Investigation of an Iron Age pit and Roman cave at Spratling Court Farm, Manston, Kent

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Summary

The outlines of two archaeological features (a cave and pit) were exposed by chalk quarrying at Spratling Court Farm, Manston in 1996. Both are deeply buried and have well-stratified natural infills extending to a thickness of 3-4 m, including three layers of residual brickearth. Faunal and molluscan evidence within the infills points to a Late Holocene chalk grassland habitat within shallowing surface depressions, with the possible addition of butchery waste. Radiocarbon dating of four vertebrate samples confirms that the cave dates to 179 cal. AD, while the pit alongside, at 124 cal. BC, predates it by about 300 years. The pit (one of two identified at Spratling Court Farm) appears to have been a sizeable chalk quarry, excavated in the Mid to Late Iron Age, while the later boot-shaped cave is tentatively interpreted as a ritual chamber of Early Roman origin, located in remnant woodland on the Thanet ridge. A few pottery sherds in the pit infill date to the Iron Age, but there are no contemporary artefacts within the cave infill. A total of 150 struck flints has been recovered from and near the residual brickearth units, clearly predating the features that contain them. These have been identified as a mixed residual assemblage dating from between the Later Mesolithic and the Late Bronze Age. Optically-stimulated luminescence (OSL) dating has revealed the age of the former periglacial coversand source from which the residual brickearths must have originated. A unique OSL signal of Later Mesolithic date has also been detected, which may be linked to either human soil disturbance or climatic deterioration around 8200 years ago (6200 BC).

Introduction

Chalk extraction at Spratling Court Farm, Manston (TR351656) was undertaken in 1992 to provide landfill for road improvements at the Lord of the Manor intersection. An early evaluation of this site (Perkins, 1991) found little of archaeological significance, but in the final stages of chalk removal in 1996 the outline of an unusual small cave was noticed in the southwest corner of the quarry. The cave, and a shallow pit alongside it, was buried by 3.5 to 4 m of stratified colluvium and preserved well below the plough layer (Figures 3 and 15).

The modern chalk quarry is cut into the Thanet ridge at a height of 46 m A.O.D. at the head of a dry valley depression that extends southwards into Hollin's Bottom and Pegwell Bay at a distance of 1.3 km. It is located on Manston Road, east of the Kent International Airport runway and about 0.5 km west of Ozengell Grange (Figure 1). Archaeologically, this area is surrounded by a rich and dense scatter of sites and monuments (Moody, 2008). A particularly high density exists west of Ramsgate, much of which has come to light in the last fifty years as a result of recent commercial, transport and residential developments (Figure 2).

Methodology

Between 2003 and 2006 the quarry section was cleaned, metre-gridded, mapped, logged and photographed (Figure 3). The cave shaft and pit west wall were examined in greater detail, involving sectioning 10-20 cm baulks one to two metres into the quarry face through the whole depth of infill. About 15 m³ of brickearth were excavated and examined at the pit west wall. Soil samples were collected from four locations for OSL dating in August 2003 and analysed by Dr Mark Bateman (at the Sheffield Centre for International Drylands Research Luminescence Laboratory). Fossiliferous sediments at various horizons were identified, sampled and sieved at 100 µm; faunal and molluscan identifications were provided by Dr Danielle Schreve (Royal Holloway College), Prof Andrew Chamberlain (Sheffield University), Dr Richard Preece (Cambridge University) and the late Prof David Keen (Birmingham University). Samples of larger vertebrate remains were submitted for radiocarbon dating to Beta Analytic Inc. and Waikato Radiocarbon Laboratory, using OxCal v4 calibration (Ramsey, 2007). Small flint assemblages were located and collected; these were examined and identified by Paul Hart (Trust for Thanet Archaeology), Rebecca Scott (Durham University) and Prof Paul Pettitt (Sheffield University). Rod LeGear (Kent Underground Research Group) visited the site in April 2005. Two metal detector scans (ferrous and non-ferrous) were conducted across the whole site in July 2006 with no recorded signal in either.

The archive has been deposited at the Trust for Thanet Archaeology, The Antoinette Centre, Quex Park, Birchington, Kent CT7 0BH.

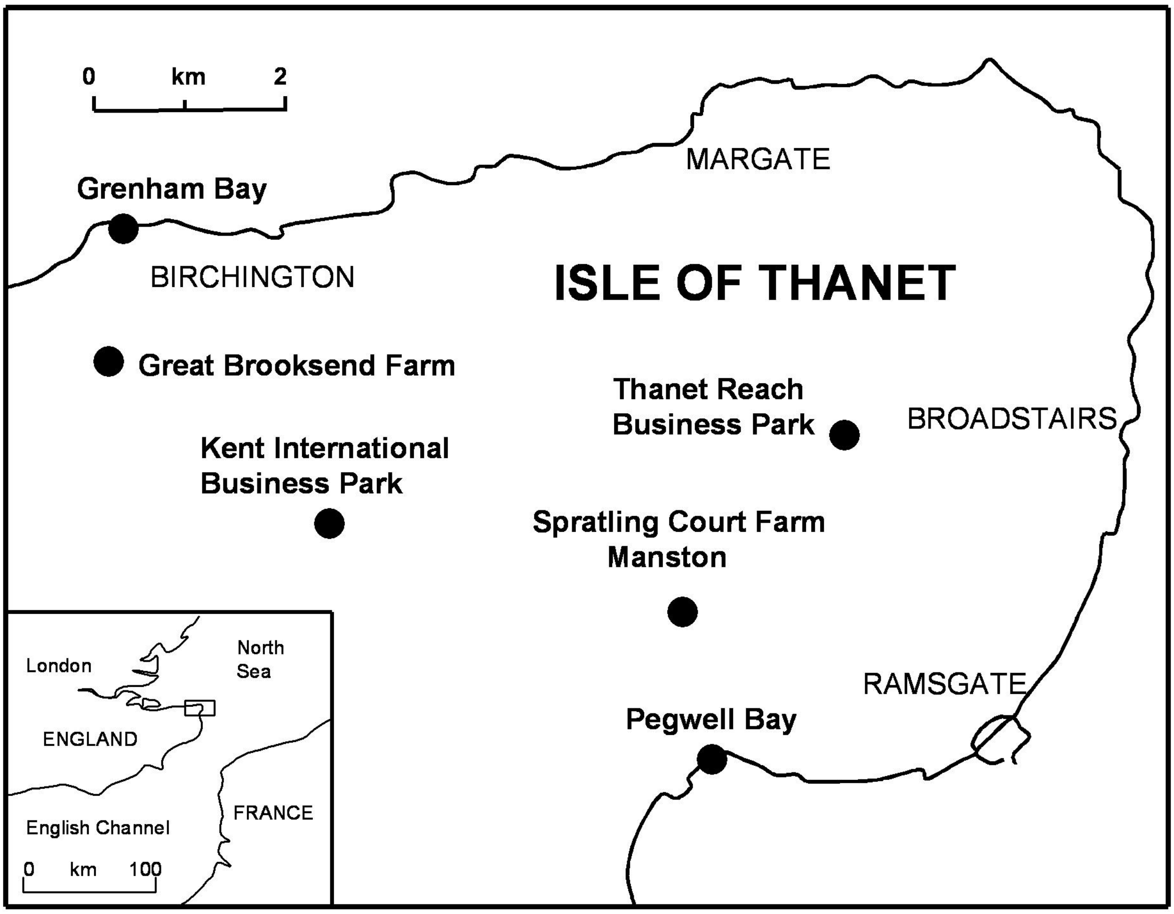

Figure 1: Location of the study area within the Thanet area

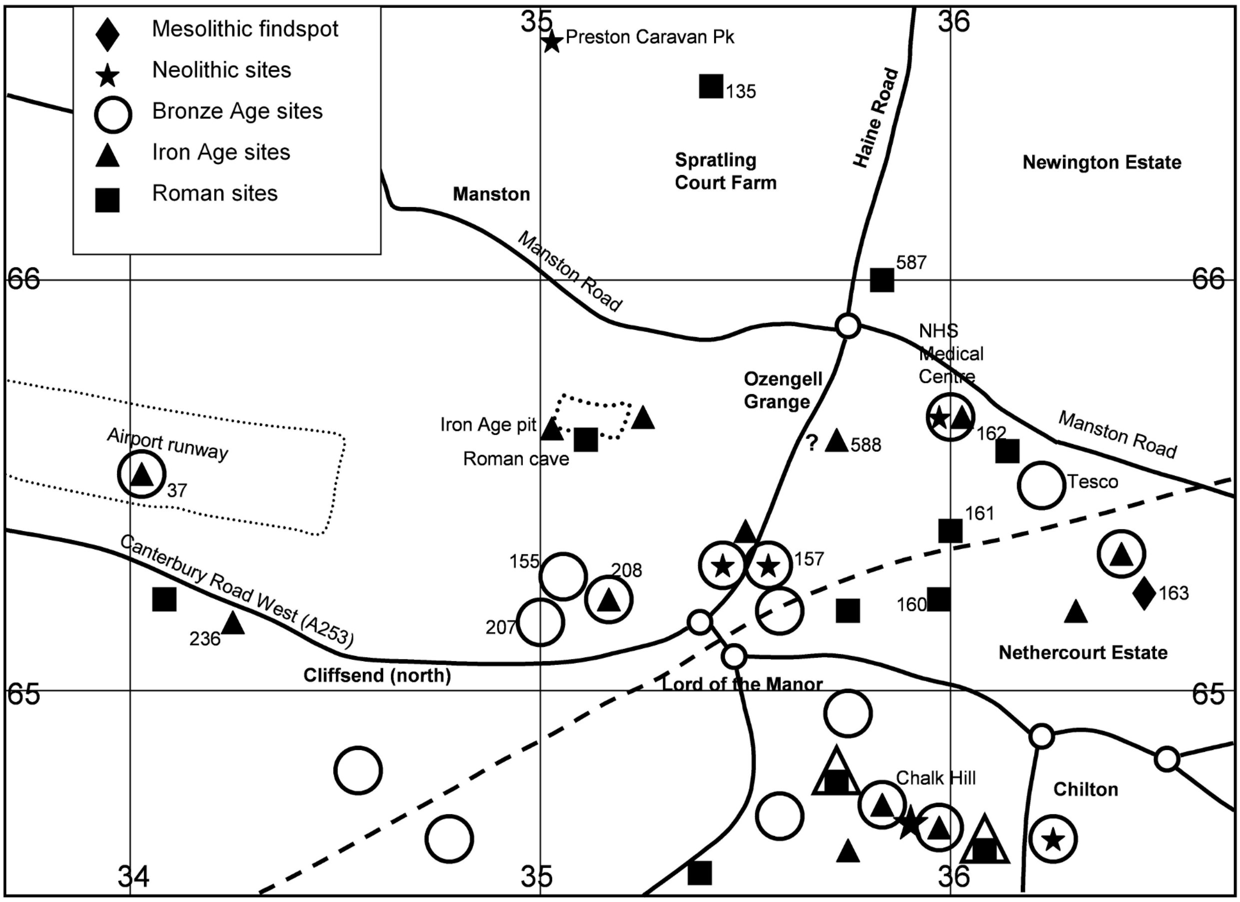

Figure 2: Distribution of sites and monuments in South Thanet, west of Ramsgate, based on the Trust for Thanet Archaeology Sites and Monuments Register (TSMR) and Kent HER (Historic Environment Record) databases.

