awe, high winds blowing along the length of the loch can create waves which, given the fetch over distances of open water, can grow to impressive heights and speeds. Such waves could potentially erode the windward sides of the artificial islets and could displace structural elements which were placed near the air-water interface. Morrison has suggested that some of the artificial islets in Loch Awe are situated so that bedrock reefs on their windward sides could serve as natural breakwaters (1985, 64). Ritchie

(1942, 54) and Childe (1935, 211) have theorised that rings of piles set in the lochbed surrounding artificial islets were also used for this purpose.

Wave action was probably not a significant problem at most of the sites in the study area, because of the limited fetch present, attributable to their small size. Only Lochs Frisa and Ba on Mull are over 2km in length and are located in the trough shaped basins noted by Morrison to accentuate wave fetch. Each of these lochs is oriented NW - SE and are especially susceptible to the north-west winds of the equinoxes. Waves up to 1.5m in height were experienced while surveying artificial islets in these lochs during high winds in March and November. Although the violence of the waves churned up the water near the sites, no noticeable shifting of the stone spreads surrounding the islets was observed. The external surfaces of the artificial islets in Loch Frisa, the largest of the lochs in the study area, had some of the steepest profiles of any of the sites in the central Inner Hebrides which one would not expect if wave action was overly destructive, and if these profiles were the result of the long-term establishment of equilibrium slopes. Furthermore, none of the artificial islets in Loch Frisa or Loch Ba displayed any evidence to suggest that breakwaters (either of wood or stone) surrounded the sites, nor did any of the other sites that were surveyed; however, it should be conceded that wave and current action could simply have destroyed any surviving traces of external timber structures that once projected above the loch-bottom deposits. The remainder of the lochs in the study area were small in size and few of the artificial islets had more than 300m of open water between them and any shore. Wave action is thus not considered to have been a significant factor in locational decision-making for this set of artificial islets.

The exposure of artificial islets to wind was also assessed separately to establish whether sites were positioned so as to be sheltered from prevailing winds. Although wave action was not deemed to be a significant problem at most of the sites, the builders may have wished to avoid placing their islets in particularly exposed locations, as wind chill would make such places colder relative to other more sheltered locations in the lochs. The concept of shelter is of course relative in the

central Inner Hebrides where some of the highest wind speeds in Scotland have been recorded (Bibby 1982, 15). Birse and Robertson (1970) have classified a majority of the land areas discussed here as exposed or very exposed to winds with only small areas of sheltered valleys on Mull and Islay receiving moderate exposure (see Illustrations 7.12-7.14). Green and Harding (1983) estimated that Coll and Tiree experience average wind speeds which are 50% higher than other islands closer to the mainland. Acknowledging such conditions, exposure as discussed here is somewhat subjective and assumes that the islet dwellers would want to minimise the impact of the prevailing and generally unfavourable wind regimes.

Appendix G, Table 5 shows the directions from which the sites in the study area are exposed to wind. The directions of exposure was based on an assessment of the topography surrounding the lochs and in most cases corresponded with the directions of the maximum distance between an artificial islet and shore, taking into account the surrounding topography. Even on the relatively flat islands of Coll and Tiree some sections of lochs are more sheltered from the wind than others. A total of 10 (33.3%) of the artificial islets, primarily ones in very small lochs, are located in positions which are relatively sheltered regardless of wind direction. Another 9 (30%) are located in positions which are only exposed to southerly or south-easterly winds, which occur in this region during the summer months of June, July and August (Boyd and Boyd 1996, 35). Winds from such directions are characteristically gentle and warm. Eight of the artificial islets were exposed to northern or north-easterly winds which sweep out of the Arctic during the winter months (Ritchie 1979, 113). These islets would be relatively sheltered during the summer months but would be highly exposed to winter storms. Four of the artificial islets are exposed to north-westerly winds, which as mentioned above, wrack the region during the periods around the Equinoxes. Only four of the islets were found to be exposed to the westerly and south-westerly winds which come off the Atlantic and predominate throughout the Hebrides for most of the year (Mather, Smith, and Ritchie 1975, figure 2.1.3; Ritchie 1979, 113).

This data then would seem generally to confirm Morrison's theory that the builders of artificial islets placed their sites where they were sheltered from the prevailing winds, although in the study area, as in Loch Awe, there are exceptions to this rule. It is not known what factors were of primary importance in the situating of the sites exposed to the prevailing SW airflows as they are located in a diverse range of landscapes and varying distances to arable land.

### **Depth of water**

The depth of water surrounding the artificial islets of the central Inner Hebrides has already been discussed in Chapter 6 and therefore will only be briefly commented upon here. Morrison has stated that artificial islets, "are unlikely where the original bottom depth was more than 10m.....with 5m as a more usual limit in Scotland" (1985, 61). The depth of water surrounding the artificial islets within the study area at the time of survey varied from 0.30 m at Loch Ardnave (Islay) to 4.00m at Eilean Ban (Mull). Just under 52% of the sites are surrounded by less than 1.5m of water and the mean water depth falls just above 1.94m with a standard deviation of  $\pm 1.12\text{m}$ .

These depths fall well short of Morrison's 5m average and reflect the shallow nature of most of the lochs in the study area. During the survey extensive areas of approximately 80% of the water bodies in the study area were physically explored by the author using scuba diving kit. With the notable exceptions of Lochs Frisa and Ba on Mull and Lochs Finlaggan, Ballygrant, Bharradail, Lossit and Staoita on Islay almost all of the lochs are not over 5m in maximum depth at any point, and many do not even surpass 3m. While these depths are sufficient to prevent unwanted visitors from accessing the sites, they do not prohibit the construction of artificial islets in a large majority of the lochs in the study area. With the exception of the lochs listed above, water depth would not have overly affected the placement of the artificial islets in the central Inner Hebrides, as in some instances at least, shallow water which could be waded through was considered an adequate deterrent.

## **Slope of lochbed**

The slope of the lochbed surrounding the artificial islets of the central Inner Hebrides has already been discussed in Chapter 6 and therefore will only be briefly reviewed here. With the exception of certain areas of the lochs mentioned above, the slope of the lochbed was not a primary factor in the positioning of artificial islets in the central Inner Hebrides, owing to the facts that so few of the lochs involved are of any depth, nor are they marked at any position by abrupt changes in loch-bed topography. Most of the lochs in the study area are small and as already mentioned were found by this survey to have shallow, relatively flat lochbeds which would not have constrained where artificial islets were placed.

## **Summary**

The overall picture which emerges from the examination of the artificial islets of the central Inner Hebrides is that the same locational requirements primarily influenced the choice of site on each of the Hebridean islands. The majority of the sites were situated in close proximity to arable soils and took advantage of both the warmer climates of low altitudes and relatively sheltered positions within each loch. To some extent these variables are interrelated and to single out any one as particularly significant would be unwise. The limited quality and scale of the present environmental data restricts analysis to generalisations and until further research is carried out on the past environments of the central Inner Hebrides the specific motivations behind the choice of each site will remain speculative in character.

The wide ranging chronology of the artificial islets raises considerable problems when comparing artificial islets with other site types or specific chronological periods. This problem cannot easily be overcome without a substantial excavation and dating programme; and will always limit findings to generalisations. The artificial islets examined here range in date from the Neolithic to the medieval

periods, and so it is unreasonable to assess the importance of any specific variable which could be applied to all sites. The artificial islet builders' perceptions of the landscape would have certainly varied throughout time with criteria, such as proximity to arable land and defensiveness, gaining importance as the value of resources were recognised and as new technologies both domestic and military were developed.

With this in mind, the artificial islets do seem to favour particular locations in the landscape over others. This may indicate that the same factors influenced the choice of site regardless of the period or that the motives and requirements underpinning construction of this type of site were sufficiently unchanging throughout the history of this type of site. The close proximity to arable soils, preference for low altitude, warm mild climates, and positions exposed to direct sunlight tempts one to speculate that the islets builders were farmers. Populations which engaged in agricultural practices would generally favour areas with similar characteristics, assuming that they recognised the variables' importance. The majority of the artificial islets are positioned so that they would make ideal defended homesteads (although most sites would be exposed to determined attackers employing fire arrows or siege tactics) for populations which wished to exploit the arable land in the immediate proximity. Although spatial correlations can only indicate the selection parameters that may originally have operated, the evidence from other excavated sites on the mainland would support this. In any case, most of the data suggests that the factors which influenced the choice of artificial islet sites did not vary significantly over time.

Two of the central Inner Hebridean artificial islets lie radically outwith the general characteristics exhibited in the distribution of sites and indicate that alternative locational demands may have influenced the positioning of seemingly specialised sites. The artificial islets in Loch Allalaidh (Islay) and Loch Sgubain (Mull) are unique in the data-set examined here in that they are located in the environments which contrast the general distribution. Each of these sites is located in the high altitude interior of their respective islands and in some of the most harsh and wet environments within the study area. The sites' relative distances to large tracts of arable land is also

singular as are the sites' positions near the middle of major cross-island mountain passes. Such characteristics may suggest that these islets were constructed for a purpose very different from that of the general population of islets. Each of these uniquely located artificial islets is enclosed by some of the most monumental walling observed in the study area and both examples are extremely difficult to access. The defensive character and isolated positions of these two islets suggests that they were constructed as refuges rather than permanent homesteads; although this conclusion may be unduly influenced by both of the sites, excellent preservation, attributable to their particularly inaccessible siting.

Other locational factors seemed to have held no, or limited, importance to the artificial islet builders. The distances to the coast seem to have been unimportant; the sites were fairly evenly spread across the whole range of available distances. This may have been due either to the fact that on islands of this size distances to the coast are relatively small regardless of location, or that the exploitation of maritime resources was not particularly important to the islet dwellers. The artificial islets were likewise indifferently situated with regard to Quaternary deposits which may have served as a particularly rich source of building material for their construction. Once again that may be due to the limited distances which had to be travelled to access this resource, or that the substantial quantities of stone required could easily be obtained from the margins of the lochs.

The use of a quantitative approach has demonstrated that many of the locational factors which Morrison suggested influenced the positioning of artificial islets in Loch Awe may have also impacted on where sites were placed in the central Inner Hebrides. This approach has also shown, however, that these preferences are neither as marked as the generalising statements emitted by previous authors on this topic might indicate. The settings of water bodies in any area will naturally favour certain characteristics of the landscape. For example, it is unsurprising that agriculturally productive soils are located near Loch Awe, as most of the loch's drainage basin is occupied with steeply sloping hillsides and in this region arable soils

tend to be found in valley bottoms (i.e. near the loch). In such circumstances it is unsurprising that artificial islets are found near arable land because the loch in which the islets are set and the arable land are restricted to the same general positions and are thus not wholly independent variables. When such landscape characteristics are considered, apparently overwhelming preferences of site location may become only marginally so. It is important that this be realised so that the natural positioning of the lochs is accounted for before theories are forwarded with certainty.

Further conclusions cannot be drawn securely in present circumstances, due to the uncertainties of the data-set. The wide ranging chronology of the sites limits the types of analysis which can be carried out and removes the possibility of reconstructing the sites' economic territories based on secure site-based data of their inhabitants' subsistence strategies. The function of these sites is also open to some degree of speculation and only excavation will remedy this situation. Reference has been made to many of the problems in dealing with environmental data at different scales throughout this chapter and such problems should be tackled more fully than has been possible in the time-scale of this project before complex hypotheses are built. This is specially a concern of future researchers who will undoubtedly build GIS-based systems for the area as the technology becomes more readily available.

## Chapter 8

### Consideration of Mainland artificial islet sites

#### Introduction

Prior to this study, the only large distributions of artificial islets in Scotland which had been surveyed to modern standards were those of Loch Tay (Perthshire) and Loch Awe (Argyll). Both of these surveys were carried out in the 1970s and they now form the core data-sets upon which many current theories concerning the structural composition and spatial placement of Scotland's artificial islets rest. Originally, it was intended that this study would compare the structural characteristics and landscape distribution of artificial islets in the central Inner Hebrides to those recorded in Loch Awe and Loch Tay. However, after examining the data which is available from these earlier surveys, it was realised that it would not be possible to undertake any kind of significant quantitative analysis due to the limitations of the 1970s material. This chapter will begin by examining the nature of the Loch Awe and Loch Tay data and will show that only a few generalised conclusions can be drawn from these earlier surveys with particular regard to comparisons with the Hebridean data rehearsed above.

Similarities between the structural details of the artificial islets of the central Inner Hebrides and those of the Loch Awe and Loch Tay distributions undoubtedly exist. Though few direct comparisons can be made, due to a lack of appropriate data for the mainland sites, this study will demonstrate that most of the sites share many of the same fundamental structural attributes, such as size and height, while retaining distinctive features which, allowing for the incompleteness of the data from which assessments must be made, seem to be characteristic of each of the regions. Two of the popular theories concerning the spatial positioning of artificial islets will also be re-examined.

## Limits of comparison

### Loch Awe

The findings of the Loch Awe survey have been reported in several different sources. The publication of the original Naval Air Command S.A.C. report by Hardy, McArdle and Miles (1973) was quickly followed by an article summarising the survey published by McArdle and McArdle (1973b) and in a separate unpublished report sent to local land owners (McArdle and McArdle 1973c). The Royal Commission included the sites as “crannogs” in their Inventories for *Mid Argyll and Cowall* (1988) and *Lorn* (1975). Dixon discussed these sites in his unpublished Ph.D. (1984) and included a set of plans of them in the appendix (1984, appendix A); these plans seem to have been obtained from McArdle. Morrison, a participant in the Loch Awe underwater survey programme, also considered the Loch Awe sites in *Landscape with Lake Dwellings* (1985), which includes another independent set of plans for these sites. Data from each of these sources is tabulated in Appendix H.

What is significant about these sources is that there are major inconsistencies in the data reported within and between the various publications. Inconsistencies were present in the Loch Awe data from the beginning. The primary problem is that individual site reports are not included in the original S.A.C. publication and much of the survey data is presented as summarised findings (Hardy, McArdle and Miles 1973, 10-13). Hand drawn plans are included for only six of the sites (here reproduced as Illustrations 8.1 and 8.2); and the measurements for nineteen of the sites are recorded in a scatter graph. Curiously, most measurements taken from the scaled plans do not correspond with those recorded in the graph and can vary by up to 3m, as in the case of Ardchonnell. Although most of the measurements vary by 2m, the differences are not consistent and in one case (Ederline Boathouse) the data-sets match. Part of the problem is probably due to the fact that Morrison (1973, appendix 3) constructed his graph using a scale of inches despite representing metric measurements. This situation unnecessarily confuses the precise value of the measurements reported.

Other discrepancies in the reports further confuse the Loch Awe data. Although, for example, most of the measurements are recorded in metric units, the artificial islets' heights are displayed in imperial units in the form of a bar graph. Timber was reported from nine of the sites but only specifically identified on six. All of the measurements appear to be rounded to the nearest metre or foot and in some cases are estimates (D. McArdle *pers. comm.* 1997).

