# Cliff End, East Sussex

[TQ 886 127]

## Introduction

Since the 19th century, the Cliff End Bone Bed, near Fairlight, East Sussex, has been a rich source of vertebrate materials, of both body and trace fossils (Benton and Spencer, 1995). Taxa include hybodont sharks (Patterson, 1966), bony fishes (*Lepidotes*), reptiles (including turtles and crocodiles) and mammals (Clemens and Lees, 1971).

## Description

The Cliff End Bone Bed (Figure 2.20) is exposed in the sea cliffs approximately 7 km east of Hastings, between Fairlight Cove and Pett Level. At their highest, the cliffs reach some 30 m. The bone-bearing facies is rarely seen in *situ* at Cliff End, but fossils are found in fallen blocks on the foreshore (Figure 2.21). The Cliff End Bone Bed has been recorded in a road cutting [TQ 888 137] through the Wadhurst Clay in the village of Cliff End, and near Guestling, Rye and Baldstow (Lake and Shephard-Thorn, 1987). Detailed sedimentary logging at Cliff End has shown that the bone bed occurs in the Wadhurst Clay, approximately 3 m above the Cliff End Sandstone (Allen, 1967; Lake and Shephard-Thorn, 1987).

The section outlined below (Table 2.5) is based on Lake and Shephard-Thorn (1987) and Benton and Spencer (1995):

The Ashdown Sand Formation consists of a series of fine- to medium-grained sandstones. The lower parts of the section contain well-developed cross-bedding, especially near Cliff End Point. Smaller-scale structures such as cross-laminations, planar bedding, silt/mud drapes, slumps and penecontemporaneous folds and faults are common (Lake and Shephard-Thorn, 1987; Stewart, 1981; Allen, 1962).

The Cliff End Bone Bed is a pale-grey, well-cemented granulestone. The average grain size (diameter) of the clasts is 2.0 mm. Some 97% of the clasts are quartz; the remainder are lithic (sandstone and claystone) lasts, fragments of wood and vertebrate fossils. The matrix consists of very fine-grained quartz and clay cemented by calcite (Cook, 1995a). The bone bed occurs in scours, runnels and gutters in the Wadhurst Clay; occasionally they join up forming small sheets (Allen, 1975; Lake and Shephard-Thorn, 1987). Occasionally blocks of the bone bed are found interdigitating with cross-laminated grey sandstone (Cook, 1995b).

(Table 2.5) Section of the Cliff End GCR site

| | Thickness (m) |
|---|---|
| Hastings Group | |
| Tunbridge Wells Sand Formation | |
| Fine-grained, yellowish sandstones and silts with impersistent seams of mottled silty clay | Up to 50 |
| Wadhurst Clay Formation | 50–57 |
| Grey mudstones interlaminated with thin siltstones | |
| Also: calcareous sandstone beds (Tilgate Stone), sandstone channel, fills, soils and, near the base: | |
| Cliff End Bone Bed | |
| Cliff End Sandstone | |
| Top Ashdown Pebble Bed | 10 |
| Ashdown Sand Formation | 180–200 |
| The upper 30–50 m are chiefly sandstones, whereas the strata below are dominantly massive mottled sideritic sandstone beds. | |

Near the base:
Lee Ness Sandstone 1–2

Vertebrate material is common in the Cliff End Bone Bed, but mammal remains are rare, representing perhaps 5% of all bones (Patterson, 1966). It has been estimated that 200 kg of sediment will produce only one mammal tooth. The Cliff End Bone Bed is dated as Valanginian in age on the basis of its position within the Wadhurst Clay, its fossil content and regional considerations (Allen and Wimbledon, 1991).

## Fauna

Many of the early records of mammal teeth from the Hastings area are vague and do not provide an accurate site location. In the following list, only specimens with a known locality are given.

MAMMALIA

Multituberculata

Eobaataridae

*Loxaulax valdensis* (Woodward, 1911)

Trechnotheria

Spalacotheriidae

*Spalacotherium* cf. *tricuspidens* Owen, 1854

Cladotheria

Dryolestidae

*Melanodon hodsoni* Clemens and Lees, 1971

Boreosphenida

Aegialodontidae

*Aegialodon dawsoni* Kermack, Lees, and Mussett, 1965

The Wealden mammal specimens from Cliff End were described by Woodward (1911), Simpson (1928, 1929), Kermack *et al.* (1965) and Clemens and Lees (1971). All of the mammal fossils occur as isolated teeth. The plagiaulacid *Loxaulax valdensis* is known from several molar teeth ((Figure 2.22)a,b) and may represent more than one species as yet too incomplete to distinguish (Clemens and Lees, 1971). The dryolestid *Melanodon hodsoni* also is represented by isolated teeth ((Figure 2.22)c,d). *Melanodon is* known also from the Morrison Formation of Como Bluff, Wyoming, USA, but the species are different. *Spalacotherium trimspidens* was named from specimens from the Purbeck of Durlston Bay (see GCR site report), but a specimen from Cliff End also may be ascribed tentatively to that species. A further specimen has been reported (Gill, 2004).

