

---

## Warden Point, Kent

([TQ 955 738]–[TR 024 717])

### Highlights

Warden Point represents the richest collecting site for London Clay reptiles. Over the years, hundreds of superb specimens have been found, representing 13 species of turtles, one snake and one crocodylian. Most of these 15 reptiles were first found in the London Clay of Sheppey, and the fauna is internationally important as a key shallow marine Early Eocene fauna (Figure 9.3).

#### Introduction

The London Clay Formation (Figure 9.2) exposed on the northern and north-eastern shores of the Isle of Sheppey has yielded an important fauna of Eocene fossil reptiles. These include crocodylians, snakes and turtles in particular, with type specimens of eight or more species. The fossil turtles from Sheppey have been known for a long time: Parkinson (1811) noted two or three fossil tortoises' from Sheppey and figured a plastron and a skull, while Cuvier (1824, pp. 165, 234–5) described further remains of turtles as well as some crocodylian bones. Specimens are still being found, and the coast of Sheppey has excellent potential for future finds.

The marine London Clay Formation is up to 153 m thick (Davis, 1936), but only the top 52 m are exposed on the Isle of Sheppey. The London Clay Formation (London Clay and Claygate Beds) in the London Basin has been divided into five zones (termed A–E) on the basis of marine molluscs, and a correlation scheme based on lithology, micro- and macrofaunas, has been developed by King (1970, 1981, 1984). The Claygate Beds consist of sparsely fossiliferous alternations of marine sands and clays and are probable lateral equivalents of the highest London Clay sequences at Highgate and Sheppey. Zones A–B of the London Clay are known only from borehole records. Divisions C (12.3 m), D (16.2 m) and E (24.8 m) comprise silty clays with silt and sand partings at some levels, and beds of sandy silt. The geology of the Warden Point section (Figure 9.3) has been described by Davis (1936, 1937) and King (1970, 1981, 1984), and the reptiles by Parkinson (1811), Cuvier (1824), Owen (1841d, 1841e, 1842b, 1850), Owen and Bell (1849), Seeley (1871), Lydekker (1889b, 1889d, 1889g), Mook (1955), Moody (1968, 1974) and Zangerl (1971).

### Description

The main fossiliferous horizon is identified as lying in division D: 'an interval 9.5 m–16 m below the base of division E. It can be seen on the foreshore and in the base of the cliff between Eastchurch Gap and Paddy's Point [TQ 997 730] to [TQ 971 735], and rises eastwards to a height of about 15 m O.D. at Warden Point' (King, 1981, p. 53). This bed, probably equivalent to bed C of Davis (1936, 1937) yields fishes, molluscs, brachiopods, bryozoans, crustaceans (including decapods, barnacles and ostracods), annelids, echinoderms, corals, foraminiferans and plants — a mixture of shallow-marine and drifted terrestrial forms.

Most of the published descriptions of fossil reptiles and museum specimens give no more locality information other than 'London Clay, Sheppey'. Warden Point is indicated for a turtle (BMNH R8353) and a snake (BMNH R5886), and Eastchurch for a crocodylian (BMNH R5879).

Davis (1936, p. 334) noted vertebrae of the snake *Palaeophis* 'rarely in the clay at Warden Point', scutes of *Crocodylus spenceri* at Eastchurch ([TQ 997 730]) and vertebrae at Warden Point [TR 021 725], as well as 'indeterminate remains' of turtles 'at all points of the section'. Davis (1937) further noted a specimen of the turtle *Lytoloma* from Warden Point. King (1981, p. 53) noted recent finds of vertebrae 'from nodule layers 5–10 m above the base of the exposed section', thus probably below Davis' fossiliferous horizon C mentioned above, and King (1984, p. 145) confirmed that most of the larger specimens probably came from the large phosphatic nodules in layer D. Hooker and Ward (1980, p. 5) note that fossil vertebrates on Sheppey occur at various points in the section from [TQ 955 738] to [TR 024 717]. Particular fossil

localities include Minster [TQ 955 736], Royal Oak [TQ 967 757], Bugsby's Hole [TQ 974 725], Eastchurch Gap [TQ 997 730], Barrow Brook [TR 013 718] and Warden Point [TR 021 725].

