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Soil micromorphology and geoarchaeology at Parknabinnia Court Tomb (Clare Megalith 153), Co. Clare, Ireland

A report for Dr. C. Jones and the Royal Irish Academy

by

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University of Oxford Department of Continuing Education

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Summary

This report describes soil micromorphological and field characteristics of profiles from the Parknabinnia Neolithic court tomb, County Clare, Ireland, and discusses how they relate to the history of the monument, its locality and the region. The tomb is located on a junction of two soil profile types, both overlying the Lower Carboniferous limestone pavement of the Burren. Despite the presence of a thick covering of soil inside the tomb before excavation, a rendzina on limestone, the typical modern soil profile for the area, is present under much of the tomb. Where the site overlies a slight hollow, however, a red clay-rich deposit is found overlain by a clayey brown earth profile. The latter appears to have derived from a localised occurrence or survival of more shale-rich or mixed limestone/shale breccia, as described for soils immediately to the south of the area (Moles & Moles 2002), although its relationship to those soils cannot be verified without further study. The hollow profile shows a change in chemistry and/or aeration with depth, with mollusc-rich and slightly calcareous organic topsoil overlying a moist parent material rich in oxidised iron and clay.

The presence of this deeper profile could be taken to support general models that soils were thicker in this landscape in ancient times. One caveat, however, is that recent geoarchaeological work in other limestone areas (French et al. 2001), suggests that even by the Neolithic period theorised thicker soils may have existed only in locations where glacial/periglacial deposits survived, and/or where topography allowed deeper soil accumulation (e.g. in hollows). This could mean that surviving thick profiles represent only small fragments of the later prehistoric landscape, i.e. that any major extensive change in soil type occurred well before Neolithic monuments were constructed.

It seems reasonable to assume that both soils discussed here have been relatively protected from subsequent major land use changes (they have not seen later deforestation, ploughing or significant grazing), due to their location underneath the tomb. The presence of a rendzina soil in those parts of Chamber 1 that do not fall over a hollow, adjacent to a thicker clay-rich profile over that hollow, highlights the importance of catenary position, especially topographic factors, in pedogenesis. The rendzina contains microscopic indicators of a potential clay-rich ancestral profile, but it is hard to explain how the rest of this profile was ‘lost’ after protection by tomb construction, especially since it survived and developed over the adjacent hollow. If there was a pedogenetic, possibly culturally induced, change from thicker soils to thinner ones across the Burren in general, the evidence from this site suggests that this happened well before the construction of this monument. This has major implications for models suggesting that shallow soil profile development on the Burren dates to the Neolithic period or later. Alternately and/or additionally, extensive soil ‘degradation’ postulated to relate to later prehistoric cultural land use may need to be rethought along more site-specific lines. More extensive, detailed and localised investigation into ancient soil types and possible erosion patterns is greatly needed, along with reassessment of models of how ancient settlement and land use are linked to these soil changes.
Introduction
A possible buried soil was identified during the 1999-2000 excavations of the Neolithic court tomb at Parknabinnia, Co. Clare, Ireland (Clare megalith 153) (Figure 1). The decision was made to examine this in more detail, given the relative lack of intact buried soil material known from the Burren, especially in direct relation to dated monuments. The main issues to be addressed include: 1) the nature of the immediate environment and cultural landscape before, during and after the construction of the court tomb, particularly in relation to regional models of forest clearance and grassland development during the Holocene, and 2) use of space within the tomb. It was hoped to obtain information on site-specific land use related to the tomb, such as whether the area was cleared, deturfed or tilled before construction, and whether ancient soil and vegetation characteristics might relate to decisions regarding monument siting. Funding for this research was provided by the Royal Irish Academy.

Figure 1 Location of Parknabinnia Court Tomb

It is thought that the Burren was covered by deciduous forest from around 15,000 years ago, with local patches of open grassland occurring in areas with shallow soils over the limestone rock. From around 6,000 years ago, forest clearance or decline is suggested from an increase in pollen of hazel, herbs and grasses (Mitchell and Ryan 1997; Watts 1983). Neolithic farming people are said to be in evidence in the region from c. 5,800 years ago, and are presumed to have been primarily pastoralist. The impact of early farming activities, and of forest clearance, on the land is expected to have led to significant alterations to soil development and sedimentation patterns in the region, but this aspect of ancient landscape history has yet to be addressed in great detail from an archaeological perspective. However, there are a few studies suggesting that erosion of surficial deposits and soils occurred after deforestation, with the general picture being of increased soil erosion related to forest decline between 4000-2600 BP, and a particularly intense erosion episode dating between 3000-2500 BP (uncalibrated) (Bronze Age) (Watts 1983; Drew 1983; Jeličić & O’Connell 1992). Some of the relevant dates are on charcoal, suggesting a relationship between forest decline and burning, although other factors are also likely to be involved. It should be noted that a study at Gortlecka Lake found pollen evidence of forest decline without related evidence for soil erosion at the same date (Watts 1983), perhaps showing local variability, or underscoring the difficulties in relating erosion evidence to land use practices and vegetation changes.
The assumption of a pastoralist lifestyle during the Neolithic in the Burren appears to be based mainly on some site-specific evidence of use of herd animals and on modern soil distribution and presumed past land potential, and has seen little direct investigation through studies of ancient land use. The impact of recent livestock farming on the soils in this area (Moles 1992, 1995; Moles & Moles 2002) is significant for model building of past interactions between people and the environment, especially if Neolithic pastoralism is represented in the archaeological record. Where is the erosion evidence associated with this and how does such evidence related to land use, soil stability or taphonomic factors? This project is not large enough to address these issues directly, but marks a significant, if rather small-scale, geoaarchaeological pilot study aimed at understanding how one site fits into this cultural and natural landscape.

**General field description and soil micromorphology sampling**

Field description carried out in July 2001 identified two main varieties of brown earth soil profile on the site (Table 1), apparently related to each other by typical catenary factors (in this case variation in topography and probably surficial geology re. parent material). Much of the site is covered by a rendzina profile – Ah horizon (topsoil) directly over Lower Carboniferous limestone pavement – the typical modern soil profile for the region. Where the site overlies a hollow the profile is deeper and includes an iron- and clay-rich deposit immediately overlying the limestone geology. This profile comprises an Ah horizon overlying oxidised iron- and clay-rich lower A and B (or B/C) horizons, the latter of which becomes more clayey but less iron stained with depth. A thin layer of yellow gritty material immediately overlies and echoes the outline of the limestone pavement. The topsoil in this profile appears to be slightly calcareous, being mollusc-rich, although the lower horizons appear acidic based on field characteristics. In the field this pattern was interpreted as relating to the influence of the weathering limestone rock, in particular the overlying boulders forming part of the monument, on the A horizon, and of the basal clay-rich surficial geological deposit on the rest of the soil profile.

**Table 1  Summary field profile description and list of soil micromorphology samples**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Field interpretation</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rendzina on limestone</td>
<td>[645] – very dark brown/black organic silt loam; frequent molluscs, fine-medium angular pebbles, occasional fine roots</td>
<td>Modern organic topsoil (Ah); found under part of the tomb; normal modern soil type for surrounding area</td>
<td>None taken</td>
</tr>
<tr>
<td></td>
<td>[653] in Chamber 1 (north side) – dark greyish brown clayey silt; gravel, small bones, soil underneath Context 650 &amp; Stone 652; appears to equal Context 530</td>
<td>Organic topsoil (Ah) in appearance; soil underlying bones within Chamber 1</td>
<td>CL153/5</td>
</tr>
<tr>
<td>Brown earth on limestone</td>
<td>[645] – as above</td>
<td>Organic topsoil (Ah)</td>
<td>CL153/3</td>
</tr>
<tr>
<td></td>
<td>[530] – rich brown to dark reddish brown silt loam; no/rare molluscs, moderate charcoal flecking, pebbles as above</td>
<td>Lower topsoil (A), becoming A/B horizon-like with depth</td>
<td>CL153/1, 153/3, 153/4</td>
</tr>
<tr>
<td></td>
<td>[585] – red-brown clay (loamy); rare charcoal and occasional fine roots, rare fine rounded stones</td>
<td>Bt (fe)/C horizon – clay-rich soil, possibly developed over glacial deposits left in hollow</td>
<td>CL153/1, 153/2, 153/3, 153/6</td>
</tr>
<tr>
<td></td>
<td>[646] – gritty yellow/brown clay; seen as a ‘halo’ echoing shape of top of underlying rock</td>
<td>C/R transition (weathering horizon)</td>
<td>CL153/2</td>
</tr>
</tbody>
</table>
Soil micromorphology samples were taken from all major horizons identified at various points across the site (Table 1 and Figure 2), with the exception of the modern rendzina outside of the tomb. Samples CL153/1-2 represent the entire deeper brown earth profile over the hollow. Further samples (CL153/3, 153/4) were taken from the iron-rich soil layers [530-585] of this profile in other parts of the tomb. Chamber 1, which contained human remains, was located on the junction between the rendzina and thicker brown earth profiles. Samples were taken from the base of the bone-containing layer where this is a rendzina soil (Context [653], sample CL153/5), and where the equivalent archaeological stratigraphic layer is iron- and clay-rich (apparently Context [585], sample CL153/6).

Samples for micromorphology are taken as intact blocks of soil, with the aim of examining in situ profiles. This allows for interpretation of the relationship of materials to each other and to the soil or sediment matrix spatially, temporally and contextually. Microscopic characterisation of materials often provides a great deal of information on landscape history, ranging from general palaeoenvironment to more location-specific cultural activities. The method has proven to be particularly informative regarding ancient land use practices, the histories of archaeological dug features, and the details of complex cultural deposits (Lewis 1998; French et al. 2001; Courty et al. 1989).

