

Fossil Beetles (Insecta: Coleoptera) from the Purbeck Limestone Group of Dorset — a Preliminary Report

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Summary

The Purbeck Limestone beetle fauna is reviewed and several taxa identified and figured for the first time. Their possible ecology is considered and comparisons are made with other fossil beetle faunas worldwide.

Introduction

Fossil beetles (Coleoptera) from the basal Cretaceous Purbeck Limestone Group were some of the first Mesozoic insects to be studied in England and among the first in the world (Brodie 1845; Westwood 1854) but our knowledge of them is still incomplete. Most of the original systematic placings of beetle taxa were suspect in the light of later knowledge. Handlirsch (1906-08) proposed new names for some Purbeck beetles but did not comment on their systematics with any confidence. Carpenter (1992) considered the systematic positions of all described Purbeck beetles to be uncertain, although Crowson (1962) judiciously placed *Carabus elongatus* Brodie 1845, from Dinton, Wiltshire, in the family Cupedidae and genus *Omma*, both extant. The named Dorset Purbeck beetle species were listed in the *Proceedings* (Jarzembowski 1993) and several fairly entire new specimens figured by Coram *et al.* 1995 were identified to family level. One of these, a weevil, was subsequently described by Gratshev *et al.* (1998). Many isolated elytra can also now be assigned to families.

Beetles are the most abundant Purbeck insect fossils, being known from several thousand specimens, mostly isolated elytra. These can be grouped into about 250 morphotypes and it is estimated that a further 250 remain to be discovered (Coram and Jarzembowski, in press). As part of the Royal Society Joint Project on Cretaceous insects, one of the authors (A.G.P.) examined the Purbeck beetles in the Natural History Museum, London, Booth Museum of Natural History, Brighton and the large quantity of material collected more recently by one of the authors (R.A.C.) and Mr A. Mitchell of Gillingham, Kent (plus some material from E.A.J.). Because of time constraints, it was only possible to examine in detail a small proportion of the recently collected material (about 200 specimens, mainly from the Middle Purbeck of Durlston Bay). Consequently, the conclusions presented below should be considered as preliminary only. All figured material was collected by R.A.C. and deposited in the Maidstone Museum and Bently Art Gallery.

Beetles are a phenomenally diverse order: Recent species account for a quarter of all animal species and

their fossils provide important information on ancient environments and climates. They include both terrestrial and aquatic (mainly freshwater) taxa. Brackish-marine lagoonal inhabitants appear to have been more common in the Mesozoic than at the present day. Although not inhabitants of the sea, Mesozoic beetles are also fairly frequently encountered in marine deposits, especially in black shales, and they could therefore be used for the correlation of marine and continental deposits, although their full potential will not be realized until their taxonomy is substantially improved.

The Purbeck beetles, being Early Cretaceous in age, are of particular interest for studies of the geological history and evolution of beetles (Ponomarenko 1995) since at this time many terrestrial and freshwater ecosystems elsewhere in the world were being affected by the geographical spread and diversification of proangiospermous plants (Ponomarenko 1998). Beetle diversity increased several-fold during the Late Jurassic and Lower Cretaceous, especially among the cucujiform and rhynchophorous taxa (see below). Beetles adapted to exploit the flower-like structures of proangiosperms became more numerous, along with aquatic beetles with adaptations for swimming.

Three beetle suborders, all extant, occur in the Purbeck: the Archostemata, Adephaga and Polyphaga.

Suborder Archostemata

The primitive Archostemata often dominated early Mesozoic beetle faunas but declined in importance through the Jurassic and Cretaceous and have few Recent representatives. Archostemata make up no more than 5% of Purbeck beetle specimens, which is somewhat lower than in Upper Jurassic localities such as Solnhofen, Germany, and Karatau, Kazakhstan, and about the same as Lower Cretaceous localities in Transbaykalia and China. The most common Purbeck family was the extant Cupedidae, or 'reticulated beetles' (Fig. 1), which are mostly xylophagous (wood-eating) and have elytra bearing rows of square punctures between longitudinal ridges. Purbeck taxa are referable to the extinct genera *Zygadenia* (= *Notocupes*),



