# A Field Guide to the London Clay of Sheppey, Kent

(based on the Field Guide by *David J Ward*)

The Isle of Sheppey lies on the south shore of the Thames Estuary about 70km east of London. The cliffs on the north of the isle expose over fifty metres vertically of London Clay Formation capped by Virginia Water Formation (Lower Bagshot Beds) and shallow Pleistocene gravels.

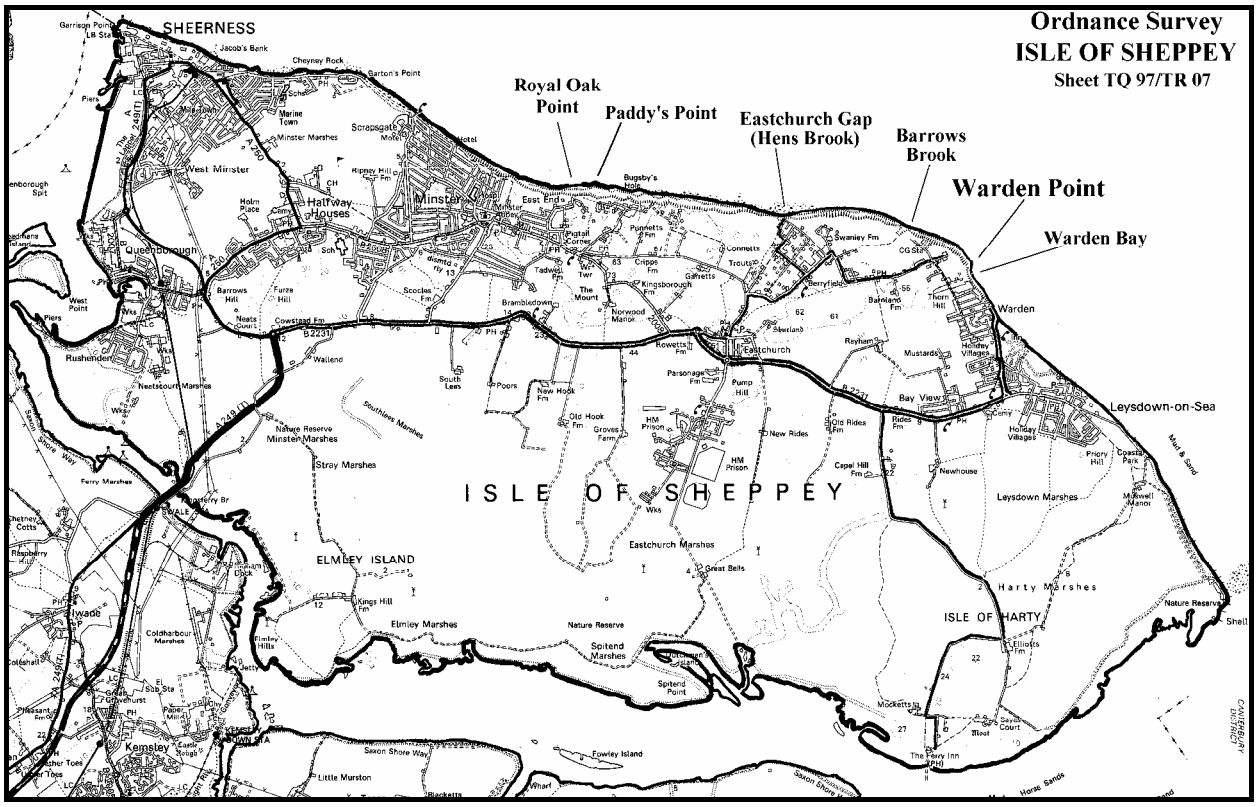


**Figure 1**. The Isle of Sheppey, showing main locations

Sheppey has been famous for its London Clay fossils for over 300 years. Unlike most geological localities, fossils are not usually found *in situ*, they are more commonly found in pyrite accumulations on the beach or in loose cement stone nodules on the foreshore. Collectors usually can be segregated into two groups. Those seeking small invertebrates, sharks' teeth, molluscs and seeds seek fresh expanses of pyrite high up the beach to closely scan from a kneeling or lying position. Cement stones with crab, lobster or large vertebrate remains are to be found lower down the beach on the wave-cut platform. Finding them is a more energetic (and muddy) pursuit and entails walking up and down and turning any likely nodule.

## STRATIGRAPHY

The London Clay is an early Eocene grey silty clay deposited over a wide area of the London and Hampshire basins. It overlies the Palaeocene Woolwich or Oldhaven Formations and is capped in the Hampshire and south-west London basins by the Middle Eocene Bracklesham group.

King (1981) reviewed the stratigraphy and established a lithostratigraphic framework based around five informal divisions (cyclotherms). This, in turn, he divided into lithological members. Division A.1 in London and Essex is a silty clay with ash bands, the Harwich Member. Division A.2, the Walton Member, is a silty clay with silt streaks and lenticular accumulations of vegetable debris. Divisions B, C and D in the London area are silty clay, grading in Division E into a sandy silt facies, the Claygate Beds, followed by the more sandy Virginia Water Formation. In the Hampshire Basin and the south-western corner of the London Basin only Division A to D are represented, part of D and the whole of E are presumed to be diachronous with the lower part of the Bracklesham Group.

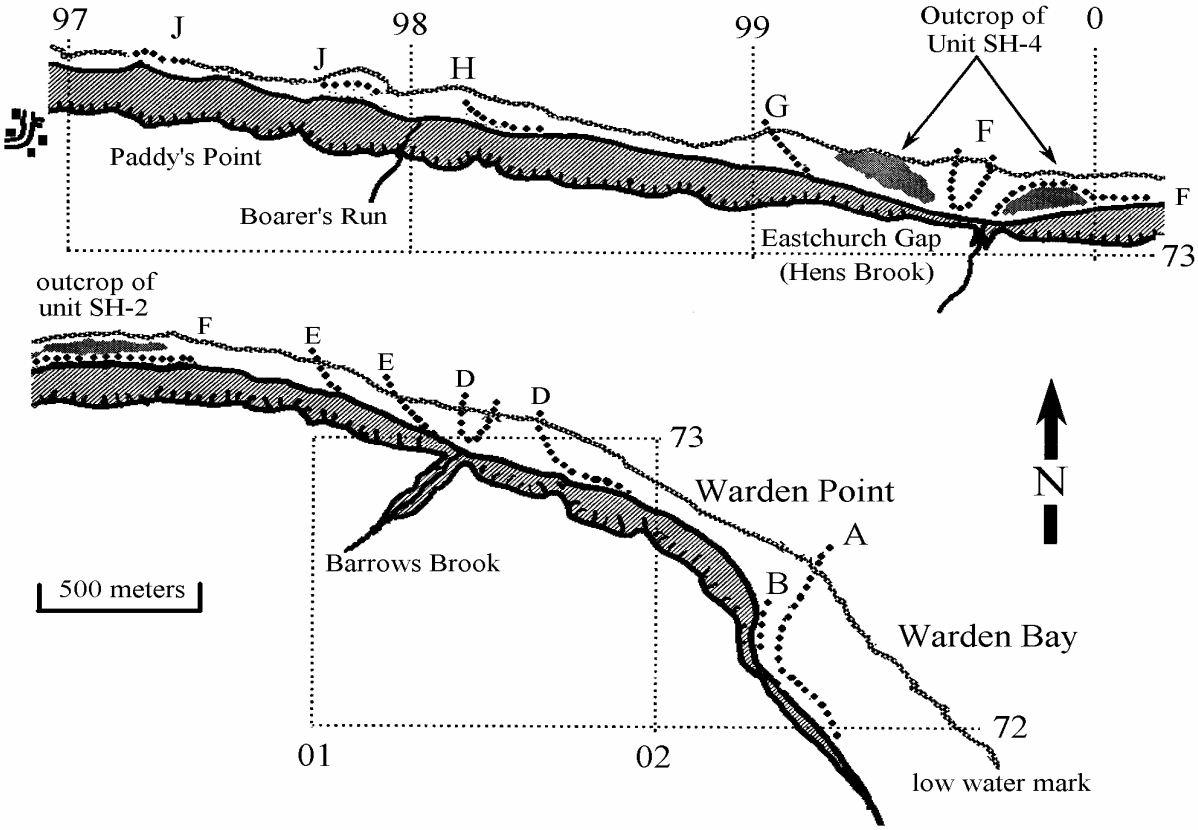


Fig 3 The north coast of Sheppey showing the positions of cement stone bands A - J; redrawn from King (1984)

The apparently featureless cliffs have defied stratigraphers up until quite recently. Davis (1936) attempted to locate the source of the fossils on the beach. He divided the cliff exposure into four beds 'A' - 'D' and concluded that the bulk of the fossils came from bed 'C', some 50 feet up from the cliff base. Unfortunately Davis did not appreciate the effect of the gentle north-westerly dip. He was confused by the two *Terebratulina* horizons, which he considered a single bed. King (1984) discovered divisions C, D and E in the cliff sections between Warden Bay and Paddy's Point. He divided the London Clay sequence into fourteen lithological units and lettered the cement stone bands for easy recognition. He demonstrated the presence of Claygate Beds - bedded silts and sands- at the top of the London Clay immediately underlying the Virginia Water Formation (Lower Bagshot Beds). King's foreshore map and logs are redrawn as Figs 3 - 6

