

Willington Quarry Extension: Charcoal from Neolithic and Bronze Age Features Rowena Gale. 27th February 2007

Introduction

Evidence of occupation on the floodplain at Willington Quarry included the remains of domestic structures, tree clearance and burnt mounds dating from the Late Neolithic and Bronze Age periods. Despite extremely poor preservation of organic materials, bulk soil samples collected from well-sealed features enabled the study of charred plant remains and charcoal. Pollen samples were also collected. Evidence from plant macrofossils and pollen suggest that occupation of the site was probably seasonal, perhaps related to summer grazing.

Forty seven samples of charcoal were selected for analysis, several of which were used for C¹⁴ dating. These samples represented residues from a) tree clearance by burning and felling, b) from domestic hearths and c) deposits of fuel debris associated with activity at the two burnt mounds. It was anticipated that charcoal analysis would illustrate the character of local woodland (for comparative purposes with the pollen record) and evidence of species selection related to economic function. But owing to the poor condition of a high proportion of the charcoal, the results proved disappointing since, even with large samples, it was often only possible to identify a relatively small amount with any certainty and, frequently, the available data was insufficient for meaningful interpretation. In contrast, however, charcoal-rich samples [273], [284], [310], [312] and [314] obtained from the fill of the trough (Burnt Mound 2) contained well-preserved fragments, including narrow roundwood.

Methods

Bulk soil samples were processed by flotation and sieving (see Monckton, this vol). Flots and residues were examined under low magnification and the charred plant remains separated from the charcoal. Sample [285] was hand-collected. Some samples were sparse and presented small fragments of very degraded charcoal, often infiltrated with mineral deposits. This material was difficult to examine and often included insufficient diagnostic information to enable identification. Charcoal-rich samples [273] and [314] were 25% subsampled. Apart from the trough samples in Burnt Mound 2, the charcoal was fragmented and intact segments of roundwood were rare.

The samples were prepared using standard methods (Gale and Cutler 2000). Anatomical structures were examined using incident light on a Nikon Labophot-2 compound microscope at magnifications up to x400 and matched to prepared reference slides of modern wood. When possible, the maturity of the wood was assessed (i.e., heartwood/sapwood) and stem diameters recorded. It should be noted that during the charring process wood may be reduced in volume by up to 40%.

Results

The taxa identified are presented in Table 1. Classification follows that of *Flora Europaea* (Tutin, Heywood *et al* 1964-80). Group names are given when anatomical differences between related genera are too slight to allow secure identification to genus

level. These include members of the Pomoideae (*Crataegus*, *Malus*, *Pyrus* and *Sorbus*) and Salicaceae (*Salix* and *Populus*). When a genus is represented by a single species in the British flora, it is named as the most likely origin of the wood, given the provenance and period, but it should be noted that it is rarely possible to name individual species from wood features. The anatomical structure of the charcoal was consistent with the following taxa or groups of taxa:

Betulaceae. *Alnus glutinosa* (L.) Gaertner, European alder; *Betula* sp., birch

Cornaceae. *Cornus sanguinea* L., dogwood

Corylaceae. *Corylus avellana* L., hazel

Fagaceae. *Quercus* sp., oak

Oleaceae. *Fraxinus excelsior* L., ash

Rhamnaceae. *Rhamnus cathartica* L., buckthorn

Rosaceae. Subfamilies:

Pomoideae, which includes *Crataegus* sp., hawthorn; *Malus* sp., apple; *Pyrus* sp., pear; *Sorbus* spp., rowan, service tree and whitebeam. These taxa are anatomically similar; one or more taxa may be represented in the charcoal.

Prunoideae. *Prunus spinosa* L., blackthorn.

Salicaceae. *Salix* sp., willow, and *Populus* sp., poplar. In most respects these taxa are anatomically similar.