Figure 1: Cupedid beetle. Middle Purbeck, Durlston Bay. MNEMG 2000.29, 9.0 mm long

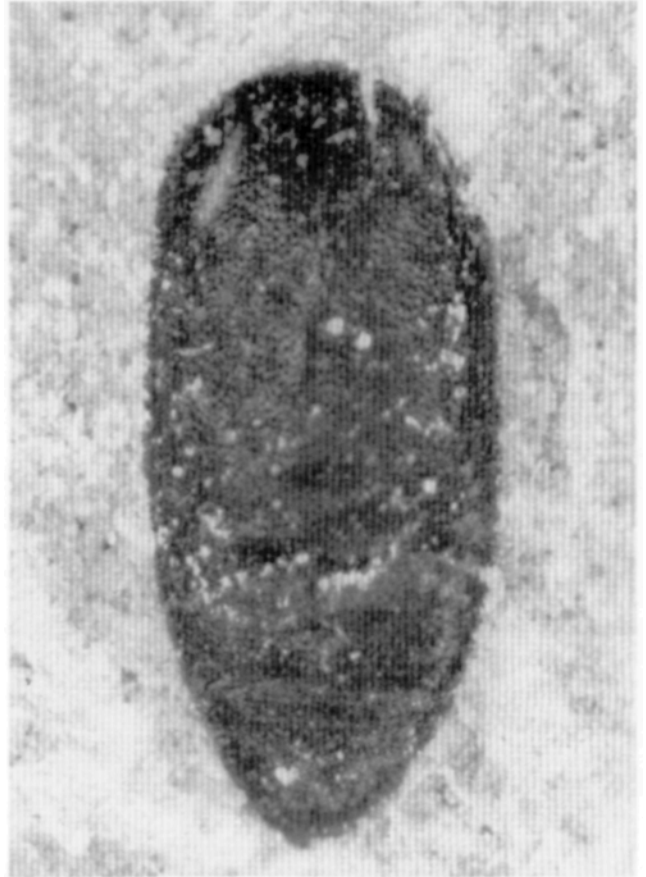


Figure 2: Schizophorid elytron. Middle Purbeck, Durlston Bay. MNEMG 2000.30, 3.6 mm long

Brochocoleus and *Cionocoleus*, and the extant genera *Omma* and *Tetraphalerus*. *Zygadenia* and *Cionocoleus* are the most common. The extinct archostematan family Schizophoridae is more rare (Fig. 2). These were evidently water beetles without swimming adaptations, known in the Purbeck from isolated elytra only, making exact generic determination impossible.

Suborder Adephaga

The Adephaga, most of which are predacious, are several times more abundant in the Purbeck than Archostemata. Both terrestrial and aquatic taxa are present. The terrestrial ground beetles Carabidae: Protorabinae (figured previously in the *Proceedings*: Coram *et al.* 1995, fig. 8), and Trachypachidae: Eodromeinae (Fig. 3) are present in roughly equal proportions, as is typical for the Upper Jurassic-lowermost Cretaceous.

Aquatic adephagans are more diverse at family level — more than five families may occur in the Purbeck, although no one family predominates. The extinct family Coptoclavidae was typically dominant among water beetles during the Upper Jurassic and Lower Cretaceous (as is also the case in the Lower Jurassic of



Figure 3: Beetle of family Trachypachidae: Eodromeinae. Head and legs not preserved. Lower Purbeck, Portland. MNEMG 2000.31, 2.5 mm long



Figure 4: Small coploclavid beetle. Middle Purbeck, Durlston Bay. MNEMG 2000.32, 5.6 mm long

