

SHEPPEY

OS Grid Reference: TQ955738–TR024717

Highlights

The fish fauna recovered from this London Clay outcrop in Kent includes an extraordinary number of both elasmobranch and actinopterygian species. Indications are that the fish communities were at an ecological acme, and developed upon a very broad feeding base.

Introduction

The London Clay Formation exposed on the northern and north-eastern shores of the Isle of Sheppey has yielded an important fauna of Eocene fossil vertebrates. Specimens are still found, and the coast of Sheppey has excellent potential for future finds. In the London Basin the marine London Clay Formation is up to 153 m thick (A.G. Davis 1936), but only the top 52 m are exposed on the Isle of Sheppey (Divisions D–E; Figure 14.8). The geology of the Sheppey section has been described by A.G. Davis (1936, 1937), Pitcher *et al.* (1967) and King (1970, 1981, 1984), and the fishes by Agassiz (1833–1845), Woodward (1889b, 1899d), Leriche (1905, 1921), White (1931), A.G. Davis (1936), Stinton (1965c, 1966), Casier (1966, 1967) and Ward (1988).

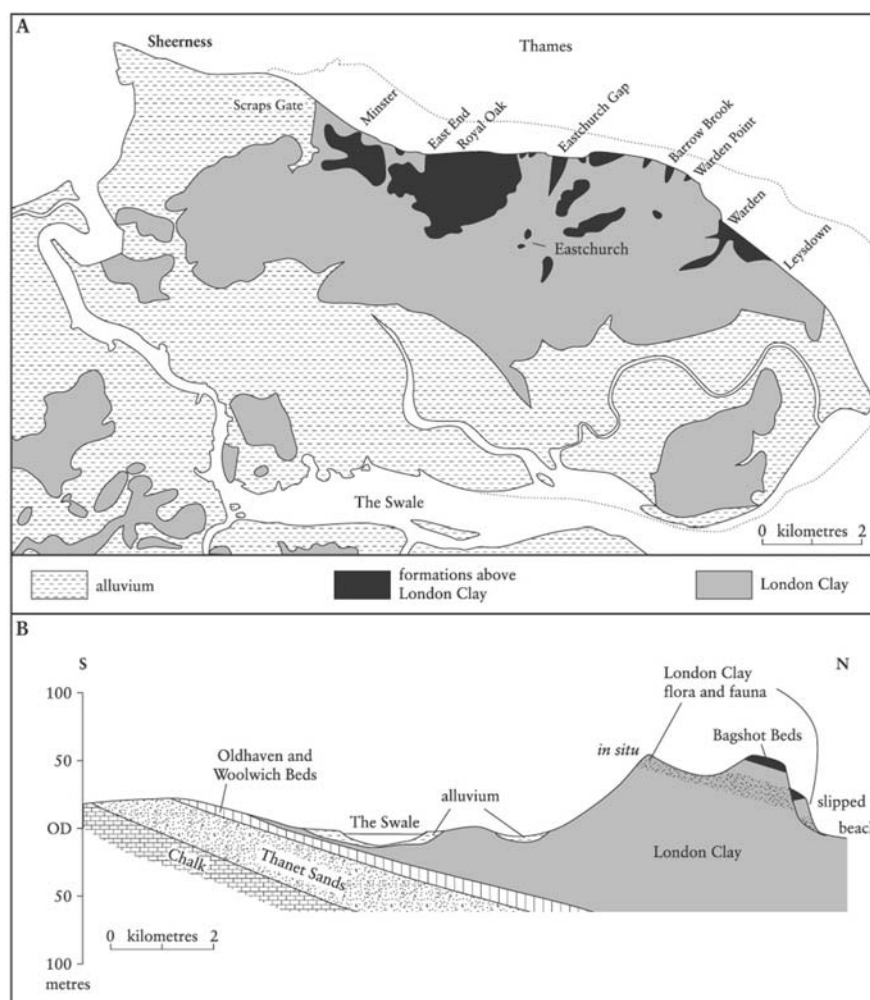


Figure 14.8: The Isle of Sheppey: (A) sketch map, (B) section.

