Characterising archaeology in machair

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1 ABSTRACT

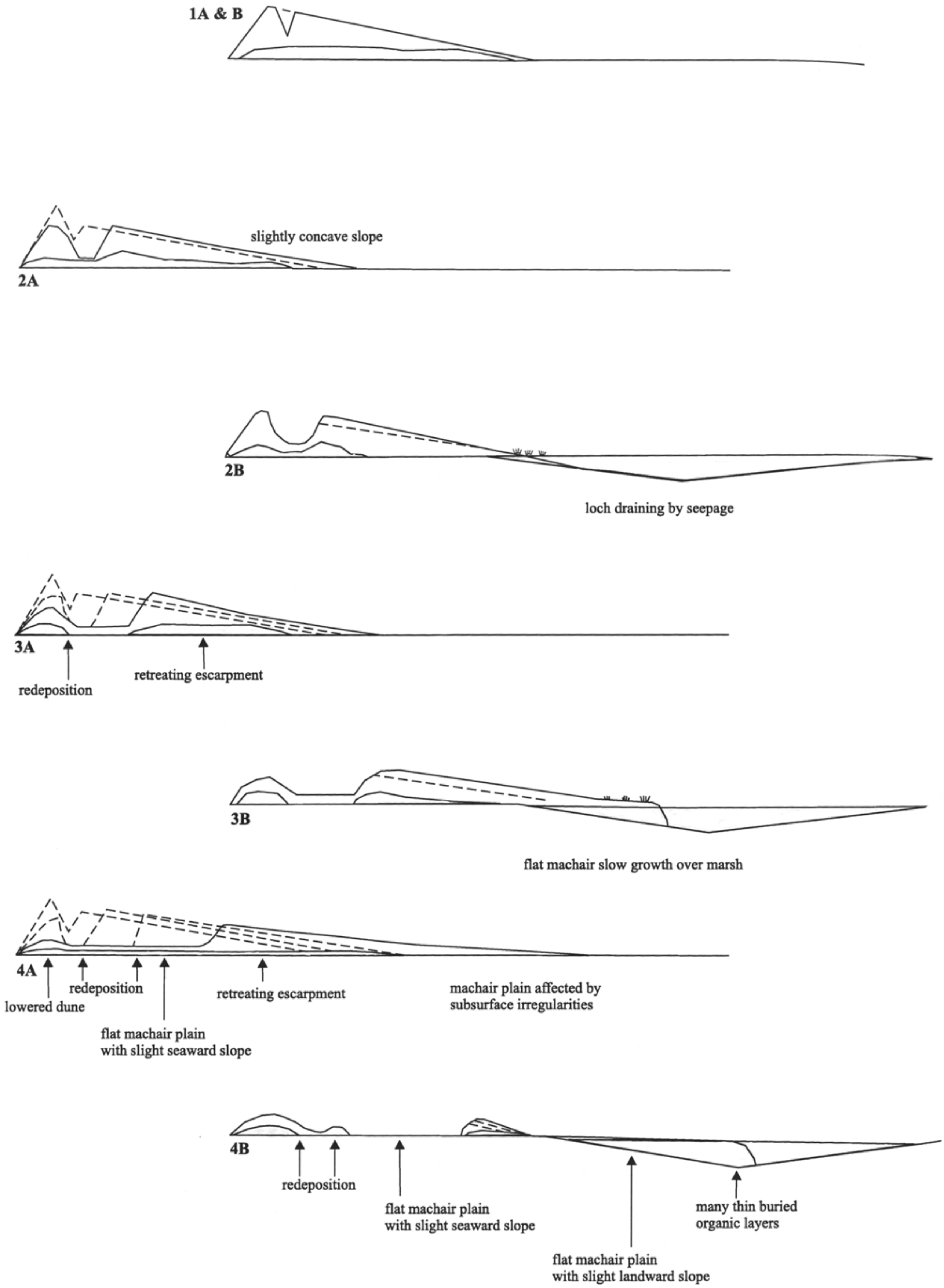
This paper deals with methodological issues involved in excavating in the machair, shell-sand systems of the Outer Hebrides and the West Coast of Scotland. The machair system is characterised by high rates of change, driven by Aeolian forces, interspersed with which human settlement intermittently occupied sites and altered the depositional regime, only in turn to have its deposits altered by subsequent human and natural processes. Characterisation of the sites and their contained deposits requires an understanding of the processes by which both anthropic and natural deposits were formed. Dating the sites and deposits requires an understanding of the dynamics of the relationship between the natural environment and the role humanity played in modifying and being modified by natural processes. Many of the richest deposits are diachronic and traditional chronology building can lead to misleading results. Rather, the focus must be on understanding and dating the sedimentary sequence and then intercalating the sequence of human activities into that depositional chronology. The almost universal availability of radiometrically datable organic materials is vitiated by the difficulties they pose for dating, and careful selection from taphonomically sound contexts is a *sine qua non*. The west coast machair sites are probably the richest, if also the most challenging sites in Scotland. In the aggregate, especially in the Hebrides, they represent a cultural landscape of outstanding cultural value. Their treatment by curators falls short of what they require and merit, and in a period of rapidly rising sea levels time is not on our side. More could be done and more must be done to salvage what we can from these wonderful archaeological monuments.

