
Lee-on-the-Solent, Gosport, Hampshire

[SU 551 016]–[SZ 569 999]

Introduction

The Middle Eocene sediments at Lee-on-the-Solent include the Elmore Member of the Barton Clay Formation and the Selsey Formation of the Bracklesham Group, both of Lutetian age. The section described on the foreshore (Figure 4.12) consists of approximately 9 m of blue-green sandy clays and silty sands, overlain by Pleistocene and Recent deposits (Kemp *et al.*, 1979).

The coastal section at Lee-on-the-Solent has produced a wide range of vertebrate fossils, including fishes, reptiles, birds and mammals (Hooker *et al.*, 1980; Dineley and Metcalf, 1999). Lee-on-the-Solent is one of a handful of localities to have produced Middle Eocene bird fossils.

Description

The main exposure of the Elmore Member is on the beach at Elmore between [SU 5635 0013] and [SZ 5657 9965] (Figure 4.12). Smaller exposures also are seen at [SZ 5670 9974] and [SZ 5678 9963]. The beds have a low angle of dip (approximately 2°) to the south-east and are visible only at low tide. The base of the Elmore Member and the contact with the underlying *Nummulites variolarius* bed' of the Selsey Formation are hidden by a Pleistocene channel-fill deposit. The upper levels of the Elmore Member also are obscured by Pleistocene and Recent sediments (Kemp *et al.*, 1979). Also known as the Huntingbridge division, the Elmore Member originally was accorded the rank of formation but later was reduced to member status (Hooker, 1986). The succession outlined in (Table 4.5) is taken from Kemp *et al.* (1979).

The Selsey Formation is best seen in the lower sections of the foreshore between Knight's Bank, Monk's Hill [SU 5510 0135] and Marine Parade East car park [SU 5622 0026]. The basal bed (the 'Campanile Bed') is not seen in the foreshore section, although it is exposed at Croften Cliff [SU 5472 0186]. At the south-eastern end of the section, the upper bed is the *Nummulites variolarius* Bed' (Kemp, 1985). A description of the Selsey Formation sediments taken from Kemp (1985, pp. 35–8) is shown in (Table 4.6).

The Elmore Member sedimentary facies are almost completely decalcified, with the exception of the 'Coral Bed' (unit 6). This is the lowest horizon in the section that has an identifiable macrofauna, which is composed of solitary corals, bivalves and serpulids. The stratigraphically younger '*Rimella canalis* Bed' (units 7–11) contains poorly preserved moulds of bivalves, gastropods and scaphopods. Phosphatic nodules from unit 7 contain crustacean remains and rare pyritized gastropods. The sequence also contains microfossils, for example diatoms and agglutinating foraminiferans (Kemp *et al.*, 1979). The underlying Selsey Formation is also well exposed at sea level (Kemp, 1985).

The vertebrate remains have been found in the foreshore sands and clays of the Selsey Formation, and of the Elmore Member of the Barton Clay Formation. Bird fossils are rare and are normally fragmentary (Kemp *et al.*, 1979). Vertebrates have been noted by Kemp *et al.* (1979) in beds L3vi, L5i, LSii, L7ii and L9.

(Table 4.5) Succession of Elmore Member sediments at Elmore, Lee-on-the-Solent modified from Kemp *et al.* (1979)

	Thickness (m)
Barton Clay Formation	
Elmore Member	
' <i>Rimella canalis</i> bed'	
11. Sandy clay, pale blue-green, pyritic, glauconitic with clay-filled burrows and mollusc-bored lignite	0.52
10. Clay, pale blue, stiff, pyritic	0.46

9. Clay, pale blue-green, laminated, with very fine glauconitic sand. Tabular siltstones at upper contact	0.35
8. Clay, pale blue, stiff, pyritic, slickensided at upper contact	0.80
7. Sandy clay, pale blue-green, nodular claystones and siltstones throughout. Probably the source of some of the vertebrate remains 'Coral bed'	0.42
6. Sandy clay, pale blue-green, Shelly, with bivalves, serpulids and corals, interspersed siltstones	0.90
Unnamed beds	
5. Clay, pale blue-green, stiff, slightly sandy, slickensided at upper and lower contacts, glauconitic in lower part	2.15
4. Sandy clay, mid-green, finely glauconitic, with some medium-grained quartz and glauconite	0.60
3. Sand, green, silty, glauconitic, clay-filled burrows	0.32
2. Clay, pale blue, stiff, increasingly sandy and glauconitic downwards, slickensided in lower part	1.54
1. Sandy clayey silt, mid-green, glauconitic	0.98
Selsey Formation	
' <i>Nummulites variolaris</i> Bed'	
Shelly sandy clay, glauconitic, with abundant molluscs and nummulites	c. 1.35

