Whitecliff Bay, Isle of Wight

[SZ 643 864]

Introduction

A section from the Reading Formation to the lower part of the Bouldnor Formation is exposed in Whitecliff Bay (Figure 3.19). Fossil vertebrates generally have been found at various horizons in Whitecliff Bay (Hooker *et al.,* 1980), but mammal remains have been found only in the Headon Hill, Bembridge Limestone and Bouldnor formations. They occur at a number of levels: in the Totland Bay, Lacey's Farm Limestone and Osborne members of the Headon Hill Formation, in the middle muds of the Bembridge Limestone Formation and in the Bembridge Marls Member of the Bouldnor Formation. The stratigraphy has been described by White (1921), Edwards (1966), Bosma (1974), Insole and Daley (1985), Daley and Edwards (1990) and Daley (1999b).

Mammal remains were reported from the Totland Bay Member by Bosma (1974), the Lacey's Farm Limestone and Osborne members (formerly 'Osborne Beds') by Bosma and Insole (1972), the Bembridge Limestone by Hooker *et al.,* (2004) and the Bembridge Marls Member by Bosma (1974), and Hooker *et at.* (2004).

Although the beach is generally covered by a substantial layer of gravel, storms often uncover the Eocene sediments. The section seen in the cliff is often leached and somewhat decalcified, except after a period of erosion, when a clean section is present.

Description

The section of Late Eocene and earliest Oligocene sediments in Whitecliff Bay (Figure 3.18) and (Figure 3.19) provides the most complete such sequence in the Hampshire Basin. Indeed, Stinton and Curry (1979) named Whitecliff Bay as the type locality for their Solent Formation, a unit that Insole and Daley (1985) raised to the rank of Solent *Group* and which includes the Headon Hill, Bembridge Limestone and Bouldnor formations. The measured section given here (Table 3.5) is simplified from Insole and Daley (1985, pp. 73, 91, 95).

The Whitecliff Bay section extends higher in the Hampshire Basin sequence than does the Headon Hill section, to include the Bembridge Marls Member of the Bouldnor Formation. It also differs in including an additional unit, the Seagrove Bay Member, at the top of the Headon Hill Formation; the Hatherwood Limestone Member is missing; the Colwell Bay Member is much thicker and fully marine at the base; and the Totland Bay Member is much thinner, through pre-Colwell Bay Member erosion. Mammal fossils have been found at six horizons through the sequence: near the base in the Totland Bay Member, in the Lacey's Farm Limestone Member, near the top of the Osborne Member, and at two levels in the Bembridge Marls Member.

The mammal remains from the Totland Bay Member occur in a lens of clay, 25 cm thick, with abundant '*Limnaea', 'Planorbis'* and *Viviparus,* termed locality WB1 (Bosma, 1974, p. 29). The lens is situated in a green clay unit, about 2 m thick, which passes up into pure lignite. The lens is about 3 m above the base of the unit, marked by the contact with the underlying Becton Sand Formation.

Mammals have been found at three horizons in the 'Osborne Beds', in marls and muds, at University of Bristol localities 7066, 7101 and 7102 (Bosma and Insole, 1972). The first locality is about 7 m from the base, and the last two 30–35 m from the base, corresponding respectively to the Lacey's Farm Limestone Member, the upper part of the Osborne Member and the lower part of the Seagrove Bay Member, in modern terminology.

Mammal bones and teeth also have been found in the Bembridge Marls Member, both right at the base of that unit and some 10 m up the section. Bosma (1974, pp. 29–30) specified that mammal remains came from her localities WB2A and WB2B, both in the cliff at Whitecliff Bay, below Bembridge School [SZ 643 865]. Site WB2A produced fossils from a white

marly limestone that fills irregular depressions in the top of a solid limestone bed. The WB2B material was collected from a yellow marl about 20 cm thick, situated 5–10 m west of WB2A at about the same level. The fossiliferous horizon is about 11.5 m above the main limestone succession of the Bembridge Limestone Formation. This unit has produced remains of some 22 species of mammals (Hooker *et al.,* 2004).

