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IONA: SOME RESULTS FROM RECENT WORK

ALISON HAGGARTY

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Description of thin sections taken from plaggen layers at Iona

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DESCRIPTION OF THIN SECTIONS TAKEN FROM PLAGGEN LAYERS AT IONA

by Dr R Shiel and Mr G P Askew

The thin section slides 3001, 3003 and 3005 were examined in detail. These slides were made from soil blocks taken from plaggen layers at 70-110 cm, 110-150 cm and 150-162 cm below deturfed soil surface, as described in Bailey's report on the exposed profile at the Northern end of the 1983 excavation on the site of Iona Abbey.

For convenience the layers from which the slides come are referred to in the text as upper (3001), middle(3003) and lower (3005) layers.

As the layers, described by Bailey, lying below the plaggen layers are clearly disturbed the whole of the plaggen layers must have been introduced from another site or sites. Any variation between or within the layers of Plaggen can therefore be assumed to indicate heterogeneity of source, although it may not be possible to locate the actual source used.

The three slides reveal that very different soil properties exist in the three soil layers. These three layers do not constitute a natural soil profile. In this report the larger-skeletal-grains which are individually identifiable, and are of sand size are first described. Then the matrix, in which the type of material can be described but only the largest grains can be recognised, and in which the particles are of silt and clay size is considered. Finally an attempt is made to discuss how the sequence of layers may have been created by the incorporation of extraneous material onto the site.

The Skeletal Grains

The most striking change down the profile is the absence of bone and shell (calcite) fragments from the two lower layers. In the upper layer bone and calcite dominate the skeletal grains; they are not only the largest grains present but also they represent over 30% of the skeletal material. The other grains consist of quartz (30%), feldspars (20%), micas (10%) and rock fragments (10%). The quartz grains are rounded while the feldspars and micas tend to be angular. The last two also show considerable alteration. The rock fragments are all well rounded and consist of a wide range of igneous and metamorphic rocks typical of the west coast of Scotland. Quartzite forms some 60% of rock fragments.

The absence of calcite and bone from the two lower layers gives a much reduced overall content of skeletal grains in these two sections. Ignoring the calcite and bone there is a steady decline down the profile of skeletal components, the relative proportions of which however remain constant.

Also present in all three layers are fragments of charcoal indicating incorporation of material from the surface.

In the middle slide in particular, reddish concretions of sand size occur. These concretions are made up of matrix material and are therefore discussed in the matrix section.

The matrix

The only individually distinguishable grains in the matrix are abundant angular silt size quartz particles. Variation in the size and distribution of these particles is associated with other features of the matrix, and is best discussed along with these features which include - density, shape and size of aggregates, colour, presence of concretionary materials and evidence of bioturbation by the soil fauna.

The relative proportion of material to voids increases down the profile indicating increasing compaction, which might be expected from the effect of the rising overburden pressure. However the porosity in none of the slides is low and all three show a porosity which would be typical of a soil surface horizon. In the middle layer aggregates are larger (2-3 mm) and often irregular in shape. In part this is due to the lower skeleton content and higher density. The lowest section shows compact large aggregates (3-5 mm), often with internal cracks. These have probably opened during drying of the soil. The majority of the matrix in all three slides is dark brown in colour indicating a high content of organic matter. (The colour darkens with depth but this may be in part due to minor variations in slide thickness). Within slides however there are zones of darker matrix indicating relatively higher compaction or organic matter content. In the middle and lower slides the colour of the matrix is very much more variable than in the upper layer due to the presence of large numbers of inclusions of variously coloured concretionary material which are described next.

The upper layer contains dominantly dark brown matrix which shows little variation across aggregates but contains small (0.1 mm), similarly coloured areas which are relatively low in silt size quartz and make up about 0.5% of the total matrix. There is a low content (<0.1%) of pale reddish brown concretions which are very small (<0.1mm) and occur within aggregates, these concretions are also relatively low in silt size quartz. The matrix also contains about 0.5% of black areas <0.1 mm across which occur throughout the aggregates.

