

## **Appendix 1: Pabaigh 2005: Soil Survey and Sampling (Jo McKenzie)**

### *Introduction*

Deepened anthropogenic, or 'plaggen' soils, which can be over a metre in thickness and are the result of long-continued manuring of early arable areas, have in recent years become a focus for geo-archaeological research into past patterns of land management and landscape organisation within (especially) the Northern Isles. Combinations of geochemical and micromorphological investigations, in allowing identification of both mineral and organic fertilisers used in antiquity, have also revealed changing patterns in the use of these resources which, when coupled with more traditional spatial and stratigraphic archaeological analyses, are providing insight into more widespread agricultural system changes (Simpson and Guttman, in Crawford 2002).

Of particular interest to these investigations is the highly significant transition in manuring strategy seen in these soils, so far datable only to the mid to late Iron Age, where the focus on domestic waste materials seen in Late Bronze/Early Iron Age deposits gives way to the reliance on livestock manure and turf additions seen in Norse period deepened soils (ibid.) While it is possible that these changes represent an indigenous development in agricultural strategies - motivated perhaps by population growth and/or increasing social complexity associated with the development of the Iron Age broch - another possible explanation for this decisive shift towards a more integrated and therefore presumably more intensive agricultural system is that these changes were introduced to the Western and Northern Isles of Scotland by early Christian missionaries: the papar priests. A deepened anthropogenic soil associated with the Abbey on Iona, possibly originating in the seventh century, supports this view (Barber 1981). In order to investigate this possible link between the papar and agricultural change in the Western Isles, a soil survey and sampling project was undertaken on the island of Pabbay, near the early teampull or chapel sites at Bailenacille, over a six day period during May 2005.

### *Pabaigh*

Extensive relict field systems marked by drystone dykes and surviving rig-and furrow testify to Pabaigh's renowned fertility and the intensive cultivation the island has seen in the past (see above). However, no previous survey or investigation into the location or survival of cultural soils upon the island has taken place, and the little archaeo-historical information available for landscape change and development in Pabaigh concentrates rather upon the severe storms which hit the island at the end of the seventeenth century (Lawson 1994, 15). As a result of these, almost a third of Pabaigh's cultivable land was lost to sand-blow, and with it much of the habitation within the easternmost parts of the island. It is therefore possible that some or all of Pabaigh's cultural soils - including those which may prove contemporary with the papar priests - may be buried beneath deep and extensive tracts of sand.

A short preliminary investigation, firstly, to establish whether deep anthropogenic soils could be located on Pabaigh and secondly, to find out whether these could safely be reached through more recent sand deposits by hand-excavation alone, was undertaken prior to the survey and sampling project. This investigation focussed on the southern area of the island, around the areas of the main townships of Bailenacille in the far south, Baile Lingay slightly to the north-east and, most significantly, the area surrounding the chapels

and graveyard, located between these two settlements. This investigation, although time-constrained, was able to conclude that anthropogenic deep topsoils reachable by hand auger (i.e. at a depth of not more than 1.2m) were located adjacent to the chapel, and also, though possibly to a lesser extent, at several points further north towards, though not immediately adjacent to, the township of Baile Lingay.

A survey and sampling programme was devised using the results of this investigation as a parameter guide. The objectives of this were, firstly, to undertake more detailed auger survey to establish the depth and extent of the cultural soils adjacent to the chapel, and, time permitting, to extend this survey through the two township areas displaying relict settlement and establish the extent of cultural soil formation over a wider area. Secondly, to sample these cultural soils for micromorphological and geochemical analysis and also for dating evidence, in an attempt to establish whether they could be related to the posited activities of the papar on the island of Pabaigh - specifically, do these soils display the characteristics associated with the Late Iron Age agricultural transition and therefore link these changes to the influence of the papar communities?

The location of standing chapel remains within the survey and sampling area offered an extra dimension to this second objective, and it was intended that sampling points within the chapel area be located within the archaeological trenches aimed at resolving the relationship between the soils and the chapel building itself.

### *Methodology*

A detailed survey was undertaken to establish the depth and nature of the topsoil in and around the chapels, and a less intensive 'fieldwalking' survey undertaken around the areas of the Bailenacille and Baile Lingay townships as well as some areas to the west of the island showing surviving evidence of field systems.

