Durlston Bay, Dorset

[SZ 040 787]–[SZ 035 773]

Introduction

Britain's finest sections through the latest Jurassic/earliest Cretaceous (Tithonian/ Berriasian age, *c.* 145 Ma) Purbeck Limestone Group are exposed in the 2 km coastal cliffs between Peveril Point and Durlston Head near Swanage in Dorset (Figure 4.45). The section is famous for its exceptionally diverse fauna, especially the vertebrates such as the fossil fishes (both marine and freshwater, see Dineley and Metcalf, 1999, pp. 405–15), reptiles (including 36 species of lizards, turtles, crocodilians, pterosaurs and dinosaurs) see Benton and Spencer, 1995, pp. 203–14) and mammals (see Benton *et al.,* 2005). It is also the most productive site in Europe for Tithonian/Berriasian age insects with about 200 described species belonging to 17 different orders being recorded from a number of different horizons within the Lower and Middle Purbeck strata.

Historically, many of the fossils, insects excepted, were recovered during commercial working of the limestones for building stone. The outcrop of some of the higher quality Purbeck 'Building Stones' was even pursued in underground workings. However, many other important finds were made In the 19th century by enthusiastic local collectors such as S.H. Beckles who collected 170 'lizard' specimens from the section, now recognized as belonging to seven genera. The section includes the type locality for the Purbeck Limestone Group (see (Figure 4.46)).

Durlston Bay is one of a network of Jurassic/Cretaceous boundary sites (see also the GCR site report for Poxwell, Dinton and Teffont Evias that preserve insects from within the Purbeck beds (Purbeck Limestone Group). In the Mesozoic Tertiary Fish/Amphibia, Mesozoic addition to the fossil arthropod importance of Mammalia, Portlandian–Berrisian and Jurassic-this site, the area is also selected for the GCR for Cretaecous Reptilia selection categories.

Description

The biostratigraphical details of the Durlston Bay section through the Purbeck Limestone Group are based on those described by Clements (1993, see (Figure 4.47)). Because of the long history of quarrying and early investigation (Austen, 1852; Bristow and Fisher, 1857), many horizons acquired local names that became entrenched in the literature. When the stratigraphy was re-appraised by Clements and others, these names were retained on an informal basis whereas the overall succession of the Purbeck beds was formally united as the Purbeck Limestone Group.

It is generally considered that the Purbeck Limestone Group spans the Jurassic–Cretaceous (Tithonian–Berriasian) boundary. The biostratigraphy is based on palynomorphs, ostracods and gastropods rather than ammonites, and consequently the actual position of the boundary in the succession has been disputed (Birkelund *et al.,* 1978). But an integrated approach to correlation has made it possible to determine the base of the Berriasian within the Soft Cockle Member (W A. Wimbledon, pers. comm.).

Details of the fossil distribution throughout the Group are given by Benton and Spencer (1995, pp. 207–8). Of particular interest in the context of the present volume are the Middle Purbeck Corbula Beds (DB 154–89, Clements, 1993, see (Figure 4.47)). These Beds lie above the marine Scallop Beds and are a relatively thick unit (7.6m). The fossils of the Corbula Beds include dinosaur footprints (West and El-Shahat, 1985) turtles, fishes and insects.

Fauna

All of the Purbeck insect orders, and over half the families, are extant. However, several important Holocene insect groups, such as the Lepidoptera (butterflies and moths) and social Hymenoptera (e.g. bees and ants) are absent and do not become widespread until the radiation of flowering plants after Purbeck times.

The overall character of the terrestrial insect fauna suggests a wooded habitat including, for example, cupedid beetles, a group that feeds on wood today. Other Purbeck insect lifestyles would have included sap-sucking (bugs), foliage-chewing (orthopteran 'grasshoppers), predation (dragonflies), scavenging (cockroaches), blood-sucking (horse flies) and parasitism (the larvae of some wasps).

The major fossil insect groups (orders) from Durlston Bay are:

Odonata (dragonflies)

Blattodea (cockroaches, see (Figure 4.48))

Orthoptera ('grasshoppers' and crickets)

Phasmatodea (stick insects)

Hemiptera (bugs)

Neuroptera (lacewings)

Coleoptera (beetles)

Diptera (true flies, see (Figure 4.49))

Trichoptera (caddisflies)

Hymenoptera (wasps)

Thysanoptera (thrips)

Raphidioptera (snake flies)

Mecoptera (scorpionflies)

Dermaptera (earwigs) — the latest protodiplatedid

Psocoptera (barklice)

Grylloblattida (rock crawlers) — an undescribed geinitziid

Ephemeroptera (mayflies)

In 2005, Grimaldi and Engel noted that *Dianafranksia* and *Opetiala* from Durlston Bay are significant earliest records of their dipteran lineages (basal empidoids and advanced Diptera [Cyclorrhapha] respectively).