Description

The main fossiliferous horizon lies 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 997730– TQ 971735), and rises eastwards to a height of about 15 m OD at Warden Point' (King, 1981, p. 53). This bed, probably equivalent to bed C of A.G. Davis (1936, 1937), yields 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 fishes and museum specimens have little locality information except 'London Clay, Sheppey'. Hooker and Ward (1980, p. 5) noted that fossil vertebrates occur at various points in the section from TQ 955738 to TR 024717. Particular fossil localities include Minster (TQ 955736), Royal Oak (TQ 967757), Bugsby's Hole (TQ 974725), East Church Gap (TQ 997730), Barrow Brook (TR 013718) and Warden Point (TR 021725).

Fauna

Fossil fish from Sheppey are to be found in many British and European museums (Figures 14.9 and 14.10). The best collections are in the NHM and CAMSM.

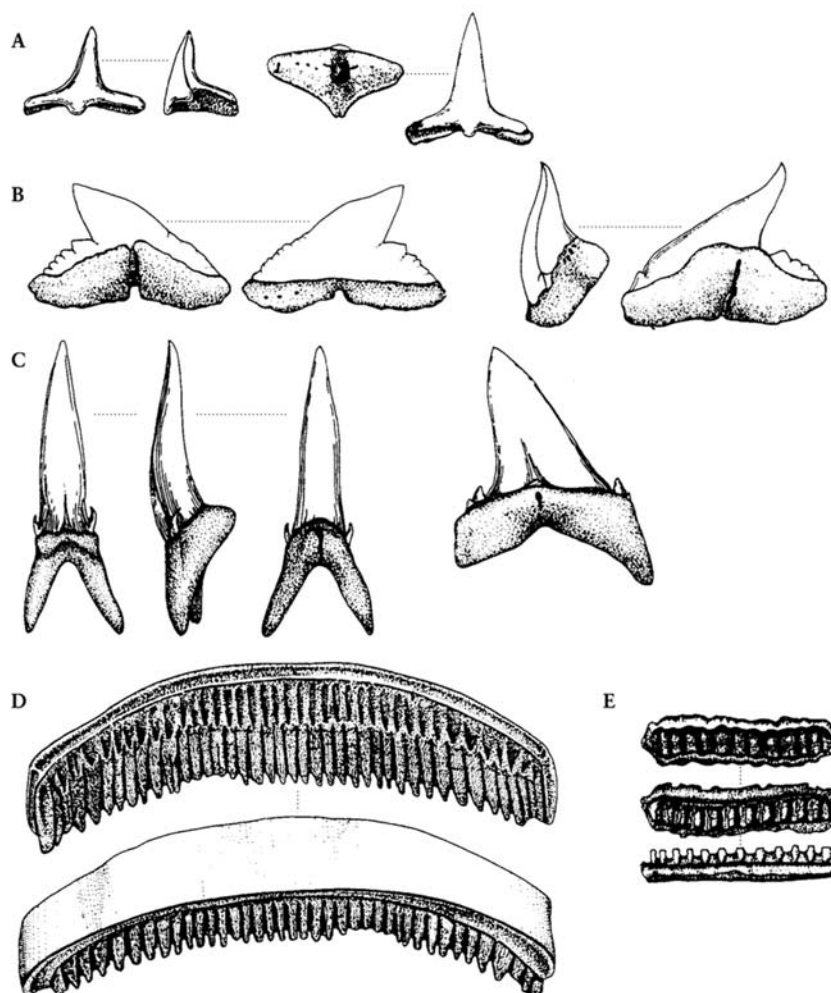


Figure 14.9: Common elasmobranch fossils from the London Clay, as at the Isle of Sheppey (after Kemp et al., 1990). (A) *Squatina prima* (Winkler), lateral tooth (left) and anterior tooth (right), $\times 2.5$. (B) *Physogaleus secundus* (Winkler) female antero-lateral tooth, $\times 2$, lingual and labial views (left) and male antero-lateral tooth, lingual and labial views (right). (C) *Carcharias hopei* (Agassiz), lower anterior tooth, $\times 1.23$, labial lateral and lingual views (left) and upper lateral tooth, lingual view (right). (D) *Aetobatus irregularis* (Agassiz), single tooth from lower dentition, $\times 1.2$, basal and occlusal views. (E) *Burnhamia daviesi* (Woodward), tooth, $\times 1.25$, occlusal, basal and lateral views.