2 INTRODUCTION

I have taken the term 'Aeolian archaeology' in the conference title to refer to Scottish west coast, shell-sand, machair sites, simply because I know a little about these sites. How transferrable my comments may be to mineral-sand sites is for the reader to judge, although my observation of sites like St Boniface and Tuquoy suggests that such sites have much in common with their west-coast cousins, particularly in terms of the formation processes involved. That said, there are also some important differences between them, the machair sands having a uniformly high pH, with associated excellent preservation of bone, for example, while mineral sands can be quite acidic and have poor preservation conditions for bone and the other calcium-based materials and for metalwork.

I use the term 'machair systemics' to describe the study of the forces, materials and processes involved in the creation, modification and destruction of machair sites and of sites within machairs. The systemics of machair formation in Scotland have been studied by Ritchie, and illus 1 is drawn from his work (Ritchie 1979). The entire machair is a system, and aspects of that natural system were also discussed during this conference. Human intervention in the machair system presents an excellent example of what Butzer (1982) described in his book of the same name as 'archaeology as human ecology'. Machair is a prime human ecological niche; it is ecotonal, between terrestrial and marine ecosystems and has positive value in its own right, especially for agriculture. The machair system is many orders of magnitude greater in all respects than the scale of cumulative human intervention in it, and it is quite impossible to understand the latter without first grasping something of the former.

Examination of the long history of human engagements with the machair landscapes has identified a pronounced human capacity to accelerate or impede the rates of natural change and perhaps from time to time also to reverse the direction of change. The substrate of the machair is shell sand. Machair systemics suggest that the natural forces, materials and processes that create, modify and destroy machair are central also to the formation, modification and destruction of archaeological sites within machair. Those forces are in continuous operation; the system is meta-stable or, at the very least, its apparent stability is a dynamic equilibrium maintained over periods probably not much longer than single human lifetimes. The principal dynamic force is the wind, while the principal static source of resistance to that force is water, particularly ground water, and the mean annual level of the water table is the determining factor in the formation of the absolutely level machair plains which give the system its name (*machair* means 'plain' in Gaelic).