Identifiable bird bones have been recovered from the Selsey Formation sediments: *Milvoides kemp* from beds L3vi to L5ii and *Percolinus proudlocki*, *Parvirallus gracilis*, *Latipons gardneri* and *Latipons robinsoni* from beds L5i to L5ii. Indeterminate bird fossils are known from all of the Selsey Formation beds (Kemp, 1985). In addition, a few that are tentatively identified to family level have been found in the Elmore Member (Kemp *et al.*, 1979, p. 102)

Fauna

Fossil vertebrates from Lee-on-the-Solent include 53 species of sharks, five chimaeroids and some isolated mammal remains (e.g. *Propalaeotherium* cf. *parvulum*, cf. *Palaeotherium* sp., *Lophiodon* cf. *cuvieri*) (Hooker, 1986, 1996b; Dineley and Metcalf, 1999). The birds from the Selsey Formation of Lee-on-the-Solent were described by Harrison and Walker (1979a).

AVES

Galliformes

Phasianidae

Percolinus proudlocki Harrison and Walker, 1979a

Litoripes medius Harrison and Walker, 1979a

Falconiformes

Accipitridae

Milvoides kemp Harrison and Walker, 1979a

Gruiformes

Rallidae

Parvirallus gracilis Harrison and Walker, 1979a

Latipons gardneri Harrison and Walker, 1979a

Latipons robinsoni Harrison and Walker, 1979a

The six birds from the Mid Eocene Selsey Formation record of Lee-on-the-Solent were collected by D.J. Kemp and R. Gardner, and the collection was described by Harrison and Walker (1979a). The gamebirds *Percolinus proudlocki* Harrison and Walker, 1979a, and *Litoripes medius* Harrison and Walker, 1979a, were each based on a tarsometatarsus ((Figure 4.13)a–c), although an additional partial tarsometatarsus and a partial femur also were ascribed to the first. The falconiform *Milvovides kemp* Harrison and Walker, 1979a, also was based on a partial tarsometatarsus ((Figure 4.13)d), and referred material includes two partial carpometacarpi and a partial ulna. The three rails, *Parvirallus gracilis* Harrison and Walker, 1979a, *Latipons gardneri* Harrison and Walker, 1979a, and *Latipons robinsoni* Harrison and Walker, 1979a, were founded on a partial left humerus, a partial right tibiotarsus and a partial left tibiotarsus respectively ((Figure 4.13)e–i). In addition, an incomplete ulna was referred to *L. gardneri* and a second partial tibiotarsus and a partial ulna to *L. robinsoni* (Harrison and Walker, 1979a).

(Table 4.6) Succession of Selsey Formation sediments at Lee-on-the-Solent, north-west of Elmore, from Kemp (1985, pp. 35–8)

	Thickness (m)
Selsey Formation	
' <i>Nummulites variolarius</i> Bed'	
L1 liii. Grey, weathering yellow-brown, glauconitic sandy clay, packed with <i>Nummulites variolarius</i> , molluscs and lignitized driftwood	0.51
L11ii. Grey stiff clay with rare molluscs	0.05
L11i. Green-grey sandy clay with patches of silty sand with fine glauconite, abundant <i>Nummulites</i> and large molluscs	0.50
'Brook Bed'	
L10. Grey-green stiff slickensided clay, molluscs and <i>Nummulites</i> concentrated in small sandy lenses	1.06
L9. Green-grey sandy clay-silty sand, fine glauconite; thin burrows filled with pyritic sand, becoming more sandy in middle; diverse invertebrate fauna; vertebrates	0.76
' <i>Pinna</i> Bed'	
L8. Grey, stiff, slickensided clays with brown patches	0.39
L7iii. Grey-green stiff sandy silty clays with well-preserved bivalves throughout	2.40
L7ii. Grey-brown stiff sandy clay, slightly slickensided at top, fine glauconite present, with large flat-oval concretions in upper part, many of which surround colonies of <i>Pinna</i> sp. and concentrated <i>Nummulites variolarius</i> ; small molluscs common throughout, rare vertebrates concentrated in green sand pockets	1.80
L7i. Dark green-grey glauconitic sandy clay-silty sand, intensely bioturbated at base, with occasional round black pebbles and large molluscs above	0.57
' <i>Miocardia</i> Bed'	
L6iii. Grey-dark-green clayey glauconitic sand, rare bivalves and small gastropods	0.63
L6ii. Light brown-grey stiff silty sand, fine glauconite, with rare small bivalves and occasional <i>Nummulites</i> sp.	0.45