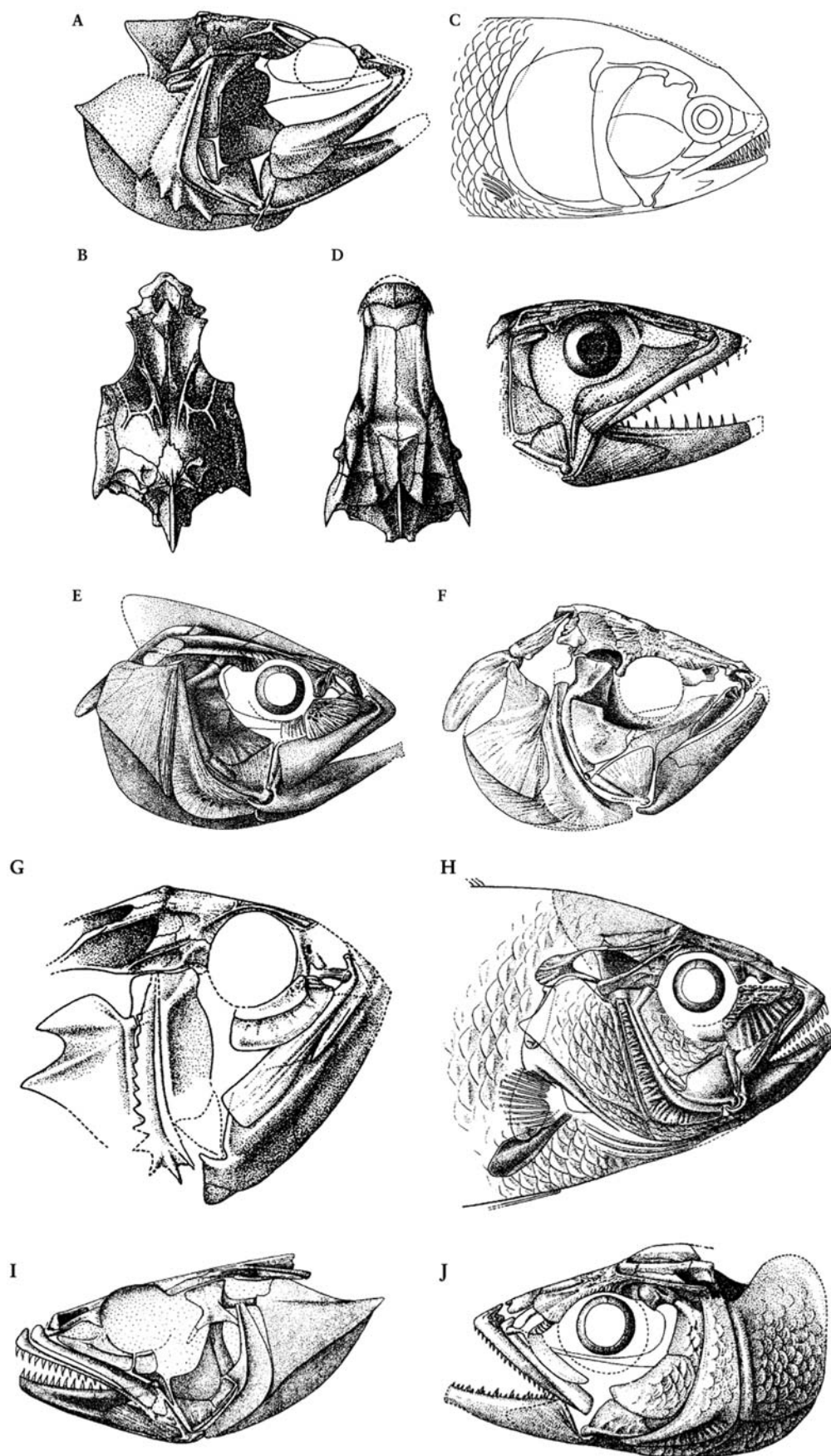


Figure 14.10: Uncommon teleosts from the London Clay at Sheppey (after Casier, 1966, © The Natural History Museum, London). (A), (B) *Ampheristus tollapicus* Konig, reconstruction of the skull, right side and dorsal views; (C) *Brychaetus muelleri* Woodward, right side of head; (D) *Eocoelopoma hopwoodi* Casier, reconstruction of skull in dorsal and right side views; (E) *Eothynnus salmonens* Woodward, reconstruction of head in right side view; (F) *Promegalops signeuxae* Casier, right lateral view of skull. All

figures c. $\times 0.5$. (G) *Percostoma angustum* Casier, reconstruction of skull in right side view; (H) *Sciaenurus bowerbanki* Agassiz, head in right profile; (I) *Rhinocephalus planiceps* Casier, skull in left side view; (J) *Wetherellus cristatus* Casier, incomplete skull in left profile. All figures c. $\times 0.5$.

