The Kavli Institute for Cosmology, Cambridge:
an archaeological excavation

Richard Newman

CAMBRIDGE ARCHAEOLOGICAL UNIT
UNIVERSITY OF CAMBRIDGE

THE KAVLI INSTITUTE FOR COSMOLOGY Cambridge

An Archaeological Excavation

Richard Newman

With contributions by
Katie Anderson, Emma Beadsmoore, Matt Brudenell,
Craig Cessford and David Webb

University of Cambridge
March 2008
Report No. 820
Event Number: ECB 2609

Summary

An archaeological excavation consisting of an open area and two additional soakaways, which covered a combined area of c.230m^2, was undertaken in advance of construction of the new Kavli Institute for Cosmology in the grounds of the University Observatory on the west side of Cambridge. Three distinct phases of activity were identified at this site. The first of these was represented by residual sherds of Late Iron Age and Early Roman pottery, which were recovered from a series of intensive Post-Medieval gravel quarries. Although extraction activity most probably began on the site in the Medieval period, it reached its apogee during the 17th century when at least 45 additional quarry pits were created; it was at this time that all in-situ traces of earlier activity appear to have been obliterated. Subsequently, during the 18th and 19th centuries, the area was used as rough pasture. In 1891, following the expansion of the University Observatory that had been established a little way to the north in 1822, a large telescope was erected on the site. This instrument, the Newall 25 inch refractor telescope, was to remain in use until 1955. It was subsequently donated to the National Observatory of Athens, at which time its former dome was demolished and a made-ground deposit was introduced above its remains.

Contents

Introduction

The Cambridge Archaeological Unit (CAU) undertook an open area excavation on a 260m^2 area of land located in the northwestern part of the city of Cambridge between the 25th of February and the 6th of March 2008. The development area, which is centred on TL 432 594, is situated on the southern slope of Observatory Hill, approximately 150m to the north of Madingley Road, where it lies within the grounds of Cambridge University's Institute of Astronomy (see Figure 1). Following an initial trial pit evaluation conducted on the site in March 2007 (see below), an open area excavation *c.*194m^2 in extent was undertaken within the footprint of a proposed new building. In addition, two soakaways sited a short distance to the south of the main trench were also investigated (see Figure 2). The project followed the specification issued by the CAU (Evans 2008) and approved by Kasia Gdaniec, Development Control Archaeologist at Cambridgeshire Archaeology Planning and Countryside Advice (CAPCA). It was commissioned by the University of Cambridge Estates Management and Buildings Service, on behalf of the Institute of Astronomy and the Kavli Foundation, in advance of construction of the new Kavli Institute for Cosmology.

Methodology

Due to the presence of a standing building in the southern part of the development area only a little less than half the site was available for investigation. Within the excavated portion, modern deposits and overburden were removed by a 360° mechanical excavator with a 1.5m wide toothless bucket. The archaeological features that were thus revealed were then excavated by hand and recorded using the CAU modified version of the MoLAS system (Spence 1994). Base plans were drawn at a scale of 1:50, whilst sections were drawn at a scale of 1:10. Context numbers are indicated within the text by square brackets (*e.g.* **[001]**), and feature numbers are denoted by the prefix F. (*e.g.* **F.01**). An assessment of the finds assemblage is presented as an appendix. The photographic archive consists of a series of digital images.

Landscape and geology

The site is located upon Observatory Hill, partway down the south-facing slope of a gravel ridge that runs in a northwest to southeast direction across the area. Geologically, this ridge comprises a drift deposit known as the Observatory Gravels which overlies solid chalk to the north and Gault clay to the south (British Geological Survey, sheet 188). Within the area of excavation the present surface height ranges between 22.85m OD to 23.20m OD, though this uniformity is primarily the result of modern building activity and disturbance. The original slope of the hill, as revealed by the profile of the underlying gravels, dropped from 23.20m+ OD at the northern edge of the site to *c.* 22m OD at the southern edge (a distance of 22.4m).

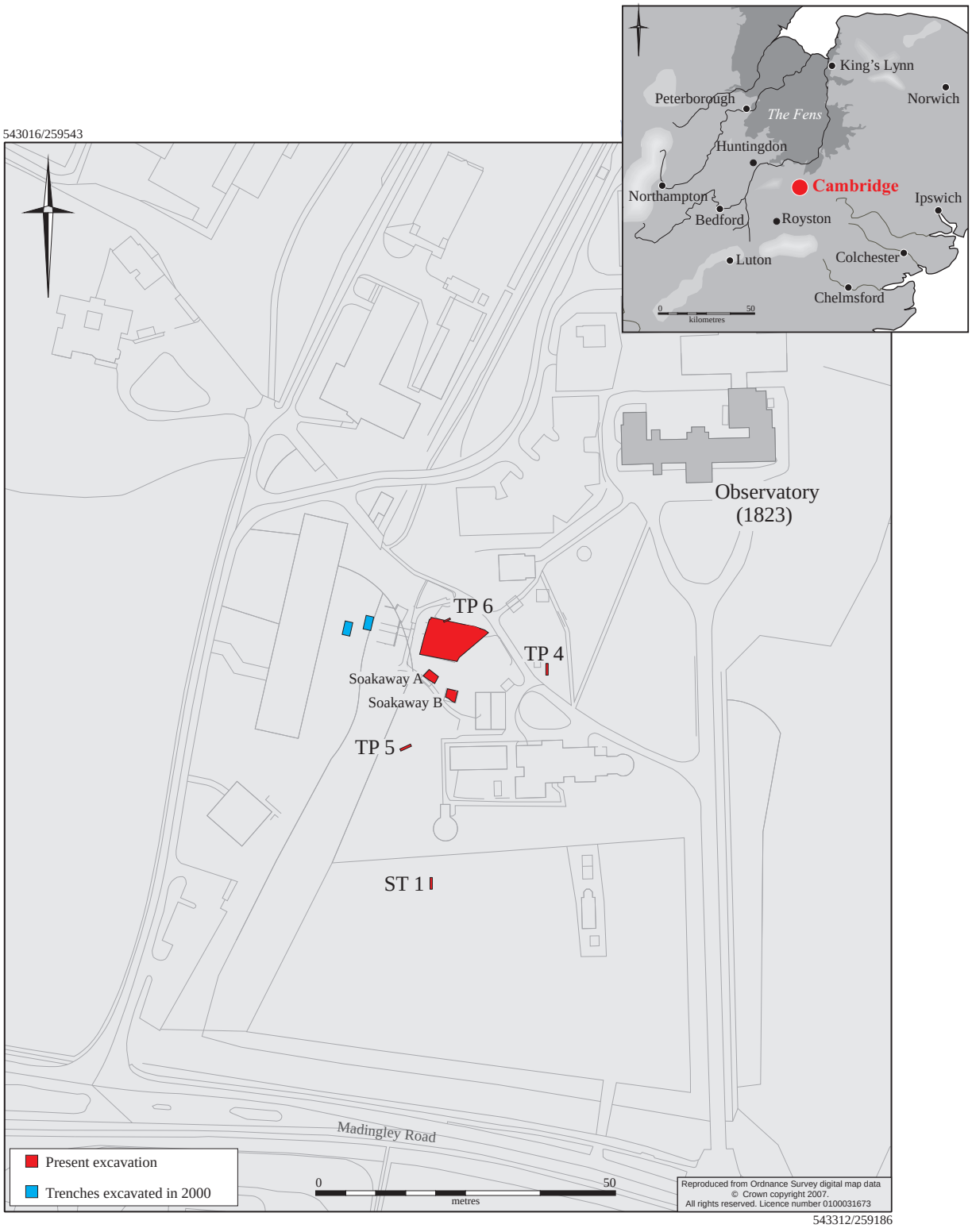


Figure 1: Location map.

Figure 2: Plan of all features.

Historical and archaeological background

The historical and archaeological background of the development area is covered in depth in two recent desktop assessments (Dickens 1999; Redfern 2001) and the wider background of Cambridge itself is reviewed in several published sources (see Bryan 1999; Taylor 1999); neither is therefore reproduced here in full. Nevertheless, it is necessary to briefly outline the background of the area in order to place the site within its wider context. Further details on specific sites directly related to its development are also discussed in the relevant sections of the excavation results.

Within the Observatory Gravels a number of stone implements of Palaeolithic date were identified during coprolite extraction in the 19th century (Babington 1883, 11-13); indeed, at least one hand axe and several palaeoliths were recovered in 1900 less than 200m to the northwest of the development area (Dickens 1999, 6). Limited evidence of later Prehistoric activity, primarily in the form of lithic scatters, has also been identified across much of the area (*cf.* Marr & Burkitt 1923) and in 1997 part of a substantial Iron Age enclosure was investigated at Marion Close, around a kilometre to the northeast of the present excavation (Mortimer & Evans 1997). In much closer proximity to the site, residual Iron Age pottery was recovered from quarry pits excavated less than 50m to the west in advance of construction of the Hoyle Building in April 2000 (Masser 2000; see also Figure 1). However, the majority of known activity in the immediate surroundings is of Roman date. Late 3rd century coins (of Gallienus, Tetricus I and Carausius), along with contemporary pottery and bronzes, are recorded from the Observatory Hill area and pottery vessels, including a jar and two flagons, were found "near the Observatory" by A. F. G. Griffith in 1878 (Babington 1883, 36). In addition, *in-situ* human remains from this period were discovered within two Barnack stone coffins found a little way to the north in 1863 (see Figure 3). These contained a male and a female interment respectively. The female had numerous grave goods placed at her feet, including glass bottles, jet jewellery and a 4th century beaker, suggesting a very late Roman date (Babington 1864; Babington 1883, 35-6; Liversidge 1977, 15-16). A further stone coffin was also identified in this area during an evaluation undertaken in 2002, although unfortunately it was no longer *in-situ* (Mackay *et al* 2002, 9-11).

The accepted picture of Cambridge during the Roman period is one of a settlement centred almost exclusively upon the Castle Hill area (Alexander & Pullinger 2000). Previously the site of a minor Iron Age settlement of 'village proportions', this hilltop location became occupied by a small Roman fort in the 1st century AD, which subsequently developed into a walled town around three centuries later (see Figure 3). Recent fieldwork, however, is demonstrating that this 'single locus' interpretation is somewhat limited as evidence of significant settlement activity has now been detected at some distance from the presumed centre. To the southeast, Roman occupation has been identified on the riverfront (Dickens 1996) and in the Park Street/Jesus Lane area (Alexander *et al* 2004) as well as extending out along Bridge Street (Newman *in prep*). Of more direct relevance to the present study, key sites have also been excavated to the west at New Hall (Evans 1996), Trinity Hall Playing Fields (Wills 2004) and Vicar's Farm (Lucas & Whittaker 2001), and it is especially notable that the latter site lies less than 200m to the south of the present excavation (see Figure 3).