L6i. Grey-blue silty sand with fine glauconite, large (100 mm diameter) calcareous concretions often containing bored drifted logs near upper contact, rare bivalves and occasional <i>Nummulites</i> sp. ' <i>Amusium corneum</i> Bed'	0.60
L5ii. Blue-grey sandy clay, with fine glauconite, becoming more sandy and glauconitic near upper contact; molluscs and vertebrate remains	0.64
L5i. Grey-green stiff sandy clay, rare glauconite with thin burrows filled with fine pyritic sand and occasional concretions throughout; frequent vertebrate remains (shark, ray, teleost)	1.60
L4. Green-dark-green clayey, silty glauconitic sand, many bivalves, burrows infilled with glauconite 'Silt Bed'	0.50
L3vi. Dark green-grey silty glauconitic sand, invertebrate, vertebrate and plant fossils, intense bioturbation at upper contact, rare black pebbles throughout 'Campanile Bed'	0.99
L3v. Grey laminated clayey silt	0.02
L3iv. Grey-green silty glauconitic sand, bioturbated	0.58
L3iii. Grey-green silty sand with fine glauconite, bioturbated	1.57
L3ii. Grey sandy silt with fine glauconite	1.60
L3i. Grey silty glauconitic sand becoming more sandy towards base	0.46
L2. Grey laminated silty clay	0.11
L1. Grey glauconitic sand with abundant molluscs	augered 0.25

The bird specimens from the Elmore Member are a broken radius of ?*Presbyornithidae*, a broken carpometacarpus of *Phasianidae* and a broken tarsometatarsus of ?*Psittacidae* (Kemp *et al.*, 1979).

Interpretation

The sediments at Lee-on-the-Solent are marine, as indicated by the abundant marine fossils throughout and the presence of glauconite. The vertebrate fauna is dominated by marine sharks, with only rare birds and mammals, the fragmentary remains of which presumably were washed in from neighbouring land masses.

The two gamebirds, *Percolinus proudlocki* and *Litoripes medius*, do not have a special affinity with forms adapted to wet conditions, although the tarsometatarsus of *Litoripes* suggests a bird with long, slender legs superficially similar to those of shorebirds (Harrison and Walker, 1979a). The three rails, *Parvirallus gracilis*, *Latipons gardneri* and *Latipons robinsoni*, are birds of shallow water and the water's edge. Rails today usually are associated with fresh and brackish, but not salt, water. Note, however, that Olson (1985, p. 162) was unhappy about referring any of these isolated Eocene bones to the family Rallidae.

Comparison with other localities

The Elmore Member and Selsey Formation are also exposed on the Isle of Wight in Alum Bay and Whitecliff Bay, but bird fossils have not been found in these units. The gamebird *Percolinus proudlocki* is a different species of a genus that is known otherwise from the Early Eocene London Clay Formation of the Isle of Sheppey (see GCR site report). *Litoripes medius* is also recorded from the Lutetian Earnley Formation site of Yateley (Walker, 1980), but the other taxa from Lee-on-the-Solent are unique to that locality at genus level. The only other British Middle Eocene bird site is Barton Cliff where late Middle Eocene (Bartonian) sediments have yielded two species (Harrison and Walker 1976c). In continental

Europe there are very few avifaunas known of middle Eocene age. Harrison (1980a) noted just one, in the Sables de Bruxelles of Etterbeek, near Brussels, Belgium, which has yielded a possible specimen of *Argillornis longipennis*, a species known from the London Clay Formation of the Isle of Sheppey. More recent finds from the Lutetian (Middle Eocene) deposits of Messel in Germany include about 20 species of birds, and these generally are superbly preserved complete specimens (Peters, 1992b; Feduccia, 1999, p. 168).

Conclusions

The sediments at Lee-on-the-Solent have produced a significant Middle Eocene avifauna. Many of the families seen here, for example the rails, are also known from the stratigraphically older Early Eocene sediments. The specimens include type specimens of six species — a highly significant total. Elsewhere in Europe there are very few bird faunas of this age known. The Lee-on-the-Solent section has recently suffered from sea-defence work. Hopefully, matters will improve and new finds will be possible in the future.

