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Soil micromorphological study of historic implement mark features from Lincent, Belgium

H. Lewis
May 2003 (finalised May 2007)

Introduction
The site of Lincent is located between Liège and Brussels, c. 50 km east of Brussels, in an old valley infilled with loessic colluvium, apparently mostly dating to historic times, although major episodes of Roman period and possibly earlier colluvium have also been identified. The site was excavated as part of a contract following the new TGV line between Köln and Brussels (Fechner et al. 1998). In September 1998, the author visited the site to examine two Roman period ard mark horizons located during excavations in 1997, and to sample for soil micromorphological study from the tillage horizons identified.

Lincent soil micromorphology sampling in 1998
In the 1998 trench, three horizons of interest were identified. One horizon showed parallel ard marks, and the other had possible ard marks. Both of these horizons are possibly Roman period in date (Fechner et al. 1998), although they were found at different levels to Roman ard marks in other locations on the site (K. Fechner pers. comm.). A set of intercutting mouldboard plough marks was also identified in section, located in what is probably a post-Medieval horizon. The relevant site stratigraphy and its general description are shown in Table 1. In general the profile was composed primarily of non-calcareous loess (in this case, mainly angular and subangular very fine quartz sand and silt). The later ploughmarks underlie a series of fine alluvial layers. In addition to examining and discussing the various horizons with K. Fechner, the author took four samples for soil micromorphological analysis. These are listed in Table 1 next to their horizon of origin.

Table 1 General stratigraphic outline and location of soil micromorphology samples from Lincent

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<td>⇒ ardmarks</td>
<td>LCT 1 &amp; 2</td>
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<td>⇒ ardmarks?</td>
<td>LCT 3</td>
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Samples for soil micromorphological study were taken from two tillage marks and the possibly tilled lowermost horizon. First, two samples from one well-defined ard mark were taken (LCT 1 & 2), from level T6 (184cm below site datum), for comparison with previously described ancient and experimental ard marks (see Lewis 2002). The ard mark was filled with dark grey mottled (iron and manganese mottles) clayey silt, and cut into a layer of light grey-brown mottled (iron and manganese, plus patches of white fine sandy silt) clayey silt with charcoal flecking. The macroscopically visible mark was V-shaped, c. 6-8cm wide and up to 5cm deep. This feature had been removed by machine within a large soil block, and had subsequently split in half along its length. It was a clean split and both sides of the mark were internally intact and undisturbed, although the top was possibly truncated by excavation. Each thin section contains one half of the entire mark in profile (see Plate 1.ii). The sampling location was recorded on site plan T3 (drawn by K. Fechner – see site archive). Plate 1.i shows the deposit represented by these samples, cut through by the bases of a few parallel ard marks. N.b. that the layer seen in plan (lower half of picture) runs up into the section (upper half of picture), despite being obscured by machine smudging – only the very tips of the ard mark features were visible in plan at the exposed level.
Second, a feature identified as the base of a possible ard mark was sampled from the lowermost exposed horizon (LCT 3), Level T8 at c. 218 cm depth below site datum, with the aim of characterising the nature of features seen at this depth. My own opinion in the field was that these features were more similar to infilled roots than to implement mark traces. Indeed, upon excavation of a further area of the trench a pattern of marks was revealed that throws doubt on the interpretation of any marks at this level as ard created features. This pattern (see Plate 2.i) is perhaps more representative of some horizontal rooting than of ard tilling, although it is possible that both tilling and rooting contribute to its origin. The possible ard marks at this level were filled with white clayey silt underlying and cut into iron-stained silty clay layers. The entire sequence overlies an unexposed bleached (Ea or possibly spodic E) horizon.

Finally, sample LCT 4 was taken from a horizon of well-defined plough marks high up in the trench profile (Plate 2.v). The date of the plough marks from Lincent is not known, but they are presumably Medieval to post-Medieval in date. They underlie a series of apparently water-lain horizons, which may have truncated any associated tilled topsoil horizon, as well as thicker deposits of an apparently colluvial nature making up the modern ploughsoil. The ploughmark horizon cuts into underlying colluvium. Relatively recent plough marks were not the focus of the consultation, but this provided the opportunity to further characterise such features in comparison to samples from other sites, such as Hengistbury Head Site 6, Dorset (Lewis 2002), especially in terms of distinguishing these from ard marks by field and microscopic soil traits. The location of both ard and plough marks in one location allows for theoretically better comparison regarding soil type and environmental influence, although at Lincent there was obviously a great deal of sediment deposition and soil growth over the >1 metre of material separating the cultivation horizons.