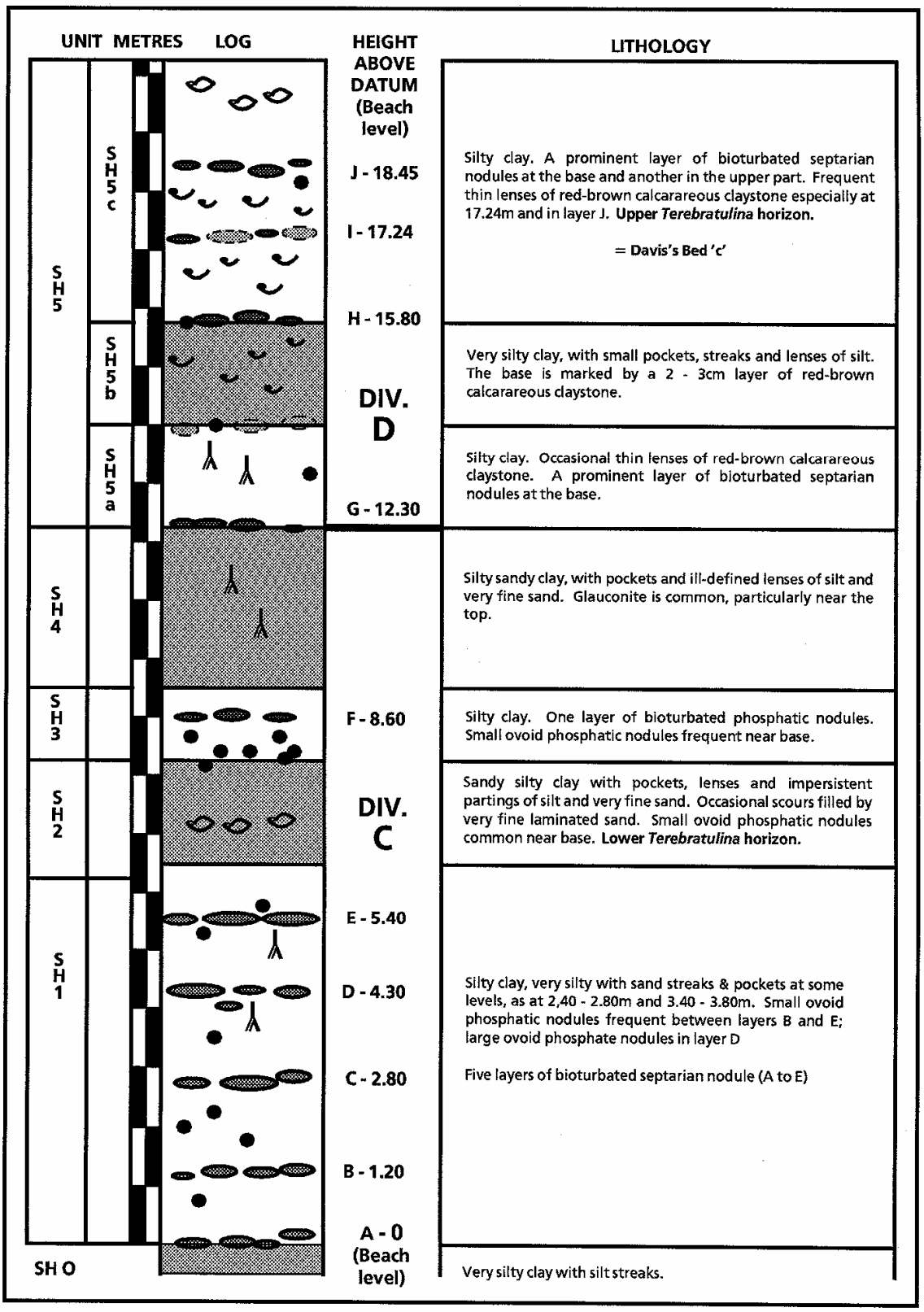


**Fig 4.** Lithostratigraphy of the London Clay at Sheppey (units SH -0 to SH 5) after King (1984)

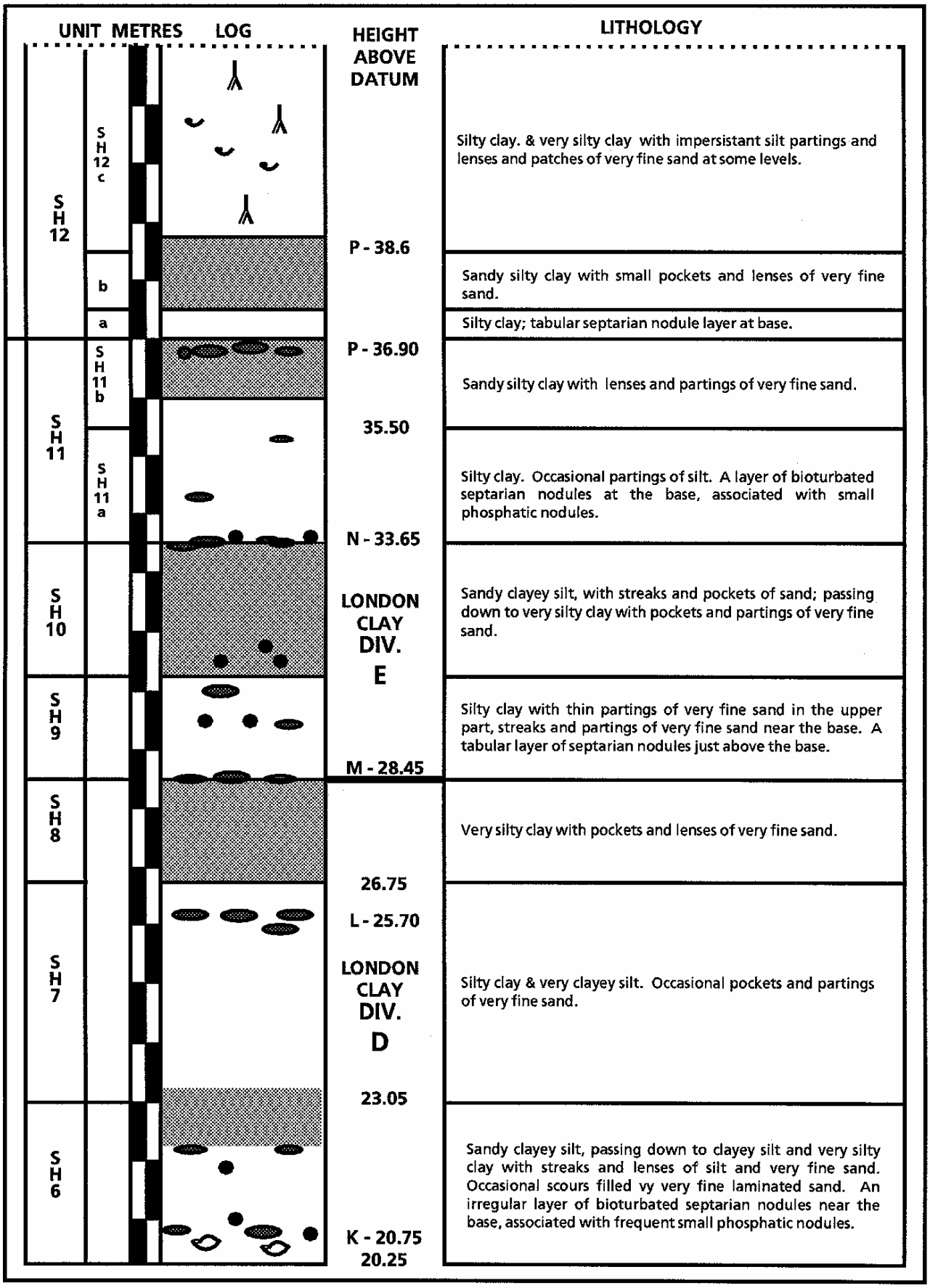


**Fig 5.** Lithostratigraphy of the London Clay at Sheppey (units SH -6 to SH 12) after King (1984).

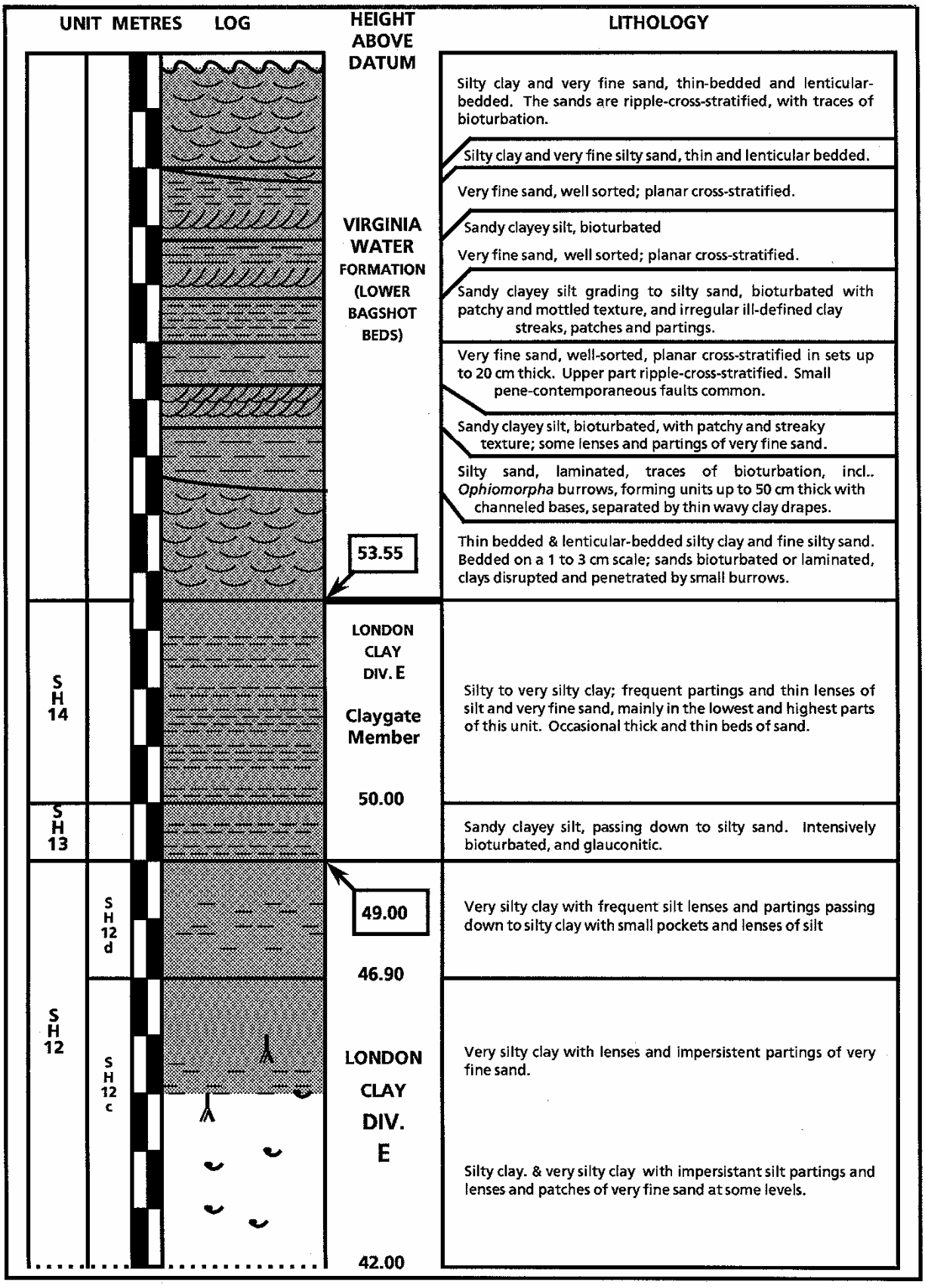


**Fig 6.** Lithostratigraphy of the London Clay at Sheppey (units SH -12 to the top of the Virginia Water Formation) after King (1984).

# THE ENVIRONMENT

The London Clay, Lower Eocene, was deposited in a well-oxygenated, low-energy, middle-shelf environment. The extent of the sea was probably similar to the present North Sea but closed to the Atlantic to the north. There was a connection to the south-west that opened within London Clay times and probably closed during the succeeding Bracklesham Beds. The water depth is estimated to have varied between 20 and 100 metres (King 1984). This is supported by the presence of sharks and teleost fishes not encountered in the shallower Tertiary waters and whose living relatives are restricted to relatively deep water. The abundance and nature of vegetable debris suggests an active river system, probably to the west, draining a tropical to sub-tropical rain forest. The mixture of plant genera with different (Recent) climatic requirements suggest an environment with no modern equivalent (Collinson 1983: 24). Fringing the coast there was probably a swamp similar to those present in parts of Indonesia and Malaysia. This reconstruction is supported by the abundance of *Nipa* fruits and species allied to the mangroves. The mean daytime temperature is estimated to be 22-25°C. A description of the detritus of a tropical river as described by H N Mosely in his account of the "Challenger" Expedition compares as though it were an authentic record of what had existed in the London Clay sea fifty million years ago. This is reproduced in Annex 1

# PRESERVATION

The wealth of fossil remains within the London Clay is due to a few specific modes of preservation:

**A. Pyritisation** - A large proportion of the flora as well as the molluscs and other invertebrates are preserved in pyrite. In the abundant seed and twig debris clear cellular details are preserved. Larger fruits and seeds are often preserved as a mixture of pyrite and acellular carbonaceous material. Gastropods and brachiopods are usually preserved with pyrite internal casts. Small fish skulls often have a pyrite endocranial cast and pyrite encrusted surfaces. Starfish and echinoids, both relatively uncommon, often have all their calcite replaced by pyrite. Accumulations of molluscan debris, barnacle plates, teleost otoliths and bones found banked up against drifted logs are a feature of the foreshore at Sheppey. They can be spotted by the blue colour the usually grey-brown clay turns with locally precipitated pyrite.

The preservation of pyrite is a difficult problem. In damp conditions it rapidly decomposes to oxides of iron and sulphuric acid. This destroys any associated calcite and damages bone. Most attempts to preserve pyrite, ranging from varnishes to 5% cetrimide solution are relatively ineffective. Washing, neutralisation and storage in silicon fluid appears to be the best currently available method.