## Fauna

Fossil reptile specimens from Sheppey are to be found in many British and European Museums. The best collections are in the BMNH and CAMSM. The reptile species represented are (turtles after Moody, 1980a):

	Numbers
<b>Testudines: Pleurodira:</b>	
Pelomedusidae ?	
<i>Palaeaspis bowerbanki</i> (Owen, 1842) Type specimen: BMNH 37209	1
<b>Testudines: Cryptodira: Cheloniidae</b>	
<i>Argillochelys cuneiceps</i> (Owen, 1849) Type specimen: BMNH 41636	10
<i>Argillochelys antiqua</i> (Koenig, 1825) Type specimen: BMNH 49465	5
<i>Eochelone brabantica</i> Dollo, 1903	1
<i>Puppigerus camperi</i> (Gray, 1831)	4
<i>Puppigerus crassicostratus</i> (Owen, 1849)	5
<b>Testudines: Cryptodira:</b>	
Dermochelyidae	
<i>Eosphargis gigas</i> (Owen, 1861) Type specimen: BMNH R31	12
<b>Testudines: Cryptodira:</b>	
Trionychidae	
<i>Trionyx</i> sp.	4
<b>Testudines: Cryptodira:</b>	
Carettochelyidae	
<i>Allaeochelys</i> sp.	1
<b>Testudines: Cryptodira: Emydidae</b>	
<i>Chrysemys bicarinata</i> (Bell, 1849) Type specimen: BMNH 39450	2
<i>Chrysemys testudiniformis</i> (Owen, 1849) Type specimen: BMNH 39767	1
<b>Testudines: Cryptodira: <i>incertae sedis</i></b>	
<i>Dacochelys delabechei</i> (Bell, 1849) Type specimen: BMNH 39257	2
<i>Pseudotrionyx delheidi</i> Dollo, 1886	2
<b>Lepidosauria: Squamata: Serpentes:</b>	
Palaeophiidae	
<i>Palaeophis toliapicus</i> Owen, 1841 Type specimen: BMNH 39447	14
<b>Archosauria: Crocodylia: Neosuchia:</b>	
Eusuchia: Crocodylidae	
<i>Kentisuchus spenceri</i> Buckland, 1837 Type specimen: BMNH 19633	21

## Interpretation

The London Clay Formation on Sheppey is interpreted by King (1984, p. 121) as a marine deposit laid down in a 'well-oxygenated low-energy shelf environment, varying in depth from c. 20 to c. 100 metres. Alternation of fine and

coarser beds is ascribed to minor sea-level fluctuations. The upper part of the London Clay Formation was deposited in a progressively shallowing environment.' The bulk of the fauna, foraminifera, coelenterates, scolecodonts, serpulids, brachiopods, bryozoans, benthic molluscs, pteropods, ostracods, crustaceans, echinoderms and fishes presumably lived in the water, or in or on the sediment. Of the tetrapods, most of the turtles were indigenous marine forms, but the remainder (as with wood, leaves, pollen and spores, and insects) may have been washed in.

Following early find of turtles (Parkinson, 1811; Cuvier, 1824), further descriptions of Sheppey finds, including the erection of many new species, were given by Owen (1841d, 1842b), Owen and Bell (1849), Seeley (1871), Lydekker (1889b, 1889d, 1889g), Moody (1968, 1974) and Zangerl (1971). Owen, in his several accounts, erected 12 or more species, but many of these have been synonymized: Moody (1980a) gives an updated list of valid species. The turtles belong to several groups: Pelomedusidae, Cheloniidae, Dermochelyidae, Trionychidae, Carettochelyidae, Emydidae and *incertae sedis* (Moody, 1980a). These are mainly medium-sized marine forms, and they all have living relatives.

*Palaeaspis* is rather poorly known from carapace remains (Mlynarski, 1976, pp. 114–15). It is a pleurodire (folds its neck sideways), belonging to the Family Pelomedusidae, which is known from the Cretaceous to the present. Modern forms occur in Africa and South America.