The samples taken here varied in size from 3x5x2cm to 5x10x5cm, all with a vertical orientation, and were prepared following the method of Murphy (1986; after Guilloré 1985) at the McBurney Geoarchaeology Laboratory, Department of Archaeology, University of Cambridge. The samples were air dried, impregnated with a cryptic resin mixture, and cured until hard. Thin section production entails sawing slices from the hardened blocks, mounting and grinding these down to 20-30um, hand-finishing to a uniform thickness, and finally cover-sluicing. The thin sections were described at the McBurney Laboratory and the Oxford University Research Laboratory for Archaeology and the History of Art under plane polarised (PPL), cross polarised (XPL) and reflected (RL) light at various magnifications, following the guidelines of Bullock et al. (1985) and Fitzpatrick (1993). Summary descriptions are presented below (see Appendix for detailed descriptions). The thin sections and resin-impregnated blocks are stored at the McBurney Laboratory.

Figure 2 Schematic location plan of sampled profiles (not to scale)
Soil profile and micromorphological descriptions

The two main soil profile types will be described here by horizon/layer: the hollow profile (brown earth on limestone) and the non-hollow profile (rendzina on limestone). Samples CL153/1-4 were taken from the excavated sections to the north-east of Chamber 1, with CL153/4 coming from the edge of the monument, and samples CL153/5-6 come from inside Chamber 1, both underlying human remains and running down into grykes in the limestone. Detailed descriptions are presented in the appendix; summary micromorphological characteristics can be found in Table 2.

Brown earth on limestone: the hollow profile (CL153/1-2) and variations (CL153/3, 4 & 6)

The non-rendzina soil profile has four clear layers: at least 5-10cm of organic topsoil [645], overlying two iron- and clay-rich layers [530] and [585] (c. 15cm and 30cm deep, respectively). These are underlain by a 1-3cm thick layer [653], which appears to be a weathering halo around the earth-fast limestone boulders.

The Ah topsoil layer (Context [645]) was sampled only in profile CL153/3, although the main field description of this layer was carried out in the sample location for CL153/1-2, underneath Stone 323 (Figure 3). In the field, this layer is a very dark brown to black organic silt loam with crumb structure, frequent mollusc shells, fine to medium angular pebbles and occasional fine roots. Field examination of the topsoil horizon both overlying the deeper brown earth and comprising the rendzina profile around the site showed little superficial difference in basic soil characteristics, with one exception. The base of the layer overlying the deeper brown earth profile has a sharp boundary (marked by colour and structure change and a line of mollusc shells) over layer [530].

In thin section CL153/3, a <1cm thick layer of [645] was sampled, along with zones infilled with this same topsoil material (filling voids between degraded rock fragments and/or created by earthworm activity and rooting) (Plates 1c, 2a-b). The microstructure is crumb, a structure created in relatively organic-rich and well aerated (topsoil) horizons strongly affected by soil faunal activity. In addition to the mollusc shells seen, further evidence for faunal impact on this layer includes texturally sorted fabric zones and infills created by earthworms, and earthworm calcitic granules. In this location the layer is highly influenced by rock weathering, as is the entire profile (see below), and frequent micritic ‘nodules’ and infilling features are seen, attesting to dissolution of the limestone rock and recrystallisation of calcium carbonate through oxidation. The generally small size of the calcium carbonate crystals (micrite) suggests relatively quick drying (Kubiena 1938, 153). A slightly calcareous nature is typical for shallow organic topsoils over calcareous rock types in moist environments, with dissolution of limestone through the impact of rainwater, leaching and then (re)precipitation of calcium carbonate in pore spaces during drying. Along with these crystalline pedofeatures, there is a crystallitic (micritic) groundmass, and frequent inclusions of calcareous rock fragments and grains. However, the soil fabric is not completely dominated by calcareous characteristics, showing strong amorphous organic and moderate iron oxide ‘staining’. The latter is also related to leaching and oxidation. In short, this appears to be a fairly typical calcareous Ah horizon, possibly slightly more calcareous than the exposed rendzina profile would be, because of the presence of overlying limestone boulders (the tomb) as well as limestone at depth. There are occasional charred plant remains in this topsoil material, and mollusc shells occur in the main fabric, and at the very the top of layer [530] in this thin section. No bone fragments or clay aggregates were noted, in contrast to the other organic layer sampled (see [653] below).
Table 2  Summary of Parknabinnia thin section descriptions (% represents visual estimate of area)

<table>
<thead>
<tr>
<th>Context</th>
<th>Structure</th>
<th>Porosity</th>
<th>c/f ratio &amp; texture</th>
<th>Mineral components</th>
<th>Organic components</th>
<th>Groundmass</th>
<th>Pedofeatures</th>
<th>Cultural materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>645 (CL153/3) Topsoil (Ah)</td>
<td>Crumb, channel</td>
<td>15%, channels</td>
<td>25:75 (Sandy) clay loam</td>
<td>40% rock fragments 200-600μm, degraded siliceous limestone, quartz sandstone. Grains: quartz, micrite. Clay: strong organic staining. Other: frequent micrite &amp; sparite infills, rare calcitic earthworm granules, rare bone fragments. Close porphyric.</td>
<td>10%: angular fragments, 'punctuations', rare roots. Strong organic staining, rare charred remains</td>
<td>Crystallitic, low birefringence, organic stained</td>
<td>Crystallitic, low birefringence; strong organic staining; earthworm sorting &amp; granules</td>
<td>Occasionally fine charred plant remains</td>
</tr>
<tr>
<td>653 (CL153/5)</td>
<td>Crumb to subangular blocky with depth</td>
<td>15-20%, interpedal channels, chambers, intrapedal cracks</td>
<td>25-30/70-75 Sandy silt loam</td>
<td>5% rock fragments &lt;5000μm, siliceous limestone, rare calcareous limestone, Grains: quartz,feldspar (platyoclase), rare olivine, rare micrite &amp; occasional sparite. Clay: strongly organic &amp; iron stained. Other: bone &amp; shell fragments, calcitic earthworm granules</td>
<td>10-15%; as in [645]</td>
<td>Stipple speckled to undifferentiated; organic stained</td>
<td>Occasional calcium carbonate neoformed features (mainly in pores); textural separation by earthworms; rare clay- and iron-rich aggregates</td>
<td>Bone fragments; occasional fine charred plant remains</td>
</tr>
<tr>
<td>530 (CL153/1 &amp; CL153/4)</td>
<td>1) channel, chamber, subangular blocky 4) sub-angular to angular blocky</td>
<td>1) 15%, channels, chambers</td>
<td>1) 35-65 4) 45.55 to 35.65 Sandy loam to sandy (clay) loam</td>
<td>1) 20% rock fragments 1000-7500μm, rounded to angular. Types: siliceous limestone (chert), quartz sandstone &amp; mica, non-siliceous limestone, shale/slate. Grains: as in [653] above. Clay: ‘dusty’, organic &amp; iron stained 4) upper 40% rock fragments 5000-20,000μm, angular; lower 20-30% 5000-7000μm, rounded and angular. Types: upper – non-siliceous limestone, sandstone; lower – siliceous limestone, siltstone, sandstone. Grains: quartz, feldspar. Clays: as in 1) above. Other: mollusc shells in upper. Close &amp; open porphyric.</td>
<td>1) 10-15%: carbonised material 100-600μm (sometimes 3000μm), rest as in [645], but more frequent modern roots 4) 10-15%: &lt;100μm angular fragments &amp; ‘punctuations’, iron-replaced roots; charred plant remains (up to 2000μm in size)</td>
<td>1) stipple speckled, low birefringence, moderate to strong organic staining 4) stipple speckled to granostriated, iron &amp; clay increasing with depth</td>
<td>1) iron stained ‘dusty’ clay infills; earthworm sorting 4) zones of stronger iron staining; ‘dusty’ clay infills &amp; coatings</td>
<td>1) Relatively coarse charred plant remains 4) Charred plant remains; possibly disturbance indicators (‘dusty’ clay)</td>
</tr>
<tr>
<td>530/585 (CL155/3) Lower A/ upper B (e) (brecchia)</td>
<td>Channel, vughy</td>
<td>10-20%, channels, cracks, vughs</td>
<td>40:60 (Sandy silt loam)</td>
<td>90-95% rock fragments 1000-4000μm, rounded. Types: degraded siliceous &amp; nonsiliceous limestone, sandstone. Grains: calcite (all sizes), quartz. Clay: mainly as pedofeatures. Close porphyric to enaulic.</td>
<td>&lt;5%: angular fragments &amp; ‘punctuations’. Organic staining on infills</td>
<td>Crystallitic, high birefringence, iron stained</td>
<td>Zones of [645]; earthworm sorting; clay coatings; calcium carbonate infills; micrite; iron staining</td>
<td>None in this fabric</td>
</tr>
<tr>
<td>585 upper (CL153/1 &amp; CL153/6) B(t/e)</td>
<td>Channel</td>
<td>1) 5-10%, channels, cracks 6) 15-20% channels, cracks</td>
<td>1) 20:80 6) 30-35: 65-70 Clay loam</td>
<td>1) &lt;2% rock fragments 1000-2500μm, as [530] + silstone. Rest as [530] + rare micrite &amp; dolomite noted. Close porphyric. 6) 20-30% rock fragments 1000-7000μm, as above. Grains &amp; clay as above. Other: frequent bone fragments in upper cm.</td>
<td>1) 5-10%, as in [530]/[585], but charred remains 50-100μm in textural pedofeatures 6) 15%, angular fragments &amp; ‘punctuations’, rare charred remains &lt;300μm and roots</td>
<td>1) &amp; 6) stipple speckled, some poro- &amp; granostriation, moderately birefringent, iron stained</td>
<td>1) rare clay rich aggregates; earthworm sorting; iron staining 6) Iron staining &amp; root replacement, iron stained clay infills, coatings &amp; ‘pendants’; rare sparite crystals in channels.</td>
<td>Occasional charred plant remains; frequent bones in 6) only; possibly disturbance indicators (‘dusty’ clay)</td>
</tr>
<tr>
<td>585 lower (CL153/2 &amp; CL153/6) B(t/e); ?surficial deposit</td>
<td>Channel</td>
<td>As above</td>
<td>25-30: 70-75 Clay loam</td>
<td>2) 20% rock fragments 1000-9000μm, as [585] upper + more shale/slate &amp; no dolomite noted. Clay: as [530] but ‘dusty’ to ‘dirty’. Close porphyric 6) as [585] upper for CL153/6, but rare bone</td>
<td>2) 5%, as in [585] upper 6) 5-10% (decreasing with depth), as in [585] upper</td>
<td>2) earthworm sorting; ‘dusty’ clay coatings; iron staining 6) rare clay rich aggregates; rest as in [585] upper, but no spartie</td>
<td>Rare charred plant remains; rare bones in 6) only; possibly disturbance indicators (‘dusty’ clay)</td>
<td></td>
</tr>
<tr>
<td>585/646 (CL153/2) B(t/e); ?surficial deposit</td>
<td>Channel</td>
<td>10%, channels, cracks</td>
<td>35:65 (Sandy) clay loam</td>
<td>As [585] lower in CL153/3</td>
<td>As [585] lower, but very rare carbonised remains</td>
<td>As [585] lower</td>
<td>As [585] lower</td>
<td>As [585] lower</td>
</tr>
</tbody>
</table>
A sharp boundary between [645] and [530] is seen in CL153/3 (Plate 1c), marked by changes in structure (from crumb to apedal channel), colour (from dark brown/black to dark yellowish-brown), and nature ([530] in CL153/3 consists mainly of highly weathered rock fragments – see below). Observations across the site suggest that besides the rare to occasional fine roots seen growing through the entire profile, and strong earthworm action, no obvious major mechanical mixing occurred across this horizon boundary. In addition to this, the accumulation of a line of mollusc shells at the boundary between these layers suggests a depth limit of significant bioturbation by certain soil macrofauna. The mollusc shell line was very distinct in the field, and in thin section shells are only found in layer [645] and at the very top of layer [530]. Presumably this boundary marks an active zone limit for at least some species of molluscs and possibly certain other soil fauna as well. This may relate to the characteristics of [530] (see below), which is less organic, with an apparent higher oxidised iron content.