The plough marks had two distinct fills visible in the field, a main/central fill (medium-light reddish-grey clayey silt) and a lens (1-2 cm thick) of a darker fill (dark grey clayey silt) lining the cut to one side and at the base (Plate 2.vi). Although this is not so clear in the images presented here, each mark was cut through by the mark to its right. As such, it is impossible to say for certain that the grey lower fill did not originally line the entire cut of each mark. It would be typical of ploughing, however, to expect that the stratigraphically basal fill should be seen only on one side, showing the asymmetrical nature of the turning operation, with upper A horizon material being turned into the feature in one direction. The marks at Lincent show other typically asymmetrical characteristics; the side of each mark that cuts the adjacent mark does so with a steep straight slope, while the opposite side (the one being cut by the next mark) has a more gradual slope. The marks were 10-15 cm deep, with pointed bases, and a ‘scooped out’ V-shape in section.

Thin section sample LCT 4 was taken through the cut and basal fill of one mark, and the underlying soil. This sample was taken to look specifically at the issue of identifying turning of soil (regarding the fine darker lens), and to examine the general organisation of fills, cut and any adjacent open or infilled shear planes (see Lewis 2002).

Sample preparation and analytical methods
Samples were transported by hand to the McBurney Laboratory, Department of Archaeology, University of Cambridge, where they were air dried for 6 weeks and then impregnated with crystic resin, dried and hardened following the procedures outlined in Murphy (1986). Thin sections were produced by Julie Miller. Microscopic descriptions followed the outline of Bullock et al. (1989), under plane polarised (PPL), cross polarised (XPL) and reflected (RL) light at the McBurney Laboratory and at the Research Laboratory for Archaeology and Art History, University of Oxford.

Thin section descriptions
Ard mark LCT 1 and LCT 2
The ard mark seen in these thin sections is typical of such implement marks (after Lewis 1998; 2002). A second feature was identified at the very top of the main ard mark. This appears to be the tip of a later ard mark (Plate 1.iii).
This base of an overlying feature is if anything even more diagnostic of ard marks in thin section than is the larger feature sampled targeted in the field. The base can be seen to have a main fill, a basal fill and a cut, cutting into the upper fill of the main ard mark sampled. The cut is seen as a zone of very fine texture (mainly silt & clay), compared to the overlying material (mainly very fine sand and silt), and the underlying fill of the main ard mark (mainly silt and clay, but with a significant proportion of sand of varying sizes). The fill of the main ard mark (Plate 1.iii-vii) is very mixed, with texturally sorted zones of internal slaking and bioturbation seen. Detailed descriptions are given in the appendix.

**Possible ard mark - LCT 3**

This sample was taken through a dubious but possible ard mark. In thin section, it is clear that this feature is an infilled and reduced root hole – its depth and shape, in particular, are not characteristic of implement marks. A 2-3cm wide grey infilled channel runs down the middle of the section; this has irregular boundaries, and a modern channel is seen in the centre, running the length of the feature. Microscopically (see below), a zone 1-2cm wide running down either side of the feature shows very mixed and very disturbed materials. The soil outside of this feature is oxidised, reddish-brown silt with several relatively large iron-stained root pseudomorphs, and modern rooting cracks, several of which are oriented to right angles of the main feature. See the appendix for detailed descriptions.

**Medieval/Post-Medieval ploughmark - LCT 4**

The total profile sampled is 11cm deep, with LCT 4a showing the upper 6.5cm (plough mark fill) and LCT 4b the lower 4.5-5cm (plough mark lowermost fill, cut, and underlying soil). The plough mark cut occurs at a depth of c.7.5cm (Plate 3). The plough mark fill is a mixed grey and reddish-brown layer (the latter mainly occurring along pores and earthworm infilled channels), which has a mixed crumb and apedal structure, and is moderately organic stained. The plough mark cut is diffuse, but is marked by several features, including an intermittent 1cm thick zone of horizontal ‘laminae’ running across the section, and linear or planar voids which are seen running horizontally and diagonally across the section, apparently following the cut outline.

