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# Brook–Atherfield Point

([SZ 375 842]–[SZ 452 788]) (Potential GCR site)

## Highlights

The Brook–Atherfield Point section on the Isle of Wight has yielded several type specimens of hybodont shark and is type locality for the aspidorhynchid *Belonostomus hooleyi* and the teleost *Pachythrissops vectensis*. The Compton Bay–Atherfield section is also well documented for the provenance of finds made.

## Introduction

The Wealden Group of the south-west coast of the Isle of Wight (Figure 13.7) is world famous for rich vertebrate faunas. It has yielded abundant material in the past (Reid and Strahan, 1889) and good finds are made frequently because of continuing coastal erosion. The overlying Atherfield Clay Formation of the Lower Greensand has also yielded abundant fish remains.

The section between Compton Bay and Atherfield Point has been described by White (1921, pp. 5–15), Daley and Stewart (1979), Stewart (1981b), Simpson (1985), Stewart *et al.* (1991) and Wach and Ruffell (1991). The exposed portions are dated as mostly Barremian, but may reach Early Aptian (Kerth and Hailwood, 1988; Hughes and McDougall, 1990; Allen and Wimbledon, 1991). The section is best known for its dinosaur fossils and has been designated an SSSI for fossil reptiles (Benton and Spencer, 1995).

## Description

The Wealden Group along the Brook–Atherfield section (Figure 13.7) and (Figure 13.8) is exposed in the core of the Brighstone anticline, the hinge of which is difficult to locate, but lies within Brook Bay. The Wealden Group and Atherfield Clay Formation (part) are to be seen at both ends of the section, and the oldest beds are in the Brook Chine area. The section, on the southern limb of the anticline, is summarized from White (1921) with refinements from Simpson (1985), and formation and member names from Stewart (1978), Daley and Stewart (1979), Simpson (1985) and Wach and Ruffell (1991).

	Thickness (m)
<b>Lower Greensand</b>	
Atherfield Clay Formation ( = Atherfield Group)	
Chale Clay Member ( = Atherfield Clay; beds 3–6 of Simpson, 1985, p. 27, fig. 4): pale bluish grey silty clay with numerous small round or irregular clay–ironstone nodules, some forming discrete bands. Highly fossiliferous, containing small fish teeth, pyritized wood and bivalves	19
<i>Perna</i> Beds Member: Upper Sandstone (bed 2 of Simpson, 1985, p. 27, fig. 4). Hard, coarse-grained, greenish calcareous sandstone in which marine fossils (bivalves, brachiopods, corals, rare ammonites, burrows and fish teeth) occur	0.54

Lower Clay and Atherfield Bone Bed (bed 1 of Simpson 1985, p. 27, fig. 4) : grey-brown, passing into dark blue, sandy clay with many bivalves (including *Panopea*, *Aetostreon* and *Mulletia*), echinoids, brachiopods, but no indigenous ammonites. At the base is a thin layer (10–100 mm) of coarse quartz grit, bone fragments, fish teeth, phosphate nodules, rolled Jurassic ammonites and reptile remains (Atherfield Bone Bed) 0.85

————— disconformity —————

### Wealden Beds

Vectis Formation ( = Wealden Shales) Shepherd's Chine Member: grey or grey-green muds and fine sandstones, deposited as a number of thin cyclic units; impersistent ironstone lenses; several thin coquina limestones, and other beds with ostracods, plants and fishes 45

Barnes High Sandstone Member ( = Sandstone of Cowleaze Chine and Barnes High of White, 1921): Massive, cross-bedded, yellow sandstone, with bands of *Filosina*, overlying thin-bedded sandstone with shale 7

Cowleaze Chine Member: blue shales containing bivalves, overlying white sand and clay 8

Wessex Formation ( = Wealden Marls) Beds with *Ophiomorpha*: at the very top, red sand with bones (*Hypsilophodon* Bed, 1 m); then reddish-brown mudstones, laminated in places, with mudcracks, calcareous nodules, burrows and rootlets, interbedded with medium-grained, cross-laminated sandstones; includes, about the middle, a new fossiliferous bed 14

