Colwell Bay, Isle of Wight

[SZ 327 878]–[SZ 331 887]

Highlights

Seven members of the Headon Hill Formation are represented in Colwell Bay and, for two of these, it is the type section. Particularly well developed is the Colwell Bay Member whose fossils have long been one of the main attractions of the section. The succession contrasts with its time equivalent in Headon Hill and demonstrates how rapidly lateral changes can occur within a small geographical area.

Introduction

From Warden Point (grid reference [SZ 325 878]) to Cliff End [SZ 330 980], cliff and limited foreshore sections occur in the Headon Hill Formation of Insole and Daley (1985) from the Totland Member to the Osborne Marls Member. The section is important stratigraphically and for both animal and plant fossils. The Colwell Bay Member (formerly the Middle Headon Beds) has provided a focus of interest since it represents a major transgressive period represented by quite a rich and diverse fauna.

Colwell Bay has been of interest to geologists for many years. Descriptions of the section include those of Bristow *et al.* (1889), White (1921) and Edwards (1967), Stinton (1971a), Insole (1972), Curry *et al.* (1972) and Daley and Edwards (1974). Palaeontological studies include work on the foraminifera by Murray and Wright (1974) and on the plant macrofossils by Chandler (1963a) and Collinson (1978a). Insole and Daley (1985) have designated the site as the stratotype for two members of the Headon Hill Formation. The section has been re-described by Daley (1999, pp. 46–49).

This site was also independently selected for its fossil plant content, a more detailed account of which can be found in the GCR series volume *Mesozoic to Tertiary Palaeobotany of Great Britain* (Cleal and Thomas, in prep.).

Description

The Colwell Bay site comprises a cliff section (Figure 5.31) truncating three chines: from south to north, Colwell Chine, Brambles Chine and Linstone Chine (Figure 5.32). Some foreshore sections may be accessible at low water. With the exception of a small, tight anticline north of Linstone Chine, the strata dip gently northwards.

Litbological succession

Altogether, the succession comprises approximately 33 m from the How Ledge Limestone (Totland Bay Member) to the poorly exposed Osborne Marls Member at the top of the succession at Cliff End (Figure 5.33). However, to the south of Cliff End, well under half of this thickness is present, with the top of the cliff formed mainly by the lowest beds of the Cliff End Member.

The essentially elastic sequence comprises a succession of variously coloured muds and sands. Amongst the distinctive lithotypes are the very shelly, muddy sands of the 'Colwell Oyster Bed' (Colwell Bay Member) and the heterolithic Linstone Chine Member. Three thin buff-coloured limestones occur. The How Ledge Limestone outcrops at the bottom of Colwell Chine and the other two at Cliff End.

Stratigraphy

Seven members of the Headon Hill Formation are represented in Colwell Bay (Figure 5.33), but in detail the sequence differs from that further south in Headon Hill. Along most of the section, the Hatherwood Limestone Member is absent

and the Cliff End Member rests on the eroded top of the Linstone Chine Member. However, at the northern part of the bay, towards Cliff End, the latter is overlain by a 0.5 m buff *Galba*-bearing limestone, the top of which is truncated by an erosion surface. This thin limestone may be the local representative of some part of the Headon Hill Limestone. The Lacey's Farm Limestone Member is completely absent in Colwell Bay.

Colwell Bay is significant stratigraphically, since it contains the stratotypes for two members in the Headon Hill Formation (Insole and Daley, 1985). The stratotype for the Colwell Bay Member is the cliff section adjacent to Brambles Chine [SZ 330 883], whilst that for the Linstone Chine Member is the upper part of the cliff between Brambles and Linstone Chines (around [SZ 331 884]). Formerly called the Middle Headon Beds, the Colwell Bay Member can be divided into a lower, grey, mainly sandy part and an upper, bright green, muddier part. This member contains the 'Neritina Bed' followed by the 'Venus Bed', although between Colwell and Brambles Chines, the latter is replaced by the lenticular 'Oyster Bed', thought to have originated as a tidal-channel fill (cf. White, 1921). The marine Brockenhurst Bed does not occur in Colwell Bay, but the brackish water 'Neritina Bed' is its probable equivalent (Vella, 1969).