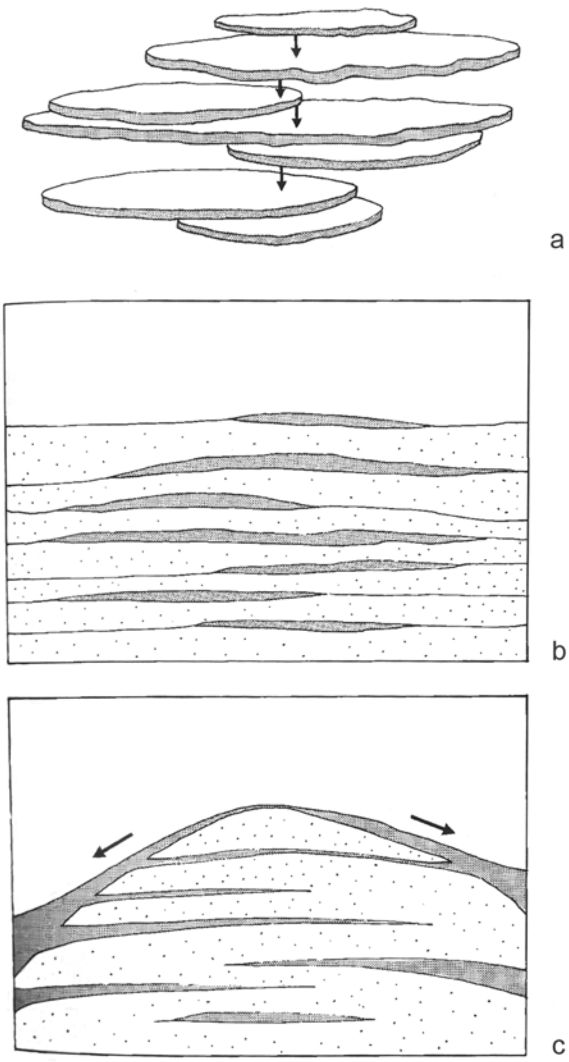
Illus 1 Models of machair evolution (after Ritchie 1979).

3 DISTINGUISHING 'ARCHAEOLOGY' FROM 'NOT ARCHAEOLOGY'

As with the loess soils of the North European Plains, the shell sands of the machair system are placed in situ by wind alone. Thus, even the merest pebble within machair deposits must have been introduced. At one level then, characterising archaeology in machair is easy: anything that is not shell sand was brought onto the machair. Seabirds do deposit some shells on the machair surface and grazing animals and some carnivores (including otters) deposit dung on the machair, and perhaps the remains of their meals, but these contributions are few and widely dispersed. The probability that any given non-sand entity is anthropic in origin is very high and if there is more than a handful of material, that probability mounts to certainty. Thus, characterising archaeology as distinct from 'not-archaeology' on the machair really is straightforward. Characterising archaeological deposits, in contra-distinction to each other, requires some consideration of how human activities meshed with machair ecosystems to result in anthropic formation processes and anthropic deposits.

4 CHARACTERISING ARCHAEOLOGICAL DEPOSITS AND FORMATIONS

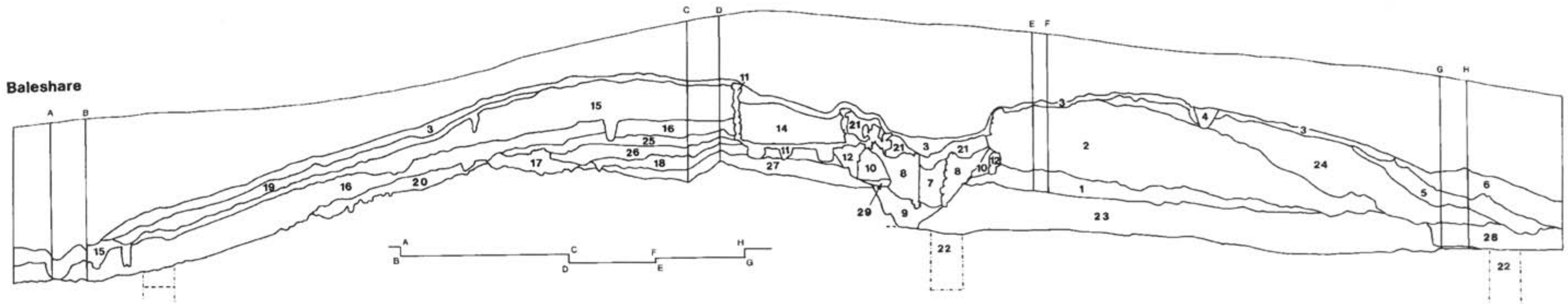
We have already noted that the formation process in machairs is dominated by the wind-powered distribution or redistribution of comminuted shells. Deposits associated with settlement are often wet or damp and retain moisture because of their clay (or clay-like) composition. These include midden material, decayed vegetable matter, faecal matter, animal dung, peat used as fuel and as bedding, decayed thatch, etc. These deposits resist movement themselves and provide a 'sticky' surface onto which mobile sand particles can adhere. Thus, anthropic deposits tend to accumulate within machairs and to include or subsume shell-sand deposits.