Chine Farm Sandstone: white and yellow sand, with fragments and large trunks of carbonized wood ('lignite') 3

Clays/marls: pale-blue and purple clays, with two plant debris beds near the top (9 m), overlying 'hard green bed, containing lignite and bones' (0.7 m), followed by deep-red marls (2 m) and purple and mottled marls (10 m) 22

Barnes Chine Sandstone: sandstone with clayey beds 4

Deep-red marls, purple below 9

Pebbly sandstone: channel fill 1

Clays, marls and sands: green and white clays with purple and red marl and white, sandy interbeds 20

Ship Ledge Sandstone: fine, white sandstone 1

Mottled marls 8+

Grange Chine Black Band (Black Band of Brixton Chine of White, 1921, p. 14): plant debris bed with bivalves and bones 0.8

White, sandy marl (1 m) overlying 'mottled red marls of Brixton ( = Grange) Chine, with a plant debris bed near the middle' (29 m). The Grange Chine Sandstone occurs to the west of Grange Chine near the top 30

Marls and sandstones: green sandy bed with bones (0.7 m), overlying red and white sandstones interbedded with marl and a (0.1 m) bed of fragmented bone and pebble bed at the base (5 m), overlying mottled marls (15 m) 30

(?) Brighstone Sandstone: pebbly band with carbonized wood and pebbles of sandstone (top of east bank of Chilton Chine) 0.7

Chilton Chine Sandstone: cross-bedded sandstone (near the bottom of Chilton Chine) 4

Marls and sandstones: mottled marls, purple marls with white calcareous concretions, and red marls passing down into cross-bedded white sandstone and marl; plant debris beds near base 13

Sudmoor Point Sandstone: massive sandstone with irregular bands of bone; 0.2–0.6 m of gravel at base, with bones; 'Iguanodon' footprints near the top 6

Deep red and purple marls seen to 6

Unlike most other British fossil fish localities, there is much information about provenance of finds made in the Compton Bay–Atherfield section. The data given below are from White (1921). Unusually, there has always been a tradition among collectors of recording the locations of fossil vertebrate finds with a degree of precision rarely encountered elsewhere in Britain. Nearly all the specimens have a label such as 'Brook Bay' or 'Cowleaze Chine', which restricts the provenance to a particular part of the stratigraphical column, and further collector information such as 'at beach level' or 'in a 6 ft thick sandstone' is sometimes sufficient to identify the exact horizon.

The fossil localities given below are arranged in descending stratigraphical order.

### Atherfield Clay Formation

1. Crackers Member at Atherfield has yielded teeth of the galeomorph shark *Lamna* spp. and the type specimen of the pycnodont *Gyrodus atherfieldensis* (H J.O. White, 1921; Simpson, 1985).
2. Chale Clay Member at Atherfield has yielded small derived teeth of the Wealden sharks *Hybodus basanus* and *Lissodus breve breve* (Simpson, 1985).
3. Perna Bed at Atherfield has yielded small derived teeth of the Wealden sharks *Hybodus basanus* and *Lissodus breve breve* (Simpson, 1985).
4. Lower Clay and Atherfield Bone Bed near Atherfield Point has yielded many species of shark including '*Lamna*' spp., *Plicatolamna*, '*Sphenonchus*', *Squatina*, *Scapanorhynchus* sp. nov. Simpson, 1985, and indeterminate fish vertebrae (White, 1921; Simpson, 1985). Derived Wealden and older forms are also present, e.g. *Lissodus breve breve*, *L. breve pustulatum*, *L. striatum*, *Hylaeobatis ornata*, *Hybodus basanus*, *H. brevicostatus*, *Synechodus*, *Polyacrodus*, *Heterodontus*, *Arthrodon intermedius*, *Lepidotes* spp., ?*Caturus* (Simpson, 1985). The same bed at Redcliff near Sandown, has yielded a similar fauna (Simpson, 1985).

### Vectis Formation

Macrofossils in the Vectis Formation are mainly concentrated in locally fossiliferous horizons, such as shelly partings, coquinas and the erosional scours of parallel laminated storm deposits (Stewart *et al.*, 1991, p. 125). They consist of abundant bivalves, gastropods, ostracods, plant fossils and fragmentary fish remains. Fish debris tends to be concentrated at the base of these accumulations.