The middle layer shows minor variations in the matrix which are due to compaction of some regions. Although a dark brown matrix similar to the upper layer is dominant, there are about 4% each of very dark reddish brown circular concretions and pale yellowish brown circular concretions of <0.2 mm diameter. Both of these types of concretion are relatively low in silt size quartz and occur at random within aggregates. These concretions tend to merge into the aggregates without a sharp boundary. There are also a few large reddish concretions (2.0 mm) which contain no particles discernible under the microscope. These concretions are separate from the aggregates and have extremely sharp boundaries. About 1% of the matrix consists of black areas 0.1 mm across similar to those noted in the upper layer. There are also small (0.1 mm) areas with a dark brown colour similar to the bulk of the matrix, but which are low in silt size quartz and make up 20% of the matrix.

The lower layer is much more variable than the upper layers. Although dark brown matrix is dominant, 30% consists of areas ~2 mm in diameter which are predominantly yellow but also can be yellowish brown, dark reddish brown or reddish. The yellowish areas are not regular and merge into the dark brown matrix. They usually have a similar coarse silt content to the dark brown matrix. The dark reddish brown concretions are circular (~1.0 mm) and frequently merge into yellowish brown material which is irregular in shape and does not follow the current boundary of the aggregates with any regularity. These compound concretions form about 5% of the matrix and many have been broken. The dark reddish brown (or e n black) central area of these concretions contains no silt visible under the microscope, but the surrounding yellowish brown material has a high content of fine silt size quartz. There are a very small number of reddish concretions similar to those in the middle layer but of smaller size (1 mm). There is about 1% of black material smaller than 0.1 mm.

The upper and middle layers show considerable evidence of bioturbation with areas of small pellets (0.1 mm) between the larger aggregates. These make up about 15% of the matrix in the upper and middle layers. Because of the smaller aggregate size this bioturbation is less obvious in the upper layer. There is little evidence of recent biological activity in the lower layer. The matrix of the smaller aggregates is similar in appearance to the larger aggregates but is marginally lower in coarse silt and fine sand particles.

Interpretation

The presence of calcite at the surface and its absence at depth indicates recent incorporation of the calcite. In the wet environment of the west coast calcareous materials are quickly leached from the soil, although coarse sand size fragments will persist longer than finer fragments. As the dissolution of the calcite saturates the leaching water with calcium ions, calcite is preferentially lost from the surface layer of the soil. This indicates that any calcite present in the lower parts of the layers must have been lost before the calcite in the upper layer became emplaced. The presence in the lower sections of skeletal grains similar to those in the upper section, means that the presence in the past of calcite in these layers cannot be ruled out. The source of the calcite and other skeletal grains is almost certainly shell sand. The presence of bone fragments in the upper section is an indicator of both youth and high pH in relation to the lower layers, where once again bone fragments may have been lost by dissolution under acid conditions. The general decline in skeletal content (ignoring the surface calcite) with depth indicates that shell sand was never applied in great quantity to the middle or lower layers.

Interpretation of the matrix presents a number of problems. The variations in the matrix suggest that it has come from at least two parent materials. The dark brown matrix with its high silt-size quartz content is homogeneous with depth but there is considerable variation in the other matrix materials, viz. the dark brown but low-silt matrix of the two upper layers, the reddish concretions which are most abundant in the middle layer, and the dark reddish brown to yellowish concretions and matrix which are most abundant in the lower layer. As the concretions are not related to the present structure, and have sharp or damaged boundaries in many cases, they are most likely to come from a different source from the dark brown material, probably in two phases. The presence of reddish concretions in the middle layer with only small numbers above and below shows a sharply different trend from the steady increase in reddish brown and yellow concretions with increasing depth. These differential trends suggest that at least the reddish concretions in the middle layer have been introduced from a separate source from the dark brown material, although the reddish brown and yellowish brown concretions may also have come from another site.

The origin of these concretions is difficult to speculate on. They do not originate from conventional gleying. The large reddish concretions have no parallel in temperate soils and may be relict features from a warmer preglacial period. The reddish brown and yellowish brown concretions appear to have developed in nearly spherical aggregates, through which diffusion of materials has led to colour differentiation. Again it is difficult to conceive a temperate process which would produce concretions of the type observed. The variation in matrix composition across these concretions also suggests diffusion of materials but such large variations in the silt content between the inner and outer portions of the concretions are rather surprising.