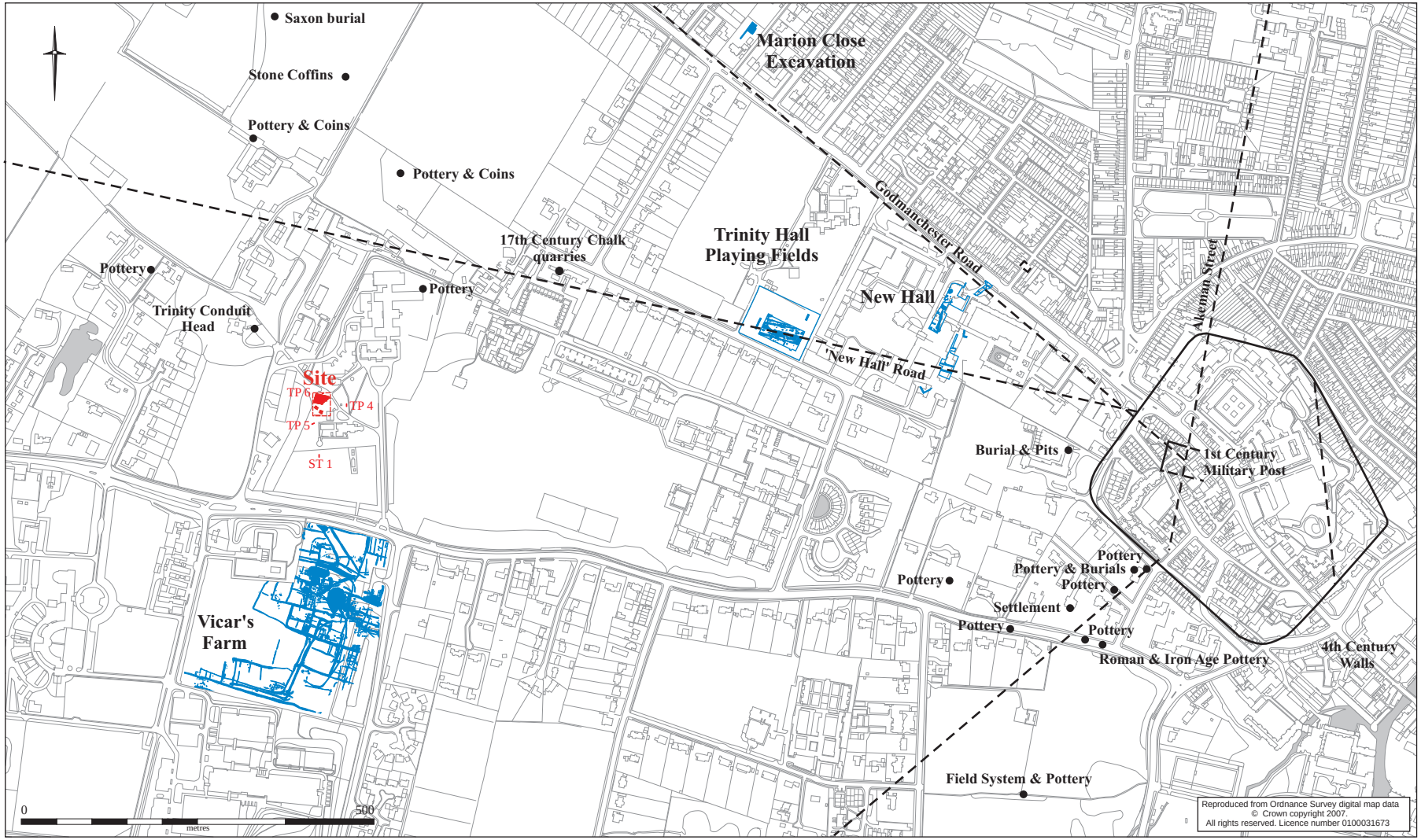


Figure 3. Major excavations (in blue) and significant find spots in the surrounding area.

The context of the present site during this period is thus one of an area situated within a dense and active hinterland; the projected route of a roadway identified during the New Hall excavations (Evans 1996, 47-9) and again at Trinity Hall Playing Fields (Wills 2004, 7-9) passes less than 200m to the north along the crest of the gravel ridge, whilst a significant settlement has been identified only a little way to the south (see Figure 3). Although observations made in 1966 of a sewer trench dug from Madingley Road to the Observatory building revealed "nothing other than normal geological stratification" (Liller 1966, 138), it appears unlikely that this area went unused in the midst of such an active landscape.

Finally, there is also clear evidence of Medieval activity in the near vicinity, primarily in the form of remnant field systems and insubstantial earthworks (Redfern 2001, 17), although unfortunately the site lies outside of the area covered by most historic maps of Cambridge (*cf.* Baggs & Bryan 2002). Certain information may, however, be reconstructed from a 14th century tithe document known as the Corpus Terrier (Hall & Ravensdale 1976). This document indicates that the area of excavation lay within a field known as 'Grithow', a name which was to survive in common usage (being modernised to 'Gravel Hill') until the foundation of the University Observatory on the site in 1822. The most significant Medieval feature known to lie in the immediate vicinity of the site is the Trinity Conduit. This 'underground aqueduct' was constructed in 1327 for the Franciscans (or Grey Friars) who occupied the site that later became Sidney Sussex College (RCHM(E) 1959: 233), although it is first mentioned historically in an inquisition held at Babraham on the 22nd of October 1434 (Willis & Clark 1886, 427-30 and 678-80). The conduit ran to the Friary from 'Bradrusshe' – now known as Trinity Conduit Head, which is located 120m to the northwest of the present site (see Figure 3) – and its construction involved the purchase of a two foot (0.6m) wide strip of land across the property of 17 landowners for a distance of 1467 tailor's ells (*virgas cissoris*). As a tailor's ell equates to around 45 inches, it was thus 5501 feet 3 inches (or 1677m) long. In addition, the identification of Roman pottery and abundant oyster shell around its springhead has also prompted the suggestion of a much earlier presence at this site (Lucas & Whittaker 2001, 20). However at the present time the origins of the spring, along with the precise route of the conduit across the area, remain unknown.

Trial Pit Evaluation (with David Webb)

Three trial pits and a soakaway 'test hole' were excavated by a JCB with a 0.5m toothed bucket between the 12th and the 15th of March 2007; their respective locations are shown in Figure 1. These trenches, which were excavated as part of a programme of geo-technical investigation in advance of the proposed development, were monitored for the CAU by David Webb.

Trial Pit 4

Trial Pit 4 was 2.50m by 0.50m in extent and was excavated to a depth of 2.60m; it is located approximately 25m to the east of the main excavation (see Figure 1). A probable quarry pit 1.05m deep was encountered in this trial pit.

> The uppermost deposit comprised very dark grey sandy silty clay 0.30m deep with occasional sub-angular small to medium gravel inclusions and frequent rooting. This overlay a deposit of dark grey sandy clay 0.25m deep with occasional sub-angular gravel inclusions. This latter material,

which had a sharp interface onto the layer beneath, most probably represents a made-ground deposit. The underlying deposit, a dark orange brown sandy clay 1.05m deep with occasional to frequent angular gravel inclusions, probably comprises the fill of a quarry-type feature. Below this lay a 0.70m deep layer of yellowish brown sandy gravel with frequent small to medium angular gravel inclusions, which in turn overlay Gault clay.

Trial Pit 5

Trial Pit 5 was 2.50m by 0.50m in extent and was excavated to a depth of 2.40m; it is located approximately 30m to the south of the main excavation (see Figure 1). A depth of 1.30m of made/disturbed ground was encountered in this trial pit.

The uppermost deposit comprised very dark grey sandy silty clay 1.30m deep with occasional sub-angular small to medium gravel inclusions. This material may represent a levelling deposit that was deliberately introduced in order to raise the surface height in this area, but is perhaps more likely to be the by-product of relatively recent disturbance. Beneath this layer, a deposit of dark yellowish brown sandy gravel 0.80m deep with frequent small to medium angular gravel inclusions was present. This overlay a deposit of firm pale brown clay, which continued below the limit of excavation.

Trial Pit 6

Trial Pit 6 was 2.50m by 0.50m in extent and was excavated to a depth of 2.60m; it is located partially within, and also extends immediately to the north of, the main excavation area (see Figure 1). The edge of a concrete foundation was encountered in this trial pit, along with further evidence of quarrying activity.

The uppermost deposit comprised very dark grey sandy silty clay 0.30m deep with occasional sub-angular small to medium gravel and occasional CBM inclusions. Immediately underlying this material at the west end of the trench a concrete footing was encountered. This has subsequently been identified as part of the foundation of the Newall 25 inch refractor telescope, which was sited here from 1891 to 1955 (see Phase 3, below). Unfortunately, below this depth the edges of the trench were highly unstable and only limited recording was possible. A mixed deposit of orangey brown sandy gravels *c.*0.50m deep with occasional silt lenses was observed; this appears likely to be associated with quarrying activity similar to that noted in Trial Pit 4, and may account for the instability of the trench at this depth. Below this material a highly unstable yellowish brown sandy gravel layer 1.80m+ deep was encountered, which continued below the limit of excavation.

Soakaway Test

The soakaway test-hole was 2.50m by 0.50m in extent and was excavated to a depth of 2.00m; it is situated 36m to the south of the main excavation area (see Figure 1). A stratified feature (**F.02**) of probable Early Roman date was identified in this location. The presence (or perhaps more probably, the survival) of such a feature may be related to the change in the underlying geology in this location, which contains a notably higher proportion of clay than that encountered in the preceding trial pits.

The uppermost deposit comprised very dark grey sandy silty clay 0.30m deep with occasional sub-angular small to medium gravel and occasional CBM inclusions. Immediately underlying this material was **F.01**, a modern field drain that bisected the trench along a northeast to southwest alignment. The ceramic drainpipe sat within a steep-sided cut with a concave base that measured 0.46m wide by 0.48m deep; this had been backfilled with a deposit of dark grey sandy silt with frequent CBM fragment inclusions. The field drain truncated a layer of mid grey sandy silt 0.26m deep with frequent angular small to medium gravel inclusions. Beneath this a second feature, **F.02**, was encountered. Within a well-defined, moderately steep-sided pit with a concave base, which measured 1.78m wide by 0.95m deep, two fills were identified. The lowest of these consisted of a

dark greyish brown sandy silt deposit with yellowish brown and orange brown sandy gravel inclusions. 29 fragments of Early Roman pottery were recovered from this context (these were conjoining and unabraded, implying that they remained *in-situ*), as well as a number of animal bones including horse teeth. An upper fill of mid greyish brown sandy silt with occasional small to medium sub angular gravel inclusions was also present. **F.02** was cut into a layer of pale brown fine sand 0.17m deep, which in turn overlay a layer of dark yellowish brown sandy gravel 0.68m deep, with frequent small to medium angular gravel inclusions. Beneath this, a little over a metre below the present ground surface, a thin layer of pale brown clay 0.10m thick with frequent well sorted medium sized rounded gravel inclusions was encountered. This sat above a layer of Gault clay that continued below the limit of excavation.

Discussion

Although very limited in scale, the results of this trial pit evaluation are significant in terms of identifying the southern limit of the Observatory Gravel ridge, a feature which defines much of the topography of this area. Whilst Trial Pits 4, 5 and 6 were clearly still located upon this ridge, and contained a number of deposits that exhibit hallmarks typical of intensive gravel extraction, the soakaway test-hole situated a little further to the south was notably distinct. Here, Gault clay was identified much closer to the surface than in any of the previous locations and *in-situ* archaeological features also appear to have survived. This implies that away from the area of later quarry-related disturbance on the ridge, stratified archaeological deposits are potentially present extending down to Madingley Road to the south.

Where relevant, the results of this evaluation will also be incorporated into the discussion of the main excavation below.

Excavation Results

Three phases of activity have been identified within the excavated sequence at the Kavli Institute site. These comprise:

1. Residual traces of Late Iron Age and Early Roman activity.

2. Features associated with intensive gravel quarrying in the Medieval and Post-Medieval periods.

3. Features associated with the erection of the Newall 25 inch refractor telescope in 1891 and its subsequent removal in 1955.

Because each of these phases represents events that occurred on a site-wide as opposed to trench-specific scale, the relevant information from each area has been amalgamated into a general phase-by-phase discussion.

Phase 1 – Iron Age and Early Roman activity

Although a significant amount of primarily Late Iron Age pottery (133 sherds weighing 1.94kg) was recovered, this material was entirely residual within later contexts. Discrete concentrations of large unabraded and often conjoining sherds were recovered from several Post-Medieval quarry features (most notably **F.206**, **F.212**, **F.218** and **F.224**; see Figure 4), suggesting the almost wholesale 'transplantation' of deposits from previously *in-situ* features. The pottery recovered included a high proportion of handmade and wheel-turned sherds, indicating a date between *c*.50BC

and 30AD (see further the pottery assessment report). This fits very neatly with the pattern established by the apparently stratified Early Roman (*c*.80-120AD) material identified during the trial pit evaluation some 36m to the south. There was a notable dearth of either animal bone or flint accompanying the Iron Age pottery, however, suggesting that it may not be directly related to settlement activity.