**Figure 3 Schematic representation of CL153/1-2 sampling location (not to scale)**

Layer [530] is an organic stained lower A horizon, with some incipient B horizon characteristics, especially oxidised iron enrichment (marked by colour, and iron staining in thin section), which becomes stronger with depth. The layer is relatively apedal regarding structure, with channel structure dominating micromorphologically. Three field characteristics suggest that [530] is more acidic than the overlying material. These are an apparent cessation of certain faunal activity (molluscan at least) at this boundary, the oxidised iron-stained nature of [530], and stronger decomposition of bone found around the old ground surface level (just below the level discussed here) compared to at higher stratigraphic levels (Jones 2000). Initial pH tests (*ibid.*) show bone-containing layers on the site have readings around 6.5-7.0 (slightly acidic to neutral), with soil around the old ground surface being slightly more acidic. However, the neutral sample is said to come from between limestone rocks, and may reflect a physical relationship to a calcareous material, rather than a depth gradient in acidity through the soil profile. It is unclear whether the slight change in acidity...
would have a major impact on bone preservation, which is a very complex process that cannot be predicted solely from the soil chemical regime (see e.g. Nicholson 1996).

The main characteristics of layer [530] will be described from **CL153/1** and **CL153/4** (Plate 1a & d). There are significant differences in the layer related to the specifics of these two sampling locations, and these will be outlined below. Despite its equivalent stratigraphic position, Context [530] in **CL153/3** (Plate 1c) has a very different nature, consisting of a few large rounded fragments of highly weathered limestone, with iron staining and some root channels where soil exists. It is not representative of the standard characteristics of [530]. With the exception of the [645] material found in large channels (see above), the main material in this thin section consists not of soil but of ‘melted’ rock. These rock fragments are siliceous limestone, and these, along with precipitated calcium carbonate (micrite), create an almost cemented fabric, which is also iron stained. In general [530] here looks like a form of breccia.

In **CL153/1**, Context [530] appears to be a lower topsoil layer, and it is still relatively organic. It is slightly enriched with oxidised iron, and has a less pedal structure with lower porosity than the upper Ah overlying it. In addition, there is more charcoal in this layer, as well as more frequent modern plant remains (roots), it is has a more clay-rich groundmass and fewer calcareous pedofeatures (Plate 2c-d).

In **CL153/4** the layer has a subangular blocky structure, and appears more highly influenced by rooting activity. There are large limestone fragments, but the matrix is relatively decalcified and very iron-rich, becoming more iron- and clay-rich with depth. There are frequent modern plant remains (roots), rare mollusc shells at the upper boundary, and occasional charcoal throughout.

There are several differences seen between the sampling locations. The first relates to soil structure. **CL153/4** was taken from underneath a stone at the edge of the cairn, to the north of **CL153/1-2**. At this location the profile was exposed on one side, and probably an ‘edge effect’ including increased faunal or rooting impact and/or increased drying and cracking related to the exposed side surface, along with the presence of more large rock fragments in **CL153/4**, can account for the structural variation. The second main difference is the composition of the included rock fragments. While almost all limestone in **CL153/1-2**, and across the site, is siliceous, there is an upper layer of non-siliceous limestone in **CL153/4** (see below for limestone descriptions). The fragments in the latter are relatively angular, suggesting they are fairly ‘fresh’ and have not been rolled (by water or through colluviation), and would appear to come from another source or another part of the source rock. Non-siliceous limestone source was noted in the field by this author, but neither was one looked for. Small fragments of this more calcareous limestone are found rarely in many of the other thin sections, but the layer of large angular examples seen in **CL153/4** suggests a nearby origin. This could be a different exposed layer or boulder of bedrock, or a natural or cultural depositional context including this different limestone. Finally here, [530] in **CL153/4** appears to be more oxidised and iron stained than in **CL153/1**, where it is more organic stained. This could relate to the exposure mentioned above, and the impact of the surviving topsoil over **CL153/1** may also be involved in the apparent increased organic matter content. A final main difference is the higher frequency and larger size of charred plant remains in **CL153/1**. This will be discussed further below.

The boundary between Contexts [530] and [585] appears relatively sharp (Plate 1a), but uneven, marked mainly by a change in colour from dark yellowish brown to reddish brown, relating to the less organic stained and more iron stained nature of [585]. However, lower [530] and upper [585] are very earthworm reworked, and it is possible that the lower 2-3cm of what was identified in the field as [530] would be better defined as a wide boundary zone between [530]-[585]. Upper [530] is relatively charcoal rich, and contains fine gravel not
present in the lower part of the horizon. It is interesting that this gravel has not been moved down the profile, given the earthworm activity seen, and that this activity has not been strong enough to erase the horizon boundary, although homogenisation is evidently occurring.

It is possible (but not demonstrable), that the relatively stone-free nature of lower [530] and upper [585] could represent a surface. Surface casting worms, for example, create stone-free upper horizons with stones moved down the profile, and this is what is seen here below the gravelly upper [530] and lower [585]-[585/646] (see Plate 1a-b). This would fit with the strong earthworm sorting seen in [530] and upper [585] (both being very mixed regarding microcomponents). Whether or not a surface is indicated at this boundary zone, the presence of earthworm indicators in upper [585] suggests that this layer as a whole does or did not deter earthworm intrusion. With depth, however, this activity declines, and soil faunal features are not strongly expressed in lower [585] or [585/646]. No other clear surface indicators were seen.

Context [585] appeared in the field to be a deposit of orange-red or red-brown (loamy) clay, with few inclusions, and was initially interpreted as being originally a water-lain deposit, probably glacial or periglacial in origin. Glacial deposits are reported in depressions and valleys in the Burren (Drew 1983, 114), and it was thought that this might represent an example or derivative of these. In thin section CL153/2 (Plate 1a-b) the layer merges at depth with [646] (see below), has a relatively low organic matter content and contains other inclusions (such as charred plant remains) mainly in channels infilled with material from upper horizons.

Except for the discussion above regarding surfaces and earthworms, the general characteristics of [585] fit with an interpretation of either in situ B horizon development over weathering limestone (deepened and preserved because of location in a hollow), or origin as a thin deposit as postulated above, which has since served as parent material for subsequent soil profile growth. B horizon indicators include enhanced clay content (including ‘dusty’ clay in the groundmass and some pores, ‘clean’ clay pedofeatures in pores, and fragments of clay-rich fabrics), and iron staining (Plate 2e-h).