All survey was undertaken with a handheld auger, allowing exploration to a depth of 1.2m. Auger point intervals varied. Initial intensive survey around the chapels was conducted over 2-5 metre intervals, dictated by the stoniness of the ground, over a 20m<sup>2</sup> grid in an area of flattish ground to the immediate north of the graveyard where deep topsoil was known to be in evidence. Further to the north of this, the ground surface became sharply undulating, indicating the possibility of either sand dune formation or possibly the survival of settlement remains beneath the modern topsoil north of the chapels. More intermittent survey, generally over 10 metre intervals, was undertaken in this area in two lines extending north from the grid over approximately 70 metres to the modern fence line. Further intermittent survey was undertaken beyond this fence line up to the township of Baile Lingay. To the east and south of the chapels, undulating ground, here more clearly associated with sand dune development, dictated the extent of an auger point survey which generally operated at 5m intervals and extended roughly 15 m to the east and south-east of the Teampull Mhòire. To the west and south-west of the chapel, grave locations prevented auger points being taken in all but a few small areas.

Intermittent survey further away from the chapels, at the Baile Lingay and Bailenacille townships and through field systems further to the west, focussed on establishing the depth of topsoil in recognisable fields, depth of rig and furrow, the relationship between several possible shieling sites and their surrounding soils, and, in the township areas, on the depth of soil in several small enclosures adjacent to standing buildings, possibly kailyard enclosures.

## Results

### *The township areas*

Survey in both the Bailenacille and Baile Lingay township areas proved disappointing, with only very limited evidence for the development of deep anthropogenic soils. Survey generally showed a thin loamy topsoil over bedrock or, more usually, a grey (7.5YR6/1) sand of varying depth. Some sand blow was evident, especially at the eastern points of Baile Lingay. Isolated small areas of deeper topsoil, generally a dark to dark greyish brown (10YR5/2 – 10YR4/2) were noted near to settlement at several points at Baile Lingay, but none of these exceeded 30 cm in depth.

### *The field systems*

No deep anthropogenic soil was noted in any survey through these areas further west. Soil texture, colour and drainage varied throughout and were not recorded.

### *The chapels and graveyard*

Detailed survey over the area around the chapels showed what appeared to be a significant depth of anthropogenic soil, located beneath a thin topsoil of organic sand and various layers of blown sand averaging about 40 cm in depth. Below these layers, a dark reddish brown (5YR3/2) sandy silt layer of apparently anthropogenic soil, featuring charcoal and shell inclusions, was recorded over the entire 20m<sup>2</sup> intensive survey area, averaging a thickness of 45-70 cm but often running below the depth of the auger (i.e. to a thickness of over 80 cm, given the 40 cm depth of sand and topsoil overburden). Although a similar profile was noted to the south and east of the Teampull Mhòire, the anthropogenic deposit was notably thinner, averaging between 15-20 cm, and often absent altogether. It would appear that any agricultural activity was focussed to the north of the chapel.

Immediately to the north of this flattish area of apparent cultural activity, sharply undulating ground indicated a possible dune formation or settlement remains. Auger survey failed to resolve this, showing a tantalising split between auger points hitting stone and having to be abandoned, and points showing a complete or almost complete profile of blown sands. Anthropogenic soil similar in colour and texture to that noted nearer the chapels occasionally showed towards the base of a profile point, indicating that in all likelihood the cultural soil continued further north in this area, beneath either sand blow or possible settlement activity. This was tentatively confirmed as the survey extended further north from the chapel. At a point roughly 50 metres north of the chapels, the blown sand overburden became thinner, allowing the auger to reach an identifiable depth of cultural soil which appeared similar to that seen adjacent to the chapels. The survey was extended north for a further 80 metres, which confirmed that, with some localised variation, a deep and apparently cultivated soil continued to extend northwards at a depth of not less than 50 cm. Time constraints prevented the survey from extending any further. No rig system or other recognisable field system was noted in relation to the deposit, which was entirely buried beneath a substantial deposit of blown sand.

## Sampling and analysis

### *Trench 1*

A trench measuring 3.7 metres N-S by 1 metre E-W was excavated across the southernmost point of the undulating ground surface and into the northernmost part of the known area of cultural soil, approximately 21 metres north of the north wall of Teampull Mhòire. This location was chosen in order to investigate the reason for this change in ground surface as well as to ascertain the depth and characteristics of the cultural soil, and of course to establish more securely the continuation of this one cultural deposit into the area beyond that of the detailed survey.

Excavation established that the undulation of the ground surface was entirely due to sand dune formation and no archaeological remains were present at the level of the chapels, with the top of the cultural soil showing only a slight upslope. The depth of blown sand in fact made it impossible to excavate the northernmost part of the trench to the level of the cultural soil (Section 1).

