
Bognor Regis, West Sussex

[SZ 920 979]–[SZ 924 983]

Introduction

The London Clay Formation is exposed on the foreshore at Bognor Regis, West Sussex. Vertebrate remains have been recovered from the outcrops on the beach and in pyritous debris pools on the shoreline; these pools concentrate scattered fossil remains (Figure 4.6). Bulk sediment sampling and processing of the beach sediments has been attempted (Dineley and Metcalf, 1999).

Six bird species have been reported from Bognor Regis, and one of these is of great potential international importance (Harrison, 1975, 1984b; Harrison and Walker, 1975, 1977a). This is the record of a possible early Tertiary passeriform (songbird), perhaps the oldest in the world, if the identification is confirmed, and occurring some 25 million years before the major songbird group began to radiate worldwide.

Description

The London Clay Formation is exposed along the coast from Bognor Regis westwards to Aldwick and Pagham. The exposure is not continuous, consisting of discontinuous foreshore exposures of silty muds and sands. The strata dip at a low angle towards the south-west. The succession was described by Venables (1962) and revised according to the new stratigraphical scheme by King (1981, pp. 71–5). The succession runs from the Oldhaven Formation, up through divisions A2, A3, B1, B2 and the lower part of division C. The junction between the London Clay Formation and the overlying Bracklesham Group is not seen (Daley, 1999a).

The section shown in (Table 4.3) is based on the studies of King (1981) and Venables (1962).

The Aldwick Beds (London Clay Formation, division B) of Bognor Regis has produced a variety of vertebrate taxa, including fishes, reptiles and birds. The material generally is well preserved. The vertebrate fossils come from the Upper and Lower Fish-tooth Beds, which lie in the Upper Aldwick Beds and Lower Aldwick Beds respectively, and from the Beetle Bed in the Lower Aldwick Beds (King, 1981; Harrison, 1982b).

To date, in excess of 200 bird bones have been found at Bognor Regis. Most have been found from three horizons. Limb bones are found most often; cranial bones have not been recovered from this site (Venables, 1962).

Fauna

In addition to abundant shark remains, mainly teeth, some fossil turtle remains have been found at Bognor Regis (Hooker *et al.*, 1980; Dineley and Metcalf, 1999), as well as the birds.

AVES

Palaeognathae

Lithornithidae

Lithornis hookeri (Harrison, 1984c)

Pelecaniformes

Pelagornithidae

Argillornis longipennis Owen, 1878

Charadriiformes

?Glareolidae

Precursor parvus Harrison and Walker, 1977a

Columbiformes

Columbidae

Microena goodwini Harrison and Walker, 1977a

Cuculiformes

Parvicuculidae

Procuculus minutus Harrison and Walker, Apodiformes

Aegialornithidae

Primapus lacki Harrison and Walker, 1975

Passeriformes

Primoscenidae

Primoscens minutus Harrison and Walker, 1977a

The London Clay Formation at Bognor Regis has produced a modest fauna of birds compared with the list of materials from the Isle of Sheppey. The struthioniform *Lithornis hookeri* is recorded here on the basis of an end of humerus found in the Fish-tooth Beds at Bognor referred to the so-called rail, named *Pediorallus hookeri* by Harrison (1984c, p. 21). It was reassigned by Houde (1988) to the genus *Lithornis*, a palaeognathous bird related to the modern flightless birds of the Southern Hemisphere.

The toothed bird *Argillornis longipennis* Owen, 1878, was named from material found on the Isle of Sheppey, but an indeterminate bird limb bone found at Bognor Regis by E.M. Venables also has been assigned to this species (Harrison and Walker, 1977a, pp. 20–1). The charadriiform *Precursor parvus* Harrison and Walker, 1977a (Figure 4.7) was based on the distal end of a left humerus and part of the shaft, with a paratype also from the Isle of Sheppey. This was a small bird, related to modern wading birds, gulls and auks. The columbiform *Microena goodwini* Harrison and Walker, 1977a, was based on a left tarsometatarsus, and it came from a small pigeon-like bird.

The cuckoo *Procuculus minutus* Harrison and Walker, 1977a, was named on the basis of a partial tarsometatarsus from the Lower Fish-tooth Beds, and this is the only known specimen (Harrison and Walker, 1977a, pp. 44–5; Harrison, 1982c).