Invertebrate macrofauna

The fossils of the Colwell Bay Member have always been one of the main attractions of the section. *Theodoxus, Potamides, Corbicula* and other molluscs occur in the 'Neritina Bed' to the north of Colwell Chine but exposures are usually poor. A particularly good locality for invertebrate fossils is either side of Brambles Chine, where the overlying 'Venus Bed', together with the succeeding bright green muds, is normally well-exposed (see Stinton, 1971a). Curry and Edwards (in Curly *et al.,* 1972) reported some hundred species of mollusc from the 'Venus Bed'. The fauna is predominantly marine, with paired valves of the characteristic *Sinodia* (*Venus*) *suborbicularis,* some in life position, but estuarine and a few freshwater molluscs also occur. Since oysters, corbiculids and cerithiids are present in large numbers and echinoids and corals are absent, inshore, muddy river-influenced conditions seem probable (Daley and Edwards, 1974, p. 284). Where the 'Venus Bed' is replaced by the 'Oyster Bed', 90% of the shells are oysters (*Ostrea velata*), together with other species such as *'Murex' sexdentatus* and *Nucula headonensis,* and together represent a death assemblage in a sandy matrix.

At other horizons, a number of assemblages are much more taxonomically restricted, although often abundant in individuals. For example, in the remainder of the Colwell Bay Member above the 'Venus Bed', *Theodoxus apertus, Potamides pseudocinctus* and *Globularia harrisi* are conspicuous, whilst more characteristic marine elements of the underlying bed are missing (Curry and Edwards, *in* Curry *et al.,* 1972). In the bottom part of the Linstone Chine Member, a nearly monogeneric assemblage of the prolifically occurring brackish water bivalve *Potamomya* is present, whilst in the Cliff End Member above, this genus recurs in abundance, together with *Corbicula* and *Potamides* in certain beds.

Whilst all of these assemblages represent a variety of hyposaline conditions, the presence of *Viviparus* and *Unio* at some other horizons is indicative of freshwater conditions. The latter are also indicated by freshwater pulmonate assemblages comprising *Galba* and *Planorbina* found in thin limestones. They also occur in the 'How Ledge Limestone' (Totland Bay Member) present at the foot of the low cliff just north of Colwell Chine and forming How Ledge on the foreshore south of Brambles Chine.

Microfauna

The foraminifera from Colwell Bay were studied by Bhatia (1955, 1957) and Murray and Wright (1974). The latter authors described two faunules from the Colwell Bay Member. The lower of these, including the 'Oyster Bed', is interpreted as indicating hyposaline estuarine or lagoonal conditions, with very shallow, just sub-tidal waters. The upper, from a 'green sandy clay', is dominated by *Quinqueloculina impressa,* many of them large, and is thought by Murray and Wright to represent near-normal (>32 parts per thousand) salinities.

The occurrence of ostracods in the Colwell Bay succession was considered by Keen (1977) in a broader study of ostracod assemblages from the Solent Group. His study included the description of a new freshwater ostracod, *Candona cliffendensis* from the 'Upper Headon Beds' of Cliff End at the northern end of Colwell Bay. Another species named after the locality is *Neocyprideis colwellensis* (Jones), which characterizes Keen's (1977) brackish, mesohaline assemblage.

Ostracods reflecting higher salinities are found in the Colwell Bay Member, although truly marine salinities were apparently not developed at this time in this area, in contrast with the situation at Whitecliff Bay and in the New Forest (Keen, 1977, p. 426).

Flora

Plant macrofossil remains from the Upper Headon Beds of Colwell Bay have been described by Chandler (1955, 1961a, 1963a) and more recently by Collinson (1978a, 1980b). Chandler (1955) recorded the occurrence of fertile fern-leaf fragments from the Headon Beds and later (Chandler, 1961a) reported the presence of five water plants from the Lower Headon Beds. Collinson (1978a) found plant macrofossils including *Typha, Azolla* and seeds of *Potamogeton* in the 'Upper Headon Beds' (probably the Linstone Chine Member) near Linstone Chine. In a subsequent paper (Collinson, 1980b), she described *Azolla colwellensis* in some detail. Colwell Bay was also extensively sampled by Machin (1971) in her comprehensive study of Palaeogene pollen and spores from the Isle of Wight.

Interpretation and evaluation

Only a limited range of strata are exposed in Colwell Bay, the succession being totally within the Headon Hill Formation. The succession is, however, important both stratigraphically and palaeontologically and contributes significantly to our understanding of contemporary environments and geography.

Dating the succession

The strata in Colwell Bay are now generally considered as being of late Eocene age (Curry *et al.,* 1978), although the Geological Survey Isle of Wight Sheet (1976) still shows them incorrectly as Oligocene. The section appears to be of limited chronostratigraphical value. It has not, as yet, been dated from in-situ material, but the Colwell Bay Member elsewhere has in part been referred to nannoplankton Zone NP 19–20 (Aubry, 1986).