1. Vectis Formation at Atherfield Point yielded the type specimens of *Hybodus basanus* and *Pachytbrissops vectensis*, associated with *Hylaeobatis ornata*, *Hybodus brevicostatus*, *Coelodus multidentis* and other indeterminate fish remains (Egerton, 1845; Mantell, 1854; Woodward, 1915–1919; Patterson, 1966).
2. Vectis Formation of Brook Bay has yielded *Hybodus basanus* and teeth of *Hylaeobatis ornatas* (Mantell, 1854; Bristow *et al.*, 1889; Patterson, 1966).
3. Vectis Formation of Compton Grange Chine or Shippard's Chine include teeth of *Hybodus brevicostatus* (Patterson, 1966).

4. Vectis Formation of Brixton has yielded the type specimen of *Hylaeobatis ornata* (Patterson, 1966).
5. Plant debris bed at [SZ 377 840], about 200 m west of Hanover Point (= locality IV.2 of Daley and Insole, 1984, p. 6; bed CH12 of Stewart, 1978). Buffetaut and Ford (1979) reported the discovery of crocodilian teeth (*Bernissartia*) and other vertebrate remains including several thousand fish teeth, including several undiagnosed species of shark and bony fish (mainly *Lepidotes*: Buffetaut and Ford, 1979, p. 905) in a marly clay horizon beneath a fossil tree trunk in the cliff face. They stated that the tree trunk occurred 'at beach level in the second of the three 'lignitic bands' depicted by White (1921, fig. 1, p. 12).' White (1921) illustrated three lignitic bands, none of which is anywhere near the site mentioned by Buffetaut and Ford (1979). The map reference is probably correct since the latter authors state that the site was 'midway between Compton Grange Chine and Hanover Point', and thus in the Wessex Formation, and probably in the region of White's (1921, p. 9) 16 ft (5 m) 'White Sandstone (east of Compton Grange Chine)' or the 'variegated marl' (30 ft, 9 m) below
6. Shepherds Chine Member 'one foot below the base of the Lower Greensand' (Bristow *et al.*, 1889, p. 14) at Cowleaze or Shepherds Chine has yielded abundant fish remains, including teeth of the shark *Hybodus brevicostatus* (Patterson, 1966).

## Wessex Formation

Though the bulk of the Wessex Formation marls is unfossiliferous, locally persistent fossiliferous bands have yielded large pieces of fossilized wood, coniferous fruits, ferns, freshwater molluscs (*Viviparus* and *Unio*), water-worn bones of reptiles and abundant fragments of fishes (White, 1921).

1. Wessex Formation at Atherfield Point included *Hybodus basanus*.
2. Wessex Formation at Brook Bay and Brook Point has yielded *Hybodus basanus*, *Lepidotes mantelli* and *Coelodus multidentatus* (Bristow *et al.*, 1889; Woodward, 1895a, 1916–1919).
3. Wessex Formation of Sedmore has yielded *Lepidotes mantelli* (Mantell, 1854; Bristow *et al.*, 1889).
4. In a bed known as the 'Pine Raft' within the shales between the *Hypsilophodon* Bed and the massive sandstone which comes in at the top of the cliff at Barnes High, and runs through Cowleaze Chine (White, 1921) at Hanover Point, numerous vertebrate remains including fin spines, scales and teeth referable to *Hybodus*, *Lepidotes mantelli* and *Coelodus* occur (Mantell, 1846; White, 1921, p. 15).
5. White (1921, p. 13) mentioned a 'lignite bed' with bones 12 m above the Barnes Chine Sandstone, which is 'seen in the top of Barnes Chine' and reaches beach level to the east of Barnes High. A second plant bed, a few metres higher, has also yielded bones. Recent finds have been made in the top bed of the Wealden Marls, a 14 m thick bed of red and mottled mudstones underlain by massive white and yellow sandstones. Buffetaut and Hutt (1980) reported a crocodilian, *Vectisuchus*, from the base of the bed at Barnes High in association with a microvertebrate fauna, which included *Lepidotes* teeth and scales, freshwater molluscs and other reptile remains.

