Clockhouse Brickworks, Surrey

[TQ 176 383]

Introduction

This early Cretaceous site is part of a network of GCR sites (see also GCR site reports for Smokejacks and Auclaye brickworks) in the Weald Clay (*c.* 130 Ma) of southern England. It has produced an abundant (several thousand fossils), and diverse (13 orders known at present) insect fauna, including one of the earliest described social insects, a termite, along with other important faunal elements such as *Iguanodon* dinosaur remains.

Description

The site includes both a landfilled old pit (the 'Clockhouse' of the British Geological Survey reports) south of the brickworks, and new pits on the east. Some 35 m of gently dipping (1.5°N) Lower Weald Clay are exposed beneath BGS bed numbers 3a and 3 (Okehurst and Clockhouse Sands respectively, (Figure 4.61)) (Jarzembowski, 1991). The Weald Clay is mainly non-marine, but a stratigraphically significant brackish/quasi-marine or 'Cassiope' band occurs near the base of the pit and is intermittently exposed here.

Fauna

The Clockhouse Brickworks site has yielded the largest number of insect remains in the Wealden deposits (several thousand specimens) and is the main fossil insect site in the Weald. The fossil insects invariably occur in lenticles and basin casts of calcareous siltstone that are usually well cemented with cross-bedded lamination internally, and fine sole markings on the underside of the beds. This is an unusual type of preservation not found elsewhere in Eurasia. The detail on small insect fossils is best-preserved in a pale yellow, fine-grained siltstone, but a coarser, blue-grey siltstone also preserves some larger specimens. The siltstones occur between Bed 3 and the 'Cassiope' band (Gallois and Worssam, 1993) and are considered to be scour fills from turbidity flows down crevasse splays or new fluvial channels.

The insect remains include the wings and body parts of at least 13 orders:

Blattaria and Blattodea (cockroaches and cockroachoids)

Coleoptera (beetles)

Diptera (true flies)

Hemiptera (bugs)

Hymenoptera (wasps)

Isoptera (termites)

Mecoptera (scorpionflies)

Neuroptera (lacewings)

Odonata (dragonflies)

Orthoptera (crickets and grasshoppers)

Psocoptera (barklice)

Raphidioptera (snakeflies)

Trichoptera (caddisflies)

The insects are associated with burrows, conchostracan (spinicaudate) carapaces (which are commonly comminuted), ostracods, isopods, amphipod- and astacuran-like crustaceans, coprolites, fish teeth, scales, bones and egg cases, bivalves (*Filosina, Unio,* which are often fragmented), occasional gastropods (*Viviparus*) and operculae, and plant remains (wood, comminuted debris, pieces of *Weichselia* and *Bevhalstia* plus rootlets).

The insects are occasionally fusainized (charred) like plants (a few Blattodea and Coleoptera, e.g. *Coleopteron semicrematus* Jarzembowski, 2003). This pit has yielded the critical material of *Valditermes brenanae* Jarzembowski 1981 ((Figure 4.64), an internationally important genus and species because it is the most basal fossil termite and one of the earliest-known social insects (Grimaldi and Engel, 2005). Also, there is a considerable range of dragonflies (Odonata), mostly known only from this locality, including true dragonflies belonging to extinct and extant lineages such as *Coramaeschnidium minimum* Fleck and Nel, 2003, *Valdicordulia wellsorum* Jarzembowski and Nel, 1996, *?Valdaeshna andressi* Bechly *et al.,* 2001, and *Plesigomphaeschnaoides pindelskii* Bechly *et al.,* 2001.

There are 'dragondamselflies' including *Proeuthemis pritykinae* and *Mesoepiophlebia bexleyi* Nel and Jarzembowski, 1996, and *Turanophlebia anglicana* Fleck *et al.,* 2004. There are true damselflies including *Cretalestes martinae* Jarzembowski *et al.,* 1998 and *Cretacoenagrion alleni* Jarzembowski,1990 ((Figure 4.62) and (Figure 4.63)) — in its own family Cretacoenagrionidae — and even 'archaic damselflies' (Nel and Jarzembowski, 1998).

