Archaeological remains on Uist's machair: threats and potential

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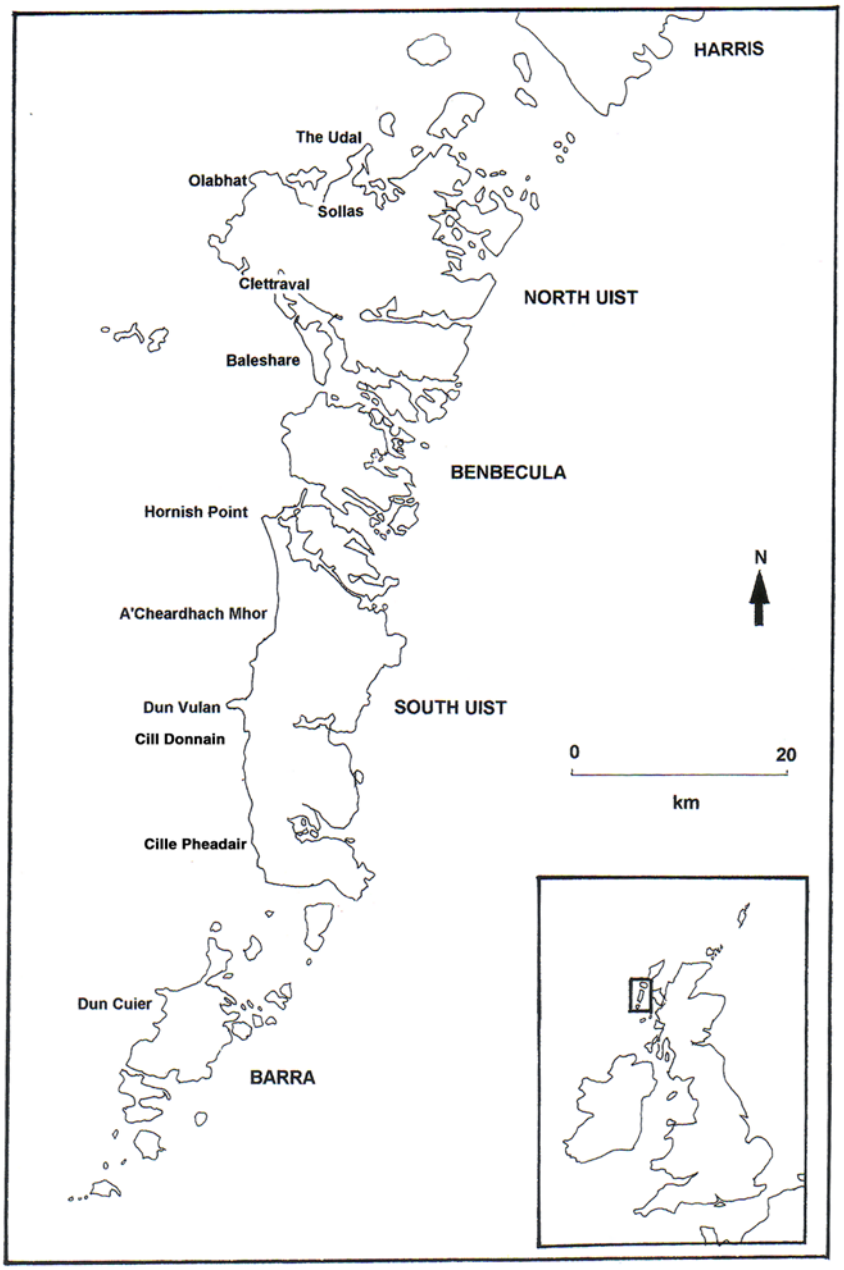
1 ABSTRACT

Since 1987 Sheffield University and latterly other universities have carried out archaeological investigations of archaeological sites on the machair of South Uist, Barra and the southern isles of the Western Isles (Outer Hebrides) as part of the SEARCH project. The remains often survive extremely well as stone-walled dwellings with intact floors, set within deeply stratified settlement mounds, dating from the Beaker period to the Post-Medieval period. This exceptional archaeological resource has come under threat especially from rabbit-burrowing as well as from coastal and wind erosion. The good preservation of floors and other features has helped in the development of new archaeological methodologies and techniques as well as providing exciting new evidence of Hebridean life through the millennia. A bibliography of the SEARCH project is appended.