**B. Phosphatisation** - Trace fossils, probably crustacean burrows, are the most commonly encountered phosphatic fossil. Balson (1987) identified six phosphogenic episodes in the Tertiary. The first of these took place in late London Clay times, during the deposition of divisions B - D London Clay. He concluded that authigenic phosphate is deposited in sediments at the time of the maximum transgressive extent and where there is a rich and diverse biota. It is as a direct result of this episode that we have the wealth of phosphatised fossils. Crustacean carapaces, usually cast, burrow systems and large vertebrates act as a

nuclei for authigenic phosphate concretions although any nucleus would do. The surface of most of the nodules is soft and can be prepared away to expose superbly preserved fossil remains.

Although not directly phosphatised, the unusually fine preservation of the isolated sharks' teeth and fish bones is also due to the high levels of non-biogenic phosphate.

**C. Septarian nodules and cement stones** - **Septaria**, so-called because they enclose calcite lined cavities, and cement stones occur in known horizons in the cliff and foreshore. They can be individually identified and are used for local correlation (King 1984). Trace fossils, usually in very fine detail, and sometimes bivalves are preserved on their surfaces. Drifted logs are often encased in cement stone.

# ECONOMIC USES

**Copperas** - The accumulations of pyrite (copperas stone - iron disulphide) that gather on the beach were formerly collected. Pyrite readily decomposed to produce green vitriol


Fig 7 Brass Copperas Token - 26mm in diameter

(ferrous sulphate), which was used to produce dyestuffs and medicines. William George (1984) gives an account of the copperas industry at Sheppey. Pyrite collectors were often paid by tokens, rather than cash.

**Cement Stone** - The collection of cement stones to burn to produce Roman or Parker's Cement started in the early nineteenth century. By the 1830's nearly all of the cement stones had been removed from the north coast of Sheppey leading to increased erosion and concern from the adjacent landowners. By the mid-nineteenth the discovery of Portland Cement, made from the readily available Chalk and Gault Clay, lead to a cessation in the trade. The fossils that were encountered whilst gathering cement stones were an additional source of revenue to the collectors. Bowerbank (1840: 205-6) in a letter to the Magazine of Natural History gives a few hints to the readers on the mode of procuring fossils of the London Clay of the Isle of Sheppey. Out of general interest his letter is reproduced at the end of this guide.

# BIBLIOGRAPHY

Bowerbank himself published on the fruits and seeds from Sheppey, for which he is rightly best known, as well as ". . . the remains of a gigantic bird" Bowerbank (1840, 1854). Many other aspects of the geology and palaeontology have been published in the intervening years. Wrigley and Davis produced papers on the fossils from Sheppey giving relatively complete faunal lists (1936, 1937). The following table lists the major systematic and stratigraphic works on Sheppey. A more complete list as well as the full references can be found in Cooper, Gamble & King (1984).

**Birds:** Andrews (1899); Bowerbank (1854); Harrison (1981, 1982); Harrison & Walker (1971, 1972, 1974, 1976,a,b, 1977); Lydekker (1891); Owen 1840, 1846, 1870a,b, 1873, 1878, 1880).