In the absence of ants, cockroaches and cock-roachoids (Blattaria and Blattodea) are numerically second only to Coleoptera (beetles). Orthoptera are represented by both main subdivisions and new species of crickets and 'grasshoppers' are described by Gorochov *et al.* (2006). Hemiptera described from here include *Penaphis woollardi* Jarzembowski, 1989, an uncommon aphid probably associated with gymnosperms, and three species of Progonocimicidae — a coleorrhynchan family with Southern Hemisphere affinity: *Yuripopovia woottoni* Jarzembowski, 1991, *Ildavia sherbakovi* and *Valdiscytina jarzembowskii* Popov in Klimaszewski and Popov (1993).

Mecoptera from here include *Antiquanabittacus nanus* Petrulevi■ius and Jarzembowski, 2004, a rare representative of the now exotic family Bittacidae (hangingflies — so-called because they hunt with their legs while suspended) as well as the more usual *Mesopanorpa* with distinctly patterned wings (Boucot, 1990). Another predator is the snakefly *Proraphidia hopkinsi* Jepson and Jarzembowski, 2008 which would have hunted insects such as *Penaphis* (above) in a snake-like manner by analogy with Holocene species. Fragile Diptera are surprisingly common and include crane-flies ('*Architipula*' *austeni* and *?Gynoplistia mitchelli* Jarzembowski, 1991) and false crane-flies (*Eoptychopterina camura* and *Zhiganka woolgari* Lukashevitch, Coram and Jarzembowski, 2001) as well as a snipe-fly (*Ptiolinites raypearcei Mostovski et al.,* 2000) and biting snipe-fly (*Athericites finchi* Mostovski, Jarzembowski and Coram, 2003). Another basal brachyceran, *Sinonemestrius akirai* Jarzembowski and Mostovski, 2000, has Chinese affinities. A non-biting mosquito (chaoborid) was figured by Coram and Jarzembowski (1998).

Hymenoptera described from here include a probable parasitoid of cockroaches (*Cretevania concordia*) plus various digger wasps (*Archisphex proximus, Angarosphex consensus, A. bleachi, ?Baissodes* sp., *?Pompilopterus worssami*, *?P. leei* Rasnitsyn & Jarzembowski in Rasnitsyn, Jarzembowski and Ross (1998). Trichoptera include two species based on imagoes, for example, *Necrotaulius mantellorum* Jarzembowski, 1991, but more significantly the first Weald Clay larval cases were described from here: *Pelindusia percealleni* and *Piscindusia sukachevae* Jarzembowski, 1995 (Figure 4.65); the latter ichnogenus is uniquely Wealden (Grimaldi and Engel, 2005).

Interpretation

The sedimentological setting in which the insects occur suggests that the remains were naturally concentrated in fills within a fluviatile environment of deposition. The insects occur in siltstone concretions whose structure indicates that they are indeed lithified current scour fills.