> The potentially 'transplanted' fill in which the majority of Late Iron Age and Early Roman pottery was discovered was relatively consistent between features; it comprised moderately soft dark greyish brown sandy clay silt with occasional to rare pale yellow gravel tips. However, it clearly did not remain *in-situ* as it also contained Post-Medieval pottery in every excavated instance.

Discussion

Unfortunately, given the high degree of later disturbance and the limited scale of the current investigation, little can be determined with certainty of the precise nature or extent of the Late Iron Age and Early Roman activity at the Observatory site. However, something of the context of this activity may be established within the contemporary landscape of the surrounding area. In 1997 a significant Iron Age enclosure was excavated around 1km to the northeast at Marion Close. Although only a small excavation (totalling 117m^2), evidence of a substantial Late Iron Age enclosure was revealed when part of an outer ditch system, consisting of at least three ditches with numerous recuts that were up to 1.35m+ deep, was uncovered (Mortimer & Evans 1997, 4-7). "Essentially, what was present was a bi-vallate circuit converging beside the western edge-of-excavation. This pattern could suggest a complicated antennae-ditch/outworks system, probably lying adjacent to an entrance located further to the northeast" (*ibid*, 10). Although no definite settlement features were identified, the quantities of domestic refuse recovered are strongly indicative of occupation. Whilst the majority of the pottery could only be generically dated to the Later Iron Age (*c*.300BC to 50AD), it primarily appears to lie in the later part of that date range (*ibid.*, 16). The Marion Close enclosure therefore comprises a potentially quite significant settlement site of broadly similar date in the near vicinity of Observatory Hill. This site has been tentatively linked to contemporary activity somewhat further to the east at New Hall (*cf.* Evans 1996), and a recent evaluation undertaken by Northamptonshire Archaeology to the north has also identified significant Iron Age activity (R. Standring *pers comm*).

In rather closer proximity to the present site, the remnants of a shallow ditch and a small pit of probable Iron Age date were identified less than 500m to the north during an evaluation of the land surrounding Gravel Hill farm (Mackay *et al* 2002, 7-8). Unfortunately, these features had been very heavily truncated by 19th century coprolite quarrying and survived only upon a small 'island' of unexcavated gravel; little other archaeological material remained present in the surrounding area. Much the same situation was also identified in 2000 during an evaluation undertaken at the Hoyle Building site less than 50m to the west of the current excavation. Here, several sherds of primarily Late Iron Age pottery were recovered as residual material within extensive Post-Medieval quarry pits, but no *in-situ* features survived (Masser 2000, 6-7). In contrast, perhaps the most significant site yet to be identified in the western hinterland of the city – that at Vicar's Farm, which is located approximately 200m to the south – did contain a number of *in-situ* features relating to this period. These consisted of a cluster of pits of "very Late Iron Age date" that were later enclosed by a series of ditches in the Early Roman period (Lucas & Whittaker 2001, 28). No

definite settlement activity of this date was identified, however, and it has in fact been noted that "apart from very low levels of activity, the site was essentially unsettled until the later 1st century AD" (*ibid.*, 120). This therefore raises the very interesting possibility of a southwards 'migration' of settlement activity during the Early Roman period, with the primary focus shifting down from the free-draining gravel ridge onto the clayier fields below. If this was indeed the case, it would appear to represent a very unusual dynamic, and might perhaps indicate the establishment of a much more regulated or controlled landscape in this area during the 1st century AD.

In addition, one further intriguing clue as to the landscape of the area at this time appears to survive within the later historical record. A small area "towards the southern boundary of the gravel ridge", and therefore probably in quite close proximity to the present site, was described as *le Greneplat* in the Medieval Corpus Terrier (Hall & Ravensdale 1976, 44). This appears to have comprised a patch of unploughed land, roughly circular in form, against whose entry "a rough sketch of what looks uncommonly like a tumulus, labelled 'Grythowe'" was included in the Terrier's margin (*ibid.*). The approximate location of this mound, in a prominent 'sky-lined' position on the gravel ridge (see Figure 6), would be consistent with the typical location of a burial mound of the later Prehistoric or Early Roman period, although it must be noted that burials of both Late Roman and Saxon date have also been recorded in the near vicinity (see Figure 3).

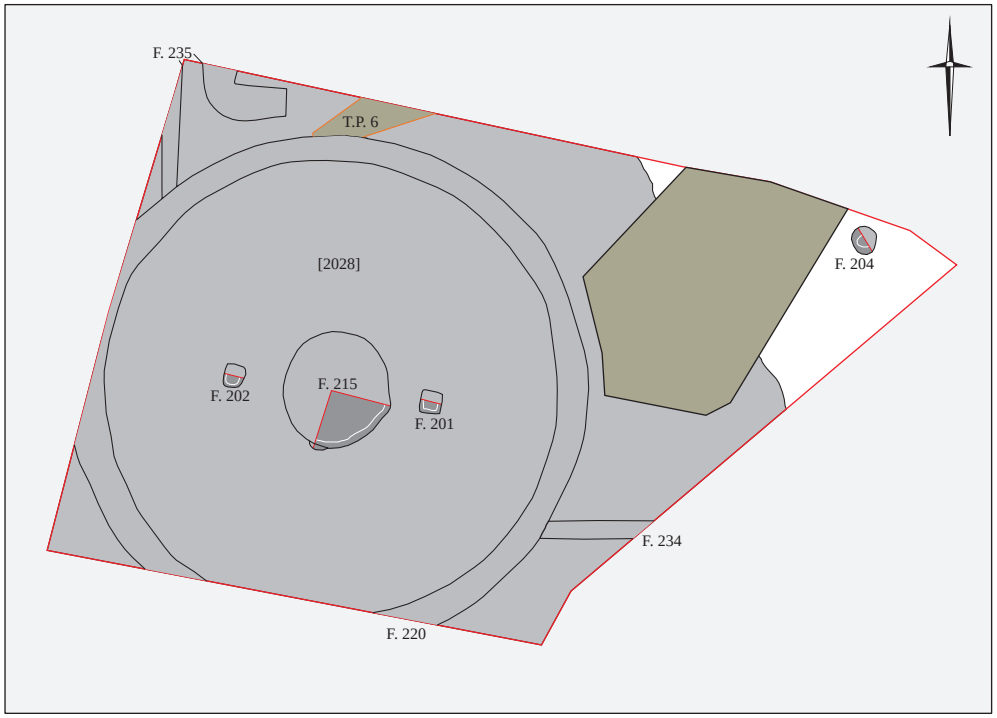
Phase 2 – Medieval and Post-Medieval quarrying

The vast majority of features identified on the site belong to the period spanning *c.*1500 to *c.*1700, when intensive gravel extraction was being undertaken both here and in much of the immediate vicinity. A large number of features relating to such activity were uncovered, and based upon both their morphology and fill characteristics three main 'types' may be identified (see Figure 5). These types appear on stratigraphic grounds to broadly conform to a wider pattern of chronological progression.

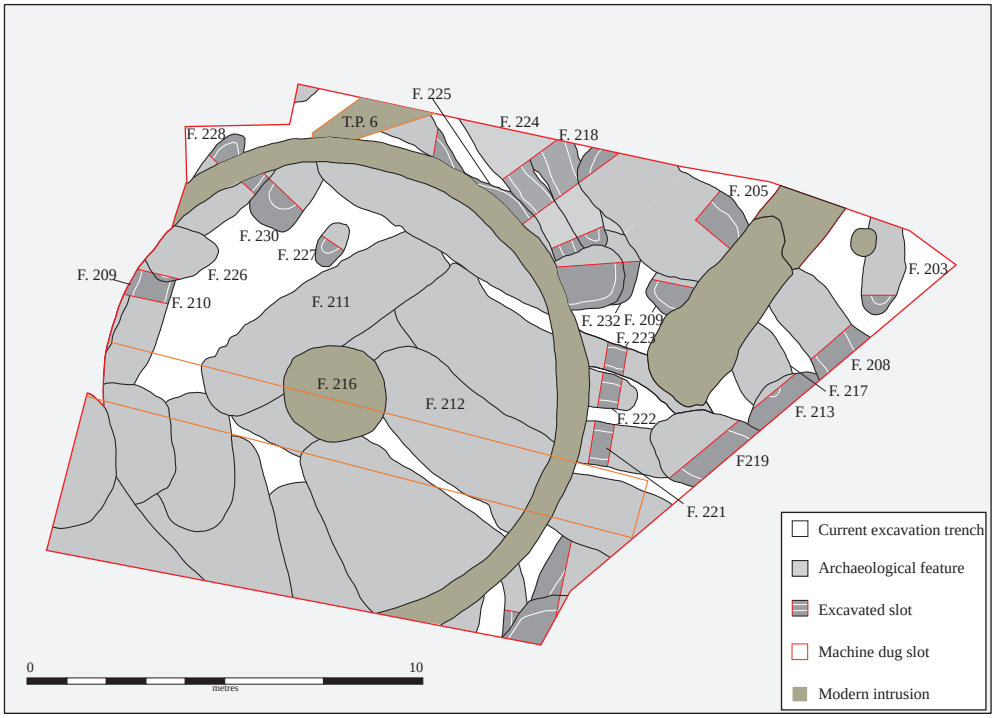
Quarry-type 1 – Medieval(?) quarry pits

The earliest surviving *in-situ* features to be identified on the site comprise a group of at least seven pits that share a very distinctive fill. This material, which bears little relation to the more humic deposits in which the majority of residual pot sherds were identified, was found to be largely sterile in nature. This fact, combined with the early origin of these features on stratigraphic grounds (see Figure 5), suggests that they most probably form the vestiges of early quarrying activity at the site. They are, therefore, most likely to be Medieval in date. Gravel extraction is known to have been undertaken in this area throughout the Medieval period (see further below), although the limited number and relatively small size of these early quarry features suggests that in its initial form this activity was somewhat sporadic in nature.

> Excavated examples of this quarry type, which included **F.227**-**F.232**, varied between 1.15m to 2.95m+ in length and 0.61m to 1.15m+ in width and were generally of irregular sub-oval form. They contained very similar deposits of dark greyish brown sandy silt with frequent bands and tips of dark yellowish orange sandy gravels and few other inclusions. They had irregularly sloping sides and varied in depth between 0.18m+ to 0.61m+, although all had been partially truncated by the introduction of later Phase 3 deposits.



Upper phase



Lower phase

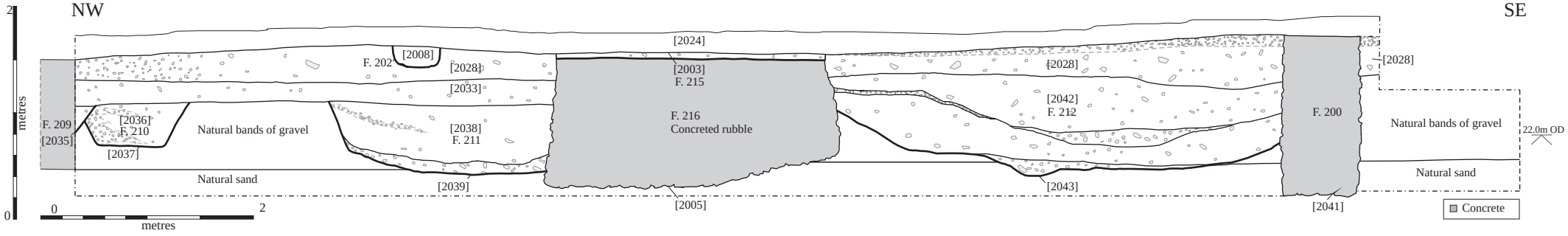


Figure 4: Phase plans and section of main area.

Figure 5: Phases of quarrying activity.