The similarity in matrix between the dark brown and yellow material (not concretions) in the lower layer suggests a common origin. The yellow material is what would be expected from a freely drained soil B horizon and may indicate that the lower layer is made up of mixed A & B horizon materials as could easily occur if a plaggen layer were being built up using a shallow soil. Variation in the matrix of the dark brown material on the other hand suggests two separate sources, one of which was significantly lower in silt size quartz. Although bioturbation of the upper part of the profile is active it is unlikely that mesofauna activity could produce the noted variation in the silt content of the dark brown material.

Several sources of material are therefore envisaged:-

1. Shell sand which has been added to the profile at different times and in varying amounts - not necessarily only by man.

2. An A horizon material with low silt size quartz content.

3. A & B horizon materials of high silt size quartz content, probably from a freely drained soil.

4. Reddish concretions which are unlikely to have been added independently and have an extremely low silt size quartz content. They may have been associated with the material in (2).

5. Dark reddish-brown/yellowish brown concretions with varying silt size quartz content which may be associated with material (3).

6. Charcoal in a range of particle sizes from silt up to <2 mm.

As the three layers examined do not form the base of the profile, and material below them is clearly disturbed, then it is essential to consider major disturbance and importation to the site for all three layers. It is difficult to see how the three layers could have originally been uniform, and by differentiation have produced the present appearance. It is therefore necessary to consider that the layers were added sequentially.

Sequential addition does create a problem as the lowest layer appears to contain a much higher proportion of B horizon than do the upper layers, but has a broadly similar matrix. This layer must therefore have been introduced to the site as a mixture of A & B horizons and subsequently more A horizon material was added to form a topsoil (the middle layer). This could have in fact occurred in a single phase with intentional partial separation of A & B horizons. The lower layer in this case appears rather thin (12 cm) in relation to the middle layer (40 cm). This arrangement of layers would require the subsoil to be dug out from another site and emplaced before the overlying top soil was emplaced. An alternate explanation is that the bottom layer consists of a mixture of topsoil and subsoil while greater care was taken to include a higher proportion of topsoil in the middle layer. The presence of material with less silt size quartz and the reddish concretions suggests that a second topsoil source may also have been used. Both these layers may have originally contained shell sand. If they contained shell sand some time must have passed before the upper layer of soil was added to allow decalcification. During this period the soil may have become acid and there may have been progressive deepening and incorporation of fresh material into the middle layer leaving residual charcoal as the only evidence. Finally the top layer was added and this either contained, or had added to it, shell sand. It appears to have come from similar sources to those of the middle layer but lacks the large reddish concretions. The material forming this upper layer must never have contained the large concretions noticed in the middle layer. The presence of small fragments of reddish concretions in the layer suggests very considerable mixing of this layer which was absent from the middle layer. The presence of these small reddish concretions is a problem. This upper layer probably consists of carefully dug out soil A horizons, which on account of its considerable depth may have accumulated over a period of time. As the shell sand is well mixed through this layer it is unlikely that it reached the soil by windblow after emplacement. It is most likely to have been dug into the soil. In the period for which this soil was at the surface there was considerable biotic activity which may have penetrated into the middle layer. Such activity indicates a steady supply of fresh decomposable organic matter, including probably household waste as indicated by bone and charcoal fragments. This layer was not at the surface long enough to become even partially decalcified. In fact the good structure of the upper layer indicates a relatively recent date for burial.

The origins of the concretions - both reddish and dark reddish brown - is fascinating. They are high in iron oxide and have bright colours suggestive of oxidation under warm - Mediterranean or tropical - temperatures. One final possibility must be that these materials are of preglacial origin and have been modified by glacial or periglacial action. They may even represent materials taken from two or more separate till sources which incorporated preglacial saprolites. A till source might satisfactorily explain the comminution of the reddish and reddish brown concretions - in the case of the reddish concretions in the upper layer to silt size - but the layers are highly unlikely to represent unaltered in situ till. A till source, as explanation for the plaggen layers, would still require the material to have been dug out from a variety of till sources - as for soil sources - with different sources being used in different proportions for the layers. Speculation of this type can only be settled by detailed investigation of the surrounding soils and till deposits.