Lithostratigraphy

The section is of lithostratigraphical importance since it is the type locality for two members from the Headon Hill Formation. One of these, the Colwell Bay Member of Insole and Daley (1985) is synonymous with the Lyndhurst Member of Edwards and Freshney (1987b).

Comparison with other localities

The sequence at Colwell Bay differs in a number of ways from successions in the Headon Hill Formation elsewhere. From Colwell Bay to Headon Hill it is apparent that the Totland Bay Member on the west side of the Isle of Wight is far thicker than at Whitecliff Bay. The presence of a number of freshwater limestones, like the How Ledge Limestone, in the west and their absence from the member in the east is a significant lithological difference. Edwards and Freshney (1987a, fig. 39) suggested that the western localities represent alluvial plains with small freshwater lakes, whilst muddy lagoons occurred further north and to the east (presumably including Whitecliff Bay). This is, however, an oversimplification since brackish and freshwater fossils occur within the member on both sides of the Island.

The Colwell Bay Member in Colwell Bay is thicker than at Headon Hill, although the 'Batillaria Bed' which forms the top of the unit at the latter locality is absent. The occurrence of rolled '*Batillaria'* at the base of the overlying unit in Colwell Bay indicates that this absence resulted from contemporaneous erosion. This member is only around 10 m thick here, compared with 30 m in Whitecliff Bay, a reflection of the marked thinning of this marine unit to the west.

Depositional environment and palaeogeography

The absence of the marine Brockenhurst Bed (present to the north towards Lyndhurst and at Whitecliff Bay) suggests that the initial Colwell Bay Member transgression failed to introduce fully marine salinities as far south-west as the Colwell Bay area (see Edwards and Freshney, 1987a, fig. 40). Hence, lower salinities gave rise to the fauna of the

apparently contemporaneous 'Neritina Bed'. Murray and Wright (1974) in fact concluded, on the basis of their foraminiferal work, that all faunas, except for one towards the top of the member in Colwell Bay, represented hyposaline conditions with the environment essentially lagoonal or estuarine. The succeeding Linstone Chine Member contains an exceptionally well-preserved variety of structures indicative of intertidal deposition, although the restricted fauna present implies hyposaline waters.

The virtual absence of the freshwater limestones, which form a distinctive feature of the upper part of the succession in Headon Hill, is an important aspect of the section in Colwell Bay. Insole (1972) noted that these limestones are at their thinnest where the Linstone Chine Member is best developed and has suggested that freshwater limestones developed in topographic hollows in a relict sandflat surface. There is, on the other hand, some evidence of erosion at this level which may have locally removed virtually all of the limestone deposited in the Colwell Bay area.

As at Whitecliff Bay, and in the north-eastern sections of Headon Hill, the Cliff End Member rests with a sharp break on the underlying strata. The fauna is clearly indicative of an environment with variable, brackish to freshwater salinities, perhaps a river-influenced lagoon. Why the Lacey's Farm Limestone (the Osborne Beds Limestone of Edwards, 1967) is absent in Colwell Bay is uncertain. It may be that this area was still submerged at the time when emergence further to the south led to its development by a process of calcretization.

Palaeontology

Within recent years, the importance of the site as a water-plant macrofossil locality has been established (Collinson, 1978a, 1980b). Whilst the foraminifera have also been the subject of modern work (Murray and Wright, 1974), a great deal of potential still exists for molluscan macrofossil work, in particular on the taxonomy and palaeoecology of the hyposaline assemblages.

Conclusions

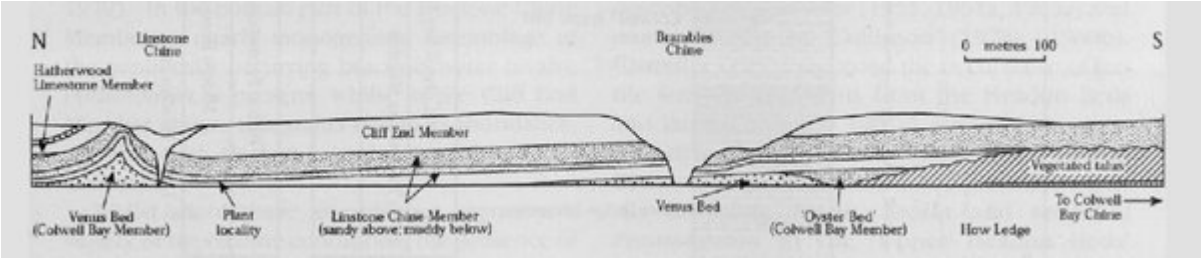
Colwell Bay is a significant section lithostratigraphically. It is the type section for two members of the Headon Hill Formation, whilst the absence of the thick Hatherwood Limestone and Lacey's Farm Limestone illustrates how rapidly lateral changes can occur in a paralic context.

