Durlston Bay, Swanage, Dorset

[SZ 035 772]–[SZ 039 786]

Introduction

The coast at Durlston Bay (Figure 2.18) exposes the finest sections of the Purbeck Limestone Group in Britain. The sediments seen here were deposited during latest Jurassic and earliest Cretaceous times. This site has produced one of the most diverse vertebrate faunas from Britain, including over 40 species of reptile (for example turtles, crocodiles, pterosaurs, dinosaurs and lizards) as well as 20 species of mammal (Benton and Spencer, 1995). Vertebrate materials have been recovered from several horizons within the Purbeck Limestone Group succession, although the occurrence of mammalian fossils is restricted to the Cherty Freshwater and Manly Freshwater Members.

Durlston Bay, or 'Durdlestone Bay' as it is known in old published accounts, has been studied for many decades. The first discoveries of mammal fossils were made around 1854 by the Reverend P.B. Brodie, who sent his finds to Richard Owen. Shortly after this, Samuel Beckles organized an excavation near the top of the cliffs. He unearthed many mammal fossils. Unfortunately there is some confusion concerning the exact stratigraphical position of these remains. Subsequent work at 'Beckles Pit' has failed to relocate the horizon excavated by him. More-recent work has focused on collecting from the 'dirt beds' and from fallen blocks of limestone found on the foreshore (Clemens *et al.,* 1979). Furthermore, teeth have been described from the horizon represented at Sunnydown Farm, which is also in the Cherty Freshwater Member (Sigogneau-Russell and Ensom, 1994; Ensom and Sigogneau-Russell, 1998, 2000).

Description

The mammalian fauna from Durlston Bay comes from the Lulworth Formation (Figure 2.18), below the Cinder Bed (Clemens and Mills, 1971). The majority of the specimens are from the Mammal Bed in the Manly Freshwater Member, although subsequent fossils have been found slightly higher in several beds in the Cherty Freshwater Member (Simpson, 1928; Ensom and Sigogneau-Russell, 2000; Gill, 2004). Benton and Spencer (1995, p. 208) described the Mammal Bed as:

'The Mammal Bed (Dirt Bed') of Beckles' excavations (Bed 93 of Austen (1852); Bed 22 of Bristow; bed 83 of Clements (in Torrens, 1969)): always equated with beds 14–16 of the shore section, has yielded plant remains, ostracods, gastropods, bivalves, lizards… dinosaurs… and mammals (19 [now 20] species)'.

(Table 2.4) Section of the Durlston Bay GCR site

	Thickness (m)
Purbeck Limestone Group	
Durlston Formation	
Upper 'Cypris' Clays and Shales Member	Total 12.8
Beds DB246 to DB224, including	
Upper Purbeck Marble (= Blue Marble) DB244	0.76
Lower Purbeck Marble (= Red Marble) DB241	0.81
Green Marble DB237 to DB234	0.46
'Crocodile Bed' top of DB221	
Unio Member	Total 1.14
Beds DB223 to DB221	
Broken Shell Limestone Member	Total 8.15
Bed DB220	
Chief Bed Member	Total 8.15
Beds DB219 to DB190	

Corbula Member	Total 10.27
Beds DB189 to DB154	
Scallop Member	Total 1.55
Beds DB153 to DB146	
Intermarine Member (or Upper Building Stone)	Total 15.64
Beds DB145 to DB112, including	
Leaning or Laning Vein DB144 to DB141	1.62
Royal Limestone DB140	0.30
Red Rag DB133	0.74–0.79
Under Rag DB131	0.69–0.76
Cinder Member	Total 2.95
Bed 111	
Lulworth Formation	
Cherty Freshwater Member	Total 8.12
Beds DB110 to DB87, including:	
Flint Bed (or Cherty Freshwater Bed) DB97	0.84
Marly Freshwater Member	Total 4.29
Beds DB86 to DB75, including	
Mammal Bed DB83	
Soft Cockle Member	Total 23.16
Beds DB74 to DB42	
Hard Cockle Member (?)	Total 4.19
Beds DB42 to DB34	
Cypris' Freestones Member (?)	Total 15.47
Beds DB33 to DB11	
Broken Beds Member	At or below beach level

Clements (1993, p. 197) described the Mammal Bed as:

'Dark-grey, Shelly, carbonaceous, calcareous clay and shale. Rests on an irregular surface of, and in part grades into, the bed below. Gastropods very abundant. Ostracods common. Some silicification.'