Pottery catalogue

A Lane and E Campbell

POTTERY CATALOGUE

The pottery is listed with consecutive numbers, in stratigraphic units ordered from most recent to oldest. Colour is described from exterior through to inside surface. Inclusions were identified under a x40 microscope as no thin-sections were available.

Layer 8/10 interface

1. Bodysherd, 5-7mm thick, well gritted, with a little organic material.

Fabric 1

Colour:- soot/grey/buff/grey.

Layer 20

2. Rim of substantial cooking pot, body thickness 7-9mm, hand built,

but wheel-finished (X-ray confirmed coil-built technique). (illus 6)

Maximum diameter 33cm, height estimated as 22cm.

Fabric 2

Colour:- buff/blue-grey/buff, exterior sooted and burnt in places

Decoration:- two lines of incised asymmetric wavy lines just below the rim, and finger impressions along the outside of the rim.

3. Rim, same pot as no. 2 but slightly different profile. This sherd

shows that the rim was formed by overfolding outwards.

4. Bodysherd with two wavy lines incised, same pot as no. 2.

5. Basesherd, 8-10mm thick, handmade. (illus 5)

Fabric 1

Colour:- brown/grey/buff

Wall rises at same angle as no. 19, but does not turn in.

Broken at beginning of base.

Grassmarked exterior.

6. Bodysherd, same fabric as no. 2, probably same pot.

7. Basesherd, same fabric as no. 2. probably same pot.
Slightly sagging base-diameter c.16cm, thickness 5mm.

8. Rimsherd, 5-7mm thick, hard, well-gritted fabric. Diameter c. 30cm. (illus 5)
Fabric 1
Colour:- soot/buff/speckled dark grey with blue-grey/buff.
Simple flat-topped rim, slightly thickened, but appearing to lean inwards. Possible open bowl form.

9-13. 5 Bodysherds, 8-9mm thick, heavily gritted, hard fabric.
Fabric 1
Colour:- soot/brown/pinkish/grey-blue.

14-16. 4 possible basesherds, 5-7mm thick, medium gritted
Fabric 3
Colour:- orange/buff/blue-grey/soot.
All these sherds are carbonised on the inside.

17. Bodysherd, 8mm thick, hard fabric, ? wheelthrown.
Fabric 4
Colour:- buff/orange/buff/grey/soot.

18. Bodysherd, 7-10mm thick
Fabric 1, also a little organic material.
Colour:- soot/grey-brown/buff/blue-grey.

Layer 10

19. Basesherd, 6-8mm thick, heavily gritted. (illus 5)
Basal diameter c. 16cms
Fabric 1
Colour:- buff/grey
Kinked base, wall rises steeply but starts to inturn.
Grassmarked exterior.

20. Bodysherd, 8mm thick, heavily gritted with a rough surface.
Fabr[illegible]
Colour:- soot/brick-red/grey.

Layer 21

21-23. Three joining rim to base sherds 8-11mm thick, height c.3.5cms, exterior diameter c.12cm. (illus 5)
Fabric 5
Colour:- orange/buff/grey
Simple flattened rim on vertical wall. Broken at basal angle. Form is a low-walled dish.

Fabrics

1. Hard, reduced fabric with abundant angular fragments of quartz, feldspar, amphibole, mica and gneiss in variable proportions. Poorly sorted, size up to 8mm. Occasional quartzite or organic inclusions.

2. Medium hard fabric, with a few large (up to 5mm) well-rounded chert, quartzite and quartz grits and a scatter of small angular quartz. Abundant cavities, well-rounded, 1-2mm in diameter, due to weathering out of calcareous grits which were probably oolitic, or perhaps well-rounded limestone.

3. Medium hard fabric, moderately gritted with rounded to angular quartz diameter 0.5-2mm.

4. Hard fabric with a few large angular feldspar and sandstone fragments (up to 5mm). Cavities common, apparently weathered out shell fragments.

5. Soft soapy fabric with sparse angular quartz, sandstone and feldspar.