2 INTRODUCTION

Since 1987 Sheffield University has undertaken a major research project investigating the archaeological and environmental aspects of settlement in the southern islands of the Western Isles of Scotland (SEARCH, or Sheffield Environmental and Archaeological Research Campaign in the Hebrides). Over the years the project has grown, drawing in collaborators from other universities, principally Bournemouth, Cardiff, Aberdeen and Boston but also Edinburgh, Oxford, Bradford, Southampton, University College London, Winchester, Plymouth, Aberystwyth, Glasgow, Newcastle and Cambridge. The aims of the project were to investigate human adaptations to this island environment, and to



Illus 1 The southern islands of the Western Isles with main SEARCH excavations and earlier archaeological excavations marked.

study the long-term processes of domestic and economic life, from earliest settlement until the nineteenth century. Much of the fieldwork on the islands of Barra and South Uist (as well as on the small isles surrounding them) has been carried out on the peatlands and rocky moorlands, but a major contribution to the project (especially on South Uist) has come from survey and excavation on the machair plains of calcareous sand on the west coast (illus 1).

Eighteen years on, the project has produced two popular books, six monographs (with seven more to come) and well over 100 published academic papers, along with a string of articles in popular magazines and newspapers both locally and worldwide (see Bibliography of the SEARCH Project below). The project has been a training ground for British and American archaeology, producing 12 PhD theses and 22 Masters dissertations as well as training around 1,000 archaeology students, Earthwatch volunteers and local participants. Five of the project's seven large set-piece excavations have been carried out on settlement sites on South Uist's machair, and the entire 35km length of this island's kilometre-wide strip of machair has been prospected for archaeological remains. Previous investigations such as Kissling and Lethbridge's excavation of a well-preserved Iron Age wheelhouse at Cille Pheadair (Lethbridge 1952), the 'Rockets Galore' project involving rescue excavation on the South Uist rocket range (Young & Richardson 1960; Fairhurst 1971; MacLaren 1974) and the Outer Hebrides farm mound project (Barber 2003) can now be reassessed within their broader archaeological context. For a more detailed account, see *South Uist: Archaeology and History of a Hebridean Island* (Parker Pearson et al 2004).

3 THE PRINCIPAL THREAT TO MACHAIR SITES: RABBIT DAMAGE

In 1996 the SEARCH project undertook a management audit of the archaeological sites surviving on South Uist's machair (Parker Pearson 1996a). Some 234 archaeological sites have been identified within this machair strip, most of them previously unrecorded. The vast majority of them are settlement mounds of varying sizes from 5m to over 100m in diameter. Of these, 30 were found to be suffering from erosion by human or natural agency. In some cases, the impact was severe: sand quarrying at Cladh Hallan, coastal erosion at Cille Pheadair (illus 2) and Dun Vulan, ploughing at Bornais and wind erosion at Cill Donnain were among the most serious threats. In all such cases where the machair's grass surface was broken, the damage was compounded by wind erosion, which has led to sand blowouts and deflation of archaeological layers.

Yet there is a more insidious threat to the archaeological remains of the Western Isles. Rabbits have been resident in these islands for many centuries, but only in the last 40 years have their numbers exploded to the level of an infestation. Previously they were hunted with dogs but the introduction of myxomatosis resulted in their no longer being considered fit for human consumption. There are various local schemes to gas and kill rabbits but, without a concerted programme of extermination, they soon recolonise those areas of machair from which they have been cleared.

The reasons for the current rabbit clearance programmes are agricultural and ecological, and have nothing to do with archaeological priorities. However, rabbits cause extraordinarily high levels of damage to the deeply preserved stratigraphic sequences within the settlement mounds' soft sand (illus 3). Their burrowing reaches to depths below 1.5m, digging through stratified floors and other layers, dislodging stones, destroying stratigraphic relationships by burrowing along wall lines, and moving material from below ground to the surface. The latter process has been extremely useful to archaeologists prospecting for occupation sites in otherwise unbroken machair grassland. However, the overall physical impact on these archaeological sites, whose stratigraphic sequences may be up to 3m deep, is to turn them from layer cakes to increasingly hole-riddled Swiss cheese. The cumulative effect on these sites has been so great in the project's lifetime that we may expect the vast majority of these settlement mounds to be 'de-stratified' within the 21st century.