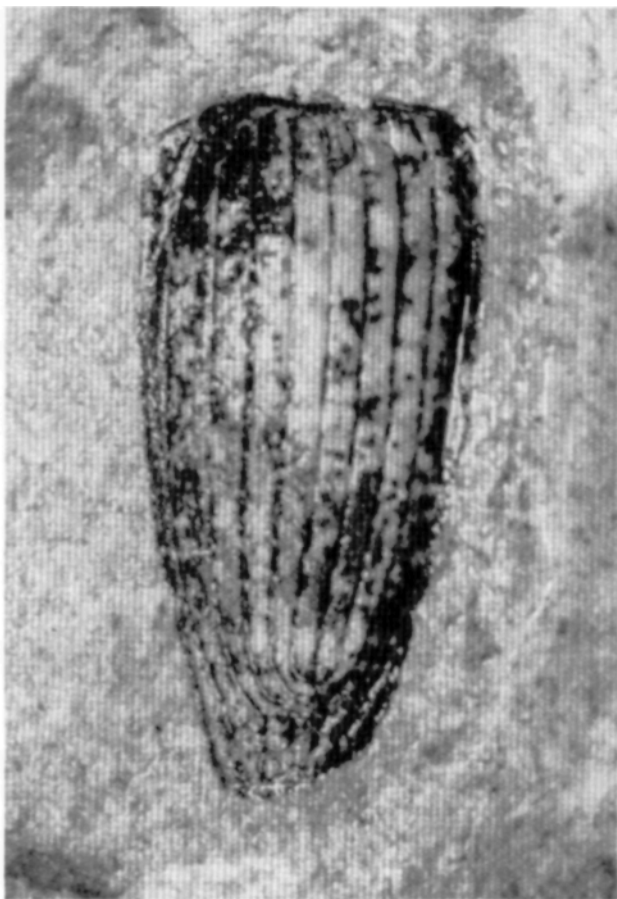


Figure 5: Elytron of gyrid beetle, aff. *Mesogyrus*. Middle Purbeck, Durlston Bay. MNEMG 2000.33, 6.7 mm long

England — *Holcoptera* Handlirsch 1906, from the Lower Lias of Dorset is a coploclavid near to *Coptoclavella*). Some small Purbeck beetles are probably referable to this family on the basis of the thin elytra through which the venation of the hind wings is visible (Fig. 4). However, large coploclavids such as *Pseudohydrophilus*, *Ditomoptera*, *Coptoclava* and *Bolbonectes* characteristic of other Upper Jurassic-Lower Cretaceous deposits are absent. Localities with small *Coptoclavella* and lacking large coploclavids were previously known only in the lowermost Cretaceous of west Mongolia.

One incomplete Purbeck beetle and several isolated elytra possibly belong to *Lyadites* in the extinct aquatic family Liadytidae which was most common in the Jurassic but occurs rarely at some Lower Cretaceous localities. Another incomplete Purbeck specimen is representative of the genus *Palaeodytes* within the extant family Dytiscidae, which includes the Great Water Beetle of British ponds. The family is very rare in the Mesozoic, with only two described species. The family Gyridae (which includes the Recent whirligig beetles) is usually more common than Dytiscidae in the Mesozoic, in contrast to the Cenozoic situation. Two specimens are known from the Purbeck of Durlston Bay: elytra with the typical striation of *Mesogyrus* (Fig. 5), and a small beetle from Wiltshire, *Coleopteron vetustus* (Giebel 1856) near to *Angarogyrus*.

A small water beetle referable to the genus *Memptus* is the most common Purbeck aquatic adephagan, although its systematic position is uncertain due to the incomplete condition of the fossil material. A further interesting Purbeck beetle with round body and wide elytra may be an aquatic adephagan (figured by Coram and Jarzembowski, in press). The metathorax is typical for the suborder but the hind coxae are more typical of the Polyphaga.

Suborder Polyphaga

The majority of Purbeck beetles, as today, belong to the Polyphaga, and the families discussed below all have living representatives. Dominant in the Purbeck is the Hydrophilidae (Fig. 6), which includes terrestrial and aquatic forms, the latter usually omnivorous scavengers. On the basis of elytron variety Purbeck Hydrophilidae are apparently more abundant (about 10% of the specimens examined) and diverse (more than ten species in several genera) than in other Lower Cretaceous localities. Although relatively entire specimens of Purbeck hydrophilids are known, these are proportionately no more common than those of several terrestrial families (e.g. Carabidae), suggesting that most or all of the hydrophilids were transported into the Purbeck lagoons rather than actually living in them.