Quarry-type 2 – Post-Medieval strip quarries

By far the most common feature-type to be identified on the site is the so-called 'strip' quarry (see Figure 5), which is typically characterised by its elongated sub-rectangular form. This distinctive shape appears to have been created via a process of worm-like excavation in which waste material was discarded to the rear of an ever advancing working-face; it is in effect, therefore, a by-product of 'horizontal tunnelling' across the surface of the landscape. For this reason such features are frequently associated with large-scale, often commercial gravel extraction, a pattern which would appear to fit with the evidence recovered from the present site. Indeed it seems very likely that the majority of quarry pits encountered during the evaluation of the Hoyle Building site less than 50m to the west in April 2000, which contained near identical fills and produced very similar material to the present group of features, also comprised part of this same phase of intensive extraction activity (*cf.* Masser 2000). The dating material recovered from all of these features indicates that they were created during a potentially quite discrete period in the 17th century (see further the pottery assessment report). Although comparable features have also been excavated recently in the Cambridgeshire region at Swavsey (Collins *in prep*) and Haddenham (Evans & Hodder 2006), the numerous examples present at both of these sites appear to be primarily 19th century in origin and were notably much more regular in alignment (M. Collins *pers comm*; Evans & Hodder 2006, 300-301). The rather haphazard nature of the quarries at the present site – which appear to reflect a somewhat piecemeal, less regulated method of excavation – can perhaps be associated with a lower demand for the extracted product in the 17th as opposed to 19th centuries. An excellent parallel to this more 'organic' quarrying technique is also to be found in the 12th to 14th century extraction pits identified at Church End, Cherry Hinton in 2002 (Cessford & Mortimer 2004, 37-40).

> Excavated examples of this quarry type, which included **F.101**-**F.109**, **F.111**, **F.112**, **F.204**-**F.208**, **F.211**-**F.214**, **F.217**, **F.220**, **F.225**, **F.226**, and **F.233**, varied between 3.45m to 6.92m+ in length and 1.81m to 3.52m in width and were generally of elongated sub-oval form. They contained very similar mid to dark greyish brown sandy clay silt deposits with occasional to frequent bands and tips of mid to pale yellow sandy gravels and occasional CBM and pottery inclusions. In general they had steeply sloping sides leading to relatively flat bases and varied in depth between 0.37m+ to 0.98m+, although all had been partially truncated by the introduction of later Phase 3 deposits. It is notable that every excavated example of this feature-type terminated at the boundary between the natural gravels and an underlying band of sand (see Figure 4), confirming that they were specifically intended to target this gravel layer.

Quarry-type 3 – Post-medieval linear 'gully' type quarries

This category of quarry feature is typified by its gully-like form, with many examples appearing to have been deliberately 'slotted-in' between pre-existing quarries in order to extract a surviving ridge of gravel. Therefore these features, of which at least 11 have been identified, appear likely to have been created during the latter stages of the quarrying sequence towards the end of the 17th century. This view is supported by the nature of the finds recovered from them, although it must be noted that several were later truncated by more standard 'strip' type quarries (see Figure 5), indicating that at least two major phases of extraction may have been undertaken in this area.

Excavated examples of this quarry type, which included **F.100**, **F.110**, **F.203**, **F.209**, **F.210**, **F.218**, **F.219** and **F.221**-**F.224**, varied between 1.62m+ and 4.15m+ in length and 0.58m and 1.07m in width and were generally of irregular linear or curvilinear form. They all contained very similar deposits of friable dark greyish brown sandy silt with occasional bands and tips of pale yellow sandy gravels and occasional CBM and pottery inclusions. They had irregularly sloping concave sides and bases and varied in depth between 0.07m+ to 0.31m+, although all had been partially truncated by the introduction of later Phase 3 deposits.

Overlying material

The remnants of at least two layers of upcast quarry material were identified, **[2033]** and **[2054]** respectively, although both were very heavily truncated. Such material, which frequently accrues in areas of intense quarrying activity, was probably present at one time across the majority of the area but appears to have been largely removed during the extensive landscaping of the site that was undertaken in the late 19th century (see further Phase 3).

[2033] and **[2054]** comprise mixed and banded deposits of dark greyish brown sandy silt with occasional to rare gravel inclusions; they were 0.27m+ and 0.32m+ deep respectively. Both layers were heavily truncated and were therefore of highly irregular form; their original extent is unclear.

Discussion

The primary documentary resource for this part of Cambridge during the Medieval period is the Corpus Terrier (or *Terrarium Cantabrigiae*) a manuscript recording the tithes due from the west fields of Cambridge that was compiled *c.*1360. This document appears to have been a 'working copy' extracted from the more extensive Barnwell Tithe Books, but which now comprises the earliest known extant record of this information (Hall & Ravensdale 1976, 7). The level of detail contained within the Terrier is very high, which has led to it forming the basis of at least two seminal works on the agricultural history of this period (*cf.* Seebohm 1883; Maitland 1898).

Based upon evidence recorded in the Terrier, it appears that the upper part of the gravel ridge was intensively quarried throughout the Medieval period; indeed, much of the area to the north of the present site was already recorded as being occupied by *gravelpyttes* in 1360 (Hall & Ravensdale 1976, 29). These were presumably created to supply the needs of the burgeoning city to the east. The 'out-sourcing' of building materials such as gravel was probably rendered necessary because at many urban sites within the city, such as St John's Triangle (Newman *in prep*) and Hostel Yard, Corpus Christi (Cessford 2005), immediately available sources of the material had largely been exhausted by the end of the 13th century. However, the area of excavation itself – lying as it does almost at the southern limit of the gravel ridge, at the greatest remove from the contemporary settlement at Howes (see Figure 6) – does not appear to have become the focus of extraction activity until somewhat later. In the original Corpus Terrier the area to the south of the possible tumulus at 'Grythowe' is recorded as containing a number of abutting *selions* (or strips), showing that it remained under cultivation in the late 14th century. However, a note added in a later hand records that:

"The selions of this furlong ought to be counted at their east head but yet it is better to begin now contrary next the conduit for it is now in the gravel pits and can scarcely be descried where the beginning of this furlong appeareth" (quoted in Hall & Ravensdale 1976, 30).

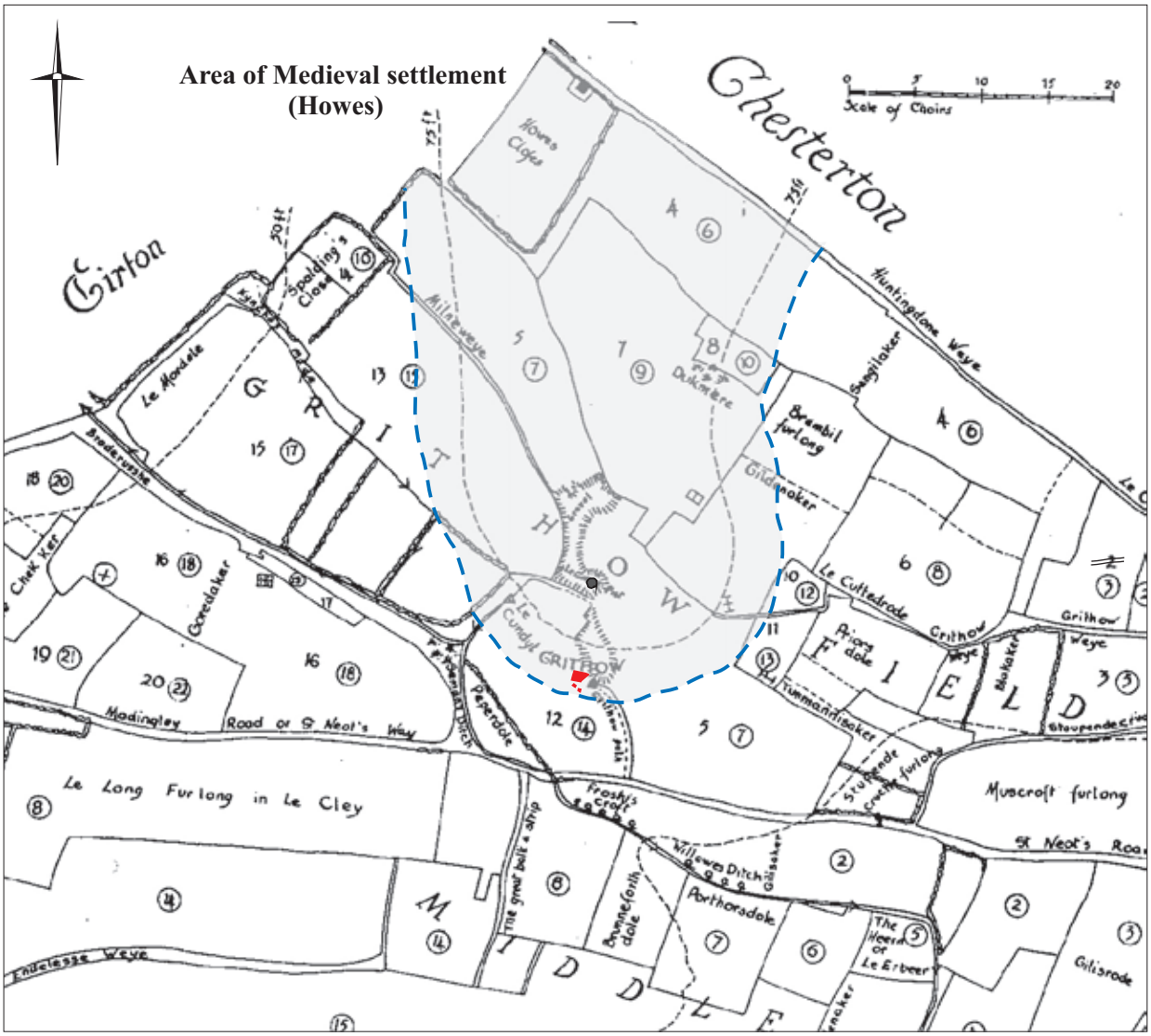


Figure 6: Medieval field-systems as recorded in the Corpus Terrier (after Hall & Ravendale 1976).

Present site
Probable extent of gravel ridge
Possible tumulus

Figure 7: Richard Banks Harraden’s 1840 view of the site (reproduced with the permission of Professor Sir Martin Rees).

Dated 1538, a Latin version of this same note was appended to the Clare Hall copy of the Terrier. This demonstrates very clearly the gradual southwards expansion of the quarried zone, which can now be shown to have reached the southernmost limit of the ridge by *c.*1600. At around the same time, some 360m to the northeast, a number of chalk quarries are also known to have been created (Whittaker 2000; see also Figure 3), indicating a potential increase in the general demand for building materials.

Once the gravel had been extracted, a pitted, almost lunar landscape was left that was no longer suitable for arable cultivation. Much of the resulting area therefore appears to have been given over to rough pasture (Hall & Ravensdale 1976, 30). This can clearly be shown to have occurred in the immediate vicinity of the present site, as it is recorded in a painting of the area made by Richard Banks Harraden in 1840 (see Figure 7). Harraden (1778-1862), who was the son of the artist and engraver Richard Harraden (1756-1832), produced a series of paintings and engravings of Cambridge during his lifetime, including many of the drawings of the city illustrated in his father's work *Cantabrigia Depicta* (1811). Although an idealised and somewhat 'romantic' depiction, his view of the nascent Observatory site in 1840 clearly illustrates in the foreground the uneven and irregular landscape created by intensive gravel extraction. In addition, it also shows that the area remained in pastoral use more than a century after the quarrying activity had ceased. Therefore, whilst it must be noted that Harraden liberally exaggerated the dominant perspective of many of the University and College buildings, no doubt in order to order to increase his painting's commercial appeal amongst its principal target audience, this image remains a valuable record of the landscape of the area during the mid 19th century.

