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# Smokejacks Brickworks, Surrey

[TQ 112 374]

## Introduction

Smokejacks Brickworks, near Ockley, Surrey (Figure 4.2) is part of a network of early Cretaceous (Wealden) GCR sites in southern England (see also GCR site reports for Clockhouse and Auclaye brickworks). The Early Cretaceous strata here are slightly younger (Barremian Stage, c. 128 Ma) than those at Clockhouse Brickworks.

The Smokejacks Brickworks pit is particularly renowned as the site of the 1983 discovery of a new genus of theropod dinosaur *Baryonyx walkeri* and the enigmatic plant *Bevhalstia pebja*. Previously, crocodylian and iguanodont remains were found in the 1950s and more recently in 2001 (Nye *et al.*, 2008). The site is not as productive for fossil insects as the nearby Clockhouse Brickworks, but nevertheless fossil insects belonging to ten different orders have been found here and are well preserved in sideritic concretions. Within the quarry there are sections through the Upper Weald Clay, which has been worked as a raw material for brick making for some time. In addition to the fossil arthropod importance of this site, the area is also selected for the GCR for the Jurassic–Cretaceous Reptilia and Wealden selection categories.

## Description

The Weald Clay is exposed in Smokejacks Brickworks as a succession of clays with subordinate sandstone of Early Cretaceous (Barremian age), lying well above the Hastings Beds.

This actively worked pit exposes 23 m of Upper Weald Clay beneath BGS bed number 5c (Alfold Sand Member) of early Barremian age, changing from dark blue-grey below to greenish-grey and reddish-brown above, associated with shoaling (Jarzemowski, 1991). A section is given by Batten (1998, (Figure 4.73)).

## Fauna

This early Barremian site is famous for having yielded the theropod dinosaur *Baryonyx walkeri* ('Claws') as well as herbivorous dinosaurs, crocodile and pterosaur bones. Insect remains commonly occur in silty ironstone (sideritic) concretions. Also found in the ironstone are burrows, plant stem/rootlet casts, clay clasts, fish fragments and egg cases, isopods, conchostracans, bivalve fragments and gastropod operculae, ostracods, plant remains including the fusainized fern *Weichselia*, conifers, and the early aquatic angiosperm *Bevhalstia pebja* (Hill & Jarzemowski, 1996). The insect remains are often concentrated in partings or thin layers and include ten orders:

Blattaria/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')

Aquatic insects include adult Odonata comprising true dragonflies like the aeschniid *Lleidoaeschnidium maculatum* Fleck & Nel, 2003 and petaluridan *Pseudocymatophlebia bennigi* Nel *et al.*, 1998 (in its own subfamily Pseudocymatophlebiinae, known only from this pit); darters are represented by the widespread *Cretaneophya strevensi* Jarzembowski & Nel, 1996a,b and damselflies by the equally widespread *Cretarchistigma greenwoodi* Jarzembowski *et al.*, 1998.

Blattodea are discussed by Ross (2001) and Orthoptera by Jarzembowski (1999, (Figure 4.74)). A true cricket, bush cricket and grasshopper are formally described and named by Gorochov *et al.* (2006). Mecoptera include undescribed 'Protomecoptera' and Hemiptera, and an unusual plant hopper (Jarzembowski, 1987). Neuroptera include a psychopsid resembling the typically Purbeck genus *Pterinoblattina* (Ross and Cook, 1995; Austen *et al.*, 2003). Hymenoptera include the parasitoid *Manlaya ockleyensis* Rasnitsyn & Jarzembowski known only from here, and the widespread digger wasp *Archisphex boothi* Jarzembowski (Rasnitsyn, Jarzembowski and Ross, 1998) (Figure 4.78). Coleoptera include basal Archostemata (*Zygadenia* [*Notocupes*]: Austen, 2005) and higher beetles (Jarzembowski and Ross, 1993, (Figure 4.75)). Diptera are uncommon, but notables include two species of biting snipe flies: *Athericites kensmithi* and *A. gordonii* Mostovski, Jarzembowski & Coram, 2003 (Figure 4.77) and (Figure 4.78) possibly associated with the vertebrates.