Clements (1993) published a sedimentary log of the section exposed in the northern half of Durlston Bay between Peveril Point [SY 040 786] and the zig-zag path [SY 035 780]. The sequence is dominated by calcareous beds with some clays, shales and sandstones. Much work has been completed on this site, so highly detailed records of the sedimentary sequence are available. The description in (Table 2.4) of the Durlston and Lulworth formations is a simplified version of the section from Clements (1993).

The Durlston Bay section spans the Jurassic–Cretaceous boundary. The boundary used to be placed at the top of the Lulworth Formation, below the Cinder Member. However, several authors have argued, on diverse biotic grounds, that the Cretaceous Period begins with the *Cypris* Freestones Member (see section above). This latter interpretation is followed here, making the Mammal Bed (within the Marly Freshwater Member in the section above) earliest Cretaceous (Berriasian) in age.

Fauna

The Durlston Bay section has yielded many thousands of identifiable specimens of fishes, reptiles and mammals. The reptiles include some 41 species of turtles, lizards, crocodilians, pterosaurs and dinosaurs and a rare plesiosaur and ichthyosaur. The fishes are described more fully by Dineley and Metcalf (1999) and the reptiles by Benton and Spencer (1995) in companion GCR volumes. The fishes and reptiles are found at a number of horizons, some of them near the base of the succession, in and around the Mammal Bed, but most of them from higher units, all of which are early Cretaceous in age.

MAMMALIA

Docodonta

Docodontidae

Peraiocynodon inexpectatus Simpson, 1928

Multituberculata

Plagiaulacidae

Plagiaulax becklesii Falconer, 1857

Bolodon minor (Falconer, 1857)

Bolodon crassidens Owen, 1871

Bolodon osborni Simpson, 1928

?Bolodon falconers (Owen, 1871)

?Bolodon elongatus Simpson, 1928

Triconodonta

Triconodontidae

Triconodon mordax Owen, 1859

Trioracodon ferox (Owen, 1871)

Trioracodon major (Owen, 1871)

Trioracodon oweni Simpson, 1928

Trechnotheria

Spalacotheriidae

Spalacotherium tricuspidens Owen, 1854 (including Peralestes longirostris Owen, 1871)

Spalacotherium evansae Ensom and Sigogneau-Russell, 2000

Spalacotherium hookeri Gill, 2004

Cladotheria

Peramuridae

Peramus tenuirostris Owen, 1871

Dryolestidae

Amblotherium nanum (Owen, 1871)

Amblotherium pusillum (Owen, 1871)

Kurtodon pusillus Osborn, 1888

Peraspalax talpoides Owen, 1871

Phascolestes mustelula (Owen, 1871)

The mammalian assemblage preserved in the sediments exposed at Durlston Bay is extremely diverse (20 species) for the Mesozoic Era (Figure 2.19), and it has been the subject of numerous descriptive works, including some major monographs (Owen, 1854, 1859, 1871; Falconer, 1857; Osborn, 1888; Simpson, 1928) and some recent revisions (Kielan-Jaworowska and Ensom, 1992; Sigogneau-Russell and Ensom, 1998; Sigogneau-Russell, 2003a). The majority of specimens are mandibles, and when Simpson (1928) wrote his influential monograph, the Purbeck assemblage was one of the best faunas of Mesozoic mammals known. The fauna is thought to represent only a fraction of the taxa present in the life assemblage (Clemens *et al.,* 1979).

The multituberculates have been described as the 'rodents of the Mesozoic', as they commonly have large incisors and sharp-edged crushing cheek teeth. However, unlike rodents, the incisors were not ever growing and probably were used to winkle out endosperm from seeds that were first crushed by the bladed premolars (Krause, 1982). The spalacotheriids were mouse- to rat-sized animals with teeth adapted to slicing and puncturing prey: they were probably insectivores (Cassiliano and Clemens, 1979). The diverse cladotheres were shrew- to hedgehog-sized and also were insectivorous. The larger triconodonts may have been carnivorous (Jenkins and Crompton, 1979).

Most mammalian specimens here are represented by upper and lower jaws and some by partial skull and skeletal elements, not just isolated teeth.