The preservation of the fish remains from the Compton Bay–Atherfield section is variable. There appear to be two modes of preservation: well-mineralized (pyrites, baryte, etc.) black bones in organic facies, such as the plant debris beds and Vectis Formation shales; and poorly mineralized pale-coloured bones, found in over-bank muds and channels.

## Fauna

The fish fauna of the Isle of Wight (Figure 13.9) has been described by Woodward (1890, 1895a, 1916–1919), and Patterson (1966). Large numbers of fossil fish from various sites in the Brook–Atherfield section are preserved in British museums, in particular the NHM and BGS (GSM).

Chondrichthyes: Elasmobranchii: Euselachii: Hybodontidae

*Hybodus basanus* Egerton, 1845

*H. brevicostatus* Patterson, 1966

*Hybodus* sp.

*Hylaeobatis (Acrodus) ornatas* (Woodward, 1889)

*Lissodus rhizion* (Patterson, 1966)

*L. breve breve* (Patterson, 1966)

*L. breve pustulatum* (Patterson, 1966)

*L. striatum* (Patterson, 1966)

*Polyacrodus* sp.

'*Sphenonchus*'sp.

Chondrichthyes: Elasmobranchii: Neoselachii: Galeomorphii

*Heterodontus* sp.

*lamna*'spp.

'*Odontaspis*'sp.

?*Plicatolamna* sp.

*Scapanorhynchus* sp. nov. Simpson, 1985

*Synechodus* sp.

Chondrichthyes: Elasmobranchii: Neoselachii: Squatinomorphii

*Squatina* sp.

Osteichthyes: Actinopterygii: Neopterygii: Halecostomi

*Arthrodon intermedius* Woodward, 1893

*Lepidotes mantelli* Agassiz, 1833–1837

*Coelodus mantelli* (Agassiz, 1839–1844)

*C. multident* Woodward, 1918

*Gyrodus atberfieldensis* White, 1927

Osteichthyes: Actinopterygii: Neopterygii: Halecomorphi

?*Caturus* sp.

Osteichthyes: Actinopterygii: Neopterygii: Teleostei

*Belonostomus hooley* Woodward, 1916–1919

*Pachythrissops vectensis* Woodward, 1890

## Interpretation

Stewart *et al.* (1991) interpreted the Wealden Group on the west coast of the Isle of Wight as a sequence that records a shift from terrestrial deposition to fully marine. The lower unit, the Wessex Formation, is a fluvial or coastal plain unit, the Vectis Formation above was deposited in a shallow lagoon and was temporarily emergent, and the overlying Atherfield Clay Formation is marine. Climatic conditions were seasonal, with wet and dry seasons in warm-temperate subtropical latitudes (Stewart, 1981b). The Wessex Formation contains numerous coarse sandstones deposited in channels, as well as overbank mudstones (marls), and a number of thin plant debris beds (carbonized wood with dinosaur and crocodilian bones, fish remains, plant cones and, occasionally, bivalve shells) represent reworked terrestrial fossils from flood events (Daley and Stewart, 1979).

The Vectis Formation was divided by Stewart *et al.* (1991) into four facies, fine sandstones, heterolithic sand/ silt and mudstones, parallel-laminated mudstones and black mudstones, which occur cyclically through the sequence. The cyclicity may relate to advance and retreat of deltaic sand bodies into the lagoon, of which the Barnes High Sandstone Member may be a major example. Mollusc and ostracod associations give measures of salinity. Salinity and the frequency of storms increase towards the top of the Vectis Formation, and the sequence is terminated by the Atherfield Clay Formation, representing the major Aptian marine transgression (Stewart *et al.*, 1991).