Shortly after the publication of the original report, McArdle and McArdle published a summary of the findings of the Loch Awe survey (1973b). This report does little to clarify individual site characteristics, although it does name the nine sites which were recognised to contain timbers. Although plans for three of the sites published in the original report (Hardy, McArdle and Miles 1973) are included, these display different conventions of drawing and are not exact copies of the originals (see Illustration 8.3). The authors do not address these differences in the report but when questioned by the author Dr. McArdle indicated that he had copied both sets of plans from a master set compiled during the survey in 1972. Minor discrepancies between plans were not considered to be important as they were, "only meant to give a rough idea of the shape of the sites" (D. McArdle *pers. comm.* 1997).

An interview between Dr. McArdle and the author in 1997 considerably helped to clarify the goals and findings of the 1972 Loch Awe survey. Firstly the survey never set out to produce exceedingly accurate plans of each of the artificial islets but rather was primarily concerned with demonstrating that the sites were actually present in the loch. Plans were only meant to be approximations illustrating the shapes of the sites. Dr. McArdle still retains the original field notes and a master set of plans for the Loch Awe sites, which clearly indicates that the plans were not data rich representations of the sites. Although the number of points taken on each site varies, the perimeters of some sites, such as Inistrynich, Rockhill and Eredine, are defined by as few as 5 measured points. This intensity of coverage, while adequate for the original survey's purposes, is not sufficient to recover accurate measurements of the maximum and minimum axis of each site. It also explains why

there are discrepancies between the plans used to illustrate various publications. As plans were redrawn for each publication there were not a sufficient number of points to ensure that portions of the perimeter of each site were always positioned identically and considerable extrapolation was required. In this situation it is unsurprising that there are differences between the various plans. A single master-plan which depicts all 20 of the Loch Awe artificial islets was drawn up by Dr. McArdle but has never been published (Dr. D. McArdle *pers. comm.* 1997).

The Loch Awe sites were next examined in detail by Dixon in his doctoral thesis (1984). Dixon included a set of plans for the Loch Awe sites in his appendix (for a sample of these see Illustration 8.4), which had at that time not been previously published. Dixon stated that these plans were obtained from McArdle, without further specifying the source. It is believed by Dr. McArdle that these plans were copied from his single unpublished master plan (Dr. D. McArdle *pers. comm.* 1997) noted above, and on comparison the plans did appear to match this source. In any event these plans are not exact copies of those included in the original report, or those subsequently published by McArdle and McArdle (1973b) and they display yet a third set of drawing conventions. Measurements vary between the original report (Hardy, McArdle and Miles 1973) and Dixon (1984) by up to 15%, with the dimensions of the site at Barr Phort shown as 29m by 37m on the original scatter graph and displayed as 34m by 36m on Dixon's plan. It is notable that the measurements on Dixon's plans generally match those of the plans in the original report and that the major discrepancies are with those sites for which statistics were reported in the original scatter graph, but without an accompanying plan.

Morrison (1985, figures 3.2-3.4) published a full set of plans for the Loch Awe sites (see Illustration 8.5), but once again these plans frequently did not correspond with those displayed in previous sources and were even in some instances reoriented. Measurements varied from those shown on the scatter graph (Hardy, McArdle and Miles 1973, appendix 3) by up to 4m, such as at Ardanaiseig, but in other instances closely matched those presented there, such as at Eilean Seileachan. Measurements differed from those displayed on the original plans by up to 2m, such

as at Carn an Roin, but in other instances matched, such as at Sonachan. Similar differences were noted between Dixon's and Morrison's plans but occasionally these too matched. Part of the discrepancy between the measurements on Morrison's plans and those reported in other sources may be due to the unorthodox convention (axonometric projection) Morrison uses to present his plans: however measurements do not vary consistently and occasionally they match with earlier publications. The writer has not been able to obtain a satisfactory explanation of how these differences may have arisen.

The RCAHMS Inventories for *Lorn* (1975) and *Mid Argyll* (1988) included the Loch Awe sites as "crannogs", but offer no clarification. In the *Lorn* volume, only an estimate for each of the sites' distances from the shore is given, while in the *Mid Argyll* volume the size of the sites is also provided. It seems that RCAHMS relied exclusively on the McArdles' publications (1973a and 1973b) for their information and only examined the sites from the shore themselves, as there is no record of Commission Investigators directly accessing any of the sites in RCAHMS card files and the surveyor's notes. The RCAHMS's measurements for the sites generally agree with those recorded in the original SAC report, but in some cases are different, for reasons not readily explicable. For example, the site at Ardanaiseig is recorded as measuring 15m by 15m in the National Monuments Record (Card NN02SE6) while in the original 1973 survey it was reported as measuring 17m by 22m. These new measurements do not agree with any previously listed for the site and are also not easily explicable. It is unclear from which source RCAHMS obtained this new data.

An examination of the Loch Awe data reported by the various sources thus shows that there is considerable confusion in at least the numerical data that is available for these sites. All measurements are rounded to the nearest foot or metre and can vary by up to 5m between sources. Neither agreements nor discrepancies between sources are consistent; therefore, without resurveying at least a considerable number of the Loch Awe sites, it is impossible to determine which of the sources is the most reliable. Even the unpublished original survey data has serious drawbacks

which limit the precision of the measurements which can be obtained. Furthermore no one published source gives a complete record of all the measurable variables and thus a more detailed data-set would be required for greater depth of quantitative analysis.

In spite of the above criticisms it should be acknowledged that the Loch Awe survey pioneered the techniques used in modern underwater surveys and the methods for recording the underwater features of crannogs in Scotland. Aside from being the first large-scale underwater survey of its type, this exercise was the first to attempt to identify a "total-cull" of the crannog sites located in a large loch (Hardy, McArdle and Miles 1973). The survey correctly identified and noted the positions of 20 artificial islets, only 5 of which were previously known, thus substantially increasing the number of known prehistoric sites in the Loch Awe basin. Although the quality of the data recovered does not meet modern standards, it should be remembered that the survey was carried out before the ready availability of modern survey equipment (discussed in Chapter 5).

### **Loch Tay**

Unlike the Loch Awe survey all the findings of the Loch Tay survey are reported by Dixon (1982) in a single paper. Site descriptions are given for each of the artificial islets and plans are included for sixteen of the seventeen confirmed sites in the loch. Although a complete data-set exists for the size, shape and height of each artificial islet, other variables such as the depth of the surrounding water, geology of the underlying lochbed, and distance from shore of each site are only occasionally noted. This limits the use of the structural elements of the Loch Tay sites for comparative purposes to an examination of the first three variables.

## Structural comparisons

Many of the features of the artificial islets of the central Inner Hebrides which were examined in Chapter 6 cannot be directly compared with those of sites on the mainland due to a lack of data. For the reasons rehearsed above, the comparisons between the characteristics of artificial islets is limited here to generalised findings rather than to quantified assessments.

### Timber

Timber has been found as structural elements on many of the mainland artificial islets. Dixon has gone so far as to state that crannogs are “categorised as artificial islands originally built of timber, utilising driven piles to create a platform above the water supporting a house or settlement” (1994, 267; 1995, 31), but has provided little evidence in his publications to sustain this assertion. McArdle and McArdle also believe that timber is a major structural element in most artificial islets stating that, “most crannogs are wooden structures with merely a facing of stone to prevent erosion” (1973, 10). The original S.A.C. report (1973) stated that nine of the sites in Loch Awe contain timbers but only six sites are specifically named in the text. At four of the sites the timbers appear to have been worked and to have played a significant part in the islet’s structure (*ibid.*). At the Sonachan site four short piles were found between flat surface timbers. The McArdles’ subsequent publication listed each of the nine sites which contained timber (1973b, 6) but did not specify further either the species of the timber nor the manner in which it was employed. Dixon noted that three of the sites (Ederline Boathouse, Keppochan and Ardchonnell) in Loch Awe displayed radial arrangements of horizontal timbers (1984, 181) but does not indicate the source of this information.

Considerable quantities of timber have also been found on seven of the Loch Tay sites. Four of the sites display timbers which have been worked, while five of the sites contain vertical piles (Dixon 1982). An examination of the excavated piles from the Oakbank site has shown that most of them are roughly pointed at their base and many still display identifiable tool marks (Sands 1997). Dixon notes that most of the

exposed timbers observed by the Loch Tay survey “were recognised as oak” (1984, 181) but that alder was revealed as the most common timber at the Oakbank excavation.

Timber has been recorded as a visible component at only four of the central Inner Hebridean artificial islets, including three instances where it was identified during the underwater survey programme reported here. At two of these sites, Loch na Meal (Mull) (where timber is known solely from a nineteenth century record) and Loch nan Deala (Islay), wood only appears to have been used in the construction of causeways (cf. comments on causeways below). Two other single pieces of wood were found at two of the sites on Mull (Eilean Ban and Ledmore). Both pieces of timber were found protruding from the base of the stone rubble on their respective islets, a location which tends to indicate that the wood was serving a structural purpose related to the initial establishment of the sites concerned; however, without excavation, this view is merely speculative. Each of the timbers from the central Inner Hebridean sites were identified as oak, with the exception of that from the Eilean Ban site (Mull) which was identified as alder.

### **Basal dimensions**

Although there is considerable variation in the reported basal measurements of the Loch Awe sites, only the scatter graph in the original report and the plans in the appendix of Dixon’s thesis (1984) provide measurements for all these sites in a single source. The data from the scatter graph (Hardy, McArdle and Miles 1973, appendix 3) has been used in the present treatment, because the source of Dixon’s information is not sufficiently specified. It will be recollected, however, that these sources disagree on the basal measurements of the sites.

Only the maximum basal dimensions of each of the artificial islets are examined here as neither the Loch Awe nor the Loch Tay surveys provide estimates of the area covered by the sites. Dixon provides calculations of the “footprint areas” for three of the Loch Tay sites (1984, 176) but states that, “...whether these figures are meaningful is questionable since the dimensions of the crannog mounds as they

now appear in the landscape may not closely relate to what was considered as functional when they were inhabited” (*ibid.* 180). This statement is tenable due to the fact that, unlike the central Inner Hebridean sites, building remains were found on very few of the Loch Awe and Loch Tay artificial islets and it is uncertain exactly where the latest phase of activity occurs on the sites.

The basal axis data from the central Inner Hebrides and each of the mainland surveys is presented in Illustration 8.6 in the form of a scatter graph. An immediately noticeable feature of the distribution is the wide range encountered in the Loch Tay data which has both the largest (Eilean Nam Ban) and the second smallest (Milton Boathouse) sites. Both the central Inner Hebridean and Loch Awe sites show a more restricted size range and tend to cluster towards the middle of the graph. Although there is considerable variation in the dimensions of the sites, 92% cover an area which falls between 15m and 50m in diameter. Only Eilean Nam Ban (Loch Tay) falls significantly above this range, which begs the question of whether it should be classified with the rest of the sites? In the terminology used in this thesis this site would be classified as an artificial island, based on its size (see Chapter 1). The smallest site (Eredine, Loch Awe) measures 9m by 10m and only one other site (Milton Boathouse, Loch Tay) is comparably small.

Although few conclusions can be reached from an examination of the artificial islets’ basal areas without also establishing the sites’ upper internal areas, the sites’ maximum basal measurements do give an approximate order of scale for the islets. Assuming that most of the islets’ structure is artificial, the wide size-range of the islets, in most cases shows considerable variation in the amount of resources that the islet builders were willing to expend in order to construct the sites. In this context the size of the sites may be a reflection of the economic wealth of the islets’ builders; however this is a highly speculative view. Whether sites of various sizes served different functions or were constructed to house varying populations is also unknown. In the case of the central Inner Hebridean sites it is fairly certain that most of the sites were used for a domestic purpose; and indeed, all but the smallest of the mainland sites could have also served such a purpose.

The total distribution of the site sizes for each of the regions examined here does not significantly vary, which strengthens the theory that most of the sites may have served the same, or at least similar, functions. There does not seem to be a link between the site sizes and their dating, as the few radiocarbon determinations for the sites in these regions fall evenly throughout the islets' size range (Holley and Ralston 1995). Until the areas of the upper internal platforms of the mainland sites are established, any discussion of the significance of site size must remain overly speculative.

### **Height**

Height measurements are available for all three of the data-sets allowing comparisons to be made. The Loch Awe heights have come from the bar graph in the original report (Hardy, McArdle and Miles 1973) but it should be noted that differences of up to 3.7m occur between these and those shown on the plans in Morrison's publication (1985).

The distribution of the heights of the three sets of artificial islets are shown in the form of a bar graph (Illustration 8.7). The most obvious feature is the wide variation in the heights of the Loch Awe sites, which range from c. 0.30m at Rock Hill Farm 1 to c. 8.20m at Ardchonnell. Both the central Inner Hebridean and Loch Tay sites display a more restricted range; and each of these distributions is skewed to the left with 76% of the sites falling under 2.50m in total height. It can therefore be proposed that this height range satisfied the needs of a significant proportion of the artificial islets' builders.

While caution should be exercised in drawing conclusions from the analysis of such approximate measurements, some general observations can be proffered. Assuming that a majority of the artificial islets did not sink into the sediments (which has been shown to be the case for the central Inner Hebridean sites at least (see Chapter 6)), and that the surfaces of the artificial islets are currently as initially built (which is less certain for the mainland sites, discussed below), it seems that the

builders in most cases did not require structures over 2.5m in total height. This would leave little room to compensate for significant seasonal fluctuations in water-level, as Dixon has stated is the case in Loch Tay (Dixon *pers. comm.* 1993), suggesting that this may have not been a concern of the islets' builders in both the central Inner Hebrides and Loch Tay distributions. However, in the case of Loch Tay, Dixon (1984) has postulated that timber pile-structures capped some of the sites so that the heights used here may not represent the total height of the original structures. Although some of the Loch Awe sites are quite tall, Morrison states that 50% of the sites are under 2m in height (1985, 61) and thus would also have been subject to seasonal fluctuations in the water-level. It is possible, however, that seasonal fluctuations in the water-levels of the mainland lochs were smaller in the past, due to the fact that the water bodies would have been surrounded by more woodland cover which would have inhibited drainage in the form of rapid run-off into the lochs.

Morrison has suggested that the variation in the heights of the Loch Awe sites may be a response to fluctuating water-levels (1973, 19) which might have been brought about by isostatic readjustment of the earth's crust. He hypothesises that the varying heights of the Loch Awe sites may reflect differing periods of settlement. Alternatively this same situation could have resulted from the blockage of the lochs' outlets by debris, an occurrence which is less common now as outlets are periodically dredged. Although loch-levels have not significantly changed in the central Inner Hebrides since the artificial islets were in use (see Chapter 6), it is likely that the water-level in Loch Tay has fluctuated since that time (Dixon 1984). It is curious therefore that there is not a greater range of heights in the Loch Tay sites.

### **Surface features**

Each of the sites in the Loch Tay and Awe distributions have been described as oval or circular mounds of stone displaying few distinctive surface features. Both Morrison (1985, 39 and 55) and Dixon (1984, 180) believe that stone was a later addition to most of the artificial islets, forming a carapace over a mound constructed of organic materials. Both state that artificial islets are timber built structures and that the stone which now covers most of the sites was only a minor structural component.