Interpretation

The Purbeck Limestone strata were deposited in a low-lying area close to the sea. The facies preserved at the Duriston Bay site are indicative of brackish and freshwater environments. The Mammal Bed appears to have been deposited in a marsh or swamp environment (Clemens *et al.,* 1979).

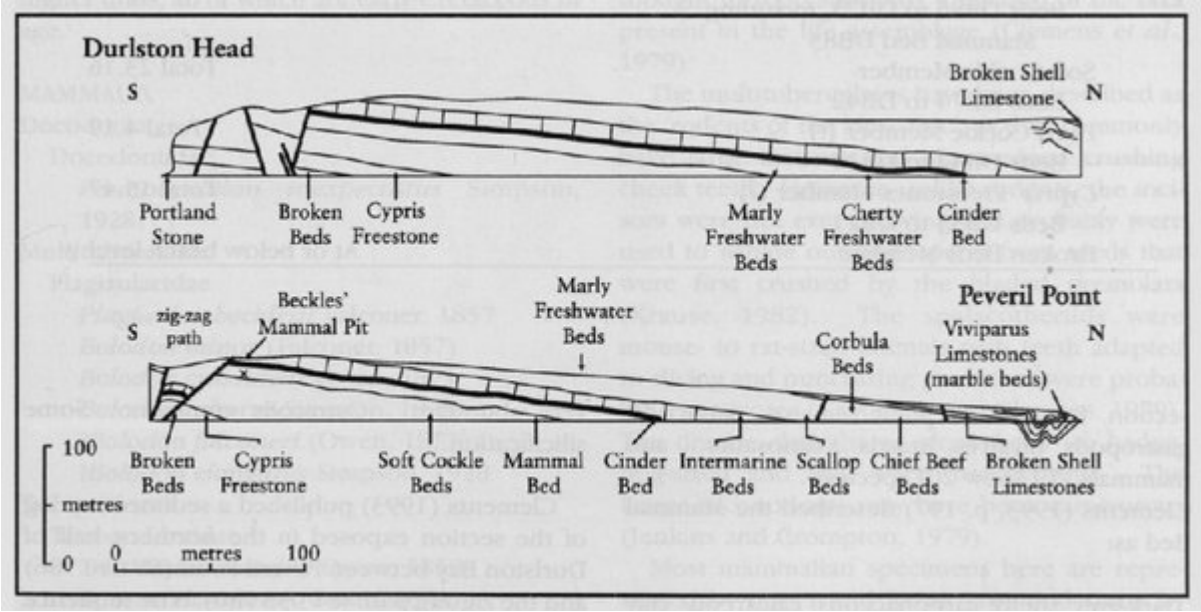
Comparison with other sites

The mammalian fauna preserved at Duriston Bay can be compared directly with the more recently discovered materials from Sunnydown Farm on the Isle of Purbeck and other sites nearby (Ensom *et al.,* 1994; Sigogneau-Russell and Ensom, 1994; Ensom and Sigogneau-Russell, 2000; Sigogneau-Russell *et al.,* 2001). Further afield, the mammalian fauna from Durlston Bay may be compared with the Late Jurassic assemblages from Como Bluff, Wyoming, USA. Two of the Durlston Bay genera have been described from Como Bluff, namely *Trioracodon* and *Amblotherium,* whereas two others, *Ctenacodon* and *Docodon,* are closely related to *Bolodon* and *Peraiocynodon* respectively. In addition, *Tinodon micron* from the Sunnydown Farm site is congeneric with *T. bellus* and *T. lepidus* from the Morrison Formation (Ensom and Sigogneau-Russell, 2000).

Conclusions

The mammal fauna preserved at the Duriston Bay site is one of the most important in the world. It is the type locality for all but one of the named species in the fauna. The faunal assemblage is especially diverse and includes taxa also found in Wyoming, USA. Much of the importance of this locality comes from its long history of research, but also from the unique diversity and excellent preservation of its mammalian fauna. The site also has great potential for continued study: the cliff section is constantly being eroded by the sea and undoubtedly will provide more fossils in the future.

References



(Figure 2.18) Cliff profiles of Durlston Bay showing the type section of the Durlston Formation. (After Strahan, 1898.)