**Brachiopods:** Davidson 1852; Elliott (1938, 1939).

**Bryozoa:** Gregory (1893).

**Cephalopods:** Crick (1901); Edwards & Wood (1849 - 1887), Foord (1871), Phillips (1982).

**Cirripedes:** Withers (1953).

**Crabs and Lobsters:** Bell (1858); Carter (1898); Collins (1961); Glaessner & Withers (1931); M'Coy (1849); Qayle (1984); Woods (1924 - 1931).

**Echinoderms:** Forbes (1852); Rasmussen (1972).

**Fish:** Agassiz (1833 - 45, 1845a, 1845b, 1846, 1847); Woodward (1889,a,b) ; Casier (1966) Stinton (1966, 1975, 1977, 1978, 1980, 1984); Ward (1979); Woodward (1888, 1889a,b,c).

**Mammals:** Davies (1884); Owen (1840, 1846, and 1865); Tarlo (1964).

**Microfossils:** Bronniman *et al* (1968); Bujak *et al* (1980); Chapman & Sherbourne (1889); Costa & Downie (1976); Downie *et al.* (1971); Islam 1983); Kitten (1881); Williams & Downie (1966a,b).

**Molluscs:** Curry (1965); Edwards & Wood (1849 - 1887); Newton (1891); Wood (1861 - 1877); Wrigley (1940); Gale 1995; Huggett and Gale (1995)

**Ostracods:** Keen (1978); Withers (1953).

**Plants:** Bowerbank (1840, 1844); Brett (1956, 1972); Brown 1837; Carruthers (1875); Chandler (1961, 1968, 1978); Collinson (1983); Collinson & Ribbins (1977); Crow (1910); Edwards (1936); Ettinghausen (1879); Jacobs (1777); Reid & Chandler (1933)

**Reptiles:** Halstead (1984); Moody (1968, 1974, and 1977); Owen (1840, 1841, 1842, 1850, 1854, 1858, and 1880); Owen & Bell (1849 - 1858).

**Stratigraphy:** Bowerbank (1840); Davis (1936); Davis & Elliott (1958); King (1981, 1984); Cooper (1985)

**Taphonomy**: Alison (1988)

# Annex I

**To anyone who has collected systematically on the shore at Sheppey the following description of the detritus of a tropical river as described by H N Mosely in his account of the "Challenger" Expedition compares as though it were an authentic record of what had existed in the London Clay sea fifty million years ago.**

"On February 22nd, at noon, the ship was about 70 miles north-east of Point D'Urville, where the great Ambernoh River, the largest river in New Guinea, runs into the sea. The river probably rises in the Charles Louis Mountains on the opposite side of New Guinea, which reach up to the great altitude of 16,700 feet. So large is this river that even at this great distance from its mouth, we found the sea blocked with the drift-wood brought down by it.

"We passed through long lines of drift-wood disposed in curves at right angles to the direction in which lay the river's mouth. The ship's screw had to be constantly stopped for fear it should be fouled by the wood. The logs had evidently not been very long in the water, being covered only by a few young Barnacles (*Balanus*) and Hydroids. Amongst the logs were many whole uprooted trees. I saw one of these of which the stem was two feet in diameter.

"The majority of the pieces were of small wood, branches, and small stems.....

"Various fruits of trees and other fragments were abundant, usually floating, confined in the midst of the small aggregations into which the floating timber was almost everywhere gathered. Amongst them were the usual littoral seeds, those of two species of Pandanus, and of a Puzzle-seed (*Xylocarpus*), fruits of *Barringtonia* and of *Ipomoea pes-capri.*

"But besides these fruits of littoral plants, there were seeds of 40 or 50 species of more inland plants. Very small seeds were as abundant as large ones, the surface scum being full of them, so that they could be scooped up in quantities with a fine net. With the seeds occurred one or two flowers, or parts of them.

"I observed an entire absence of leaves, excepting those of the Palm, on the midribs of which some of the pinnae were still present. The leaves evidently drop first to the bottom, whilst vegetable drift is floating from a shore. Thus, as the debris sinks in the sea-water deposit abounding in leaves, but with few fruits and little or no wood, will be formed near shore, whilst the wood and fruits will sink to the bottom farther off land.

"Much of the wood was floating suspended vertically in the water, and most curiously, logs and short branch pieces thus floating, often occurred in separate groups, apart from the horizontally floating timber. The sunken ends of the wood were not weighted by any attached masses of soil or other load of any kind. Possibly the water penetrates certain kinds of wood more easily in one direction with regard to its growth than the other. Hence one end becomes water-logged before the other;...

"... The fruits and wood were covered with the eggs of a Gasteropod Mollusc, and with a Hydroid, and the interstices were filled with Radiolarians washed into them and gathered in masses... Two species of Crabs inhabit the logs in abundance, and a small *Dendrocoele* Planarian swarms all over the drift matter and on the living crabs also. A *Lepas* was common on the logs.

"Enormous quantities of small fish swarmed under the drift-wood, and troops of Dolphins (*Coryphaena*) and small sharks (*Carcharias*), three or four feet long, were seen feeding on them, dashing in amongst the logs, splashing the water, and showing above the surface, as they darted on their prey. The older wood was bored by a *Pholas*.

# Annex 2

## A Letter from Joseph Bowerbank to the Editor *of Magazine of Natural History*

Mr Editor,

I have been so frequently applied to by geologists, as to the best way of procuring the fossils of the London clay from the Isle of Sheppey, so that I am induced to send you a few hints as to the mode of collecting at that locality. Although one of the most accessible, it is probably the least known of any of the rich geological fields that are within a short distance of the metropolis. A trip to this interesting spot can be accomplished by an absence from London of only three days, and yet the collector be amply laden with fossils on his return, I will endeavor to put your readers in possession of the best mode of conducting such an excursion. The best conveyance is by the Southend and Sheerness steam packets, which leave London Bridge on Tuesdays, Thursdays and Saturdays, at 11 o'clock in the morning and reach Sheerness at 4 or 5 o'clock in the afternoon. The town is divided into two parts,- one contained within the limits of the garrison being designated the Blue-town, while that beyond the fortifications to the north-east is designated the Mile-town; and it is to this portion that I should recommend the visitor to proceed, and to take up his quarters either at the Royal Hotel, or at the Wellington: the latter is an exceedingly snug and comfortable house, and is the one which I have resorted to for many years. After having established yourself at your inn, request the Boots to desire the attendance of Mr. Hays, (better known perhaps by the name of Paddy Hays), from whom you may purchase, at a reasonable rate, some good fossils, such as crabs, lobsters, heads and portions of fishes, and numerous species of fossil fruits. Our traveller will then have accomplished all that can be done towards the acquisition of fossils until the following morning; there not being, I believe, any other collector in the town from whom purchases can be made.

On the following morning I should recommend an early breakfast, as a considerable extent of ground is to be traversed. It is advisable to go provided with five or six sheets of soft paper, to wrap fragile specimens in, and a few cotton or linen bags, of about four or five inches in diameter, to separate the large from the small fossils; the whole to be carried in a good sized blue bag or haversack, no chisel or hammer being necessary on this occasion. If our geologist has a desire to view the great section of the London clay, afforded by the cliffs of the north shore of Sheppey, and is content with comparatively the few fossils which he may be able to procure by his own exertions, he may proceed in the following manner. - Leaving Sheerness by the new town, he will pass along the sea wall, towards Minster, until he reaches Scaps-gate, where the cliffs begin to rise from the low lands of the western end of Sheppey. A few cottages are scattered round this point, some of the inhabitants of which work upon the beach, either collecting cement stone or pyrites, the latter being better known by the name copperas. To these, application should be made to know if they have any ”curiosities,” and very frequently excellent specimens, and at a small price, will be thus procured. From this point the route will be beneath the cliffs upon the shingle, amidst which, dark patches, ten or fifteen yards in length, will be observed, composed of nodules of pyrites, intermixed with pyritised fragments of

branches of trees, in great abundance. It is at such spots that the numerous and beautiful specimens of fossil fruits are found; but, to ensure success, the collector must be content to go upon his knees, and carefully search among the fragments. The whole of the beach, from about the parallel of Minster church to Warden Point, abounds with these patches of pyrites, and I have by this means obtained in the course of a morning upwards of one hundred fine fruits of various sizes. Care must be taken in such an investigation of the coast that it be undertaken during the falling of the tide, or unpleasant consequences may arise from being shut in between the shoots of mud which are projected into the sea at many of the coast.