The Wealden fish fauna recovered from the Brook–Atherfield section comprises a mixed freshwater and brackish-water shark and bony fish assemblage (Figure 13.9). Hybodont sharks are again common and include the type specimen of *Hybodus basanus* Egerton, 1845 from the Vectis Formation (Wealden Shales) at Atherfield Point. This species is known from about 20 skulls, plus the dentition, fin spines and fragments of the postcranial skeleton, and is one of the best-known hybodonts of the Wealden (Patterson, 1966: (Figure 13.9)E,F). Based on this material, descriptions of the cranial morphology and dentition of the species have been given by Maisey (1983) and Patterson (1966). Complete skulls of this form have also been found at Pevensey Bay, Sussex.

The ptychodont shark *Hylaeobatis ornata* (Woodward) was described from material from the Vectis Formation at Brighthelm (Brixton) Bay (Patterson, 1966). Ptychodonts are Cretaceous hybodonts which lacked fin and cephalic spines, and possessed elongate jaws with a specialized dentition of flattened, crushing teeth confined to the broad symphyseal region. The teeth were arranged in up to nine paired files and one unpaired file at the front in each jaw, and decrease in size and complexity of ornamentation posteriorly (Patterson, 1966). This form has also been found in Vectis Formation of Atherfield Point, and along the coast at Yaverland and Sandown (Patterson, 1966).

Halecostomids are represented in the Vectis and Wessex Formations between Atherfield and Brook by abundant scales, teeth and isolated bone material of the ubiquitous Wealden fishes *Lepidotes mantelli* Agassiz and *Coelodus mantelli* (Agassiz). These are associated with a further species of the pycnodont *C. multidentis* Woodward (Figure 13.9)B, which form has also been recovered from Sevenoaks, Kent and Battle, Sussex (Woodward, 1918).

Also found in the Atherfield–Brook section are scales and incomplete fishes of the long-snouted aspidorhynchid *Belonostomus hooleyi* Woodward. The scales and skull roof of the fish were heavily ornamented in a series of irregular ridges, grooves and low tubercles.

*Pachytrissops (vectensis)* Woodward is a primitive teleost (Figure 13.9)C only known from the British Wealden (although the genus also is found in the English and Bavarian Purbeck sections; Woodward, 1919a) and seems to have been a rather large fish, attaining over 1 m.

The Atherfield Clay Formation of the Atherfield–Brook area has produced a derived Wealden assemblage of small reworked fish teeth, scales and worn bones, and several Lower Greensand and Gault species of fish. These include galeomorph ('*Lamna*' spp., *Plicatolamna* and *Scapanorhynchus* sp. nov.) and squatinomorph (*Squatina* sp.) neoselachians (Simpson, 1985). These are in association with indeterminate bony fish remains, and the pycnodont *Gyrodus atherfieldensis* White, known from the Crackers Member of the Atherfield Clay Formation at Atherfield Point. Except for the odd fragments and isolated teeth, *G. atherfieldensis* is the first pycnodont species to be described from Aptian age beds of southern England. It is distinguishable from most other species of *Gyrodus* by the smoothness and arrangement of teeth on the vomer.