## Interpretation

The sedimentary environment in which the insect remains are preserved has been interpreted as representing to overbank deposits developed during a flood (Benton and Spencer, 1995, p. 234). The overall environment of deposition of the Weald Clay has been reconstructed by Allen (1976, p. 414) as an alluvial floodplain with lagoons and short-lived sand-filled channels (Figure 4.79). With links to the East Anglian Sea to the north-west, salinities varied from nearly marine to freshwater. All sediments were liable to exposure, as reflected by the presence of large dinosaur footprints in the sands, sun cracks and mudflake conglomerates, soil beds and horsetail stems in life position.

The fossil biota combines both terrestrial forms (such as the dinosaurs and trees) and aquatic (freshwater-brackish) ones such as crocodylians, fish and molluscs. The insects and other arthropods also include both terrestrial forms (such as the cockroaches and wasps) and freshwater aquatic ones (such as the ostracods and conchostracans).

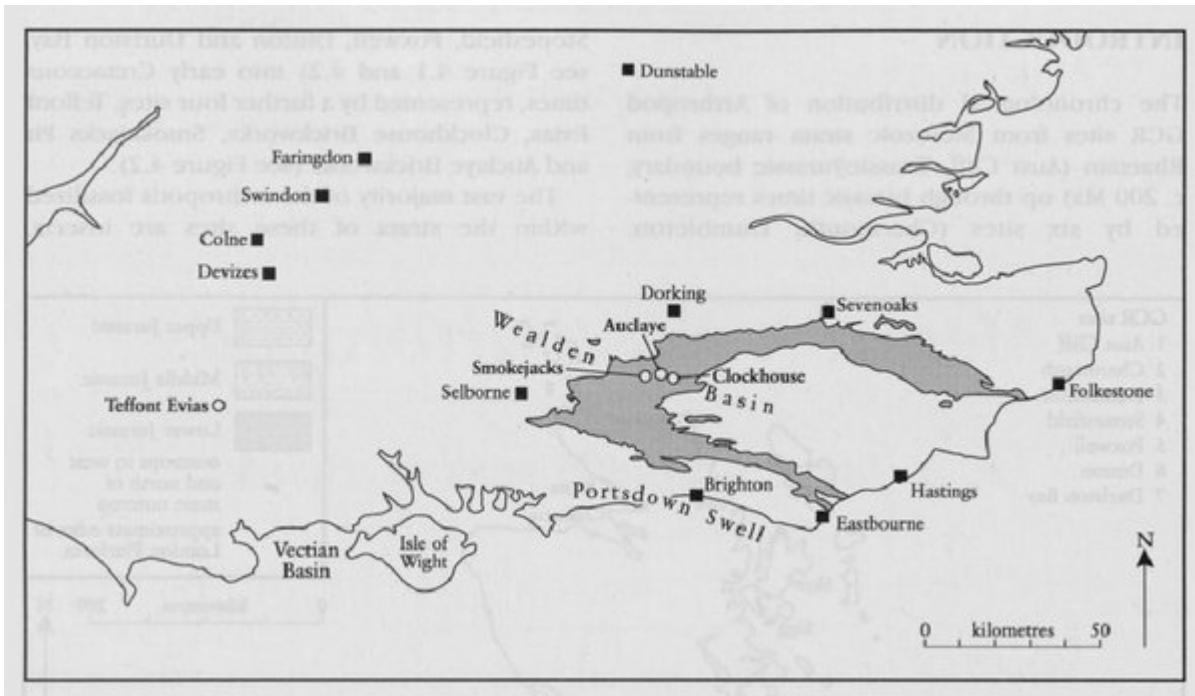
The insects are typically preserved in sideritic (iron carbonate) concretions showing more details than the siltstones at Clockhouse Brickworks (see GCR site report). Such ironstone preservation is usually associated with the Carboniferous Coal Measures or even the Lower Tertiary deposits in the UK (Chapter 5). Some insect species from Smokejacks Brickworks are widespread, for example, the orthopteran *Panorpidium bimaculatum* Gorochov *et al.*, 2006, whereas others belong to genera only known from this pit, e.g. the cricket *Speculogryllus* Gorochov *et al.*, 2006, and a problematic 'grasshopper' (Baldock, 1999). *Mesochlorogomphus crabbi* Fleck *et al.*, 2008, is a dragonfly from here uniquely in its own family, Mesochlorogomphidae. Also found is the only Weald Clay representative of the extinct neuropteran (lacewing) family Kalligrammatidae, typically known from the Solnhofen Plattenkalke Lagerstätte. Wealden Neuroptera are dominated by Psychopsidae (silky lacewings) unlike the myrmeleontoid (e.g. antlion)-dominated fauna from the arid Brazilian Lower Cretaceous (Jepson pers. comm.). A relatively humid Weald Clay climate is supported by the much more common cockroach (Blattodea) remains.