Most of the terrestrial insect remains are disarticulated; less common intact specimens probably represent either flying insects (usually small) which were blown directly into the lagoons in which they were preserved, or were scavenging insects (e.g. cockroaches) which lived on the lagoon margins rather than in the more distant woodland (Coram, 2005). Remains of aquatic insects are abundant and often well-preserved. Near-freshwater bodies would have supported a high diversity of insects, including beetles, water bugs, the larvae of dragonflies and caddisflies and, more rarely mayflies. More saline (brackish) lagoons had a much more restricted insect fauna dominated by a few species of hardy water bugs and chironomid fly larvae (Coram and Jarzembowski, 1998).

The mid-Purbeck moistening of the climate was reflected by relatively subtle changes in the insect fauna. For example, there is a proportional increase in some moisture-favouring terrestrial taxa (e.g. empidid dance flies), and a Middle Purbeck increase in caddisfly diversity probably resulted from the greater availability of fresher water for their larval development.

Interpretation

Although both Lower and Middle Purbeck insect-bearing horizons are within micrites, they represent slightly different environments of deposition. The soft white micrites of the Lower Purbeck were deposited under arid conditions whereas those blue-grey micrites of the Middle Purbeck formed under a wetter, Mediterranean-type climate.

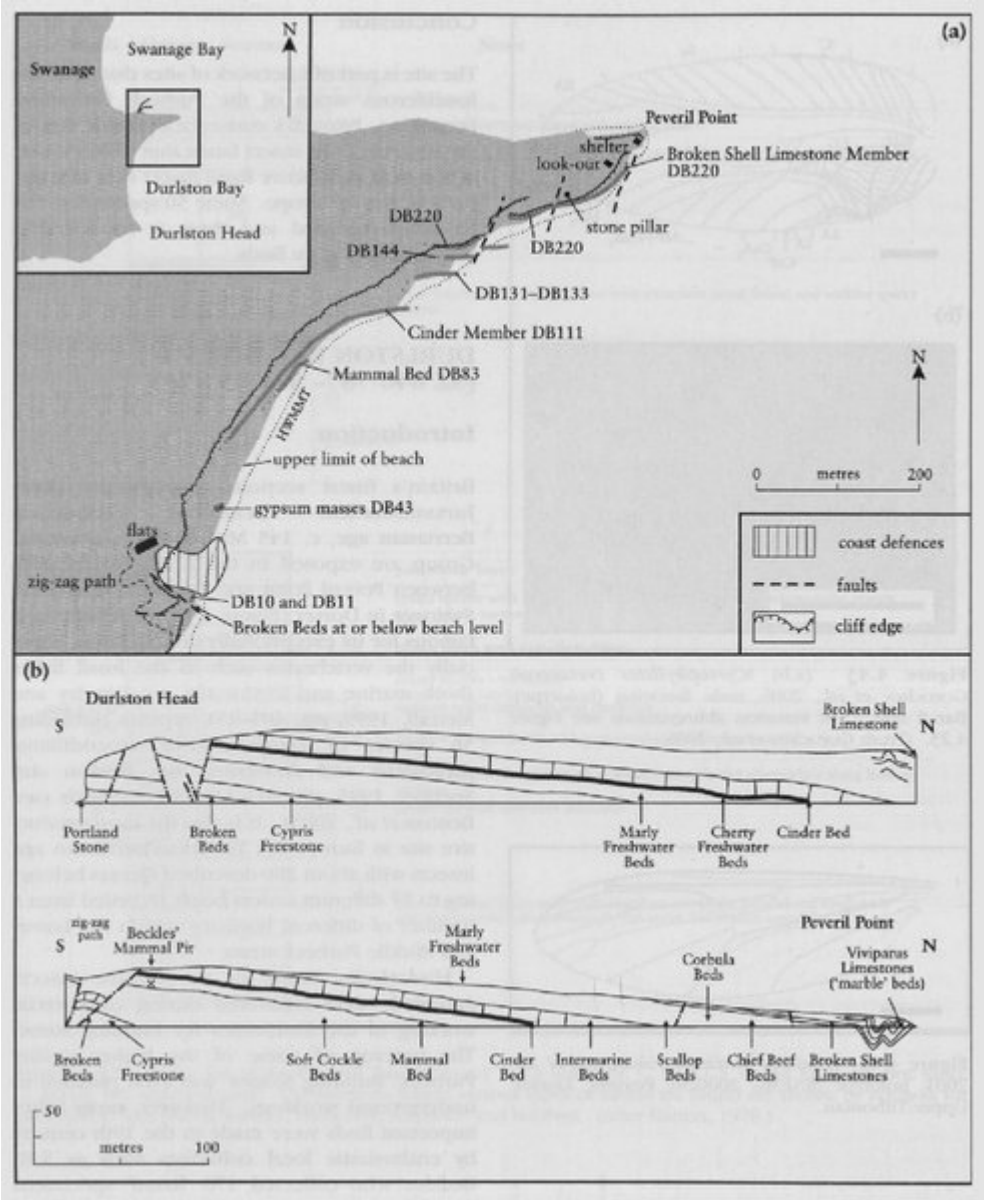
Comparison with other localities

Lithological comparison between limestones producing insect fossils at Durlston Bay (Corbula Beds) and similar but younger (Eocene) age limestones in the Isle of Wight resulted in the discovery of a rich new insect-bearing locality near Cowes (see GCR site report for Thorness Bay).