The function of this carapace has never been explained by either author. McArdle and McArdle also believed that artificial islets were primarily timber structures and that the stone found on most sites was merely a facing to prevent erosion (1973, 10).

Only three of the sites in Loch Awe display remains of stone-built features on their upper internal areas. The site at Rockhill has a line of stones ending in a right-angle corner, which McArdle and McArdle theorised were the remains of a house foundation from a late occupation. Another site at Eredine has 'a circular stone hearth composed of two or three courses' near its centre while the Ederline Boathouse site is crowned by, "...several stones set edgeways into its surface; possibly reminiscent of box-like cists" (McArdle and McArdle 1973b, 7). While each of these features may indicate that the present surfaces of the sites were directly utilised, the remainder of the sites in Loch Awe display no such evidence and it is less certain that their present surfaces are those utilised in prehistory. Morrison even went so far as to state that the stony tops of most artificial islets, "do not represent a surface intended for direct inhabitation" (1985, 40). In Loch Tay, with the exception of Priory Island, only one other site has a stone-built feature on its upper internal surface; Dixon notes that on Eilean nam Breaban there is, "...a linear arrangement of boulders that appears to be the remains of a stone structure of unknown function" (1984, 166).

Unlike the mainland sites, a majority of the artificial islets of the central Inner Hebrides do display evidence of occupation on their upper internal surfaces. It can be argued that on 70% of the central Inner Hebridean sites surveyed, the present stone surfaces are contemporary with at least one phase of occupation, because structural remains which were intended to be above the water-level are found at this level (Appendix A and Appendix E). Various types of walling are found on the surface of 65% of the examined sites. An element of perimeter walling is identifiable on 50% of the sites and in 35% of these cases this perimeter walling is over 1.5 m in height. The remains of building foundations are observed on 45% of the central Inner Hebridean sites. In 5 cases (17%), of which 2 are on Coll and 3 on Islay, the plans of these structures seem to have been sub-rectangular. Based on this evidence, it is

reasonable to assume that an occupation level exists on, or near, the present-day surface of at least 70% of the surveyed sites in the central Inner Hebrides.

The mainland and central Inner Hebridean artificial islets thus display very different types of structures on their surfaces. This apparent contrast may occur for a variety of reasons. One of the distinctive characteristics of the central Inner Hebridean sites is that their surface features are remarkably well preserved and few of them have been interfered with in modern times. Unfortunately, the mainland sites do not enjoy such seclusion; both Loch Tay and Loch Awe have been intensively exploited by various recreational user-groups in the last two hundred years, and thus unsurprisingly artificial islets within them have suffered from relatively modern disturbances. Dixon records that the surfaces of three of the sites in Loch Tay were, "...built up in fairly modern times to support beacons for warning off boats" (1982, 20) and that one other was demolished in order to build a marina (1984, 176). The occasional visits of anglers and wildfowlers to the islets have also made an impact on the sites and their rearrangement of the islets' surface stone to build piers and jetties can complicate the interpretation of the structures' surface features. On Spar Island (Loch Tay) Dixon notes that, "modifications in shape and size were carried out by the Marquis of Breadalbane for a visit by Queen Victoria in 1842" (1982, 37). Consequently its present size and appearance do not correspond with its pre-Victorian form (Morrison 1985, 22). Wave action (which is noted by Morrison (1985, 62) to be severe in both Loch Tay and Loch Awe) may have also played a significant role in scattering any stone-built features which crowned the sites. It can therefore be argued that the current featureless surfaces of the sites in Loch Tay and Loch Awe may be at least in part the by-product of poor preservation, rather than being indicative of the true absence of stone-built structures.

Alternatively, it is possible that the mainland sites were crowned by structures wholly built of organic materials which have not survived. For example, the Oakbank excavation in Loch Tay (Dixon 1984) has shown that substantial timber structures can be found beneath the stone carapace. Such remains are not likely to have survived above the protective stone coverings and would have quickly

deteriorated due to the constant wave action, strong currents and temperature extremes encountered in the large mainland lochs.

A final possibility is that not all of the mainland sites may have been crowned by structures. Morrison (1985, 21) for example suggests that in some instances the islets may have been used as unenclosed platforms, perhaps as fishing or fowling stations, or as secure stores.

### **Geology of lochbed**

One of the key variables in determining the types of structures which may have crowned artificial islets is the geology of the lochbed on which they rest. Although very little site specific data concerning this variable has been recorded by either the Loch Awe or Loch Tay surveys, Morrison (1985, 61) has found that there is a positive relationship between artificial islets and natural features, such as bedrock outcrops and natural rises in the lochbed. McArdle and McArdle note that 15 of the artificial islets in Loch Awe, "...were built (or partially built) on glacial mounds, ridges of bedrock or natural islands" (1973c, 1), while Dixon indicates that "...only one site, number 6, in Loch Tay displays any evidence of bedrock" (1984, 179). Like the sites in Loch Awe, 65% of the artificial islets of the central Inner Hebrides have been found to have been built on firm areas of lochbed. Bedrock seems to have been one of the most commonly sought after foundation surfaces, with 11 (38%) of the sites being situated upon it. Two (7%) sites were built on gravel while another six (21%) were built on very firm sand. The remainder of the sites were surrounded by silts of varying texture and consistency.

Several points may be noted on the basis of the geological characteristics of these settings. It would seem that the connection between artificial islets and bedrock outcrops observed by McArdle, McArdle and Morrison in Loch Awe also holds true for the central Inner Hebrides. The positioning of a majority of the sites in these two series over firm areas of lochbed indicates that most of the artificial islets could not have been pile-dwellings as it would have been impossible with the technology then available to have sunk piles into bedrock, gravel or hard-packed sand. Although it is

feasible that some of the artificial islets could have had wooden substructures, the only way of anchoring the islets to the impenetrable lochbeds would have been by depositing substantial quantities of stone on top of them, as has been hypothesised by Munro (1882, 261). Evidence for this type of structure can be found at three of the sites in Loch Awe (Larach Ban, Ardchonnell, and Ederline Boathouse), which display timbers radiating horizontally from their centres beneath the surface stone (McArdle and McArdle 1973, 10). In a region like the central Inner Hebrides, where timber was likely always to have been a scarce commodity during the currency of the construction of artificial islets, it is far more probable that the artificial islets were primarily stone-built structures which were constructed by off-loading gathered stones from the surface directly onto the lochbed. This would also explain why very few timbers were recovered from these sites, compared with the frequency at which timber was noted in underwater survey in Loch Awe and Loch Tay.

### **Accessibility**

The accessibility of an artificial islet from the loch shore is determined by a number of factors. Water depth is a crucial variable in this regard; and, when combined with an assessment of the nature of the lochbed, an estimate can be made as to whether a site could be reached by wading from the shore. The assessment of the water-levels of the past in Loch Tay and Loch Awe, however, is problematic as each has been adjusted in modern times. Seasonal fluctuations are also likely to be present in the large mainland lochs and it would be very difficult to establish the mean water-level during the period when the sites were in use. It is thus very difficult to discuss the depth of water originally surrounding the mainland sites on this basis and therefore accessibility in these cases must be discussed in the context of the sites' auxiliary features.

### **Causeways**

Causeways are a common feature of artificial islets throughout Scotland and are found on sites in both Loch Tay and Loch Awe. The data concerning causeways in the Loch Awe distribution is somewhat confused. In the original S.A.C.

publication, McArdle and McArdle report that three or maybe five sites are connected to the shore by causeways (1973a, 11) but the individual sites are not named and a causeway is shown on only one of the six site plans accompanying this account. In their follow-up article this number rises to "...four (or maybe six) with causeways" (1973b, 7), with no explanation then being made available for the increase. Dr. D. McArdle has stated that this increase was the result of a later reinterpretation of the sites (*pers. comm.* 1997). The plans in Dixon's appendix (1984) shows each of the six sites connected to the shore by a causeway-like feature. In Loch Tay, only the Oakbank site was found to be accessed by a causeway (Dixon 1982, 22), in this case a timber one which was identified during field-survey in 1979.

Causeways are a far more common feature of the artificial islets in the central Inner Hebrides, where thirteen (43%) sites are accessed by this means. Each of the central Inner Hebridean causeways are substantial stone-built structures the purpose of which is beyond question. Only two of these causeways display evidence that timber was used in their construction. The Loch na Meal (Mull) site, drained in the 1870s, was approached by what was described as, "...a stone causeway laid upon {horizontal} oak trees" (Campbell 1870, 465). On the site in Loch nan Deala (Islay), a 0.8m long and 0.40m wide timber was discovered protruding from the top of a stone causeway, c. 3.00m from the edge of the artificial islet. In this case the function of the wood is unknown.

Few comparisons can be drawn between the causeways accessing mainland sites and those accessing the artificial islets of the central Inner Hebrides. This is largely due to the poor description and lack of measurements for the mainland examples. Causeways are more common in the central Inner Hebrides than in the two mainland lochs. This may be due to a variety of reasons. Perhaps direct access to the shore was more important than security to the islet dwellers in the central Inner Hebrides; although it should be remembered that many of the sites are highly fortified and defensive features were encountered in 8 of the 13 causeways accessing the artificial islets of the study area. This preference for a direct connection to the

shore may therefore indicate that the central Inner Hebridean sites were accessed considerably more frequently than those in the two mainland lochs.

Alternatively, the islets' dwellers on the two large mainland lochs may have preferred to use boats to access their sites (see discussion of harbours and jetties below). These craft could also be used to travel, transport goods and fish on these large water bodies. Most of the artificial islets in the central Inner Hebrides are situated in small lochs where boats would have been of limited use and of no practical benefit to travelling.

There are also other major differences between the causeways of the artificial islets of the central Inner Hebrides and the two large mainland lochs. The central Inner Hebridean causeways are substantial stone constructions whereas the mainland causeways appear to be slight scatters of stone and sometimes incorporate timber. However, this may be a result of a difference in preservation rather than a difference in design. In one case (Oakbank) a causeway in Loch Tay has been shown to be an entirely timber construction. No evidence was found for this type of causeway in the central Inner Hebrides. Defensive features, such as bends and cross walls, were also not found on the causeways in the large mainland lochs though once again this may be due to poor preservation.

### **Harbours and jetties**

Harbours and jetties are also common features of artificial islets throughout Scotland and are found on sites in both Loch Tay and Loch Awe. Five harbours of two different types were found on the Loch Awe sites. The first type, which can also be described as a 'boat noost', was found at Ederline Boathouse. This type of harbour was also found at Barr Phort and Rockhill but in these cases McArdle and McArdle stated the harbours were, "...modern versions built by fisherman" (1973, 11). This distinction was made on the observed lack of discoloration of the surrounding stone, indicating that it had been recently overturned (Dr. D. McArdle *pers. comm.* 1997). Features which may be described as 'boat noosts' were also found on four of the central Inner Hebridean sites. These features consisted of low

spots in the islets' stone-covered surfaces, which resembled the shape of a small boat. The second type of harbour, of which there are two examples in Loch Awe (Opp. Lochawe and Kilneuair), is somewhat larger and consists of stone-built enclosing arms projecting into the loch. McArdle and McArdle have proposed that the arms may have served as bases for timber structures but offered no evidence to support this view (1973, 11). No harbours were found connected with the Loch Tay sites (Dixon 1984, 183).

Jetties were found connected to four of the sites in Loch Awe (Hayfield, Achlian, Keppochan and Sonachan) and in each case consisted of short c. 2m projections of piled stones. McArdle and McArdle once again speculated that these stone mounds may have served as the supporting base for timber piers without finding any associated timbers as evidence (1973, 11). No jetties were found connected with the Loch Tay sites (Dixon 1984, 183). Nor were any recognisable jetties found connected with the central Inner Hebridean sites.

The presence of harbours and jetties on artificial islets may indicate that boats were used to access them. Based on the number of sites with harbours and jetties in Loch Awe, McArdle and McArdle were confident that boats were used by the islet dwellers claiming that, "...it was commonest in this area to reach the crannog by canoe" (1973, 11). The absence of such visible features, however, does not preclude the use of boats and many of the sites in Loch Tay, none of which show evidence for these features, must have by necessity been reached by boat.

Boats would have been required to reach only twelve (38%) of the artificial islets of the central Inner Hebrides, as five (17%) could be reached by wading and a further thirteen (45%) were approachable from the shore by means of a causeway. It should also be noted that 91% of the central Inner Hebridean lochs are under 0.25km<sup>2</sup> in size (Maitland and Holden 1983, 232) and consequently boats would not provide a major saving in time by making travel possible across such small water bodies.

## **Spatial comparisons**

### **Arable land, artificial islets and duns**

As was already mentioned in Chapter 7, Morrison's study of the Loch Awe artificial islets led him to observe that they shared several characteristics in their placement in the landscape; primarily that they were almost always positioned next to arable land and that they were seldomly located near to other types of later prehistoric defended homesteads situated on the shore. Thus, Morrison postulated that, "... in some periods at least, those who required a secure base adjacent to their farmland might elect to build either a dun or a crannog" (1985, 75), depending upon the local topography and available building materials. This hypothesis, of course, assumes that artificial islets and duns were being constructed within the same time frame and that an either/or choice was being made. This assumption may not hold true either for the artificial islets in Loch Awe or for those located in other areas. The dating of duns on Argyll has recently been re-assessed by Harding (1997). An examination of the radiocarbon determinations obtained from artificial islets shows that while many in Loch Awe and Loch Tay are datable to later prehistory (Dixon 1982; Morrison 1981b), the central Inner Hebridean sites display individual dates ranging from the Neolithic to the Medieval period (See Loch nan Dealala (Islay), Ledmore (Mull) and Eilean Ban (Mull), Appendix A). Such a wide ranging chronology undermines the value of Morrison's analysis of the relationship between artificial islets and other archaeological sites of specific periods.

Geographical factors also limit the appropriateness of this type of spatial analysis in other landscapes. Both Loch Awe and Loch Tay are over 20km in length and are surrounded by steeply sloping land surfaces covered with fairly poor soils. Small areas of good soils are found in the valley bottoms and near the edges of the lochs. Such areas are essentially linear and discontinuous. Their intermittent presence thus theoretically allows an either/or choice to have been made concerning the type of settlement to be constructed. These same types of linear conditions are not present in the central Inner Hebrides where such large water bodies are absent and arable

land is not restricted to the immediate localities of lochs. In this region agriculturally-based settlements are not confined to the lochs' immediate catchments and thus the circumstances that underpinned Morrison's vision are largely absent.

