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## London Clay Formation

The London Clay Formation (Thames Group; Early Eocene) is characterized by monotonous dark-grey to bluish marine mudstones, some of which are intensely bioturbated. London Clay facies are spread over the whole southern Britain basin, and represent deposition in a fairly deep sea (c. 180 m; Davis and Elliott, 1957; Curry, 1965). The London Clay is thickest in the London area (London Basin; over 160 m), although it reaches 90 m in the eastern parts of the Hampshire Basin, where the deposit is much more sandy and probably shallower in origin. The lowest few metres of the London Clay are known in the literature as the 'London Clay Basement Bed' and this unit is invariably a glauconitic and shelly sand (Curry, 1965), corresponding to deepening marine conditions following the initial transgressive pulse in Blackheath and Oldhaven Formation times.

Towards the end of London Clay times the sea shallowed, and silty sandstones of the Claygate Beds and basal Bagshot Beds (Early–Late Eocene) were laid down in the London Basin (Curry, 1965). The Bagshot Beds are in part equivalent to the lower units of the Bracklesham Group of the Hampshire Basin (see below).

The London Clay Formation (London Clay and Claygate Beds) has been divided into five zones (termed A–E) on the basis of marine molluscs, and a correlation scheme, based on lithology, micro- and macrofaunas, has been developed by King (1970, 1981, 1984). Zones A and B of the London Clay are recorded only from borehole records in the London Basin, but are well known from condensed sequences at the basin edge in Essex and south Kent, and occur in the equivalent sections of the Hampshire Basin. Divisions C (12.3 m), D (16.2 m) and E (24.8 m) comprise silty clays with silt and sand partings at some levels, and beds of sandy silt.

The Claygate Beds consist of sparsely fossiliferous alternations of marine sands and clays, and are probably laterally equivalent to the highest London Clay sequences at Highgate and Sheppey (q.v.). The overlying Bagshot Beds are composed of decalcified, sparsely fossiliferous marine sands and continental clays of the London Clay Formation and Bracklesham Group.

The London Clay in the London and Hampshire Basins is the most uniform of the Palaeogene deposits. Its macrofossils are only locally common, but include about 350 species of molluscs and representatives of a wide range of other phyla, both animal and plant. Deposition occurred in the proximity of tropical rainforest land, where a mean annual temperature of about 25°C prevailed. Abundant fine sediment flowed in almost continuously, and there were probably seasonal floating mats of vegetation offshore. Despite this, there were well-oxygenated waters, which were highly productive organically and supported a range of animal bottom communities and nekton. This encouraged the development of broad trophic (feeding) pyramids upon which are sited, at several levels, the fish taxa listed. Bulk sampling methods provide a quantifiable means of assessing the ecological structure of the London Clay fauna.

The abundant London Clay fossils include diverse molluscs (bivalves, gastropods and nautiloids), crustaceans, fishes and tetrapods, and over 500 species of flowering plants (angiosperms) and gymnosperms, both groups being represented by pollen, logs, fruits and leaves (Reid and Chandler, 1933; Chandler, 1961). Many of the marine assemblages are facies controlled and faunal content varies widely over the whole outcrop. Fossil fish finds are relatively common within all divisions of the London Clay Formation, including the glauconitic sandy Basement Bed and the sands of the Claygate Beds (Hooker and Ward, 1980). Most finds are tiny fish teeth, scales and teleost otoliths, and are usually recovered by bulk sampling of the unconsolidated sediments. Hence, although some sampling was done in the early part of the 20th century (Sheppey (q.v.): Leriche, 1905, 1921; White, 1931; A.G. Davis, 1936), most of the literature has been written in the past 30 years, and includes important references by Venables (1963), Stinton (1965b, 1975–1980), Casier (1966), George and Vincent (1977), Cappetta (1976a), Cappetta and Ward (1977) and Ward (1979, 1988).

Collections of London Clay fossil fish are in the NHM.

## Fish sites

Sporadic fish material has been recovered from many localities throughout the outcrop of the London Clay Formation in the London and Hampshire Basins, and on the Isle of Wight. However, most of these sites have only yielded fragmentary remains of one or two fish species, and thus only the more significant ones are listed below by county from the south-west to north-east (taken mainly from Hooker and Ward, 1980):

ISLE OF WIGHT: Alum Bay, cliffs and foreshore exposures (London Clay Division A, 'Basement Bed'; [SZ 305 855]; unusual shark fauna: D. Ward, pers. comm., 1995).

SUSSEX: Bognor Regis foreshore exposures (London Clay Division B, Aldwick Beds'; [SZ 920 979]–[SZ 924 983]; 76 species including otoliths, see report; Venables, 1963).

KENT: Herne Bay sea cliffs and foreshore exposures (London Clay, Division A, 'Basement Bed'–Division B, *Isselocrinus* horizon; [TR 187 683]–[TR 197 684]; over 22 species, see report; Cooper, 1978, Ward, 1979); Studd Hill, Herne Bay (London Clay Division B, *Isselocrinus* horizon; [TR 152 677]; one species; Cooper, 1978); Sheppey (London Clay Divisions D–E; [TQ 955 738]–[TR 024 717]; over 50 species, see report; White, 1931, A.G. Davies, 1936); Swalecliff foreshore (London Clay Division B; [TR 140 685]; phosphatic nodules containing partial and whole fish specimens, D. Ward, pers. comm., 1995).

ESSEX: Harwich Harbour foreshore (London Clay Division A2, Harwich Stone Band (volcanic tuff); [TM 263 317]; five species; D. Ward pers. comm., 1995); Walton-on-the-Naze sea cliffs and foreshore exposures (London Clay Division A2 (volcanic ash and marine silty clays: beds 1–11 of George and Vincent, 1977); [TM 267 243]; six species; George and Vincent, 1977); Grange Farm clay pit, South Ockendon (London Clay Division A (bed 1 of George and Vincent, 1977); [TQ 611 833]–[TQ 615 833]; six species; George and Vincent, 1977); Maylandsea foreshore and slipped river-cliff exposures (London Clay Division C; [TL 908 035]; over 20 species, see report); Burnham-on-Crouch foreshore and river-cliff exposures (London Clay Division D; [TQ 921 967]; 48 species, including 13 type specimens, see report; Cappetta and Ward, 1977).

Four sites are selected as GCR sites on the basis of their important Eocene fish faunas (the London Clay of Herne Bay, Kent, is described in the section as the pre-London Clay Tertiaries section). These are:

1. Bognor Regis, West Sussex ([SZ 920 979]–[SZ 924 983]). Early Eocene, London Clay Formation, Division B1 (Aldwick Beds').
2. Maylandsea, Essex [TL 908 035]. Early Eocene, London Clay Formation, Division C.
3. Sheppey, Kent ([TQ 955 738]–[TR 024 717]). Early Eocene, London Clay Formation, Divisions D–E.
4. Burnham-on-Crouch, Essex [TQ 921 967]. Early Eocene, London Clay Formation, Division D.

## [References](#)