Programmes of gassing and eradication of rabbits are the only way forward if this new threat is to be halted (unless they once again become a human

Illus 2 The Norse settlement of Cille Pheadair during excavation. Exposed by the sea in 1992, it has since been almost entirely washed away.

Illus 3 Rabbit damage of machair settlement mounds is extensive. White sand marks the locations of burrows into a prehistoric mound at Machair Meadhanach, South Uist.

food resource as in pre-myxomatosis times). Whilst gassing has been carried out in recent years, its effects are temporary and partial, allowing rabbit colonies to re-infest previously cleared areas. The rabbit will probably never be eradicated from these islands but it may be possible to keep it at low numbers through regular pest control. At the same time, rescue excavation will still be required on settlement mounds and other sites suffering from damage by rabbit burrowing.

4 THE QUALITY OF ARCHAEOLOGICAL EVIDENCE ON THE MACHAIR

Although the machair is largely unoccupied today, it was densely occupied in later prehistory and the early historic period, as indicated by more than 200 surviving settlement mounds along 20 square miles of South Uist's west coast. The most important feature of these abandoned settlement sites is their tell-like formation into deeply stratified mounds as the result of accumulative processes of sand deposition. This appears to have been due in large measure to the ability of ancient stone structures and organic-rich layers to trap sand as it was blown inland off the beach, either forming clean layers of windblown sand or becoming mixed with occupation-derived detritus.

Geophysical methods of magnetometry, magnetic susceptibility, resistivity and ground-penetrating radar (GPR) have been used with success on the settlement mounds of the machair (Hamilton & Sharples 1996; Sellers & Chamberlain 1999). In particular, Mike Hamilton's magnetometry and resistivity survey of the Norse-period mounds at Bornais identified traces of 22 buildings, mostly arranged into farmyard clusters. For those settlement remains buried deeply beneath windblown sand, GPR has been of use, capable of detecting built stone features at 3m depth, as was confirmed at Cladh Hallan. Coring has also been used successfully, for example to recover the extent and contours of an Early Bronze Age Cordoned Urn settlement mound beneath the Iron Age settlement at Cill Donnain (Parker Pearson 2003; Parker Pearson & Seddon 2004). Nonetheless, these prospection techniques provide only the crudest indications of what lies buried beneath. They are no substitute for excavation.

4.1 STRATIGRAPHY AND PRESERVED FLOOR ACCUMULATIONS

The depth and quality of stratigraphy in these settlement mounds is their most important feature. Unlike the largely eroded, ploughed and truncated sites of mainland Britain, these small 'tells', with their long chronological sequences, are a remarkable archaeological survival (a potential first appreci-

Illus 4 The floor accumulation within a roundhouse (House 1370) at Cladh Hallan.

ated fully by Iain Crawford in his excavations at the Udal in North Uist (Crawford, 1986)). Among the complex deposits of windblown sand, fill layers, construction dumps and abandonment layers, there are also preserved house floor deposits. By happy accident, the floor accumulations within the vast majority of dwellings – whether from prehistoric times or later – were formed of a soft mixture of peat and sand, trapping micro debris where it fell (illus 4). This has given archaeologists a perfect opportunity to study activity patterning within houses in a way which is not often possible in the stone-paved buildings that are more common in, for example, the Northern Isles.

In some circumstances, as Werner Kissling and Tom Lethbridge found at Cille Pheadair (Lethbridge, 1952), dwellings and other stone buildings might be abandoned wholly intact except for their roofs, providing a degree of architectural survival which is exceptional for prehistoric remains. In other situations houses burnt down, leaving the burnt roof spars as a charred lattice on top of the abandoned floor, as in the Pictish-period house at Bornais (Sharples 1999). More often, however, the materials from abandoned buildings were regularly 'robbed' and reused in later structures, thereby recycling the stone (which does not occur naturally on the machair) from generation to generation. Fortunately, most house floors have, in our experience, survived the ravages of time (at least until the rabbit population explosion of the last two decades). This is due, in part, to what may have been reluctance by later generations to dig new footings below the levels of previous floor surfaces.