Whilst acknowledging the potential inappropriateness of this type of analysis, it is employed here to test heuristically whether Morrison's theory can be applied to the distribution of the artificial islets of the central Inner Hebrides. The Mull sites were chosen as a case study because that island has four of the largest lochs in the study area and therefore most closely mirrors the conditions found in the large highland lochs, at least in limited areas within Mull. Illustration 8.8 shows the distribution of lochs, artificial islets, and the later prehistoric enclosed settlements (i.e. brochs, duns and forts) on the island of Mull (RCAHMS 1980). Of the 56 known later prehistoric enclosed settlements on Mull, only 7 (12.5%) were within 2km of the island's lochs. The average distance between the later prehistoric settlements and the nearest fresh water body was in fact 5.6km with a standard deviation of 3.3km. Only in one instance (Loch Assapol) was a dun's 1km catchment found to overlap with that of an artificial islet; similarly, in only one case (Dun an Fheurain) did the 1km catchment of a fort include a loch. While all but 2 (3.5%) of Mull's brochs, duns and forts are situated on, or near (within 1km), arable land, their distribution is also largely skewed towards the coast, where fresh-water bodies are absent. Therefore, although this data shows that there is a relationship between Mull's later prehistoric enclosed settlements and areas of arable land, it has demonstrated that the builders of these sites had no desire to be situated next to lochs, and thus to potential sites of artificial islets. In this case Morrison's theory is not supported.

### **Arable land and artificial islets**

Another of Morrison's theories concerning the spatial positioning of artificial islets in Loch Awe is that they are almost always positioned next to arable land (1985, 74). Later surveys have also found artificial islets are often placed next to what researchers describe as, "good arable land" (Dixon 1985, 173; Henderson 1994, 151). This connection has been incorporated in various summaries of Scottish

prehistory (Armit 1997, 35; Sykes 1997, 79; Ross 1991, 70; Dyer 1990, 144) without defining either what distances are considered 'close' or what characterises 'good arable land'.

While this theory seems reasonable and is widely supported by those working in the field, as discussed in Chapter 7, the association of artificial islets and 'arable land' remains a tenuous one which has not been systematically examined and relies exclusively on the individual researcher's interpretation of what constitutes arable land. Morrison has defined arable land in the Loch Awe basin as, "...land that was either being actively worked up to the 1930s as arable, or was then classified as good quality meadowland" (1985, 74). However, he offers no distribution maps indicating where arable land is located in relation to specific artificial islet sites as evidence for his claim. Considerations such as the soil types involved or the amount of area covered by arable soils were left undefined in the published text. The only specific graphic proof Morrison offers to link artificial islets with arable land is the rather loose association of artificial islets and the pre-improvement land divisions on the north side of Loch Tay (1985, 78). Dixon is less precise in his definition of arable land, describing it simply as, "...areas of lesser slope" (1984, 173), and notes that all but one of the sites in Loch Tay were located next to land which was under cultivation in 1983. Neither particular soil characteristics nor estimates of the area of shoreline covered by arable land were identified in his work.

The associations between arable land and artificial islets in Loch Tay are re-examined here, employing the methods used to assess the soils surrounding the artificial islets of the central Inner Hebrides (discussed in Chapter 7). These methods are used as a test case for evaluating the differences between the distributions of artificial islets on the mainland and in the central Inner Hebrides. For the purposes of this study the Loch Tay soils are divided into two separate categories: arable and grazing, based upon soil type and the corresponding type of vegetation they did, or could have, supported (these criteria are identical to those used in the central Inner Hebrides, Chapter 7). These classifications were simplified from the *Soil Survey of*

*Scotland* soil maps (Sheets 47 and 51 at 1:50,000 scale, Appendix I) and represent the relative value in agricultural terms of each soil type.

Of the 17 artificial islets in Loch Tay, 9 (53%) have been found to lie within 1km of significant areas of arable land (Illustration 8.9). In 7 (77%) of the cases arable soils covered over 10% of the area within 1km of the site. This shows that although just over half of the artificial islets are located next to arable land, a significant proportion (47%; 8 sites), far more than Dixon's single site (1984, 173), are not considered to be 'close' when employing the criteria defined here. While in many respects the distance of 1km is an arbitrary figure (see Chapter 7) and although Morrison has argued that this type of site catchment analysis has, "... serious limitations when dealing with lifestyles so intimately involved with access by water" (1985, 71), due to the fact that little was known about prehistoric boat types, it can certainly be argued that distances over 1km cannot be considered 'small' given that all the Loch Tay sites are within 100m of the nearest shore. Nearly half of the artificial islets in Loch Tay are thus not situated as near to arable land as they could be and can hardly be argued to have a particularly 'close' relationship to arable soils.

When compared with the artificial islets of the central Inner Hebrides, the relationship between the Loch Tay crannogs and arable land does not appear to be particularly strong. In the central Inner Hebrides 24 (80%) of the 30 artificial islets have been found to lie within 1km of arable land and in 18 (60%) of the cases arable soils covered over 20% of the catchments within 1km of these sites.

The differences between the two distributions may be explained in several ways. The nature of the topography in which the lochs are set certainly influences where arable soils are found in their vicinities. In the central Inner Hebrides small lochs are found in a wide range of topographical settings, several of which are located near to areas covered with arable soil. Thus the islet dwellers had the opportunity to situate close to arable soils if they so chose. Loch Tay, by contrast, is surrounded by steep hills and arable soils are confined to alluvial deposits located in the valley bottoms. In this landscape only limited areas of the loch's margins consist

of arable land and consequently the islet dwellers had less of an opportunity to be situated in its immediate proximity. Although areas of arable land are limited, almost all of the land immediately surrounding Loch Tay is covered by soils which will support plant communities suitable for grazing.

The size of the lochs also affects how much of the artificial islets' catchments can potentially be covered with arable soils. A majority (91%) of the lochs of the central Inner Hebrides are under 0.25km<sup>2</sup> in size (Maitland and Holden 1983, 232) and therefore only relatively small areas of the artificial islets' catchments are covered by water. Loch Tay, however, is an extremely large loch over 1km in width so many of the islets' catchments comprise substantial areas of water. While this fact decreases the potential amount of land in the artificial islets' immediate vicinity, it also means that if the islet dwellers had boats they could easily travel the distances required (in this case up to 2.8km) to reach arable land. In the lochs of the central Inner Hebrides, however, water-borne travel would have been of limited advantage as has been discussed above.

## **Summary**

The primary aim of this chapter has been to compare and contrast the structural form and spatial positioning of the artificial islets of the central Inner Hebrides with those found in large mainland lochs. The data for the mainland series in Lochs Awe and Tay has shortcomings: however, this exercise has demonstrated that the variability in the structural form of both the mainland and central Inner Hebridean sites is considerable. Accepting the data limitations already enunciated, differences between the structural forms encountered are still apparent. The comparison of the mainland and central Inner Hebridean data may be summarised as follows:

- There is ample evidence to suggest that the majority of artificial islets in the central Inner Hebrides are entirely composed of stone and that timber played only a minor role in their construction. This observation undermines both Morrison's

and Dixon's generalisation that stone was inevitably a later addition to sites, although this may remain true at a regional scale. Although many of the central Inner Hebridean sites do display evidence for multi-period activity, their position on consolidated areas of lochbed and the lack of observed timbers both indicate the limited use of timber as a structural component. At least 70% of the Loch Awe sites are also situated on consolidated areas of lochbed, which excludes the possibility of the sites being pile-type structures. Only one of the sites in Loch Tay is situated on bedrock.

- The upper surfaces of the artificial islets of the central Inner Hebrides seem to have been crowned by stone-built structures, of types which were generally not found on the sites in the large mainland lochs. Structural remains in the form of stone-built building foundations and perimeter walling have been found on the surface of 70% of the central Inner Hebridean sites. This suggests that the present stony surfaces are contemporary with at least one phase of occupation on the majority of the sites surveyed. Stone-built features were found on only 4 (10.5%) of the mainland sites and in each of these cases the features were very slight. The reason that there is an apparent contrast in the typology of surface remains may in part be attributable to the fact that the upper platforms of the mainland sites are less well preserved than those of the central Inner Hebrides; however, it is equally possible that the mainland sites were not crowned by stone-built structures. Alternatively the mainland sites may have been crowned by less permanent structures composed of organic materials which have not survived.
- The height of the structural remains of the sites examined here was found to vary disproportionately in each of the regions examined. The Loch Awe sites display a wide range of heights (almost 8m) while both the Loch Tay and the central Inner Hebridean sites display a more restricted range, with 76% of the sites measuring under 2.5m from the lochbed to the site's upper surface. Such restricted heights would have left little room to compensate for seasonal fluctuations in water-levels, which suggests that this may have not been a concern for the islet builders

in these instances at least. While Loch Tay was likely to have experienced seasonal flooding due to its large catchment, it is possible that timber pile-structures may have capped some of the sites, thus placing floor-levels somewhere above the upper stone-covered surfaces now observed. In the central Inner Hebrides most of the sites are located in shallow lochs which have comparatively restricted hydrodynamic catchments, which would minimise seasonal rises in water-level.

- After examining the heights of the 65 artificial islets noted here, Morrison's estimate of 10m (1985, 61) as the maximum depth of water in which sites are found seems to be excessive. His "more usual limit" (*ibid.*) of 5m is far more realistic with only 7.7% of the sites (all in Loch Awe) exceeding this depth. Most of the sites (83%) examined here are in fact under 3.5m in height.
- The wide range of sizes of these structures reflects considerable differences in the scale of construction, both in terms of the quantities of materials employed and of time taken in construction. Whether these differences are the result of the islet's intended function or an expression of the builders' economic standing is, without substantial excavation, unknowable.
- If the islets are presumed to be sites for habitation, the capacity of individual sites for the accommodation of people displays considerable variability. Whether this indicates that accommodation was intended for varying population sizes, or whether space on each islet involved differing functions, is not clear.
- Causeways were found to be a common feature of the central Inner Hebridean sites and were only occasionally noted on the mainland sites. This may indicate that the central Inner Hebridean sites needed to be accessed more frequently, or that other means of access, such as boats, were not practical in the small central Inner Hebridean lochs. Each of the central Inner Hebridean causeways were substantial stone-built structures, while the few mainland examples tended to be either slighter stone-built structures, or were composed of timber. This variance is

probably an expression of the types of materials which were locally available in each of the regions. Many of the central Inner Hebridean causeways also had defensive features incorporated into them while these features were apparently absent on the mainland causeways. This may suggest that defence was a primary concern of the central Inner Hebridean islet dwellers.

- Harbours and jetties were found to be a common feature of the artificial islets of the large mainland lochs (cf. Loch Tay and Loch Awe comments above) but were found less frequently on the central Inner Hebridean sites. This is probably due to the fact that boats would have been far more advantageous for travelling and transporting goods across the long distances of the large mainland lochs, than in the small central Inner Hebridean water bodies.
- Morrison's theory that artificial islets were seldomly located near other types of later prehistoric defended homesteads, to which they were an alternative, was tested on the distribution of artificial islets on Mull. This study showed that very few of the later prehistoric enclosed settlements on Mull were located within 2km of the island's lochs. Only a single dun's catchment was found to overlap with an artificial islet's and a single fort with a loch's. While all but 2 (3.5%) of Mull's brochs, duns and forts are situated on, or near to (within 1km) arable land, the distribution is also largely situated on the coast of the island where fresh-water bodies are absent. It is unsurprising that these settlements were not located near artificial islets as they were not located near the island's lochs. In this case Morrison's theory was shown to be inapplicable.
- The relationship between arable land and the distribution of the artificial islets of the central Inner Hebrides and Loch Tay was also compared. Just over 50% of the Loch Tay sites were found to be located within 1km of arable land while 80% of the central Inner Hebridean sites were. This difference was considered to be due to the variation in the topography of the two areas examined.

## Chapter 9

### Consideration of the artificial islet sites of the Western Isles

#### Introduction

The Western Isles are home to one of the richest concentrations of artificial islets in Scotland. In recent years, some of these sites have been examined as part of the Archaeology Department of the University of Edinburgh's wider research into later prehistoric sites of the Western Isles (Harding and Topping 1986; Harding 1986, 21-22; Harding 1987, 14-15; Dixon and Harding 1988, 19-20; Dixon 1989c, 19-20; Dixon 1990, 17; Dixon and Andrian 1995b, 42-45; Harding and Armit 1990, 76-84; Dixon 1991, 4-6; Armit 1992, 25-26; 1996, 117-118). An organised programme of field-survey has greatly increased the number of known sites and added detail to what were previously tenuous site descriptions. Limited excavation (Dixon and Harding 1988; Dixon 1989c; Dixon 1990; Dixon and Andrian 1995b; Armit 1986; 1987; 1988; 1989) has given valuable insights into the function and structural composition of artificial islets and has indicated that they were occupied in both the Iron Age and the Neolithic periods. Such early dates are, as yet, unprecedented elsewhere in Scotland, indicating that the Western Isles may be home to an older tradition of islet building.

This chapter will outline the archaeological work that has been carried out on the artificial islets of the Western Isles in order to establish what is known about their nature, structure, chronological range, functions, and spatial positioning. This information will be examined here in order to elucidate the wider context of islet building in Atlantic Scotland and so that comparisons may be made between the artificial islets of the central Inner Hebrides and those of the Western Isles. It is clearly appropriate to balance comparisons with mainland crannogs, which have dominated recent syntheses on such sites, with a consideration of other examples from Scotland's off-shore island chains, although the database for so doing is necessarily in a more primitive state. An examination of the data which has been recovered from the artificial islets of the Western Isles over the course of the last century will show that it

is highly variable in quality and detail and that their distribution, as presently recorded, is very incomplete. The results of a small-scale programme of underwater investigation carried out by the present writer are included (Holley and Pickard 1995) but most of the sites considered here are incorporated on the basis of published information.

Although 142 islet sites have been identified in the Western Isles (see Appendix J), these sites have been labelled using a variety of terminologies (discussed below) and in recent years have been considered to be different from the crannogs of the Scottish mainland. Both Morrison (1985, 37) and Dixon (1991, 189; 1994, 268) classify the artificial islets of the Western Isles as either 'islet duns' or 'islet brochs' based upon their heavy stone superstructures, while admitting that these sites probably served the same functions as the crannogs of the Scottish mainland. As will be discussed below, the use of these terms has been called into question by recent excavations (Armit 1989; 1996) which have shown that sites which have been traditionally described as 'islet duns' neither fulfil the function nor occupy the chronological range implied by this terminology. Whether these sites should continue to be labelled separately from their mainland counterparts based solely upon their external features is debatable, and so the functionally and chronologically neutral term 'artificial islets' has been applied here.

## **Terminology**

The artificial islets of the Western Isles have been labelled with a myriad of terms. This tangle of terminology is confusing, and at least potentially blurs distinguishable site types. Moreover, the suite of terms currently employed gives no indication of the degree to which individual sites were modified by man. For this reason, each of the relevant terms will be defined here.

Crannogs \ Artificial Islets: Following Morrison's (1985, 19-21) definition - 'any islet that is at least partly artificial and originally intended to be surrounded by water'.

Island Duns: This term was first coined by Beveridge (1903) for sites on Coll and Tiree. He later applied it to a variety of islet sites on North Uist (1911). Over half the sites labelled with this term have artificially modified bases; however, walled natural islets are also included in this group. These sites usually have massive stone walling around their perimeter and vary greatly in size.