**General points**

All of the samples show strong influence of iron and manganese oxidation throughout the soil, including general iron oxide staining, root pseudomorphs, and iron and manganese mottles and fine nodules. The processes of both reduction and oxidation (redox) have greatly affected much of the profile. Ard and plough marks appear to have been visible macroscopically due to a concentration of these precipitated oxidized minerals along their cuts. Their fills were white in the field, showing relative reduction regarding iron, or a lack of iron influence. Oxidized iron along the cuts was usually also related to indicators of rooting, suggesting that certain aspects of the cut visibility (pore lines, iron staining) have been retained or enhanced by rooting and subsequent replacement by root pseudomorphs. Manganese nodules were mainly found near, but usually just underneath the implement mark cuts in the micromorphology samples examined, as well as being associated with what appear to be fairly recent root remains.

There may be a tendency for manganese and iron to be precipitated at the edge of such features due to changes in soil density and related pore pressures. The inside of tillage feature fills consists of broken-up soil with a higher porosity compared to the original soil, and the edges of these features are subject to implement pressures causing compression and compaction. Based on these changes, the cuts of implement marks are often the location for the accumulation of organo-mineral complexes - fine materials including fine silt, clay, particulate organic matter, along with phosphates and iron, manganese and organic staining (Lewis 2002, 1998). In addition, linear void space often demarcates implement mark cuts (ibid), and roots entering these more easily-penetrated areas appear to be involved in the development and retention of these void spaces. These roots may see replacement with materials such as iron and manganese, thereby increasing the likelihood of encountering these precipitates at the cut of the features. The loosened soil in the fills may be more susceptible to leaching. Iron oxidation, leaching and possibly reduction are all involved in making the ard and plough marks visible to the naked eye, and are clearly seen in the thin sections examined. In the case of the plough marks, inversion of the profile, bringing organic material from the surficial horizons to the base and sides of the mark, may also contribute to this.
Conclusions
The two ard marks sampled at the level of T6, on plan T3, are typical for the feature type (samples LCT 1–2). The possible mark T8-1, at a lower level, cannot be shown to be an implement mark, and shows only rooting influences (sample LCT 3).

For the plough marks from the top of the section (LCT 4) it should be noted that there are certain features that remind one of those of an ard mark, although it was a definite plough mark in the field. There are also some very fine soil aggregates that look like alluvium.

The marks are affected by the surrounding soil, namely by phenomena related to reduction and oxidation of iron and manganese, and roots following or marking the feature cut lines.

There is a very clear zone of sorted illuviated fine particles at the base of one of the marks and the possible occurrence of crusting (LCT 2). The only phytolith that observed in thin section was badly preserved (in 4b).

Acknowledgments
I would like to thank Kai Fechner for organising this project and hosting me in Belgium. I am grateful to Julie Miller for producing the thin sections, and to Charles French and the McBurney Laboratory (Department of Archaeology, University of Cambridge), the Research Laboratory for Archaeology and Art History (University of Oxford), and the Department for Continuing Education (University of Oxford) for facilities and support.

References


Appendix - Soil thin section descriptions from tillage marks at Lincent, Belgium
C:f set at 50µm