## Conclusion

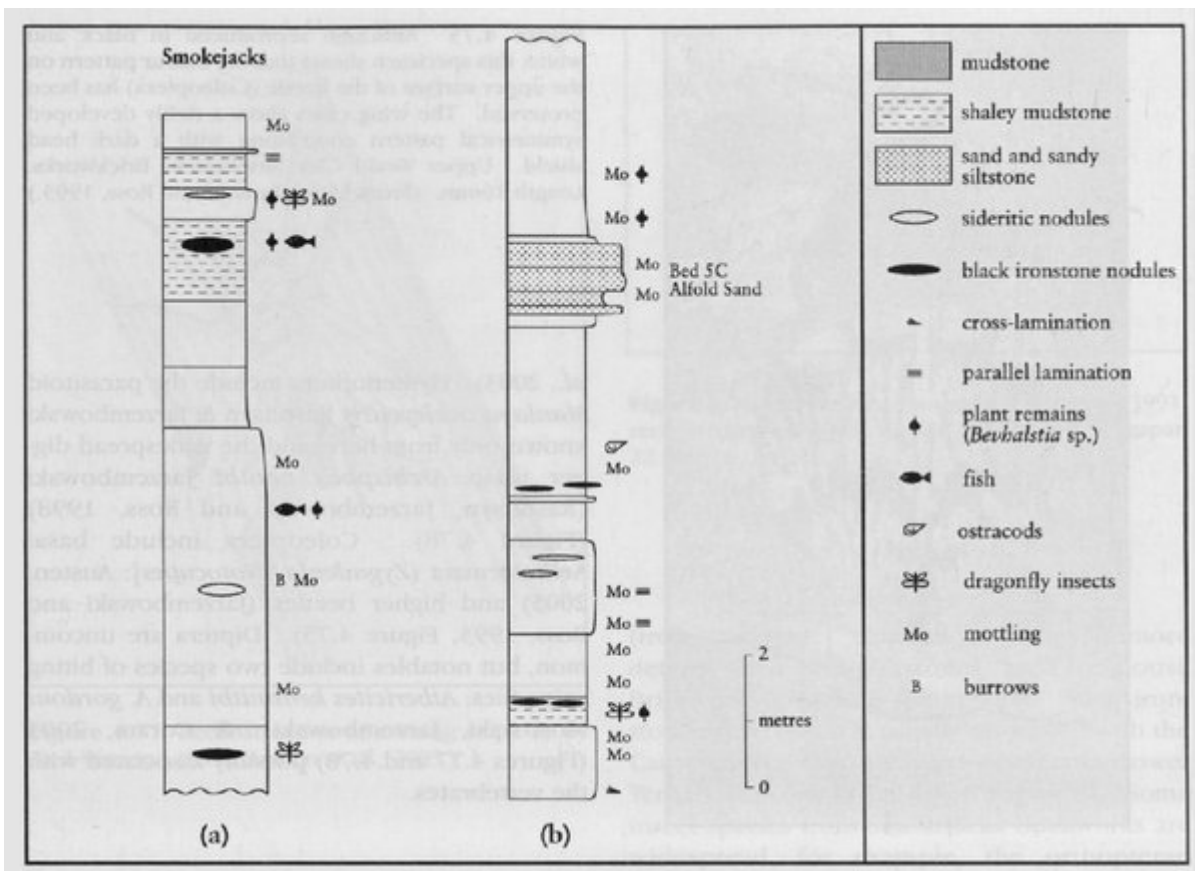
Part of a network of sites (see also GCR site reports for Clockhouse and Auclay brickworks) in the Weald Clay, this early Cretaceous site has younger (Barremian, c. 128 Ma) strata than Clockhouse Brickworks. Although insects are less common here than at Clockhouse Brickworks, nevertheless, fossil representatives of some ten orders of insects have been found in more detailed preservation. The preservational facies — in sideritic ironstones — is more commonly associated with the British Carboniferous and complements the other Wealden insect GCR sites dominated by siltstone

or phosphatic concretions. The Smokejacks fossil insects include taxa unique to this pit as well as representations of widespread Lower Cretaceous species. The site is also famous for its reptile remains and was selected separately within the GCR for its fossil reptiles. The extensive excavation offers considerable potential for future finds.