The species *Aegialodon dawsoni* has special significance as the talonid of its unique lower molar is indicative of the tribosphenic grade of evolution. When named, it was the earliest mammal to show such structure. It is thus a therian mammal more derived than dryolestids or peramurids, although belonging to neither the marsupial nor the placental clade (Kielan-Jaworowska *et al.,* 1979; Luo *et al.,* 2001, 2002). Since it was described, earlier tribosphenic teeth have been discovered, viz. *Tribactonodon* from the English Purbeck Limestone (Sigogneau-Russell *et al.,* 2001), *Hypomylos* from Berriasian deposits in Morocco (Sigogneau-Russell, 1992) and *Ambondro* from Madagascan Bathonian sediments (Flynn *et al.,* 1999).

## Interpretation

The Hastings Group is composed primarily of arenaceous sediments, with subsidiary clay units. The sandy sediments were deposited predominantly on a series of braidplains (Allen, 1975, 1989). Meandering channels account for the wide lateral extent of the sandstone lithofacies (Stewart, 1983). The finer-grained sediments were deposited in swamps, lakes and brackish lagoons. The climate was warm temperate, with some degree of seasonality and humid–arid climate cyclicity (Allen, 1981; Allen *et al.,* 1998).

The Cliff End Bone Bed represents a reworked bone accumulation. Initial deposition of the bone materials was in a high-energy fluvial regime as winnowed lag deposits. The fluvial lag sediments were reworked during non-marine transgressions forming shoreline deposits (Allen, 1975; Cook, 1995a). The predominance of fish and shark remains reflects the aquatic nature of the deposit. The crocodile and mammal fossils indicate a minor input from partially and fully terrestrial systems (Cook, 1995b).

### Comparison with other localities

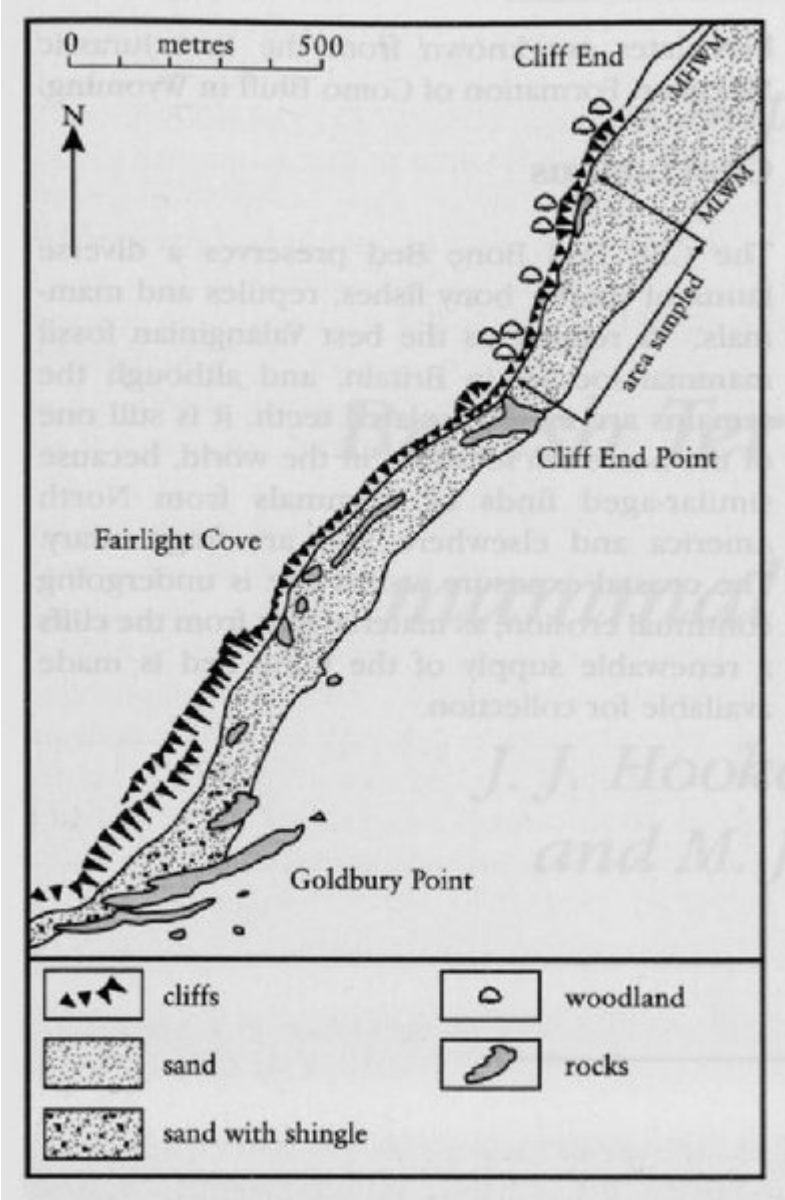
The sediments preserved at Cliff End are thought to be coeval with those at Tighe Farm. Here, similar sedimentary facies have produced only two mammals, *Melanodon hodsoni* and *Spalacotherium* sp.. The slightly younger Paddockhurst Park site has two taxa shared with Cliff End, but attributed only doubtfully. The third is a different species of *Spalacotherium. Spalacotherium tricuspidens* was first reported from the older Purbeck limestone site of Durlston Bay. Farther afield, *Melanodon* and different, but related, spalacotheriids and multituberculates are known from the Late Jurassic Morrison Formation of Como Bluff in Wyoming.