Members of the terrestrial family Staphylinidae (rove beetles) are predators or omnivorous scavengers recognizable by the very short elytra which expose the abdomen. They are uncommon in the Purbeck: there are

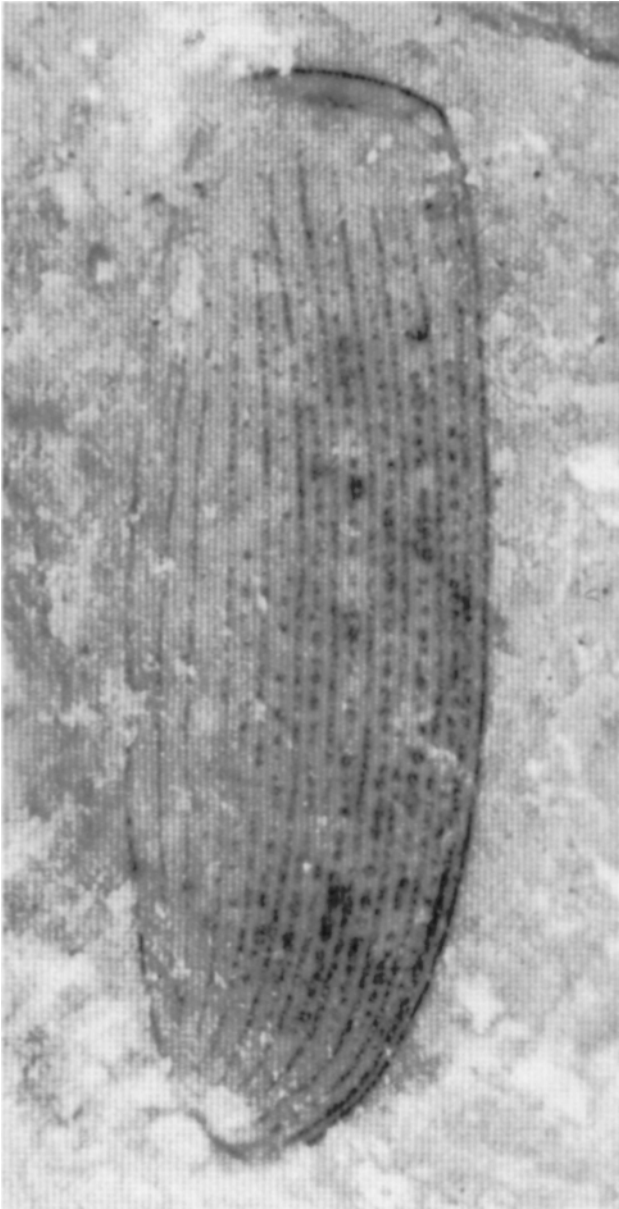


Figure 6: *Hydrophilid elytron*. Middle Purbeck, Durlston Bay. MNEMG 2000.34, 4.4 mm long

two specimens in the Brodie collection in the Natural History Museum and four were noted among the more recently collected material (one previously figured in the *Proceedings*: Coram *et al.* 1995, fig. 9).

The Buprestidae (jewel beetles: Fig. 7) are relatively abundant today and most have an attractive metallic sheen. They are herbivorous, the larvae often boring into wood, and can be serious pests. They are possibly as common in the Purbeck as Hydrophilidae and dominant among the xylophagous beetles. Several genera comprising about ten species are known from the Purbeck.