Walled Natural Islet: An islet, the base of which is a natural feature, most often bedrock, around which dry-stacked stone walling has been placed. This walling is most often on the perimeter of the islet and may vary greatly in extent. The chronology and function of these sites are entirely unknown, but may correspond with those of artificial islets.

Islet Brochs: Sites similar to Island duns, but which meet the classic criteria for being labelled as brochs (e.g. MacKie 1965). Most of these sites have substantial artificial bases.

Causewayed Natural Islets: Natural islands which contain no trace of artificial/man-made structures but which are accessed by causeways. Their purpose and chronological position are presently unknown.

As discussed below, the terminology which has been applied to the islet sites of the Western Isles is often only tenuously established and is considered generally unhelpful. In many cases, sites have only been observed from shore so that the labels applied to them should be viewed with a degree of scepticism. Until further field

survey which confirms their characteristics is carried out on the islet sites it is premature to accept the terminology applied to many of them.

## **History of research**

### **Early work**

The first organised research in the Western Isles which included artificial islets was carried out shortly after the turn of the century by the antiquarian Erskine Beveridge. In the years between 1897 and 1911, he excavated a large number of sites on North Uist and carried out extensive archaeological survey of the island. The results of this research were published in *North Uist*. A large component of this work focuses on duns and fortifications, over seventy of which are described as being located on small islets described as, "... at least partly artificial" (Beveridge 1911, 132). The quality and thoroughness of description which Beveridge provides varies from site to site and he only occasionally makes explicit reference to their artificial nature. Most of Beveridge's material was not referenced by other archaeologists researching artificial islets in Scotland (e.g. Ritchie 1942; Piggott 1953; Morrison 1985; Dixon 1991) until Armit re-examined the evidence in 1990. Unfortunately, for the principal focus of the writer's interest, Armit was more concerned with the islets' surface structures rather than on confirming or rejecting their artificial nature.

The first survey of artificial islets which encompassed all of the Western Isles was produced by Blundell in 1913. He identified eight islets on South Uist and Barra as being artificial but only visited and described a single site in Loch na Faoillen (*ibid.* 293-295). The other sites were identified as being artificial by local people who may, or may not, have been qualified to make such identifications. It is assumed that these individuals had no comparative knowledge of artificial islets which would enable them to make accurate identifications. A total of nine sites were identified as 'lake dwellings' on Lewis, in this case purely based upon the opinions of locals (*ibid.* 300-301), while two further examples were identified on Harris (*ibid.* 298). A good

example of how far Blundell was removed from his sources of information is demonstrated in his notice of a lake dwelling at Tolsta, Lewis. This site was described by Blundell (*ibid.* 300) using third hand information and was identified by him as a 'lake dwelling' thirty-seven years after the site had been drained. Apparently Blundell did not realise this same site had already been described firsthand by Liddel (1874). Blundell's one experienced source of information in the Western Isles was Beveridge, who provided brief descriptions of seven sites on North Uist which he believed to be built on artificial islets. Once again it does not appear that Blundell visited the sites himself and sole discretion of definition was left to Beveridge. As a general rule Blundell did not describe the sites found in the Western Isles, but only mentioned their existence.

The next major work to be published which included descriptions of artificial islets was the RCAHMS survey of the Outer Hebrides (1928). Most of the associated fieldwork was carried out in a piecemeal fashion over many years and did not make a special effort to include underwater or islet sites. The RCAHMS was hampered by both lack of a boat and of the time required to visit water-bound islets. This inability to reach sites meant that many islets which were suspected to be artificial had to be described from shore and their measurements estimated. When artificial islets were visited, as described "in some cases a partially submerged causeway could be used" (RCAHMS 1928, v), the descriptions concentrated on surface structures to the virtual exclusion of consideration of submerged features.

### **Limitations of early work**

As outlined by Armit (1992, 13), the initial archaeological fieldwork carried out in the Western Isles has many shortcomings. Areas of survey and excavation were largely determined by the whims of individuals; for example Beveridge only investigated areas near to his home, whereas Blundell relied upon second-hand information and did not attempt to produce an exhaustive survey. Other large-scale field surveys, such as that of RCAHMS, were severely hampered by lack of time and

resources and thus also omitted many relevant sites. The information gathered by these early surveys, therefore, is highly biased and cannot be relied upon to provide an accurate picture of the surviving site distributions.

The information gathered by early survey and excavation has several other shortcomings. Sites were classified solely on the basis of the structures which survived on each islet's surface. No consideration was given to the possibility that the islets upon which the structures were built could pre-date or might even be a separate class of structure in themselves. This bias is apparent in that islets which did not have well-preserved structures on their surfaces were not generally noted. No attempts were made to describe either the nature of the islets' foundations nor the extent of features which were concealed by water; none of the early surveys attempted to identify sites which were entirely covered by water.

Under such circumstances it can be safely assumed that the current recorded distribution of artificial islets of the Western Isles is far from complete. Furthermore, the data for sites which have been identified is highly variable in both quantity and quality and it is likely that many sites may have been misidentified. This uncertainty limits the value of the data and hinders quantitative analyses.

### **Later work**

After the RCAHMS survey very little systematic work was carried out on the Western Isles until Armit and the Callanish Archaeological Research Project began widespread surveys in the mid 1980s. Broch development was studied in the interim period by Scott (1947) and Young (1961), but neither investigated the islets upon which many of the brochs were situated. Discussion was instead focused upon developing classification systems and theories of the diffusion of elements of broch architecture from south-west England. Scott sought to trace the development of brochs as part of a wider tradition including wheelhouses and other structures, but curiously not artificial islets (Scott 1947). Young followed up Scott's work, retaining

the view of the ultimate southern English origin of brochs, and developing her own classificatory system which divided brochs into three groups. This system, however, only included upstanding broch structures located on dry land and did not make allowances for sites surrounded by water. Young's only comment on islet sites was that sometimes duns are located upon them and that they are often accessed by causeways (Young 1961, 176). In later years MacKie would follow Young's example and develop elaborate classificatory systems for brochs (MacKie 1965) but again failed to include sites surrounded by water. The lack of organised research into the nature of the islets upon which brochs and duns were situated would continue for another twenty years.

The mid 1980s saw the dawn of a new era of organised survey and research into the archaeological monuments of the Western Isles. At that time a research project was begun by Edinburgh University's Department of Archaeology to investigate the later prehistoric monuments of the islands of Lewis and Harris. Large scale field-surveys were initiated both on land and, albeit to a lesser extent, underwater and discovered many previously unrecorded sites. Excavation was carried out on a variety of sites both underwater (e.g. Dixon 1989b; Dixon and Harding 1988; Dixon 1989c; Dixon 1990; Dixon and Andrian 1995b) and on dry land (Harding 1985, 17; Harding and Topping 1986; Armit 1986; 1987; 1988; 1989) with the aim of producing a thorough settlement study. This intensive research scheme was the first of its kind in the Western Isles and the first project in Scotland to investigate underwater sites as an integral part of settlement patterns.

The first major investigation of the artificial islets of the Western Isles was carried out by Dixon and Topping (1986) who produced an underwater survey of 24 of Lewis's lochs. Although hampered by problems of limited visibility, this survey identified the underwater features of eight artificial islets, six of which were already known. This survey was particularly useful in identifying those lochs which did not contain visible evidence of artificial islets; however, it only added minimally to the distribution of known sites.

After this initial survey a series of excavations were carried out on artificial islets in the Western Isles (e.g. Harding and Topping 1986; Harding 1986, 21-22; Harding 1987, 14-15; Dixon and Harding 1988, 19-20; Dixon 1989c, 19-20; Dixon 1990, 17; Dixon and Andrian 1995b, 42-45; Harding and Armit 1990, 76-84; Dixon 1991, 4-6; Armit 1992, 25-26; 1996, 117-118). Although all of these excavations have yet to be fully published, the findings of their interim reports are discussed briefly below.

### **The excavations:**

#### **Dun Bharabhat, Cnip, Lewis**

Dun Bharabhat was initially investigated by Harding and Topping (1986) as part of the Callanish Archaeological Research Centre's investigation into the later prehistoric monuments of the Valtos peninsula on the island of Lewis. Before excavation, the site appeared to be the tumbled remains of a typical islet dun which displayed no evidence of architectural complexity and was linked to shore by a partially submerged stone causeway, 20m in length. Excavation quickly revealed that the islet was in fact crowned by the remains of a complex Atlantic roundhouse, complete with intra-mural galleries, stairs and cells, which had collapsed soon after completion. Excavations of the submerged portions of the islet were carried out in order to complement the land-based excavation. The underwater investigation revealed that the Atlantic roundhouse capped earlier levels of occupation which were extremely well preserved. Although the findings of the underwater excavations have not been fully published, a partial picture of the site can be gained from the interim reports (Harding 1985, 17; Harding and Topping 1986; Harding 1986, 21-22; Harding 1987, 14-15; Dixon and Harding 1988, 19-20; Dixon 1989c, 19-20; Dixon 1990, 17; Dixon and Andrian 1995b, 42-45) and other overviews (Harding and Armit 1990, 76-84; Dixon 1991, 4-6; Armit 1992, 25-26; 1996, 117-118).

Underwater excavations carried out at Dun Bharabhat for five seasons between 1985 to 1990 and in 1995 revealed that a circular dry-stone building underlay the east side of the Atlantic roundhouse (Illustration 9.1). This earlier structure was well preserved and still contained several undisturbed floor deposits of straw, heather and hearth debris. Throughout these deposits were found a number of cut wooden artefacts, including a wooden scoop, serving dish and small toggles, along with a bone weaving comb and a large number of decorated pottery sherds. Great quantities of organic remains including the remains of beetles, human lice and fleas; bones of cattle, sheep, pigs, red deer, fish, grey and common seal; and marine molluscs including oyster, scallop, common limpet, edible periwinkle, flat periwinkle and dogwhelk were also recovered (Dixon 1991, 270; Dixon and Andrian 1995, 44).

Underwater investigation revealed that several phases of occupation had occurred on the site prior to the construction of the Atlantic roundhouse. The earliest excavated phase consists of a platform of large stones which had been deposited around the periphery of a bedrock outcrop directly onto the lochbed silts. A sub-circular stone structure was built over the top of this platform but collapsed soon after its construction due to the subsidence of the stone into the lochbed silts. The platform was then rebuilt with additional stones and peat and a second building constructed. This too soon collapsed and was replaced by a third structure which was constructed closer to the centre of the islet, where subsidence, at the time of construction and subsequently was at a minimum.

Although the first two occupational sequences were only partially excavated, floor deposits were recovered from the interiors of the first two buildings to occupy the site. The first floor consisted of a deep layer of peat blocks which was covered with small cobbles and then a layer of white beach sand. Several layers of heather, straw, peat and ash, in which were found bone and antler tools and wooden utensils, built up over this floor. The presence of the artefacts led Dixon to label this structure as a 'workshop' (Dixon and Andrian 1995b, 42-43) although it is equally possible that the building could have been used as a midden. After this building subsided into the

lochbed silts, a second structure was built directly over it. This building was approximately circular and measured c. 4.0m in internal diameter. It was divided in two by a wall and contained what is described as, “a small fence-like structure made of bent branches and a hurdle” (*ibid.*), which had been stapled into the organic matrix of the floor with wooden pegs. This feature was interpreted as an animal pen or storage area for peat. At a later point a small, stone-slab trough was built into the upper layers of the main floor just inside the doorway to the structure. Dixon suggests that that the trough was used for feeding animals and states that the surrounding matrix of straw interspersed with “... significant amounts of animal dung” (*ibid.*), infers that the building was used as a byre.

### **Eilean Domhnuill, Loch Olabhat, North Uist**

The islet of Eilean Domhnuill is located in Loch Olabhat on the north-west corner of North Uist. The site was first excavated in the first decade of this century by Beveridge (1911, 197-198) and subsequently re-excavated by Armit (1996, 43-50). Armit chose the site because its position relative to the occupation levels of a nearby enclosed promontory (Eilean Olabhat) indicated that it would have been submerged when the promontory was in use, and must thus relate to a different water table; it was therefore probable that Eilean Domhnuill was antecedent to the Iron Age structure (*ibid.* 44-45). Excavations carried out on the sites between 1986 and 1989 revealed that they are indeed chronologically distinct settlements and that Eilean Domhnuill has a long and complex history. Although the results of these excavations have not yet been fully published, a fairly detailed picture of the site can be gained from Armit’s interim reports (1986; 1987; 1988; 1989) and other works (1990b; 1992; 1996).

The initial results of the Eilean Domhnuill excavation were surprising and indicated that both the artificial islet’s structure and chronological position had been misinterpreted previously. Beveridge had described the site as an “island-fort” into which the remains of “two secondary buildings” had been set. These buildings stood

on a thick deposit of midden material which Beveridge thought was associated with an earlier structure. The site was thus incorporated into the archaeological record as an 'island dun', probably of Iron Age date, which had been reoccupied, perhaps in the medieval period (RCAHMS 1928, No.180).

Armit's excavation quickly revealed that this interpretation was incorrect. No trace of an island dun or any evidence datable to the later prehistoric period was recovered. The two supposedly later structures were found to be, "... the last phases of a Neolithic settlement, capping the deeply stratified layers of former houses and middens which Beveridge had noted in the lower parts of his trench" (Armit 1997, 45). There was no evidence to indicate post-Neolithic occupation and it was concluded that it may have been submerged throughout later prehistoric times.

Although only a limited depth of the deposits have been excavated thus far, they indicate that Eilean Domhnuill experienced at least 11 successive phases of construction. The absolute dating of these excavated phases awaits further study but the occupational sequence of the site is fairly well understood. The evidence recovered from the earliest excavated occupation levels indicates that the islet was initially accessed by a timber causeway and was probably surrounded by a timber palisade which was set atop stone foundations (Illustration 9.2). Admission to the islet's interior was controlled through a narrow timber corridor set directly in front of the causeway. The interior of the site was occupied by a single house, built of turfs set upon stone footings, around which were slighter stake-built outbuildings and structures. The remains of mounds of domestic waste consisting of decayed organic debris and broken, but distinctively Neolithic, pottery were also found in several areas. This phase of settlement was concluded when rising water-levels forced the perimeter walling to be moved back a few metres towards the islet's centre. After the construction and abandonment of a further series of houses (Illustration 9.3), the perimeter walling was moved inwards yet again on at least two occasions. At this point (the end of Phase 5) water-levels rose and the islet was submerged for an unknown duration, as is evidenced by a deposit of lake silts across the site. Sometime

after the water-level retreated, a stone causeway was built out to the islet and occupation resumed (Phases 1-4) on the reduced internal area (Illustration 9.4). This phase of reoccupation, however, was also terminated by a final episode of flooding after which the site remained covered by water for several thousand years.