Coatings and infillings of sorted or intermixed clay, silt and sand particles are formed by the deposition (illuviation) of materials from upper layers. ‘Clean’ clay infillings result from the slow movement (translocation) of clay particles down the profile in solution under rainwater, and are generally related to ‘undisturbed’ soil profiles, especially those under forest, where such features form frequently. These have been contrasted with ‘dusty’, ‘dirty’ and ‘silty’ clay coatings, which contain various silt-sized mineral and organic particles as well as clay. These are thought to form through disruption of the strong bonds that hold aggregates together, allowing larger particles to be taken up into the soil solution in suspension, and then translocated downward. The movement of these larger particles is also associated with stronger water flow. These types of features are generally indicators of some sort of disturbance, including cultural interaction with the soil resulting from such activities as deforestation, cultivation, levelling and construction (Macphail 1998, 1987; Jongerius 1970; Gebhardt 1993). The fragments of clay-rich, oxidised fabrics (Plate 2e-f) are very silty, and very different to the main fabric. These may represent an alluvial origin, perhaps relating to a clay-rich surficial geological deposit (which is also seen in [585] through an increase in shale/slate fragments) and its early soil development. Overall, the clay features in layer [585] suggest that this soil developed on an initial geological deposit (i.e. not just from in situ weathering of limestone), initially in a stable, probably wooded, environment, and that it has seen some later physical disturbance. The latter could relate to land use before the monument was built, to the impact of monument construction, and/or to post-monument construction disturbance of overlying layers.
The equivalent of this horizon sampled from the top of a gryke under the bones in Chamber 1 (CL153/6 – Plates 1f, 2m-n) shows a somewhat different nature. In this location the layer is more organic and pedal (organic stained, with some crumb to subangular blocky structure), with frequent bone fragment inclusions, and moderate charred plant remains. Features related to earthworm activity, rooting and disturbance are also seen. Most of these characteristics can be directly tied to tomb construction & burial of human remains at this location – this can account for the increased faunal and floral activity, as well as the disturbance indicators. The horizon becomes increasingly iron stained and clay rich with depth, and iron-rich clay is frequently found in close association with eroding siliceous limestone fragments (around fragments and within pores in rock fragments). This suggests that at least some of the main characteristics of [585] are being created in situ. The idea of origin as a laid deposit is probable given the inclusions mentioned above, but the layer does mainly represent a B(t/fe) of a soil profile, and not solely a surficial geological deposit.

A grey lens is seen running across this thin section, and a second similar zone is found at the base of the section. This is comprised of highly weathered (almost dissolved) mixed siliceous and non-siliceous limestone fragments, with precipitated calcium carbonate (micrite) also present, often cementing included quartz grains and limestone fragments in the layer.

Context [646] is a yellowish brown gritty clay layer that echoes the shape of underlying rocks, and appears to be a transitional/weathering horizon immediately over the limestone geology. The horizon appeared less oxidised/ferric (compared to the overlying red clay loam) in the field, possibly reflecting a more alkaline chemistry immediately adjacent to the limestone. The grit appeared to be very fine fragments of limestone, presumably weathered off the underlying rock. Although a 1-2cm layer of this context was sampled in thin section CL153/2, it is impossible to clearly distinguish this layer, which is described in the appendix as [585/646]. This is the lower 4-5cm of the thin section (Plate 1b), which does not correspond to the thickness sampled in the field. In general, the layer is reddish brown (iron stained), with channel structure, and moderate to frequent angular and subangular fine gravel (up to 1.2cm). This marks a significant increase in stone inclusions compared to the rest of overlying [585], and its inclusion may relate to limestone weathering (as well as the potential impact of earthworm sorting above), although it does not exactly correspond to the layer seen in the field. Only slight differences were noted in the lowest 1-2cm of the thin section. These are a general increase in fabric and textural pedofeatures (including relatively clean clay features that seem to relate to limestone weathering (Plate 2i-j), ‘dusty’ clay infills as seen in the overlying horizons, and fabric mixing apparently related to bioturbation). In addition, there was a slight increase in the number of shale and (banded) siltstone fragments, although these are still low in number. While the former characteristics would suggest that this layer is a transitional weathering horizon, the latter suggests some increased input from a separate deposit with shale inclusions (see above).

Based on fragments found in all the thin sections, most of the limestone rock fragments found in the samples are grey fossiliferous (radiolaran?) chert, with frequent calcitic infillings and hypocoatings. Megaquartz and occasional chalcedonic silica inclusions are seen. The presence of areas with chalcedony may suggest some extreme weathering conditions. Non-siliceous fragments are mainly calcitic and fossiliferous (radiolaran), with micrite cement but frequent microsparite & sparite zones, usually as infills. Many echinoderm fragments in these are twinned. The limestone has weathered strongly and has a strong impact on the soil, with frequent components such as sparitic nodules and fossils occurring individually in the soil, even where this is relatively decalcified. Where it is more calcareous, there are frequent nodules (micritic and microsparitic), and soil pore hypocoatings and infills. Where root structures exist in the soil (mainly in layer [653]), these are occasionally replaced by calcium carbonate crystals.
Rendzina on limestone in Chamber 1 – Profile CL153/5
This profile is represented by Context [653], which is located in the part of Chamber 1 that does not overlie the hollow. It underlay human remains, and was sampled from the top of a gryke. The horizon is highly organic and faunally reworked, with a crumb to subangular blocky structure, few rock fragments (mainly siliceous limestone), and characteristics of earthworm sorting (Plates 1e & 2k-l). It is relatively low in clay content compared to the samples discussed above, with rare clay- and iron-rich aggregates, and is a rendzina topsoil horizon. Occasional bone fragments and charred plant remains are found, along with neoformed calcium carbonate features (mainly micrite in pore spaces) and calcitic earthworm granules. Compared to adjacent Context [585] (soil in Chamber 1 under bones in the hollow) as seen in CL153/6, it is more strongly reworked by soil fauna, and more organic in nature (staining and ped types). In this case, the lack of the underlying clay- and iron-rich horizon probably relates to the increased influence of the calcareous parent material (limestone), and faunal activity over the whole depth of the profile. Finally here, at the very base of thin section CL153/5 there is slight iron staining, associated with a slight increase in clay content. The presence of these pedofeatures at the base of the rendzina profile might suggest that processes leading to the accumulation/precipitation of oxidised iron and clay are normally occurring on site, and that it is the preservation of the results of these processes that is the key factor in the creation of the deeper clay and iron-rich profile in the hollow.

The fact that [653], despite being inside the chamber, and underneath the level of the human bones, appears to be a modern topsoil means that this layer has been open to faunal disturbance for some time. However, both the gryke samples show significant bioturbation. This being the case, it is difficult to securely relate the bones to the surrounding sediment, which has been reworked over time. The larger particles appear to be less disturbed, with bone fragments and larger charcoal fragments being found only in the chamber in the thin sections – evidently, despite strong disturbance of the soil material, the larger clasts have at least remained in horizontal spatial association with each other.

Discussion & conclusions
Certain issues regarding the history of the site itself and of the area can be addressed through the results of this research, including origins and history of the soil profiles, site-specific land use and sitting decisions related to the tomb itself, and regional models of landscape development during the Holocene.

Variations in possible cultural deposition and activity across the site
The samples from grykes inside Chamber 1 are significantly different to the samples taken from the tomb outside of this chamber in a number of aspects, in addition to the fact that one of the Chamber 1 samples is a rendzina. Field observations found that Context [585] was relatively dry and compact in the chamber as compared to elsewhere. This probably reflects the protection afforded by the chamber compared to other parts of the monument. Although increased compaction could relate to trampling or other activities specific to the chamber, no clear micromorphological evidence was found for these. The chamber had also seen a particularly thick accumulation of soil/sediment (c. 70cm), much of which was presumably blown in (C. Jones, 2002, pers. comm.).

It was anticipated that the Chamber 1 samples from Contexts [653] and [585] underneath the bones, going down into the tops of grykes, would give the best results for pre-monument landscape interpretation, given their relatively protected location, and possibly have included any buried soil horizons or fragments of these. However, both profiles showed strong bioturbation in the chamber, and this has effectively negated any protection the chamber might have given in regard to preservation of buried soils.
Regarding cultural inclusions, bone and charred plant remains are found in the soils immediately underlying the skeletal remains in Chamber 1 of the monument. The presence of small bone fragments and charred plant remains in the grykes is not surprising given the overlying association with similar remains found during excavation within the chamber. Of all the samples studied, bones were only seen in these two profiles; this suggests that despite disturbance indicators in the profiles, these large fragments were not significantly displaced laterally to other locations. The bone fragments have probably become sorted down into the grykes under bioturbation. It may prove useful in future situations to examine soils within grykes for such cultural remains even where overlying soils (or even monuments) are not found, if ancient cultural activity is suspected. It seems likely that grykes will retain evidence of the locations and limits of such cultural activities, thus giving an opportunity to map sites on the landscape in the horizontal plane, although this evidence may not be stratified due to faunal & rooting disturbance.

Unlike the larger, heavier bone fragments, charcoal is found in subsurface horizons outside of the chamber. Despite the presence of these charred remains in horizons assumed to relate to Neolithic activities within the chamber, taphonomic issues mean that attribution to that period is troublesome. Layer CL153/1 contains charred remains in all locations sampled, and the increased number and size of charred remains in layer CL153/2 is interesting. The presence of charcoal in CL153 can relate to many possible activities, ranging from pre-monument clearance or land use, deposition related to construction, cremation burial and/or later use of the monument itself, or possibly even localised burning related to historic land use. This is one instance where poor understanding of the temporal relationship of the tomb to the underlying and surrounding soil profile hampers interpretation (see below). It is difficult to directly relate any of the soil material present to monument construction or use, as a great deal of remixing and later addition has taken place. However, the fact that it is a location outside of the chamber, and near the top of the soil profile, that appears to have a stronger charcoal presence suggests that the charcoal found in CL153 is not simply explained by disturbance of cremation deposits in Chamber 1, especially since the larger (bone) inclusions are not seen outside the chamber. Regarding possible later land use practices, sampling for macrobotanical analysis from the soils and grykes outside of the monument would help determine if such remains are specific to the tomb or more widespread. No evidence for in situ burning was seen in the field or in thin section.