Illus 2 a, b, c Plates of settlement-related deposits (a) are laid down in a continuously accumulating wind-blown sand matrix (b); subsequently, deflation of the matrix produces a domed mound covered by a conflation deposit (c).

4.1 DYNAMISM AND SENSITIVITY: PROCESSES OF WHOLE-SITE FORMATION

It is almost always impossible to relate anthropic site deposits to their contemporaneous machair landscapes or to contemporaneous natural machair deposits. The formation of a typical machair site is predicated on the use by humans of a particular location over time and it does not matter whether the occupation was continuous or intermittent. Let us envisage a situation in which sand is being continuously deposited at the particular point in a machair system at which human settlement is in progress. It is reasonable to assume that, over time, the extent and the foci of human settlement would have varied. Thus, the superimposed deposits would not fit exactly over each other in the deepening natural shell sand but instead would resemble an untidy pile of pancakes. If the settlement is intermittent or if the intensity of settlement (as represented in the volumes of detritus accumulating on-site) varies, and assuming that the machair continues to form while this settlement is in use, we would arrive at the situation modelled in illus 2a. In section these would appear as represented in illus 2b. However, the real-world situation is typified by that represented in illus 2c. The sites are in general dome-shaped (illus 3), the upper surface of the dome being a more or less continuous layer, apparently comprising an archaeological sediment. This covering layer often merges into the edges of the more or less horizontal layers of the site. It is not possible for this situation to arise naturally. The covering layer cannot be contemporaneous with the succession of deposits and yet this is apparently implied by the way it touches most or all of them. If, however, we imagine that the shell-sand matrix in which the site's deposits accumulated was blown away in some past storm or during some period of erosion of the machair, we can begin to understand the gross morphology of these sites. Initial removal of the surrounding sand would have exposed the succession of layers in the margins of the site and the wet material in these layers would have resisted further erosion, to greater or lesser extent. Grass cover would eventually have stabilised the site and a new A-horizon would have formed over the whole of the site, creating an apparently continuous layer but one that would incorporate materials from all of the periods represented in the sediments of the site exposed around its margins (illus 2c). It may also include material from layers that have been completely removed by aeolian erosion, the more dense materials simply dropping down the profile as the softer sands were blown away.



Illus 3 The domed structure of the site at Baleshare is clear from this photograph, despite the deep overburden of wind-blown sand. In the cross-section, a conflation deposit (Strat Block No. 3) comprising, effectively, a single layer, covers the archaeological deposits on the left-hand part of the site. In comparison, the block of deposits beneath this (Strat Block No. 15) comprises 14 separate deposits.

The processes of aeolian erosion and of the formation of deposits as a direct result of this purely natural process contribute to and sometimes confuse site formation in machair. The processes involved are set out here to introduce and define some terms of more general use.

4.1.1 Deflation

The process of deflation means the removal of sand by the force of the wind alone. Used as an adjective, the term can refer to the resultant landforms, for example 'deflation hollow' or 'deflation deposits'.

4.1.2 Conflation

Following the removal by wind (that is, deflation) of sandy deposits, the anthropic component of these deposits, for example bone, shell, pottery and so on and, in the context of machair sites, including stone also, does not blow away but comes to rest on some arbitrary surface, forming a deflation deposit. The resulting spread of materials may include remains of different origins and dates and at South Glendale, for example, includes Beaker, Iron Age and Medieval pottery (Barber 2003). The spread of materials can become incorporated into a new deposit, either by inundation in a fresh deposit of wind-blown sand or as a result of incorporation by bioturbation, in the deposit on whose surface they have come to rest. In either event, the resulting deposit is known as a 'conflation deposit'.