Phase 3 – The establishment of the Newall Telescope

Following the expansion of the University Observatory, which had been established a short distance to the north in 1822, the Newall 25 inch refractor telescope – one of the greatest scientific instruments of its age, which was described at the time of its creation as an "imperial philosophical machine" (Pritchard 1868, 130) – was erected on this site in 1891. Although previously sited in Gateshead, both the telescope's mount and its dome had been specifically designed to be transportable (Dewhirst 1970, 493) and the patch of former pastoral ground chosen as its new location was suitably landscaped prior to the instrument's arrival. In order to provide a stable base for the telescope, the gentle slope of Observatory Hill was levelled off via the introduction of banded make-up deposit **[2028]** and deep concrete foundations **F.200** and **F.216** were established. The impact of these works upon the preceding archaeology can be clearly seen in Figure 8.

> Levelling deposit **[2028]** consists of banded layers of mid greyish brown sandy clay silt and mid to pale yellowish sandy gravels that are up to 0.81m deep. The presence of truncated natural gravels lying at current surface height at the northern edge of the excavation implies that much of layer **[2028]** was derived from ground works conducted in this area; this in turn implies that a combination of terracing and made-ground were employed to provide the most stable footing possible. Subsequent foundations **F.200** and **F.216**, which were employed as supports for the dome and telescope respectively, were both constructed from pale grey trench-built mortared CBM hardcore surmounted by 0.27m+ deep bands of dense pale creamish grey concrete. **F.200** is 12.80m in overall diameter and an average of 0.72m wide, whilst **F.216** is 2.58m in diameter. Both foundations appear to have been deliberately set down upon the band of natural sand that underlay the numerous archaeological features (see Figure 4), and were thus excavated to a maximum depth of 1.45m+ and 1.27m+ respectively.

Figure 8: The impact of the telescope upon preceding archaeology (view facing north)

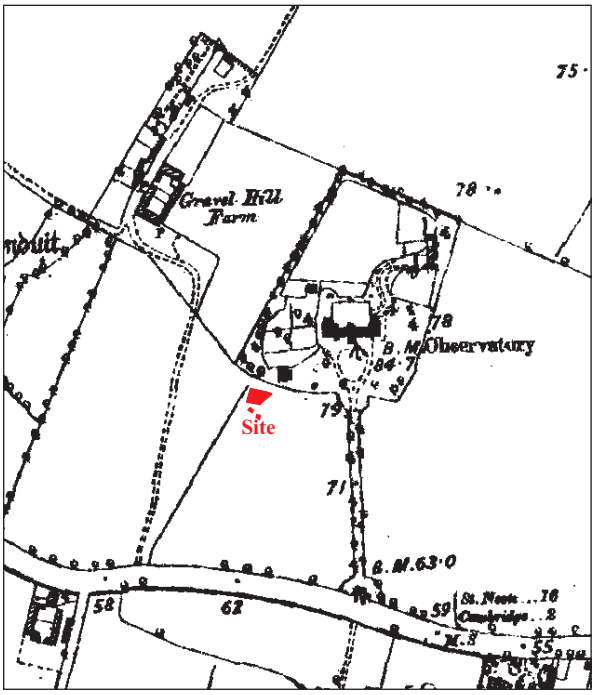
In the early 20th century two ancillary buildings were appended to the northern and eastern sides of the dome (**F.235** and **F.234** respectively) in order to house additional scientific instruments (Milne 1944, 726). However, in 1955, having been superseded by newer telescopes employing more advanced optical and radiographic technologies, the Newall telescope was dismantled and shipped overseas (see below). A number of features relating to this period have survived within the archaeological record, including the telescope's central extraction pit (**F.15**), the stop-holes for scaffolding employed in its dismantling (**F.201** and **F.202**) and the made-ground established above the remnants of its dome (**[2024]**).

> **F.234** and **F.235** both consist of dense mid to pale grey concrete foundations up to 0.38m+ deep; they measure 2.34m+ by 0.48m and 3.32m+ by 0.95m in extent respectively and were clearly very heavily truncated during the demolition of the dome in 1955. Several elements of this latter process have also survived, the most notable being central 'extraction pit' **F.15**. This measures 2.92m in diameter by 0.11m+ deep, and was backfilled with a deposit of relatively loose dark greyish brown sandy clay silt with very few inclusions. Two sub-square features – **F.201** and **F.202**, which measure 0.58m by 0.54m and 0.62m by 0.50m in extent respectively and are 0.32m and 0.18m deep – also appear most likely to have been associated with the telescope's dismantlement. Both were backfilled with near identical deposits of firmly compacted dark brownish grey with rare pale yellow sandy gravels. Once the dome had been fully dismantled, **[2024]**, a layer of dark greyish brown sandy clay silt with occasional to rare gravel inclusions 0.28m deep, was established above its remains.

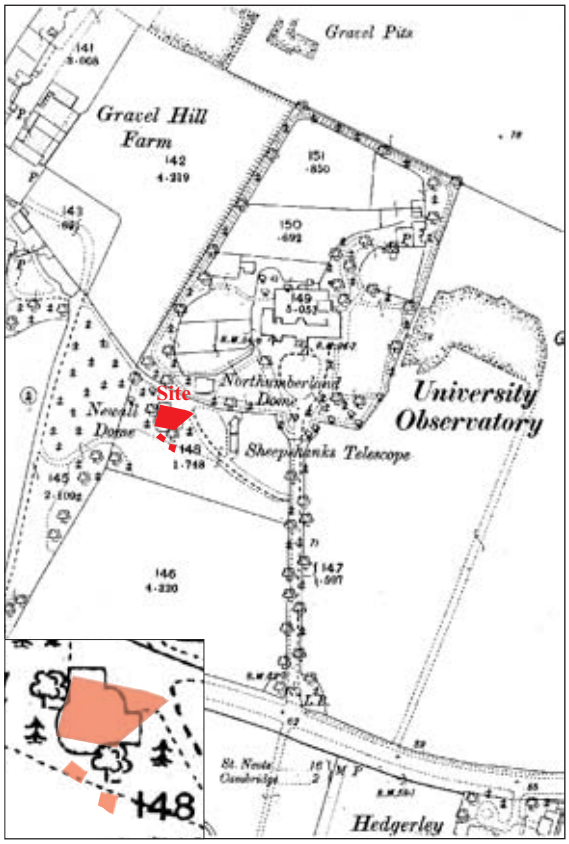
Discussion

Although quarrying activity on the site itself had been concluded by the early 18th century, further to the north and west clear evidence survives of the intensive 19th century coprolite industry in this area (*cf.* Grove 1976; O'Conner 1998); the residues of several of these vast extraction pits were encountered during an evaluation of the land surrounding Gravel Hill Farm in 2002 (Mackay *et al* 2002). The University Observatory, now known as the Institute of Astronomy, had been established immediately to the north of the area of excavation in 1822 (RCHM(E) 1959, 22). The main Observatory building, which was constructed in the Doric style by John Clement Mead and completed in 1823 (*ibid.*, 23), was set within carefully landscaped grounds, thus precluding the intrusion of large-scale coprolite workings onto this part of the ridge. Indeed, the long straight avenue leading down from the structure to Madingley Road, which is clearly shown in Baker's map of 1830 (see Figure 9), was initially utilised to establish a standard alignment for the various observational instruments (*ibid.*). In 1838 the Northumberland Dome was added to the site, immediately to the north of the present area of excavation (see the 1st edition Ordnance survey map, Figure 9). This housed one of the most powerful telescopes of the day, and its location was seen as "very good … the only objections to the site are that the ground is a little lower than that of the observatory, and that the dome is so near to the boundary of the Observatory-grounds that it is exposed to danger from mischievous persons on the outside" (Airy 1844, 2). In 1891 the boundary of the Observatory's grounds was moved somewhat further to the south when the Newall telescope was established (see the map of 1911, Figure 9). It reached its present extent in 1913 (see the map of 1966, Figure 9).

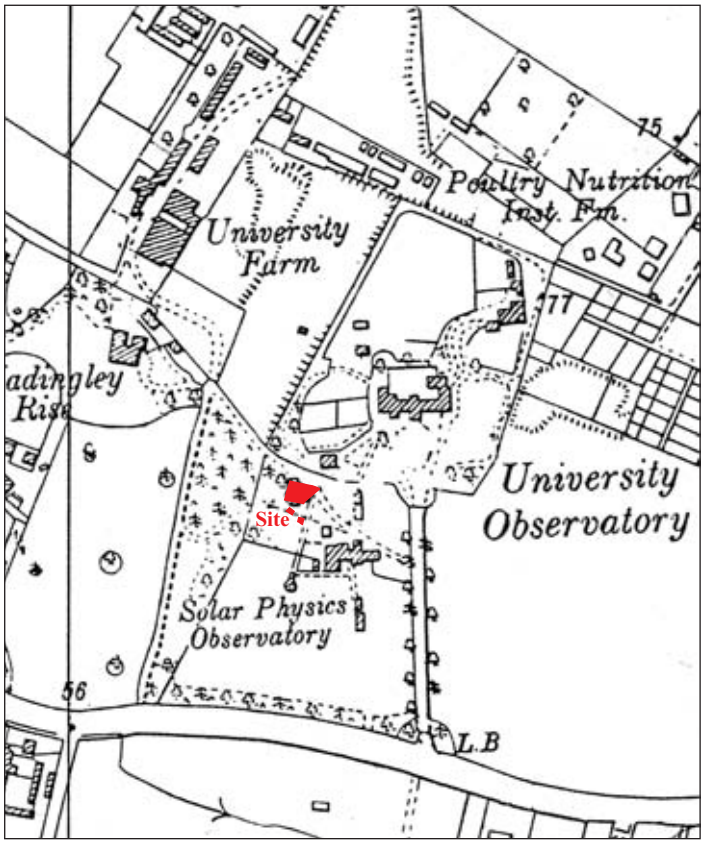
Baker 1830



1st ed OS map (1884)



3rd edition OS (1911)



6th edition OS (1966)

Figure 9: Historic map sequence.

The Newall 25 inch refractor telescope was originally commissioned in 1862 by Robert Stirling Newall (1812-1889), a pioneering scientist and inventor who had amassed a fortune through his work in the field of under-sea cables. Among many notable projects, he was responsible for the first successful transatlantic cable which was laid by the *SS Great Eastern* in 1865 (Milne 1944, 717-18). The instrument was constructed by Thomas Cooke of York (*cf.* Argyle 2007), with an equatorial pedestal mount by W. G. Armstrong & Co. of Elswick-on-Tyne, and was first erected at Newall's home *Ferndene* in Gateshead in 1871 (Dewhirst 1970, 493). At the time of its completion this telescope was the largest and most powerful instrument of its kind in the world (Anon 1870), although it was superseded only two years later by a 26 inch refractor built by Alvan Clark for the U.S. Naval Observatory in Washington DC (Watson 2004, 241), and it "attracted visits from the great and learned of the day, astronomers and others, including the Emperor of Brazil" (Milne 1944, 718). In 1889 R. S. Newall offered to donate the telescope "together with its dome and accessories" to the University Observatory; this offer was accepted on condition that his son, H. F. Newall, acted as observer without stipend for a period of five years (*ibid.*, 721). Accordingly, the instrument was re-erected on the present site in 1891, and H. F. Newall continued to act as its principal observer until his death in 1944 (Dewhirst 1970, 494).