Fauna

The mammal fauna of the Totland Bay Member so far recorded is restricted to the rodent *Thalerimys headonensis* (Bosma, 1974). That from the Lacey's Farm Limestone Member is restricted to *Isoptychus pseudosiderolithicus* (Bosma and Insole, 1972), and that from the Osborne Member includes only *Tarnomys quercyi* and *Isoptychus* (Bosma and Insole, 1972; Hooker, 1987). The Bembridge Marls Member mammals are accompanied at the base of the unit by shark teeth (Hooker *et al.,* 1980). The faunal list given is just for the Bembridge Marls Member and is from Bosma (1974), Hooker (1987) and Hooker *et al.* (1995, 2004) and includes smaller mammals found at the Whitecliff Bay microvertebrate localities, as well as larger animals found by prospecting in both Whitecliff Bay and Howgate Bay at higher horizons in the member.

(Table 3.5) The measured section of the Solent Group for Whitecliff Bay (after Insole and Daley, 1985; Daley and Edwards, 1990)

	Thickness (m)
Pleistocene	
Plateau gravels	
Bouldnor Formation	
Bembridge Marls Member	
Mud, green-grey to grey, with shell bands	*c.* 18.0
Siltstone, grey-green, erosional structures, pseudomorphs after gypsum, gastropods	1.4
Mud, grey-green, occasional sandstone bands	1.2
Marl, light green-grey, some siltstone bands	0.9
Mud, green-grey mottled red, sandy lenses	9.0
Mud, dark green-grey, pyritized shell band at base	1.2
Mud, green-black, discontinuous argillaceous limestone near middle	0.9
Muddy sand, light green-grey, marine fossils	0.4
Mud, grey-green, with shelly sands and muds	1.4
Bembridge Limestone Formation	
Marls, pale-green, burrowed top	1.2
Limestone, white, conglomeratic at base	1.4
Limestone, pale-brown, with gastropods	0.7
Marl and mud, grey, becoming darker downwards, with *Corbicula*	1.3
Limestone, pale-brown to pale-grey at base, lignitic near middle	2.3
Marl, pale-grey, with thin limestone at base	1.8
Headon Hill Formation	
Seagrove Bay Member	
Mud, dark green with pale green siltstone above	2.8
Sandstone and sandy limestone, with mud band	0.8
Mud, green with brown mottling, some calcareous concretions	4.8
Sandstone, yellow, with basal erosion surface	0.7
Osborne Member	

Mud, red and green mottled near top, grey in middle, grey-green with red mottling lower, and black at base	10.4
Fishbourne Member	
Mud, grey and grey-green, shaly with sporadic *Viviparus* bands	10.9
Lacey's Farm Limestone Member	
Marl, green, with concretions and calcareous bands	6.7
Cliff End Member	
Mud, green with red mottling	4.0
Mud, grey-green	8.0
Linstone Chine Member	
Fine-grained pale-green sandstone	1.5
Colwell Bay Member	
Mud, green and green-grey, with *Lymnaea*	5.8
Fine-grained sand, pale-green to mud, grey-green	1.6
Mud, dark-green, passing down into pale-yellow fine-grained sand	3.2
Sandy mud, blue-grey, very shelly in upper half	4.1
Mud, pale grey, abundant *Ostrea* at base	1.2
Sandy mud, blue-grey, with shell beds, basal erosion surface	12.9
Totland Bay Member	
Marl, pale-green, with shelly bands	1.8
Muddy fine-grained sand, pale-grey, sandy ironstone at base	1.8
Mud, pale grey, with several lignitic layers	2.8
Mud, bright green	1.7
Rests conformably on Becton Sand Formation	

MAMMALIA

Marsupialia

Herpetotheriidae

Amphiperatherium spp.

Rodentia

Pseudosciuridae

Tarnomys schmidtkittleri Hooker and Weidmann, 2000

Treposciurus gardneri Hooker, 1991a

Suevosciurus ehingensis Dehm, 1937

Theridomyidae

Isoptychus pseudosiderolithicus de Bonis, 1964

Ectropomys exiguus Bosma and Schmidt-Kittler, 1972

Gliridae

Glamys devoogdi (Bosma and de Bruijn, 1979)

Bransatoglis bahloi Bosma and de Bruijn, 1982

Lipotyphla

Amphilemuridae

Gesneropithex sp.