Finally regarding inclusions, as noted previously, the source of the fragments of non-siliceous limestone found is unknown. While this is likely to be localised, and these fragments are possibly natural inclusions, the angular non-siliceous limestone fragments in a layer in CL153 cannot have travelled far, given their angularity. Perhaps some non-siliceous stones were used in tomb construction? Choice of construction materials is a further issue that could profitably see further investigation.

Relating the soils to the monument
Relating the actual soil material to the monument is very difficult, and dating the speed of soil development and the relative ages of Contexts [645] (in Chamber 1) and [580]-[585] (outside Chamber 1), will probably prove impossible given the formation processes seen. It is likely that much soil been lost over the Holocene, particularly outside of the hollow and the chamber, which appear to act as sediment traps (at least for blown-in topsoil regarding the latter). In most places, even underneath large stones forming part of the monument, an Ah horizon (645) was seen overlying or comprising the profile. The presence of this topsoil underneath these orthostats/boulders, including over the deeper hollow profile, suggests that much of the soil material involved in the profile may simply have blown in and trickled down through the monument, i.e. that most of this profile post-dates monument construction.
However, there is clearly a sequence of deposition over the hollow, and in a few places only lower topsoil/B horizons (Contexts [530]-[585]) were found immediately under stones. In addition, the stratigraphic equivalent of the latter context was found in a 1-2cm thick layer around and under the skeletal remains located within Chamber 1, where it overlies the hollow. This layer could thus represent some pre-monument and/or immediately post-monument prehistoric soil growth (and possibly surface in Chamber 1). The assumption is that such a layer would have survived outside of the tomb, predating the modern topsoil, if conditions had allowed for its preservation. However, it does not contain clear indications of having been a surface horizon, and there are no definitive truncation indicators, even in the rendzina profile sampled. My impression is that [530] is the best candidate for a pre-modern surface layer, although, if the on-site stratigraphy is correct, this should post-date cremation interment in Chamber 1. Layer [530] currently has lower A/upper B characteristics, which can be postulated to have developed later, and it certainly has some indicators of surface events and processes: it is relatively organic, despite the fact that it underlies the modern main depth limit for topsoil creation, and in all locations sampled it contains charred plant remains, including a substantial deposit of large charcoal fragments in one location (CL153/1-2).

Since the layer is not riddled with dug contexts such as pits, postholes or hearths, it seems likely that this charcoal represents surface or near surface depositional events.

The soil profiles and Holocene land use and landscape history
In general, the study finds that the two soil profiles are different primarily due to topographic factors (presence/absence of hollow), but that the soil in the hollow may also have a slightly different parent material. No soils in the tomb could be called ‘buried’ per se, as they have been and are still growing profiles, but both have been protected from later land use practices by the Neolithic monument. As such, the presence of the rendzina, in particular, in Chamber 1 has implications for models of extensive soil, land use and landscape change in later prehistory. The deeper profile over the hollow, however, presents the most information on site-specific land use history.

The hollow profile contains occasional shale/slate gravel, and some clay features possibly representative of alluvial environments. This fits with the idea that the deeper soil profile in the hollow developed on a surficial geological deposit (i.e. not just from in situ weathering of limestone), perhaps a localised occurrence or survival of more shale-rich or mixed limestone/shale breccia, as described for soils immediately to the south of the area (Moles & Moles 2002). As very few shale rock fragments were seen in the thin sections or in the field, a mixed origin is suggested for this soil profile in this location. The source of the non-siliceous limestone fragments seen is unknown. Further examination is needed before this site can be fitted into Moles & Moles scheme, but the remains are not significantly different from the soils described therein (ibid.)

However, the clay-rich nature of the lower hollow layers is not solely attributable to the presence of a surficial geological deposit, as strong weathering of the limestone on site is also seen, and this appears to contribute at least some clay (as well as calcareous characteristics) to the profile. In addition, most of the clay in all of the horizons examined is illuviated from above, deposited in the form of coatings, infills and additions to the main fabrics, and this impact increases with depth. The lower, oxidised layer of the hollow soil can thus be described as primarily representing the B(t/fe) horizon of a brown earth profile, i.e. pedogenetic processes appear to contribute greatly to the distinctive nature of the originally presumed geological deposit. However, a distinct eluvial horizon (Ea), as normally seen in deeper argillic brown earths, is not well developed, or the remains of such a horizon have been disrupted by bioturbation reworking and significant amorphous organic matter addition. Finally here, the rendzina profile in the tomb was seen to contain very rare microscopic indicators (pedofeatures) of a potential clay-rich ancestral profile, but it is difficult to explain how any deeper horizons were ‘lost’ in this location after protection by tomb construction. In addition, their rare presence is not strong enough on its own to support an interpretation of a
substantial, but reworked or lost to erosion, clay-enriched lower horizon. Indeed, the fabric pedofeatures seen could easily be argued to originate from the hollow, being moved laterally through events such as tomb construction. It would be desirable to compare this profile to the modern rendzina outside of the tomb and away from the hollow, especially in regard to clay content and fabric and textural pedofeatures, to see whether any evidence of extensive deeper brown earths survives in the modern rendzina profiles.

The lower layers in the hollow show rare textural pedofeatures suggestive of the presence at some time (pre-monument) of a stable, possibly wooded, environment. The date and extent of this land cover is unclear. The hollow, with its deeper soil, would be a preferential location for tree or shrub growth compared to the adjacent limestone pavement, and these pedofeatures could simply represent localised cover, or they could represent the wider Mesolithic-early Neolithic landscape as currently envisioned (Mitchell and Ryan 1997; Watts 1983). Given the development of a mature rendzina soil within & underneath Chamber 1 (outside of the hollow), however, a generally more wooded environment should pre-date the tomb by quite some time (Mesolithic). Although rendzinas can form under woodland (Fischer 1982), these shallow organic soils are normally found under grassland vegetation. In addition, there is evidence for generally thicker soils being eroded in the Holocene across much of north-west Europe, including Ireland, and the change or loss of these profiles (usually dated by palaeoenvironmentalists to the Mesolithic period, and by archaeologists to the Neolithic or Bronze Age) needs explanation. A version of this general model of soil history has been supported in the Burren by a few studies, mainly based on vegetation history (Watts 1983; Drew 1983; Jelić and O’Connell 1992). Assuming that thicker woodland soils did exist in this location, then, the rendzina soil under the tomb suggests that major changes to the profile here occurred well before the tomb was constructed.

Both profiles under the tomb contain disturbance indicators (textural pedofeatures such as ‘dusty’ clay coatings) which could relate to land use before the monument was built, to the impact of monument construction, and/or to post-construction disturbance of overlying layers.
The date of origin of these pedofeatures is unknown, but they are localised indicators of disruption of the profile. Again, comparison to profiles outside of the tomb would be useful in regard to relative degree of disruption seen in the monument itself compared to soils exposed and subject to later prehistoric, historic and modern land use practices.

Chamber 1 appears to have been constructed directly over the edge of the clay- and iron-rich soil of the hollow, i.e. one part of the chamber shows a rendzina profile (Ah directly on limestone), while the other, northern part overlies the hollow with clay. If, as it seems, both soil types were developed to some degree by the time of monument construction, choice of monument siting on the boundary of soil profile types could also benefit from further study in this region. This location may be significant regarding ancient decisions on appropriate sites for monument construction. The nature of the physical changes involved suggests that factors in addition to topography and viewshed, such as rock and soil colour, and depth of soil material, all of which are expressed on the surface through vegetation type distributions, may have been part of these decisions. Clay-rich wooded points in the landscape, in particular, appear to be relatively tenacious over time in many areas, with these patches often being retained over the very long term under forest. In Cranborne Chase, for example, deep brown earths with Bt horizons and clean clay pedofeatures are still found under woodland in parks, rides and hollows, although the remainder of the modern and buried landscapes show shallow rendzina soils under grass since the early Neolithic (French et al. 2001). Perhaps such preferences regarding siting decisions are localised; perhaps, unlike in Cranborne Chase, many monuments in the Burren were constructed over clay-rich soil ‘sinks’ such as the hollow studied here. The choice of this location for clearance and (much?) later monument construction is interesting in this regard, and monument siting in relation to soil types could be further addressed in this region. Many more investigations into soils and land use across the Burren are needed, especially focusing on soils thought to date to prehistoric and later periods, in order to gauge the impact of location versus landscape-scale evolution of soils and the impact of land use history across the region, along with further assessment of models of how ancient settlement, land use and siting decisions can be linked to proposed soil changes.

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Bibliography


**Appendix – Detailed thin section descriptions**

**CL153/1-2**

**Macroscopic description**

There are two clearly visible horizons in thin section 153/1 – 3-4cm of context [530] with a relatively sharp but uneven boundary with underlying context [585], which is seen in the lower 5-6cm of the thin section. Thin section 153/2 also represents two contexts: the lowermost part of context [585] and 1-2cm of context [646]. There is, however, no clear boundary between the two sampled horizons in the thin section, except for a significant increase in stone inclusions (0.5-1.2cm size), especially in the lower 4-5cm of the thin section, accompanied by an increase in larger channels and cracks. The inclusion of this gravel may relate to weathering of the underlying limestone, but it does not exactly correspond to the layer of [646] seen in the field, which was less than 2cm thick. However, there are other slight differences noted in the lowermost 1-2cm of the thin section, with a general increase in fabric and textural pedofeatures (see ‘pedofeatures’) and in the occurrence of shale and (banded) siltstone fragments. In terms of overall characteristics, the profile will be described as follows: [530], upper [585], lower [585] and [585/646].
Context [530] is dark brown (7.5YR 3/3 to 10YR 3/3) in daylight, with moderate charcoal inclusions and subrounded, subangular and angular stones (0.5-1cm) visible to the naked eye. It has a clear channel structure throughout (0.5-1mm), and one especially large (1.5-2mm wide) and distinct planar void/channel is visible near the base of the layer.