Brickearth and OSL dating

The term brickearth is used throughout this report to signify wind-deposited (aeolian) sediment. Brickearth is a composite term that encompasses both wind-suspended silt dust (loess) and wind-saltated and wind-rolled dune sand (coversands) that date to the closing periglacial stages of the Last Glacial (Devensian) period. Variable silt and sand fractions are present within brickearth, requiring detailed particle size analysis accurately to assess the relative proportions of each. In colour, brickearth varies from pale buff (in more silt-dominated and calcareous soil) to orange-brown (in sand-dominated and/or more decalcified soil). Main sources of local brickearth were the thin weakly-cemented Thanet Sand Formation which overlies Upper Chalk, and loess derived from the continental mainland (Weir, Catt and Madgett, 1971) and exposed floor of the drained English Channel at a time of low sea-level (Antoine *et al.*, 2003).

Optically stimulated luminescence (OSL) dating is well suited to brickearth soils based on the principle that over time low-level background radiation from naturally-occuring elements in sediments (potassium, thorium, uranium) is slowly absorbed within the quartz lattice structure of silt and sand particles, and will continue to do so while the sediment is buried and stable. When sediment is exposed to sunlight, silicate grains are ‘bleached’, and the palaeodose which had accumulated within the quartz lattice structure during burial is then reset. The atomic clock is effectively zeroed. Field procedures involve the collection of sediment samples in opaque PVC tubes, and *in situ* measurement of the background radioactivity using a micronomad portable gamma spectrometer. The latter measures the ambient radiation levels from K, Th and U elements in the sediment, called the dose rate. Laboratory preparation requires controlled red light conditions in which quartz is extracted and cleaned from a sample; measurement is then carried out in a Riso luminescence reader with luminescence stimulated from quartz via a filtered halogen lamp and measured in the UV end of the spectrum with a photomultiplier tube. This process calculates the palaeodose. Dividing the lab-measured palaeodose by the field-measured dose rate yields the age of burial of the sediment in years prior to when the sample was measured (in this case, 2004). Though the technique is used to assess the age of a bulk sample of sand, it must be recognised that while some individual sand grains may become bleached by exposure to sunlight, others, partially buried or shaded from sunlight, are incompletely bleached. Good reproducible results indicate that sediments were well-bleached prior to deposition (wind-blown sediments are ideally suited to this with comprehensive grain-by-grain movement). Poor results with a high degree of data scatter may be attributed to poor exposure to sunlight prior to burial, a common problem with non-aeolian deposits. See Baker (2010) and Baker and Bateman (2010) for further discussion of the methodology, interpretation and evaluation of this OSL dating.

The Cave

The Spratling Court Farm cave feature is, unusually, boot-shaped with a clear vertical shaft entrance, a horizontal gallery, adit or passage, and a rounded chamber at the 'toe' end (Figure 4). Well over half of the feature was lost to the road contractors in 1996, but sufficient survived to make a reasonable estimate of the cave's original shape and size. The shaft neck (Figure 4, columns 7-8) is 1.5 m wide and 3.0 m deep, cut in solid flint-free Upper Chalk, taking the cave floor (E7) to 4 m below present ground level. No footholds are visible. The passage, with one surviving concave side, exceeds 1 m in height and runs left (west to east) for 4 m (E6 to E3), before entering a slightly enlarged concave chamber up to 2 m high (Figure 4, columns 2-3). The inclination of the floor and inward-dipping soil layers at E7 point to a second passage possibly branching off to the south; this may denote an underground network rather than a single adit. Between these two passages a spur lies to the east of the shaft (behind E7); smooth and well worn, it suggests continued use over a prolonged period. The west side (E8) is only poorly preserved, having suffered greater weathering and internal collapse. No wall inscriptions have been located, but tool markings on the passage back wall (at E5) do indicate the use of a short-headed iron pick with a right-handed action (Rod LeGear, *pers. com.*).

Figure 3: Full view of the cave (left) and pit (right) in summer 2004. The section runs for 26 m from east to west and extends 5 m vertically from 41 m to 46 m AOD

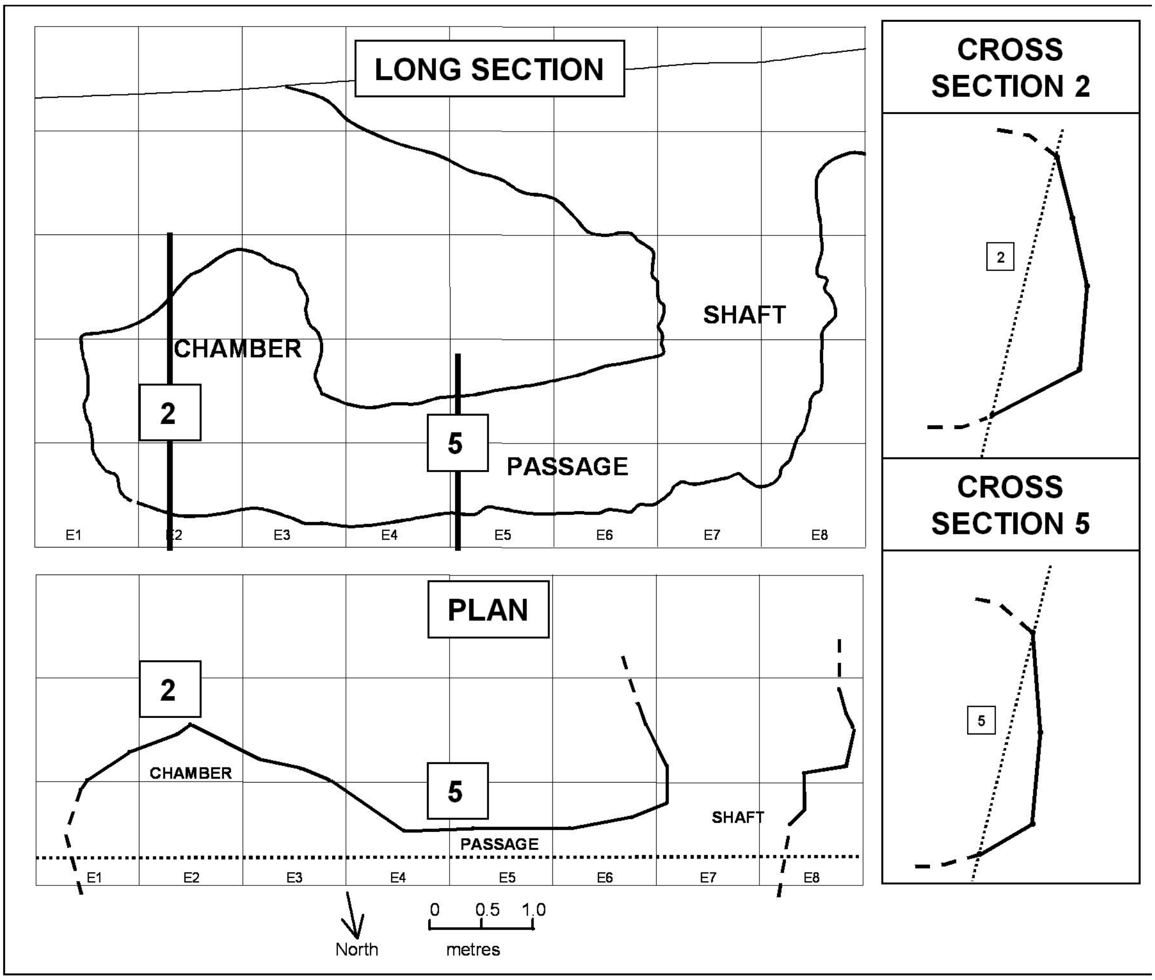

Figure 4: Long section, cross sections and plan of surviving cave rock walls. Dotted lines show where the modern quarry face truncates the feature and dashed lines indicate conjectured rock surfaces.

Cave infill

Well-stratified colluvial deposits completely fill this subterranean cavity, including various layers of chalk breccia, sand and sandy loam, fine chalk gravel, flint gravel and brickearth. Figure 5 illustrates this infill, which is best preserved in the chamber at the eastern end and the shaft entrance(west). Units are numbered 1-14 in the end chamber (column 2) and i –xviii in the shaft (column 7).

The end chamber appears to have filled in from above, possibly from a surface doline (collapsed cave) where the roof may have opened up to give another point of entry. Two fossiliferous layers occur (Figure 5, D2). The lower, a fine-grained chalk gravel (unit 9) contains small fragile remains of bird and frog/toad, together with land mollusca (*Helicella itala, Monacha cantiana, Cepaea* sp.), indicating recent burial and typical dry chalk grassland conditions. Higher in the sequence there is a coarser bone bed (unit 6) containing disarticulated bones of horse, cow, pig and deer. This could be discarded butchery waste: a cut horse femur displays striations that could have been produced by a Roman saw (Andrew Chamberlain, *pers. com.*).

The shaft infill predates that of the chamber. Steeply-inclined chalk breccias at the base (Figure 5, E7-D7) represent the initial infilling of the vacant cave after abandonment; these partly originated from internal wall collapse, but they probably also came from chalk rubble dislodged from former spoil tips which once surrounded the cave entrance. There is no evidence for agricultural or domestic waste (as seen, for example, in deliberate backfilling strategies in Neolithic flint mines, Russell, 2000); a process of natural infilling is implied. The chalk breccias are particularly clean and sterile; no metal or pottery finds were made. They overlie a number of large animal remains, disarticulated and scattered on the cave floor – a pelvis, femur and scapula of cow, and a horse jawbone. Unlike those in chamber unit 6, there are no signs of butchery, but one bone does show teeth puncture marks indicative of scavenger activity. A radiocarbon date was obtained from the cow femur: 179 cal. AD (95% probability range 30-336 cal. AD) (Beta-201974). This yields a minimum age for cave abandonment; original cutting of the cave must logically precede this.

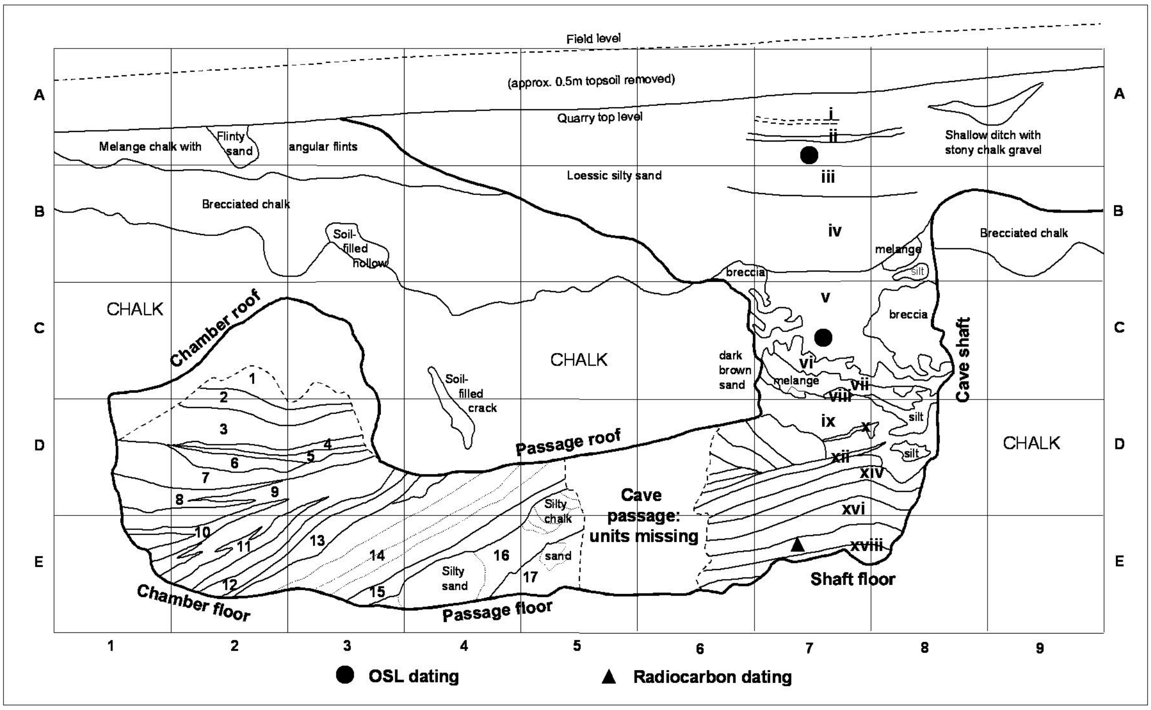

Figure 5: Infill stratigraphy preserved within the Roman cave at Spratling Court Farm