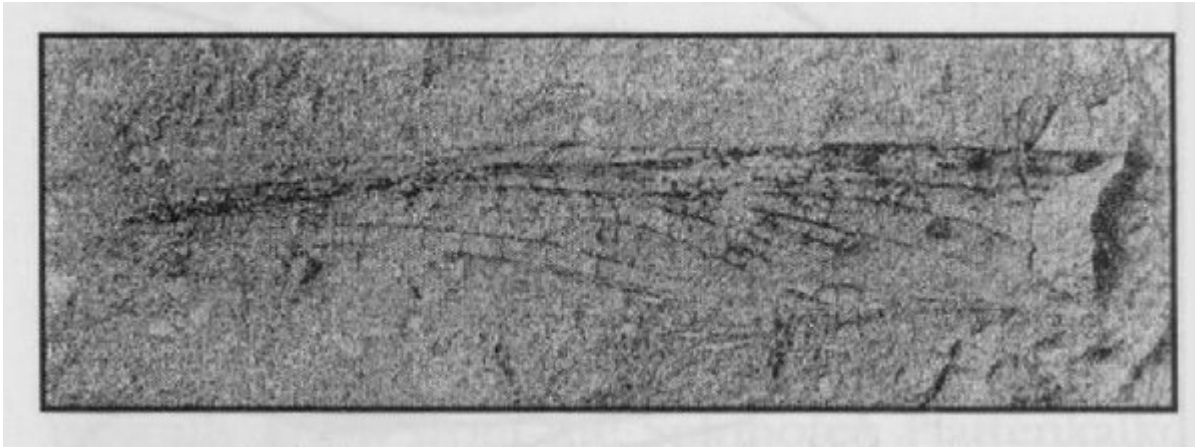
## References



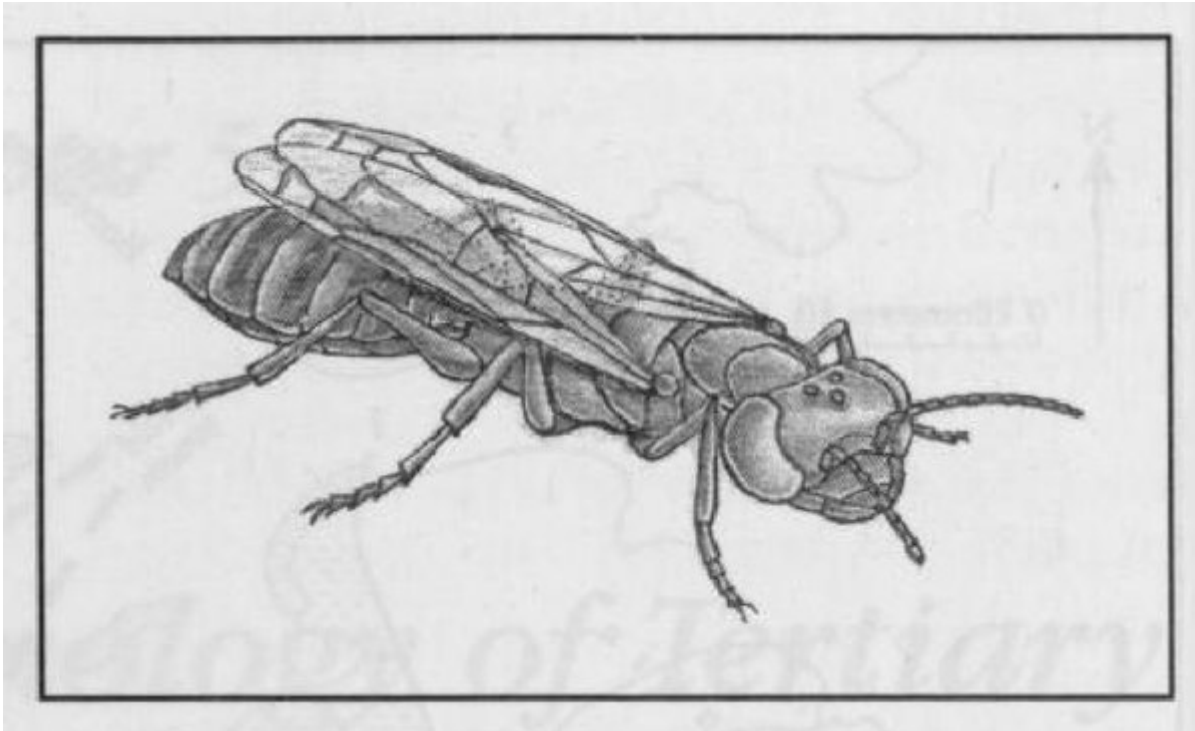
(Figure 4.2) Location of Lower Cretaceous GCR sites described in the present chapter. (After Duff and Smith, 1992.)