If the principal object be the attainment of the greatest quantity of fossil organic remains, a different course should be pursued. The collector should then, after having made his purchases at Scapps-gate, direct his steps towards Minster church, passing which, he will proceed on the road towards Warden. About three quarters of a mile beyond the church, he will find a lane on his left hand, leading towards the Royal Oak, in which lives a woman named Mummery, and several others, who work upon the beach, and from whom fossils are frequently to be procured. These people will direct the traveller to the cottage of the family named Crockford, where there is usually a good assortment of fossils, and will direct our fossil-hunter to many other parties who also work upon the beach, and who reside between this point and Hensbrook, to which our traveller must now direct his steps. At Hensbrook enquiry should be made for a man named Pead, who has usually a considerable number of good specimens in his possession. From this point, Hensbrook, the collector must proceed along the top of the cliff towards Warden, calling at the various cottages in his way, until he arrives at Warden Point, at which place he must enquire for Mud Row, many of the inhabitants of which work along the beach, and from whom a considerable addition to the specimens already collected may be purchased. Beyond this point nothing will be obtained, and the best way to return to Sheerness is by the road which runs through the most level portion of the country; the path along the north cliff undulates very considerably more than the road.

The course of proceeding thus sketched applies to the supposition that the time is limited to three days, but if a greater extent of time can be spared, I should recommend the tourist not to leave Sheerness without viewing the dock-yard; and the return to London may be made by the way of Chatham and Gravesend, affording the gratification of a view of the dock-yard and lines at Chatham, and of the fine old cathedral and castle at Rochester; and, at the same time, enabling him to arrive in London of the evening of the same day that he quits Sheerness.

I remain, Mr. Editor,
Yours, &c, &c.

J.S. BOWERBANK.
19, Critchell's Place, Hoxton,
March 24th, 1840

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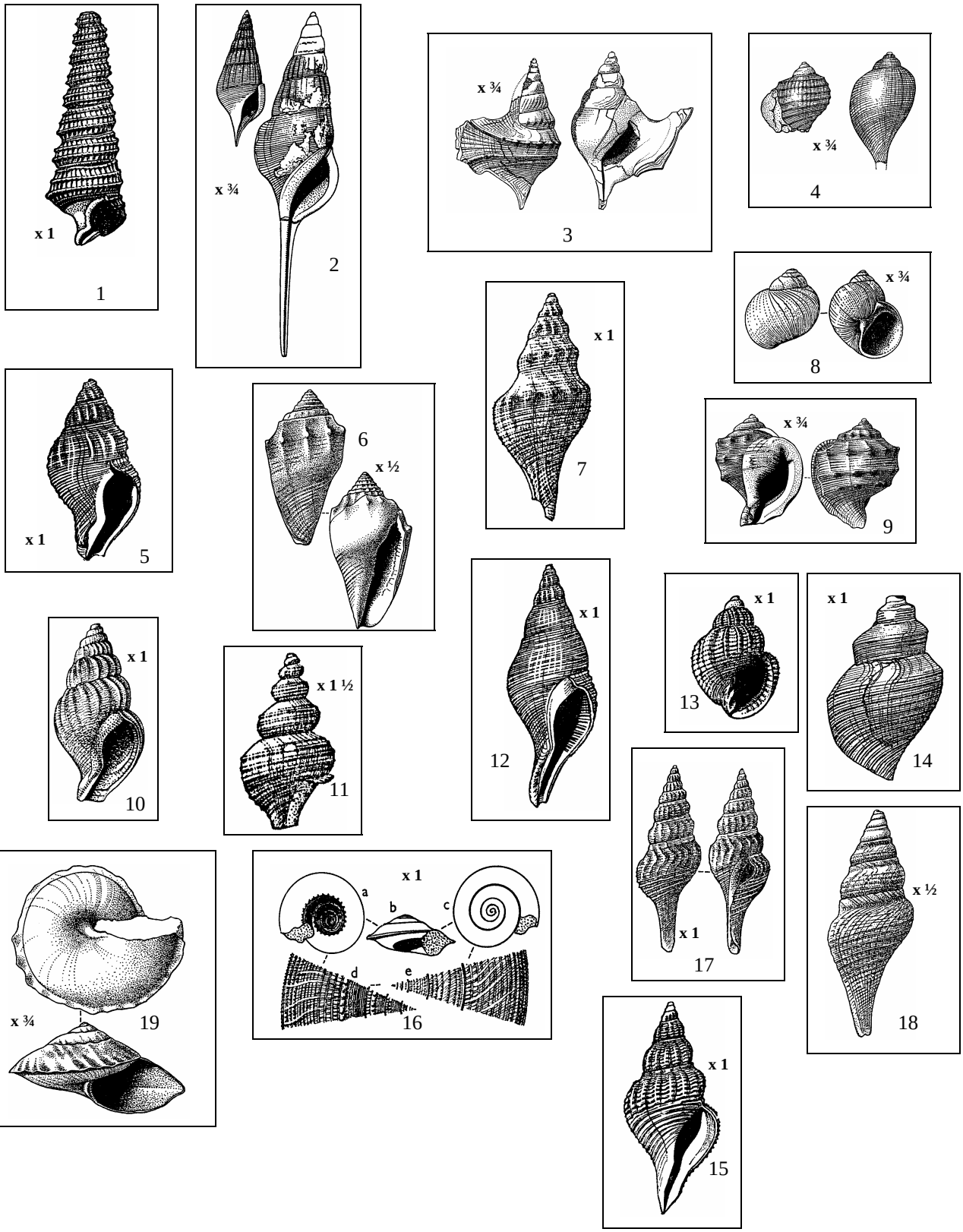
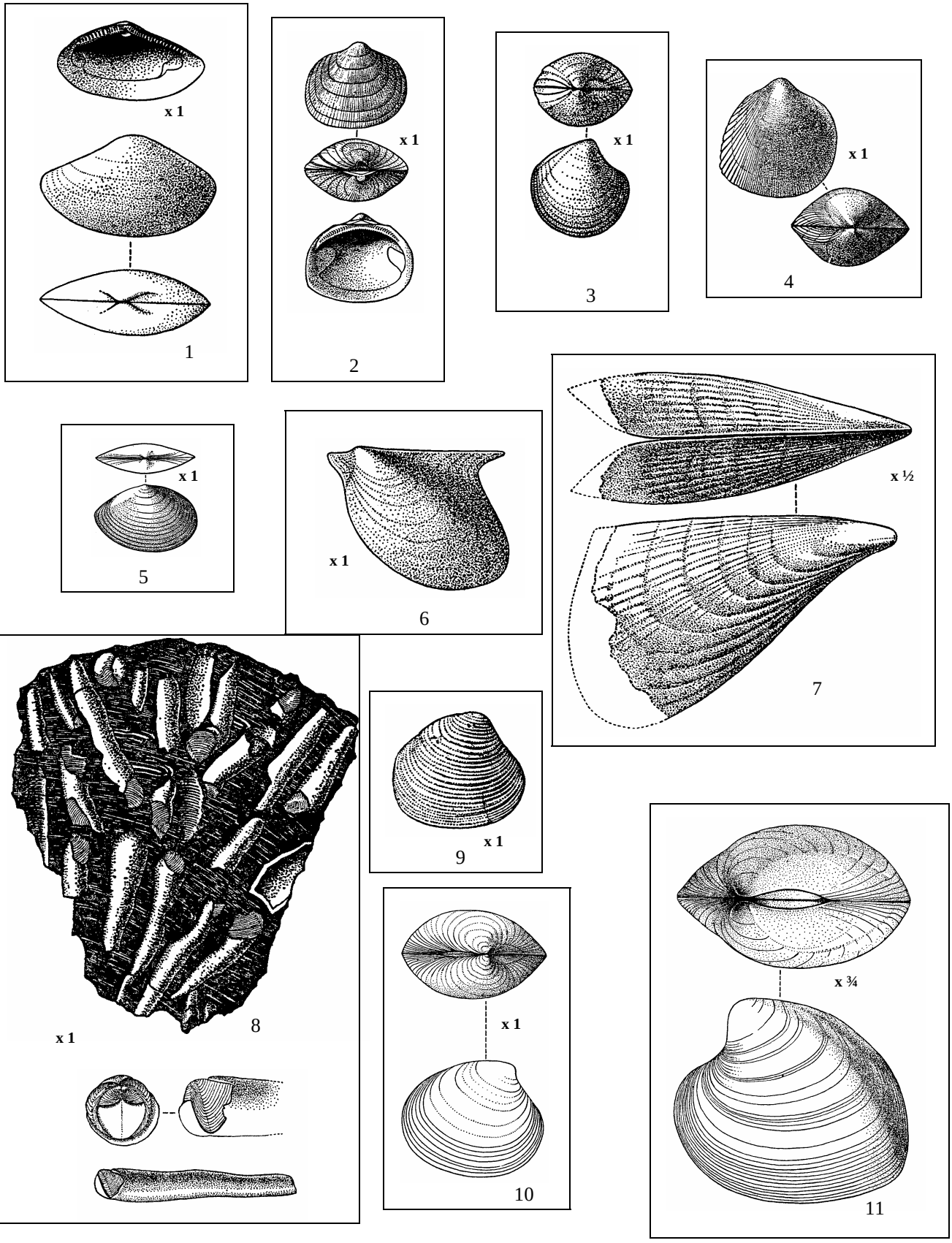
# Sheppey London Clay Representative Fossils **Gastropoda**