Archonta undiff.

Nyctitheriidae

Saturninia gracilis Stehlin, 1941

Paradoxonycteris tobieni (Sigé, 1976)

Amphidozotherium cayluxi Filhol, 1877

Primates

Omomyidae

Microchoerus edwardsi (Filhol, 1880)

Apatotheria

Apatemyidae

Heterohyus nanus Teilhard, 1922

Pantolesta

Pantolestidae

Cryptopithecus sp.

Artiodactyla

Choeropotamidae

Choeropotamus parisiensis Cuvier, 1821

Tapirulus sp.

Cainotheriidae

Paroxacron sp.

Anoplotheriidae

Anoplotherium commune Cuvier, 1804

Xiphodontidae

Xiphodon gracilis Cuvier, 1822

Haplomeryx zitteli Schlosser, 1886

Perissodactyla

Palaeotheriidae

Plagiolophus minor (Cuvier, 1804)

The rodents from Whitecliff Bay have had an important influence on studies of early rodent evolution, forming the basis of a number of papers (Bosma and Insole, 1972; Bosma and Schmidt-Kittler, 1972; Bosma, 1974; Bosma and de Bruijn, 1979, 1982). The sequences at Whitecliff Bay and Headon Hill, together with supplementary shorter sections at Lacey's Farm Quarry and Bouldnor Cliff, have formed the basis for a detailed rodent biostratigraphy of the Late Eocene to early Oligocene time interval (Bosma, 1974; Bosma and de Bruijn, 1979, 1982).

The Osborne Member at Whitecliff Bay has so far produced only small mammals, whereas the Bembridge Marls Member fauna consists of small and large mammals, with a modest array of artiodactyl and perissodactyl remains.

The mammal teeth and bones from the Osborne Member were obtained by sieving (Bosma and Insole, 1972). Similarly, the mammal remains from the Bembridge Marls Member, as sampled by Bosma and Schmidt-Kittler (1972), Bosma (1974) and Hooker (1991a), also were obtained by sieving sediment and subsequent concentration using acetic acid. The bones and teeth were essentially small elements, and those from Bosma's locality WB2A at least included 'polished bone fragments'.

The Bembridge Marls Member of Whitecliff Bay is the source of the type specimen of the rodent *Ectropomys exiguus* Bosma and Schmidt-Kittler, 1972 (Figure 3.20).

Interpretation

The lower parts of the succession are similar depositionally to the equivalent units at Headon Hill. An exception to this is the Colwell Bay Member, which is fully marine at its base and contains calcareous nannoplankton as well as a diverse mollusc fauna, an important point of calibration to standard marine sequences. The sediments of the Osborne Member are dominantly colour-mottled clays with mudcrack horizons and occasional bone concentrations, which suggest the overbank facies of a floodplain. The overlying Seagrove Bay Member appears to be a higher-energy fluvial deposit prograding over the Osborne Member (Hooker, 1992).

The Bembridge Marls Member mammal fauna, according to its ecological diversity signal, indicates an open woodland (Collinson *et al.,* 1993). The depositional environment of the Bembridge Marls Member varies from lagoonal near the base to fluvio-lacustrine alternations higher up (Daley, 1972, 1973).

Comparison with other localities

The presence of *Thalerimys headonensis* in the Totland Bay Member indicates an age-correlation of site WB1 with the lower fauna of the Totland Bay Member at Headon Hill (Bosma, 1974).