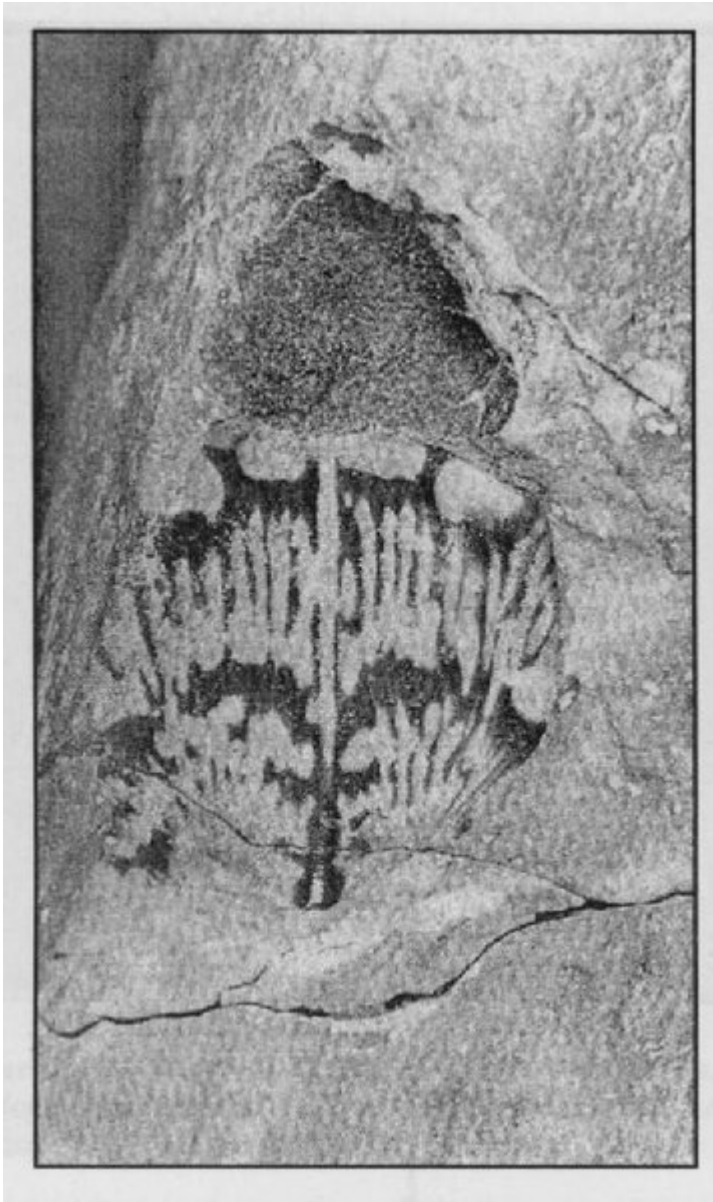
(Figure 4.73) Composite lithological log of the lower part of the Upper Division of the Weald Clay Formation exposed in the Smokejacks Brickworks pit (TQ 112374). (After Batten, 1998.)