Higher in the sequence, breccia units xi and xiii (Figure 5, D7) yield further microfaunal remains similar to those already recovered from chamber unit 9. These include small fragile bones of bird, frog/toad, common mole, mouse and vole, suggestive of local denning or nesting activity within a shallowing depression as the cave shaft gradually filled up. A total of eight molluscan species are recognised here *(Ceciliodes acicula, Cepaea nemoralis, Helix aspersa, Helicella itala, Monacha cantiana, Trichia hispida, Vallonis* sp. and a zonitid), all typical Holocene dry chalk grassland snails. The presence of H. *aspersa* is notable since it was introduced as a Roman food source, and therefore generally taken to date soils to 100 AD or later (David Keen*, pers. com.*). Consequently, the lower end of the radiocarbon calibration can be shortened, reducing the age range to 100-336 cal. AD (Early to Mid Roman).

Unit v is a residual sandy brickearth fragment (Figure 5, C7) associated with complex distorted layering, confined to the shaft infill but absent in the end chamber. Underlying distortions (C7, C8) record a phase of rapid sand collapse and slumping, postdating the earlier chalk breccias beneath.

Figure 6: Cleared area of cave shaft E7 exposing a well-worn floor and spur with a second gallery branching off from the base shaft.

OSL dating

Unit v was dated by optically stimulated luminescence in 2003 (Shfd03088). Preliminary analysis, reported in 2005, identified considerable statistical scatter in the data, with an approximate depositional age appearing to fall between about 12 and 6 thousand years BP. This was clearly anomalous, being far older than the cave itself; the brickearth was thus believed to be residual. Later statistical refinement (in 2009) isolated the relative contribution of three OSL components, each representing a distinct phase of sand reactivation. The derived components are: 12,970±750 years BP (60%), 19,930±1330 years BP (37%) and ~6270 years BP (3%). The third component age is statistically insignificant and can be effectively disregarded. The first however is very significant (at 60%): at ~12 ka BP, this signals the latest of a number of periglacial coversands identified in Thanet (Murton *et al*., 2003). The second component age, at ~20 ka BP, is the principal coversand in Thanet identified at Grenham Bay and Great Brooksend Farm *(ibid.*). Together these two components record a mixed coversand or brickerth layer that previously existed over much of the Thanet chalk ridge. The cave was cut through this shallow overburden into solid Upper Chalk beneath. After abandonment, mounds of chalk spoil fell back into the shaft, followed by a sudden collapse of the now-exposed and unsupported brickearth wall. Falling into position, this then loaded and distorted the underlying soil layers (units vi-viii).

In the Late Roman and post-Roman period, widespread woodland clearance continued across Thanet, exposing the last few remaining brickearth patches. These have largely been lost to erosion now, and only small remnants survive *in situ* within central Thanet; one such may exist at Kent International Business Park (Allen and Green, 2003).

A further OSL date of 710±80 years AD (Shfd03087) in layer iii (Fig 5, A7) above the brickearth confirms a steady accumulation of more recent soil creep and hillwash throughout the Saxon period. This topsoil completes the four-metre excavation examined within the cave shaft (column 7).

Figure 7: Layered chalk breccias interbedded with sand layers (D7 and E7) resulting from initial natural chalk rubble infilling the cave shaft after abandonment. The rhythmic bedding may represent annual or seasonal layering; the *Bos* femur C14-dated to 179 cal. AD (30-336 cal. AD at 95%) was located at the base of this sequence.

Flintwork in the cave

A small collection of 14 worked flints was recovered from within and around shaft sand unit v. This was identified as a mixed residual assemblage ranging from Later Mesolithic at the earliest to Late Bronze Age (Hart, 2010). It is clearly older than the cave itself, and links to the well-documented array of occupation sites and monuments in the surrounding area (Figure 2). These must have provided the knapping sources that once existed on the former brickearth land surface. Two hollow scrapers, a potential awl, a notched flake, and a side scraper are included in the cave flint list. See below (Figure 11 and Table 1) for further discussion of flintwork.

Origin and purpose of the cave

The position of the cave in a relatively undeveloped location coincides with low archaeological visibility during Roman times (Figure 2). Perkins (2001) has mapped this negative area (approximately 3 km by 2 km in size); it implies a late remnant of original uncleared woodland. This fact, together with the considerable depth of post-Roman colluvium which overruns the cave, suggests that the Thanet ridge at Manston was indeed wooded, well into the Roman period and beyond, until forest clearance eventually exposed the remaining brickearth to soil erosion. This view concurs with Scaife (in Hearne *et al.*, 1995) who found evidence of late survival of oak-hazel woodland in the Weatherlees Hill (Wantsum Channel) pollen record.

Figure 8 proposes a cut-and-fill sequence summarising the stratigraphic evidence discussed so far. Key to this reconstruction is the position of the residual brickearth that demonstrates that the former land surface (Stage 1), from which it originated, was a late survival in the erosional history of the area. Chalk spoil from the cave excavation is believed to have been dumped nearby (Stage 2) and thus briefly protected the old land surface. Only after spoil had fallen back into the shaft (Stages 3 and 4) was the brickearth re-exposed and, unsupported, then collapsed into the shaft on top of the basal breccias (Stage 5). Later, wider forest clearance in the Late Roman and post-Roman period removed the last vestiges of this old land surface from the Thanet ridge, completing the sequence (Stage 6).

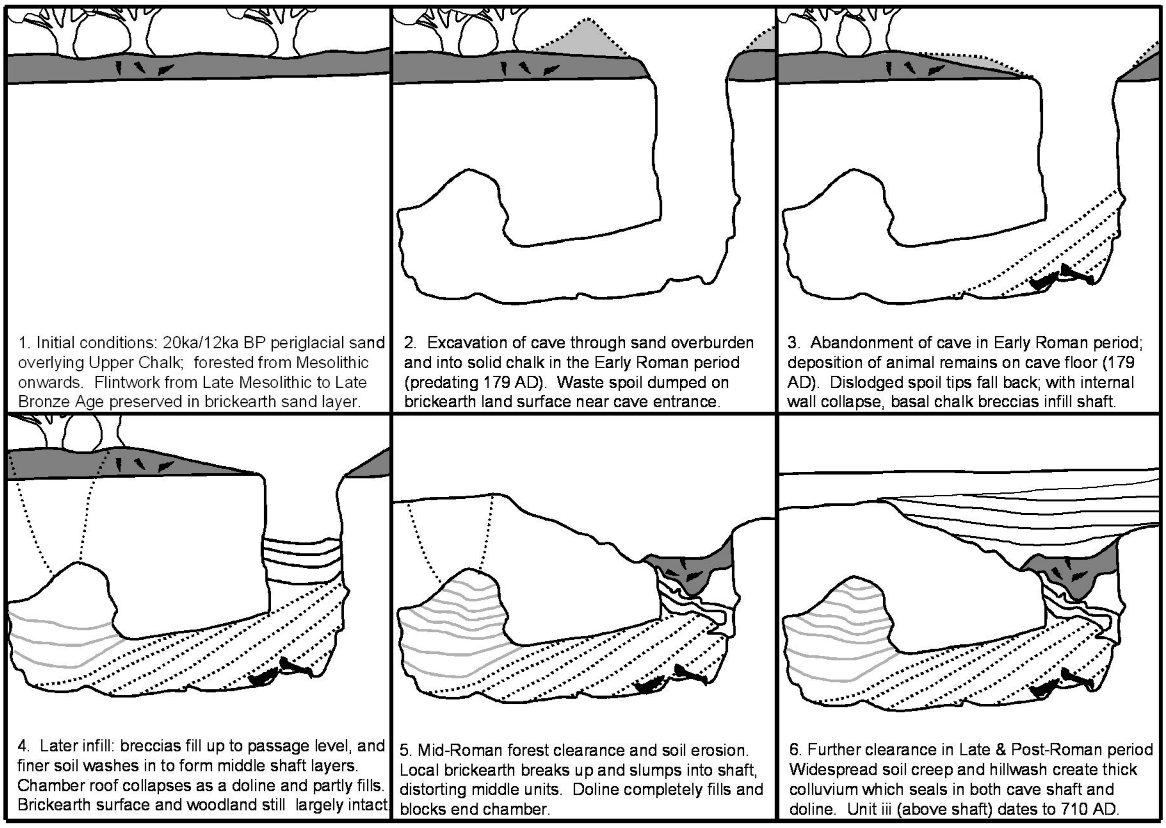

Figure 8: Proposed cut-and-fill sequence for the cave at Spratling Court Farm.

The original purpose of the cave is uncertain. A number of possibilities need to be considered. There is no flint stratum in the immediate chalk, so flint mining is out of the question. The feature is far too elaborate for burial purposes and would be entirely inconsistent with early Roman cremation practice (Perkins, 2001). Underground catacomb-like habitation cannot be substantiated without clear evidence of settled domestic activity, which is lacking. Similarly a lack of evidence for grain residues, amphorae debris, *etc.* precludes a storage pit idea, and distances from known Roman dwelling sites (all lying between 1.3 and 1.8km distant) would also render this unlikely. Two alternative interpretations are proposed.

1*. A denehole or chalkwell hypothesis.* As a local method of chalk mining (described as early as AD 75 by Pliny the Elder, Natural History, vol. 4) deneholes must have been an established tradition from the Later Iron Age onwards. LeGear's Type I denehole with a two or three chambered trefoil pattern would most closely match the Manston shape (LeGear, 1992). This is only a superficial resemblance however, and it should be noted in particular:

> (a) the length of passageway (at 4 m) is too long for manually dragging mined chalk;
>
> b) there are no friction markings on the rock walls; rope grooves are common in deneholes where chalk-filled baskets were drawn up;
>
> (c) the left wall spur is smooth and well-worn, suggesting long continued use rather than short-term mining activity;
>
> (d) the cave appears to have been located in a still wooded area prior to clearance; deneholes were normally dug along cultivated field boundaries;
>
> (e) most deneholes were deliberately backfilled with spoil for safety reasons, and stopped with a brick dome or tree stump. The Manston fill is apparently natural, and it is unlikely that perfectly serviceable marling lime would have been backfilled in this way.

For these various reasons it does not appear that the Manston cave is a denehole (LeGear, *pers. com.*). Recent excavations by the Canterbury Archaeological Trust at the Thanet Earth site (Plateau 6) have revealed a set of subterranean tunnels and caves with side chambers and galleries; these may be both deneholes and storage pits, but their infill is dated to the medieval period (11^{th} to 13^{th} century) (Rady, 2009).