Ulmaceae. *Ulmus* sp., elm

Neolithic, 3600 – 3000 BC

The general paucity of cereal remains in Neolithic deposits suggests that occupation during the early Neolithic occurred in a wooded landscape with little or no cultivation of crops (Monckton, this vol). Domestic occupation was recorded in Zone 2, the highest part of the site. Features in Group 2503 included structural pits/ postholes and cooking pits/ hearths. Fuel debris from contexts (1448), a structural pit/ posthole, and (1499), a cooking pit, was identified as oak, hazel, the hawthorn group, blackthorn and probably birch. A small pit in group 2504, context (1477), filled with fire-cracked stones (and later overlain with midden material), was probably used for baking food. Associated charcoal, although scant, included blackthorn and oak. Charcoal was similarly sparse in residues from three stone-lined hearths/ ovens, contexts (1073), (2064) and (2076) (Group 2530), which identified blackthorn and probably hazel.

The first evidence of tree clearance dates to the late third millennium BC, indicated by scorched areas and surface burning across the site. These were sometimes associated with pits, probably from tree-throws. Charcoal residues in these areas almost certainly relate to felling activities and/ or the disposal of tree debris or scrub by burning. For example, charcoal-rich samples from contexts (63) and (64) (Group 805), identified as mainly oak, may relate to the remains of burnt-out oak trees. This interpretation, however, is not straightforward since small amounts of alder, birch and blackthorn were also present. These additional species may have accrued from the general disposal of waste from clear-felling mixed woodland or, perhaps, from dumped hearth debris. A single fragment of birch was named from an area of *in situ* burning in context (75) (Group 2543).

Charcoal from truncated postholes/ pits (291), (293) and (299) (Group 802), adjacent to a tree-throw, consisted of hazel and blackthorn. In addition to charcoal, context (458) (Group 803), a small pit-type feature, also contained the remains of foodstuffs such as hazel nutshell, sloe stones and possibly cereal; by implication at least part of this sample, which included oak, blackthorn and the hawthorn group, derived from hearth material.

Late Neolithic/ Early Bronze Age, 2400 – 1800 BC

Repeated episodes of land clearance appear to have continued well into the early second millennium (Marshall *et al*, this vol). The frequency of oak in small quantities of charcoal collected from numerous areas of scorched soil and burnt spreads suggests that oak probably formed the main woodland cover, with blackthorn, hazel and the hawthorn group in marginal or more open areas.

Evidence of clearance burning was recorded in contexts (302) Group 803, (1428) Group 2509, (78) and (135) Group 2543, (4108) and (4156/7) Group 4504, contexts (4489), (4490) and (4494) Group 4561 and context (4239) Group 2503. Associated charcoal was sparse but included oak, hazel, blackthorn, the hawthorn group, ash and alder (Table 1). Root wood recorded from burnt surfaces in Group 4561, context (4490) and Group 2543, context (78), was identified as ash and oak respectively.

Deposits from the fills of structural pits are more likely to originate from dumped hearth debris as, for example, in contexts (53), (1328), (1450) and (1451) (Group 2503), which identified the use of hazel, the hawthorn group and blackthorn.

Burnt Mound 1 (Group 2550) was sited on slightly elevated ground in Zone 2 and dated to 2200 – 1900 Cal BC. The feature included a hearth and two troughs. A small amount of charcoal (of unknown origin) was collected from context (1817) (subgroup 1550/2), a layer predating the burnt mound, and named as oak, blackthorn and either hazel or alder; no other plant remains were found. Charcoal was also recovered from contexts directly related to activity at the burnt mound from subgroup 1550/3: from hearth (1691) and (1881); from the upper layers of the burnt mound (1487) and (1799); and from the fill of the trough (1653/1651). These indicated the use of firewood composed of mixed broadleaf species: oak, hazel ash, the hawthorn group, blackthorn and probably alder. Similar taxa were named from a small sample from the central trough context (1654) (subgroup 1651). An unusually large sample of charcoal recovered from the pit/ trough (1654) subgroup 1550/4, sited adjacent to the hearth, suggested a strong preference for oak fuel.