Chondrichthyes: Elasmobranchii: Neoselachii: Squalomorphii

Hexanchus agassizi Cappetta, 1976

H. hooker Ward, 1979

H. collinsonae Ward, 1979

Isistius trituratorus (Winkler, 1874)

Notorhynchus serratissimus (Agassiz, 1844)

Squalus minor (Leriche, 1902)

Weltonia burnhamensis Ward, 1979

Chondrichthyes: Elasmobranchii: Neoselachii: Squatinomorphii

Squatina prima (Winkler, 1874)

Chondrichthyes: Elasmobranchii: Neoselachii: Galeomorphii **Anomotodon sheppeyensis**
(Casier, 1966)

Carcharias hopei (Agassiz, 1843)

Galeorhinus lefevrei (Daimeries, 1891)

G. minor (Agassiz, 1843)

G. recticonus (Winkler, 1873)

Heterodontus vincenti (Leriche, 1905)

H. woodwardi Casier, 1946

H. wardenensis Casier, 1966

Isurus praecursor (Leriche, 1904)

Isurolamna affinis (Casier, 1946)

'*Lamna*' *lerichei* Casier, 1946

Megascyliorhinus cooperi Cappetta and Ward, 1977

Mustelus whitei Cappetta, 1976

Odontaspis winkler Leriche, 1905

Otodus obliquus Agassiz, 1843

Palaeohypotodus rutoti (Winkler, 1874)

Physogaleus secundus (Winkler, 1874) (= *Physodon secundus*, *P. tertius*, *Galeorhinus minor*)

Scyliorhinus gilberti Casier, 1946

S. casieri Cappetta, 1976

'*Scylliorhinus minutissimus* (Winkler, 1873)

'*S. biauriculatus* (Casier, 1950)

Synodontaspis macrotus (Agassiz, 1843) *S. striatus* (Winkler, 1874)

Triakis wardi Cappetta, 1976

Xiphodolamia eocaena (Woodward, 1889)

Chondrichthyes: Elasmobranchii: Neoselachii: Batomorphii

Aetobatus irregularis (Agassiz, 1843)

Burnhamia daviesi (Woodward, 1889)

Dasyatis daviesi Casier, 1966

Myliobatis raouxi Arambourg, 1952

M. dixonii Agassiz, 1843

M. latidens Woodward, 1888

M. toliapicus Agassiz, 1843

Myliobatus sp.

Raja sp.

Chondrichthyes: Holocephali: Chimaeriformes

Edaphodon bucklandi Agassiz, 1843

Elasmodus hunteri Egerton, 1843

Osteichthyes: Acanthopterygii: Scombroidei

Acestrus elongatus Casier, 1966 *A. ornatus* Casier, 1966 Osteichthyes: Actinopterygii:
Acipenserodei

Acipenser toliapicus Agassiz, 1844 *Lehmanna* sp.

Osteichthyes: Actinopterygii: Teleostei: Osteoglossomorpha

Brychaetus muelleri Woodward, 1901 Osteichthyes: Actinopterygii: Neopterygii: Teleostei:
Elopomorpha

Albula oweni Leriche, 1905

Echilus branchialis (Woodward, 1901)

Egertonia isodonta Cocchi, 1866 *Elops* sp. *Phyllodus toliapicus* Agassiz, 1844 *P.*
sheppeyensis Casier, 1966 *Promegalops signeuxae* Casier, 1966 *Protarpon oblongus* (Woodward,
1901) *P. priscus* (Woodward, 1901) Osteichthyes: Actinopterygii: Neopterygii: Euteleostei

Aglyptorhynchus sulcatus Casier, 1966

Ampheristus toliapicus König, 1825 ?*Ardiodus marriotti* White, 1931 ?*Argillichthys*
toombsi Casier, 1966 *Aulopopsis depressifrons* Casier, 1966 *A. egertoni* Casier, 1966 *Beerichthys*
ingens Casier, 1966 *Beerichthys?* sp.