2. *A ritual pit hypothesis.* An isolated wooded grove near the brow of the Thanet ridge might have offered a desirable location for a secluded sacred shrine. Millett (2007) observes that we still lack good evidence for the nature of religious observance in Kent at this time, but draws attention to the view that 'structured deposition' of animal remains is now commonly associated with Iron Age and Roman religious practice. Hence, the final abandonment of a ritual cave could have been marked symbolically by the deliberate sacrificial offering of valued livestock. The cult of Mithras was associated with underground mithracea; however Mithraism rose to prominence in the 3^{rd} century (Beck, 2006), so Manston may be too early for this. An east-west alignment in the cave might have an early Christian connotation. The nearest temple with Roman origins is located at Worth (Klein, 1928), while the outline of a possible shrine is associated with a group of sunken buildings at Monkton (Bennett *et al.*, 2008). One possible comparable underground chamber of Roman age in Thanet was reported by Perkins (1982), and another nearby chamber was

earlier described by Dowker (1877). Perkins refers *inter alia* to a fish symbol and a "REX" inscription. A better-documented example at Mill Hill, Deal, has been described by Parfitt (1986 and 1992): similarly boot-shaped, it was much smaller in size than Manston, and partly back-filled with mixed loam and chalk rubble containing Roman domestic debris of late 1st/early 2nd century pottery. An unusual chalk statuette and small niche suggested a ritual function, which was interpreted as Celtic in origin. Romano-British pits with possible structured deposition have been reported from Birchington (Burchell, 1949; Perkins, 2001); one of these is described in the KCC Historic Environment Records as a Romano-British ritual shaft (HER no.TR26NE8).

A ritual pit hypothesis for the Manston cave is still speculative at this stage. If these suggested parallels have any validity, perhaps four such shafts and caves exist locally: Manston, Northdown Hill, Grenham Bay, Mill Hill Deal. Clearly these would have been small informal shrines rather than established surface temples of permanent structure. After abandonment, little direct evidence of religious activity seems to have survived. Further excavation is necessary; future investigations at Manston could focus on the search for wall inscriptions, candle or lamp-stained niches, discarded religious artefacts, and additional structured deposition of sacrificial food and animals. These would help to build up a better picture of the likely religious practices that took place here in the Early to Mid-Roman period.

The pit

At least two prehistoric chalk pits have been identified at Spratling Court Farm which can be confidently dated to the Mid to Late Iron Age. The first of these was briefly described by Perkins (1991) in the northeast corner of the 1996 quarry; the second and larger feature in the southwest corner has been excavated in greater detail (Baker, 2010) and is described here.

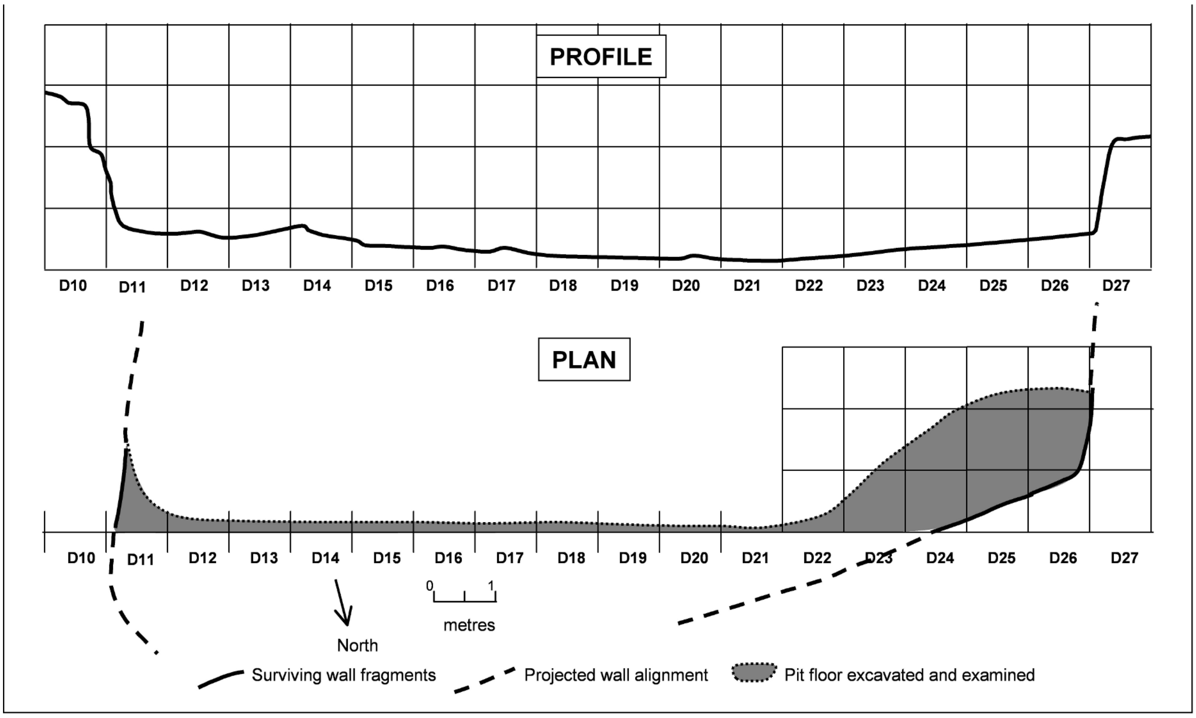

Figure 9: Outline profile and plan of the main Iron Age pit.

Chalk removal in 1996 left only partial evidence of the pit's shape and size (Figure 9). Steep east and west walls, about two metres high, are visible with an inter-connecting sub-horizontal floor 15 m across. These worked walls have clearly suffered later weathering and collapse, so they probably exceeded two metres originally. Their alignment appears to converge northwards into the modern quarry centre, defining an oval or sub-rectangular outline. While the north easterly margin is lost, the south westerly still survives below the adjacent field. About 7 m² of floor have been excavated and examined so far. Available evidence suggests that the floor is generally clean and featureless, lacking, for example, domestic hearths, butchered bones, refittable flint scatters, infilled postholes, *etc.*, any of which might point to a settled occupation horizon. On the contrary, its clean nature suggests a more rapid removal of chalk (exploiting the natural bedding planes of Upper Chalk) with little opportunity for build up of human debris. A few small pottery sherds have been located but there is a complete absence of metal finds. At 15 m, the long profile may not represent its true length, depending on how obliquely it was cut. The estimated size of an earlier pit discovery (Figure 10, Pit 1) suggested a width of 9-10 m and a depth of over 2 m (Perkins, 1991). Similarly shaped Romano-British chalk pits have recently been identified at Upton House, Broadstairs, the lengths of which appear to measure between 11.0 m and 20.5 m; one width is 3.8 m, and depths vary from 0.84 m to 2.3 m (Moody, 2007). The Manston pits were probably quarried on a similar scale.

Pit infill

The main pit (Figure 10, Pit 2) possesses stratified colluvial infill, layers of chalk breccias, sands, sandy loams, fine chalk gravels, flint bands and brickearths, similar to those infilling the cave but arranged in a more bowl-shaped synclinal pattern. In the far wall corners, colluvial units are numbered a-i on the east (columns 11-12), and 1-9 on the west (columns 23-26). Infilling is believed to have been a slow natural process, with no clear evidence of deliberate backfilling.

Eastern wall of pit

At the eastern wall (Figure 10, column 11) the oldest soil is represented by a thin basal wedge of residual brickearth (unit i), resting directly on the pit floor, that has been OSL-dated (see below). It is overlain by banded and fractured layers of silty sand with fine chalk debris (units g and h) that display arching, back-tilting and flame-like protrusions. These structures are interpreted as load deformation, denoting wall collapse in a debris mound. Within unit g (D12), the lowest available organic sample (a horse radius and ulna) yields a calibrated radiocarbon age of 25 cal. AD (95% probability range 162 cal. BC to 209 cal. AD) (Beta 201975), a Late Iron Age/Early Roman date. Above this, the exposed rock wall, increasingly weakened by weathering, fed steeply inclined chalk breccias (units d-f) across the thickening infill. Thick sandy loams (units a-c) complete the soil profile, the bulk of which occupies the full central pit infill (columns 19-20); these resulted from post-clearance soil erosion. A clear erosional horizon can be identified at four points (Figure 5 4, B5 and B9; Figure 10, B10 and B27). Baker and Bateman (2010) show that surface lowering of between one and two metres must have occurred at this time, based on the erosional truncation of the periglacial stratigraphy. Soil erosion was followed by subsequent colluvial build-up in the pit which acted as a sediment trap. Unit c (B12) contains shell midden debris, occasional bone fragments and mollusca including *Helix aspersa* (dating the layer to 100 AD or later). A further OSL date obtained from bed c confirms this, giving a Mid-Roman age of 220±100 years AD (Shfd03086). Taking a broad view of the complete section (Figure 10), the eastern wall layering appears to resemble the western wall with mirror-image symmetry, lower soil units feathering inwards and cross-cut by the thickening upper units. This arrangement suggests that colluvium gradually infilled the abandoned pit by progressive soil creep and hillwash encroaching across the pit floor from both directions in a stepwise *en échelon* manner.

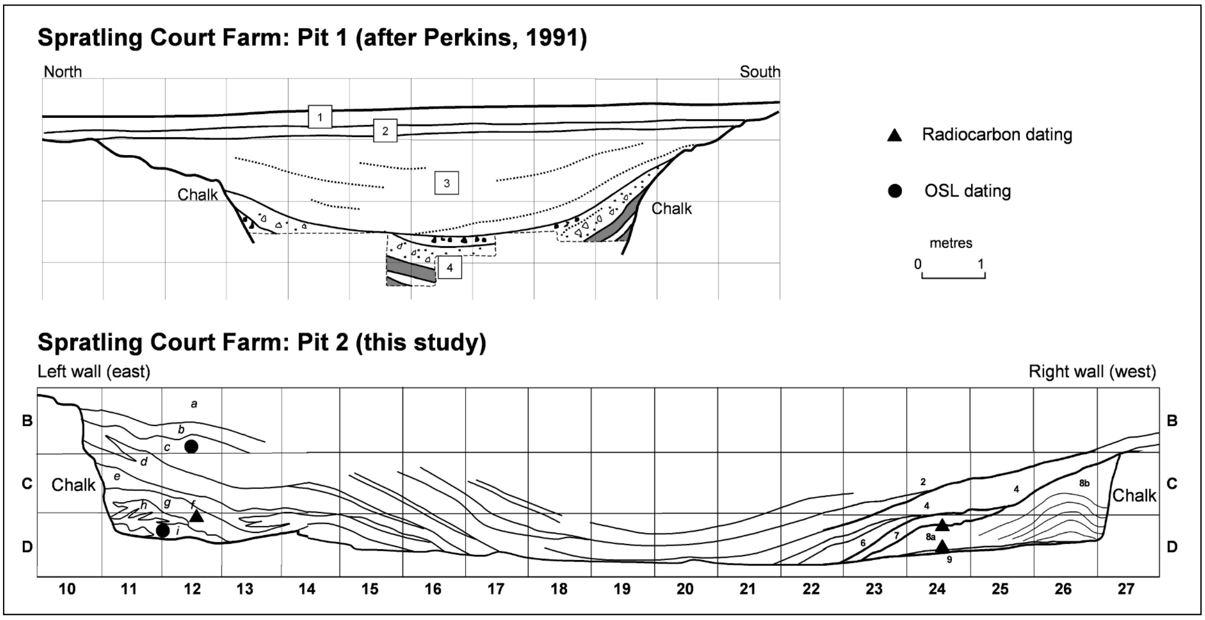

Figure 10: Infill stratigraphy of the two Iron Age chalk pits at Spratling Court Farm

Western wall of pit

At the west wall (Figure 10, columns 24-25) the earliest soil is represented by a thin basal chalk gravel (unit 9) with frequent mollusca of a single, pioneer, calciphile (rock-feeder) species *(Helicella itala)* (Richard Preece, *pers.com*.). This species colonised the initial soil that developed on the newly exposed pit floor. Two beds of residual brickearth follow (units 8 and 6), typically uniform buff silt and fine sand, mottled in places, and containing frequent worked flints (see below). Traced inwards, unit 8a expands, becoming more flint-dominated, and is noticeably arched (Figure 10, unit 8b) – a second slump structure, repeating the distortion already observed in D11 opposite. Two AMS radiocarbon determinations below and above brickearth unit 8a provide a tight time frame. These are: 124 cal. BC (95% range, 349 cal. BC to 4 cal. AD) (Wk 23660) below, and 2 cal. BC (95% range, 88 cal. BC to 70 cal. AD) (Wk 23659) above. An unequivocal Mid to Late Iron Age date for the emplacement of unit 8a can thus be confidently stated.