Middle Bronze Age, 1200 – 1000 BC

Burnt Mound 2 (Group 4563) was located some distance east of the earlier burnt mound. This feature was dated to about 1100 BC and included a hearth, a timber-lined trough and spreads of burnt stones. Charcoal-rich samples were collected from trough fills (4479), (4459), (4478) and (4482), and from a layer that appeared to have been inserted between the trough and the cut, context (4497), possibly to act as a filter. These samples were in a much better state of preservation than those from elsewhere on the site and included a

high ratio of narrow roundwood. The taxa named included oak, alder, hazel, ash, the hawthorn group, blackthorn, buckthorn, dogwood, willow/ poplar and elm. Although much of the oak consisted of heartwood this probably originated from fairly narrow roundwood. Charcoal residues from hearth (4477), however, was poorly preserved and infiltrated with reddish deposits; not surprisingly, correspondingly fewer taxa were named: oak, ash, buckthorn, alder and the hawthorn group. Charred plant remains from woody species were also fairly frequent in this group, e.g., alder cones, hazel nutshell and sloe stones (Monckton, this vol)

Well-preserved charcoal, including alder, buckthorn, the hawthorn group and very narrow oak roundwood, was also recovered from a layer in a palaeochannel, context (4483) (Group 4564), which predated the trough construction.

Discussion

Deposits of charcoal were collected from features and burnt spreads dating from Neolithic, Beaker and Middle Bronze Age occupation. The origin of the charcoal can be divided roughly into a) fuel from domestic hearths/ ovens and from burnt mounds and b) debris from trees clearance by burning. Despite the frequency of charcoal in many contexts, soil conditions were not conducive to long-term preservation and the potential of the charcoal to produce significant data was greatly reduced. With the exception of samples 273, 314, 310, 312 and 284 from the trough and palaeochannel at Burnt Mound 2, preservation across the site was very poor. There was no obvious explanation for this differentiation, especially since, in contrast, hearth samples from the Burnt Mound 2 complex were degraded. Perhaps, the trough feature, which was timber-lined, offered greater protection. Overall, however, there is no doubt that alluviation and fluctuating water-levels on the floodplain accounted for much of the structural damage to the charcoal.

Early occupation

The site was mostly low-lying with numerous streams; a major part of site was occupied by a broad pre-historic palaeochannel. The frequency of alder in the pollen deposits (Greig, this vol) is indicative of damp or waterlogged soils; flooding was recurrent throughout the winter months. Occupation of the site during the Neolithic period (3600 – 3000 Cal BC) appears to have been seasonal and related to stock grazing on the higher ground such as that in Zone 2. Fuel residues from hearths in this area, Groups 2503, 2504 and 2530, although scant, indicated the use of oak, birch, hazel, blackthorn and the hawthorn group. It is probable that mixed deciduous oak woodland was extant on the better-drained soils and thus readily available as a source of firewood. There was little evidence to indicate cereal cultivation in this area (Monckton, this vol)

Tree clearance

Major episodes of tree clearance occurred over several centuries from the late 3rd – early 2nd millennia, possibly to increase grazing areas. Although the extent of felling is unknown, evidence of tree clearance was recorded across the site. Some trees were almost certainly burnt-out, which suggests that the aim was total destruction and removal rather than felling to promote coppice growth. Areas of scorched soils and burnt spreads

may have resulted from bonfires from the disposal tree/ scrub debris as, for example, in contexts (57) Group 803 and (63) Group 805, which included oak, alder, birch, blackthorn and the hawthorn group. The slightly larger sample from context 63 (Group 805), the fill of a tree throw with a burnt pit in the centre, consisted entirely of oak which may offer a more secure identification of the felled tree. Narrow roots from oak and ash trees occurred in contexts (278) Group 4561 and (78) Group 2543 (Table 1). The apparent increase in soil moisture/ alluviation at this time may be partly attributable to tree felling and the associated reduction in water uptake (evapo-transpiration).