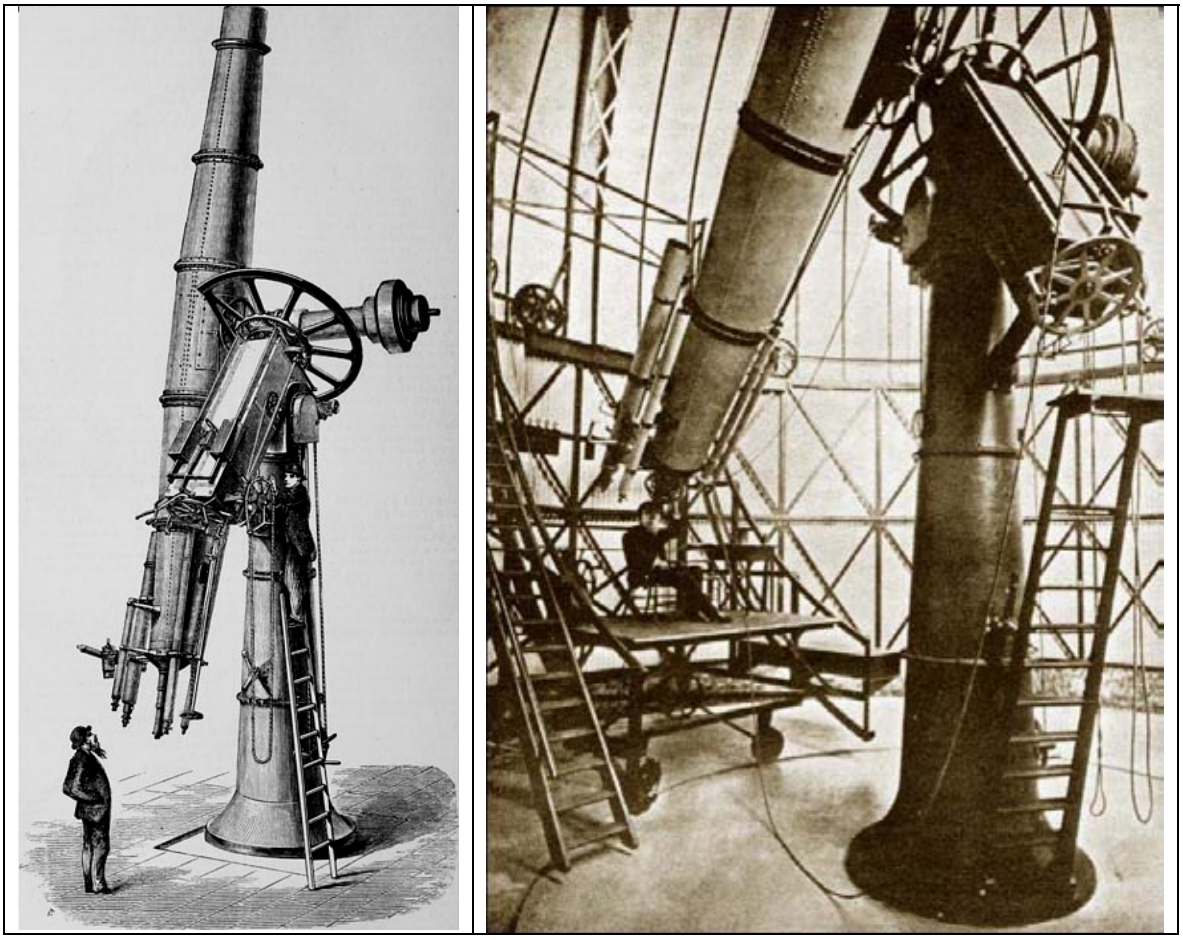


Figure 10: the Newall telescope as it was first constructed (left), and as it appeared when it was in use on the Observatory site (right).

Many important discoveries were made using the Newall telescope (*cf.* Milne 1944; Matsopoulos *et al* 1995), and H. F. Newall was eventually raised to the position of Professor of Astrophysics. However, advances in optical technology, allied with the development of new radiographic techniques for probing deep space, had rendered the instrument largely redundant by the mid 20th century. Thus, in 1955, it was removed from the Observatory site and donated to the National Observatory of Athens (Dewhirst 1970, 495). Once again the telescope was dismantled and transported to a new location, although on this occasion a new dome was purpose-built to receive it (Matsopoulos *et al* 1995, 10). It was finally reinstalled in 1958 at the Astronomical Station on Mount Penteli, where "it is now used by amateur astronomers, for student training, and for public observing nights" (Argyle 2007, 400).

Conclusion

Although limited in scale, this excavation has produced results in three important areas. In the first instance, the information recovered has gone some way towards establishing the chronology and potential distribution of the intensive Medieval and Post-Medieval quarry pits that have decimated so much of the Observatory Gravel ridge. This will allow future work in the area to avoid the areas of greatest disturbance and truncation. In the second instance, clear evidence has been gained of extensive Late Iron Age and Early Roman activity in the near vicinity. Although the precise nature of this activity remains unclear – the dearth of animal bone and flint at the site perhaps indicating a non settlement-related focus such as has been identified during the same period at Vicar's Farm to the south (Lucas & Whittaker 2001, 28) – this information does add to our knowledge of the landscape of the area at this time. Indeed, a provisional model may now be proposed in which the focus of activity appears to have shifted from the free-draining gravel ridge in the Late Iron Age to the much clayier soil of the plain below by the close of the 1st century AD. The stimulus for such a movement, however – the reorganisation of the surrounding landscape, for example, or the adoption of new agricultural techniques – clearly requires further investigation.

In addition, a second major change in the use of the landscape has been identified at the site in the 19th century. The establishment of the University Observatory in 1822 led to the reorganisation of the area to conform to a new astronomical agenda, with the layout now being determined by strict scientific principles. In this context, it is notable that the archaeology of an 'imperial philosophical machine' such as the Newall 25 inch refractor telescope has not previously been explored. Whilst the instrument itself remains extant and available for study, and numerous photographs and written accounts survive to record both its housing and mechanical operation, the nature of its foundation and initial construction remain poorly understood. This clearly has potential implications for the reliability of the results obtained from its use, but also serves as an illustration of the extent to which the new scientific agenda impacted in physical terms upon the preceding landscape of the Observatory's surroundings. In a sense, therefore, the telescope can be seen as part of the growing 'Industrial Archaeology' of Cambridge, a city whose primary industry has long been centred upon the University itself.

Acknowledgments

The project was commissioned by the University of Cambridge Estates Management and Buildings Service (EMBS), on behalf of the Institute of Astronomy and the Kavli Foundation, and we are grateful for the co-operation of Brian Lees of EMBS throughout. The fieldwork was monitored by Kasia Gdaniec, Development Control Archaeologist at Cambridgeshire Archaeology Planning and Countryside Advice (CAPCA), and the project was managed for the CAU by Christopher Evans. The excavations were directed by Richard Newman and were undertaken in the field with the assistance of Katie Anderson, Craig Cessford, Ilanith Pongolini, Virginia Vargo and Andy Whelan. Rachel Causier managed the finds processing and specialists who examined material from the site included Katie Anderson (Roman pottery), Emma Beadsmoore (flint), Matt Brudenell (Iron Age pottery) and Craig Cessford (clay tobacco pipe). The graphics were produced by Bryan Crossan and Andy Hall and the photographs were taken by David Webb. Special thanks are also due to Professor Sir Martin Rees for his permission to reproduce Harraden's 1840 painting of the site.

Appendix: Finds and Environmental Reports

361 items, weighing 5.17kg, were recovered from the excavation at the Kavli Institute for Cosmology site. However, many of these items represent residual material that was redeposited within Post-Medieval quarry pits. The relative dearth of Post-Medieval refuse in these same features reinforces both their non-domestic nature and their distance from any contemporary settlement.

Provisional assessments of the most significant classes of material are presented below; in certain cases, however, insufficient quantities were recovered for a full assessment to be worthwhile. The quantity of animal bone recovered, for example, (94 fragments, weighing 1.37kg) is insufficient for any useful interpretation to be derived. The small quantities of CBM (50 fragments, weighing 773g) and shell (8 fragments, weighing 15g) are similarly difficult to interpret. Finally, the glass assemblage is also sparse. Only two fragments were recovered; **<022>** F.105 is a fragment of a green Post-medieval bottle (weighing 7g), whilst **<003> [1000]** represents a small undiagnostic fragment from a 19th century clear glass bottle (weighing 4g).

Pottery

The total amount of pottery recovered during the excavation comprised 169 sherds weighing 2.60kg. Although the majority of these sherds are of Late Iron Age or Early Roman origin, such fragments were present only as residual material within Post-Medieval quarry pits. Nevertheless, as they comprise 79% of the total assemblage, they form a significant group that merits further analysis.

Iron Age and Roman Pottery (by Katie Anderson with Matt Brudenell)

The assemblage yielded a total of 133 Iron Age and Roman sherds of pottery, weighing 1.94kg and representing 1.35 Estimated Vessel Equivalents (EVEs). All of the pottery was examined and details of fabrics and forms were recorded, along with details of decoration, usage, EVE and date.

Assemblage composition

The condition of the assemblage makes accurate dating problematic, since the majority of sherds were small and abraded (a result of the residual nature of their final deposition). This also means that there is no stratigraphic relationship available to further clarify the dating process. Therefore, with a few exceptions (namely Early Iron Age sherds), the pottery has been broadly divided into three categories. The first of these is Late Iron Age (LIA), referring primarily to hand-made forms where both the fabric and form (when clear) have more in common with the Middle Iron Age tradition. A date of 50BC-50AD has been given to this group. The second category is Late Iron Age/Early Roman (LIA/ER), which includes sherds which may have an Iron Age fabric but a Romanizing form (or *vice versa*). Studies of other assemblages of this date in Cambridgeshire have suggested that this type of material can date from 30-70 AD, with Iron Age forms, fabrics and/or manufacturing techniques still in use well into the Roman period (Brudenell *pers comm*). The final category is Early Roman (ER), which refers to those vessels which have a combination of Roman or

Romanizing fabric or form and are dated to 50-80 AD. Within this assemblage there is no evidence for any Roman sherds which postdate this period. The quantity of pottery from each phase is shown in Table 1.

Date	No.	Wt(g)	EVE
EIA	7	61	0
LIA	68	1258	0.97
LIA/ER	49	510	0.28
ER	9	109	0.1
TOTAL	**133**	**1938**	**1.35**

Table 1: Iron Age and Roman pottery by date.

A variety of fabrics were present in the assemblage (see Table 2), although sandy fabrics dominated, representing 52%. This is typical of an assemblage of this period. Most LIA pottery in Cambridgeshire is dominated by sandy wares, with grog, shell, calcareous and vegetable tempered fabrics generally representing much smaller percentages (Brudenell *pers comm*). Grog-tempered fabrics did, however, feature relatively highly (28%), which supports the view that some earlier LIA pottery (50BC-1AD) was present, since grog-tempered fabrics tend to be earlier in the sequence. It seems likely that most of the pottery was made locally and no imported wares were identified in the assemblage. The small number of Early Iron Age sherds were all flint-tempered, as is again typical of this area during that time.

Fabric	No.	Wt(g)
Calcareous	5	98
Sand	69	1059
Flint	7	61
Grog	37	522
Rock and sand	10	109
Shell	4	82
Vegetable	1	7
TOTAL	**133**	**1938**

Table 2: Iron Age and Roman pottery by fabric.

The manufacturing techniques were recorded where possible, with three different categories being represented. Firstly there were a number of handmade vessels present. These broadly date to 50BC-50AD, although it is probable that vessels were made in this technique beyond 50AD. The second category comprises 'wheel-turned' vessels, which denotes pots that were primarily handmade but then finished on a slow wheel. These vessels tend to be slightly later in origin than the handmade vessels, although there is no doubt that the two were produced alongside one another in the early-mid 1st century AD. Finally, there were also a number of wheel-thrown vessels present. These are generally, although not exclusively, a sign of the 'Romanization' of pottery, and thus a date of *c.*30AD+ is given to these vessels. Chart 1 illustrates the division of manufacturing techniques, and shows that handmade and wheel-turned vessels were fairly evenly represented, with wheel-thrown vessels representing a smaller percentage of the assemblage. This supports the evidence of the fabrics and forms which suggest a predominantly Late Iron Age assemblage, with only a small quantity of Romanizing/Roman vessels.