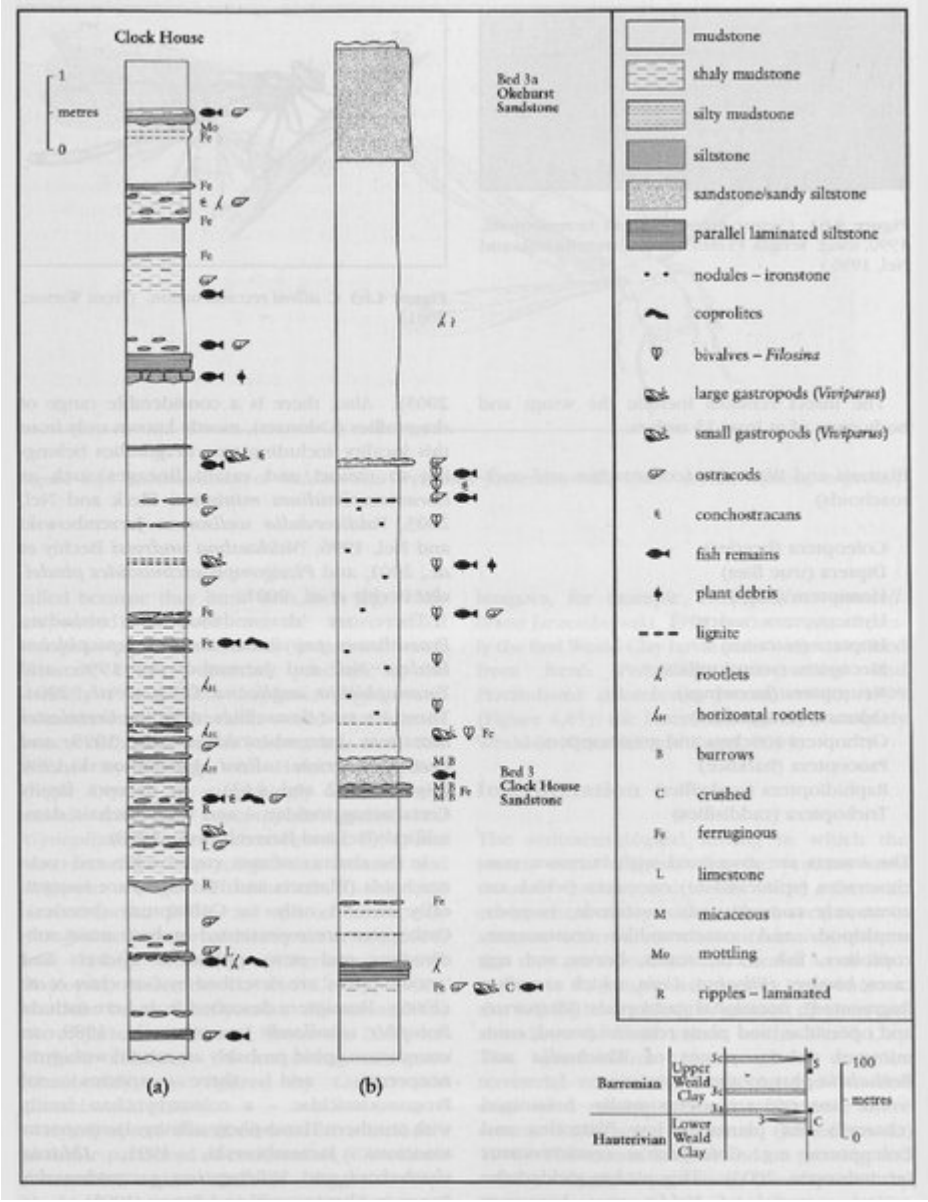
Due to its unique sedimentary environment, this locality has yielded the greatest diversity and abundance of fossil insects in the Weald Clay. The entomofauna represents a complex terrestrial community living on the wooded edge of a muddy wetland with some more remote fresh water elements (Jarzembowski, 1995). The insects lived in and on growing and rotting marginal vegetation, accompanied by their predators, parasites and scavengers.

Valditermes and other insects support the interpretation of the climate as a humid 'Mediterranean' one (Coram and Jarzembowski, 2002; Ross *et al.,* 2000).