Burnt Mound 1

Burnt Mound 1 (Group 2550) (dated to 2200 – 1900 Cal BC) was unusual in that it was sited in Zone 2 away from any immediate source of water. Charcoal collected from hearth contexts (1691) and (1881), trough contexts (1653/1651), (1582) and (1654), and from burnt mound contexts (1487) and (1799) represented fuel debris from heating stones to raise the temperature of the water in the trough. These samples were mostly very small and identified a similar range of taxa to that from domestic hearths in Neolithic contexts in Zone 2 (see above). A large quantity of (degraded) oak in context (1582), the base of the secondary trough next to the hearth, could be considered more indicative of species selection but owing to its fragmentation it was not possible to assess sourcing from managed woodland.

Palynological evidence from the palaeochannel dating from about 2100-2000 to 1300-1100 BC suggests that woodland consisted mainly of oak, alder and hazel with some beech, and marginal woodland or scrub including blackthorn/ cherry, purging buckthorn, and hazel (Greig, this vol). Elder (*Sambucus* sp.) seeds were also recorded.

Burnt Mound 2

Burnt Mound 2, dated to about 1100 BC, was sited on damp ground close to the eastern edge of the palaeochannel. This was more complex in construction than the earlier feature and included a wood-lined trough, associated scatters of heat-cracked stones and a possible hearth feature. A layer of charcoal apparently packed between the timber lining and the cut of the trough may have served as a filter to purify water entering the trough. In comparison with charcoal from elsewhere on the site, deposits in the trough and in the palaeochannel predating the trough were large and particularly well preserved. The charcoal consisted predominantly of narrow roundwood and included a much broader range of taxa than apparent from earlier features. Interestingly, there appears to be more use of alder, which correlates with evidence from the pollen record indicating increased levels of alder and oak at this time, although this could also reflect the wetter character of the immediate environment in which the burnt mound was located. The use of additional species including elm, dogwood, purging buckthorn and willow/ poplar may also relate to environmental factors or to distribution patterns. The taxa identified from the charcoal deposits closely parallel those named in the pollen record.

The high ratio of narrow roundwood in these deposits indicates that fuel supplies were obtained from juvenile growth such as that produced in coppiced or frequently cropped woodland. The felling of immature timbers to line the trough (Morgan, this vol) and to

consolidate orrevet the banks of the channel may have initiated coppice-type growth that, in subsequent years, was used as fuel. Brushwood from the conversion of the timbers would also have provided a source of firewood, although this would only have been available during construction or repair work. Greig (this volume) suggests that the increase in tree pollen towards the end of this phase may have resulted from overgrown and denser woodland following the abandonment of the site.

The character of the fuel used at Burnt Mound 2 compares favourably with that from a large burnt mound feature sited close to the River Dove at Cox Bank Farm, Marchington, a few miles west of Willington Quarry (Gale, unpub). Large charcoal deposits from the mound indicated the exclusive use of narrow alder stems, although samples from the trough also included hazel and ash roundwood. The feature was based on an emergent spring (still extant today) where alders growing on the locally wet or boggy soils would have provided a ready source of fuel. Despite its poor quality as firewood (Edlin 1949; Porter 1992), the sites at Cox Farm and Willington Quarry made good use of alder, thus it could be argued that ease of access to adequate supplies of fuel was more important than the efficiency of the fuel.

Conclusion

The identification of selected samples from Neolithic and Bronze Age features indicated access to a wide range of woodland species but, owing to poor preservation of much of the charcoal, it was difficult to obtain significant data on the preferential selection of species (if any) related to function. More or less similar species were identified from domestic hearths and structural pits associated with Neolithic and Early Bronze Age occupation and from Burnt Mound 1.

Burnt Mound 2 was located in an area of wetland. The preservation of associated fuel residues and deposits in these contexts was comparatively good and it was evident that firewood was composed mainly of narrow roundwood, which, as might be anticipated in this location, included a high proportion of alder.

Burnt tree-throw pits and areas of surface burning, probably resulting from bonfires of tree-felling debris and scrub clearance, indicated the widespread reduction of woodland across the site. Samples collected from these areas included oak, hazel, blackthorn, ash, birch and the hawthorn group.