4.2 CLARITY OF SEQUENCES

The visual discrimination of different layers within machair sites can be exceptionally fine, although it can become impossible in dry conditions. Sections through archaeological sequences are often a riot of colours – red, orange, yellow, brown, grey, black – as each layer, however thin, can be picked out with clearly defined boundaries (illus 5). Even where the wind-accumulated sand has been dug into with a pit immediately backfilled with the same, clean sand, the experienced archaeologist can identify the cut by the feel (and sound on the trowel) of the realigned sand grains. Interpreting the often complex stratigraphy of accumulating layers and cut features is certainly a challenge, but generally machair deposits are among the most rewarding to excavate in terms of context definition.

Illus 5 The fill within a pit (Pit 2508) at Cladh Hallan, exhibiting clearly differentiated layers in machair sand.

Episodes of windblown sand deposition can result in extensive layers across a large area of a settlement mound, allowing the identification of stratigraphic contemporaneity between otherwise unrelated contexts. It also provides a vanilla-white blanket of sand which protects outdoor surfaces, and sometimes ephemeral traces such as the hoofprints of cattle and other animals may be preserved along with the more robust plough furrows.

4.3 BONE PRESERVATION

Bone is well preserved in machair sand, although other organic materials do not normally survive (but see below). The calcareous component of the machair's shell sand is sufficiently alkaline (pH of 7.5–8; Hudson 1991) to preserve bones in excellent condition. The bones of small mammals, fish, birds, molluscs and large mammals are well preserved except in conditions where deposits are affected by groundwater or tides, when preservation may be slightly poorer. The fine sand makes complete dry sieving of all deposits (through a 10mm mesh) and large-scale flotation (through 1mm and 300 micron mesh sieves) relatively cost effective.

The islands have been largely treeless since *c* 2500 BC (Brayshay & Edwards 1996) and past populations have used the bones of stranded whales and other cetaceans to fashion artefacts which elsewhere were made of wood. This means that an entire range of artefacts – flax beaters, weaving batons, smoothing boards, handles and so on – has survived in conditions where their wooden counterparts would have perished. Whale bones were also occasionally used as furniture, notably as cist covers. Handles of tools were commonly made of antler and bone although, in the appropriate waterlogged conditions, wood assemblages retain tool handles made of wood.

4.4 JUXTAPOSED CALCAREOUS, ACIDIC AND WATERLOGGED CONDITIONS

The calcareous machair and the acidic peatlands immediately to the machair's east provide a remarkable juxtaposition of landforms whose preservative properties are entirely different. The blanket bogs and freshwater lochs of the peatlands preserve sequences of pollen, beetles, timber and plant remains (unburnt) – materials which rarely survive in machair environments. These complementary

Illus 6 Excavating waterlogged deposits (foreground) at the broch of Dun Vulan, South Uist.

materials can provide useful information, especially on the natural environment, not otherwise available from the machair settlements. As a result, palaeoecological sampling sites are often close to contemporary archaeological sites on the machair, thereby providing a better insight into the impact of human activity on landscape change.

Very occasionally, long-term waterlogged contexts survive on the machair where all these forms of evidence – bone, molluscs, pollen, beetles, timber, carbonised and unburnt plant remains – survive in wet, alkaline conditions. This was the case along the waterfront at Dun Vulan (Parker Pearson & Sharples with Mulville & Smith 1999), where beetles and calcareous spherulites (identified by soil micromorphology) were used to infer the presence of a dung heap, and where artefacts of locally grown wood as well as of North American driftwood were recovered (illus 6). The remarkable preservation of this part of the Dun Vulan site is undoubtedly due to its having been built within a freshwater loch. Whilst most other Uist brochs are similarly located on islets within lochs, Dun Vulan's machair setting is highly unusual – most of the others are found in acidic peatland environments. This is because Dun Vulan was built on an islet within a freshwater loch that was inundated by machair sand (ibid, 58).

5 THE MACHAIR SEQUENCE OF SETTLEMENT AND LAND USE

The calcareous sand plain formed in the third millennium BC, burying a land surface covered with freshwater lochs (Ritchie 1979). The earliest settlements that have been found on top of it in the Uists are small, low mounds of the Beaker period (2400–1700 BC). In South Uist, four such settlement nuclei have been found. The largest is at Iochdar, where it covers an area of about 150m in diameter. Cross-ploughed fields have been identified at the Cladh Hallan and Cill Donnain settlements, and stray finds indicate settlement on the island's south coast at South Glendale (Barber 2003, 104–8). There were probably settlements off the machair in this period but they are difficult to find (for example, the Neolithic settlement at Allt Chrisal [also known as Allt Easdal] on Barra was only discovered during excavation of a nearby blackhouse (Branigan & Foster 1995, 49–50). In later millennia, South Uist's peatlands supported only a few roundhouses, the vast majority of the settlements being located on the machair.