Stone structures that have been exposed by the landward progression of steep-sided erosion hollows tend to collapse into more or less amorphous piles of stone. However, where the eroding stone structure is revealed in an area from which sand is being removed over an extensive horizontal surface, the gross morphology of the structure may survive deflation.

4.1.3 Diachronic deposits

The sediments of a typical machair site contain *deflation deposits* that once lay on *stabilisation horizons* and that may, or may not, have become incorporated in *conflation deposits*. Both *deflation* and *conflation deposits* are diachronic. They are commonly the richest deposits on these sites but their assemblages are palimpsests and potentially misleading. Best practice requires that radiocarbon submissions from machair deposits should contain evidence that the deposits are neither deflation nor conflation deposits, otherwise the dates resulting are likely to prove misleading, especially if the chronology building for the site follows the traditional pattern of dating 'keynote' events rather than trying to establish a date-and-duration framework for the depositional sequence. On more extensive sites, like the lower Bronze Age field system at Baleshare (Barber 2003, 44) conflation may be harder to see because the exposures over which we typically observe them are too small. But the likelihood is that these large exposures are all diachronic since their morphology (extensive horizontal spreads) and heterogeneity imply formation by deflation, probably to some then-current water table.

5 DEPOSIT FORMATION

Separate deposits build up into sites and some understanding of these deposits and their formation processes should guide our understanding of the sites themselves.

5.1 DUMP DEPOSITS AND DUMPED DEPOSITS

Dumped deposits are characterised by their clear boundaries and usually by the low volume of the individual contributions. They will have been formed in discrete packages, such as could be carried on or in a shovel or basket or, perhaps, wheelbarrow or cart. Dumped deposits need not contain any anthropic materials but often do so in considerable quantity. In the aggregate, a contiguous set of dumped deposits constitute a dump deposit. Dump deposits usually display large-scale heterogeneity coupled with small-scale homogeneity, that is, while the single dumped deposits may be quite homogeneous, there can be considerable diversity amongst the individual contributions making up one dump deposit. Needham & Spence (1997) and McOmish (1996) emphasise intentionality as an important consideration in the definition of dumps and the categorisation of dumping activities. Intentionality can be confidently attributed to the removal of material from its original source. The act of gathering it together and moving it to its find-location (archaeological context) is a necessary precondition for the deposit's formation and cannot be other than deliberate. However, it is difficult to demonstrate intentionality in its disposal. Was its final resting place selected as a conscious act of human will? Structured deposition, a heavily overworked concept, presumably results in deposits for which, it is argued, their final resting place was not only selected as a conscious act of human will, but was selected to the conscious exclusion of all other places, in the enactment of some form of ritual (see Hill 1995 for discussion). The identification of structured deposits relies on an interpretation that cannot be verified in the contents of the deposit alone, and thus it should probably not be used as a primary descriptor of deposits. Rather, it should be identified explicitly as an interpretation (or a conclusion) arising from specific observations of particular material remains in specific contexts.

5.2 MIDDEN

The term 'midden', of Scandinavian origin, is composed of the elements *møg* (muck) and *dynge* (heap) and simply means 'muck heap' or 'dung heap' (*OED*). In the late nineteenth century it came to be used as an abbreviation for 'kitchen midden'. The latter term was a useful archaeological descriptor but the archaeological abuse of the term 'midden' has devalued it and caused some confusion (see Needham & Spence 1997; and McOmish 1996 for useful discussions). Here the term is reserved strictly for deposits that are interpreted as accumulations of refuse intended for reuse as manure. A midden may contain dumped deposits and incorporate midden-site deposits.