Brychaetus muelleri Woodward, 1901 *Bramoides brienii* Casier, 1966 *Bucklandium diluvii* König,
1825 *Cybiium* cf. *proosti* (Storms, 1876) *Cylindracanthus rectus* (Dixon, 1850)

Enniskillenus radiatus Casier, 1966 *Eocephalopoma cole* Woodward, 1901 *E. gigas* Casier, 1966 *E. hopwood* Casier, 1966 *Eothynnus salmoneus* (Agassiz, 1844) *Esocelops cavifrons* (Agassiz, 1845) *Eutrachiurides winkleri* Casier, 1944 *Goniocranium arambourg* Casier, 1966 *Halecopsis insignis* (Delvaux and Ortlieb, 1887) *Hemirhabdorrhynchus elliott* Casier, 1966 *Labrophagus esocinus* Agassiz, 1844 *Laparon alticeps* Casier, 1966 *Lehmanamia sheppeyensis* Casier, 1966 'Myripristis toliapicus' Agassiz, 1845 *nomen nudum Naupygus bucklandi* Agassiz, 1844 *Paraberyx bowerbanki* David, 1946 *Percostoma angustum* Agassiz, 1845 *nomen nudum Phyllodus toliapicus* Agassiz, 1844

Plesioserranus cf. *wemmelensis* Casier 1966 *Podocephalus curry* Casier, 1966 *P. nitidus* Casier, 1966 *Progempylus edwards* Casier, 1966 *Promegalops signeuxae* Casier, 1966

P. sheppeyensis Casier, 1966

Protarpon oblongus (Woodward, 1901) *P. priscus* (Woodward, 1901)

Pseudosphaerodon antiquus Noetling, 1885 *Pycnodus bowerbanki* Egerton, 1877 *Pycnodus*. sp. *Rhinocephalus planiceps* Casier, 1966 *Sciaenurus bowerbanki*? Agassiz, 1845 *S. bowerbanki* cf. *crassior* Casier, 1966 *Sciaenuropsis turner* Casier, 1966 *Scombramphodon crassidens* Woodward, 1901 *S. sheppeyensis* Casier, 1966 *Scombrinus macropomus* (Agassiz, 1835) *S. nuchalis* Woodward, 1901 *Serranopsis londinensis* Casier, 1966 *Sphyaenodus priscus* Agassiz, 1839–1844 *Tamesichthys decipiens* Casier, 1966 *Teratichthys antiquitatis* König, 1825 *Trichiurides sagittidens* (Winkler, 1874) *Wetherellus brevior* Casier, 1966 *W. cristatus* Casier, 1966 *W. longior* Casier, 1966 *Whitehippus tamesis* Casier, 1966 *Whitehippus* sp. *Woodwardella patellifrons* Casier, 1966 *Xiphiorhynchus priscus* (Agassiz, 1839) *X. parvus* Casier, 1966

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 layers 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 and echinoderms were predominantly epifaunal or infaunal in habit. The fishes and turtles were indigenous marine forms, but the remainder (as with wood, leaves, pollen and spores and insects) may have been washed in.

The abundance of elasmobranch fishes indicates a great range of predatory forms attracted to the wealth of small animals present, especially the benthos. The primitive squalomorphs were probably bottom-dwelling forms, like the extant dogfishes. *Squatina prima* is present, as in almost all the sites described and is the single squatinomorph, but the galeomorph sharks were in great variety as active fusiform-bodied predators. Their prey presumably included much nekton. The batomorphs, too, may have been, like *Myliobatis*, widespread benthonic ray-like animals. Teleosts, though by no means rare, are by contrast poorly represented, perhaps for overall reasons of taphonomy.

Allison (1988) has studied the taphonomy of the prolific and diverse London Clay biota at Sheppey. He found that apatite was the first preservational mineral to form, followed by calcite and pyrite. Only those organisms with an original phosphate content (such as the vertebrates) have become phosphatized. Organisms preserved during the earliest phase of mineralization retain the most detail. Soft-part preservation is very rare while the hard parts are almost always preserved in three dimensions within the pyrite and calcium phosphate concretions (Casier, 1966; Ward, 1979).

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.

Conclusions

The London Clay Formation fish fauna at Sheppey is important for both its relative abundance and diversity, and the good quality of preservation, hence the site's conservation value. The locality has been well known by palaeontologists for over 150 years, yielding many type specimens.