LCT 1 & LCT 2
General description: LCT 1 & 2 were taken from the same ard mark feature. LCT 1 has 13-14cm depth of soil, with the main implement mark cut clearly visible about halfway down the section. In addition, a small zone at the top of the thin section may mark the base of a second, overlying feature. LCT 2 is 6cm deep, with the main implement mark cut found dividing the section in half. In both cases, the ard mark feature is distinguished because of colour change at its boundary or cut (reddish-brown with increased manganese mottling and iron-stained roots, vs the light grey fill and underlying soil). The extant mark has dimensions of 6-8cm width and 5cm depth (it was unclear whether any truncation of the top had occurred). It is U-shaped. The implement mark appears to be cut into a buried ?Ap horizon of silt subjected to redox conditions. At the very top of LCT 1, the base (>1cm) of a possible additional feature is visible, cutting into the top of the main ard mark fill. This possible feature base is concave in section, and its cut is marked by a lens of fine nodules/aggregates rich in oxidised iron. These nodules are mainly 200-300µm in size, up to 2500µm. Microscopically, the fill of this feature has two layers (see below). A zone strongly influenced by iron staining and replacement of roots is also seen to the edge of the LCT 1, internal to the ardmark. While this could indicate a further feature cut, the available data do not allow it to be characterised as distinct from general rooting zones in this sediment, and it will be described as a pedofeature within the main ard mark fill. The thin sections are described by subhorizons as follows: H1 (2500-3200µm thick) & H2 (1750-2000µm thick) - fills of possible feature base, H3 (2500-10000µm thick) - cut of possible feature base, H4 (4-5cm) - main implement mark fill, H5 (10000-15000µm thick) - main implement mark cut, H6 (3-4cm) - soil under implement mark.