Upper [585] is brown (7.5YR 4/4) to reddish brown (5YR 4/3) with depth, with occasional fine angular black inclusions (possibly charcoal) visible. It has a weakly developed channel structure, in places appearing apedal. Lower [585] is reddish brown (5YR 4/3), with occasional fine gravel (0.5cm).

Structurally, it is similar to upper [585], but with a more distinct channel structure in places (<1mm wide channels visible macroscopically).

Context [585/646] is reddish brown to dark reddish brown (5YR 4/4 to 5YR 3/3), with moderate to frequent angular to subangular gravel (0.5-1.2cm), and a moderately developed channel structure (<1mm to 1.5mm wide channels).

Microstructure & Porosity
[530] – channel & chamber, some very poorly developed subangular blocky (0.5cm). 15% porosity: 10% channels (250-500μm wide, 700-1000μm long, straight & partially accommodated; also 3000-7000μm long, curved, partially accommodated; 50-100μm wide, 500-1000μm long, straight to curving, unaccommodated) and 5% chambers (750-1500μm wide, 5000μm long, often partially filled with plant remains (charcoal)). A linear void or channel (1000μm wide, 10,000μm long, straight, unaccommodated to partially accommodated) is located on one side of the horizon, near the base. This appears to be a ‘natural’ channel, although it is similar to some channels seen at the edges of cultural features (Lewis 2002).

[585] upper & lower – channel. 5-10% porosity, increasing with depth: mostly channels or rounded vughs (50-500μm in diameter, channels 300-6000μm long, unaccommodated to partially accommodated). Most channels appear to be related to fine rooting. <5% cracks (<50-150μm wide, 200-500μm long, partially accommodated).

[585/646] – channel. 10% porosity: channels and cracks (100-1000μm wide, up to 8,000μm long, accommodated, partially accommodated and unaccommodated, straight and curved), often lined with <20μm thick dusty to dirty clay lenses (see ‘Pedofeatures’).

c:f ratio
[530] – 35:65 - very coarse sand 5%, coarse sand 5%, medium sand 10%, fine sand 15%, very fine sand 15%, silt 35%, clay 15%. Sandy loam.

[585] upper – 20:80 - very coarse & coarse sand 5%, medium sand 5%, fine sand 10%, very fine sand 20%, silt 40%, clay 20%. Clay loam.


[585/646] – 35:65 - very coarse sand 5%, coarse sand 10%, medium sand 10%, fine sand 10%, very fine sand 15%, silt 30%, clay 20%. Clay loam to sandy clay loam.

Mineral components
[530] – moderately to poorly sorted; c. 20% of visual area is composed of rock fragments >1000μm to 7500μm in size. These are almost all siliceous limestone fragments (chert) (with rare cloudy zones of chaledonic quartz in associated pore spaces), with rare quartz sandstones and micas, non-siliceous limestone fragments and shale/slate; several appear to be stained with amorphous iron. Grains are mainly quartz (90+%%) and feldspar (mainly plagioclase). Clay in the groundmass has a low birefringence, being masked by strong organic staining, and appears very dark brown (PPL), dark brown to dark reddish brown (XPL) and bright reddish orange (RL). Rare broken fragments of shell (100-250μm thick, up to 1500μm long) at the very top of the layer.

[585] upper – moderately sorted; <2% of visual area is composed of rock fragments >1000μm to 2500μm in size. These are all siliceous limestone fragments (chert). Smaller rock fragments also include quartz sandstones, micaceous sandstones, occasional shale/slate and siltstone (c. 750μm size, light brown (PPL), yellow brown (XPL) with ultrafine crystalline structure and internal banding (30μm thick bands that are black (all lights))). Grains are as above, but with rare micrite (only on limestone fragments), rare olivine crystals, and rare zones with dolomite crystals. There are also <30μm sized lath shaped crystals (white PPL; yellow & white XPL) occasionally throughout the groundmass. Clay is moderately birefringent dusty dark brown (PPL), reddish-brown (XPL) and bright reddish orange (RL).

[585] lower and [585/646] – poorly sorted to unsorted; 20% of visual area is composed of rock fragments >1000 to 9000μm in size. Rock fragments are as in upper [585], with a slight increase in
occurrence of shale and siltstone (sometimes banded) in the lowermost 1-2cm. Grains are as in
[585] upper, except that no dolomite was noted. Clay in the groundmass is moderately birefringent
dusty to dirty, medium reddish brown (PPL), red (XPL) and orange-yellow to reddish orange (RL).

**Organic components**

[530] – 10-15% overall; 5-10% cellular material (mainly carbonised material 100-600μm in size,
ocasionally 500-3000μm in size; occasional non-carbonised cellular material (roots) 200-3500μm
in size), 5-10% angular and subrounded fragments of non-cellular organic material (<50-100μm in
size, black (under all light), with occasional amorphous fragments of recent decaying plant remains)
and 5% ‘punctuations’.

[585] upper – as above, but 5-10% and decreasing with depth, except in small patches of earthworm
sorted soil features (textural pedofeatures), where 15-20%, mostly 50-100μm cellular charred
material and ‘punctuations’.

[585] lower – 5%, mainly ‘punctuations’ and angular fragments of black and very dark brown non-
cellular material (<50-150μm), carbonised cellular fragments (<300μm in size), and roots (<200-
500μm in diameter).

[585/646] – as lower [585], but very rare carbonised remains.

**Groundmass**

[530] – stipple speckled, dark brown (PPL), grey to dark reddish brown and stipple speckled (XPL),
light golden to yellow brown (RL). Materials are in a close porphyric related distribution.

[585] upper – stipple speckled with some porostriation, reddish brown with frequent light reddish
brown patches (earthworm sorted) (PPL), moderately birefringent stipple speckled dark reddish brown
and grey (XPL), orange-red throughout (RL).

Groundmass colours are as in upper [585], except that in XPL the reduction in silt means there is
less grey visible, and there are few sorted areas.

**Pedofeatures**

*Fabric:* [585] upper – rare subrounded to subangular clay-rich aggregates (250-1000μm in size), dark
brown (PPL), highly birefringent orange-red (XPL), reddish orange (RL), with a c:f ratio of 0:100
(very fine sand <5%, silt 40-50%, clay 50-55%).

[585/646] – rare rectangular and ovoid zones 250μm in size of stipple speckled dusty to very dusty clay
(yellow-orange (XPL), greyish brown (PPL), dark brown (RL)). These appear to be aggregates,
although found in channels. Also in this layer there are rare zones (c.1000μm in size) of included
organic ‘topsoil’ material, often with internal clay infills and coatings (see ‘textural pedofeatures’);
these appear to be channel infills related to bioturbation. The latter are more frequently found in
the lowermost 1-2cm of the thin section.

*Textural:* [530] – occasional iron-stained slightly ‘dusty’ to clean clay infills/aggregates (50-200μm in
size, reddish brown (PPL) and orange-yellow (RL)).

[530] & [585] upper – earthworm sorting seen throughout (separation of silt, with lack of organic
staining on this component, ‘banded’ with main groundmass lenses), and also strongly expressed in
rounded zones c. 2500-3500μm in size. These are normally associated with an increase in the
presence of fine charred plant remains (10-20%).

[585] lower & [585/646] – moderate ‘dusty’ to ‘dirty’ 20-250μm thick clay void linings and coatings
on grains and peds (very dark brown (PPL), dark reddish-brown (XPL), orange-red (RL)), organic
and iron stained; these are also evident in old void spaces now incorporated into the groundmass.
Rare slightly ‘dusty’ medium reddish brown (PPL), highly birefringent red (XPL) and orange-
yellow (RL) laminated clay pore infills (100-250μm in size, cracked).

[585/646] – at the base of the thin section there are rare to occasional iron-stained highly birefringent
slightly dusty clay inclusions, both as fragments 10-50μm in size and as laminated and non-
laminated infills in fine pore spaces. These are medium reddish brown (PPL), red (XPL)
and orange-yellow (RL). This clay is often associated with weathering limestone fragments, and its
occurrence presumably reflects rock weathering as well as some infilling. Inside the rare zones of
included organic ‘topsoil’ material (see fabric pedofeatures) there are clay linings (50-150μm),
which are similar to the ‘dusty’ coatings described for lower [585] above, but darker in XPL, very
‘dusty’, and sometimes also silty.

**Amorphous & cryptocrystalline:** [530] – moderate to strong amorphous organic staining
[585] upper & lower – moderate to strong iron staining
[585/646] – moderate to strong iron staining; moderate iron mottling in rounded zones (100-500μm, dark reddish brown (PPL), black (XPL), very dark brown (RL); the larger mottles have 200-400μm thick layers concentrically oriented and appear to relate to plant root replacement/infills

CL153/3

Macroscopic description

Although taken through the sequence [645]-[530]-[585], this thin section does not show an obvious distinction between layers [530] and [585]. The 1cm representing the base of Context [645] is a layer of dark (reddish) brown (7.5YR 3/3 to 5YR 3/3) loose soil, with crumb structure (0.2-0.5cm) and moderate to frequent rock fragments (<1.3cm). This overlies and has a sharp boundary with 7-8cm of dark yellowish brown (10YR 4/4) apedal material with frequent rounded rock inclusions (mostly 0.3-0.6cm, rarely 1-2cm). Microscopically, this material appears to consist primarily of very highly degraded limestone rock fragments. This layer is interrupted at 4-5cm depth by a diagonal linear void (2-5mm wide, running across the thin section) partially infilled with material resembling that in [645]. There is a lower patch of similar material, apparently infilling another diagonally running linear void space.