The terminology used in the description of 'middens' and the deposits they contain is fraught with difficulty. Michael Schiffer (1987), more than any other archaeological writer, has provided a relatively clear account of deposit formation. Implicit to his exegesis is the interplay of natural and anthropic processes in deposit formation. This interplay merits consideration in dealing with machair deposits which occur in a spectrum of proportions of natural to anthropic. Deposits of machair sand with minor anthropic inclusions lie at one end, while dumped deposits of purely anthropic material with only minor amounts of machair sand lie at the other. In my publication of work in the Hebrides (Barber 2003), I used terms like 'midden-site' deposits to name certain deposits formed on the types of sites that were then called 'middens', and so on. Prompted by one of our editors (Ashmore) I move away from this here, to embrace the principles underlying the terminology of Schiffer, in the hope that this will make things a little clearer for the reader. Thus, where the term 'midden-site deposits' was used in SAIR 3 (ibid), the term 'anthropic deposit' is used in this paper to emphasise the fact that a deposit of this type is characterised by its anthropic content rather than its natural (shell-sand) matrix.

5.3 ANTHROPIC DEPOSITS

An anthropic deposit is a deposit whose matrix has been enriched with relatively large amounts of anthropic material, artefactual and ecofactual, where the material has not entered the deposit as a result of deliberate dumping. Rather, the anthropic material arrived in these contexts by some combination of loss (accidental dumping), abandonment (of butchery waste, for example, at a primary butchery site), or incidental discarding (littering).These contexts can be quite extensive and where sufficiently extensive are perhaps better described as anthropic *soils*, rather than deposits. This distinction is based on the probability that anthropic material has been incorporated into an existing matrix or was progressively included into a matrix being formed by natural processes. Anthropic deposits can also be created where dumped or other deposits have been cultivated and further manured, but these deposits are treated as 'cultivated deposits' (see below).

5.4 MIDDEN SITES

A midden site is a site composed principally of anthropic deposits but which includes other types of deposit within the machair system. This term substitutes for the archaic term 'kitchen midden'.

5.5 CULTIVATED DEPOSITS

Virtually all of the deposit types encountered on machair sites exist also in hybrid or mixed forms, and cultivation is the most frequent cause of their hybridisation. Dumped deposits or anthropic deposits are the most commonly cultivated deposit types. The resulting cultivated horizon (it can and probably always does include more than one original deposit) is usually so heterogeneous that it is not often possible, unambiguously, to identify the nature of the parent deposits. Further, there seems to be a more or less continuous spectrum embracing cultivated dumped or anthropic deposits, highly manured cultivated sands and plaggen soils. Of course, the practice of making soils continues to this day in the Hebrides, with the Lewisian Black Earths compounded of mineral soil, peat and shell sand in varying combinations which form extensive areas of cultivated land in Lewis and Harris. Glentworth (1979, 134–35) has commented on the heterogeneity of these anthropogenic soils in the Hebrides, which extend to their composition, superficial forms and the patterns of their use. It is probable that the cultivated deposits of the machair sites would not look out of place in modern Lewis. In Orkney the anthropogenic soils associated with Norse settlement (the Bilbster Soil Series) are sufficiently extensive to have been mapped and categorised by the Scottish Soil Survey.

6 PRESERVATION IN MACHAIR SOILS

Preservation of calcium-based materials in machair sites is facilitated by the high pH of the shell-sand matrix. Materials that are relatively rare on Scottish sites, bone (animal, human, fish and bird) and shell (sea, snail and egg), survive in relative abundance on machair sites. The soft, uncompacted matrix means that pottery sherds survive in abundance. Even in cultivated, heavily trampled or re-worked deposits, potsherds survive in large numbers. With the enhanced survival of sherds, it is possible to use the distribution of sherd sizes from a context as an index of the extent of turbation of that context. Iron and other metals are rare in the machair sites and even slag is relatively uncommon. However, hammer scale and very small fragments of casting flash are regularly encountered in these sites. This implies that metals would have survived on-site, had they been deposited there. The relative absence of metal objects implies that cultural factors, like the heirloom status of metal objects, precluded their accidental or deliberate inclusion in machair deposits.