Figures: **Figs 1 - 19** Gastropoda **Fig 1** *Orthochetus elongatus* Wrigley; **Fig 2** *Tibia lucida* (J Sowerby); **Fig 3** *Apporhais sowerbyi* (Fleming); **Fig 4** *Ficopsis multiformis* (Wrigley); **Fig 5** *Pollia londini* (Wrigley); **Fig 6** *Athleta nodosus* (J de C Sowerby); **Fig 7** *Euthriofusus complanatus* (J de C Sowerby); **Fig 8** *Euspira glauconoides* (J Sowerby); **Fig 9** *Galeodea gallica* Wrigley; **Fig 10** *Bartonia curta* (J de C Sowerby); **Fig 11** *Fusinus wetherelli* Wrigley; **Fig 12** *Streptolathyrus zonulatus* Wrigley; **Fig 13** *Bonellitia laeviuscula* (J Sowerby); **Fig 14** *Surculites errans* (Solander); **Fig 15** *Euthriofusus transversarius* Wrigley; **Fig 16** *Stellaxis pulcher* (J de C Sowerby); **Fig 17** *Fusiturris simillima* (Edwards); **Fig 18** *Turricula teretrium* (Edwards); **Fig 19** *Trochotugurium extensum* (J Sowerby)

From: British Caenozoic Fossils (BM (NH))

# Sheppey London Clay Representative Fossils **Bivalves**

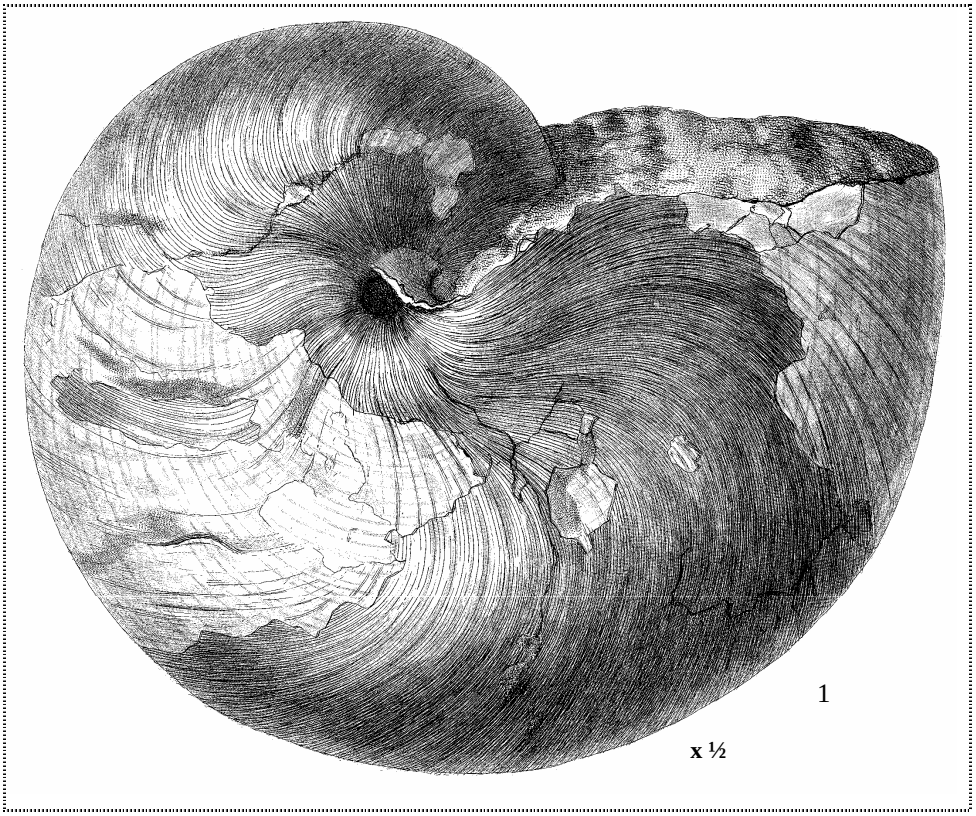



**Figs 1 - 8** Bivalvia: **Fig 1** *Ledina amydgaloides* (J de C Sowerby); **Fig 2** *"Glycymeris" wrigleyi* Curry; **Fig 3** *Thyasira goodhalli* (J de C Sowerby); **Fig 4** *Nemocardium nitens* (J Sowerby); **Fig 5** *Abra splendens* (J de C Sowerby); **Fig 6** *Pterelectoma media* (J Sowerby); **Fig 7** *Pinna affinis* J Sowerby; **Fig 8** (shipworm) *Teredina personata* (Lamarck); **Fig 9** *Astarte filigera* S.V. Wood ; **Fig 10** *Calpitaria sulcataria* (Deshayes); **Fig 11** *Arctica planata* (J de C Sowerby)

From: British Caenozoic Fossils (BM(NH)

Sheppey London Clay Representative Fossils

# Cephalopoda and Scaphopoda



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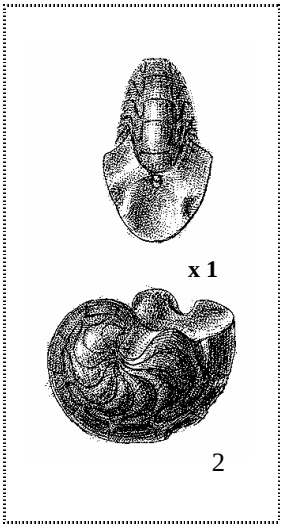

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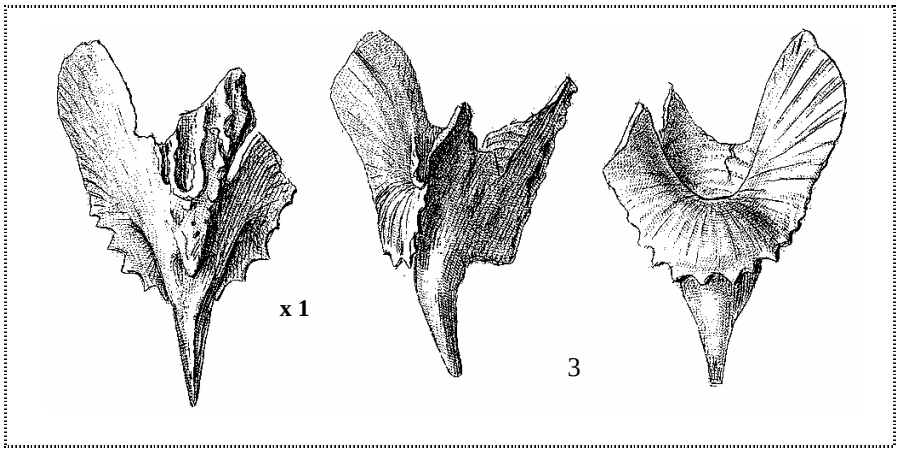

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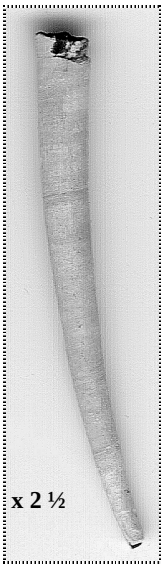


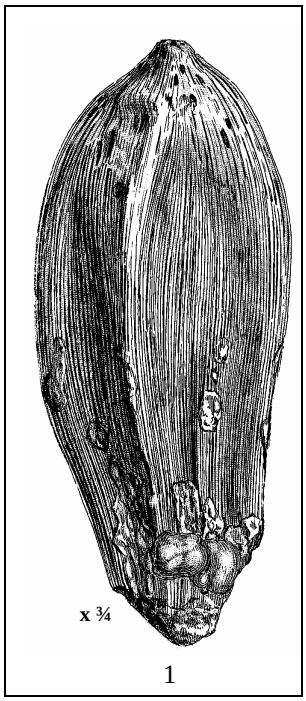
**x 2 ½**

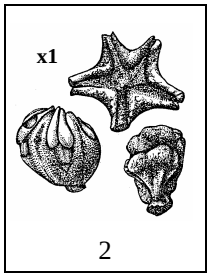
4

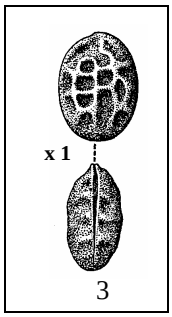
Figures: **Fig 1** Pearly Nautilus *Cimomia imperialis* (J Sowerby); **Fig 2** Nautilus *Aturia ziczac* (J Sowerby); **Fig 3** Coleoid *Belosepia sepioidea* (Blainville); Fig 4 Scaphopod *Antalis nitens* (J Sowerby)

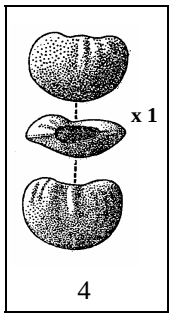
F E Edwards - The Eocene Mollusca - Pal Soc