The three west coast locations at Cladh Hallan, Cill Donnain and Iochdar were favoured locations for settlement throughout the Bronze Age (2200–800 BC). At Cladh Hallan the Beaker fields were inundated with sand and then reused as a cremation cemetery, on top of which an oval house was built around 1500 BC. Around 1100 BC this settlement was re-established as a terraced row of four or more sunken-floored, substantial roundhouses. Such nucleation is extremely rare, as prehistoric houses are normally found singly. The long-term settlement pattern of these islands, just like today's pattern, is one of dispersal.

The Late Bronze Age was a time not only of substantial houses but also of fast-accumulating settlement mounds. Whereas those mounds of the Early and Middle Bronze Age are rarely above 1m in height, Late Bronze Age and Iron Age stratigraphic sequences are often over 3m. This difference may be due to various factors: increasing dwelling size (trapping more sand), abandonment of middening on surrounding fields and retention of refuse around the houses. At Cladh Hallan, the settlement mound was ploughed right up to the walls of the roundhouses, rather different from the previous practice of manuring fields at a distance from the dwellings.

Around 200 BC there was a substantial increase in machair settlements, with mounds located about 1km apart along South Uist's west coast, in contrast to the 8–15km spacings of earlier machair settlement nuclei. Of course, coastal erosion may have destroyed some of these earlier settlement remains, but this Iron Age expansion is still remarkable. The historically recorded tradition of townships consisting of east–west strips across the island – with each managing a section of machair, peatland and east-coast moorland (Caird 1979) – may have come into being at this time (Parker Pearson 1996b). The settlement pattern consisted of brochs (in use here by at least 100 BC) and roundhouses; the higher proportions of pig bones at sites like Dun Vulan suggest that broch inhabitants enjoyed dietary as well as architectural distinction from their roundhouse-dwelling neighbours.

In the Pictish period (AD 400–900) the settlement pattern was largely unmodified, with new settlements placed in close proximity to old ones or even reusing Iron Age dwellings (Mulville et al 2003). The reduction in house size and the emphasis on bodily adornment and presentation (Sharples 2004) suggest a growing involvement in long-distance social networks. It may be significant that the only Pictish burial from this period in South Uist (at

Illus 7 A Pictish-period skeleton buried under a cairn at Cille Pheadair.

Cille Pheadair) is that of a woman (illus 7) who was an incomer, on the evidence of her strontium isotope levels (Janet Montgomery, pers comm).

The Norse period (AD 795–1266) began with a significant rupture in social and economic life, with longhouses replacing curvilinear architecture, a new emphasis on meat production rather than on dairying, and new crops such as flax and rye being cultivated. Shielings for summer grazing in the moorlands also probably came into existence in this period. There are strands of continuity, however, across this chronological divide. Pottery-making continued (albeit with a new ceramic technology), and there was a strong degree of continuity in settlement locations on the machair. At Cille Pheadair, a Pictish-style bone pin was found on the floor of the earliest farmstead, in use around AD 1020. In this period, one settlement grew larger than the others. Bornais (the name is derived from borg – broch – on the ness – promontory) was located in the middle of the island, close to the broch of Dun Vulan from which it probably takes its name, and is the only complex which was substantially bigger than a single farm.

In the Medieval period (AD 1266–1500) settlements began to decline on South Uist's machair. A few survived as late as the 17th–19th centuries, but many were abandoned towards the end of the 14th century. The settlement at Bornais was finally left at some point in the 14th century, just as a new settlement sprang up 600m away on the edge of the peatland at Bhac na Mhic Aongheis. This shift from machair to peatlands appears to have been widespread and long-term (Raven 2005). Its cause is not fully understood. Was it linked to population movements as people left for Scotland's towns? Was it due to greater use of the peatlands and moorlands for grazing? Or was it a response to increasing storminess causing devastation to machair-grown crops (Gilbertson et al 1999)?