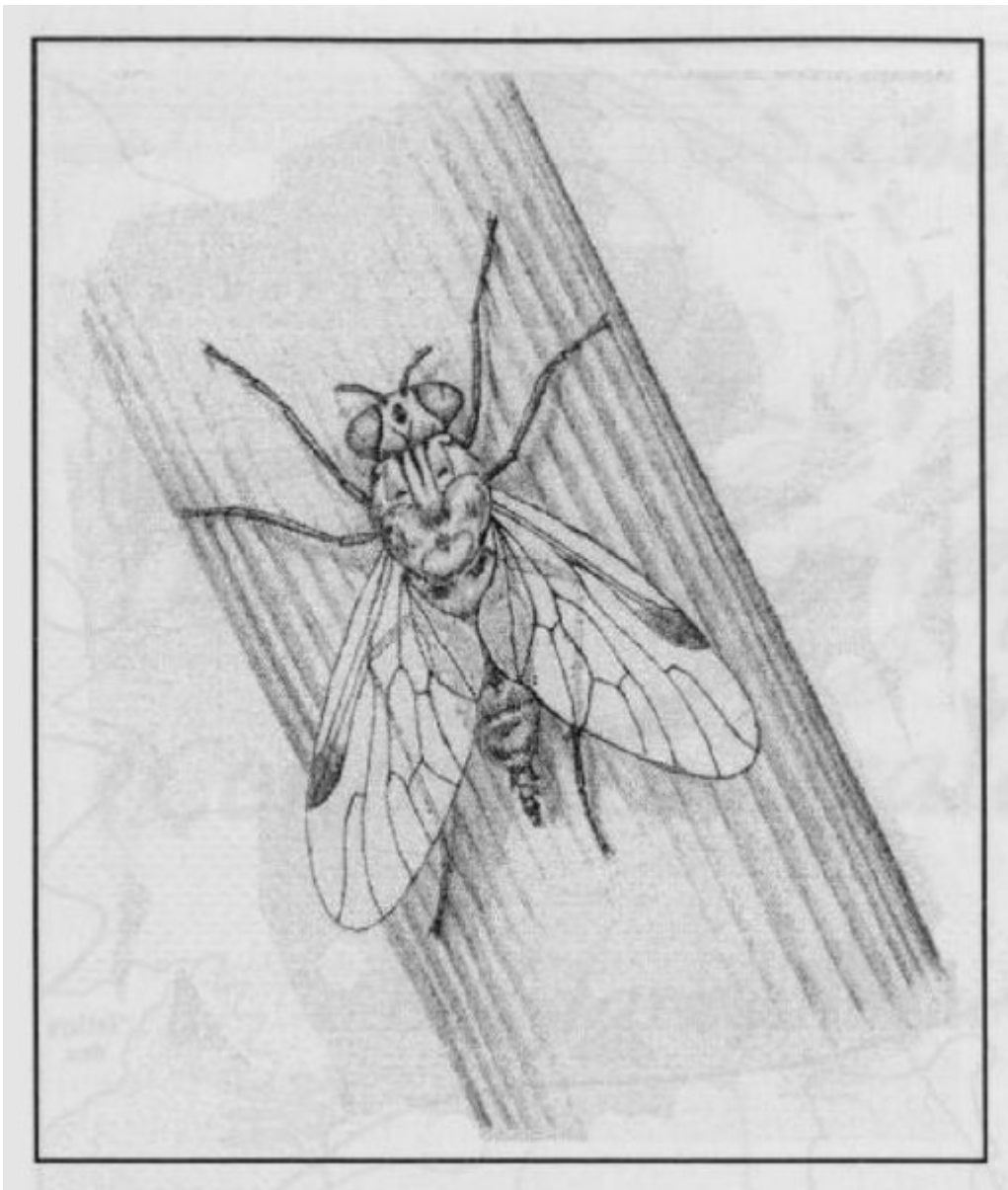
(Figure 4.74) Locustopseid forewing, *Mesolocustopsis problematica* Gorochov, Jarzembowski and Coram, 2006. Upper Weald Clay, Smokejacks Brickworks. Length 16 mm. (From Jarzembowski and Coram 1997.)