The apodiform *Primapus lacki* Harrison and Walker, 1975, was based on the distal end of a right humerus from the Fish-tooth Beds. This is a relative of modern swifts and hummingbirds (Harrison and Walker, 1975, 1977a; Harrison, 1984b).

(Table 4.3) Succession of the London Clay Formation at Bognor Regis after King (1981) and Venables (1962)

Thickness (m)

London Clay Formation

Division C (of King, 1981)

5. Upper Clay (of Venables, 1962)	
Undescribed deposits	6.1
Grey clay with plant remains	0.9
Undescribed deposits	3.5
Pagham Rock	0.6
Clay (partly described, sparsely fossiliferous)	18.6
<i>Cainocrinus</i> Bed	1.2
<i>Pholadomya</i> Bed	0.6
Clay, partly described, with basal glauconitic pebble bed	3.7
Division B (of King, 1981)	
4. Barn Rock Bed (of Venables, 1962)	2.4
3. Middle Clay (of Venables, 1962)	
Base of Barn Rock	1.2
Undescribed deposits	1.2
Craigwell Bed	1.5
Undescribed deposits	3.0
3.3. Upper Aldwick Beds (of Venables, 1962)	
Clay with pyritized plant remains	2.4
Two septarian bands	0.6
Clay with pyritized plant remains	1.2
Septarian band (with <i>Artica planata</i> in clay)	0.3
Upper Fish-tooth Bed	1.5
3.2. Clay, unfossiliferous, with septarian band 1 m above base	3.7
3.1. Lower Aldwick Beds (of Venables, 1962)	
Beetle Bed. Clay with septarian band	1.2
Lower Fish-tooth Bed. Earthy clay, with clay pellets and basal black flint pebble bed	0.6
Division A3	
2. Bognor Rock Group (of Venables, 1962), Bognor Member (of King, 1981)	
Bognor Rock Bed. Interbedded unconsolidated grey sand and partially cemented, fine glauconitic sandstone	6.7
Sandy Clay and soft sandstone	3.0
1. Lower Clay (of Venables, 1962)	
Septarian band, with white clay, iron stained	0.6
' <i>Cyprina</i> ' Bed,	5.5
Starfish Bed	1.8
Clay	1.2
<i>Astarte</i> Bed	2.4
Division A2, Walton Member (of King, 1981)	
Friable clay	2.7
Clay with occasional pyritized plant remains	2.7
Sandy layer	0.3
Clay, partly described	4.6
Septarian band, with white clay, iron stained	0.3
Dark-grey, silty clay	0.6+
Oldhaven Formation (of King, 1981)	
Decalcified glauconitic sandy silts obscured by alluvium	3.0+

The passeriform *Primoscens minutus* Harrison and Walker, 1977a, was based on a partial right carpometacarpus from the Fish-tooth beds. If identified correctly, this is the oldest perching bird. However, isolated postcranial elements of

passeriforms cannot be distinguished readily from those of piciforms (the woodpeckers), and the identification of this and other putative early songbirds (e.g. Boles, 1997) are all hotly debated.

Bognor Regis has been the source of holotypes of five species, the charadriiform *Precursor parvus* Harrison and Walker, 1977a, the columbiform *Microena goodwini* Harrison and Walker, 1977a, the cuculiform *Procuculus minutus* Harrison and Walker, 1977a, the apodiform *Primapus lacki* Harrison and Walker, 1975, and the passeriform *Primoscens minutus* Harrison and Walker, 1977a.

Interpretation

The coarsening-upward cycles seen in divisions A and B of the London Clay Formation are indicative of transgressive and regressive cycles. The sediments were deposited in a shallow sea, and the majority of fossils are marine, with occasional inputs from the nearby land masses. The bird remains probably were transported from nearby land or resulted from death over the sea and were buried in the marine sediments.

The floral assemblages indicate a paratropical-like vegetation that grew in a humid, warm, low seasonality climate (Collinson, 1983a; Collinson and Hooker, 2003). Insect remains are abundant and well preserved and suggest a nearshore environment of deposition (Jarzembowski, 1992).