Possible feature base (H1-3): General: H1 has one main fabric, H2 (lower fill) comprises four main lenses sorted by size and with varying amounts of organic staining, H3 is one layer marked by frequent iron mottling. Microstructure: all subhorizons are apedal, mainly massive, but rarely apedal channel. Porosity: all subhorizons generally have >2% porosity, consisting of rare channels (mainly 200µm diameter). At some places at the base of H1, just above the sorted lenses (H2) there are larger, circular channels (500-1000µm diameter) with clay coatings (see ‘textural pedofeatures’). Mineral components: in all subhorizons, >95% of grains are quartz, with the remainder being mainly mica, and rare biotite. Quartz grains are mainly angular to subangular. Clay occurs mainly in very fine zones (<20µm in size), which are moderately birefringent, very light brown to light reddish brown (PPL), white to dusty orange brown (XPL) (see ‘groundmass’ & ‘textural pedofeatures’ for variations). There are no rock fragments. c:f ratio: H1: 15:85 (very coarse & coarse sand 0%, medium sand <2%, fine sand 15%, very fine sand 50%, silt 30%, clay <5%). H2 lenses 1 & 3: as H1. H2 lens 2: 10:90 (very coarse, coarse & medium sand 0%, fine sand 10%, very fine sand 45-55%, silt 35%, clay 5-10%). H2 lens 4: <2:98-100 (very coarse & coarse sand 0%, medium sand <2%, fine sand 0%, very fine sand 15%, silt 80% (of which >20µm size is 30% & <20µm size is 50%), clay <5% (any clay is undifferentiated)). H3: 10:90 (very coarse & coarse sand 0%,...
medium sand 5%, fine sand 5%, very fine sand 10%, silt 60%, clay 20%). Groundmass: all three subhorizons are stipple speckled, with coarse:fine fractions being in an open porphyric related distribution. H3 has zones (250 x 3000µm) of granostriation & linear striation. The groundmass of H1 is greyish-white with very dark brown zones (PPL), very dark reddish brown (XPL). H2 lenses 1 & 3 are as H1. H2 lens 2 is organic stained, dark brown (PPL), black (XPL). H2 lens 4 is very dark brown to black (PPL & XPL). H3 is iron stained, reddish brown (PPL), dusty orange (XPL). Organic components: all subhorizons have c. 5% organic matter, mainly very fine angular fragments 10-100µm in size and ‘punctuations’. H2 fabric is organic stained, and H1 & H3 contain zones (<15% of total area) of organic-stained fabric pedofeatures. Pedofeatures: Fabric: H1 & H3 contain 150-250µm sized ovoid & rugose aggregates of organic stained, dark brown (PPL), very dark brown to orange-brown (XPL), clayey very fine silt. Textural: voids are often clay coated in H1 (100µm thick ‘dusty’ coatings, light reddish brown (PPL), orange brown (XPL), often integral with first layer of grains at pore edges. In upper H1 there is a zone (2500x3000µm) of alternating lenses (150-250µm thick) of the same types as lenses 2 & 3 in H2, except that the lens 3 type has more fine sand than in H2 (c. 20%). Amorphous & cryptocrystalline: H2 groundmass is organic stained, H1 & H3 contain organic stained fabric pedofeatures. H1 moderately occurring iron stained root hole pseudomorphs (up to 750µm in size). H3 is largely composed of irregularly shaped oxidised iron nodules 200-1000µm in size, and has general iron staining on its groundmass. Ardmark (H4-5): General: The arnd mark cut (H5) is marked by several fabrics occurring in small zones: 1) a highly disturbed iron stained fabric related to modern and old root holes; 2) organic stained and non-organic stained/depleted silt zones (250x50-70µm in size); 3) ‘banded’ layers, comprising lenses (1000-1250µm thick) of almost pure very fine & fine sand (50-150µm size), alternating with 500µm thick lenses of organic stained, very fine material (clay & very fine silt 80%, coarse silt & very fine sand 20%). In LCT 1 the cut is also characterised by a line of linear/planar voids and packing voids, and zones of types 2 and 3 above are often found at a 90° angle to the cut line. In this location, Fabric type 3 appears to mainly comprise size sorted channel infills, although one zone is similar to a sorted crust fragment (described in ‘textural pedofeatures’). This is a very complex arrangement and variety of characteristics. Microstructure: apedal channel. Porosity: H4: 10-20%, channels (150-3000µm, rounded and irregular). Mineral components: H4 & H5: as in H1-H3, but also light orange-brown (PPL), orange (XPL), clay in groundmass. c:f ratio: 10-12.88:90: (very coarse sand 0%, coarse sand <2%, medium sand 5%, fine sand 5%, very fine sand 15%, silt 55%, clay 20%). H5 Fabric 2: sorted zones of fine & very fine sand 20% and silt 75%, with <5% clay; adjacent to zones of fine & very fine sand <10%, silt 60% and clay 30-35%. Groundmass: H4: mixed stipple speckled, granostriated and occasionally porostriated, mixed light to medium brown and light orange brown, with reddish brown (mottles) (PPL), very dark reddish brown and orange (XPL). H5 Fabric 2: fine zones are organic and iron stained. Organic components: 5%, angular and rounded black fragments (200-2000µm) and ‘punctuations. Rare cellular charred remains (100-1000µm); charcoal in H5 at edge of cut. Pedofeatures: Fabric: H4 has very rare rounded to subrounded clayey aggregates (200-500µm in size, slightly ‘dusty’, moderately birefringent, yellow and red (PPL), orange, red and yellow (XPL), with cracking (1-2µm wide, 20µm long). H5 has one subangular blocky ped (2500µm sized) that is lightly organic stained, with a c:f ratio of 5:95 (very coarse & coarse sand 0%, medium & fine sand 5%, very fine sand <25%, coarse silt 30%, fine silt and clay 30%), and with internal zones of fine iron mottling & iron staining (200-600µm, with a c:f ratio of 0:100 (very fine sand 10%, coarse silt (25µm) 15%, fine silt (2-25µm) and clay 75%)). Textural: H4: about 50% of channels have clay coatings 