6 DEVELOPMENT OF ARCHAEOLOGICAL METHODS AND TECHNIQUES

Machair environments are not the easiest for excavation, given the strong winds and heavy rain that may come at any time of the year. In the 1960s and 1970s Iain Crawford was advertising in the CBA newsletter for 'mesomorphs' to join his team at the Udal. He also outlined how conventional excavation techniques such as maintaining permanent sections were unsuited to the fierce weather conditions and soft sand (Crawford 1978; Crawford & Switsur 1977).

6.1 ENVIRONMENTAL ARCHAEOLOGY

Crawford was one of the first archaeologists working in Britain to employ flotation at the Udal, but it was really in the 1980s that John Barber's team brought a suite of environmental archaeological methods to machair excavation, with questions of subsistence and economy forming a substantial part of the research design (Barber 2003, 114–6). Studies of human, animal, bird and fish bones, charred plant remains, molluscs, phytoliths, pollen and diatoms accompanied the structural and artefact reports, highlighting the huge potential of machair sites and environments for integrated scientific analysis.

Most of the archaeological scientists working with John Barber were based at Sheffield University, and so it was a logical development for SEARCH to continue in this vein, refining and learning from the lessons already learned. David Gilbertson was largely responsible for training a generation of PhD students in the early years of this project, and it was their input which had a huge impact on the project's innovations and integration of methods. In particular, Helen Smith developed a methodology of analysing formation processes through an integrated suite of analytical techniques (Smith 1996) which has served as a guiding approach and way of thinking in subsequent years by developing analogues from her ethnoarchaeological analysis of farmsteads and agricultural activities.

6.2 FROM TAPESTRIES AND TEST PITS TO OPEN-AREA EXCAVATION

Dun Vulan was, hopefully, the last of the 'tapestry' excavations (in which a thin trench is cut along the eroding face of a mound). Machair settlement sites are extremely complex, and limited interventions are doomed to fail to understand the spatial ramifications of what is excavated. Tapestry excavations, test trenches and sondages can answer basic questions about sequence and chronology but they cause enormous damage on machair sites, making them methods of last resort. There is no substitute for open-area excavation.

The large-scale excavations at Bornais, Cille Pheadair and Cladh Hallan have demonstrated the merits of open-area digging with cumulative sections, planning and interpreting layers, positive features and negative features in ways that are simply not possible within narrow trenches. The folly of such approaches became clear after we had cut test pits into the main mound at Cladh Hallan. Only subsequently did we realise that identification and understanding of floor layers, interior and exterior space, house walls and fill layers had been impossible within narrow trenches. We could document sections but we couldn't satisfactorily understand them. At the same time, we dug through deposits – notably floor layers – which should only have been tackled in plan. It is now generally recognised that house interiors should be excavated in full – there is little point in excavating just part of a dwelling.

6.3 ANALYSING HOUSE FLOORS

Unlike houses in the Northern Isles, those of the Western Isles' machair have little in the way of stone 'furniture' or flooring. Often the mixed peat and sand floor layer is sealed beneath a fill of windblown sand, sometimes with an organic layer of decayed roof turfs and other vegetal matter lying between the floor and the clean sand (or interleaved with it). There may also be materials which have been left on the floor's surface, that are separate from the micro debris that has become incorporated into the floor matrix. To complicate matters further, floors

Illus 8 Phosphorus, nitrogen and magnetic susceptibility sampling on a 0.5m grid within a late Norse barn at Bornais, South Uist.

Illus 9 Flotation sampling in 0.5m squares of house floors and yard surfaces at Cladh Hallan, South Uist.

were patched and relaid, with one example from the Norse period at Cille Pheadair incorporating artefactual and ecofactual material within the matrix before it was laid. The patterning of materials is also affected by sweeping, although the distinctive distributions left by sweeping are not found before the Norse period. We assume that, previously, rubbish was removed by hand.

Occupation of houses can present us with complicated sequences of use, abandonment and re-use. The middle roundhouse at Cladh Hallan, for example, was inhabited for about 900 years (although the nature and intensity of that inhabitation changed through time), with seven rebuilds and re-floorings (in which the old floor was covered with fresh sand on top of which a new floor was laid). In contrast, other houses exhibit far more discontinuity of inhabitation. The Norse farmstead at Cille Pheadair was periodically abandoned and reoccupied over a 200-year period (*c*1020–1220), as demonstrated by evidence of abandonment in the form of rebuilds, windblown sand layers, owl pellets and human and animal faeces. In such studies, soil micromorphology, analysis of small mammal bones and plotting of faeces have complemented conventional methods of macro-scale investigation.