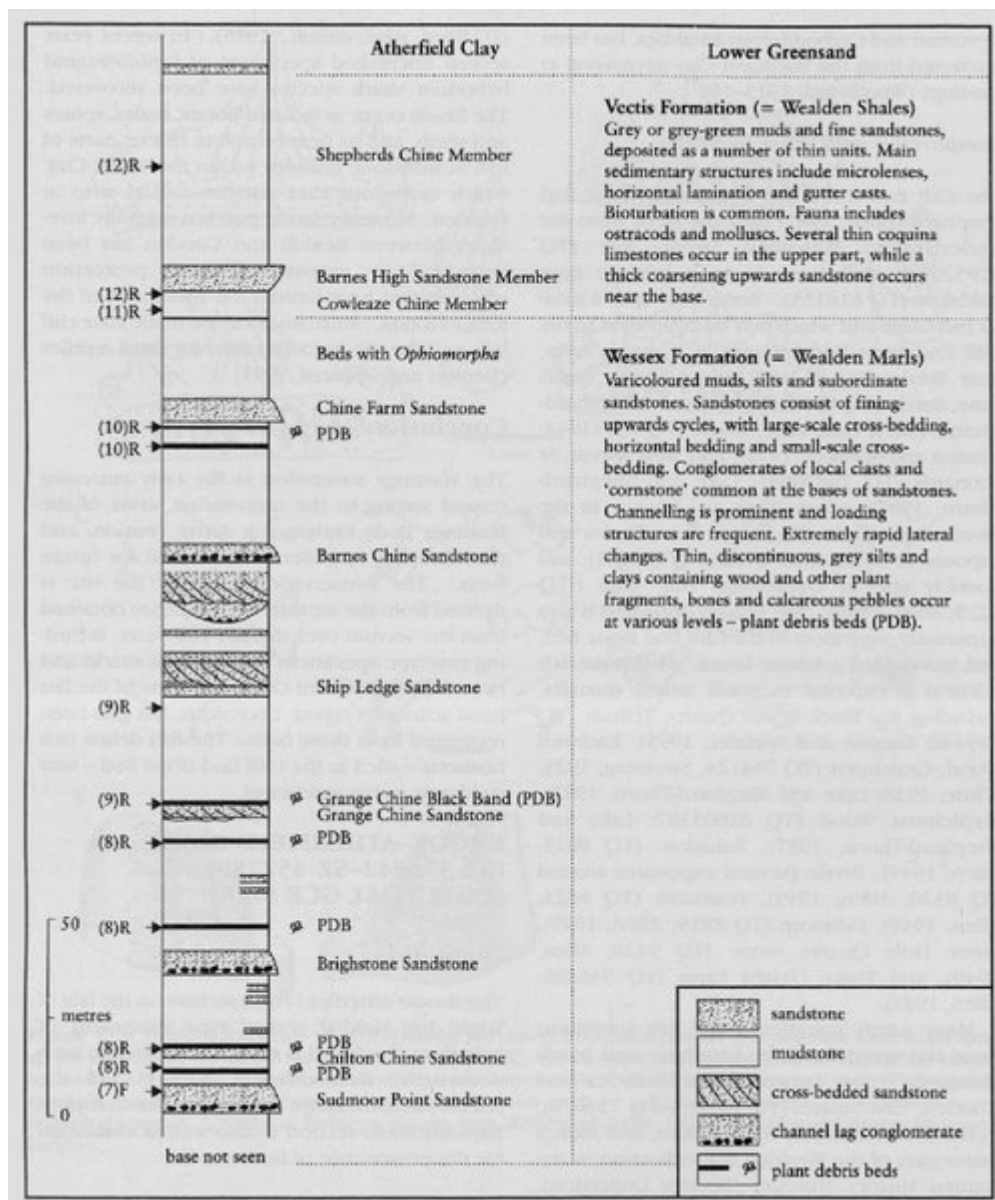
## Comparison with other localities

The nearest comparable Wealden locality to the Compton–Atherfield section is the coast at Yaverland, near Sandown [SZ 613 850] on the south-east coast of the Isle of Wight. Here a similar section is exposed, yielding the type specimen of the hybodont subspecies *Lonchidion breve pustulatum* Patterson, from the Perna Bed, Atherfield Clay Formation, in association with further fish (*Lepidotes*, *Lissodus breve breve* and *Hylaeobatis ornata*) and reptile remains (Patterson, 1966; Benton and Spencer, 1995). Yaverland is an SSSI for fossil reptiles (Benton and Spencer, 1995). The exposed Isle of Wight Wealden is largely, or wholly, Barremian in age (mid-Early Cretaceous), whereas vertebrate localities in the Wealden of the Weald are generally Valanginian (earliest Early Cretaceous). The exception in the Weald is Smokejacks Pit, Ockley [TQ 113 372], which is in the Weald Clay (Hauterivian–Barremian) in age. The vertebrates include *Lepidotes*, actinopterygian fish scales, hybodont shark teeth and reptile remains.

