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# Charlton Sand Pit (Gilbert's Pit), Kent

[TQ 419 786]

## Highlights

Charlton Sand Pit is the best remaining section in the Lambeth Group strata in the London area. Here, Palaeocene sediments rest unconformably on the Chalk. Various facies of the Thanet Sand Formation and the Woolwich Formation are exposed whilst the presence of the Blackheath Beds, now rarely seen elsewhere, further enhances the value of the site.

## Introduction

Charlton Sand Pit (grid reference [TQ 419 786]), known also as Gilbert's Sand Pit, in Maryon Park, Greenwich, comprises a long disused sand pit in which a succession of Palaeogene strata comprising the Thanet Sand Formation, the Upnor Formation and the Woolwich Formation (both formerly considered as the Woolwich Beds) and the 'Blackheath Beds' occur above an unconformable contact with the Upper Cretaceous Chalk.

The exposures, widely recognized as the finest of their type in the London area, have attracted the attention of geologists since the middle of the 19th century. Following an early section of the pit produced by Prestwich (1854a), Lavis (1876) compared the 'Lower London Tertiaries' exposed at Charlton with those at Lewisham and made some perceptive observations on both the conditions of deposition and sources of sediment. Charlton has been visited on many occasions by the Geologists' Association, whose earliest recorded excursion was documented by Lobley (1881). Subsequent visits by the Association are recorded in a number of field meeting reports (Holmes, 1895; Leach, 1908, 1915, 1920, 1930, 1939; Pitcher, 1948; Epps, 1950, 1956). Later work on the site was undertaken by the Tertiary Research Group and recorded by Rundle (1970b, 1972), whose later paper includes a comprehensive review of the literature. References to the site are made also in Gamble (1982) and in Ellison (1983), who referred to the locality as a classical Tertiary exposure. The reference to Charlton Brickpit in Costa and Downie (1976) is thought to refer to this locality.

## Description

The lower part of the Palaeogene succession in the pit, including the contact with the Chalk, is presently obscured but it provides the best outcrop at this stratigraphical level in the area where the formerly named Woolwich Beds were originally defined (Figure 3.17).

## Lithological succession

The succession (Figure 3.18) comprises less than 20 m of sediments. The Thanet Sand Formation comprises somewhat glauconitic sands. The Lambeth Group (now the Upnor Formation and the Woolwich Formation) are some 10.4 m in thickness. This unit commences with sands, glauconitic below but brown and yellowish-weathered above. Next, comes the mud with numerous shells of the 'Woolwich Shell Bed' and above, the heterolithic 'Leaf Bed of Lewisham', comprising sands, muds and lignitic lenses. The top of the succession is completed by up to 3 m of flint-pebble conglomerate comprising the Blackheath Beds.

## Thanet Sand Formation

This unit comprises a fine glauconitic slightly silty sand lacking a macrofauna. Although presently unexposed, its base rests upon an eroded surface of the Chalk, the contact being marked by the celebrated 'Bullhead Bed'. The latter comprises (as at other localities) unabraded, green-coated flint nodules whose shape probably reflects in-situ dissolution of the Chalk.

## Lambeth Group

The beds above the Thanet Sand Formation comprise the best extant exposure of the 'Woolwich Beds', a unit assigned by Hester (1965) to the Woolwich and Reading Beds Formation but now divided into the Upnor Formation and the Woolwich Formation, part of the Lambeth Group of Ellison *et al.* (1994). According to a geological site description published by the Nature Conservancy Council (1987), Charlton Sand Pit is the type locality for the Woolwich Beds, whilst of the six component lithofacies of the Woolwich and Reading Beds described by Ellison (1983), five are represented here. For two of these, the 'Shelly clay' and 'Laminated sand', Ellison (1983) considers Charlton Sand Pit as the best representative section.

Stratigraphically, the Lambeth Group at Charlton may be considered to consist of four units. The lowest comprises the 'Woolwich Bottom Bed', glauconitic sands, with well-rounded flint pebbles at their base, now called the Upnor Formation. The remaining three units above comprise part of the Woolwich Formation, for which the pit is the type section (Ellison *et al.*, 1994). The first comprises sands, brown and yellow-weathered above. This is followed by the Woolwich Shell Bed ('Shelly clay' of Ellison, 1983) which contains a restricted fauna of molluscs, particularly *Brotia*, *Corbicula*, *Ostrea* and *Tympanotonus*. Above, is the Leaf Bed of Lewisham ('Laminated sand' of Ellison, 1983), comprising wavy and lenticular bedded fine sands and silty clay. Bioturbated thicker beds also occur. *Ophiomorpha* is the principal trace fossil, with the molluscan fauna confined to *Corbicula*. Lavis (1876) found terrestrial plant fossils at this horizon.