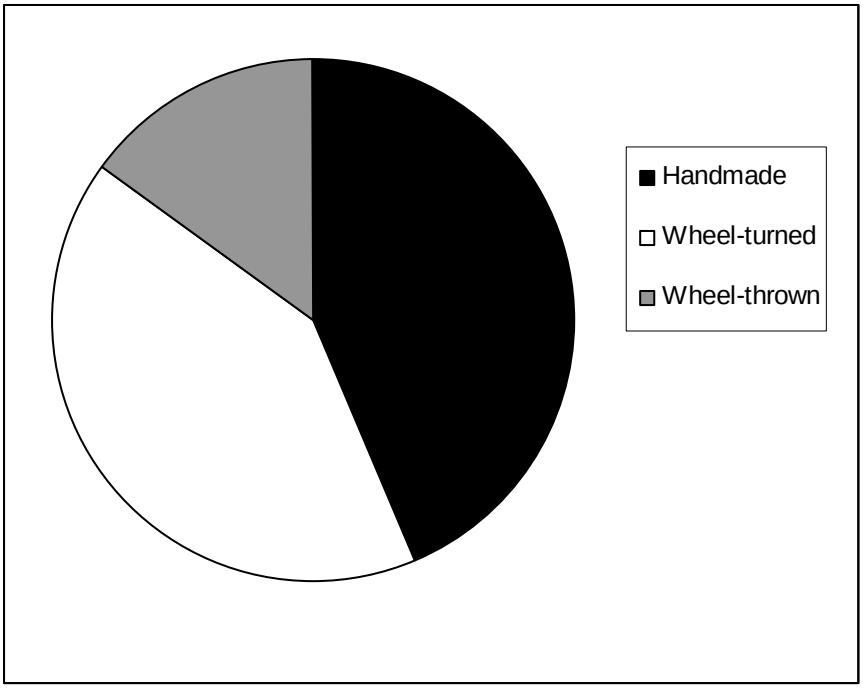


Chart 1: manufacturing technique (excluding unknown).

A minimum of 26 vessels were recorded in this assemblage, although this only included rim and base sherds. As would be expected from an assemblage of this nature, very few vessel types were identifiable, comprising just 26 jar sherds and four bowls. Of the jars identified, forms included slack shouldered jars with beaded rims and necked jars with everted or beaded rims. 20 sherds were recorded as being burnished, including a small number with burnished lines or lattice type decoration. Four sherds were recorded as being highly burnished/polished, which is a common technique used on Iron Age vessels. In terms of decoration, combing was the most prevalent, which is a common trait seen with Late Iron Age assemblages.

Soakaways

A total of 15 sherds were recovered from the two soakaways, weighing 85g. Six sherds were recovered from the cleaning of these areas, with the remaining sherds coming from excavated quarry pits. The pottery included one handmade jar rim, dating to the Late Iron Age, along with one wheel-made jar dating to the early Roman period (ER). The remaining sherds were all non-diagnostic and consisted of LIA, LIA/ER and ER sherds.

Open Area

The majority of the sherds were recovered from the open area, with no single feature containing an abundance of material (although this is of course a result of all of this pottery being residual). Pottery was collected both from dug features and from the cleaning of this area. For the purposes of this report, only a selection of features and contexts have been chosen for further discussion.

Features

F.206 contained ten sherds of pottery, weighing 159g. This included one Early Iron Age flint-tempered sherd and one sherd from a slack-shouldered bowl with horizontal combing dating to the LIA. Several other handmade forms were recovered, in addition to one wheel-made jar dating to the LIA/ER period. **F.213** contained five sherds, weighing 37g. All of these were non-diagnostic; however, their fabrics suggest two EIA sherds, two LIA sherds and one LIA/ER sherd. 12 sherds were recovered from **F.220**, weighing 216g. Eight of these were LIA in date and included one wheel-turned jar with a small cordon, one highly burnished/polished body sherd and two combed sherds. There were also two LIA/ER sherds and one ER sherd.

Cleaning/Layers

The cleaning of the open areas produced a total of 53 sherds of pottery, weighing 842g, coming from both layers and the surfaces of features. **[2000]** contained seven sherds, weighing 75g and comprising two LIA sherds, four LIA/ER sherds and one ER bowl. This was an initial cleaning of the telescope area and it is unclear whether these finds were from the topsoil or from the top of features. 12 sherds (212g), were recovered from **[2028]**, a banded layer of levelling for the telescope foundations from the 19th century. Four refitting sherds were from a handmade, neckless jar with an everted rim, which had combed and stabbed decoration. This vessel dates to the LIA. A further sherd, which is probably from the same vessel, was recovered from **[2027]**. Within this layer, two different wheel-made jars were recovered, one of which was rippled, and both of which dated to the LIA/ER period. 20 sherds (weighing 218g), which were clustered in groups, were collected from **[2046]**. Five of the sherds were LIA in date, including four sherds from a sand and grog-tempered vessel with burnished lattice decoration. 14 sherds were from a single grog-tempered greyware vessel, although none of these sherds could be refitted and no vessel form was determinable. The fabric suggests a LIA/ER date. A sherd of a similar date was also present, although this was from a jar with a large beaded rim and an angular shoulder. **[2047]**, a cluster of pottery from the cleaning inside the telescope foundation ring, contained eight sherds of pottery weighing 262g. This equates to an above average mean weight for this assemblage at 32g. Three refitting sherds from a large combed jar (172g) were identified, along with some LIA and LIA/ER sandy sherds.

Although the sherds from **[2046]** and **[2047]** are from the surface, they still strongly indicate that there were once LIA/ER features on the site that were later destroyed by the quarrying. The presence of large, refitting sherds suggests that although residual, the pottery is unlikely to have moved far from its original place of deposition.

Discussion

All of this earlier material was found within quarry pits and usually alongside much later pottery, with no possibility of any of the features being Iron Age or Roman. However, the quantities of material recovered are somewhat higher than would usually be expected in such a context and include some relatively large, unabraded sherds. The overall impression is therefore that much of the material is unlikely to have moved far from its original place of deposition, and it seems likely that many of the quarry pits cut directly into earlier, predominately Iron Age features. The small quantity of Early Iron Age pottery was generally much smaller and more fragmented

than the later material, thus any discussion of possible Early Iron Age activity is speculative. There is no apparent cluster of material across the site, supporting this view. However, a small number of Early Iron Age sherds were recovered from the adjacent Hoyle Building site (Masser 2000), suggesting that activity in the vicinity during this period is a possibility.

It is interesting to note that no later Roman pottery was recovered from the site, which suggests that any site/settlement here during the LIA/ER period did not continue beyond the mid 1st century AD. The presence of Early Roman pottery dating to the mid-late 1st century AD in the Soakaway test-hole immediately to the south of the main area of excavation suggests a possible 'migration' of activity further down the slope in the mid 1st century AD. Beyond this is the site at Vicar's Farm, which was a large Roman settlement which peaked in the late Roman period (3rd-4th century AD), although there was evidence that the site had been occupied in the early Roman period (*cf.* Lucas & Whittaker 2001). Overall, it is unfortunate that such little interpretation can be put on an assemblage of this type, as without additional stratigraphic evidence understanding the nature of the site which utilized this pottery is unfeasible. However, the pottery recovered does suggest the likelihood of a potentially quite large Late Iron Age/early Roman site, of unknown function, which appears to have gone out of use by the mid 1st century AD.

Post-Medieval

A small amount of Post-Medieval pottery (43 sherds, weighing 486g) was recovered from the site. This low quantity is especially notable because these sherds were all derived from the same exclusively Post-Medieval features that produced much larger quantities of residual Iron Age and Roman pottery. Material of this date was evenly distributed across the site, with no feature containing more than three fragments (usually less than half the number of residual sherds present).

Fabric	No.	Wt(g)
Glazed Red Earthenware	21	399
Tin Glazed Earthenware	5	28
Lead Glazed Earthenware	1	13
Broad Street Bichrome	1	7
Westerwald Stoneware	1	7
Frechen Stoneware	1	32
TOTAL	**43**	**486**

Table 3: Post-Medieval pottery by fabric.

As Table 3 clearly shows, the assemblage was dominated by Glazed Red Earthenware (21 sherds weighing 399g). This is a basic utilitarian fabric that was first produced in the 16th century and continued in use into the 19th century; sherds of dishes, bowls and jars were identified. Five sherds of Tin Glazed Earthenware (weighing 28g) were also recovered. The earliest material in this fabric was imported from the Low Countries in the 15th century, although all of the sherds identified at the present site appear to be of English manufacture. Production of Tin Glazed Earthenware began in England in the 16th century and continued into the 18th century. In addition, one sherd of Broad Street Bichrome (weighing 7g) that was manufactured in Ely in the 16th century, was present, along with a single sherd of black Lead Glazed Earthenware (weighing 13g)

that may have come from a similar source. Two imported fabrics were also identified: **<034> [2000]** comprises two conjoining sherds (weighing 32g) of a Frechen Stoneware Bellarmine jug from Germany, whilst **<047> [2020]** comprises a sherd (weighing 7g) of Westerwald Stoneware, also from Germany.

Based upon typologies of Post-Medieval pottery in the Cambridgeshire region (*cf.* Edwards & Hall 1997; Hall 2001), the form and fabric of the Glazed Red Earthenware and Tin Glazed Earthenware sherds indicate a consistently 17th century date for this assemblage. Whilst the individual sherds of Frechen Stoneware and Broad Street Bichrome may perhaps be 16th century in origin, and the production of Lead Glazed Earthenware and Westerwald Stoneware continued into the 18th century, the group as a whole is most likely to have been deposited in a discrete period during the 17th century.

Modern

A very small quantity of Modern pottery (six sherds, weighing 173g) was recovered from the site. This material was derived from features associated with the establishment of the Newall 25 inch refractor telescope.

Fabric	No.	Wt(g)
Refined White Earthenware	4	137
Unglazed Red Coarseware	2	36
TOTAL	**6**	**173**

Table 4: Modern pottery by fabric.

Six sherds of late 19th century Refined White Earthenware were found to be present. This included a large sherd (**<035>,** weighing 130g) from a probable chamber pot that was incorporated into concrete foundation **F.200**, and two sherds (weighing 5g) with transfer print decoration that were recovered from made-ground **<065> [2028]**. Two sherds of 19th century Unglazed Red Earthenware plant pots were also identified. Although very small, this group of material is entirely consistent with the date of the telescope's establishment in 1891.

Clay tobacco pipe (with Craig Cessford)

12 stem fragments, weighing 48g, were recovered from eight separate quarry features (**F.100**, **F.104**, **F.108**, **F.202**, **F.207**, **F.208**, **F.225** and **F.226**), although no more than two fragments were present in any one feature. The presence of clay tobacco pipe fragments in a context indicates a date between the late 16th and early 20th centuries (*c.*1580-1910). It is normally only possible to derive a precise date from bowls, marked pieces and some heel or spur fragments (*cf.* Oswald 1975). Stem bore apature is a less relibale indicator of date as it altered at a much slower rate than the changing fashions of bowl form. However, the consistantly very wide stem bore apature present in all of these pieces does indicate that they are likely to be primarily early (*i.e.* 17th century) in date.

Metalwork

The metalwork recovered during the excavation, which includes 12 fragments, weighing 187g, consists of both iron and copper alloy objects. Although derived from separate contexts, these artefacts were all found to be in a poor state of preservation. They comprise:

> **<102> [1012] F.104** contained a Cu round-headed pin of Post-Medieval date (weighing 1g). This measured 23mm in length and 1mm in width.
>
> **<103> [2024]** contained an unidentifiable Fe fragment (weighing 2g). This measured 34mm in length and 9mm in width.
>
> **<104> [2026]** contained an Fe square-headed screw thread bolt (weighing 106g). This measured 71mm in length and 14mm in width.
>
> **<105> [2048] F.218** contained a square sectioned Fe nail fragment (weighing 2g). This measured 47mm+ in length and 5mm in width. In addition, there were also three unidentifiable Fe objects (weighing 5g).
>
> **<106> [2051] F.205** contained a Pb 'strip' that is possibly a fragment of window came (weighing 46g). This measured 53mm in length, 17mm in width and 1.5mm in depth.
>
> **<107> [2061] F.221** contained a square sectioned nail fragment (weighing 7g). This measured 59mm in length and 5mm in width.
>
> **<108> [2074] F.224** contained two square sectioned nail fragments (weighing 17g). These measured 42mm+ and 21mm+ in length respectively (their widths were heavily obscured by corrosion).
>
> **<109> [2084] F.230** contained a badly degraded Cu coin fragment (weighing 1g). The dimensions of this coin, which was 13mm in diameter and 1mm thick, indicate that is most probably Late Roman in origin. However, it is too badly degraded for any detail to be discernable.