Three small sherds of crude pottery were recovered from unit 8 (Hart, 2010). Two fragments of flint-tempered pottery point to a Mid Bronze to Iron Age date, but could well be Mid to Late Iron Age. One abraded piece of grog-tempered pot rim is clearly of later style, dating to the Belgic period, the only contemporaneous artefact to clearly match the radiocarbon dating. Pottery evidence from the adjacent pit (Figure 10, Pit 1) suggested Belgic or Romano-British origin, although Early to Mid Iron Age sherds and Medieval sherds were also present (Perkins, 1991).

Higher in the sequence, a coarse chalk breccia (unit 4) truncates the top of the west wall and overrides the lower brickearth units (Figure 10, C26). Above this, a thick layer of more recent colluvium completes the infill sequence. Scattered remains of horse, cow, pig and sheep are found throughout these upper layers, which may be butchery waste, but in unit 2 (Figure 10, C22) bones of two cows (an adult, and a juvenile with unfused femur epitheses) indicate the presence of a cow and calf together. Butchery is therefore less likely (Andrew Chamberlain, *pers. com.*), and an animal trap scenario might apply. Scattered midden shell debris, charcoal fragments and daub flecks are also present in unit 2, with further evidence of *Helix aspersa,* again indicating post-clearance colluvium.

OSL dating

Residual brickearth in unit ii (Figure 10, D11) was sampled for OSL dating in 2003 (Shfd03085). Preliminary analysis, reported in 2005, identified moderate statistical scatter in the data, with an approximate depositional age appearing to fall within the range 8.4 to 7.5 thousand years BP. As with the cave dating, this was clearly anomalous, being far older than the pit itself; this again hinted at the residual nature of the brickearth fragment. Later statistical analysis isolated the relative contribution of two components, each representing a phase of sand reactivation. These components are: 12,000±740 years BP (61%) and 8570±590 years BP (39%). The first component age (~12 ka BP) is very prominent, overlapping well with the main cave signal (12,970±750 years BP) and correlating with the same periglacial coversand identified at Grenham Bay (Murton *et al.*, 2003). The second component age (~8 ka BP) is unique to this sample: at 8570 years BP it cannot have had a periglacial origin but, coinciding with the Mesolithic period, human agency might be a distinct possibility. Any convincing account of this OSL signal must explain how soil disturbance and sand reactivation came about.

At Pegwell Bay a Later Mesolithic palaeosol dated to 6120±250 years BP (5540-4490 cal. BC) is preserved under colluvium containing Neolithic flint flakes (Weir, Catt and Madgett, 1971) suggesting an Early Neolithic start to deforestation. This does not quite square with radiocarbon dating of organic muds at Weatherlees Hill, within the Wantsum Channel, which at 3505-3350 cal. BC (Late Neolithic) points to local oak-hazel woodland having survived undisturbed throughout most of the Neolithic (Cook and Naysmith, in Hearne *et al.*, 1995). Nevertheless, most authors agree that the advent of farming in the Early Neolithic period coincided with widespread forest clearance and increased rates of soil erosion (Short, 2006; Champion, 2007). But what ground impact (if any) might their Mesolithic predecessors have had? Could human activity alone have been sufficient to account for soil disturbance as far back in the Mesolithic as 8570±590 BP (6570 BC)?

By definition, pre-agricultural Mesolithic communities (10,000-4000 BC) were mobile subsistence hunter-gatherers. It is questionable therefore whether temporary hunting camps could have caused any measurable soil disturbance. Recent excavations at North Park Farm, Bletchingley, Surrey (Poulton, 2006) however have provided new insights into Mesolithic behaviour on the Lower Greensand outcrop. Here the traditional low-impact scenario is being reinterpreted in terms of repeated visits to a Mesolithic site over an extended period of time (from 8,000 to 4500 BC) with perhaps significant long-term ground effects. So, woodland clearance and management, more typical of the Neolithic period, may already have been practised in the Mesolithic period (Simmons *et al.*, 1981) and a human cause for the 8.57±0.59 ka event may therefore be a possibility.

An alternative climatic explanation for Early Holocene soil disturbance is the focus of current Quaternary research (see Baker and Bateman, 2010, and references therein). Alley *et al.* (1997) identify widespread records in the northern hemisphere of a short-lived climatic perturbation resulting in cool, dry, windy conditions throughout the northern hemisphere at about 8200 years BP. This strong Early Holocene cooling episode is believed to have been linked to the North Atlantic thermohaline circulation, in turn linked to the decay of the Laurentide ice sheet. A number of European studies have demonstrated significant fluctuations in vegetation cover during this time, including a marked dieback in hazel woodland. Other studies in both Europe and Asia have identified sand reactivation during the '8200 Year Event'. These environmental changes may be causally linked for, as woodland briefly retreated, vulnerable sand-based soils may have suffered wind erosion of 'dustbowl' character. Within Britain, sandy environments such as East Anglia certainly experienced inland aeolian activity at this time (Bateman and Godby, 2004), so a dustbowl scenario on the superficial brickearth cover of Thanet during the Later Mesolithic may have some credibility. Greenland ice cores demonstrate that the cooling period lasted for only about 100 years, but was more intense than the 'Little Ice Age', with temperatures dropping by around 3°C. If substantiated within British palaeo-records, such an event may provide new insights into Mesolithic behaviour. It could, for example, be implicated in regional patterns of migration. Decimated woodland, intolerable dustbowl conditions and drought lasting perhaps four or five generations around 6200 BC would have been sufficient to drive Mesolithic inhabitants away from sand-based soils such as existed on Thanet at that time. Only with a recovery to normality in the environment would new settlers then have made an appearance.

Late Prehistoric Flintwork

A total worked flint assemblage of 150 pieces has been recovered from both cave and pit features at Spratling Court Farm. In the pit, these appear to be confined to the residual brickearth (unit 8) and beds immediately adjacent (units 4-9) at the western wall. This suggests an activity focus of some kind, but with a low flint density of only ten pieces per m^3 it falls well short of a settlement cluster. A full report and review of this mixed residual assemblage is given in Hart (2010). As with the cave group, the pit group is predominantly unpatinated, with rapid burial and little time for exposure at the surface after discard. In terms of lithic shape, most flakes are of longer (44%) or squat (27%) variety, and blade or bladelet percentages are low (7% and 2% respectively) *(ibid.)*. Many flakes are secondary or tertiary pieces, relatively small and thin, with fine retouching; most display hard hammering technique, though some were possibly soft hammered; platform preparation is frequently observed. 38% are waste débitage flakes; 46% are retouched tools, showing reworking; 16% are utilised tools, with recognisable evidence of use-wear *(ibid.)*. Figure 11 illustrates examples of this flintwork, and Table 1 charts time ranges for a selection of some diagnostic pieces together with the few pottery sherds recovered. Lithic range thus extends from Later Mesolithic to Late Bronze Age. It is clearly evident that post-depositional mixing has occurred, disturbing any original flint distribution that might once have existed on the former brickearth land surface.

Eleven lithics display potential Later Mesolithic features, including possible microburins, awls, blades, blade flakes and an end scraper. Such tools are common in Later Mesolithic/Earlier Neolithic contexts, but Hart (2010) stresses the uncertainty attaching to some of them. There is little, typologically speaking, to distinguish Mesolithic from Neolithic, and the transition is equally arbitrary in other Later Mesolithic/Earlier Neolithic sites such as Manston Road (Boast *et al.* 2006) and Thanet Reach (Perkins, 1997). It has been argued (Hammond, 2007) that a clear line should be drawn conceptually in East Kent between Mesolithic and Neolithic activity; Neolithic people were, in Hammond's view, newly arrived pioneers introducing entirely novel farming methods from the near-continent, rather than indigenous innovators who were continuing an already-established Mesolithic tradition. So uncertainty remains over the exact significance of the Mesolithic flint evidence at Manston.

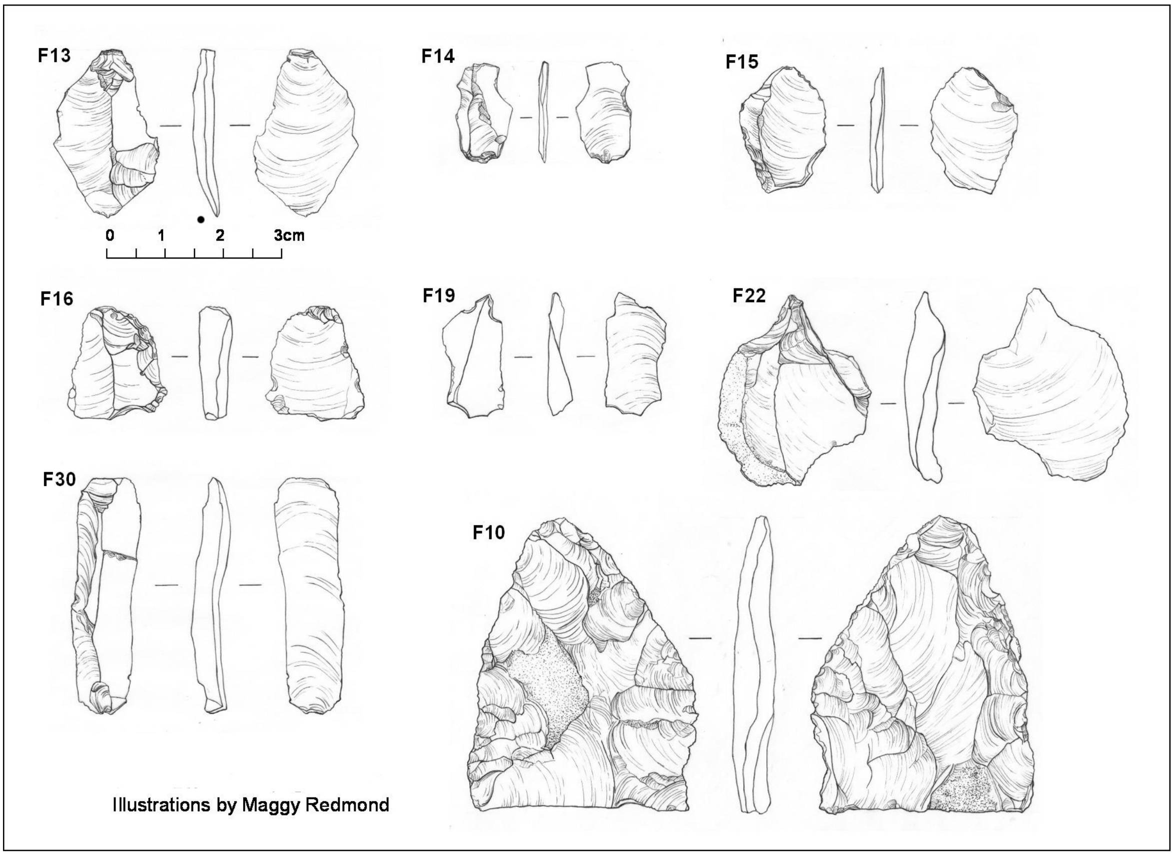

Figure 11: A selection of mixed residual flintwork from the west wall of the pit and cave shaft based on Hart (2010) with illustrations by Maggy Redmond.