## Harwich Formation

The highest unit in the pit comprises the Blackheath Beds, which Ellison (1983) considered as part of the Woolwich and Reading Bed Formation but which Ellison *et al.* (1994), whilst reiterating the uncertainty regarding their stratigraphical relations, have more recently placed in the Harwich Formation. This unit comprises black, well-rounded flint pebbles typical of the Blackheath Beds in a matrix of silty fine sand. Shelly lenses occur in places. The base of this pebble bed is erosive and irregular.

## Biostratigraphy

All the strata in the pit above the unconformity are considered to be of Palaeocene age. Costa and Downie (1976, p. 600) found *Apectodinium* (formerly *Wetzeliella*) *hyperacantha* in the Woolwich Beds of Charlton 'Brickpie, which is assumed to be this locality.

## Interpretation and evaluation

Charlton Sand Pit is the best and most complete existing exposure of pre-'London Clay' Palaeogene rocks in the London area.

## Age of the succession

The presence of *A. hyperacantha* in the Woolwich Beds confirms an Upper Palaeocene age for the sequence and allows their correlation with the Landenian, the Lower Sparnacian and the upper part of the German Paläozän. Proximity to the top of the Palaeocene is emphasized by the fact that in Herne Bay and Whitecliff Bay, the top of the *A. hyperacantha* Zone lies in the basal few metres of the 'London Clay'.

## Comparison with other localities

A comparison of the section with the sequence in other pits and selected boreholes is given in Ellison (1983, fig. 2). The Thanet Sand Formation is thinner and less well-exposed than at localities further east (e.g. Herne Bay), although the 'Shelly clay' and 'Laminated sand' of the overlying Woolwich Formation are better represented here than at other localities. The 'Shelly clay' does not contain the argillaceous limestone with freshwater fossils known as the 'freshwater bed' or 'Paludina Bed' (Curry, 1958b, p. 64) found in the boreholes between Rotherhithe and Croyden (Dewey and Bromehead, 1921), at Peckham (Berry and Cooper, 1977) and on the Isle of Dogs (Ellison, 1983).

King's (1981, p. 20) reference to the rarity of good exposures of the Blackheath Beds elsewhere further emphasizes the importance of this site. This facies (the 'Pebble Beds' of Ellison, 1983) only occurs in the central part of the London Basin, with a maximum thickness of 24 m around Bromley (Ellison, 1983, p. 315). The stratigraphical relationships of the Blackheath Beds to other early Palaeogene deposits has been under consideration for many years (see discussion in King, 1981, pp. 19–20). Ellison (1983) considered these deposits as one of his six facies from the Woolwich and Reading Beds.

### **Palaeogeographical significance**

The importance of Charlton Sand Pit is reflected by an interest dating from the 19th century. It provides a record of three transgressive events: the earliest of the Palaeogene transgressions (the Thanetian), a second evidenced by the Upnor Formation (Woolwich Bottom Bed) (the 'Landenian'), and a third perhaps more geographically restricted one represented by the Blackheath Beds.

Whilst the Thanet Sand Formation and the Upnor Formation are clearly marine in origin (see discussion elsewhere), the Woolwich Formation represents less saline waters. The 'Woolwich Shell Bed' consists almost entirely of brackish water shells whilst the overlying 'Leaf Bed of Lewisham' indicates a closeness to land. Lavis (1876) noted that whilst an aquatic flora occurred at Lewisham, terrestrial plants were present here. Ellison (1983, p. 314) saw this unit as representing a back barrier lagoon. Also, it may be that at some stage, freshwater conditions were established here, for King (pers. comm.) has pointed out that the freshwater 'Paludina Bed' is from a higher level in the formation and that its absence at Charlton reflects erosion in pre-Blackheath times.

The erosional relationship of the Blackheath Beds developed in Charlton Sand Pit and more extensively elsewhere is thought to represent the accumulation of this pebbly facies in tidal channels and associated barrier complexes (cf. Ellison *et al.*, 1994).

### **Conclusions**

Charlton Sand Pit is the finest and scientifically most important Palaeogene site in the south London area.