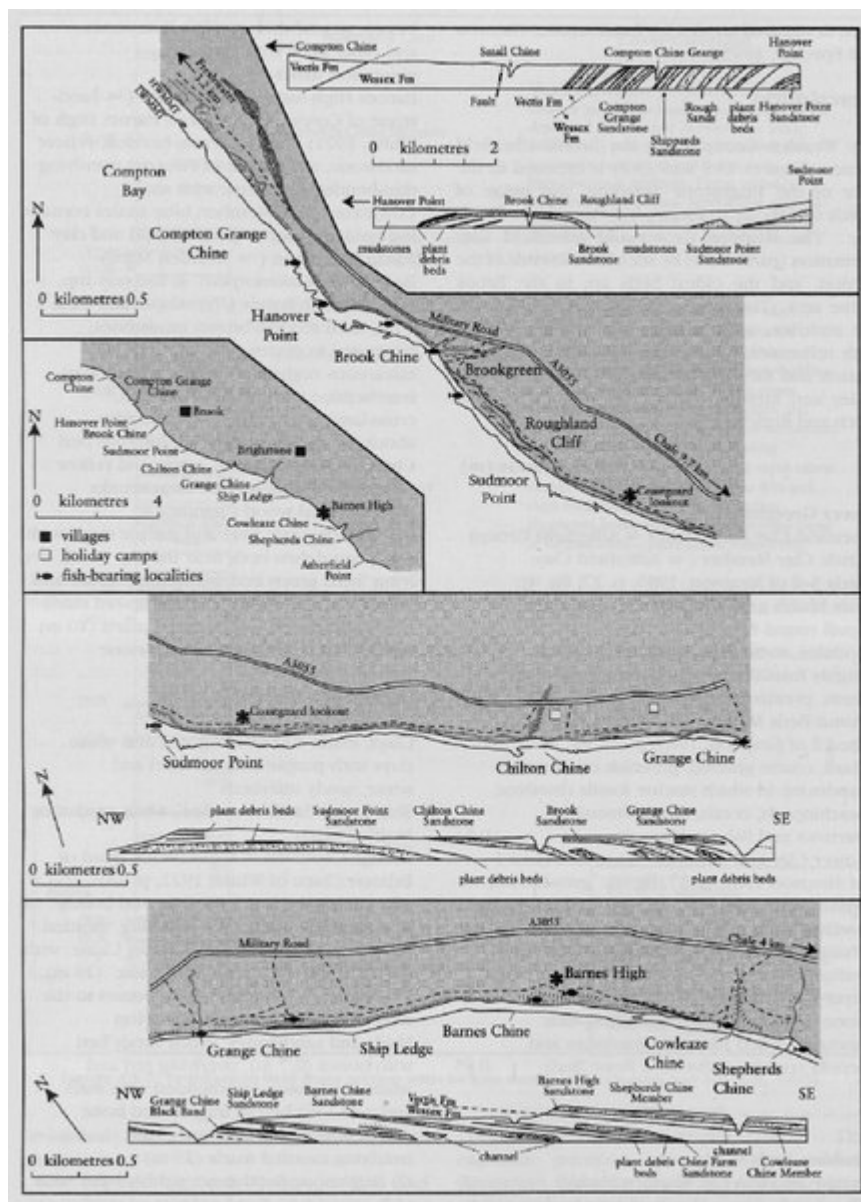
## Conclusion

The Wealden and Lower Greensand series between Brook Bay and Atherfield Point on the Isle of Wight is one of the richest Lower Cretaceous sources for fossil fishes in Britain, hence its conservation value. The section has produced type specimens of the hybodonts *Hybodus basanus* and *Hylaeobatis ornata*, the holosteans *Gyrodus atherfieldensis* and *Coelodus multidentis* and the teleosts *Belonostomus hooleyi* and *Pachythrissops vectensis*. The coastal exposures are continuously eroding and there is potential for significant future finds.