The range and abundance of material recoverable from machair has met with the usual responses from finds specialists; and typologies have been formed in varying degrees of sophistication for individual sites. Most of these have proved utterly inapplicable on other sites. The pottery sequences proposed by various authors are *sui generis* to their sites and indeed more often than not even conflict with the evidence from that site's stratification. Of the available typologies only that for pins seems broadly applicable, and the apparent duration of the currency of, for example, nail-headed pins means that they are not really chronologically diagnostic (A Heald pers comm). Though this writer cannot demonstrate it, he surmises that the characterisation of entire site assemblages and the phenomenon of assemblage-variation over time may prove a more useful diagnostic than our current emphasis on individual material typologies, much less our reliance on isolated exotic imports for dating of sites and deposits (Clarke 1971).

6.1 CHRONOLOGY-BUILDING ON MACHAIR SITES

As we might expect with depositional environments that are so dynamic, the rates of deposition on machair sites can be very high. Sets of deposits between 2m and 3m deep were formed at Hornish Point, Balelone and Baleshare in periods of time too short to be resolved by the radiocarbon method. However, the correspondence between radiocarbon dates and stratigraphic position is uniformly excellent. Thermoluminescence dates, including OSL dates, are far too imprecise for meaningful use in this rapidly accreting environment. Traditional archaeological dating strategies may not provide the most productive approach to chronology-building in machair sites. The traditional strategy has been to radiocarbon-date contexts that have significant contents or that date or bracket the foundation of structures. This inherently unsatisfactory practice has an even greater than usual capacity for misleading results in machair sediments because so many of the richest deposits are conflation deposits and thus are diachronic. However, machair-site sediments usually form coherent depositional systems, and reliable chronologies can be formed by dating the sedimentation process rather than by cherry-picking specific events within it.

6.2 LOSS OF SEDIMENTS

Ard marks in the cultivated deposits are sometimes filled with material that differs not only from the deposit in which they are found but also from the overlying layer through which, in theory, they were cut. I have interpreted some of these occurrences as evidence for the loss of the upper part of the cultivated horizon. During my stay in the Uists I have seen examples of the desiccation and resultant aeolian erosion of cultivated fields during the summer months. To limit this, the farmers set their ploughs very shallow in an attempt to preserve the root mat in situ, as an obstacle to erosion.

6.3 PRACTICAL PROBLEMS IN THE USE OF RADIOCARBON DATING ON MACHAIR SITES

The machair environment presents some severe challenges to the radiocarbon method. Driftwood from the Americas is regularly found on the Hebridean beaches (Dickson 1992) and was no doubt used in antiquity as fuel and for structural timbers, as it still is. Peat was widely used as a fuel, and carbonised twiggy material from burned or charred peat is also commonly encountered in site deposits. Unburnt and charred peat was also abundant in the sites I have examined (Barber 2003). Carbonised material like charcoal or seeds is highly mobile in the machair environment and pockets of carbonised materials have been observed forming behind stones or in shallow depressions in current deflation horizons. Clearly, this material may have derived from any number of discrete contexts, the matrix of which has been blown away. The impacts of these problems can be mitigated by proper identification and by careful study of the taphonomic processes involved in the formation of the deposits in which the samples are found. However, they cannot be eliminated completely.

The 'old-wood' problem may prove particularly severe in machair areas also because of the general scarcity of trees. In addition, large timbers were curated and acquired heirloom status. Loss of such timbers by accidental conflagration, for example, would incorporate in apparently 'sealed' contexts dating samples that are significantly older than the contexts from which they come. Taken as a whole, cereal grains from well-defined and taphonomically well-understood contexts probably constitute the only carbonised material that holds much prospect of providing reliable dating.