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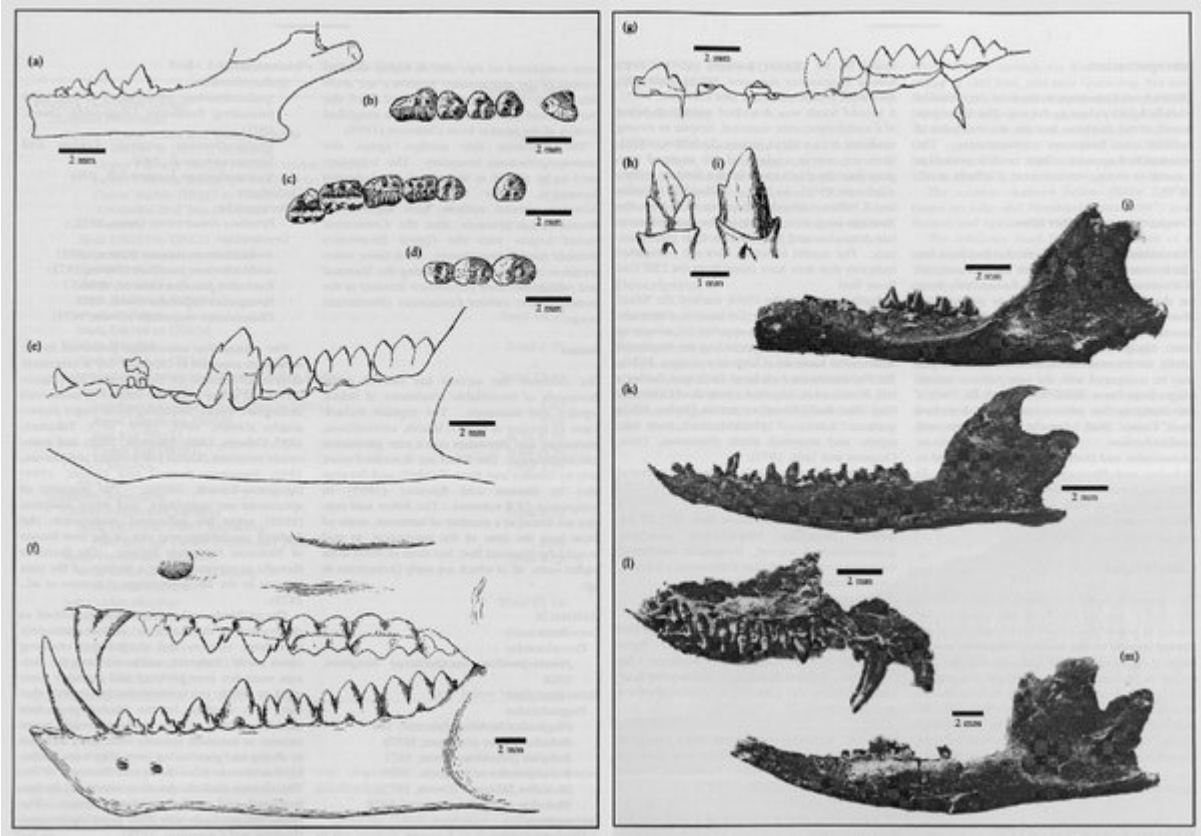

(Figure 2.19) Teeth and jaws of mammals from the Early Cretaceous deposits of Durlston Bay, Dorset. (a) Left lower jaw of the docodont Peraiocynodon inexpectatus in external view. (b-d) Crown views of the known upper dentitions of the species of Bolodon; B. crassidens (b), B. osborni (c), and B. elongatus (d). (e) Left lower jaw of the triconodont Triconodon mordax in external view. (f) Composite reconstruction of the jaws and teeth of the triconodont Trioracodon ferox. (After Simpson, 1928.) (g) Internal view of the right lower teeth of the triconodont Thioracodon oweni. (h,i) Left lower molar of the spalacotheriid Spalacotherium tricuspidens in internal and external views. (j) Left lower jaw of the peramurid Peramus tenuirostris in external view. (k) Right lower jaw of the dryolestid Amblotherium pusillum in internal view. (l) Left maxilla of the dryolestid Kurtodon pusillus in internal view.(m) Right lower jaw of the dryolestid Phascolestes mustelula in internal view. (After Simpson, 1928.)