The other Warden Point turtles are cryptodires, forms that fold their necks vertically. *Eochelone* and *Puppigerus* ((Figure 9.4)A-D), both cheloniid sea turtles, are well known from a fair number of specimens from Sheppey and Belgium (body length 0.6–0.8 m) (Moody, 1974). *Argillochelys*, another cheloniid, is represented by skull and carapace remains which suggest a body length of 200 mm. The Cheloniidae have a record extending back to the Cretaceous, and they live worldwide today. *Eosphargis* (body length 1–1.5 m) is represented by skull and limb remains; it is the oldest undisputed dermochelyid turtle in the world (Benton, 1993). *Eosphargis* is known from Eocene deposits in Denmark, Belgium, and possibly offshore South Africa. The dermochelyids are now cosmopolitan. Carapace fragments of *Trionyx* sp. represent the Trionychidae, soft-shelled turtles, a widespread group of freshwater turtles known from the Cretaceous to the present. *Allaeochelys*, a carettochelyid, is represented by carapace elements. The Carettochelyidae is another marine turtle group that is present today in seas off Asia and North America, and known since the Cretaceous. The two species of *Chrysemys* ((Figure 9.4)E) are based on carapace remains; they are the oldest representatives in the world of Emydidae (Benton, 1993).

*Pseudotrionyx* and *Dacochelys* are noted as *incertae sedis* by Moody (1980a). Mlynarski (1976, pp. 73–4) had suggested that the former might belong to the carettochelyid genus *Allaeochelys*.

The snake *Palaeophis toliapicus* was described by Owen (1841e) on the basis of a partial backbone consisting of 28 vertebrae, as well as some other vertebrae and ribs (Figure 9.41). The total length of *Palaeophis* is unknown, although Owen noted that its vertebrae were 'as large as those of a Boa Constrictor ten feet in length'. There has been some confusion over whether *Palaeophis* was a snake or a lizard, since complete skeletons are not known. Holman (1979) argues strongly that it was a snake. Further material of this genus is known from Belgium, France and Denmark (Rage, 1984), and the genus has been reported from Late Cretaceous to Late Eocene rocks of Europe, Africa and North America.

*Kentisuchus spenceri* was based on an incomplete skull of an animal approximately 1.5 m long ((Figure 9.4)H,I). Earlier, a Sheppey crocodylian (that of Cuvier, 1824) had been named *Crocodylus delucii* Gray, 1831, but the description was inadequate. Owen (1842b) ascribed other material to *K spenceri*, and later (Owen, 1850) erected the new species *C. toliapicus* for a skull from the London Clay, and *C. champsoides* for an incomplete skull and other material from Sheppey. Lydekker (1887b, 1888a) described more Sheppey material, and reduced *C. champsoides* to synonymy with *C. spenceri*, and Mook (1955) placed them in the new genus *Kentisuchus* (Steel, 1973, pp. 69–70). *K spenceri* is represented by skull remains, limb bones, vertebrae, ribs and scutes from Sheppey. Some remains from Bognor, Sussex and from Morocco have been ascribed to this species.

## Comparison with other localities

The nearest comparable units with the London Clay Formation of Sheppey outside Britain are the Sables de Erquelinnes (Hainaut, Belgium; Late Palaeocene), the Argile d'Ypres (France, Belgium; Early Eocene), and the Sables de Bruxelles (Belgium; Mid Eocene), as well as equivalent-age units in France, Morocco, Nigeria, Mali and the eastern United States. These have yielded abundant specimens of turtles, including many that are conspecific with those from Sheppey, as well as lizards, snakes and crocodylians.