References

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Table 1. Charcoal

Key. h = heartwood; r = roundwood (diameter <20mm); s = sapwood (diameter unknown); u = maturity undetermined (*Quercus* only)
The number of fragments identified is indicated

| Sample | Context | Description | <i>Alnus</i> | <i>Betula</i> | <i>Cornus</i> | <i>Corylus</i> | <i>Fraxinus</i> | Pomoid- eae | <i>Prunus</i> | <i>Quercus</i> | <i>Rhamnus</i> | <i>Salix/ Populus</i> | <i>Ulmus</i> |
|----------------------------------|---------|---|--------------|---------------|---------------|----------------|-----------------|----------------|---------------|----------------|----------------|---------------------------|--------------|
| Neolithic, 3600 – 3000 BC | | | | | | | | | | | | | |
| Group 802 | | | | | | | | | | | | | |
| 25 | 291 | Fill of pit | - | - | - | 1 | - | - | 1 | - | - | - | - |
| 26 | 293 | Fill of pit | - | - | - | 1 | - | - | 1 | - | - | - | - |
| 34 | 299 | Shallow pit in tree throw | - | - | - | - | - | - | 2 | - | - | - | - |
| Group 803 | | | | | | | | | | | | | |
| 57 | 458 | Burnt spread and pit | - | - | - | - | - | 1 | 5r | 1h | - | - | - |
| Group 805 | | | | | | | | | | | | | |
| 3 | 63 | Burnt surface spread from clearance | 3 | 2 | - | - | - | - | - | 40h | - | - | - |
| 4 | 64 | Fill of tree throw, spread with burnt pit in centre | - | - | - | - | - | - | - | 29h | - | - | - |
| Group 2503 | | | | | | | | | | | | | |
| 65 | 1448 | Fill of structural pit/posthole | - | ?1 | - | 1 | - | 1 | 2 | - | - | - | - |
| 71 | 1499 | Fill of cooking pit | - | - | - | 1 | - | - | 1 | - | - | - | - |
| Group 2504 | | | | | | | | | | | | | |
| 68 | 1477 | Fill of cooking pit and midden | - | - | - | - | - | - | 3 | 1u | - | - | - |
| Group 2530 | | | | | | | | | | | | | |
| 145 | 2064 | Fill of stone- | - | - | - | cf. 1 | - | - | cf. 1 | - | - | - | - |

| | | | | | | | | | | | | | |
|--|------|--|----|---|---|----|---|---|----|---------|---|---|---|
| 146 | 1073 | lined hearth/ oven | - | - | - | - | - | - | 2 | - | - | - | - |
| 149 | 2076 | | - | - | - | - | - | - | 2 | - | - | - | - |
| Group 2543 | | | | | | | | | | | | | |
| 8 | 75 | Burnt surface spread in tree throw | - | 1 | - | - | - | - | - | - | - | - | - |
| <i>Late Neolithic/ Early Bronze Age 2400 – 1800 BC</i> | | | | | | | | | | | | | |
| Group 803 | | | | | | | | | | | | | |
| 27 | 302 | Burnt surface spread from clearance | - | - | - | - | - | - | - | 11h | - | - | - |
| 28 | | | - | - | - | - | - | - | 4 | 6h | - | - | - |
| 31 | | | - | - | - | - | - | - | - | 15h | - | - | - |
| 54 | | | - | - | - | - | - | 1 | 3 | 2h | - | - | - |
| Group 2503 | | | | | | | | | | | | | |
| 64 | 1328 | Spread of burnt clay, small pit in centre | - | - | - | - | - | - | 3 | 51h, 2s | - | - | - |
| 113 | | Fill of structural pit/ posthole | - | - | - | 2 | - | - | - | - | - | - | - |
| 112 | 53 | Fill of structural pit/ posthole | - | - | - | - | - | - | 2 | - | - | - | - |
| 114 | 1451 | Fill of structural pit | - | - | - | 1 | - | - | 1 | - | - | - | - |
| 115 | 1450 | Fill of posthole | - | - | - | - | - | 2 | - | - | - | - | - |
| 233 | 4239 | Burnt surface | - | - | - | - | - | - | - | 2u | - | - | - |
| Group 2509 | | | | | | | | | | | | | |
| 120 | 1428 | Burnt surface | - | - | - | - | - | 1 | - | 6h, 3u | - | - | - |
| Group 2543 | | | | | | | | | | | | | |
| 6 | 78 | Burnt surface from clearance | - | - | - | - | - | - | - | 1 root | - | - | - |
| 17 | 135 | From clearance burning | - | - | - | - | - | - | 2r | cf. 1 | - | - | - |
| Group 2550, Burnt Mound 1 | | | | | | | | | | | | | |
| <i>Subgroup 1550/2</i> | | | | | | | | | | | | | |
| 123 | 1817 | Pre burnt mound layer | ?1 | - | - | ?1 | - | - | 2 | 2u | - | - | - |