50-200µm thick (moderately birefringent light orange-brown (PPL), orange and yellow (XPL), ‘dusty’ and ‘dirty’). H5 Fabric 2: both zones have ‘dusty’ clay channel infills and coatings (150-250µm thick, orange-brown (PPL), dusty orange (XPL). H5 Fabric 3: a sorted infill series relating a sorted crust fragment is located at the upper part of the cut. This consists of zones of horizontally oriented, size sorted lenses 50-70µm thick, of alternating ‘clean’ very fine sand and coarse silt lenses, and organic stained silt lenses with ‘dusty’ clay and ‘punctuations. Amorphous and cryptocrystalline: H4: frequent iron staining and nodules, especially associated with old root channels. In LCT 1 there is a strongly rooted zone internal to the ard mark, at the edge of the section. This zone has a strong presence of iron replaced root pseudomorphs, and is very strongly iron stained, with very dusty clay coatings seen in pores. H5 Fabric 2: iron staining on fine zones, iron replaced root pseudomorphs and mottles seen in both zones. H5 Fabric 3: alternate lenses are organic stained. Excrement: H4: occasional rounded pellets (100-150µm) associated with old root holes. Underlying soil (H6): Microstructure: apedal channel. Porosity: 10-15%, channels (100-500µm diameter, rough and smooth walls). Mineral components: as in H1-3, but rare subrounded quartz grains, and very rare rounded glauconite grains occur. Also one angular fragment (100µm) of chert noted. c:f ratio: 5:95 (very coarse, coarse sand 0%, fine sand 5%, very fine sand 35%, silt 50%, clay 5-10%). Groundmass: light greyish brown (PPL), very dark brown to black (XPL), stipple speckled. Organic components: 5%, ‘punctuations’ and <50µm sized round and angular black fragments. Pedofeatures: Fabric: moderately organic stained zones with gradual boundaries with the main groundmass of 5:95 c:f ratio (fine sand 5%, very fine sand 10%, silt 75%, clay 10%). Textural: occasional old pore infills (250-350µm) of yellowish brown (PPL), orange & yellow (XPL), slightly dusty clay. Modern channels also occasionally coated or partially coated with 20-50µm thick coatings of clay as described above (but yellow under XPL). Rare ‘clean’, cracked infills (200x500µm), yellowish-brown (PPL), red, orange & yellow (XPL). Amorphous and cryptocrystalline: very light organic staining on fine groundmass & fabric pedofeatures. Mottles (150-1000µm), often related to root holes or infilled root holes; redox features. LCT 3 General description: This sample was taken through a dubious but possible ard mark. In thin section, it is clear that this feature is an infilled and reduced root hole – its depth and shape, in particular, are not characteristic of implement marks. A 2-3cm wide grey infilled channel runs down the middle of the section; this has irregular boundaries, and a modern channel is seen in the centre, running the length of the feature. Macroscopically (see below), a zone 1-2cm wide running down either side of the feature shows very mixed and very disturbed materials. The soil outside of this feature is oxidised, red/brown-brown silt with several relatively large iron-stained root pseudomorphs, and modern rooting cracks, several of which are oriented to right angles of the main feature. The thin section is described by ‘context’: H1 = main channel infill, H2 = edge (‘micromorphical’) zone, H3 = main soil (two main fabrics will be described). Microstructure: all three contexts have mixed apedal channel, cumb (0.2-0.5cm), and with fine subangular to angular blocky (0.5cm) where modern rooting occurs. Macroscopically, the slide shows a larger (c. 4cm) angular blocky structure defined by rooting. Porosity: 5-20%, channels (100-2500µm). H3 Fabric 2: 10%, channels (50-200µm). Mineral components: as LCT 1-2. c:f ratio: H1: 10-90 (very coarse and coarse sand 0%, medium sand <2%, fine sand 10%, very fine sand 40%, silt 35%, clay 10%). H2: overall 10-90, with variation in zones similar to H1 and H3 fabrics. H3 Fabric 1: 10-15:85-90 (very coarse and coarse sand 0%, medium sand <5%, fine sand 10%, very fine sand 40%, silt 35%, clay 10%). H3 Fabric 2: 5:95 (very coarse, coarse and medium sand 0%, fine sand 5%, very fine sand 20%, silt 35%, clay 40%). Groundmass: H1 is stipple speckled and iron stained, light brown (PPL), very dark brown to black (XPL). H3 Fabric 2 is linear and granostriated, brownish yellow (PPL), yellow (XPL). Pedofeatures: Fabric: H3 Fabric 2 – crumb aggregates (<0.5cm), reddish-orange (PPL), dark reddish-orange (XPL), stipple speckled and ‘dirty’ with fine microcontrasted particles, and a c:f ratio of <5:95 (very coarse, coarse and medium sand 0%, fine sand <5%, very fine sand 10%, silt 40%, clay 45%). Also occasional zones (500µm size) of sorted very fine and fine sand (50-150µm fraction). Textural: H2 & H3 – occasional ‘dusty’ clay infills (100-200x500-
1500µm, iron stained, dark reddish brown to orange (PPL), very dark reddish brown to orange-brown (XPL), and coatings (50-150µm thick) of similar, but iron stained, ‘dusty’ to ‘dirty’ clay in modern pore space. H3 also has channel infills of sorted fine sand (100µm), often alternating with mixed silt-clay layers and iron-stained lenses, and zones (150-500µm) of thick, laminated, iron stained infills or old ped coatings (brown-orange (PPL), orange-red (XPL), ‘dusty’ to ‘dirty’ (some laminae ‘dusty’, some ‘dirty’)). H3 Fabric 2 also has cracked, laminated, slightly dusty clay infills up to 1000µm thick (medium brown and yellow (PPL), reddish brown (XPL), and rare clean infills (300µm sized)). Amorphous and cryptocrystalline: H1 fabric is generally reduced regarding iron; fabrics as pedofeatures in H2 & H3 also show this. H2 channels are often associated with iron coatings and pseudomorphs. H3 fabric shows general iron staining.