Reference list

- Agassiz, J.L.R. (1833–1845) *Recherches sur les Poissons Fossiles*, 5 volumes, and atlas 5 volumes, Imprimerie Petitpierre, Neuchatel, France, 1420 pp.
- Agassiz, J.L.R. (1835) On the fossil fishes of Scotland. *Report of the British Association for the Advancement of Science*, British Association for the Advancement of Science, Edinburgh.
- Agassiz, J.L.R. (1839) Fishes of the Upper Ludlow Rock. In *The Silurian System*, R.I. Murchison (ed.), Vol.2, 605–7, John Murray, London.
- Agassiz, J.L.R. (1844–1845) *Monographie des poissons fossiles du Vieux Grès Rouge ou système Devonien (Old Red Sandstone) des Iles Britanniques et de Russie*. Jent et Grassmann Neuchâtel, xxxvi and 171 pp.
- Allison, P.A. (1988) Taphonomy of the Eocene London Clay Biota. *Palaeontology*, **31**, 1079–100.
- Casier, E. (1966) *Faune ichthyologique du London Clay*. British Museum (Natural History), London, 2 vols, 496 pp.
- Casier, E. (1967) Le Landâniën de Dormaal (Brabant) et sa faune ichthyologique. *Institut royale des Sciences naturelles de Belgique*, Memoire **156**, 1–66.
- Davis, A.G. (1936) The London Clay of Sheppey and the location of its fossils. *Proceedings of the Geologists' Association*, **47**, 328–45.
- Davis, A.G. (1937) Additional notes on the geology of Sheppey. *Proceedings of the Geologists' Association*, **48**, 77–81.
- Dixon, F. (1850) *The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex*. Longmans, Brown, Green and Longmans, London, 422 pp.
- Hooker, J.J. and Ward, D.J. (1980) List of localities. *Tertiary Research*, **3**, 3–12.
- King, C. (1970) The biostratigraphy of the London Clay in the London district. *Tertiary Times*, **1**, 13–15.
- King, C. (1981) The stratigraphy of the London Clay and associated deposits. *Tertiary Research Special Paper*, **6**, 158 pp.
- King, C. (1984) The stratigraphy of the London Clay Formation and Virginia Water Formation in the coastal sections of the Isle of Sheppey (Kent, England). *Tertiary Research*, **5**, 121–58.
- Leriche, M. (1905) Les poissons éocènes de la Belgique. *Memoires du Museum d'Histoire naturelle Belgique*, **III**, 49–228.
- Leriche, M. (1921) Sur les restes de Poissons remaniés le Neogène de la Belgique. *Bulletin de la Société Belge de Géologie de Paléontologie et d'Hydrologie* **30**, 115–20.
- Pitcher, W.S., Peake, N.B., Carreck, J.N., Kirkaldy, J.F. and Hancock, J.M. (1967) *The London Region (South of the Thames)*. *Geologists' Association Guides*, **30B**, 32 pp.
- Stinton, F.C. (1965c) Teleost otoliths from the Lower London Tertiaries. *Senckenbergiana lethaea*, **46a**, 389–425.
- Stinton, F.C. (1966) Otoliths des poissons du London Clay. In *Faune ichthyologique du London Clay*. (ed. E. Casier) British Museum (Natural History), London, 2 vols, 496 pp.
- Ward, D.J. (1977) The Thanet Beds exposure at Pegwell Bay. *Tertiary Research*, **1**, 69–76.
- Ward, D.J. (1979) Additions to the fish fauna of the English Palaeogene. 3. A review of the hexanchid sharks with a description of four new species. *Tertiary Research*, **3**, 111–29.
- Ward, D.J. (1988) *Hypotodus verticalis* (Agassiz 1843), *Hypotodus robustus* (Leriche 1921) and *Hypodus heinzlini* (Casier 1967) Chondrichthyes, Lamniformes, junior synonyms of *Carcharias hopei* (Agassiz 1843). *Tertiary Research*, **10**, 1–12.
- White, E.I. (1931) *The Vertebrate Fauna of the English Eocene: Volume I, From the Thanet Sands to the Basement Bed of the London Clay*. British Museum (Natural History), London, 23

pp.

Woodward, A.S. (1889b) Note on *Bucklandinia diluvi*, Koenig, a Siluroid Fish from the London Clay of Sheppey. *Proceedings of the Zoological Society*, 208–10.

Woodward, A.S. (1899d) Notes on the teeth of sharks and skates from the English Eocene formations. *Proceedings of the Geologists' Association*, **16**, 1–14.

Woodward, A.S. (1901) *Catalogue of the fossil fishes in the British Museum. Part IV. Containing the actinopterygian Teleostomi of the suborders Isopondyli (in part), Ostariophysii, Apodes, Percosces, Hemibranchii, Acanthopterygi and Acanthinj* British Museum (Natural History), London, 636 pp.