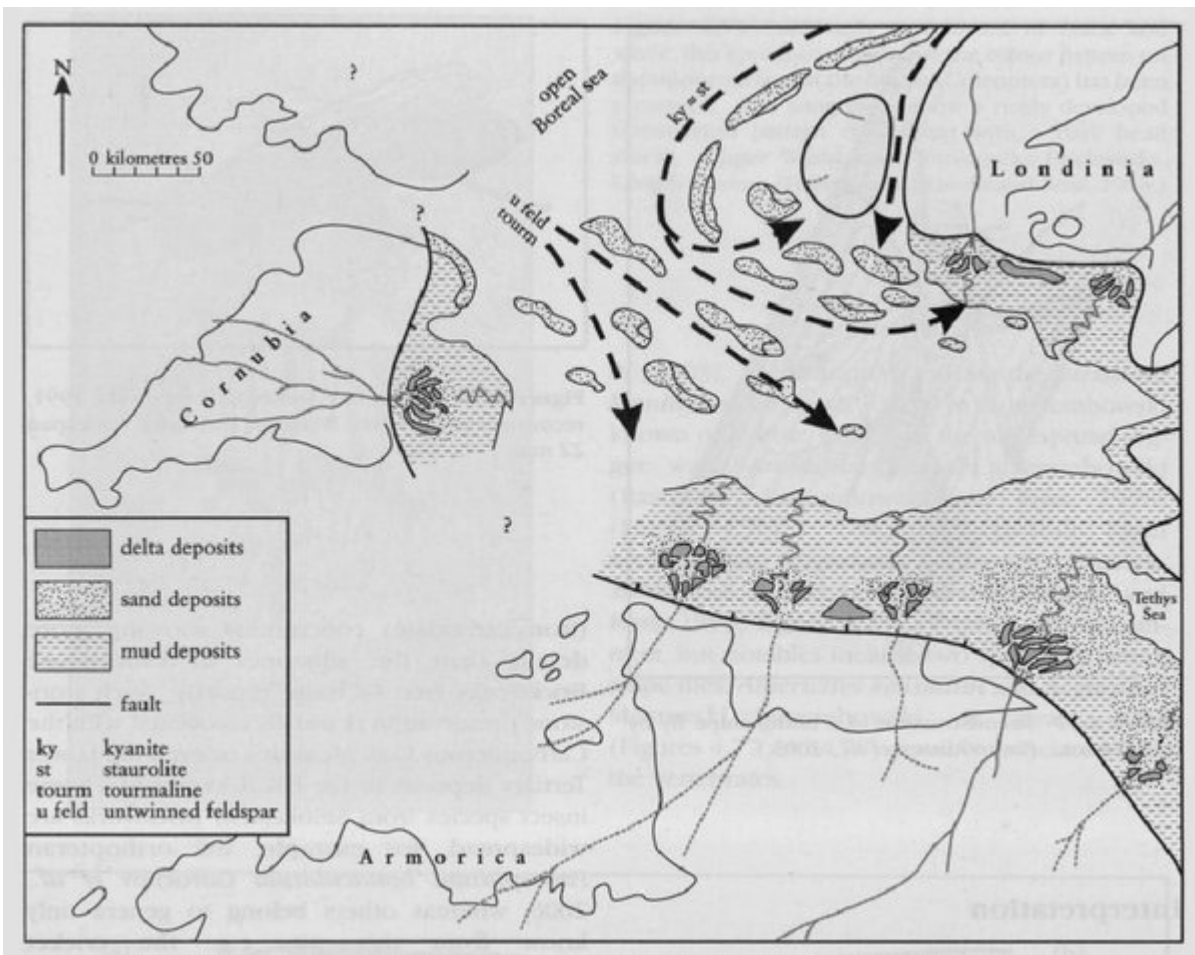
(Figure 4.78) *Archisphex boothi* Jarzembowski, 1991, reconstruction by Neil Watson. Estimated wingspan 22 mm.



*(Figure 4.75) Although reproduced in black and white, this specimen shows that the colour pattern on the upper surface of the beetle (Coleoptera) has been preserved. The wing cases show a richly developed symmetrical pattern contrasting with a dark head shield. Upper Weald Clay, Smokejacks Brickworks. Length 16mm. (From Jarzembowski and Ross, 1993.)*



*(Figure 4.77) Reconstruction of a biting snipe fly by Neil Watson. (From Austen et al., 2003.)*



(Figure 4.79) Provincial model for argillaceous Wealden formations in southern England and northern France. (After Allen, 1981.)