The excavation of Eilean Domhnuill allowed several details concerning the function and type of buildings placed upon the artificial islet to be understood. Although many of the structures were poorly preserved, several houses were defined by rough stone alignments. With one exception, all of the buildings were described as "... oval or rectilinear in form with rounded corners" (*ibid.* 48). The internal dimensions of the buildings ranged from approximately 6.8m by 4.4m (structure 7.1) to 5.2m by 3.2m (structure 1.2). The best preserved (structures 1.1 and 1.2) were found to have stone faced walls which had been packed with earth and rubble and were 0.6m-0.8m thick. Large amounts of stone were absent from earlier structures, and these rarely displayed any indication of coursed walling. The lack of rubble in these layers led Armit to suggest that the walls of earlier structures may not have been substantial stone constructions but instead formed of turfs laid onto stone footings (*ibid.*). The interiors of most of the buildings were dominated by stone hearths which were centrally situated and frequently replaced. Large amounts of domestic waste were also present. Although few substantial post-holes were observed, charred stakes and fragments of wattlework representing internal fittings and partitions survived in the lower, waterlogged layers (*ibid.*).

Excavation showed that Eilean Domhnuill itself is entirely man-made and that the deposits are composed wholly of the remains of human settlement. As yet no deposits of natural material have been uncovered and the islet's foundations appear to be entirely artificial. Trenches excavated underwater showed that earlier phases of occupation are well-preserved beneath the water's surface and that these deposits extended at least 5m from the islet's shoreline at the time of the excavation (Dixon 1989b, 22). This led Armit to conclude that, "... in its earlier phases, the islet was far larger than it is now" (1997, 45), and that, "... the general trend appears to have been

that the islet grew gradually smaller as the loch waters engulfed its periphery” (*ibid.*). The underwater work also showed that Armit's excavations had, “... done little more than scratch the surface of the site” (*ibid.* 46), and that layers of organic materials consisting of straw, peat, bracken, ferns, and twigs, representing successive living floors, still remained *in situ* (Dixon 1989b, 22). What are described as, “... thirty apparently structural timbers” (*ibid.*), identified as birch and willow (Armit 1989, 15; Armit 1989b, 21), were also uncovered by the underwater excavations, indicating early phases of the site had timber components, thus qualifying the site on this criterion as a crannog.

### **Eilean Olabhat, Loch Olabhat, North Uist**

Eilean Olabhat is a small natural promontory, formerly an islet, which projects from the south-east shore of Loch Olabhat, North Uist. The site was initially excavated as an adjunct to the excavation of the Neolithic settlement of Eilean Domhnuill, in the same loch, and described above. Excavations carried out on the sites between 1986 and 1989 revealed that they were chronologically distinct settlements and that the last phase of Eilean Olabhat was a specialist metal-working workshop datable to the Early Historic period. Although complete excavation reports have not yet been published, a fairly detailed picture of the site can be gained from Armit's interim reports (1986; 1988; 1989) and other works (1990b; 1992; 1996).

The first phase of Eilean Olabhat (Illustration 9.5) consisted of a single building situated near the islet's centre. This building was oval in shape, measuring 4m by 5m internally and had a central hearth. A “profusion of pits” (1996, 173) which Armit speculated once held votive deposits were spread across the building's floor. The structure was dated to the last centuries BC, based upon pottery finds (*ibid.*). In its second phase (Illustration 9.6) the building was re-shaped to include an entrance passage in one of its long axes. Once again there was evidence for ritual activity in the form of a pit into which a pot had been placed and through which a stake had been deliberately driven. The centre of the building was occupied by a triangular shaped

patch of cobbling into which was set a socket stone which Armit presumed had supported a central post bracing the roof. Unlike its predecessor this building had no surviving hearth and very little occupation debris. This led Armit to suggest that it may have served a specialist or ritual function.

After a long period of abandonment the structure was again re-built around the sixth or seventh centuries AD. This phase (Illustration 9.7) consisted of a series of cells set around the perimeter of the earlier building and covered by a single roof. This occupation was accompanied by a substantial accumulation of debris associated with metal working, most of which was dumped in the cells. The largest of the cells was free of debris, suggesting it may have been used as a living area. Around 150 fragments of clay moulds, 185 crucible fragments, pieces of tuyère and other metal-working by-products were found indicating that bronze or precious metals were worked on the site. No kiln was encountered, so that Armit assumed that a simple hearth was sufficient for the scale of production required. Although none of the products of the metal-working were recovered on the site, the clay moulds indicated that items such as small pins, ingots, penannular brooches and hand pins of characteristically Early Historic type were being made. Radiocarbon dates obtained from pieces of birch and hazel charcoal confirmed that the earliest activity in this phase occurred c.550-650 AD (Armit 1996, 177).

### **Limits of comparison**

Beyond the excavation and survey of the sites examined above, very little work has been carried out on the artificial islets of the Western Isles making it difficult to draw comparison with the artificial islets of the central Inner Hebrides. As already discussed above, the majority of the sites in the Western Isles have not been examined closely in the field due to the inability of researchers to gain access to the islets. Although the locations of a great number of sites are known, few have been subject to measured survey or have been adequately described. This severely limits the quality of the data available for these sites and therefore limits the comparisons which can be

drawn between the artificial islets of the Outer Hebrides and those of the central Inner Hebrides. However, the theories which have been forwarded to explain the distribution and spatial positioning of the artificial islets of the Western Isles can also be examined in the context of the central Inner Hebridean sites.

Armit is the only archaeologist who has given organised thought to, and published an analysis of, the artificial islets of the Western Isles. For this reason his work as it applies to artificial islets will be reviewed in detail below.

### **Review of Armit's research in the Western Isles**

Armit's *The Later Prehistory of the Western Isles* (1992) is primarily concerned with one thing: the definition of sites and their categorisation. Armit has endeavoured to group several traditionally separate site types - brochs, duns, forts, and wheelhouses, together into one all encompassing term: 'Atlantic roundhouses'. Island duns, which are certainly artificially modified islets, are also included by Armit in his category of Atlantic roundhouses. Excavation at Dun Bharabhat, Cnip (Lewis) (Harding and Topping 1986) and Loch na Berie (Lewis) (Harding and Armit 1987; 1988) have indicated that island duns share many features with brochs. Armit has observed that in each of the thirteen cases where island duns have been excavated they have revealed architectural features which place them into his complex Atlantic roundhouse category (Armit 1992, 49).

Other artificial islets which were termed 'walled islets' and 'miscellaneous structures' were described as, "... principally causewayed natural islets and crannogs" (*ibid.* 97), and were excluded from Armit's Atlantic roundhouse category based upon their non-monumentality and lack of dating evidence. These sites were discussed separately and were considered to hold three possible relationships with Atlantic roundhouses:

1. The slighter structures may be contemporary non-monumental elements of the same settlement patterns as the Atlantic roundhouses, thus representing the same communities.
2. The slighter structures may be later structures built after the abandonment of the Atlantic roundhouse form.
3. They may be earlier structures, representing sites of similar function to the Atlantic roundhouses, which had ceased to be occupied by the period of monumental building. (Armit 1992, 98)

Each of these relationships is reasonable; and there is excavation evidence to support each of them. The first of the possible relationships is sustained by Armit's excavation of Eilean Olabhat (discussed above) which was found to have been initially occupied during the last centuries BC based upon pottery finds (1996, 173). The second is also confirmed by Armit's excavation of Eilean Olabhat, which in its final phases was a specialist metal-working workshop datable to the Early Historic period c. 550-650 AD (Armit 1996, 177). The last option is favoured by Armit and is supported by his excavation of Eilean Domhnuill which uncovered a series of domestic structures all datable to the Neolithic. Eilean an Tighe (North Uist) (Scott, 1950) has also been dated to such an early period. Early phases of Dun Bharabhat, Cnip (Lewis) have been dated to the eighth century BC (Armit 1997, 117; Dixon and Andrian 1995b, 42-43).

Armit argues that wood was scarce in the Western Isles during later prehistory and therefore postulates that the walled islets and miscellaneous structures are most likely to date to earlier periods. This assumption was heavily influenced by the Neolithic dates which he obtained for Eilean Domhnuill (Armit 1989). This early date, however, does not negate the possibility that a few of the many islet sites could be later prehistoric in date and this should be considered when constructing site distributions for that period. Armit concedes that most islet sites, "... have never been

examined through excavation and their chronology is entirely unknown” (Armit 1990, 191).

He has defined a further 52 sites as ‘miscellaneous structures’. In many cases these sites are islets which have previously been labelled as crannogs and have produced indications that they are at least partially artificial. The only sites of this class which have been excavated are Eilean Domhnuill, Loch Olabhat (North Uist) and North Tolsta (Lewis). Organic dating material is not available for North Tolsta as it was discovered during loch drainage operations in the late 19<sup>th</sup> century (Liddle 1884).

### **Spatial analysis**

Spatial analysis of archaeological sites is prone to certain problems considered in Chapter 7. Armit has identified six primary factors which might bias spatial analysis in the Western Isles: subsequent settlement, stone-robbing, peat growth, machair movement, coastal erosion, and misidentification (Armit 1992, 109). As discussed in Chapter 7, only one of these factors, machair movement, seriously affects the perceived distribution of artificial islets, as the other elements largely do not affect lochs in the region. The largest factor biasing the known distribution of artificial islets in the Western Isles is that large-scale, systematic underwater survey has not yet been carried out in the region, with minor exceptions (Dixon and Topping 1986; Holley and Pickard 1995). So far only sites which stand above water or which have been drained have been identified. On the Scottish mainland between 75% and 41% of the artificial islets in large lochs such as Loch Tay and Loch Awe (Dixon 1982; McArdle and McArdle 1973) have been found to survive in a permanently submerged state. Although this problem was found to be of minimal significance in the small lochs of the central Inner Hebrides, where only 3 (10%) sites were found to be permanently submerged (cf. Appendix A), the possibility remains that many submerged artificial islets in the Western Isles are as yet unidentified.

Previously unrecognised artificial islets are continuing to be found on Lewis where recent underwater survey, restricted to the Valtos Peninsula, has identified 4 new sites (Holley and Pickard 1995; Burgess and Church 1995). The data set is therefore demonstratively incomplete, minimising the usefulness of spatial analysis techniques. The conclusions which Armit makes based upon spatial analysis are therefore – in common with all such projects - provisional and should be revised as new data becomes available.

Upon analysing the distribution of walled islets, miscellaneous structures and Atlantic roundhouses on North Uist, Armit found a marked series of dissimilarities between the spatial positioning of the monuments in these categories. Some 75% of the Atlantic roundhouses on North Uist are located on islets (in most cases artificial) and indeed every loch of any size on the nearby island of Barra contains one (Armit 1992, 113). Atlantic roundhouses, none the less, were found to have a largely coastal distribution which avoided the inland and eastern areas of North Uist. The walled islets and miscellaneous structures, on the other hand, favoured such areas and appeared to avoid the best land on the island which Armit states was, "... inhabited and extensively exploited in the historical period" (1992, 110). He attributed these markedly contrasting distribution patterns to either a genuine avoidance of the respective areas by the builders of the other monument types, or to an uneven survival of the monuments.

The dissimilarities in distribution which Armit observes between Atlantic roundhouses and walled islets and miscellaneous structures, however, is as likely to be due to a lack of underwater fieldwork rather than the to the decision-making of ancient man. Although Armit was confident that the intensity of past fieldwork had recovered the total surviving distribution of Atlantic roundhouses on North Uist, it is far less certain that the surviving distribution of miscellaneous structures and walled islets has been realised. No underwater survey work has been carried out on North Uist and many submerged sites may yet to be identified. When it is also considered that much of the present known distribution of walled islets and miscellaneous

structures was identified by Beveridge (1911), who on Coll (1903) (as discussed in Chapter 4) wrongly identified seven natural features as artificial islets (thereby provoking a 77% increase in the real numbers of such islets on that island), it is extremely questionable if all the defended islet sites on North Uist are correctly identified. Clearly more field-survey will be required to confirm or reject known sites and to identify new sites before the surviving distribution can be confidently considered sufficiently robust for fuller analyses.

Despite the uncertainty of the data, Armit developed a model to explain the apparent differences in siting between Atlantic roundhouses and miscellaneous structures (artificial islets). The Atlantic roundhouses were theorised to have developed from the earlier walled islets and miscellaneous structures based upon the evidence recovered from Eilean Domhuill (North Uist) and Dun Bharabhat (Lewis) (discussed above). As climatic conditions in the Western Isles deteriorated after the Neolithic, later prehistoric people were forced to abandon the interiors of the islands due to the widespread development of blanketpeat; they moved to the coasts in order to broaden their economic base. Monumental architecture (i.e. Atlantic roundhouses) was a result of this mass movement as people began to compete for decreasing resources, creating conflict (Armit 1992, 125). Atlantic roundhouses were situated in coastal locations to allow the later prehistoric inhabitants easy access to low-lying land, much of which was presumably farmed, and the sea, where a wider range of maritime resources could be exploited.

While this model may hold true more generally for sites in the Western Isles, it may not be valid for those located in the central Inner Hebrides. Like the artificial islets of North Uist the artificial islets of the central Inner Hebrides (many of which would be considered as “miscellaneous structures” according to the classification employed by Armit) also have a largely inland distribution. However, as discussed in Chapter 8, this distribution is conditioned by the physical location of the lochs which tend to be located inland. Only 3 of the artificial islets (Eilean Ban (Mull), an Duin (Coll), and Fhir Mhoir (Islay)) of the central Inner Hebrides are occupied by remains

which may qualify as Atlantic roundhouses and in each case these sites are located well inland (see Appendix A) and are surrounded by areas of peat moor. Two radiocarbon determinations obtained from timbers protruding from artificial islets (Eilean Ban and Ledmore) in Loch Frisa on Mull (Holley and Ralston 1995) indicate that sites located over 4km inland from the coast were occupied in the later prehistoric period and in medieval times. Curiously, the earliest radiocarbon date for the artificial islets of the central Inner Hebrides comes from the Loch nan Deala site ( $6060 \pm 70$  BP (Beta-099284, calibrated at  $2\sigma$  to 5205-4800 BC)) which is only located 0.71km from the coast of Islay. The evidence here therefore seems to indicate that chronological determinations cannot be made based on a site's distance from the coast, as Armit's model for North Uist implies.

### **Structural comparisons of artificial islets**

It will be useful to summarise here what is known about the artificial islets of the Western Isles so that comparisons of the observed structural features can be made with the artificial islets of the central Inner Hebrides. Although the poor quality of the Western Isles data prevents quantitative analysis from providing meaningful results, some general observations can be proffered.

The notices of the artificial islets of the Western Isles are distinctive from those of mainland Scotland in that timber was seldom found as a major structural component of the sites. Only two notices, both describing sites in the Stornoway area (Lewis), indicate that timber was found as a major component of artificial islets. A notice of a crannog at Tolsta identifies timber in an islet's substructure: "at the outside there is a row of piles 5 or 6 inches diameter, then large stones, than another row of piles, then heather and moss, the whole covered with gravel and earth" (Liddle 1874, 741). Wooden logs were also noted to be part of an islet discovered during drainage operations in Loch Airidh na Lic (RCAHMS 1928, 15). Timber is not mentioned in any of the 68 other notices of artificial islets in the Western Isles (Beveridge 1911; Blundell 1913; RCAHMS 1928).