House floors often survive as contoured surfaces on which it is possible to identify working and sleeping areas, the latter identifiable as raised 'platforms' which often have hollows moulded into them. Geochemical (phosphorus and nitrogen) and geophysical (magnetic susceptibility) sampling at 0.5m intervals (illus 8) can further enhance our picture of their use, identifying high values of nitrogen, for example, in the sleeping areas and in the cooking area next to the hearth (Parker Pearson et al 2004, 70–3; see also Smith et al 2001). Flotation of floor layers in 0.5m × 0.5m blocks (illus 9) also enables plotting of the spatial distribution of carbonised plant remains (seeds of cultigens and weeds, chaff, charcoal, burnt organic matter, peat) as well as of the heavy residues from flotation and the material from sieving (bone and antler fragments, tiny sherds, mould fragments, beads and small artefacts, potting clay and so on). These can be compared with the distributions of larger or complete artefacts, many of which were left on floors at abandonment.

6.4 ABSOLUTE DATING

Machair site sequences present problems of interpretation concerning accumulation and deflation. A deep layer of windblown sand can accumulate in a single storm whereas centuries of stratigraphic increment can similarly be destroyed in an instant. In such mercurial depositional circumstances, absolute dating becomes an essential tool, as does careful appraisal of what precisely is being dated and what formation processes it has been subjected to.

With growing awareness of the unsuitability of certain materials for radiocarbon dating (charcoal might come from ancient peat or from driftwood; anything with a substantial marine diet contains old carbon; disarticulated bones are potentially residual) so sampling has to be carefully thought out (Ashmore 1999). In our experience, carbonised seeds (from clusters of burnt grain) and articulated animal bones (with wholly or largely terrestrial diets) are the most reliable materials for dating.

In recent years, improvements in the precision of optically stimulated luminescence dating (OSL) have made it a useful method which is even better than radiocarbon dating within the first millennium BC (when the calibration curve is particularly flat). Jean-Luc Schwenninger's involvement in the project, initially as PhD student and latterly as OSL specialist, has been a major asset in this respect. Cathy Batt of Bradford University has also obtained good results from archaeomagnetic dating of hearths, despite initial pessimism from other archaeomagnetic specialists about the suitability of such deposits. Finally, new advances in extracting tephra from sand samples potentially offer a fourth means of relating sediments to dated volcanic activity (Simon Blockley, pers comm) but such approaches will need to be able to distinguish reworked layers from undisturbed ones.

7 DIET: RESIDUES AND ISOTOPES

Certain scientific methods have been developed as a result of the project, either as responses to questions asked of the sites or because these sites offer a useful testing ground for the methods. A good example of the latter is the development of protein residue analysis of pot interiors (Craig et al 2000; 2005). At Cladh Hallan, Oliver Craig has extracted bovine casein (the protein in cow's milk) from the walls of about three-quarters of the sampled cooking pots. This method is very effectively used in tandem with lipid analysis and is providing a good insight into the foodstuffs boiled in prehistoric roundhouses. High lipid values just below rims (ie indicating cream settling at the top) suggest that milk was left to settle in these pots rather than being introduced as a waterproofing agent.

Oliver Craig and Jacqui Mulville have also developed a programme of stable isotope analysis ($\delta^{13}C$ and $\delta^{15}N$) on bones of different species to compare with levels in human bones. This has demonstrated that, despite the quantities of limpets and winkles, little marine-derived protein was being consumed by Bronze Age individuals (Parker Pearson et al in press). Analysis of strontium and oxygen isotopes in human teeth has also shown that these prehistoric Hebrideans grew up locally and that it was only in the Pictish and Norse periods that incomers are evident among the population of these islands (Montgomery et al 2003).

7.1 INFERRING MUMMIFICATION FROM SKELETONS

The discovery of some unusual skeletons buried as foundation deposits beneath the Cladh Hallan roundhouses has led to a programme of chemical analysis to confirm that three of these were retained long after their deaths as mummified corpses (Parker Pearson et al 2005; 2007). Mummification has not been previously recognised in prehistoric Britain and thus these finds of a woman's skeleton, a composite skeleton of three different men and a three-year-old child's skeleton are of considerable interest. Radiocarbon dating established that the bodies were much older than their context of deposition. Analysis of the bones by mercury porosimetry (MgP), short-angle X-ray scattering (SAXS) and thin section microscopy have revealed that processes of bodily decay were interrupted and halted soon after death. Fourier-transform infra-red spectroscopy (FTIR) has also identified a demineralised surface layer on the bones, which suggests that the corpses were preserved by short-term soaking in peat (Parker Pearson et al 2005). The new suite of methods offers the possibility of examining other suspected examples of prehistoric mummification from Britain and elsewhere.