[References](#)



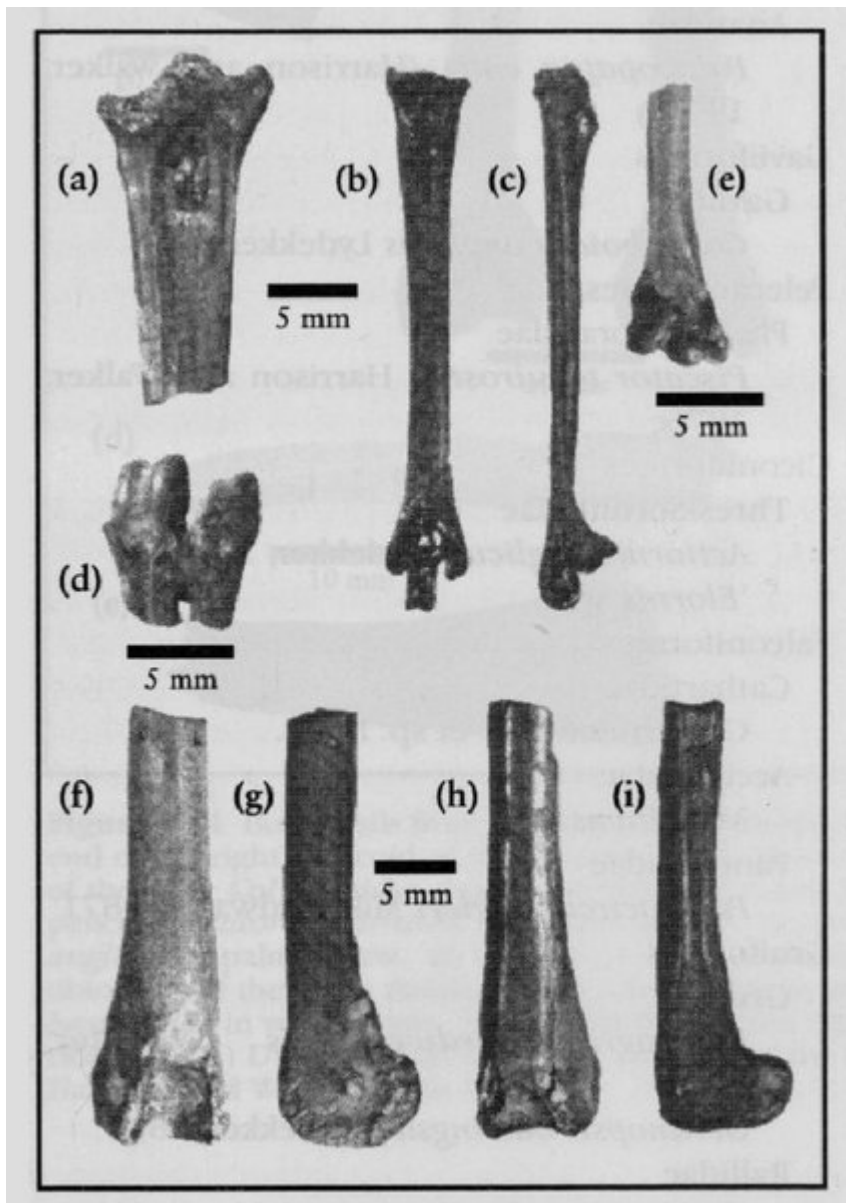
(Figure 4.12) General view of the Lee-on-the-Solent GCR site, which provides foreshore exposures of Middle Eocene sediments, one of the very few Middle Eocene fossil bird localities. (Photo: Dave Evans.)

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L3vi.	Dark green-grey silty glauconitic sand, invertebrate, vertebrate and plant fossils, intense bioturbation at upper contact, rare black pebbles throughout	0.99
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(Table 4.6) Succession of Selsey Formation sediments at Lee-on-the-Solent, north-west of Elmore, from Kemp (1985, pp. 35–8)



(Figure 4.13) Bird fossils from the Middle Eocene Selsey Sand Formation of Lee-on-the-Solent, Gosport, Hampshire. (a) Tarsometatarsus of the gamebird *Percolinus proudlocki* in anterior view. (b,c) Tarsometatarsus of the gamebird *Litoripes medius* in posterior (b) and internal (c) views. (d) Distal end of the tarsometatarsus of the falconiform *Milvoides kempi* in anterior view. (e) Distal end of the humerus of the rail *Parvirallus gracilis* in anterior view. (f,g) Distal end of the tibiotarsus of the rail *Latipons gardneri* in posterior (f) and external (g) views. (h,i) Distal end of the tibiotarsus of the rail *Latipons robinsoni* in posterior (h) and external (i) views. (After Harrison and Walker, 1979a.)