The absence of timber in the Western Isles sites is also attested by the evidence recovered from the artificial islets which have been excavated. Only Eilean Domhuill, North Uist (Armit 1989; 1992) has yielded substantial amounts of timber in the form of the vertical piles of the perimeter wall and causeway and the “thirty apparently structural timbers” (Dixon 1989b, 22), which were revealed by the underwater investigations. Timber was not recovered as a structural component of the three other artificial islets which have been excavated (Armit 1996; Dixon and Andrian 1995b; Scott 1950).

Stone is thus the primary material from which the artificial islets of the Western Isles are constructed. Each of the excavated sites have shown that stone was used to construct both the artificial islets themselves and the structures which occupied them.

There are at least two reasons why stone was the favoured building material. Firstly, it was more readily available than timber. Environmental evidence examined by Armit (1996, 24-25; 1992, 5-9) indicates that woodland was declining in the Western Isles from the end of the Neolithic and was almost exhausted by the Iron Age. This led him to conclude that timber “... must have been a prized resource” (1992, 25) by later prehistory and thus artificial islets with significant timber components, like North Tolsta, are “... likely to date to the Neolithic or Bronze Age when sufficient timber may have been available for its construction” (1996, 52). Another reason that stone was utilised by the islets’ builders is that timber structures would not have been able to support the massive weight of a complex Atlantic roundhouse. At least 60 artificial islets in the Western Isles are occupied by the remains of such massive drystone structures (see Appendix J), thus eliminating any likelihood that timber played a significant structural role in their foundations.

The artificial islets of the central Inner Hebrides are also primarily stone-built structures. Timber was found as a visible component at only four sites in the study

area. This absence of timber is most readily explained by the fact that the central Inner Hebrides are set in an environment relatively similar to that of the Western Isles, more particularly in regard to the apparent decline in woodland cover and the islands bioclimate (Birse, Dry and Robinson 1971). A review of the soil and pollen evidence presented in Chapter 2 of this thesis indicates that by the Iron Age only scattered strands of alder, oak and birch were growing on Mull and Islay; and it is thus a reasonable assumption that timber would have been a scarce resource in the central Inner Hebrides, just as it was in the Western Isles. In what absolute quantities timber would have been available is unknowable from the palynological evidence; none the less, in an environment where constructional timber was clearly not plentifully available, it seems unlikely that the large amounts needed to construct an artificial islet (upwards of 600 tonnes: the basis of this calculation is included in Appendix D) could easily be obtained. It should not be surprising then that artificial islets in both regions are primarily stone constructions.

## **Summary**

Despite the fact that only a limited understanding of the artificial islets of the Western Isles can be gained from the review of past field-surveys, recent excavations have considerably enhanced what is known about the function, form and chronology of the sites. It is now known that artificial islets of the Western Isles had their origins in the Neolithic, while many were undoubtedly constructed or reused during the Iron Age or later periods. In each of the excavated examples artificial islets have been shown to have been habitation sites.

The artificial islets of the Western Isles were found to display as much structural variation as was encountered with the crannogs of the Scottish mainland. As yet, little wood has been found on sites in the Western Isles. In almost every case, crannogs on the mainland have a significant wooden component. This difference may be explained as the exploitation of locally available resources but alternatively it may represent a need for more substantial superstructures for the sites on the off-shore

islands. Many of the Western Isles sites are topped with monumental stone structures which a wooden sub-structure would not support.

As Armit has observed, islets, many of which are substantially artificial, were the preferred location for monumental buildings and settlements in the Western Isles. This preference is most likely due to a need to maximise security as many of the lochs are too small to be exploited for major fishing or to be used as routes of transportation; however, a structure placed in their centre would enjoy a certain degree of security. The additional presence of monumental stone walling would further enhance their defensive posture, making them appear almost impregnable. This may indicate that security was a more pressing concern in the Western Isles than in other areas of the Scottish mainland.

As indicated throughout this chapter, further fieldwork in the form of organised underwater survey needs to be done before quantitative structural and spatial analysis techniques can be applied to artificial islets. Current theories and analysis rests upon a sporadic and highly biased data-set which under-represents artificial islets in comparison to other upstanding monuments. The future of artificial islet research in the Western Isles should concentrate on extending field surveys and identification of those sites fully submerged.

This chapter has shown that the artificial islets of the central Inner Hebrides and the Western Isles share many characteristics. Sites in both regions are primarily stone constructions which are occupied by stone-built structures. It is concluded that this may be attributable to the fact that these regions experienced a similar environment in which timber was a scarce resource during the currency of islet building.

## Chapter 10

### Conclusions

This final chapter is divided into two parts. Firstly the main points of the preceding chapters will be summarised and their contribution to artificial islet research discussed. In the second part, avenues for future research will be set forth.

#### Summary

The history of artificial islet research was firstly reviewed in this thesis; the theories propounded by major researchers were discussed and the limitations of the data on which they based their hypotheses were identified. The contribution of each of the recent excavations of artificial islets was outlined and the findings critically examined. From this exercise, it was concluded that it is premature to make generalisations applicable at the Scottish scale concerning artificial islets based upon the information gathered over the last hundred years. This is a consequence of the poor quality of both the published excavation reports and the incompleteness of distribution maps of such sites. The almost total lack of published, up-to-date evidence recovered by modern excavations employing scientific techniques has also seriously retarded the study of these enigmatic sites. Hypotheses now over a decade old, based upon the results of single excavations and restricted programmes of underwater survey, have been incorporated into recent syntheses, without any real effort to evaluate their applicability. Any attempt at critical appraisal runs up against the problem that only five sites have been excavated in the last 50 years and only the earliest two of these (Ritchie 1942; Piggott 1953) have been fully published, while two of the others are currently still being either excavated or written up. However important these excavations may be individually, they are hardly a representative sample of a population of sites certainly numbering over 500.

In the case of the study area, the extent to which reference material is useful in identifying artificial islets is demonstrably variable. Maps, historical accounts, local records, aerial photographs, earlier archaeological reports and place names

were all examined in order to attempt to recover as complete a distribution of the artificial islets of the central Inner Hebrides as was possible. Although these sources have provided clues to the location of many sites, they have been found to be unreliable and so cannot be used to establish the total surviving population of sites. It is thus concluded that underwater survey is the only sure method of identifying sites.

This thesis has made a significant contribution to the study of artificial islets by substantially increasing at the Scottish scale the number of surveyed sites using modern scientific techniques of archaeological underwater survey. The aims of the survey undertaken in the central Inner Hebrides were stated in Chapter 6. The problems inherent in working on partially submerged sites in such remote areas were also discussed. A gazetteer of thirty artificial islets, many of which had not previously been inspected in detail, was produced by the survey, increasing the number of surveyed artificial islets in Scotland by almost 60%. The site reports presented in Appendix A now represent the largest body of detailed survey data collected from artificial islets in Scotland. All of this data has been made publicly available on the Internet via the World Wide Web and summaries have been published annually in *Discovery and Excavation in Scotland*.

### **The contribution of structural analysis**

The primary contribution of the structural analyses presented in this thesis has been to demonstrate methods for measuring the variability of artificial islets from data derived from surface inspection, including underwater survey, and in illustrating the types of conclusions which can be drawn from this information. The simple analyses carried out in Chapter 6 have a number of implications for the interpretation of the function and utility of artificial islets in the central Inner Hebrides.

Beyond demonstrating the application of such an analysis, this thesis has also made significant progress in examining and testing the prevailing theories of artificial islet construction. It was shown in Chapter 3 that the images of artificial islets which currently illustrate popular publications are almost exclusively those of

free-standing pile-dwellings. It was also demonstrated that this interpretation of an artificial islet is based upon tenuous field evidence and is largely a result of artistic licence and the unquestioning acceptance of conventional wisdom. The survey evidence collected here challenges the universal validity of this image and suggests that the majority of artificial islets in the central Inner Hebrides are composed entirely of stone and that timber played only a minor role in the construction of these islets. This observation contradicts both Morrison's (1985, 39) and Dixon's (1984, 180) theories that stone was predominantly a later addition to these sites. Although many of the sites examined here do indeed display evidence for multi-period activity, their position on consolidated areas of lochbed and the lack of observed timbers indicates the limited use of timber as a structural component. It is further suggested that even on the Scottish mainland convincing evidence that artificial islets were crowned by free-standing round-houses set on vertical piles is substantially lacking.

Further conclusions have been drawn from the Inner Hebridean data which contradicts the theorised function of artificial islets posited by other researchers. Although both Morrison (1985, 21) and Dixon (1984, 171) have suggested that artificial islets were used as byres for livestock, the uneven nature of the stone covering the upper external surface of the islets suggests that they were not. Attention was called to the fact that in the absence of timber causeways animals would have had no simple way of accessing the sites. On small islands such as Coll and Tiree, which were devoid of natural predators and from which large animals could not be removed easily on the hoof, it is questionable whether resources would have been diverted to construct water-bound corrals in order to provide this level of security.

The nature of the features present on the surface of the central Inner Hebridean sites also indicates that current theories regarding the chronology and utility of the uppermost stratigraphy of artificial islets, which have been based upon features found on artificial islets in large Highland lochs, may need to be rethought for sites located in other environments. Perimeter walling and building foundations were present on almost 70% of the central Inner Hebridean sites suggesting that the

present surfaces of a large majority of the sites are those of the latest occupation. This observation contradicts the belief held by both Morrison (1985, 55) and Dixon (1984, 180) that the present surfaces of artificial islets were not associated with any phase of occupation, primarily because timber structures could not be placed upon them. The evidence presented here, therefore, suggests that not all artificial islets were occupied by timber roundhouses, as proposed in most popular publications, but that a majority of the sites in central Inner Hebrides were crowned by stone-built structures.

The findings of this survey also indicate that the problem of establishing the water-levels which were contemporary with the artificial islets' final phase of occupation may not be a difficulty in all environments. While water-levels are known to have fluctuated in the large Highland lochs since the artificial islets were inhabited, they apparently have not substantially deviated in the majority of small central Inner Hebridean lochs. In this region most lochs' water-levels have not fluctuated by more than  $\pm 0.5\text{m}$ , as shown by the close association between the sites' perimeter walling and the water's surface. This finding agrees with Munro's (1882) observations in the SW of Scotland where, once again, small lochs were being examined.

This thesis is also significant in that it includes the first measured survey of a large number of artificial islets which presents the raw data for each of the sites examined (Appendix A), as well as the conclusions drawn from this information. This level of detail has been absent in the published findings of previous surveys of artificial islets, and limits any discussion of the survey results to the generalised findings and personal opinions of the relevant researchers. Until more site-specific data is made publicly available, it is hard to envision how anything approaching an accurate picture of the artificial islets' diversity can be gained, nor how fuller comparisons can be made between regional distributions.

The main factor which limits the conclusions which can be drawn between the characteristics of the artificial islets of the central Inner Hebrides and broadly

comparable sites in other areas of Scotland is the desperate lack of measured survey data. Chapter 3 demonstrates that most descriptions of artificial islets lack measurements and detail and that many sites have only been examined from shore. The submerged features of sites are rarely noted and any measurements which are proffered are inevitably estimates which have been rounded to an unknown degree. Recent underwater surveys have attempted to address these problems but only two (Dixon 1982; Henderson 1994) have published even limited amounts of the raw data. Chapter 8 demonstrates that the data recovered by other surveys (Hardy, McArdle, and Miles 1973) is confused and that widely divergent findings have been published within and between various reports. Until more accurate and detailed data is available it is likely to be premature and potentially misleading to draw conclusions.

This caution is also warranted in discussing the known distribution of artificial islets in many parts of Scotland. It is shown in Chapters 3, 8, and 9 that many of the features which have been classified as artificial islets in Scotland were only examined from shore and identified by individuals who may or may not have been qualified to make such identifications. The current distribution maps of artificial islets in Scotland (Oakley 1973; Dixon 1984, 218; Morrison 1985, 10; Henderson 1994, figure 5.1) incorporate these earlier notices without critical appraisal. It is shown in chapter 5 that 20% of the sites identified as artificial islets in the central Inner Hebrides were, in fact, natural features which had been misidentified by non-experts. When this number is added to the fourteen (46%) sites identified by the present survey which were not reported on the national distribution maps, it is clear that no understanding of the sites' true distribution and density at the Scottish scale can be gained from the database of these sites as presently established.

### **Methodological contributions of spatial analysis**

At this point the contribution which the analysis of environmental data has made to the general understanding of the nature and function of the artificial islets of the central Inner Hebrides should be clear. To begin with, a series of classificatory techniques has been put forward which allows the statistical description of artificial

islet position in the landscape. Significant progress can be made towards testing the validity of current theories concerning the spatial positioning of artificial islets from such classifications. Furthermore, some methods of quantification have emerged which allow well-known concepts to be defined with a new measure of precision. The most important of these is a method for defining the formerly imprecise term “arable land”.

Following from this scheme, a series of simple analyses of the correlations between artificial islet distributions and environmental factors has made it possible to advance suggestions concerning the economy of the islet dwellers, their apparent preferred areas of settlement, and consequently the nature of the threat against which these artificial islets were built. Not only is it possible to demonstrate that artificial islets may have functioned as secure farmsteads (due to their close proximity to arable land) but it can also be suggested that some of the siting constraints, such as altitude, bioclimate and exposure to direct sunlight, would have only been a major consideration if the islets were indeed used in such a manner. Other factors seemed to hold no, or limited, importance to the artificial islet builders. The sites’ distance to the coast seemed to be unimportant, which may be due either to the fact that on islands of this size distances to the coast are relatively small regardless of location, or that the exploitation of maritime resources was not particularly important to the islet dwellers. The artificial islets were likewise indifferently situated with regards to Quaternary deposits, which may have served as a source of building material for their construction. Once again that may be due to the limited distances which had to be travelled, or to the fact that the stone could be easily obtained from the margins of the lochs themselves.

The main contribution of this approach has been to demonstrate that a considerable body of data exists which can be readily collected and simply analysed in order to provide testable hypotheses as to the economic modes and preferences which influenced the spatial positioning of this class of monument. This is something which excavation can not achieve at a similar cost of time, labour, and finance. Although the conclusions which have been reached here are limited to

generalisations, they make significant progress towards elucidating the basic questions which have been applied to artificial islets throughout Scotland. In many respects, general information is what research on artificial islets in Scotland desperately requires, considering that so much has been made in the past of the details from very few excavated sites. While it is unlikely that many artificial islets will be excavated in the foreseeable future, due to the cost in time, finance and expertise required to excavate submerged sites, this thesis demonstrates that this need not prevent the discussion of general questions such as those addressed here.

### **Future of research**

The work presented here has highlighted several themes which are deserving of further research. These areas can be divided into three fields of approach: field-survey, environmental research and excavation.