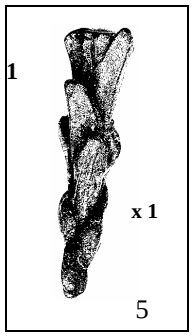
# Sheppey London Clay Representative Fossils **Plantae; Foraminifera; Echinodermata; Brachiopoda; Serpulidae; Cirripedia**

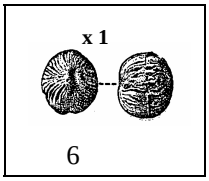


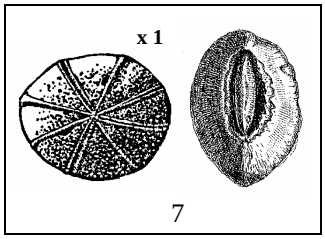



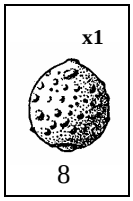



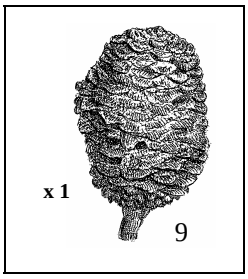



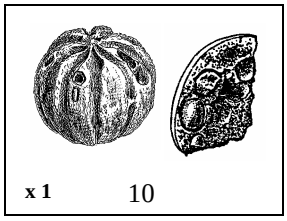



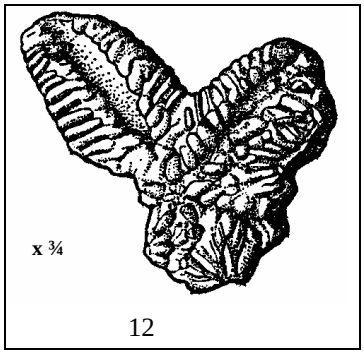



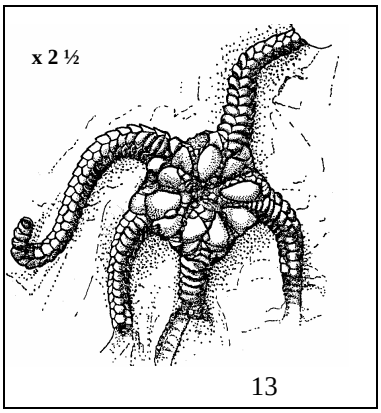



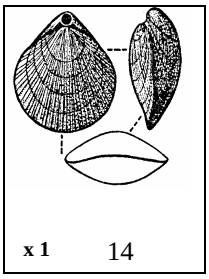



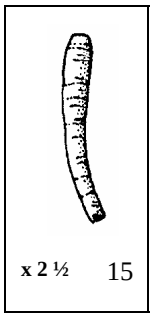



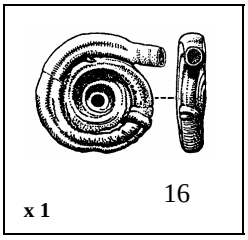


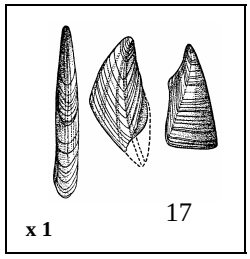



**Figs 1 - 10 Plantae**: 1 *Nipa burtini*, Bowerbank: 2 *Hightea turgida*, Bowerbank: 3 *Iodes conrniculata* Reid & Chandler: 4 *Magnolia lobata* (Bowerbank): 5 *Araucarites sp*: 6 *Anonaspermum rotundatum* Reid & Chandler: 7, *Wetherellia variabilis* Bowerbank: 8 *Cinnamomum globulare* Reid & Chandler: 9 *Platycarya richardsonii* (Bowerbank): 10 *Oncoba variabilis* (Bowerbank): **Fig 11 Foraminiferida**: *Marginulina wetherelli* Jones: **Figs 12 & 13 Echinodermata**: 12 *Caulonia colei* (Forbes): 13 *Ophiura wetherelli* Forbes: **Fig 14 Brachiopoda** *Terebratulina wardensis* Elliott: **Figs 15&16 Serpulidae** 15 *Ditrupa plana* (J Sowerby): 16 *Rotularia bognoriensis* (Mantell) **Figs 17-18 Arthropoda**: 17 *Cirripede Arcoscalpellum* quadratum (J de C Sowerby:

From: British Caenozoic Fossils (BM(NH))

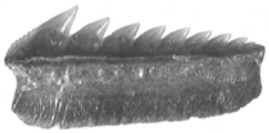
# Common Sheppey shark teeth

*Abdounia beaugei*
(requiem shark)
(x4) - common

*Anomotodon sheppeyensis*
(goblin shark)
(x2) - common

*Carcharias hopei*
(sandtiger shark)
(x1) - common

*Heterodontus vincenti*
bullhead shark
(4) - scarce



*Hexanchus agassizi*
(cow-shark)
six-gill shark
(x2) - scarce

*Isistius trituratus*
(cookie-cutter shark)
(x5) rare

*Jaekelotodus trigonalis*
(extinct genus)
(x1.5) - uncommon

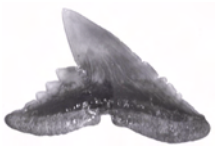
*Lamna lerichei*
("Porbeagle" shark)
(1.5) - common

*Notorhynchus serratissimus*
(seven-gill shark)
(x2) - uncommon

*Odontaspis winkleri*
(ragged-tooth shark)
(x 2) - common

*Palaeohypotodus rutoti*
(extinct genus)
(x2) - uncommon

*Striatolamia macrota*
(extinct genus)
(x1) - common



*Physogaleus secundus*
(tiger shark)
(x4) - common

*Otodus obliquus*
(Sheppey "jaws")
(x 0.5) - uncommon

*Squatina prima*
(angel shark)

(x 3) - scarce

*Xiphodolamia ensis*
(extinct genus)
(x1.5) - uncommon

Sheppey London Clay Representative Fossils - Plate 7

# Shark and bony fish vertebrae, spine, rostrum and dentitions

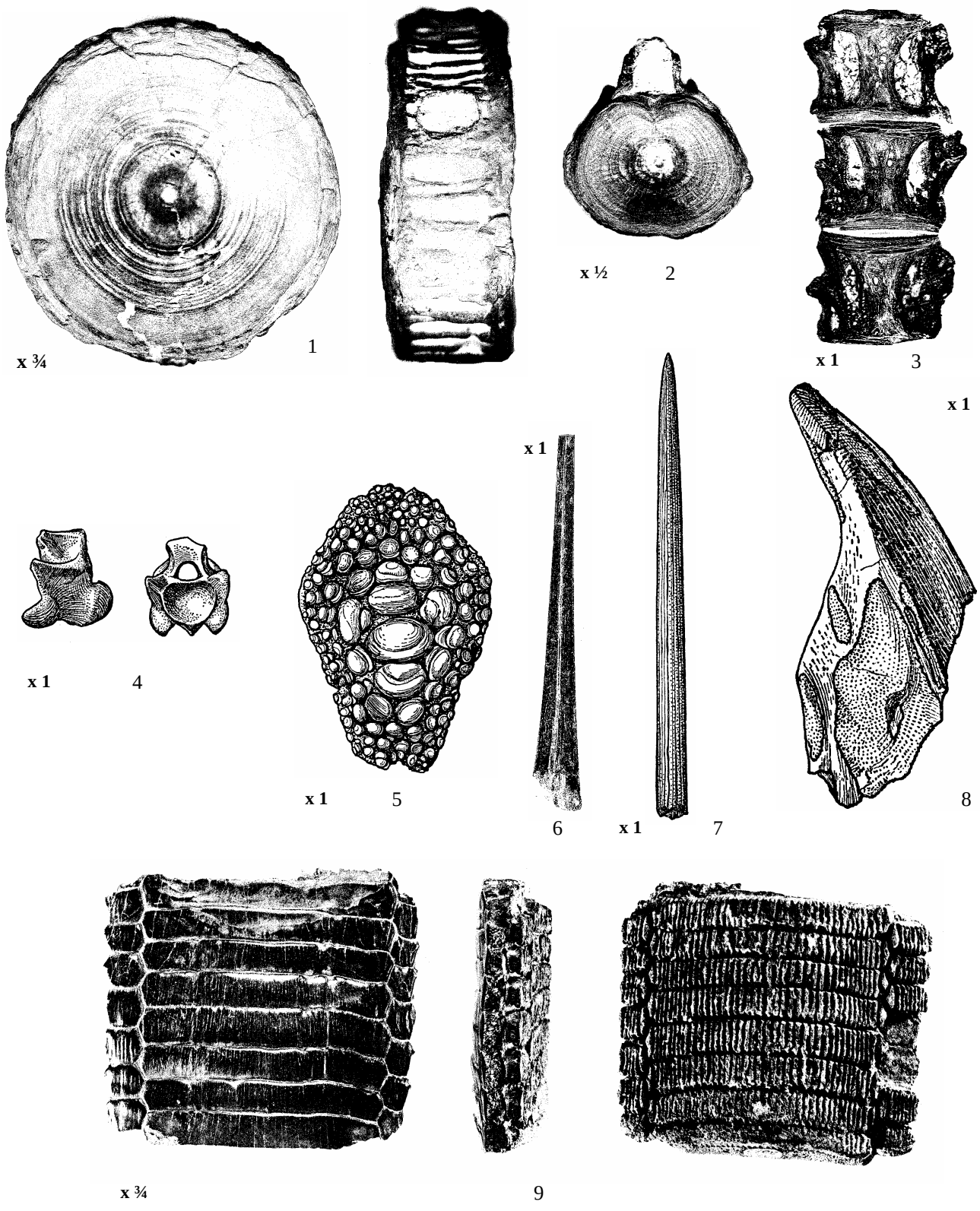
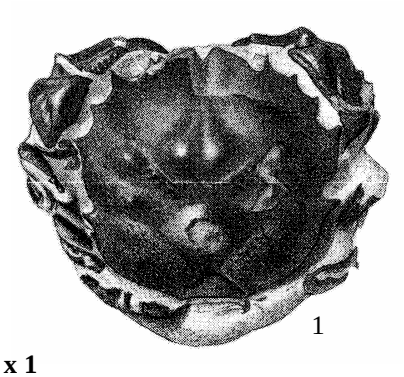