Conclusion

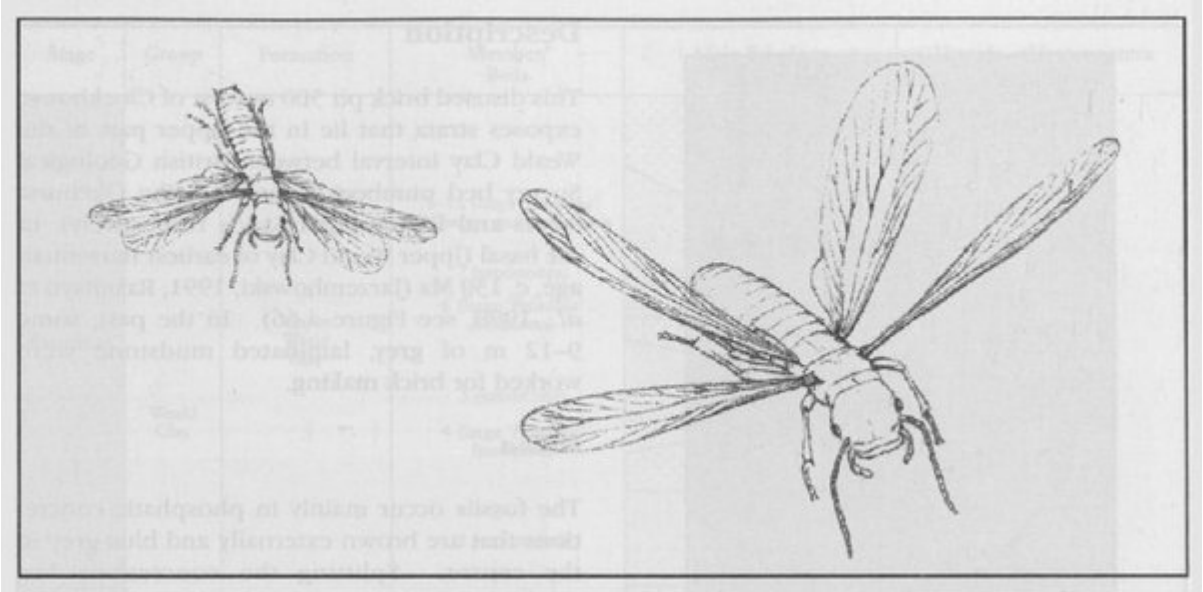
The Lower Weald Clay of Clockhouse Brickworks near Capel, Surrey is the most productive strata for fossil insects of Early Cretaceous age in southern England. The conservation value of the site lies in the abundance, diversity and scientific value of its insect fauna which includes one of the earliest records of a social insect, the termite *Valditermes brenanae.* Potential for future finds is good as the site is actively worked for brick making, and insect-bearing siltstones are regularly exhumed.