Microstructure & porosity

[645] – crumb (500-4000μm in size, mostly c. 2000μm) and channel structure (where silty infills seen). Porosity is 15%, mostly interpedal channels (500-1000μm wide, 1000-5000μm long, unaccommodated to partially accommodated, straight & curved, often with fine linings (1-2 grains thick) of quartz silt).

[530/585] – channel (mostly partially infilled with calcium carbonate crystals) with some vughy zones. Porosity is variable: 10-15% within degraded limestone zones, 15-20% in where soil infills occur. In both cases porosity is mainly channels and cracks (50-2000μm wide, 500-2000μm long, partially accommodated, curved and straight). In zones with a vughy structure porosity is mainly irregular vughs (<50-400μm). The diagonal linear void running across the section is 1500-3000μm wide, straight, and partially infilled with [645] material, with unaccommodated sides. This appears to be a channel.

c:f ratio

[645] – 25:75 - very coarse sand 5%, coarse sand 5%, medium sand 5%, fine sand 10%, very fine sand 20%, silt 35%, clay 20%. (Sandy) clay loam.

[530/585] main fabric (weathered limestone) – 40:60 - very coarse & coarse sand 5%, medium sand 20% (mostly calcareous nodules), fine sand 15% (mostly calcareous nodules), very fine sand 5%, silt 40% (of which 25% is micrite), clay 15%. Sandy silt loam. Soil infilling fabric as [645].

Mineral components

[645] – rock fragments make up 40% of the visible area. These are mainly siliceous limestone (chert) (200-6000μm), often very degraded and mixed with soil, and calcareous (micritic) quartz sandstone. Grains are mainly quartz, micrite &olivine. There are occasional mollusc shells (articulated but broken) in areas 2000x2000μm in size, rare earthworm calcitic granules, and rare bone fragments (750μm in size). Clay in the groundmass is strongly marked by amorphous organic staining - see ‘Groundmass’ and ‘Textural pedofeatures’ for further description.

[530/585] – ‘melted’ rock fragments make up 90-95% of the visible area. The matrix is mainly degraded limestone fragments 2-4cm in size, running slightly diagonally across the slide. Some areas are siliceous, some calcareous. All smaller rock fragments seen (<2% of total area) are chert or calcareous sandstone. There are rare earthworm granules. Grains are mainly micrite, microsparite & sparite and quartz. Clay zones are mainly masked by organic & iron staining – where visible these are grain coatings or infills (see ‘Textural pedofeatures’).

Organic components

[645] – 10%, mostly angular black fragments (<= 150μm in size), with rare 1000-2000μm sized root remains. Strong organic staining on 80% of the groundmass (except where ‘sorting/infilling’ zones seen – see ‘textural pedofeatures’). With depth there is a slight increase in larger angular fragments (up to c. 200μm) and modern root remains of the same size.

**Groundmass**

[645] – crystallic, with low birefringence (strongly organic stained), rich brown (PPL), dark reddish brown (XPL), golden brown (RL). Components show a close porphyric related distribution.

[530/585] – crystallic, highly birefringent, light orange-brown (PPL), yellow-brown (XPL), light yellow to orange (RL). Components show a close porphyric to (low porosity) enaulic related distribution.

**Pedofeatures**

**Fabric:** [530/585] – Intrusive patches of [645]-like material as partial infills in pore spaces and between large degrading rock fragments. These zones show earthworm structural features (excremental fabric) and include rare areas of textural sorting (silt separation).

**Textural:** [645] – zones c. 2000μm in size with strong infilling with fine sand and silt-sized mineral grains (mostly quartz). These are often separated by curved linear features (100-200μm thick) of very fine sand, silt and clay, with strong organic staining. Together these zones relate to 1) earthworm mixing and 2) some translocation of fine sand and silt into the groundmass.

[530/585] – rare fine reddish clay infills as described above, c. 50μm thick, related to very fine old pore spaces (zones of infills c. 100μm in size each). Also very dark brown (PPL), moderately birefringent reddish-brown (XPL), light yellow-orange (RL) grain coatings or infills 50μm thick, or in zones up to 150μm in size. These clay features become frequent in one area near the base of the thin section, creating a zone c. 3000μm in size in which this clay in a dominant part of the groundmass, surrounding pore spaces, calcitic and siliceous zones. In zones of [646] type fabric infills, silt separation is seen in areas of earthworm excremental fabric.

**Depletion:** In both horizons, but especially in [530/585] there are zones of calcium carbonate depletion of the groundmass at the edge of channels filled or partially filled with sparite.

**Crystalline:** [645] – occasional earthworm granules, occasional void linings with sparite (check as below), and some calcium carbonate (sparite) replaced root remains.

[530/585] – frequent compound partial and complete calcitic infillings, sparite (calcium carbonate crystals 50-150μm in size) pore linings and infills, also micritic features throughout. Frequent quartz silt infills – many of these may be part of highly weathered siliceous limestone fragments.

**Amorphous & cryptocrystalline:** [645] – strong organic staining on 80% of groundmass (not strong where “sorting/infilling” zones seen – see “textural pedofeatures”).

[530/585] – amorphous iron staining throughout, weak amorphous organic staining also seen (strong where [645]-like material). Both are strongly expressed on clay coatings & infills.

**CL153/4**

**Macroscopic description**

The sample of upper [530] shows one horizon of subangular blocky reddish brown organic soil (as in [530] lower, CL153/1), with frequent subrounded and subangular rock fragments (0.5-2cm), diagonally bedded. The rock fragments are sorted, with larger white fragments in the upper 4cm, followed by a lens of 0.5cm sized more rounded grey fragments, and then a zone of soil with more angular 0.5-0.7cm sized grey fragments (colours here are reflected, in daylight). Fine charcoal (1-2mm) is visible.

**Microstructure & porosity**

The horizon has a subangular to angular blocky structure, with organisation suggesting significant rooting action. The uppermost 0.5cm shows a fine crumb structure (0.2cm – 2000-2500μm). Porosity is 10%, mainly interpedal channels and cracks (300-1000μm wide, 4000-20000μm long, straight and accommodated to partially accommodated (cracks), curved and undulose, partially accommodated to unaccommodated (channels)). Intrapedal porosity is <5%, mainly fine cracks (30-50μm wide, 200-600μm long, straight, partially accommodated).

**c:f ratio**

[530] upper – 45:55 - very coarse sand 5%, coarse sand 5%, medium sand 15%, fine sand 20%, very fine sand 20%, silt 20% (of which <5% micrite), clay 15%.

[530] lower – 35-40:60-65 very coarse sand 5%, coarse sand 5-10%, medium sand 5-10%, fine sand 15%, very fine sand 20%, silt 25-30% (of which <5% micrite), clay 15%.
**Mineral components**

Rock fragments make up 50% of visible area in the upper 4cm, 20-30% in the rest of the thin section. All of the larger bedded rock fragments in the upper 4cm are angular fragments of calcareous limestone, as are almost all of the smaller rock fragments in this layer. This is significantly different from all of the other samples from the site, and suggests some inclusion of fairly recently fractured rock from a different source to the standard, siliceous limestone seen on the site. This could be a very local source (a variation in the limestone outcrop). The rest of the thin section has siliceous limestone fragments (chert) as main inclusions, with occasional to rare siltstones (some banded). In the thin section as a whole, there are also frequent sandstone fragments, some micaceous. Grains are mainly quartz, but with some feldspars. Rare mollusc shells are seen at the very top (also the top of the layer in the field).

**Organic components**

10-15%, mostly <10-100μm black angular fragments and ‘punctuations’, also modern and iron-impregnated root fragments & decaying cellulose, also charred cellular remains (up to 2000μm in size, angular and subangular).

**Groundmass**

The groundmass appears decalcified, despite the presence of limestone fragments, and is very iron-rich, becoming more iron- and clay-rich with depth. It is stipple speckled with rare zones of granostriation, medium reddish brown (PPL), grey and dark reddish brown (XPL), reddish-orange (RL). There is a mixed close and open porphyric related distribution.

**Pedofeatures**

**Fabric**: Especially near the base of the thin section, subrounded zones (<1000μm in size) of more strongly iron-stained material (but otherwise the same basic fabric as the main groundmass) are found surrounded by the main groundmass, with distinct but not sharp boundaries. These appear to be faunally-created peds and/or infills.

**Textural**: Especially near the base of the thin section, old and partial channel infills/coatings of medium reddish brown (PPL), dusty orange reddish (XPL), orange-red (RL) clay (up to 100μm thick, some with microlaminations).

**CL 153/5**

**Macroscopic description**

One horizon is visible macroscopically (Context [653]). This is a dark to very dark brown (7.5 YR 2.5/3 to 10YR 3/3) soil with crumb structure (1-15mm), and occasional fine charred plant remains (<0.5cm).

**Microstructure & porosity**

Crumb structure (1mm-1.5cm) to subangular blocky (1cm) with depth; occasional chambers filled with microaggregates (faunal). Porosity is 15-20% (higher where chambers and microaggregates occur). Most of this is interpedal channels (500-1500μm wide, 1000-10 000μm long, curved and straight, partially accommodated and unaccommodated), with some chambers (2000-5000μm wide, up to 12000μm long, unaccommodated and partially infilled with rugose microaggregates). 5% is intrapedal cracks (50-150μm wide, 500-1200μm long, straight, partially accommodated).