| <i>Subgroup 1550/3</i> | | | | | | | | | | | | | |
|--|---------------|--|-----|---|---|----|---------|-----|----|---------|----|---|---|
| 91 | 1691 | ?Oven/hearth | - | - | - | 1 | 9r | 3 | 2 | - | - | - | - |
| 111 | 1487 | Upper layer of burnt mound, in central feature | - | - | - | - | 3 | 1 | 1 | 2u | - | - | - |
| 117 | 1799 | Upper layer of burnt mound | ?2 | - | - | ?2 | - | - | 3 | 1 | - | - | - |
| 122 | 1881 | Hearth | ?1 | - | - | - | 1 | - | 1 | 6h | - | - | - |
| 152 | 1653/ 1651 | Fill of trough, near base of central burnt mound | - | - | - | - | - | 3 | - | 43u | - | - | - |
| <i>Subgroup 1550/4</i> | | | | | | | | | | | | | |
| 81 | 1582 | From base of secondary trough adjacent to hearth/ oven | - | - | - | 1 | 1 | - | - | 328h | - | - | - |
| <i>Subgroup 1651</i> | | | | | | | | | | | | | |
| 104 | 1654 | Fill of central trough | - | - | - | 1 | 1 | 1 | 1 | 1 | - | - | - |
| Group 4504 | | | | | | | | | | | | | |
| 183 | 4108 | From clearance burning | 3 | - | - | - | - | - | - | - | - | - | - |
| 187 | 4156/7 | From clearance burning | - | - | - | - | - | - | 2r | 1 | - | - | - |
| Group 4561 | | | | | | | | | | | | | |
| 276 | 4489 | Surface burning from clearance | - | - | - | 1 | - | - | - | 1u | - | - | - |
| 278 | 4490 | From clearance burning | - | - | - | - | 2 ?root | - | - | - | - | - | - |
| 280 | 4494 | Burnt-out tree throw | - | - | - | - | - | - | - | 8h | - | - | - |
| Middle Bronze Age, 1200 – 1000 BC | | | | | | | | | | | | | |
| Group 4563, Burnt Mound 2 | | | | | | | | | | | | | |
| 272 | 4477 | Fill of ?hearth | 26 | - | - | - | 7r | 16r | 2 | 4h, 2s | 7 | - | - |
| 273 | 4479 | Upper fill of | 31r | - | - | 3r | 2 | 6 | 2 | 15h, 4r | 3r | 2 | - |

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|-------------------|------|--|-----|---|---|----|---|-----|----|----------|---|---|----|
| 314 | | trough | 51r | - | - | 4 | 4 | 11r | 4r | 15h,4r | 3 | 3 | - |
| 285 | 4497 | From ?filter in trough between timbers and cut | 21 | - | 1 | 1 | 2 | 3 | 2 | 2s, 2r | - | - | - |
| 307 | 4459 | Fill of trough | 1 | - | - | - | - | 2 | - | 3s | - | - | - |
| 310 | 4478 | | 18r | - | - | 4r | 1 | 2 | 2 | 16h,6r | 4 | - | 1r |
| 312 | 4482 | | 12r | - | - | 1 | - | 6 | - | 8h,1r,2s | 1 | - | - |
| Group 4564 | | | | | | | | | | | | | |
| 284 | 4483 | Layer in palaeochannel, predating trough | 19 | - | - | - | - | 5 | - | 17r | 4 | - | 3r |