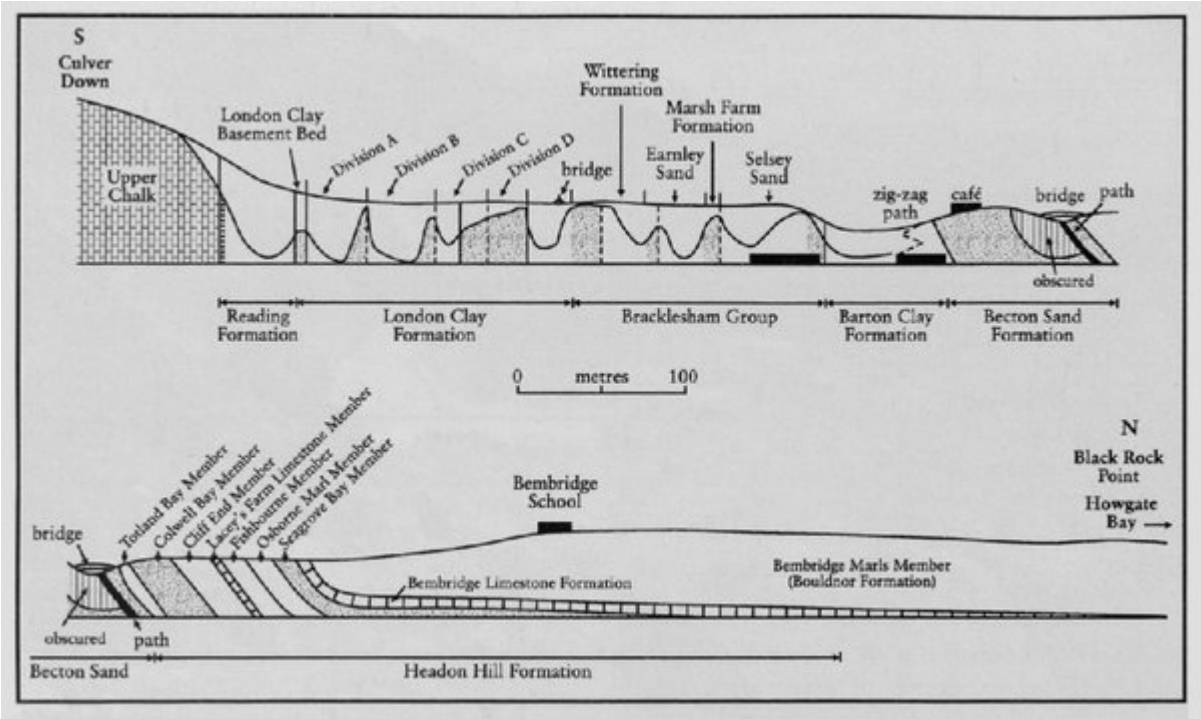
Mammals from the other members of the Headon Hill Formation are currently too sparse to attempt correlation other than by lithostratigraphy.

The Bembridge Marls Member mammal faunas of Whitecliff Bay are attributed to Mammal Paleogene Reference Level MP20 (Schmidt-Kittler, 1987), equivalent to the sites Huermeces del Cerro in Spain, St Capraise, Tabarly, Baby 2 and Villeneuve la Comptal 2 in France, and Frohnstetten, Neustadt and Nordshausen in Germany. They also may belong to the *suevicum–frohnstettense* Zone, although this is uncertain (Hooker, 1987).

Conclusions

Mammal fossils can be found at several horizons in the rock succession at Whitecliff Bay, spanning the entire Late Eocene and earliest Oligocene times. The fauna from the Bembridge Marls Member is by far the best known in that unit from any British site and includes the type material of the rodent *Ectropomys exiguus.* Faunas from other levels are as yet poorly known but potentially are important, as the Standard Calcareous Nannoplankton Zone NP19/20 is recorded at the base of the Colwell Bay Member, facilitating correlation with the marine realm. Correlation thence via mammals to Headon Hill provides a vital chain of relative dating between marine and non-marine provinces in Europe. The total Whitecliff Bay section, because of its long uninterrupted timespan, is critical as a European standard for geological time through this interval, and the intercalation of several mammal faunas, although overall less diverse than at Headon Hill, is important in this broader context. The mammal-bearing horizons are still available, and ongoing intensive collecting is enhancing their importance.

References



(Figure 3.19) Cliff profile of the Paleogene section at Whitecliff Bay, Isle of Wight. (After Insole et al., 1998.)

(Figure 3.18) The Bembridge Marls Member of the Bouldnor Formation at Whitecliff Bay, Isle of Wight. (Photo: Dave Evans.)