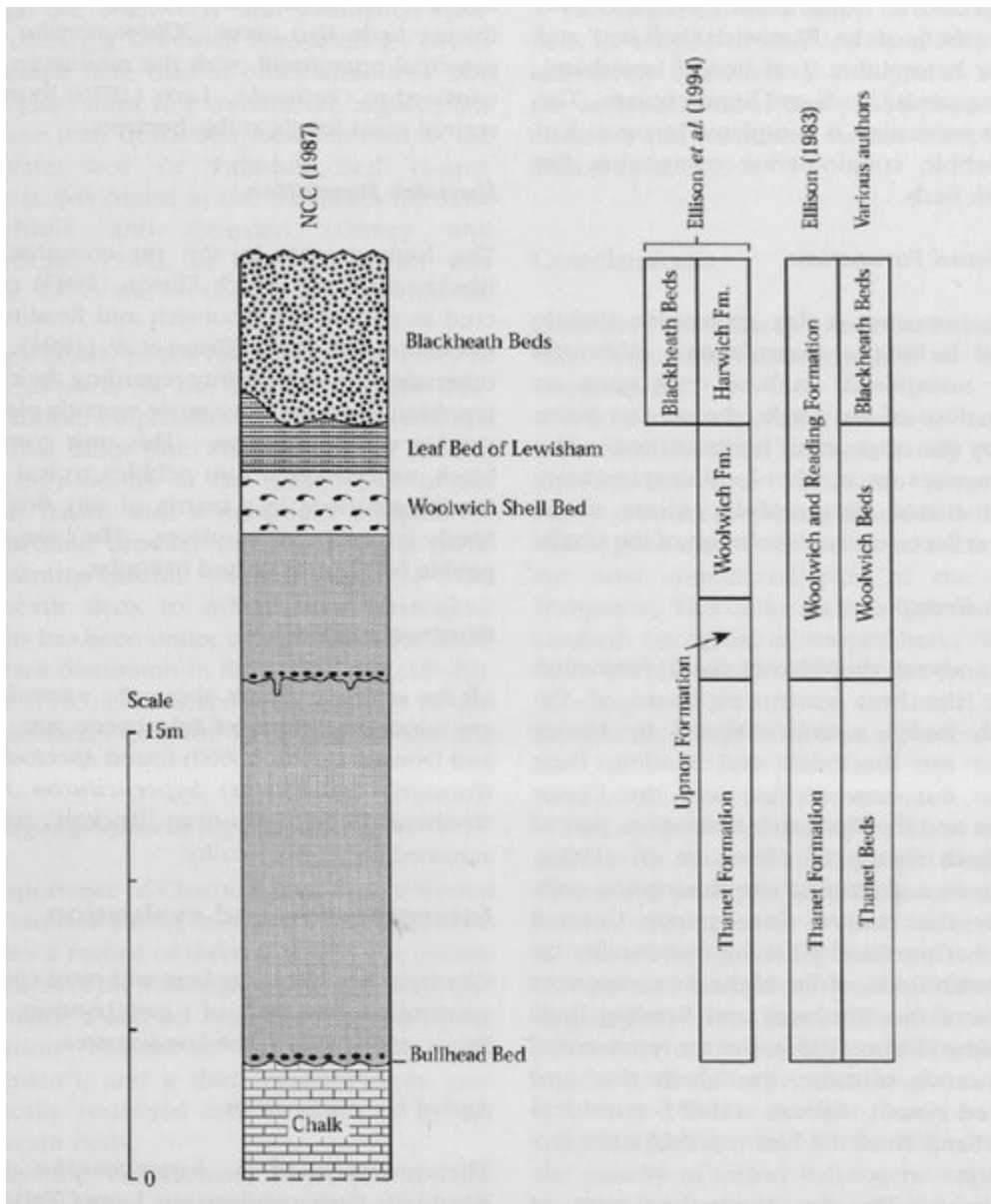
It is of particular value since it contains a varied succession of the Lambeth Group (Woolwich and Reading Beds Formation *sensu* Hester, 1965) plus the overlying Blackheath Beds, for which good exposures are now rare and which are now considered part of the Harwich Formation. Five of the six main lithofacies in the Lambeth Group are developed here. Whilst the often purple to red mottled clays typical of the 'Reading Beds' to the west are absent, the pit is thought to provide the best representative section for the 'Shelly clay' and the 'Laminated sand' of the Woolwich Formation.

The site provides one of the finest records of Palaeocene times in south-eastern England and the earliest examples of the transgressive cyclic pattern, which goes on to characterize the whole of the Palaeogene succession in both the London and Hampshire basins. It provides an opportunity for continuing research into Palaeocene environments, including palaeontological work on the prolific though taxonomically restricted faunas thought to represent essentially brackish waters. Furthermore, in view of the paucity of inland Palaeogene exposures in the London area, its potential for educational purposes should not be underestimated.

### **References**



*(Figure 3.17) Charlton Sand Pit, Maryon Park, Greenwich, Kent. The 'Woolwich Shell Bed' (Woolwich Formation).  
(Photograph: B. Daley)*



(Figure 3.18) Lithostratigraphical succession of the Thanet Formation, Upnor Group and Blackheath Beds (Harwich Formation) at Charlton Sand Pit, Kent (after Nature Conservancy Council, 1987 and other authors). (Currently the contact with the Chalk is not exposed.)