There is firmer evidence, however, of Neolithic flintwork, including end scrapers, notched knives, a polished flint tool flake, and a laurel leaf blade flake. Most of this material could date to Early and Middle Neolithic (Hart, 2010), linking it to several significant Neolithic monuments in the immediate vicinity (Figure 2). Similar evidence was recovered by Perkins from an adjacent trench - polished Neolithic flint tool fragments and débitage of Mesolithic and Neolithic flakes (Perkins, 1991). Nearby, Chalk Hill (Hearne *et al.*, 1995), Lord of the Manor (Perkins, 1980), Preston Caravan Park (Moody, 2004) and Manston Road Medical Centre (Boast *et al.* 2006) are all potential knapping sources for this flintwork, suggesting that visits to the central Manston ridge were made, at least intermittently, during this phase. Several of these flint types have extended ranges and would not be out of place in Bronze Age contexts (Hart, 2010), while simple expedient flints, of which there are several in the pit group, are typical of Late Bronze Age. Links to the general spread of local Bronze Age settlement activity are therefore likely. Thanet is exceptionally rich in such sites (Figure 2) and proximity ensured that flint working at Manston continued throughout the Bronze Age period. Radiocarbon dating of contemporary pottery, in particular the beaker culture, places local Early Bronze Age activity to between 2350 and 1922 cal. BC (Bennett, 1995).

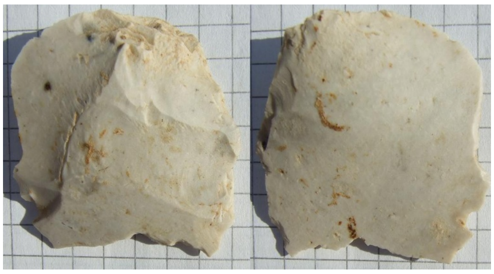

Figure 12: A retouched flake struck from a polished flint tool (bed 7-8 transition, D25). Earlier Neolithic to Bronze Age. Scale: squares 0.5 cm

Only a single spheroidal hammerstone coincides or overlaps chronologically with the Iron Age. Paucity of Iron Age flintwork may have been the result of flint use reduction, or a decrease in farming intensity, or possibly a shift in population distribution within Thanet itself. However, nearby evidence of significant Late Iron Age settlement comes from Canterbury Road West (Perkins, 1985), and Hearne *et al.* (1995) paint a picture of a flourishing community on Thanet between 150 BC and 50 AD, with dense Late Iron Age and Belgic occupation along the coastal strip. Lack of Iron Age finds therefore at Spratling Court Farm is surprising, and all the more since the pit is so firmly radiocarbon-dated to the Mid-Late Iron Age.

Figure 13: A speroidal hammerstone (bed 4, D21) typical of the Iron Age or possibly Mid Bronze Age to Late Iron Age. Scale: squares 0.5 cm.

Origin and purpose of the pit

Figure 14 proposes a cut-and-fill sequence summarising the stratigraphic evidence presented so far. The residual brickearth fragments (units i and 8) provide the important dating and lithic evidence on which Stage 1 is reconstructed. The pit profile with its worked walls and floor is the basis for Stage 2. Faunal evidence in unit 9 and three radiocarbon dates underpin Stages 3-5, and the final stage of soil erosion (Stage 6) is deduced from the unusual thickness of colluvium and the two highest OSL dates. This sequence is consistent with, and complements, the evidence from the adjacent cave infill (Figure 8).

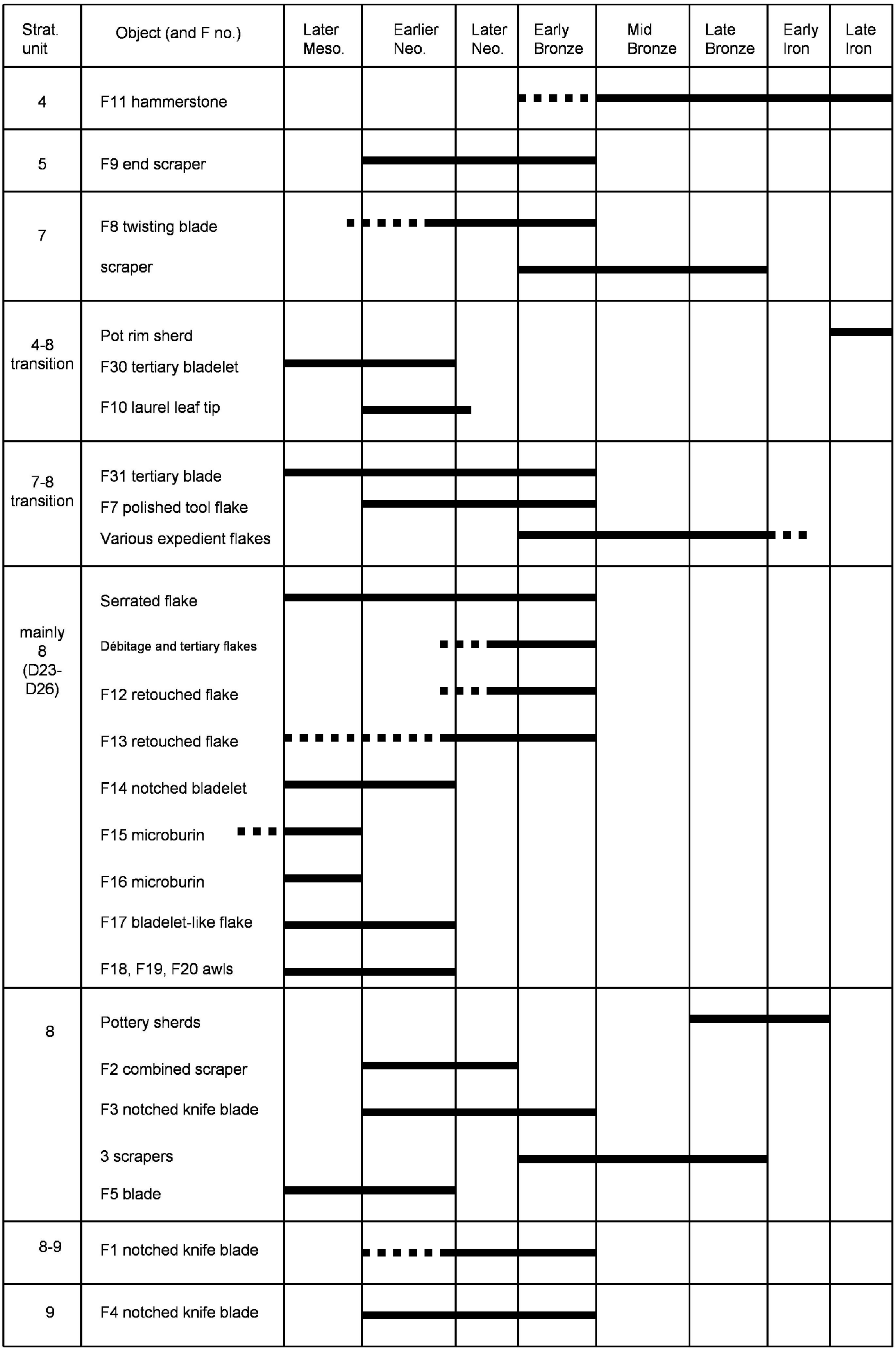

Table 1: Vertical distribution and approximate horizontal time ranges for some diagnostic flints and pottery sherds in infill of west wall of the pit, beds 4-9.

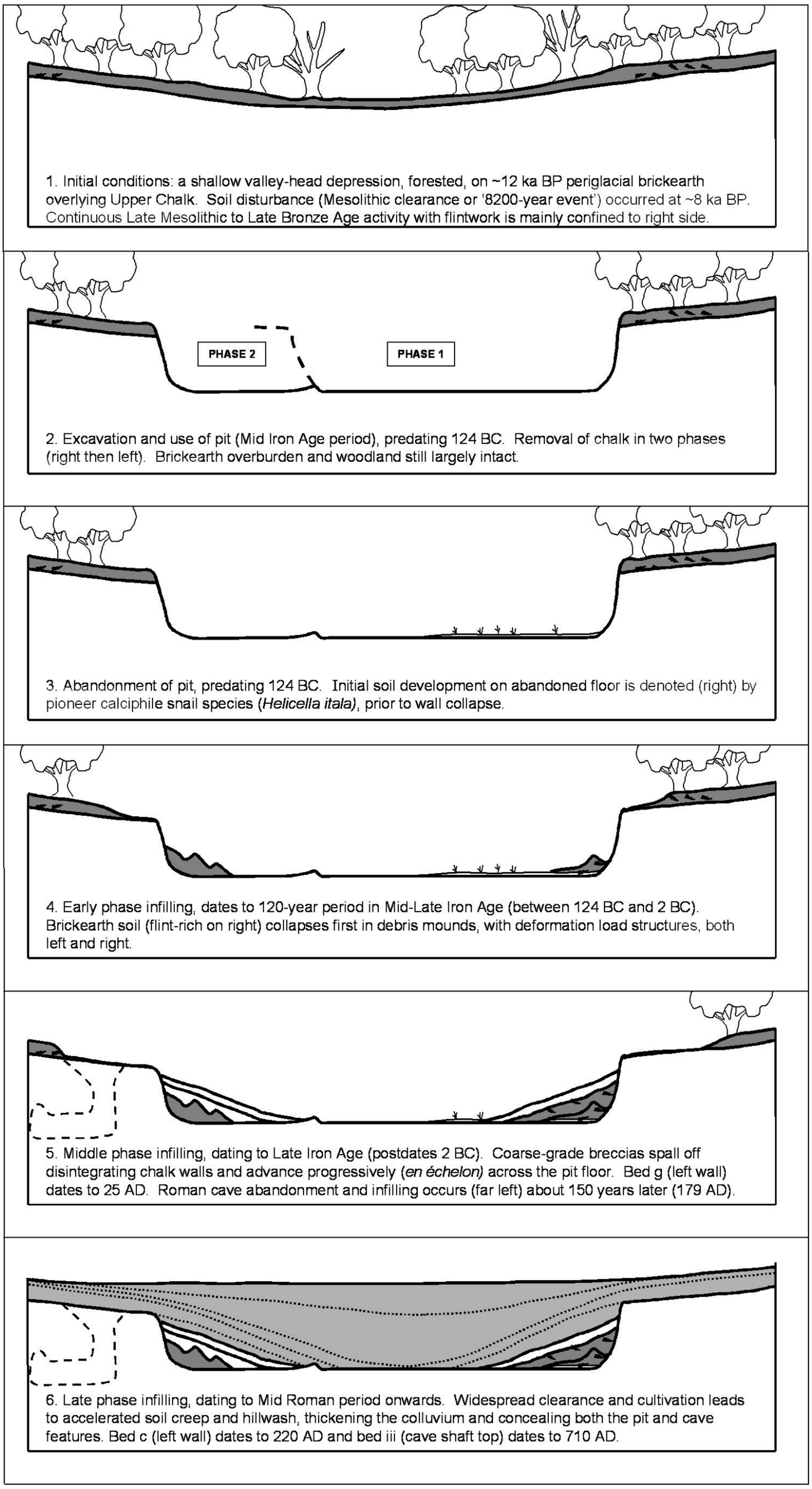

Figure 14: Proposed cut-and-fill sequence for the Iron Age pit.