**Mineral components**

Rock fragments make up 5% of visible area; these are as described in CL153/1-2 Context [530], but mainly <0.5cm in size, and there are rare non-siliceous calcareous limestone fragments (<1.5cm size, with some twinning of crystals), as seen in CL153/4. Grains are as in CL153/1-2 Context [530], but with rare micrite (only on sand grains) and occasional partial sparite infills. Clays are mainly masked (see ‘groundmass’), but there are rare rectangular zones of dusty highly birefringent clay (100x300μm, orange (PPL), bright yellow and orange (XPL), light orange (RL)). Occasional bone fragments are located at c. 3cm depth. These are 750-2000μm in size and appear to be uncharred. There are rare shell inclusions.
Soil micromorphology and geoarchaeology at Parknabinnia Court Tomb (Clare Megalith 153)

Organic components
10-15%, mostly amorphous, black angular fragments (<50-200μm), and ‘punctuations’, but also occasional live fine root remains and charred plant remains (with cell structure visible).

Groundmass
Stipple speckled to undifferentiated, dark brown (PPL), dark reddish brown (XPL) and dark red (RL), with low birefringence. Materials are poorly sorted to moderately well sorted, in a close to open porphyric related distribution.

Pedofeatures
Fabric: rare clay- and iron-rich subrounded aggregates (c. 100-200μm in size) with silt-sized particles of isotropic material.
Textural: rare to occasional fine infills (<50-150μm thick), very organic stained, usually found in fine pore spaces. Also similar infills, but mixed with sand grains, as infills; these appear to relate to bioturbation. Rare zones of relatively clean clay (orange-red in all lights) are seen, usually surrounding and on mica fragments and quartz grains; these presumably relate to rock weathering.
Amorphous and cryptocrystalline: strong organic staining on main groundmass, weak iron staining at the base of the profile.
Excrement: coalesced excrements make up most of the groundmass.

CL153/6
Macroscopic description
Two (sub)horizons are visible macroscopically, divided by a lens of light grey material <1cm thick. The uppermost 2-3cm of [585] is brown (7.5YR 4/2) with a crumb (<3cm) to channel structure. The lens of light brownish grey material (10YR 6/2) appears macroscopically to be either an infill or a lens of ‘melted’ limestone. (Microscopically it can be seen that other zones of this fabric/material are present in the lower part of [585]). Around and underlying this for 4-5cm is the rest of [585], which is a horizon of crumb (<0.6cm) to subangular blocky (<1cm) dark brown (7.5YR 3/2) soil. All horizons are downward (diagonally) bedded.

Microstructure & porosity
For microstructure see ‘macroscopic description’. The grey lens & other zones of ‘rotting’ rock have channel microstructure. Porosity is as follows:
[585] upper – 15-20%, mainly interpedal channel (200-1500μm wide, 2000-3000μm long, curved, crooked and straight, partially accommodated to non-accommodated), with some cracks (50-100μm wide, 200-1500μm long, straight and crooked, accommodated to partially accommodated).
Grey lens & other zones of ‘rotting’ rock – 10-15%, mainly channels (100-1500μm diameter) & vugh-like pores (400-1000μm). The channels appear to be root holes, while the vugh-like pores seem to mark the former locations of weathered-out components.
[585] lower – 15-20%, mostly interpedal cracks and channels (100-2000μm wide, 1000-7500μm long, partially accommodated, straight & crooked; also 100-1000μm wide, 1000-2000μm long, accommodated to partially accommodated, straight & curved. Patches of grey ‘rotting’ rock have porosity as described above. The very base of the thin section shows an increase in coalesced microaggregates (faunal excremental pellets), associated with an increase in iron and organic staining (and possibly clay).

c:f ratio
[585] upper – 30-35:65-70: very coarse sand 5%, coarse sand 5-10%, medium sand 5%, fine sand 15%, very fine sand 20%, silt 30-35% (of which <5% microsparite & micrite), clay 15%. Sandy (silt) loam.
Grey lens & other zones of ‘rotting’ rock – 35:65 - very coarse sand 0%, coarse sand 0%, medium sand 10%, fine sand 25%, very fine sand 15%, silt 25-30% (of which 15% microsparite & micrite), clay 20-25%. (Sandy) clay loam.
Lower [585] – 25:75: very coarse sand 5%, coarse sand 5%, medium sand 5%, fine sand 10%, very fine sand 15-20%, silt 35-40% (of which <5% microsparite & micrite), clay 15%. Sandy silt loam.

Mineral components
[585] upper & lower – rock fragments make up 20-30% of visible area. These are mainly siliceous limestone fragments (sizes as described in CL153/1-2). Grains are as described in CL153/1-2;
sparite is found in pore spaces and replacing zones of rock fragments, micrite is <5% of the silt fraction. Clays are as described in ‘groundmass’ Frequent bone fragments are found in the upper centimetre, but are rare in the lower part of horizon. These are up to 10,000μm long and 1500μm wide, apparently uncharred, and in some places have fragmented in situ.

Grey lens & other ‘rotting’ rock zones – rock fragments make up <5% of the visible area. These are non-siliceous and siliceous limestone fragments. Most of the zones consist of crystals of varying sizes of calcium carbonate (85-90%). In the soil component of the lens and zones there is also quartz and feldspar (mainly silt, very fine and fine sand sized). Clays are mixed: most clay is part of the soil matrix, and is organic-stained, very dark brown (PPL & XPL) and orange (RL). Small zones (c. 50-100μm in size) of clean to slightly ‘dusty’ clay. (dark reddish brown (PPL), highly birefringent red (XPL) and orange-brown (RL)) are found in close association with calcium carbonate crystals. Some of these zones are microlaminated.

Organic components

[585] upper – 15%, frequent angular black fragments and ‘punctuations’ as in as in CL153/1 [530], and occasional to moderate charred plant remains.

Grey lens & other zones of ‘rotting’ rock – <2%, rare angular black fragments and charred plant remains. Strong organic staining on textural pedofeatures (see below).

[585] lower – 10%, as in [585] upper. Decreasing with depth, and including rare to occasional root remains as described in CL153/1-2 [585] lower.

Groundmass

[585] upper & lower – stipple speckled to granostratied, dark brown (PPL), very dark reddish brown to black (XPL), reddish orange to reddish brown (upper [585]) to orange (lower [585]) (RL); poorly sorted, close porphyric related distribution.

Grey lens & other zones of ‘rotting’ rock – soil components as in [585] lower, but with grano- and porostriation in places. Rest is crystallitic (calcitic), with moderate to high birefringence, greyish-white (PPL), white to yellowish white (XPL), cream-silver white (RL).

Pedofeatures

Fabric: [585] lower – a rounded fragment of clay-rich fabric 1000μm in size is located in the lower 2cm of the thin section. This is greyish-brown (PPL), moderately birefringent orange-yellow (XPL), and silver-yellow (RL), and has a c:f ratio of 0:100, with clay:silt being 70:30 (coarse silt 5%, medium silt 5%, fine silt 20%, clay 70%). Its groundmass is stipple speckled.

Textural: In all layers there are strongly organic stained clay infills and coatings (50-250μm thick), often mixed with silt and very fine sand, and, rarely, strongly organic stained thick silt-clay ‘pendants’ (500-1000μm thick) on the bases of some grains and rock fragments.

[585] upper & lower – strongly iron stained, less sandy fabric apparently clay rich (masked by staining) found infilling some larger pores; possibly related to earthworm activity.

Crystalline: [585] upper – some root remains show sparite crystal replacement

Amorphous and cryptocrystalline: All layers – strong organic staining on textural pedofeatures

[585] upper – occasional iron replacement of some root remains; light to strong amorphous iron and organic staining of groundmass.

Grey lens & [585] lower – moderate to strong iron staining and light organic staining of fine (non-calcareous) groundmass.

[585] lower – at the very base of the thin section, amorphous organic and iron staining appears to be stronger than in the rest of this context.

Excrement: Grey lens – occasional zones at top of this layer with fine coalesced rugose excrements & microaggregates.

[585] lower – the very base of the thin section shows an increase in coalesced microaggregates (faunal excremental pellets - rugose), associated with an increase in iron and organic staining (and possibly clay).
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<tr>
<th>a) CL153/1 – [530] (dark brown, charcoal rich) over [585] upper (red, oxidised, iron rich)</th>
<th>b) CL153/2 – [585] lower – [585/646] (with gravel)</th>
<th>c) CL153/3 – base of [645] (topsoil) over and in voids in ‘melted’ limestone version of [530]</th>
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<th>d) CL153/4 – [530] at edge of monument, with angular non-silicified limestone (white) in upper part</th>
<th>e) CL153/5 – [653] under bones in Chamber 1 - rendzina profile, with visible charcoal &amp; bones</th>
<th>f) CL153/6 – [585] under bones in Chamber 1 – over hollow, with lenses of ‘melted’ limestone, charcoal &amp; bones present</th>
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**Plate 1 Scanned images from Clare Megalith 153**
Plate 2 Micrographic images from Clare Megalith 153

a-b) [645] PPL & XPL, typical fabric, mollusc fragment, silicified limestone; CL153/3
c-d) [530] PPL & XPL, typical organic-stained fabric, charred plant remains; CL153/1
e-f) [585] upper PPL & XPL, typical fabric & fragment of clay-rich fabric; CL153/1
g-h) [585] lower PPL & XPL, typical iron-stained fabric and clean clay infill; CL153/2
Soil micromorphology and geoarchaeology at Parknabinnia Court Tomb (Clare Megalith 153)
Plate 2 (cont.)
i-j) [585/646] PPL & XPL, iron-rich slightly dusty laminated clay in pores of a limestone fragment; CL 153/2
k-l) [653] typical fabric, bone fragment; upper part of gryke under bones in chamber; CL153/5
m-n) [585] typical fabric, bone fragments; upper part of gryke under chamber; CL153/6
o-p) Rounded clay-rich fragment in base of [585]; CL153/6