## Conclusions

The Cliff End Bone Bed preserves a diverse fauna of sharks, bony fishes, reptiles and mammals. It represents the best Valanginian fossil mammal locality in Britain, and although the remains are merely isolated teeth, it is still one of the best such localities in the world, because similar-aged finds of mammals from North America and elsewhere also are fragmentary. The coastal exposure at this site is undergoing continual erosion; as material falls from the cliffs a renewable supply of the bone bed is made available for collection.

**References**

*(Figure 2.20) Part of the Cliff End GCR site, east of Hastings, East Sussex. The Cliff End Bone Bed occurs at the top of the section. Fossil mammal teeth and bones have been found in fallen blocks from the bone bed on the foreshore. (Photo: R. Edmonds).*




*(Figure 2.21) Map showing the section of foreshore where fallen blocks of the Cliff End Bone Bed may be found in Fairlight Cove, east of Hastings. (MHWM = Mean high water mark; MLWM = Mean low water mark; after Cook, 1995a.)*

| | Thickness (m) |
|---|---|
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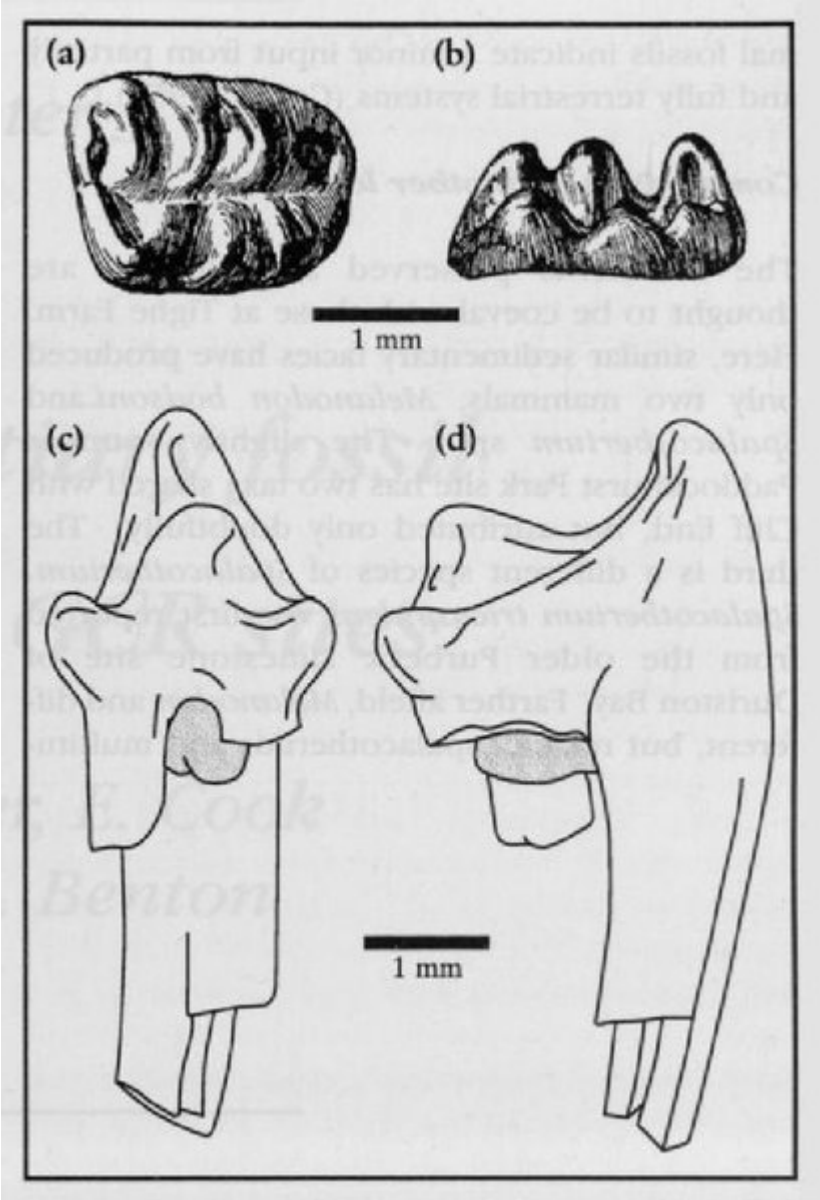
*(Table 2.5) Section of the Cliff End GCR site*




*(Figure 2.22) Teeth of mammals from the Early Cretaceous Cliff End Bone Bed, near Hastings, East Sussex. (a,b) Lower molar of Loxaulax valdensis in crown (a) and external (b) views. (c,d) Right upper molar of Melanodon hodsoni in external (c) and back (d) views. (Based on Simpson, 1928; and Clemens and Lees, 1971.)*