There is abundant evidence for chalk digging throughout Thanet; well shafts, pits, ditches and hollows are widespread, many of which could have been cut deliberately for chalk or flint extraction. Deneholes have already been mentioned. At Vale Road, Broadstairs, Moody (2007) describes several large pits cut into solid flint-free chalk with infills of late 2nd century date. Late Iron Age quarry pits have also been reported from between Westwood and Margate, and at Dumpton Gap (Moody, 2008, p.136). These observations point to a tradition of chalk quarrying, use and trade in Thanet throughout the Iron Age and Roman period. Chalk was not only a source of builders' lime and farmers' marl, but also (in its hardest form) useful constructional material. It might also have been used locally as a plaster (Boast and Gardner, 2006). Cross-channel trade in stone was also in place by the mid-Roman period. In *Collectanea Antiqua* vol 6 (Smith, 1868 p 247) Charles Roach Smith gives a revealing description of the Romano-British stone trade:

> 'There is an interesting inscription which should not be forgotten in connection with British chalk and marl. It is a dedication by a successful dealer in British chalk who, in consequence of having prosperously imported in the low country now known as Zealand (where the inscription was found) his freights of chalk, discharged his vows to the goddess Nehalennia'.

Dating to the 2nd or 3rd century,160 votive altars to the Germanic or Celtic goddess Nehalennia have been discovered within the Dutch province of Zeeland; they were placed to show gratitude for a safe passage across the North Sea and were often linked to the cross-channel stone trade (Jenkins, 1956; Lendering, 2002). Earlier, the Greek geographer Strabo (*Geographica* vol 4, chapter 5, writing about 20 BC) observed Late Iron Age trade, recording that Britain was exporting 'grain, cattle, gold, silver and iron' to the mainland, as well as 'hides, slaves and hunting dogs' but with no reference as yet to the stone trade implied by the later Nehalennia inscriptions. It is within this Iron Age context that chalk was almost certainly being quarried commercially in the Manston area as a sought-after local commodity serving the local community; export to the continent, however, may not yet have become established at that stage. Quarried commodities within Kent, such as brickearth, salt and marcasite iron ore were in common circulation (Champion, 2007), and to this list chalk should be added as another valued raw material. Such commercial activity can be confidently dated to before 124 cal. BC, the earliest recorded radiocarbon date within the Spratling Court Farm pit.

Synthesis of dating evidence

Eight age determinations (four radiocarbon and four OSL) from the Spratling Court Farm excavations are summarised in Figure 15.

The relationship between the true ages of the cave and pit features and the much older, seemingly anomalous, dates of the residual brickearth fragments is highlighted in Figure 15. Archaeological remains contemporary with the true ages are disappointingly meagre, so dating has had to rely instead on a co-ordinated radiocarbon-OSL approach supported by the faunal evidence and the indirect evidence of, for example, tool markings. On the far east (Figure 15), the cave chamber has no diagnostic evidence, except for a single saw-cut bone in unit 9 pointing to Roman butchery practice. Tool grooves on the adjacent passage wall indicate the use of a short-headed iron pick (Iron Age or Roman). Within the cave shaft, basal chalk breccias are radiocarbon-dated to AD 179, and the presence of *Helix aspersa* confirms a post-AD 100 date. Above the shaft infill, unit 3 loam is OSL-dated to AD 710. Sandwiched between these Roman and Saxon dates is the residual brickearth, unit v, OSL-dated to the Last Glacial period (~20 ka and ~12 ka BP). At the pit's eastern wall, residual brickearth unit i sits directly on the pit floor and is OSL-dated to ~12 ka and ~8 ka BP; immediately above this, unit g is radiocarbon-dated to 25 AD. One metre higher, unit c contains *Helix aspersa* and is further OSL-dated to AD 220 (Mid-Roman). At the pit's western wall, residual brickearth unit 8 is tightly time-constrained between radiocarbon dates below (124 BC) and above (2 BC), confirming Late Iron Age emplacement. Only three pottery sherds within unit 8 have Iron Age affinities. *Helix aspersa* recurs in unit 2 loam, one metre higher. Thus the combined analysis of stratigraphy, palaeoecology and archaeology, constrained by four radiocarbon ages on vertebrate remains and four OSL ages on brickearth, reconstructs a palaeo-record spanning the Last Glacial Maximum (20 ka BP) to post-Saxon times (post-AD 710).

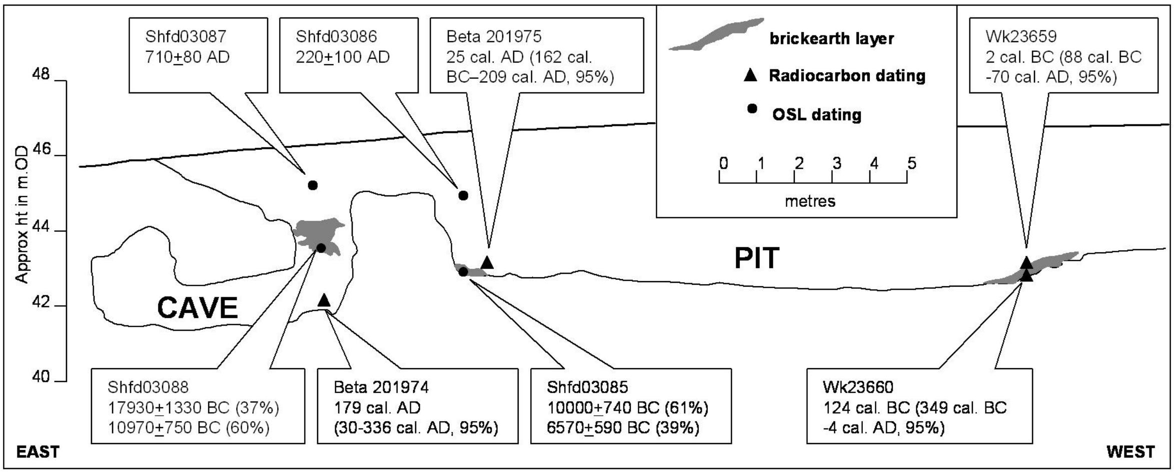

Figure 15: Synthesis of eight age determinations in the combined cave and pit profile. Note that all dates are standardized to calender years BC/AD.

Age-depth relationships (Figure 16) derived from these radiocarbon and OSL dates allow mean colluvial accumulation rates to be estimated. An overburden of brickearth was the first to collapse, followed by chalk breccias spalling off the disintegrating rock walls at a mean rate of 0.60cm/year. Later Roman soil built up at a more measured rate of 0.20cm/year, with a slower pace of 0.12cm/year in the post-Saxon period. Overall, a mean accumulation rate for the complete sequence appears to be 0.20cm/year over the last 2000 years. Together these figures represent the rate of natural soil infilling expected in shallow chalk pits with a thin brickearth overburden, located on gently sloping ground within the central Thanet area.

Conclusions

A pre-settlement land surface, developed on periglacial (Devensian) brickearth provided the initial postglacial (Holocene) conditions for human occupation in Thanet. Brickearth locally consisted of a mixture of wind-blown coversand and loess that was laid down under treeless tundra conditions between 20 ka and 12 ka BP. As climatic conditions improved, woodland was established over an interval of about 4000 years. Mesolithic presence was potentially the first to make any significant impact on the local landscape at around 8 ka BP (6000 BC); this is recorded both in OSL dating and in residual flintwork. However, a natural climatedriven hypothesis of hazelwood dieback accompanied by dustbowl conditions is preferred for this ‘8200 Year Event’ horizon. Another lengthy period of 4000 years followed in which a continuity of occupation was played out on the brickearth land surface. This is recorded in a broad flint assemblage exhibiting a diversity of tool types, workmanship and age, spanning the Later Mesolithic to Late Bronze Age. Small in number, these flint clusters point to no more than a local activity focus with flintwork sourced from a number of important settlement sites in the immediate surroundings. Iron Age flintwork and pottery are surprisingly rare. A measure of local, but probably not wholesale, deforestation is implied since the old brickearth soil continued to survive.

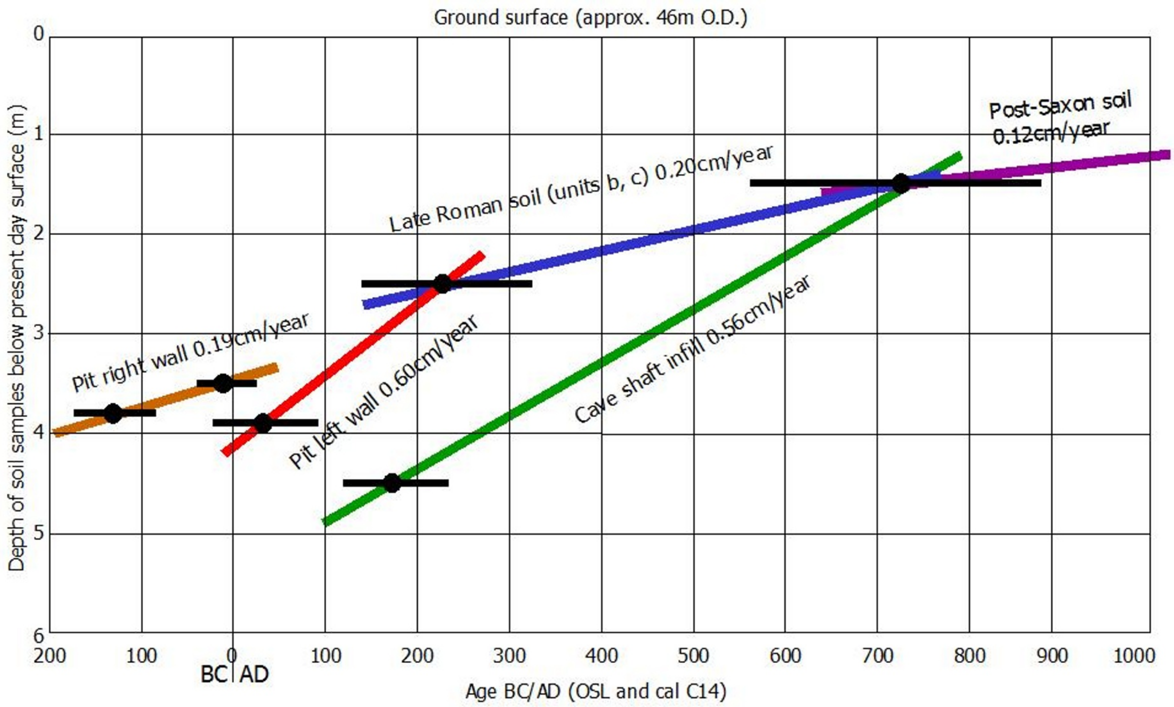

Figure 16: Age-depth relationships showing colluvial accumulation rates in both cave and pit infills; the combined data equate to a mean rate accumulation rate of 0.2cm per year (20 cms per century) within the last 2000 years

In the Mid to Late Iron Age, the area was selected for commercial chalk quarrying, after which (by 124 cal. BC) diggings were abandoned, and began to infill naturally. A further 300 years on, this neglected and still-wooded part of the Thanet ridge was used again, this time as the site of a possible Early Roman pit shrine, which in turn was abandoned (by 179 cal. AD), abandonment perhaps being symbolically marked by structured deposition of animal remains. As each feature fell out of use, surrounding walls of unsupported overburden brickearth collapsed in and became buried within the thickening fills. Limited woodland clearance may have accompanied these developments; microfauna and mollusca record denning and nesting activity within surface depressions in a dry chalk grassland habitat. Wholesale woodland clearance was only completed later, in the Late to Post Roman period. This caused significant loss of soil, lowering the ground surface by between one and two metres, removing most of the remaining original brickearth, and resulting in up to three to four metres of colluvium accumulating in sediment traps,such as the pit, at a rate of about 0.2 cm per year. In the Late Roman (AD 220) and Saxon (AD 710) periods further aeolian events may have occurred, reactivating the last vestiges of surface sand that finally became incorporated into the plough layer. Table 2 summarises this full environmental reconstruction based on the combined cave and pit evidence obtained from Spratling Court Farm.