References

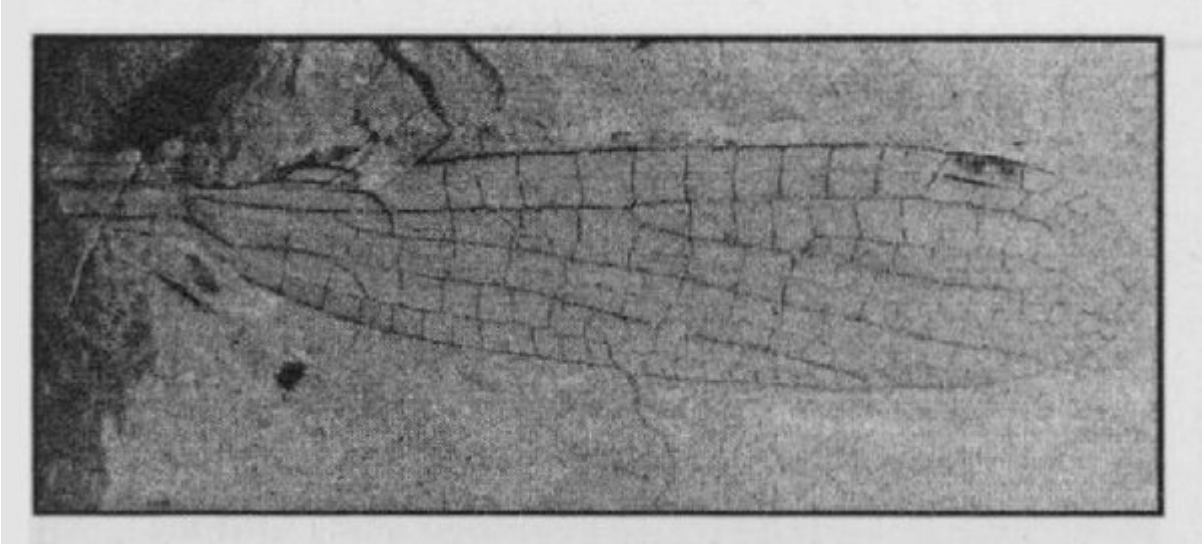


(Figure 4.61) Composite lithological log (a, b) of the upper part of the Lower Division of the Weald Clay Formation exposed in the 'new' pit at Clockhouse Brickworks, based on unpublished field notes and Horne (1988, figs 9 and 10). The beds yielding bones other than those of fish, and the colours of the deposits are not shown. Sampling horizons are

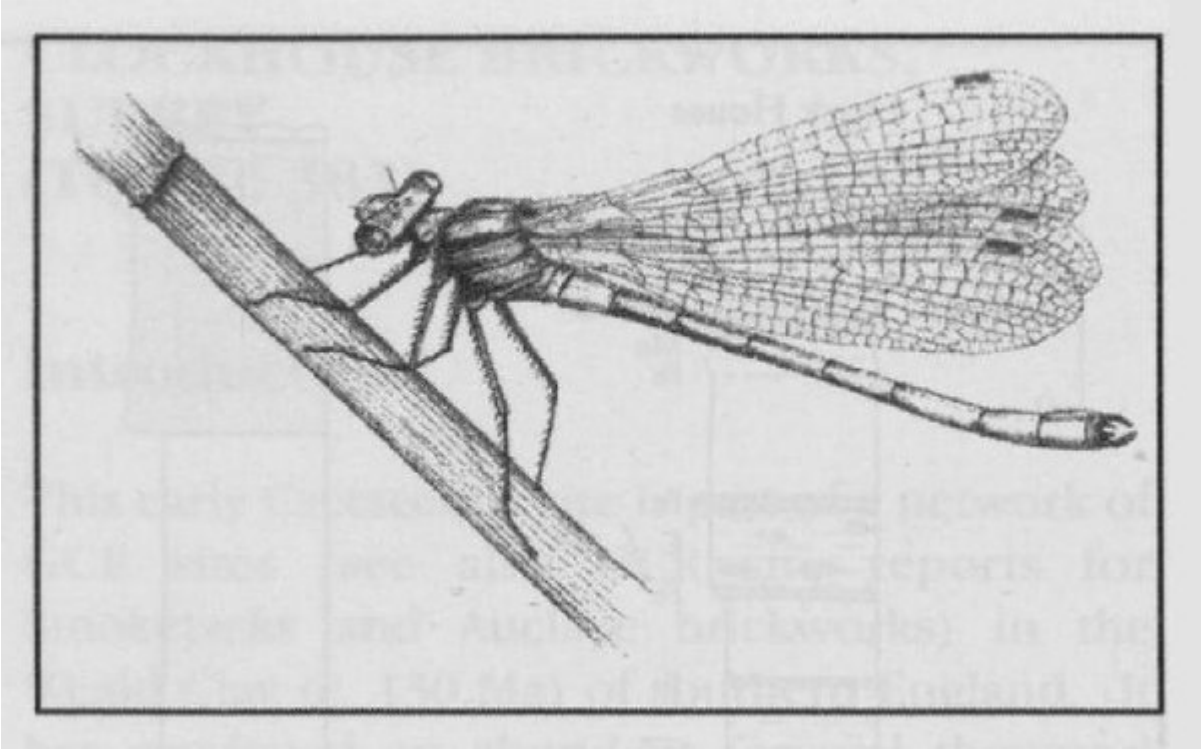
indicated on the left-hand side of the column. The inset beneath it, shows the stratigraphical location and extent of the section relative to BGS beds 3, 3a, 3c and 5c, and compared to that at Smokejacks Brickworks (S).