The section provides an opportunity to study a wide variety of environments from freshwater to almost wholly marine conditions. It is particularly famous for the rich faunal assemblages of the Colwell Bay Member (formerly Middle Headon Beds), although it is now known that, for most of the time represented by this unit, conditions were not quite fully marine. The heterolithic lithology of the Linstone Chine Member is a particularly striking example of an intertidal deposit.

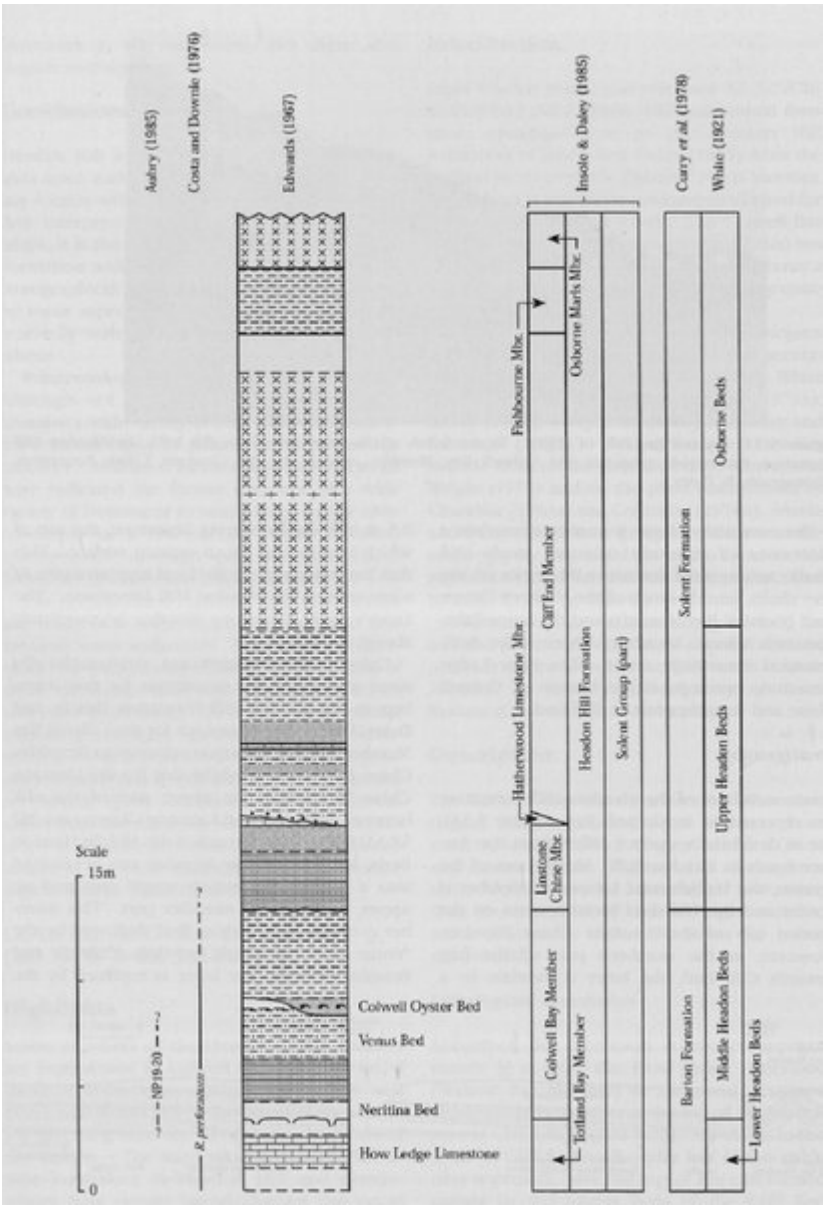
Apart from the molluscan fauna of the above and other horizons, Colwell Bay has proved an important locality for microfaunal research on ostracods and foraminifera and for plant macrofossil studies, particularly of water plants. It is therefore considered to be a major palaeontological site.

References

(Figure 5.31) Colwell Bay, Isle of Wight. To the south of the Brambles Chine (far left), the Headon Hill Formation succession comprises the Colwell Bay Member overlain by the Linstone Chine Formation. (Photograph: B. Daley.)



(Figure 5.32) Colwell Bay, Isle of Wight: cliff profile (after N. Edwards, pers. comm.; Daley and Insole, 1984).



(Figure 5.33) Lithostratigraphical and biostratigraphical succession of the Headon Hill Formation, Colwell Bay, Isle of Wight (after Edwards, 1967; Insole and Daley, 1985 and other authors).