Event	Stratigraphy	Palaeoecology	Archaeology	Dating OSL and C14	Interpretation
Post-Roman activity	Plough layer and decalcified loam	-	Charcoal, bone fragments and daub flecks	OSL: 710±80 AD	Intensive medieval (Saxon) rural land-use; OSL signifies an aeolian event
Late Roman colluviation	Sandy loams	Mollusca; bones of horse, cow, pig, sheep	Midden debris- oyster, mussel, and charcoal	OSL: 220±100 AD	Dry chalk grassland habitat; thick colluvial accumulation; possible butchery waste; OSL signifies an aeolian event
Late Roman soil erosion	Erosional horizon	-	-	-	Late woodland clearance; surface lowering of c.1-2 m
Mid Roman – later cave infill	Doline infilled; shaft residual brickearth and slump structure	Microfauna and mollusca; bones of horse, cow, pig, sheep, deer	One saw-cut bone (Roman?)	(*H. aspersa* post-100 AD)	Dry chalk grassland in shallowing depressions with nesting/denning and possibly butchery waste; sand overburden collapse into shaft
Mid-Early Roman – earlier cave infill	Basal breccias	Microfauna and mollusca; bones of cow and horse	-	(*H. aspersa* post-100 AD) C14: 179 cal AD	Structured deposition; cave abandoned; spoil tips dislodged and internal wall collapse
Early Roman activity	Cave outline	-	Tool marks on passage wall (Roman?)	-	Cave cut and used pre-179 AD
Late Iron Age – early pit infill	Residual brickearth and slump structure	Horse, cow and vole bones; *Helicella itala,* pioneer calciphile	-	C14: 25 cal AD C14: 2 cal BC C14: 124 cal BC	Pit abandoned; soil development on floor; sand overburden collapse; rock wall disintegration
Mid-Late Iron Age activity	Pit outline	-	Grog-tempered pot rim sherd and flint-tempered sherds; flint hammerstone	-	Pit cut and used pre-124 BC
Bronze Age	Residual brickearth	-	Scrapers, retouched flakes, expedient tools	(Beaker burials- C14: 2350-1922 BC)	Activity focus on brickearth
Neolithic	Residual brickearth	-	Scrapers, serrated flake, notched knives polished tool flake, laurel leaf blade flake	(Weatherlees- C14: 3505-3350 BC) (Pegwell Bay- C14: 5540-4490 BC)	Activity focus on brickearth Weatherlees date records LN woodland; cf. Pegwell Bay date records EN clearance
Later Mesolithic (Earlier Neolithic?)	Residual brickearth	-	Microburins, awls, narrow blades and bladelets	-	Activity focus on brickearth
'8200 Year Event' (6200 BC)	Residual brickearth	-	-	OSL: 8.57±0.59 ka	Hazelwood dieback; dustbowl sand reactivation and drought; possible local Mesolithic exodus
Early Holocene (12-8 ka BP)	(inferred)	-	-	-	Postglacial climatic warming; woodland established on brickearth surface
Last Glacial Maximum periglacial phase (~20 -12 ka BP)	Residual brickearth (coversand and loess)	-	-	OSL:12.97±0.75 ka OSL:12.00±0.74 ka OSL:19.93±1.33 ka	Treeless tundra with aeolian deposition, correlating with the Grenham Bay and Brooksend coversands

Table 2: Summary of palaeoenvironmental reconstruction from the combined pit and cave colluvial fills.

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Access to archives

Copies of the main report are avaiable from the Trust for Thanet Archaeology (sales@thanetarch.co.uk), also a full flint review by Paul Hart. Original archive material including flint, pottery and faunal finds are held at the Trust for Thanet Archaeology, The Antoinette Centre, Quex Park, Birchington, Kent, CT7 0BH.

References

Allen, T.L. and Green, C. 2003. *An assessment of archaeological works on land north-west of the "Loop", Manston.* Unpub. report, Canterbury Archaeological Trust.

Alley, R.B., Mayewski, P.A., Sowers, T., Stuiver, M., Taylor, K.C., Clark, P.U., 1997. Holocene climatic instability: a prominent, widespread event 8200 years ago. *Geology* 25, 483–486.

Antoine, P., Catt, J., Lautridou, J-P.,and Somme, J., 2003. The loess and coversands of northern France and southern England. *Journal of Quaternary Science,* 18, 309-318.

Baker, C.A., 2010. *Excavations of an Iron Age pit and Roman cave at Manston in the Isle of Thanet.* Unpub. report, Trust for Thanet Archaeology.

Baker, C.A. and Bateman, M.D., 2010. The residual coversand deposits of central Isle of Thanet, Kent, UK. *Quaternary Newsletter,* 122, 16-34

Bateman, M.D. and Godby, S.P., 2004. Late Holocene inland dune activity in the U.K: a case study from Breckland, East Anglia. *The Holocene,* 14, 579-588

Beck R., 2006. *The Religion of the Mithras Cult in the Roman Empire. Mysteries of the Unconquered Sun.* Oxford University Press.

Bennett, P., 1995. *Monkton: Roads to the Past.* Unpub. report, Canterbury Archaeological Trust.

Bennett, P., Clark, P., Hicks, A., Rady, J. and Riddler, I. 2008. *At the Great Crossroads. Prehistoric, Roman and medieval discoveries on the Isle of Thanet 1994–95.* Canterbury Archaeological Trust.

Boast, E.J. and Gardner, O.W., 2006. *1 Seacroft Road, Broadstairs, Kent, Archaeological Report.* Unpub. client report, Trust for Thanet Archaeology.

Boast, E.J., Gardner, O.W., and Moody, G.A., 2006. *East Kent Community NHS Health Trust Medical Centre, Manston Road, Ramsgate.* Unpub. report, Trust for Thanet Archaeology.

Burchell, J.P.T., 1949. *Archaeological Newsletter,* 2, 3 (quoted in KCC Historic Environment Records, www.kent.gov.uk/ExploringKentsPast)

Champion, T., 2007. *Prehistoric Kent*. Chap 4 in The Archaeology of Kent to AD800 (ed. John H. Williams). East Lothian, Boydell Press.

Dowker G., 1877. On a cave near Margate. *Archaeologia Cantiana,* vol XI p.126-7

Hammond, J., 2007. How Kent's recently discovered Causewayed Enclosures impact on our understanding and interpretation of the Early Neolithic in the region. *Archaeologia Cantiana*, 127, 357-382.

Hart, P.C., 2010. Appendix II: Flint report and Appendix III: Pottery Report. In Baker, C.A., 2010, *Excavations of an Iron Age pit and Roman cave at Manston in the Isle of Thanet.* Unpub. report, Trust for Thanet Archaeology.

Hearne, C., Perkins, D.R.J. and Andrews, P., 1995. The Sandwich Bay Wastewater Treatment Scheme Archaeological Project 1992-1994. *Archaeologia Cantiana*, 115, 239-354

Jenkins, F. 1956. Nameless or Nehallenia. *Archaeologia Cantiana* 70, 192-200

Klein, W.G., 1928. Roman temple at Worth, Kent. *Antiquaries Journal,* 8, 76-86

LeGear, R.F., 1992. *The Bexley Deneholes.* Bexley Libraries and Museums Department, London Borough of Bexley

Lendering, J., 2002. Nehalennia. Available at www.livius.org/ne-nn/nehalennia

Millett, M., 2007. *Roman Kent.* Chap 5 in The Archaeology of Kent to AD800 (ed. John H. Williams). East Lothian, Boydell Press.

Moody G.A., 2004. *Land adjacent to Preston Park Caravan Site, Spratling Street, Manston, Kent. Archaeological Evaluation Report*. Unpub. client report, Trust for Thanet Archaeology.

Moody, G.A., 2007. *Proposed Residential Development, Land at Upton House, Vale Road, Broadstairs, Archaeological Report.* Unpub. client report, Trust for Thanet Archaeology.

Moody, G.A., 2008. *The Isle of Thanet from Prehistory to the Norman Conquest.* Tempus Publishing Ltd.

Murton, J.B., Bateman, M.D., Baker, C.A., Knox, R., and Whiteman, C.A., 2003. The Devensian periglacial record on Thanet, Kent, U.K. *Permafrost and Periglacial Processes*, 14, 217-246.

Parfitt K., 1986. The Deal Man. *Current Archaeology*, 101, 167-168

Parfitt K., 1991. Deal. *Current Archaeology*, 125, 215-220

Perkins, D.R.J., 1980. *Lord of the Manor (Ozengell), Ramsgate.* Isle of Thanet Archaeological Unit, Interim Excavation Reports 1977-1980

Perkins, D.R.J., 1982. A Thanet catacomb. *Bygone Kent*, 3, 8, 469-472

Perkins, D.R.J., 1985. The Monkton Gas Pipeline: phases III and IV 1983-84. *Archaeologia Cantiana,* 102, 43-69.

Perkins, D.R.J., 1991. *The archaeological evaluation of a development site at Spratling Court Farm, Manston, Ramsgate,* 1991. Unpub. client report, Trust for Thanet Archaeology.

Perkins D.R.J., 1997. Thanet Reach Business Park site, St. Peter's, Broadstairs. *Archaeologia Cantiana*, 117, 229.

Perkins, D.R.J., 2001. The Roman Archaeology of the Isle of Thanet. *Archaeologia Cantiana,* 121, 43-60

Poulton, R., 2006. *A Mesolithic site at North Park Farm, Bletchingley.* Available at www.surreycc.gov.uk/sccwebsite/sccwspages.nsf

Rady J., 2009. *Thanet Earth, Monkton.* Canterbury's Archaeology, 2007-2008, 32nd annual report of the Canterbury Archaeological Trust.

Ramsey, C.B., 2007*, OxCal Program 4.0.* Available at http://www.rlaha.ox.ac.uk/ oxcal

Russell, M., 2000. *Flint mines in Neolithic Britain.* Tempus Publishing Ltd.

Short, B., 2006. *England's Landscape: The South East.* English Heritage.

Simmons, I.G., Dimbleby, G.W. and Grigson, C. 1981. *The Mesolithic.* In Simmons, I.G. and Tooley, M.J., editors, *The environment in British prehistory.* Duckworth.

Smith C.R., 1868*. Collectanea Antiqua*, vol. 6, 247

Weir, A.H., Catt, J.A. and Madgett, P.A. 1971. Postglacial soil formation in the loess of Pegwell Bay, Kent*. Geoderma,* 5, 131-149