## References

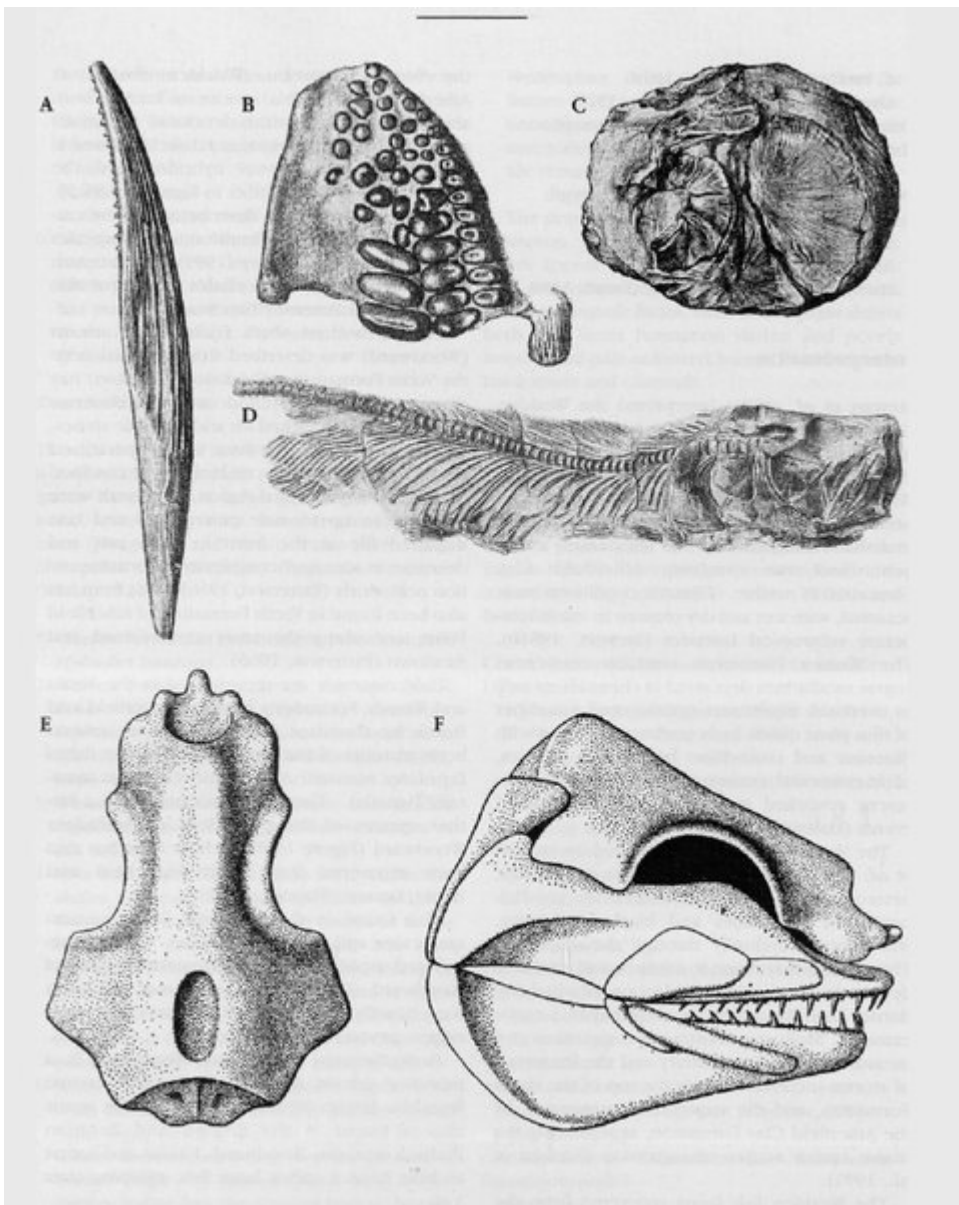


(Figure 13.7) Brook–Atherfield Point section with locality details (after Benton and Spencer, 1995).



(Figure 13.8) Location map, Brook-Atherfield area (from Benton and Spencer, 1995).





(Figure 13.9) Wealden fossil fishes from Brook-Atherfield and other localities (after Woodward, 1917): (A) *Hybodus ensis* Agassiz, fin spine, x 0.5; (B) *Coelodus multidens* Woodward, right splenial with teeth, x 1.0; (C), (D) *Pachythrissops vectensis* Woodward: (C) crushed parts of right opercular region, x 0.5; (D) right lateral view of skull and axial skeleton, x 0.25; (E), (F) *Hybodus basanus* Egerton, restoration of the cranium in dorsal view and right lateral view of the skull with jaws, about half natural size. Figures from Woodward © The Natural History Museum, London.