However, the cultural soil itself showed a complexity of formation which may indeed point to a level of archaeological activity in this area more recognisable as settlement-based than agricultural. Although fairly homogenous in colour and texture, the area of cultural soil excavated in the southern part of Trench 1 was split into three distinct horizons, an upper (006) and lower (008) deposit of similar appearance separated by a thin (007) layer of stonier soil. Into this layer, a deposit of large stones were set (021). These appeared to be structural, with a possible setting of four stones running NNW-SSE in a construction seen in the south-west corner of the trench. The excavation area was too small to investigate this further. While it is possible that (021) is a clearance cairn, its general appearance suggests the presence of an area of settlement-based activity rather than the intensive cultivation associated with soil amendment and the development of deep cultural soils.

A second indication of a possibly more complex formation process than that generally seen in an agricultural soil was the very frequent occurrence of a variety of shell fragments, seen throughout the anthropogenic deposits, but most notably at the top of the cultural horizon, where a thick layer consisting almost entirely of shell fragments was recorded as a separate layer (005). Rather than being fragmented to the extent which would be expected of a ploughed soil, these inclusions were characteristically well preserved. It was evident that significant dumps of this shell had been made throughout this topmost portion of the soil. This may indicate that (006) and possibly also (007) and (008) may be related to midden accumulation rather than to agricultural activity and soil amendment. However, the extensive horizontal spread of cultural deposits indicated by auger survey seems to make this interpretation less likely.

Further indication of settlement-based activity was seen below the amended soil layers, at the base of cultural deposit (008), where three, possibly four small postholes appeared cut into the glacial sand (009) below. These were all approximately 12-15 cm in diameter and appeared filled by (008), although their extreme shallowness (maximum depth 12 cm) makes it likely that they had been truncated prior to the development of (008). Again, too small an excavation area was available to further investigate these features.

Further excavation in this area would be required to fully understand both the

significance of (021) and its relationship with the cultural deposits above and below it, to assess the characteristics of (006) and (008) over a larger area in order to achieve a better understanding of their formation processes, and to investigate the survival of features pre-dating these soils.

Kubiena tin samples were taken at five points in the north-facing section of Trench 1 through the blown sand and cultural soil deposits, for preparation as slides for micromorphological analysis at the University of Stirling. Bulk soil samples were taken alongside each Kubiena sample point for further geochemical analysis, also to be carried out at the University of Stirling, and where possible, samples of shell and charcoal for radiocarbon assay were taken from corresponding points.

### *Pits 1 and 2*

Further, but more limited excavation for further sampling of the cultural soil layers identified in survey was taken at two additional points. A small (1x1.5 metre) soil pit (Pit 1) was excavated approximately 32 metres north of Trench 1, and approximately 53 metres north of the chapels (Section 2).

No structural or other archaeological features were noted in Pit 1, but once again, certain aspects of the cultural soil, here present as four distinct deposits, indicated that the profile may have formed as a result of midden-type activity. Once again sealed by blown sand, topmost anthropogenic deposit (028) - a very dark (10YR2/2) sandy silt loam - was rich in well-preserved shell, as to a lesser extent was lighter brown sandy silt loam (029) below. Beneath this, a thick layer of shell reminiscent of layer (005) in Trench 1 was seen (030), sealing another dark brown, anthropogenic sandy loam layer (031). Once again, the small area of excavation made it difficult to assess the archaeological context of these deposits.

Pit 2 was excavated a further 70 metres to the north of Pit 1, approximately 133 metres north of the chapel, and at the furthest point of the surveyed area (Section 3). This was the most typically 'agricultural' of all three sampled soil profiles, showing a largely homogenous deposit of dark greyish brown (10YR4/2) sandy loam (036) as its main anthropogenic layer. Shell deposits were largely absent.

Samples for thin section, geochemical and dating analysis were taken from both profiles in the same manner as from Trench 1 (see Sections 2 and 3).

### *Conclusions*

While the auger survey, particularly adjacent to and to the north of the chapels provided a positive result for the formation and survival of cultural soils on Pabaigh, the sampling and excavation programme for these has thrown up several questions. In particular, excavation in Trench 1 revealed that not only may there be a greater degree of archaeological activity in the vicinity of the chapels than previously thought, but that it may be closely linked with the development of the soils themselves, possibly placing these soils in the context of settlement, rather than solely agricultural activity. Indications of earlier archaeological, again possibly settlement, activity in this area further complicate the picture. Samples taken for scientific dating may help to place these issues in context.

Evidence from the cultural soils themselves further illustrate this likely complexity of formation. Inclusions of well-preserved shell in Trench 1 and Pit 1 indicate a possible midden-type formation process comprising household waste. While this is not uncommon

as a means of soil fertilisation (and possibly amendment), the level of preservation of these features is not consistent with a ploughed agricultural soil. Pit 2, inn appearing the most typically agricultural of all three profiles, indicates the possible level of variation between different areas of this extensive series of cultural deposits. It is hoped that evidence from both geochemical and thin section analysis will further help to define the nature and formation history of these soils.