8 PRIORITIES FOR THE FUTURE

The SEARCH project and its successors are currently winding down but fieldwork still continues and there are still research objectives which have yet to be met. At Howmore, Andrew Reynolds and John Raven have been investigating the island's ecclesiastical history. On Cill Donnain machair, Early Bronze Age settlements and monuments provide an important prehistoric landscape which requires further investigation. ARCUS (Archaeological Research Consultancy, University of Sheffield) has excavated remains of Neolithic and probably Mesolithic activity in advance of a road improvement scheme at the base of Bharpha Langass in North Uist. Another Neolithic settlement at An Dorlinn near Orosay in South Uist has been exposed by winter storms and requires excavation before it is washed away. There are also priorities for future management and public involvement as well as research:

1. Rabbit damage has to be controlled if not curtailed throughout the islands. Overshadowed by recent wildlife concerns about the impact of hedgehogs on bird populations, rabbits are causing long-term and systematic damage to stratified settlement mounds on a scale which will render most of these sites archaeologically useless (except for those, such as Cladh Hallan, that are deeply buried beneath windblown sand) within this century if not very soon.

2. After Ritchie's pioneering work on machair formation in the 1970s, relatively little has been done to date the spread of machair across the west coast of the Uists. Its progress in the last 5,000 years, covering the coastal plain and infilling freshwater lochs, could be easily tracked with a well-targeted programme of sampling and dating of machair sands and associated sediments.

3. Major events of deposition of blown sand can be dated by OSL, both within settlements and elsewhere on the machair. The current framework (Gilbertson et al 1999) can be tested through a wider systematic study.

4. The SEARCH project and subsequent studies have made relatively little impact on our knowledge of early prehistoric settlement. It seems unlikely that the Beaker-period settlements sit on top of Late Neolithic occupation sites in a manner similar to that at Northton on Harris, given the great depth of machair sand in these localities. On the other hand, pre-Beaker settlements are more likely to be found off the machair on the blacklands (where the Neolithic chambered cairns are located) and further work is required in these landscapes to provide a complete sequence of island history from the Mesolithic onwards.

5. Beaker-period and Early to Middle Bronze Age settlement mounds are a high priority for further research. It is highly likely that the earliest use of Beaker pottery in Britain (*c* 2600–2500 BC) predated its appearance in burials (2400–1700 BC) and thus the settlement sequences of the Western Isles may provide evidence of this earliest horizon of use. Even in the light of excavations at Northton (Harris), Dalmore (Lewis) and Rosinish (Benbecula), we still know little about domestic use of space in this period or about other aspects of social and economic life. Pottery styles such as Cordoned Urns (*c* 2100–1600 BC) are mostly known from their funerary contexts, and this is an opportunity to study their use in domestic settings. The Middle Bronze Age is also the period when mummification and curation of preserved corpses was practised (Parker Pearson et al 2005; 2007), and we need to shed light on how this was effected in daily life. On Cill Donnain machair a standing stone and a suspected stone circle (both buried beneath the sand) provide a monumental dimension to this landscape. The close spatial juxtaposition of stone monument(s) and settlements at Cill Donnain provides an important opportunity to explore this landscape in more detail.

Illus 10 Jim Symonds and the information board at the Flora MacDonald Birthplace, Airigh Mhuillin.

6. Popular involvement in presenting and visiting archaeological sites and exhibitions is growing strongly (illus 10). The new extension at Kildonan Museum and the new Barra heritage centre provide foci for interest among locals and visitors. An on-site display is planned for Cladh Hallan and there are further plans for better presentation of Dun Vulan and the Cille Pheadair wheelhouse site. Conservation of stone buildings on the machair, with their sand mantles removed, is a difficult and expensive option, but there is great public interest in making more of these structures visible and visitable, as has been shown in Shetland at Old Scatness (Shetland Amenity Trust 2007).

9 ACKNOWLEDGEMENTS

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