#### **Field-survey**

It is abundantly clear that what is desperately needed to further our understanding of the artificial islets of Scotland is the continuation of the comprehensive field-survey of sites. This should be the first priority of any future research. If the total number of artificial islets in Scotland is near to the estimate of 500 (Dixon 1984, 15) only 10% of the country's sites have thus far been accurately measured and recorded. Until this short-coming is made good and there is a record of what is visible in the field it will be hazardous to further develop any meaningful theories regarding the structural form and spatial positioning of artificial islets at a national scale. The most important aspect of any future survey should be the full publication of all of the raw data collected in the field. Summaries of findings are of limited utility as so little is known about most sites; consequently it would be best if survey information was made publicly available and this can be easily accomplished using the Internet via the World Wide Web, as demonstrated in Chapter 6.

Although a large proportion of Scotland's artificial islets still need to be comprehensively surveyed, this task may produce the most useful results if it is initiated in regions of the country which have hitherto been unstudied. The advantage of such a scheme would be to generate survey data from alternative environments which could be contrasted with that which has already been recovered from the Highlands and central Inner Hebrides. The Western Isles can be put forward as one of the first areas which should be surveyed. At least 142 islet sites, for which little reliable data is available, are noted to exist in this region (Appendix J). Recent excavations of sites in this area have indicated that islet building began in the Western Isles as early as the Neolithic and continued through into the later prehistoric period and indeed into more recent centuries. Previous archaeological surveys of the region have indicated that surface features may be well preserved on the sites. Other areas which have not been adequately surveyed and would provide useful contrasts to the current data-set would be Aberdeenshire, Sutherland, and the Borders. Aberdeenshire, for example, has very few water bodies, but definite evidence of medieval recourse to artificial islets (Munro 1882, 19-27; Burnett 1855).

Another area where the comprehensive field-survey of artificial islets is needed is Ireland where there are estimated to be a surviving population of between 400 (Raftery 1951, 43) and 1200 (Edwards 1990, 37) sites. Although several underwater surveys have been carried out on artificial islets in Irish lochs (Farrell, Kelly and Gowan 1989; Farrell 1989) the information gathered by these remains largely unpublished. Organisations such as the Irish Archaeological Wetland Unit are helping to address this dearth of information (see Keane 1995; Moloney 1994) but as in Scotland major underwater surveys are largely lacking. Until more measured survey data is available for the Irish sites, attempts to make structural and chronological comparisons with artificial islets in Scotland, as has been attempted by Crone (1993), Edwards (1990, 37) and Lynn (1983), seem premature, overly speculative and inaccurate as they rely on evidence gathered from the tiny fraction of excavated sites. It seems preferable at this point to wait for the publication of additional Irish material, such as the Lough Gara survey (Raftery 1994, 32) before drawing any comparisons between the artificial islets of the two countries.

## **Environmental research**

This thesis has also identified several areas in which further environmental studies could significantly enhance our understanding of artificial islets of the central Inner Hebrides and the environments in which they were initially constructed. One of the key issues in determining the structural typology of the artificial islets of the region would have been the islet dwellers' access to timber. The evidence examined in Chapter 2 has shown that most of woodlands were cleared from the central Inner Hebrides since well before the later prehistoric period. However, almost no environmental work has been carried out on the islands of Coll and Tiree and yet it is questionable if these islands were forested at any period subsequent to the last glaciation. Research has already been initiated on Coll to help answer this question (Holley and Coles, *forthcoming*) but much more will be required before definitive conclusions can be reached.

A further area of environmental research which would contribute towards understanding the artificial islets' relationship to "arable land" would be an investigation of the soil histories of the fields surrounding the sites. As discussed in Chapter 2 the central Inner Hebrides have experienced significant environmental changes throughout the last 5000 years which have radically transformed the landscape within which the artificial islets are set. Peat bog has developed over vast inland areas, while machair sands have been blown onshore from the coasts. These factors make the identification of previous land surfaces difficult from superficial examination, although they contribute to the possibilities for the preservation of land surfaces contemporary with the use of artificial islets. To what extent these processes had altered the landscapes of the off-shore islands by the later prehistoric period is unknown beyond some detailed case-studies, but they have certainly modified the landscape since that time and continue to do so to the present day. Recent research on Islay has demonstrated that buried soils and field-systems still exist in the region (Barber and Brown 1984) and can be found if looked for. A large scale programme

of soil analyses combined with excavation would make substantive progress towards determining if the islet dwellers were indeed farmers.

### **Excavation**

Several opportunities for excavation in the central Inner Hebrides have also been identified during this study. In Chapter 3 it was shown that, as yet, very few artificial islets have been excavated in Scotland and none in the central Inner Hebrides. The few excavations which have been carried out in the last forty years remain largely unpublished and thus have not significantly enhanced our understanding of the sites. Although it is arguable whether excavation should be given the same priority as further field-survey, as the investigation of a single site is unlikely to answer more than a small proportion of the questions posed for an entire class of monuments, it will ultimately be required to add detail to our understanding of the internal structure, economy and function of artificial islets. It is also unlikely that the chronology of individual sites will be deduced from field-survey alone in the near future and therefore excavation in some form will be required to date artificial islets. The key priority of all future excavations, however, should be the timely publication of their findings. Delays of over a decade in publishing excavation data are clearly unacceptable and the future of artificial islet research will be severely retarded if such practices are allowed to continue.

Three sites may be identified in the central Inner Hebrides which should be given priority for excavation. Each of the sites is located in a loch which has been drained and each site has therefore already been disturbed to some extent. Although excavating a drained site may not allow the recovery of the substantial amounts of organic materials which are found on submerged sites, it is far more cost-effective in time, energy and resources. Safety and support aspects are also considerations when working underwater in such remote areas and it may not be practical to undertake such dangerous operations where additional equipment and emergency services are not readily at hand. The excavation, even partial, of a number of sites seems to be the

most effective way of conclusively proving if the artificial islets of the central Inner Hebrides had a significant organic component to their internal structure, in addition to further enhancing the understanding of the typology of the sites in the region. Each of the three sites proposed for excavation will be considered below.

The artificial islet in Loch Breachacha (Coll) (Appendix A) has been chosen as the primary candidate for excavation in the central Inner Hebrides for a variety of reasons. The site sits at the edge of a drained loch which is accessed by a track and is close to hired accommodation. The artificial islet sits on top of a bedrock outcrop which will limit the time required to excavate the site down to its foundations. The site has already been disturbed, as evidenced by several large pits which have been dug into its side, and thus excavation would not be destroying a site in pristine condition. An investigation of the loch's sedimentary sequence and vegetational history has already been initiated and its findings will provide a useful source of information in determining the environment in which the artificial islet was set. The loch in which the site is located is presently being re-flooded by the RSPB so that excavation in the dry may not be possible in the future. The manager of the RSPB sanctuary on Coll is open to the possibility of excavation in order to determine if re-flooding the loch will adversely affect the artificial islet.

The second candidate for excavation which also has several factors favouring its further investigation is the artificial islet in Loch na Meal (Mull) (Appendix A). This site is conveniently situated 2km SE of Tobermory where both accommodation and supplies can be obtained. Like Loch Breachacha, this site also sits on a shelf of bedrock which would limit the amount of time needed for its excavation. Loch na Meal was drained over a century ago in order to extract marl and fertile soils so it may not be possible to recover useful environmental evidence from the vicinity of this site. Further disturbance to the area around the artificial islet is known to have occurred at the end of last century when it was intensively farmed and two decades ago when it was planted with conifers by the Forestry Commission. Both of these events have undoubtedly affected the preservation of the site which now appears as a mound of rubble. Nothing is known about the internal structure, function or

chronology of the site and excavation seems to be the only way to answer these questions. The Forestry Commission is open to the possibility of excavating this site.

The final candidate for excavation considered here is the site in Loch nan Deala (Islay) (Appendix A). Although in many respects this site is the most interesting of the three, its excavation may prove to be problematic. The site is located on boggy ground where the high water table may prevent the excavation of the site's foundations if they are significantly below the contemporary ground surface. A trench for a water main has recently been cut through the side of the site so that a portion of it is already disturbed. The site is of particular interest and significance because the remains of building foundations on its surface are similar to those found on Eilean Olabhat (North Uist) (Armit 1988), which were dated to the Neolithic period. A timber recovered from the causeway of the Loch nan Deala site during the present survey produced a radiocarbon determination of  $6060 \pm 70$  BP (Beta-099284, calibrated at  $2\sigma$  to 5205-4800 BC) which strengthens the supposition that it may also be early in date. Excavation of the site may therefore offer a rare opportunity substantially to increase our understanding of the earliest periods of artificial islet building in Scotland.

Another feature of the artificial islets of the central Inner Hebrides which deserves further investigation through excavation is the area immediately adjacent to where the causeways are joined to the shore. These areas have thus far not been investigated in Scotland but surely must contain a wealth of archaeological information. The remains of outbuildings and corrals associated with the artificial islets may be present in such areas and their excavation could give valuable clues as to the economy of the islet builders. The cost of such a venture would be minuscule in comparison to excavating a site underwater. Three sites can be identified in the study area (Loch Cinneachan (Coll), Loch Anlaimh (Coll), Loch Allallaidh (Islay) (Appendix A)) which are accessed by well preserved causeways and which are suitable for this type of investigation, as they are situated in upland areas where there is a high probability that the ground surfaces near the lochs have not been disturbed subsequent to the sites' abandonment.

## **Closing remarks**

This thesis has demonstrated that the present disparity of knowledge which has retarded the study of artificial islets in Scotland can be significantly reduced by detailed field-survey. It is hoped that the current work has demonstrated various areas of site interpretation that can benefit from the simple analysis of a number of unexcavated, but well surveyed, sites. It is unlikely that many artificial islets will be excavated in the near future and, until they are, the techniques demonstrated here may serve as a useful way with which to test theories before they become enshrined in general syntheses.

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### Abbreviations

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GAJ Glasgow Archaeological Journal  
IJNA International Journal of Nautical Archaeology  
PPS Proceedings of the Prehistoric Society  
PSAS Proceedings of the Society of Antiquaries of Scotland  
TGAS Transactions of the Glasgow Archaeological Society

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## Published Maps

MacAulay Institute for Soil Research  
Soil Survey of Scotland

Western Scotland  
Soil  
Sheet 4  
1: 250,000

Coll and Tiree  
Soil  
Sheet 46  
1:50,000

South West Scotland  
Soil  
Sheet 6  
1:250,000

Islay  
Soil  
Sheet 60  
1:50,000

Loch Tay  
Soil  
Sheet 51  
1:50,000

Crief  
Soil  
Sheet 47  
1:63,360

Ordnance Survey 1:25,000

Coll  
NM 05/15/25 Arinagour  
NM 26 North Coll

Tiree  
NL94/NM 04

Ordnance Survey 1:50,000

Sheet 46 Coll & Tiree  
Sheet 47 Tobermory & North Mull  
Sheet 48 Iona, Ulva & West Mull  
Sheet 49 Oban & East Mull  
Sheet 60 Islay

Ordnance Survey 1:25,000 (First edition)

Coll  
Sheets 21/22/36/37/49/50

Tiree  
Sheets 50/64/65/78

Mull  
Sheets 52/69/83/96/105/108/117

Islay

Sheets 186/187/196/198/208/231/232/239

**Unpublished Maps**

SRO RHP Scottish Record Office Register House Plan

**Mull**

SRO RHP 3273

Plan of Estate of Jarvisfield 1826

SRO RHP 12783

Plan of the farm of Ensay and hill of Calgary 1837

SRO RHP 3354

Plan of the Estate of Tenga late 19<sup>th</sup> century

SRO RHP 23452

Plan of the lands of Scallastle 1848

SRO RHP 3519

Plan of the lands of Lochbuie 1849

Tobermory Museum

The Plan of the Estates of Aros and Tobermory property of Farquhar Campbell Esq.  
1849

National Map Library - Edinburgh

Plan of the Farms in Mull and Morven property of his Grace The Duke of Argyll.  
Surveyed by J.A. Richmond in 1770.

**Tiree**

SRO RHP 8826/1

Plan of the Island of Tiree 1769

SRO RHP 6795

Photostat copy of a sketch plan of Tiree ca 1680

**Coll**

SRO RHP 3368

Photostat plan of the Island of Coll 1794

**Islay**

SRO RHP 11691

Sketch plan of Islay, Jura, Kintyre and Knapdale 19<sup>th</sup> century

SRO RHP 10965

Photostat copy of plan of Island of Islay 1749-51

SRO RHP 11037

Photostat copy of sketch plan of Island of Islay 19<sup>th</sup> century

SRO RHP 11033

Photostat plan of Ardnave 19<sup>th</sup> century

SRO RHP 11043

Photostat plan of first part of McLeans Farm at Carnduncan 19<sup>th</sup> century

SRO RHP 11044

Photostat plan of second part of McLeans Farm at Carnduncan 19<sup>th</sup> century

SRO RHP 13094

Sketch plan of Loch Gruinart 1891

SRO RHP 11080

Photostat copy of plan of last division of the farm of Gruinart 19<sup>th</sup> century

SRO RHP 11058

Photostat copy of sketch plan of Kilchoman 19<sup>th</sup> century

SRO RHP 11106

Photostat copy of sketch plan of East Kilchoman 19<sup>th</sup> century

SRO RHP 11052

Photostat copy of sketch plan of the sands and links of Loch Gruinart 1749

SRO RHP 30983

Photostat copy of sketch plan of land attached to distillery at Ardbeg 1835

SRO RHP 10981

Photostat copy of sketch plan of Cornabus 19<sup>th</sup> century

SRO RHP 30978

Photostat copy of plan of farm at Leorin 1827

SRO RHP 30976

Photostat copy of part of the muir of Torra 1827

SRO RHP 30977

Photostat copy of plan of farm of Upper Leorin 1827

SRO RHP 11082

Photostat copy of plan of farm of Airidh Ghuaidhre 19<sup>th</sup> century

SRO RHP 11089/1

Photostat copy of plan of farms between Gruinart and Mulindry 19<sup>th</sup> century

SRO RHP 11098

Photostat copy of plan of East Killchoman 1769

SRO RHP 10999

Photostat copy of plan of march between Gruinart and Leckgruinart 1866

SRO RHP 11100

Photostat copy of plan of infields of the farm of Kilchonon 18<sup>th</sup> century

SRO RHP 11058

Photostat copy of plan of Kilchoman 19<sup>th</sup> century

SRO RHP 10996

Photostat copy of plan of muir near Glenegadale 1828

SRO RHP 11085

Photostat copy of plan of Laggan 19<sup>th</sup> century

SRO RHP 11039

Photostat copy of plan of march between the properties of Charles Morrison and Kirkman Findlay 1870

SRO RHP 11084

Photostat copy of plan of Carnbeg 19<sup>th</sup> century

SRO RHP 11059

Photostat copy of plan of Persobolls and Pert Askaig 19<sup>th</sup> century

SRO RHP 11016

Photostat copy of plan of Persobolls and Pert Askaig 19<sup>th</sup> century