## Context descriptions

### *Trench 1 (seen in Section 1)*

001: Modern topsoil, consisting largely of organics and sand. 10YR 3/2: very dark greyish brown.

002: Clean blown sand. 10YR8/1: white.

003: Ten very thin 'bands' of blown sand, five 10YR8/1 (white), and 5 10YR/3.2 (very dark greyish brown).

004: Narrow band of sandy silt loam, 7.5YR3/2: dark brown. Possibly anthropogenic, containing very occasional fine charcoal inclusions.

005: Narrow band of mainly well-preserved shell fragments within a sandy silt loam matrix, 7.5YR3/2: dark brown. Occasional large bone fragments. Dumped material: possibly midden.

006: Sandy silt loam, 5YR 3/2: dark reddish brown. Anthropogenic deposit. Occasional bone and fine charcoal pieces, frequent lenses of well-preserved shell. Cultural soil.

007: Narrow band of cultural soil deposit, appears similar to (006) and (008) but is noticeably stonier. Sandy silt loam, 7.5YR3/2: dark brown. Cultural soil?

008: Sandy silt loam, 5YR 3/2: dark reddish brown. Anthropogenic deposit. Occasional fine to medium charcoal pieces. Cultural soil.

009: Glacial sand. 10YR5/4: yellowish brown.

010: Blown sand. 10YR7/3: very pale brown.

011: Blown sand. 10YR7/1: light grey.

012: Blown sand. 10YR5/3: brown.

013: Blown sand. 10YR4/3: brown.

014: Blown sand. 10YR5/3: brown.

015: Blown sand. 10YR7/1: light grey.

016: Blown sand. 10YR5/3: brown.

017: Clean blown sand. 10YR8/1: white. (Possibly = 002)

018: Blown sand. 10YR4/3: brown.

019: = (003): thin 'bands' of blown sand, 10YR8/1 (white), and 10YR/3.2 (very dark greyish brown).

020: = (003): thin 'bands' of blown sand, 10YR8/1 (white), and 10YR/3.2 (very dark greyish brown).

021: Deposit of large stone, possibly structural. Partly excavated in south-west corner of Trench 1.

### *Pit 1 (seen in Section 2)*

022: Modern topsoil, consisting largely of organics and sand. 10YR 3/2: very dark greyish brown.

- 023: Clean blown sand. 10YR8/1: white.
- 024: Thin layer of blown sand. 10YR3/1: very dark grey.
- 025: Thin layer of clean blown sand. 10YR8/1: white.
- 026: Thin layer of blown sand. 10YR3/1: very dark grey. Slightly stonier than the blown sand layers seen above.
- 027: Blown sand, 10YR5/1: grey. Fairly disturbed, showing several lenses of darker greyish brown (also blown) sand, 10YR5/2.
- 028: Sandy silt loam, 10YR 2/2: very dark brown. Anthropogenic deposit. Occasional bone and fine charcoal pieces, frequent lenses of well-preserved shell. Cultural soil.
- 029: Sandy silt loam, 10YR3/4: dark yellowish brown. Anthropogenic deposit. Occasional fine charcoal pieces, frequent lenses of well-preserved shell. Cultural soil.
- 030: Narrow band of mainly well-preserved shell fragments within a sandy silt loam matrix, 10YR3/4: dark yellowish brown. Possibly midden material – similar in appearance to (005).
- 031: Sandy loam, 10YR4/3: brown. Anthropogenic deposit. Occasional fine charcoal pieces, occasional clayey lenses. Poorly drained base of cultural soil?
- 032: Glacial sand, clayey lenses: poorly drained 2.5Y4/4: olive brown.

*Pit 2 (seen in Section 3)*

- 033: Modern topsoil, consisting largely of organics and sand. 10YR 3/2: very dark greyish brown.
- 034: Clean blown sand. 10YR8/1: white.
- 035: Three thin bands of blown sand, 10YR8/1 (white), and 10YR/3.2 (very dark greyish brown).
- 036: Sandy loam, 10YR4/2: dark greyish brown. Anthropogenic deposit. Occasional light sandy lenses. No large shell inclusions, occasional charcoal pieces. Cultural soil.
- 037: Loamy sand, 10YR4/4: dark yellowish brown. Anthropogenic deposit. Few inclusions. Base of cultural soil?
- 038: Sand, 10YR7/6: yellow.
- 039: Fine sandy loam, 10YR4/6: dark yellowish brown.
- 040: Bedrock