## Conclusions

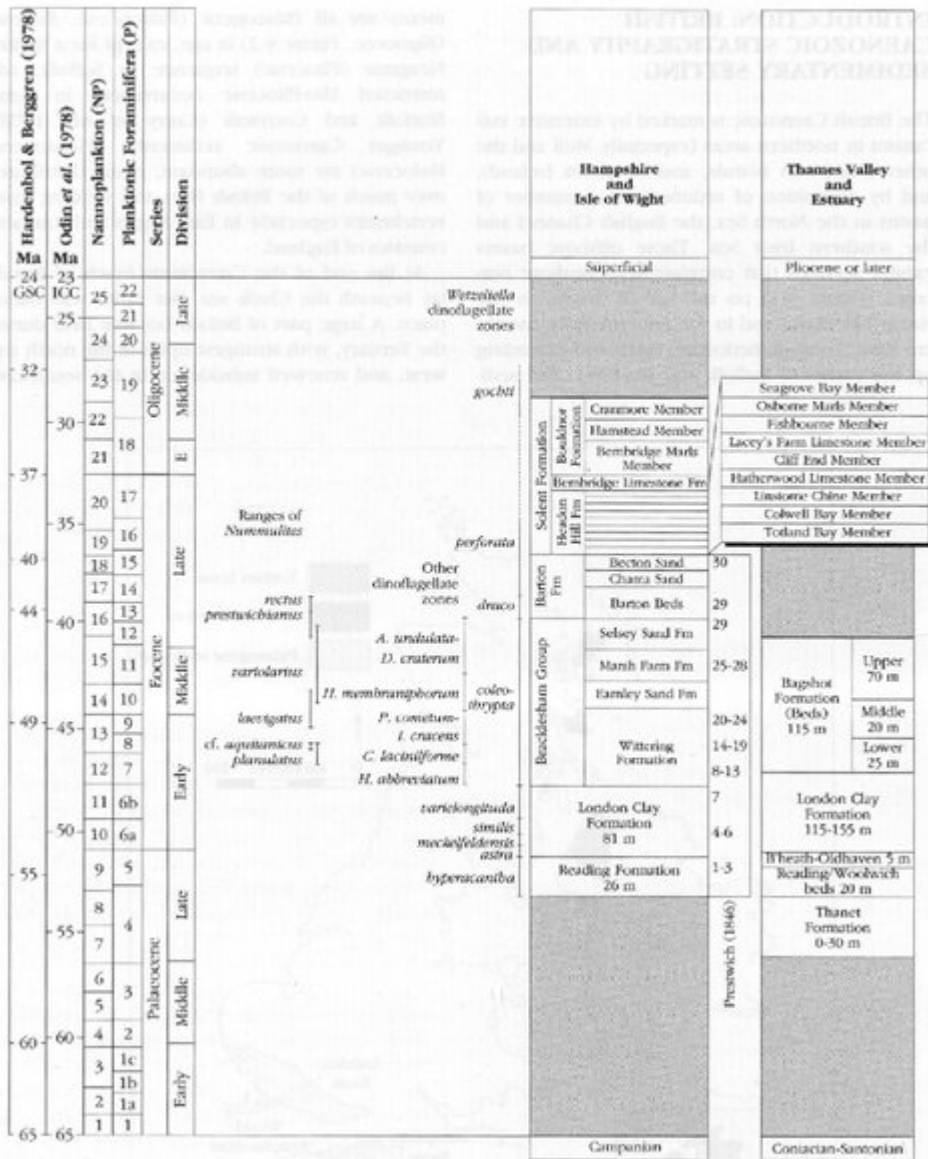
The London Clay Formation at Sheppey has yielded Britain's best fauna of Tertiary fossil turtles. The fauna is important for both its relative abundance and diversity, and the good quality of preservation. The locality has been well known for over 150 years and has provided the basis for many important works on the evolution of turtles. The turtle fauna includes numerous type species, as well as the oldest undisputed dermochelyids and emydids in the world.

The international importance of the site and its continuing supply of new specimens define its high conservation value.