None of these objects require further study.

Flint (with Emma Beadsmoore)

A single flint flake (weighing 2g) was recovered from **<002> [1000]** in Soakaway B; this is a chronologically non-diagnostic waste flake of generic late Prehistoric origin. The general absence of flint at this site, in comparison to the large quantities of Iron Age pottery recovered, appears to reinforce the transitional Late Iron Age/Early Roman date of the activities that were undertaken here.

Bibliography

Airy, G. B. 1844. *Account of the Northumberland equatoreal and dome, attached to the Cambridge Observatory.* Cambridge: Cambridge University Press.

Alexander, J. & Pullinger, J. 2000. 'Roman Cambridge: excavations 1954-1980', *Proc. Cambridge Antiq. Soc.* 87, 1-268.

Alexander, M., Dodwell, N. & Evans, C. 2004. 'A Roman cemetery in Jesus Lane, Cambridge', *Proc. Cambridge Antiq. Soc.* 93, 67-94.

Anon. 1870. 'The Newall telescope', *Nature* 1, 408-10.

Argyle, R. W. 2007. 'Thomas Cooke (1807-1868): a great English telescope maker', *The Observatory 127*, 392-400.

Babington, C. C. 1864. 'On Roman interments by the side of the so-called Via Devana, near Cambridge', *Communications of the Cambridge Antiquarian Society* 2, 289-294.

Babington, C. C. 1883. *Ancient Cambridgeshire*. London: Deighton Bell & Co.

Baggs, T. & Bryan, P. 2002. *Cambridge 1574-1904: a portfolio of twelve maps illustrating the changing plan of Cambridge from the sixteenth to the twentieth century.* Cambridge: Cambridgeshire Records Society.

British Geological Survey. 1976. *Cambridge*: *Sheet 188*. Southampton: Ordnance Survey.

Bryan, P. 1999. *Cambridge: the shaping of the city*. Cambridge: privately published.

Cessford, C. 2005. *Hostel Yard, Corpus Christi College, Cambridge: an archaeological excavation.* Cambridge Archaeological Unit Report No. 673.

Cessford, C. & Mortimer, R. 2004. *Land adjacent to 63 Church End, Church End, Cherry Hinton: an archaeological excavation.* Cambridge Archaeological Unit Report No. 607.

Collins, M. in prep. *The route of the Cambridge Guided Bus: a series of archaeological excavations.* Cambridge Archaeological Unit Report.

Dewhirst, D. W. 1970. 'The Newall telescope', *Journal of the British Astronomical Association* 80, 493-95.

Dickens, A. 1996. *Archaeological excavations at St. John's College, Cambridge*. Cambridge Archaeological Unit Report No. 175.

Dickens, A. 1999. *Gravel Hill Farm, Cambridge: an archaeological desktop assessment*. Cambridge Archaeological Unit Report No. 319.

Edwards, D. & Hall, D. 1997. 'Medieval pottery from Cambridge', *Proc. Cambridge Antiq. Soc. 86*, 153-68.

Evans, C. 1996. *New Hall College: Prehistoric landuse and Roman hinterland*. Cambridge Archaeological Unit Report No. 190.

Evans, C. 2008. *The Kavli Institute for Cosmology: project specification for archaeological investigation.* Unpublished CAU document.

Evans, C. & Hodder, I. 2006. *Marshland Communities and Cultural Landscape: The Haddenham Project Volume II*. Cambridge: McDonald Institute for Archaeological Research.

Grove, R. 1976. *The Cambridgeshire coprolite mining rush.* Cambridge: Oleander Press.

Hall, C. P. & Ravensdale, J. R. 1976. *The West Fields of Cambridge*. Cambridge: Cambridge Antiquarian Records Society Volume III.

Hall, D. 2001. 'The pottery from Forehill, Ely, Cambridgeshire'. *Medieval Ceramics* 25, 2-21.

Harraden, R. 1811. *Cantabrigia Depicta: a series of engravings representing the most picturesque and interesting edifices in the University of Cambridge.* Cambridge: Harraden & Son.

Liller, W. 1966. 'The Roman road out of Cambridge leading to St. Neots', *Proc. Cambridge Antiq. Soc.* 59, 136.

Liversidge, J., 1977. 'Roman burials in the Cambridge area', *Proc. Cambridge Antiq. Soc.* 67, 11-38.

Lucas, G. & Whittaker, P. 2001. *Vicar's Farm, Cambridge: post-excavation assessment report*. Cambridge Archaeological Unit Report No. 425.

Mackay, D., Mortimer, R. & Evans, C. 2002. *Gravel Hill Farm, northwest Cambridge: an archaeological evaluation.* Cambridge Archaeological Unit Report No. 513.

Maitland, F. W. 1898. *Township and borough*. Cambridge: Cambridge University Press.

Marr, J. E. & Burkitt, M. C. 1923. 'A Neolithic site northwest of Cambridge', *Proc. Cambridge Antiq. Soc.* 25, 11-15.

Masser, P. 2000. *Archaeological investigations at the Hoyle Building site, Madingley Rise, Cambridge*. Cambridge Archaeological Unit Report No. 391.

Matsopoulos, N., Yiotis, C. & Markea, M. 1995. 'The travels of an impressive refractor: the 25" Newall', *Journal of the Antique Telescope Society* 8, 8-11.

Milne, E. A. 1944. 'Hugh Frank Newall: 1857-1944', *Obituary notices of Fellows of the Royal Society* 4 (13), 717-32.

Mortimer, R. & Evans, C. 1997. *The Marion Close enclosure: archaeological excavations at 138 Huntingdon Road, Cambridge*. Cambridge Archaeological Report No. 203.

Newman, R. in prep. *St. John's Triangle, Cambridge: an archaeological excavation.* Cambridge Archaeological Unit Report.

O'Connor, B. 1998. *The dinosaurs on Coldham's Common: the story of Cambridge's coprolite industry.* Sandy: self-published.

Oswald, A. 1975. *Clay Pipes for the Archaeologist.* British Archeological Reports British Series 14. Oxford: BAR.

Pritchard, C. 1868. 'Obituary of Thomas Cooke (1807-1868)', *Monthly Notices of the Royal Astronomical Society* 29, 130.

RCHM(E) 1959. *An inventory of the historical monuments in the city of Cambridge*. London: Her Majesty's Stationery Office.

Redfern, N. 2001. *Northwest Cambridge: an archaeological desk based assessment.* Cambridge Archaeological Unit Report No. 455.

Seebohm, F. 1883. *The English village community*. London: Longmans, Green & Company.

Spence, C. 1994. *Archaeological Site Manual* (3rd edition). London: MoLAS.

Taylor, A. 1999. *Cambridge: the hidden history*. Stroud: Tempus.

Watson, F. 2004. *Stargazer: the life and times of the telescope*. London: Allen & Unwin.

Whittaker, P. 2000. *An archaeological evaluation at 44 Storey's Way, Churchill College, Cambridge*. Cambridge Archaeological Unit Report No. 402.

Willis, R. & Clark, J. W. 1886. *The architectural history of the University of Cambridge and of the Colleges of Cambridge and Eton.* Cambridge: Cambridge University Press.

Wills, J. 2004. *Trinity Hall Playing Fields, Cambridge: an archaeological excavation*. Cambridge Archaeological Unit Report No. 637.

OASIS DATA COLLECTION FORM: England

OASIS ID: cambridg3-39605

Project details

Project name	The Kavli Institute for Cosmology, Cambridge: An Archaeological Excavation
Short description of the project	An archaeological excavation consisting of an open area and two additional soakaways, which covered a combined area of c.230m2, was undertaken in advance of construction of the new Kavli Institute for Cosmology in the grounds of the University Observatory on the west side of Cambridge. Three distinct phases of activity were identified at this site. The first of these was represented by residual sherds of Late Iron Age and Early Roman pottery, which were discovered within a series of intensive Post-Medieval gravel quarries. Although extraction activity most probably began on the site in the Medieval period, it reached its apogee during the 17th century when at least 45 additional quarry pits were created; it was at this time that all in-situ traces of earlier activity appear to have been obliterated. Subsequently, during the 18th and 19th centuries, the area was used as rough pasture. In 1891, following the expansion of the University Observatory that had been established a little way to the north in 1822, a large telescope was erected on the site. This instrument, the Newall 25 inch refractor telescope, was to remain in use until 1955. It was subsequently donated to the National Observatory of Athens, at which time its former dome was demolished and a made-ground deposit was introduced above its remains.
Project dates	Start: 25-02-2008 End: 06-03-2008
Previous/future work	No / Not known
Type of project	Recording project
Site status	None
Current Land use	Vacant Land 1 - Vacant land previously developed

Monument type	PIT Medieval
Monument type	PIT Post Medieval
Monument type	GULLY Post Medieval
Monument type	LAYERS Post Medieval
Monument type	FOUNDATIONS Modern
Significant Finds	POT Late Iron Age
Significant Finds	POT Roman
Significant Finds	POT Post Medieval
Significant Finds	CLAY PIPE Post Medieval
Investigation type	'Full excavation'
Prompt	Direction from Local Planning Authority - PPG16

Project location

Country	England
Site location	CAMBRIDGESHIRE CAMBRIDGE CAMBRIDGE Kavli Institute for Cosmology
Postcode	CB3 0HA
Study area	260.00 Square metres
Site coordinates	TL 432 594 52.2137568032 0.09624372550790 52 12 49 N 000 05 46 E Point
Height OD	Min: 22.01m Max: 23.20m

Project creators

Name of Organisation	Cambridge Archaeological Unit

Project brief originator	Local Authority Archaeologist and/or Planning Authority/advisory body
Project design originator	Christopher Evans
Project director/manager	Christopher Evans
Project supervisor	Richard Newman
Type of sponsor/funding body	Landowner
Name of sponsor/funding body	University of Cambridge

Project archives

Physical Archive recipient	Cambridge Archaeological Unit
Physical Archive ID	KIC08
Physical Contents	'Ceramics','Metal','Worked stone/lithics','other'
Digital Archive recipient	Cambridge Archaeological Unit
Digital Archive ID	KIC08
Digital Contents	'Ceramics','Metal','Worked stone/lithics','other'
Digital Media available	'Images raster / digital photography','Images vector','Spreadsheets','Text'
Paper Archive recipient	Cambridge Archaeological Unit
Paper Archive ID	KIC08

Paper Contents	'Ceramics','Metal','Stratigraphic','Worked stone/lithics'
Paper Media available	'Context sheet','Drawing','Map','Miscellaneous Material','Photograph','Plan','Report','Section','Unpublished Text'
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	The Kavli Institute for Cosmology, Cambridge: An Archaeological Excavation
Author(s)/Editor(s)	Newman, R.
Other bibliographic details	Cambridge Archaeological Unit Report No. 820
Date	2008
Issuer or publisher	Cambridge Archaeological Unit
Place of issue or publication	Cambridge
Description	A4 wire bound with plastic laminate front. 33 pages of text incoporating 10 colour figures.
Entered by	Jo Wilson (jepw3@cam.ac.uk)
Entered on	25 March 2008

OASIS:

Please e-mail English Heritage for OASIS help and advice