Pill beetles (Byrrhidae) have an oval, convex shape which conceals the head from above. They are often found on lake shores and can be pests of tree seedlings. They are a common family in many Mesozoic localities



Figure 7: *Buprestid beetle*, lower Purbeck, Durlston Bay. MNEMG 2000.35, 21 mm long



Figure 8: *Byrrhid beetle*. Middle Purbeck, Durlston Bay. MNEMG 2000.36, 4.1 mm long

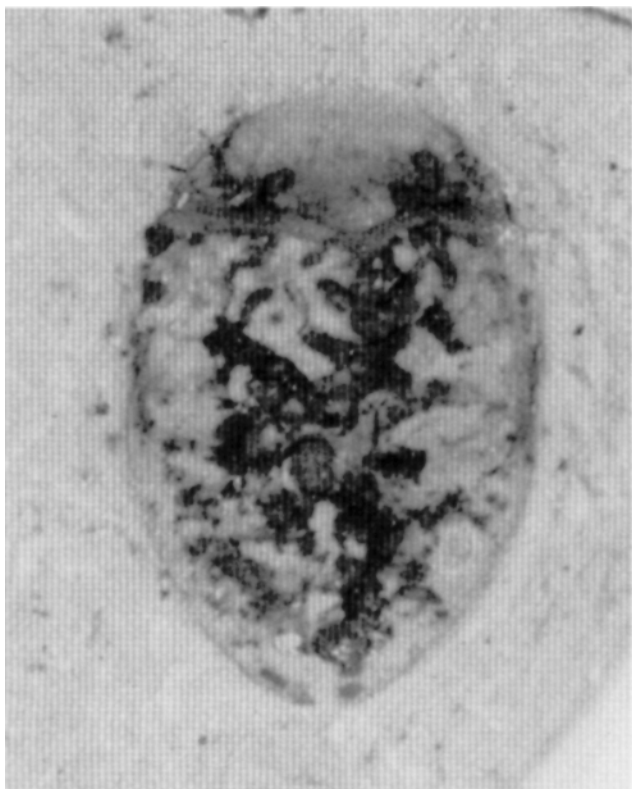


Figure 9: Eucinetid beetle. Lower Purbeck, Portland. MNEMG 2000.37, 2.9 mm long



Figure 10: Cucujiform beetle cf. Melandryidae. Middle Purbeck, Durlston Hay. MNEMC, 2000.38, 2.4 mm long

but scarce in the Purbeck, comprising one intact specimen of a byrrhid close to *Amphicyrtella* (Fig. 8) and one isolated elytron of *Dzeregia* type. Mesozoic byrrhids probably lived on aquatic hepatics (liverworts). One specimen of *Mesocinetus*, referable to the small terrestrial and xylophagous fungivorous family Eucinetidae, is known from the lowermost Purbeck of the Isle of Portland (Fig. 9).

The Elateridae (click beetles) are well known for their ability to jump into the air by flexing their bodies when placed on their backs. They have elongate elytra; the larvae live in rotting wood or soil and some are pests. Relatively abundant today, they are generally the most common family in Mesozoic localities but are more rare in the Purbeck. One intact specimen and several elytra possibly belong to the family. The Scarabaeidae include the dung beetles and plant-feeding chafers. They are a large family, usually stout bodied with distinctly clubbed antennae. Usually a common family in Cretaceous localities, they were also rare in Purbeck. One intact specimen of scarabacid beetle is known from Durlston Bay.

The cucujiform beetles (a collection of families, including ladybirds) are diverse and widespread today. These were much more scarce in the Mesozoic, although present at many localities. A single Purbeck specimen may belong to the family Melandryidae (false darkling beetles: Fig. 10), the adults of which are usually associated with loose bark, rotting wood or fungi.

A single rhynchophorous beetle (family group Curculionioidea or 'weevils') was figured in the *Proceeding?* by Coram *et al.* (1995, fig. 10) and subsequently described by Gratshev *et al.* (1998) as *Metrixenoides pusillus* (Nemonychidae?), which probably lived within gymnosperm strobili.

Conclusions

The preserved faunal composition of Purbeck beetles differs from that of the succeeding Wealden in containing many more water beetles, although some or all of these may have been transported from other water bodies since whole remains are relatively rare and aquatic larvae absent. Aquatic taxa that usually dominated East Asian Cretaceous lakes (e.g. *Coptoclava*) are also absent. Xylophilous wood-boring beetles are abundant in the Purbeck. They were dominated by Buprestidae, and also included Cupedidae and more rarely Elateridae. Carnivorous terrestrial beetles were dominated by Trachypachidae and Carabidae in equal proportion, with less common Staphylinidae.

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