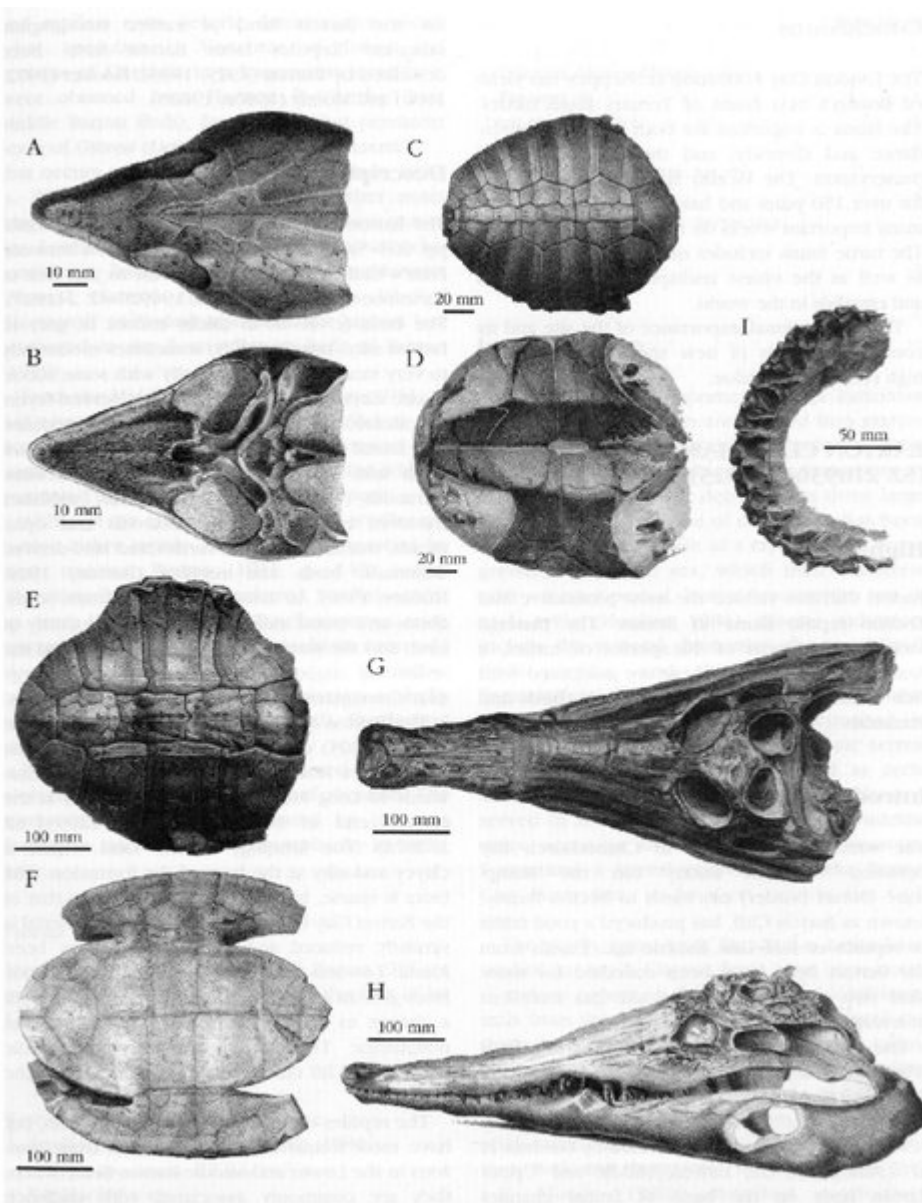
## [References](#)



*(Figure 9.3) The London Clay, exposed at Warden Point, Isle of Sheppey, showing collapsed cliffs and fossil-bearing material on the foreshore. (Photo: D.J. Ward.)*



(Figure 9.2) Summary of Tertiary stratigraphy, showing global standards and some major British formations. Based on Curry et al. (1978).



(Figure 9.4) Typical reptiles of the Eocene London Clay of Sheppey. (A)–(D) The turtle *Puppigerus camperi* (Gray, 1831), skull in (A) dorsal and (B) ventral views, (C) carapace in dorsal view, (D) plastron in ventral view; (E) *Chrysemys bicarinata* (Bell, 1849), partial carapace in dorsal view; (F) *Platemys bullocki* Owen, 1841, plastron in ventral view; (G) and (H) the crocodile *Crocodilus spenceri* Buckland, 1837, skull in (G) dorsal and (H) lateral views; (I) the snake *Palaeophis toliapicus* Owen, 1841, 30 dorsal vertebrae in side view. (A)–(F) After Owen and Bell (1849); (G) and (H) after Owen (1850b); (I) after Owen (1850c).