**Fig 1**: Shark vertebra *Otodus obliquus* Agassiz; **Figs 2** and **3** Unidentified teleost (bony) fish vertebrae; **Fig 4** Sea snake vertebra *Paleophis toliapicus* Owen; **Fig 5** Fish upper pharyngeal dentition *Phyllodus toliapicus* Agassiz; **Fig 6** Fish spine *Aglyptorhynchus sulcatus* (Casier); **Fig 7** Fish rostrum *Cylindracanthus rectus* (Dixon); **Fig 8** Mandibular tooth of Chimaeroid *Edaphodon bucklandi* Agassiz; **Fig9** lower dentition of the eagle ray *Myliobatis toliapicus* Agassiz

British Caenozoic Fossils - BM(NH)
Casier: Fauna Ichthyologique du London Clay BM(NH)

Sheppey London Clay

# Fossil Crabs (Malacostraca)



1

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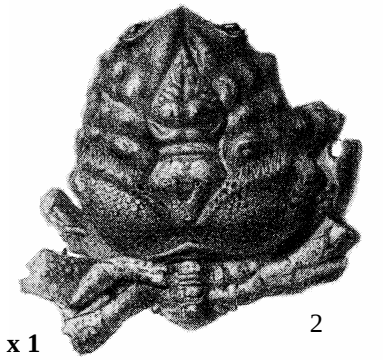
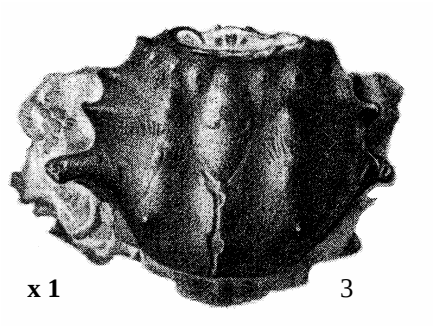


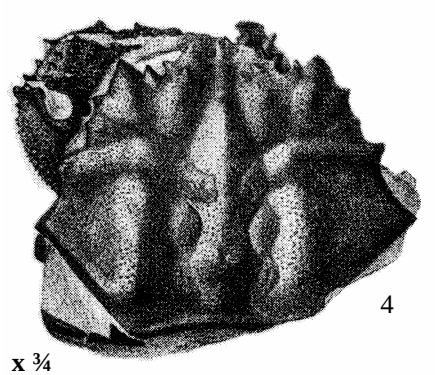
2

**x 1**



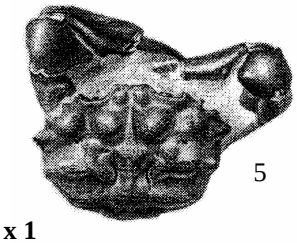
3

**x 1**



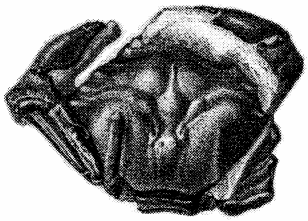
4

**x ¾**



5

**x 1**

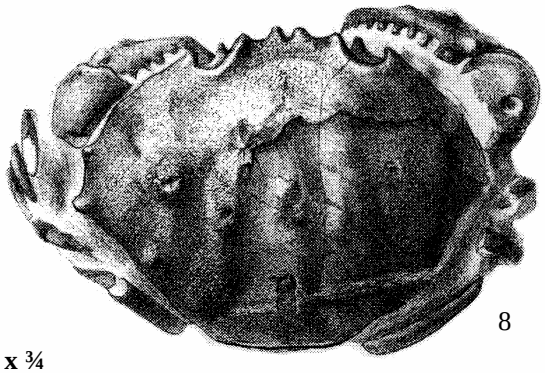


6

**x ¾**

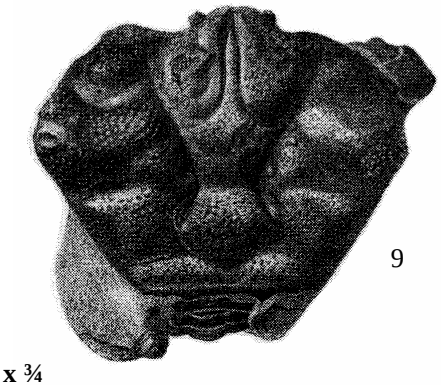
7

**x 1 ½**



8

**x ¾**



9

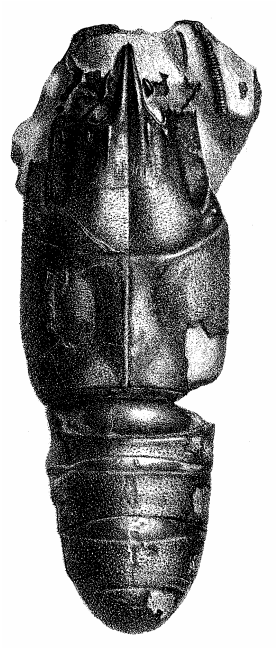
**x ¾**

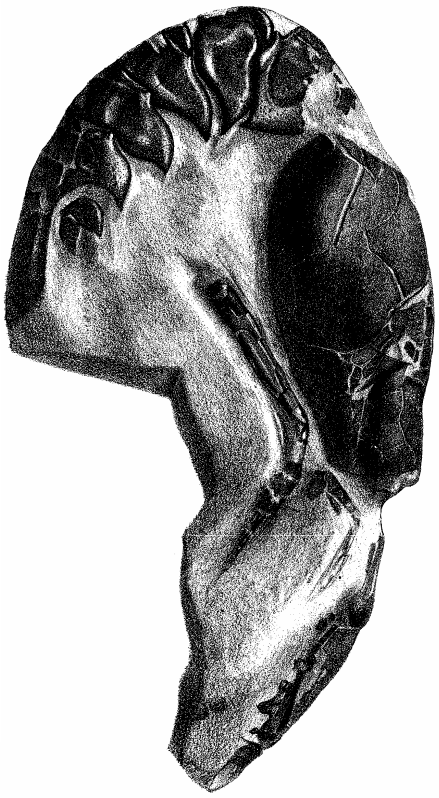
**Fig 1** *Dromilites bucklandi*, Edwards; **Fig 2** *Dromilites lamarcki* (Desmarest)
**Fig 3** *Campylostoma matutiforme* Bell; **Fig 4** *Goniochele angulata* Bell
**Fig 5** *Glyphithyreus wetherelli* (Bell); **Fig 6** *Portunites incerta* Bell;
**Fig 7** *Mithracia libinioides* Bell; **Fig 8** *Zanthopsis leachi* (Desmarest);
**Fig 9** *Xanthilites bowerbankii* Bell

Professor Bell's Monograph of the Fossil
Malacostracous Crustacea of Great Britain

Sheppey London Clay

# Fossil Lobsters





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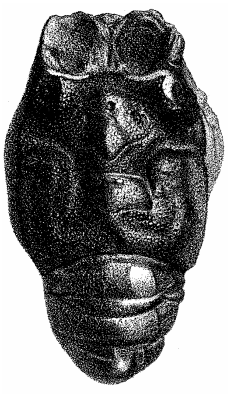

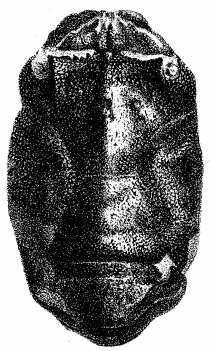

3

4

5

Figures

**Figs 1 and 2** *Hoploparia gammaroides* McCoy
**Fig 3** *Scyllaridia koenigii* Bell
**Fig 4** *Archaeocarabus bowerbankii* McCoy
**Fig 5** *Hoploparia belli* McCoy

Professor Bell's Monograph of the Fossil Malacostracous Crustacea of Great Britain