The marine reservoir effect complicates the radiocarbon assay of sea shell which is abundant in almost every context encountered in the machair sites. Carbonised cereals and sea shells from an inadequately small number of samples from these sites were dated, in an attempt to examine the stability of the marine reservoir effect, and these seemed to suggest that Harkness' standard correction, that is 405±40 for marine reservoir effect was not perhaps as universally applicable as had been believed (Harkness 1983). A research programme was initiated (Barber 2003, 18.12.1) to examine the hypothesis that this relationship was not a constant. First results (Ascough et al 2004, 2005a, 2005b & 2006) indicate that our suspicions were well founded and specifically, that a reduction of 80 years should be applied to the standard 405 years for date in the few centuries either side of the beginning of the Christian millennium. It is ironic, perhaps, to note that had we ignored our concerns and applied Harkness' correction factor we would have been closer to a defensible estimate of true age than we would have been had we argued for the use of determinations completely uncorrected for marine reservoir effect. The significance of the dating of the Hebridean sites will be considered in a forthcoming paper (Barber et al forthcoming) which this writer hopes will resolve any confusion his treatment of the chronologies has created.

Whom the Gods wish to destroy . . . Radiocarbon dates for the Iron Age machair sites wreak a final indignity on the archaeologist. Significant numbers of these Iron Age dates lie in what Baillie (Baillie & Pilcher 1983) has described as the disaster zone of the first millennium BC calibration curve, making their calibration extremely problematic. In practice, adjusted for the revised MRE value, the dates for the sites reported upon in SAIR 3 (Barber 2003), in the main miss the most difficult part of the curve. However, the problems posed in calibration for the first millennium BC are real, and are significantly amplified for sites from which there are only single or few dates. It further complicates the issue of inter-site comparability of site chronologies in the treatment of which the greatest caution should be exercised.

It is perhaps ironic that so many problems attach to the dating of sites so exceptionally rich in potential dating material. There is clearly a need for some sophistication in the design of chronology-building strategies for these sites. These strategies must rely on 'absolute' methods, and radiocarbon dating is the only practicable method available to us. For the foreseeable future artefactual dating will have to be derived from radiocarbon dating, and while the proposed material typologies are undoubtedly of general interest, their chronological value remains to be demonstrated. We may hope for further improvements in the techniques of radiocarbon dating and its calibration, but it should be clear that a meaningful understanding of the taphonomic processes of deposit formation within machair sites will remain an absolutely essential prerequisite to their successful dating.

7 CURATORIAL RESPONSE

The sites examined in this writer's campaign in the Outer Hebrides are actively eroding. Balelone has now been totally removed by the encroaching sea and the erosion faces of all the other sites now lie up to 10m back from the faces examined by AOC in 1983–85. As part of the work of the final season on these sites, we cored extensive areas behind the known sites. Subsequent survey and other work by Sheffield University has also explored the machair, especially that of South Uist (see Parker Pearson et al 1999, which references earlier works in the SEARCH project and see Parker Pearson in this volume, for a SEARCH bibliography). It seems reasonable to conclude that the sites we can now see represent the greater part of the available resource of such sites. They are without doubt amongst the richest sites in Scotland, particularly for the Iron Age, but are of great significance for the deposits of all periods that they contain. By the internationally (Burra Charter 1999) and nationally (proposed new Scheduling criteria, HS 2005a) agreed criteria for the determination of cultural value, these sites are of national importance and, in the opinion of this writer, the Hebridean coastline is a cultural landscape of the organically evolved type and of the relict species (UNESCO 1999). As a group of sites, this cultural coastline is of international significance for the way in which the machair sites and the machair system demonstrate the evolution of the relationship between people and place over time.

The curatorial response to the loss of these sites has been inadequate. That is not to say that nothing has been done or nothing achieved; neither conclusion is fair. But the scale and duration of our investigations of these machair sites is wholly inadequate and their continuing and certain loss reflects poorly on those charged with their preservation, even if that preservation can now only be achieved by record. The recently published volume on coastal erosion sites in Scotland (HS 2005) bears witness to the work of surveys already undertaken, but this is only of academic interest to administrators and students of heritage management. Heritage value will not accrue until we move forward with programmes of on-site management, recording and salvage, augmented by extensive excavation analysis and publication of some of these remarkable sites.

Future generations will rightly hold us to account if we fail to make a response to this threat that is commensurate with the value of these sites and the scale of our potential loss.

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