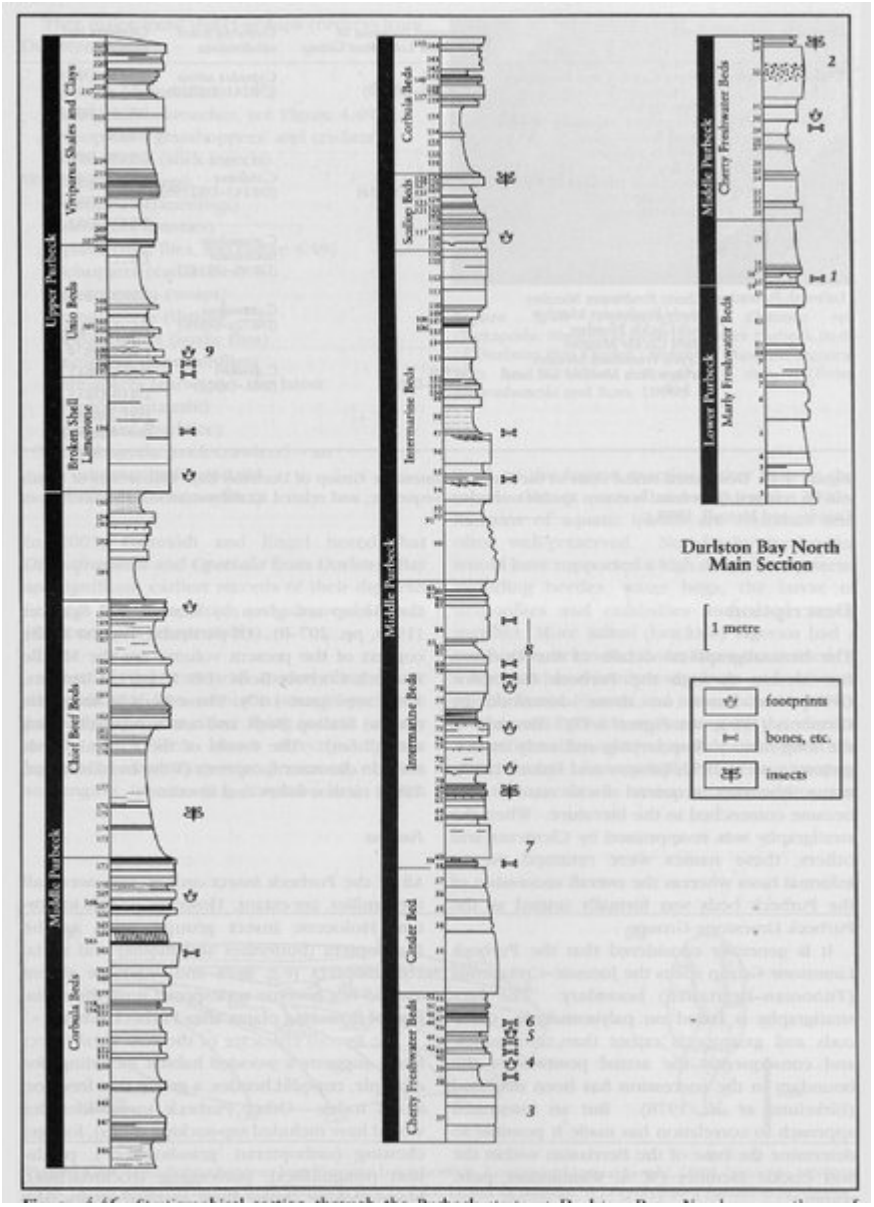
Conclusions

The Purbeck beds of latest Jurassic–earliest Cretaceous (Tithonian–Berriasian age, *c.* 145 Ma) age in Durlston Bay, Dorset have provided Britain's richest Jurassic–Cretaceous insect fauna. The entomofauna includes around 200 described insect species and another around 1000 yet to be described, belonging to 17 orders ranging from beetles to mayflies. This is also the most productive site for insects of this age in Europe. The conservation value of the site is based not only upon the important insect fauna but also upon the fossil fishes, reptiles and mammals that have been found here. Despite some loss of the section due to coastal defence works, Durlston Bay remains