**LCT 4a-b**

General thin section description

The total profile sampled is 11cm deep, with LCT 4a showing the upper 6.5cm (plough mark fill) and LCT 4b the lower 4.5-5cm (plough mark lowermost fill, cut, and underlying soil). The plough mark cut occurs at a depth of c.7.5cm. The thin sections will be described by subhorizons as follows: H1 (implement mark fill - upper 7.5cm above implement mark cut); H2 (implement mark cut – 1cm boundary zone with macroscopically visible horizontally bedded ‘banded’ lenses; H3 (soil under/outside of implement mark cut – 3.5cm).

H1 – The plough mark fill is macroscopically a mixed grey and reddish-brown layer (the latter mainly occurring along pores and earthworm infilled channels), and comprises one main fabric (c. 70% of the context) and several minor fabrics. **Structure**: mixed crumb (<0.5-1cm) and apedal channel. **Porosity**: 20%, channels (100-2000µm). **Mineral components**: as in LCT1. **Groundmass**: moderately organic stained, medium to dark brown (PPL), very dark reddish brown, stipple speckled (XPL). **C:f ratio**: 10:90 (very coarse, coarse & medium sand 0%, fine sand 10%, very fine sand 35%, silt 35-40%, clay 15-20%). **Organic components**: 5-10% (‘punctuations’, angular and subrounded fragments <100-150µm in size, organic staining as above).

H2 – The plough mark cut is diffuse, but is marked by several features. 1) At the very base of the main fill there is an intermittent 1cm thick zone of horizontal ‘laminae’ running across the section. 2) Linear or planar voids are visible running horizontally (c. 5000µm long, 250-350µm wide, straight, with squared to rounded ends, and partially accommodated, straight sides) and diagonally (c. 2000µm long, 350µm wide, straight, with squared ends, and partially accommodated, straight sides). These voids are part of a void line that runs across the section, apparently following the cut outline. **Microstructure**: mixed crumb (0.5cm), occasional angular to subangular blocky (0.5cm), and apedal channel.

H3 - H3 is very similar to H1 macroscopically, but contains manganese staining at the edges of some pores. **Microstructure**: mixed crumb (0.5-0.7cm) and angular to subangular blocky (1-1.2cm).
Plate 1 The ard mark samples

i) The main ard mark layer at Lincent. Only the tips of the marks are visible in plan.

ii) Scanned image of thin section LCT 1, showing half of sampled ard mark (fill & cut). Original is 12x5cm.

iii) Scanned image of thin section & close up of possible feature in top of LCT 2

iv) & v) Cut of main ard mark in LCT 2, with charcoal fragment (PPL & XPL). Frame length 2.4mm

vi) & vii) Typical fabric outside ard mark (PPL & XPL). Frame length 2.4mm
Plate 2

i) The location of sample LCT 3

ii) Scanned image of LCT 3 (original is 5x 12cm)

iii-iv) Typical fabrics in LCT 3 (PPL & XPL)

Frame is 2.4mm long

v) The sampling location of LCT 4

vi) Plough mark before sampling (nail is 1cm wide)
Plate 3  LCT 4a & 4b

i) 4a, scanned image, original 6cm x 10cm

ii) 4b, scanned image, original 6cm x 10cm

iii-vi) LCT 4a, typical fill fabrics, PPL & XPL. Frame 1.5mm long

vii-x) LCT 4b, lenses at base of plough mark, PPL & XPL. Frame 4.5mm long vii & viii; 1.5mm long ix & x

xi-xii) LCT 4b, features under plough mark, PPL & XPL. Frame 3.5mm long