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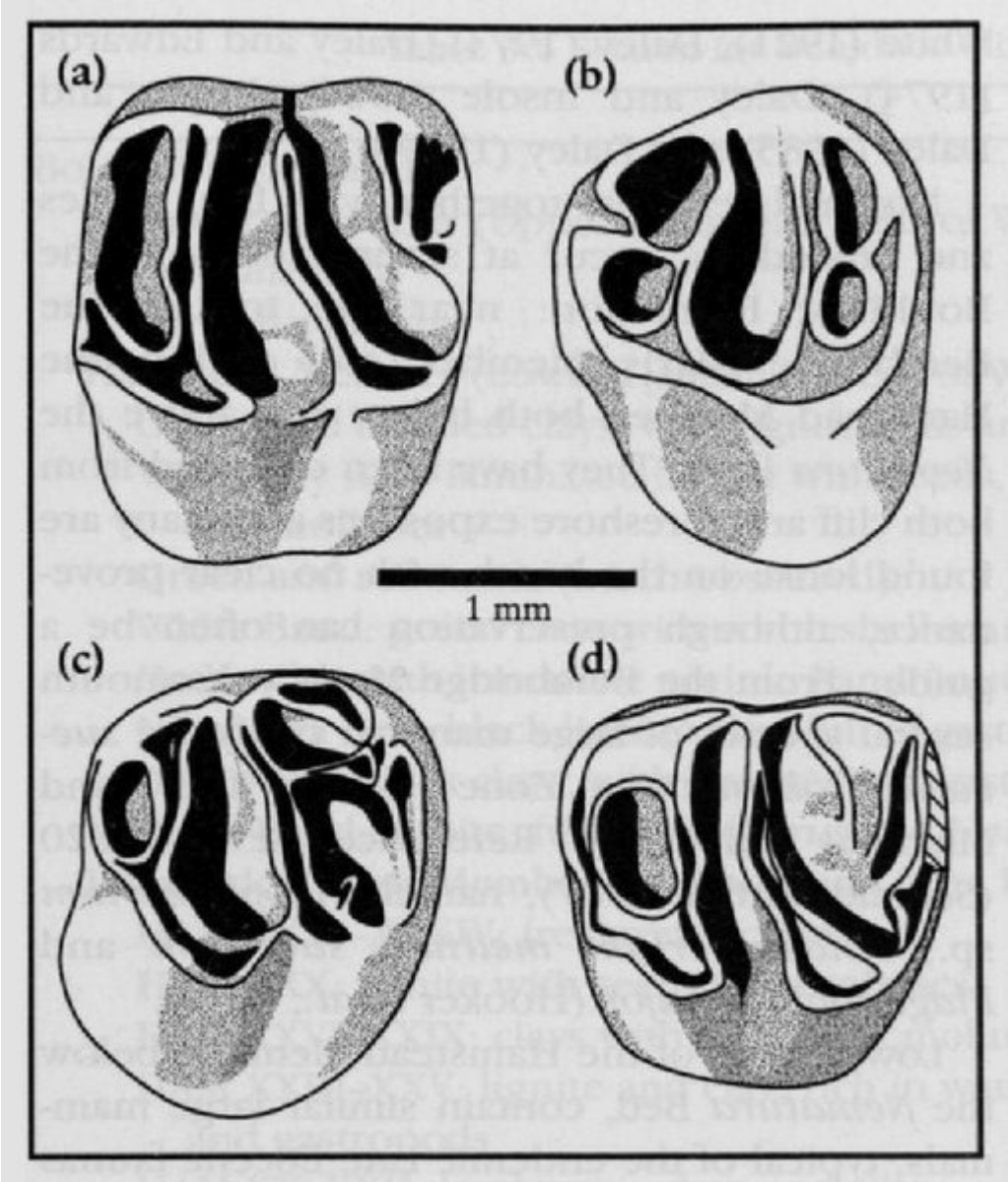

(Figure 3.20) The rodent Ectropomys exiguus from the Bouldnor Formation of Whitecliff Bay, Isle of Wight. (a) Upper molar 1 or 2. (b) Upper molar 3. (c) Upper premolar 4. (d) Upper milk premolar 4. All in crown view. (After Bosma and Schmidt-Kittler, 1972.)