the type section of the Purbeck Limestone Formation and has been a continuing source of fossil insects since they were first found here in 1850, during the early decades of British palaeoentomology. The site still has considerable potential for future finds and lithological comparison with late Eocene limestones in the Isle of Wight resulted in the discovery of a rich Tertiary insect fauna near Cowes (see GCR site report for Thorness Bay.

References



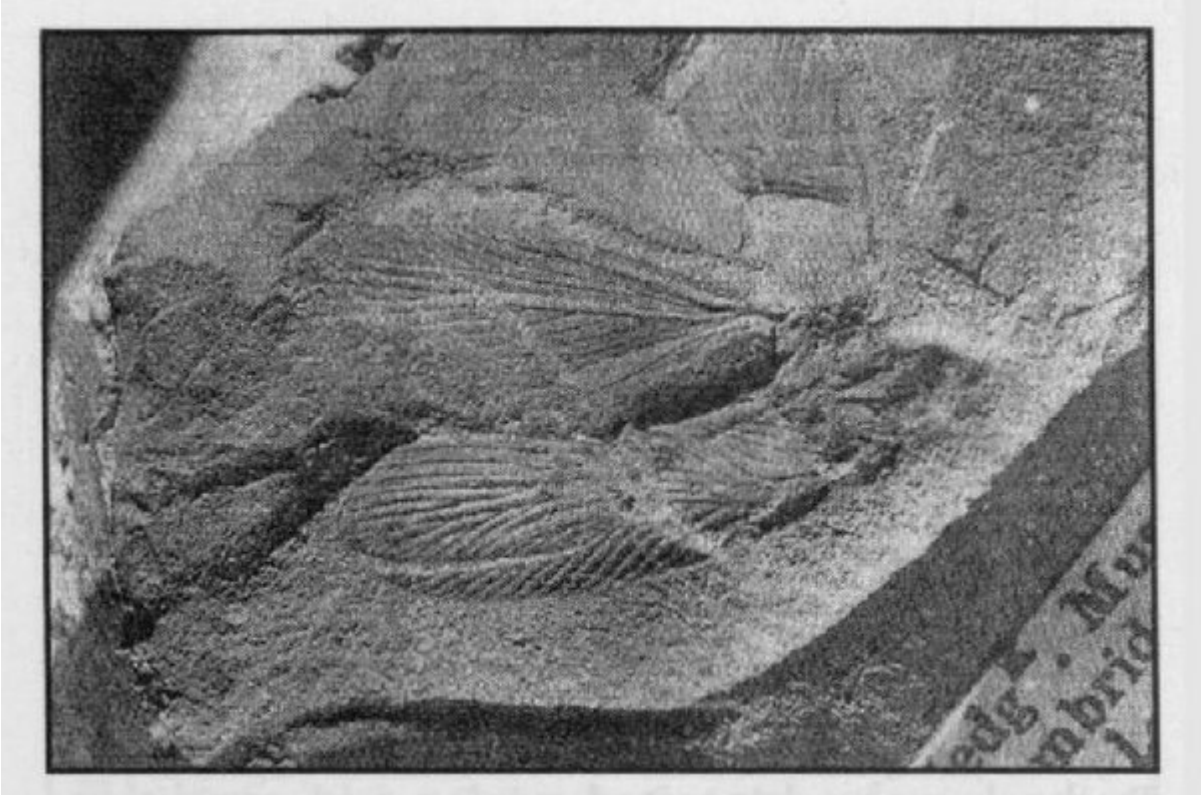
(Figure 4.45) (a) Sketch map of the northern part of Durlston Bay (after Clements, 1993); letters and numbers refer to Clements' labelling of the beds. (b) Cliff profile at Durlston Bay. (After Benton and Spencer, 1995.)