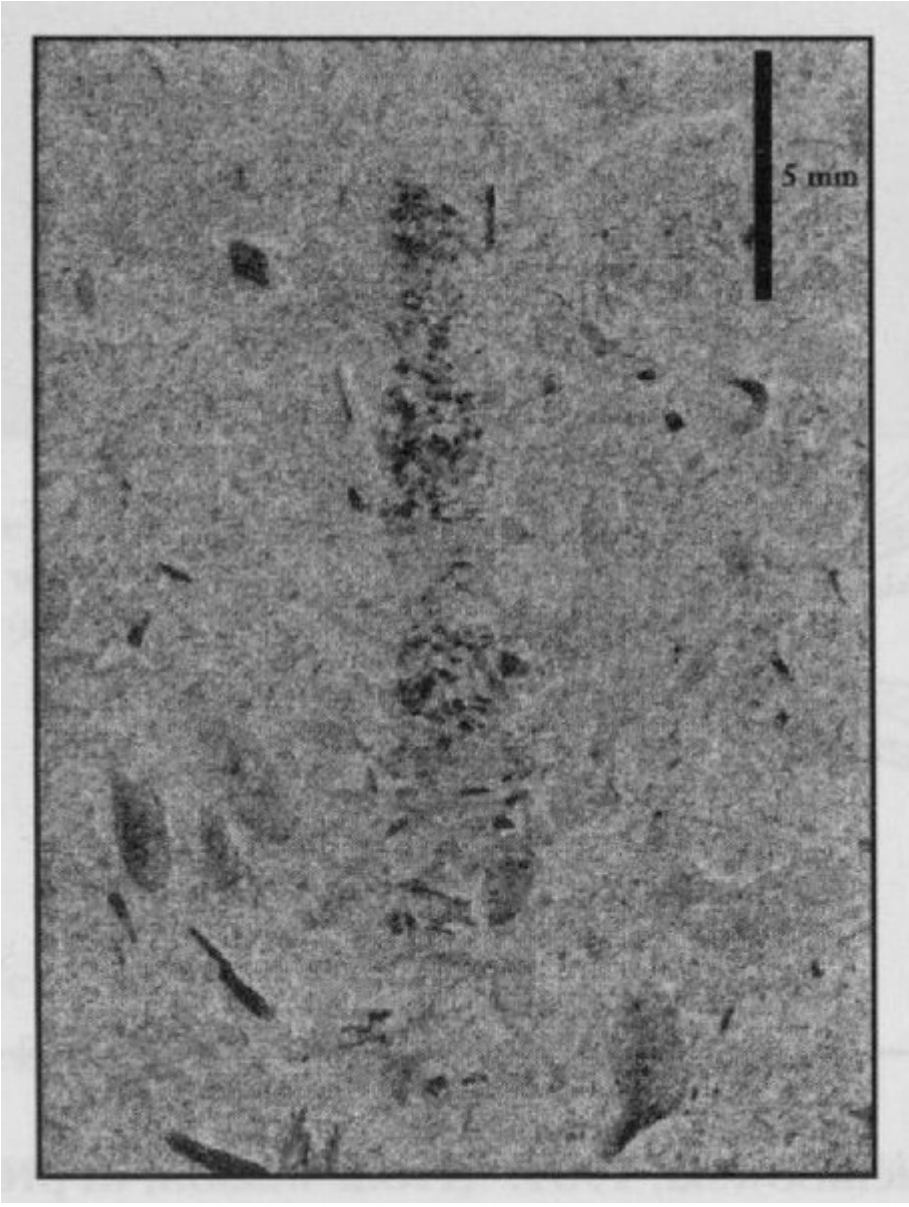
(Figure 4.64) Reconstruction of Valditermes brenanae Jarzembowski, 1981. (From Watson, in press.)



(Figure 4.62) Cretacoenagrion alleni Jarzembowski, 1990, wing. Length 15 mm. (From Jarzembowski and Nel, 1996.)



(Figure 4.63) C. alleni reconstruction. (From Watson, 2001.)



(Figure 4.65) Caddis case: holotype of Piscindusia sukachevae Jarzembowski, 1995. (From Jarzembowski, 1995.)