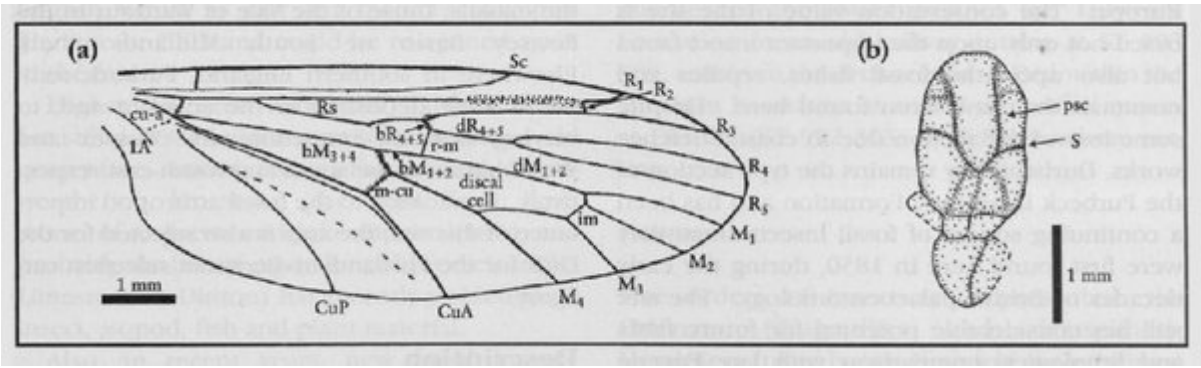
(Figure 4.46) Stratigraphical section through the Purbeck strata at Durlston Bay. Numbers are those of Clements. (After Benton and Spencer, 1995; Coram and Jarzembowski, 1998.)

Formal stratigraphic terms		Informal divisions of Purbeck Limestone Group	Ostracod zonal subdivisions	Clements bed numbers
Durlston Formation	Upper Cypris Clays and Shales Member	'Upper' (DB246–DB220)	*Cypridea setina* (DB245–DB220)	DB224–DB245
	Unio Member			DB221–DB223
	Broken Shell Limestone Member			
	Chief Beef Member			DB220
	Corbula Member			
	Scallop Member			DB190–DB219b
	Intermarine Member (or Upper Building Stones)	'Middle' (DB219b–DB75a)	*C.vidrana* (DB143–DB219b)	DB154–DB188/189
	Cinder Member			DB146–DB153
				DB112–DB145
			C.granulosa fasciculata (DB97–DB142)	DB111
Lulworth Formation	Cherty Freshwater Member			DB87–DB110
	Marly Freshwater Member		*C.granulosa* (DB72a–DB96)	
	Soft Cockle Member			DB75a–DB86
	Hard Cockle Member			
	Cypris Freestones Member			DB43–DB74
	Broken Beds Member and basal beds	'Lower' (DB74–DB1)	*C.dunkeri* (DB1–DB71)	DB34–DB42
				DB10–DB33
				DB1–DB10 (not exposed)

(Figure 4.47) Designated stratal units in the Purbeck Limestone Group of Durlston Bay. Discoveries of fossils can be referred to precise horizons in this unbroken sequence, and related to the ostracod zonation. (From Dineley and Metcalf, 1999.)



(Figure 4.48) 'Polyneopteran': Elisama sp. (Hexapoda: Blattodea) from the Lower Purbeck Beds of Durlston Bay, Dorset. Sedgwick Museum registration no. X24676a. Length 14 mm. (From Jarzembowski and Ross, 1996.)



(Figure 4.49) (a,b) Eoptychoptera longifurcata Lukashevitch, Coram and Jarzembowki, 1998, holotype MNEMG 1998.18, (a) wing; (b) thorax from Durlston Bay, Dorset, Lower Berriasian; (c) Ptychoptera handlirschi, thorax,. Scale bars 1.0 mm. (From Lukashevich et al., 2001.)