The three orders Charadriiformes, Columbiformes and Apodiformes are unique to Britain during Early Eocene time, the next records being from the Middle Eocene Messel site in Germany and then generally the Oligocene and Miocene epochs elsewhere. There is some doubt about the validity of *Procuculus minutus* Harrison and Walker, 1977a, which Olson (1985, p. 135) asserted cannot be a cuckoo for anatomical reasons and might turn out to be a synonym of the swift species *Primapus lacki* Harrison and Walker, 1975. He noted a more complete skeleton from the Early Eocene Green River Formation of Wyoming, which also might be assignable to *Primapus lacki*. Dyke (2001a) accepted the validity of *Primapus* and found it is a basal member of Apodiformes, related to *Scaniacypselus* and *Aegialornis*.

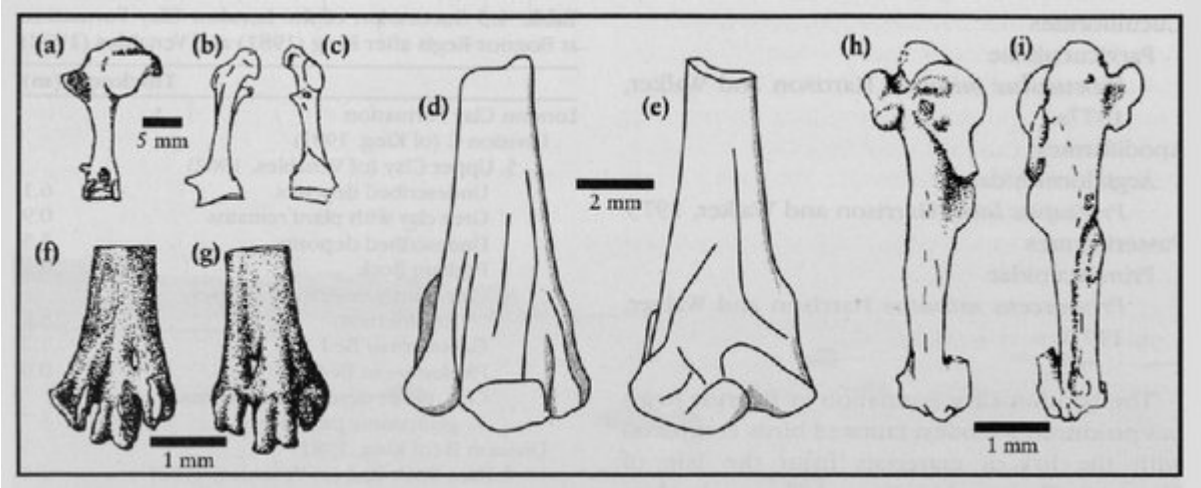
The record of a songbird *Primoscens minutus* Harrison and Walker, 1977a, from Bognor is hotly debated. It was ascribed to the new family Primoscenidae by Harrison and Walker (1977a, pp. 47–8) and Harrison (1982c), and an unnamed Middle Eocene bird from Messel also has been ascribed to the family (Unwin, 1993, p. 734). If *Primoscens* truly is a passeriform, it predates the general radiation of the order in the Miocene Epoch by some 25 million years. It is not, however, clear whether it really is a songbird, and the Family Primoscenidae is listed under *Incertae sedis* by Unwin (1993, p. 734). Olson (1985, pp. 139–41) noted the oldest certain passeriforms from the late Oligocene and early Miocene deposits of Europe, and a more recent discovery (Boles, 1997) suggests that the songbirds may have originated as early as Early Eocene times in Australia.

Comparison with other localities

The London Clay Formation of Bognor Regis, where the bird fossils come from division B, is not directly comparable in age with the other bird GCR sites, which are either older (Walton-on-the-Naze, divisions A1 and A2) or younger (Isle of Sheppey, divisions C–E and Burnham-on-Crouch, division D). However, the avifauna from Bognor Regis is a subsample of the larger one from the Isle of Sheppey, with all the main groups shared by both. Some of the species also are shared, although some are unique to Bognor Regis. Olson (1985, p. 135) noted an American specimen from the Early Eocene Green River Formation of Wyoming that might belong to *Primapus lacki*.

Conclusions

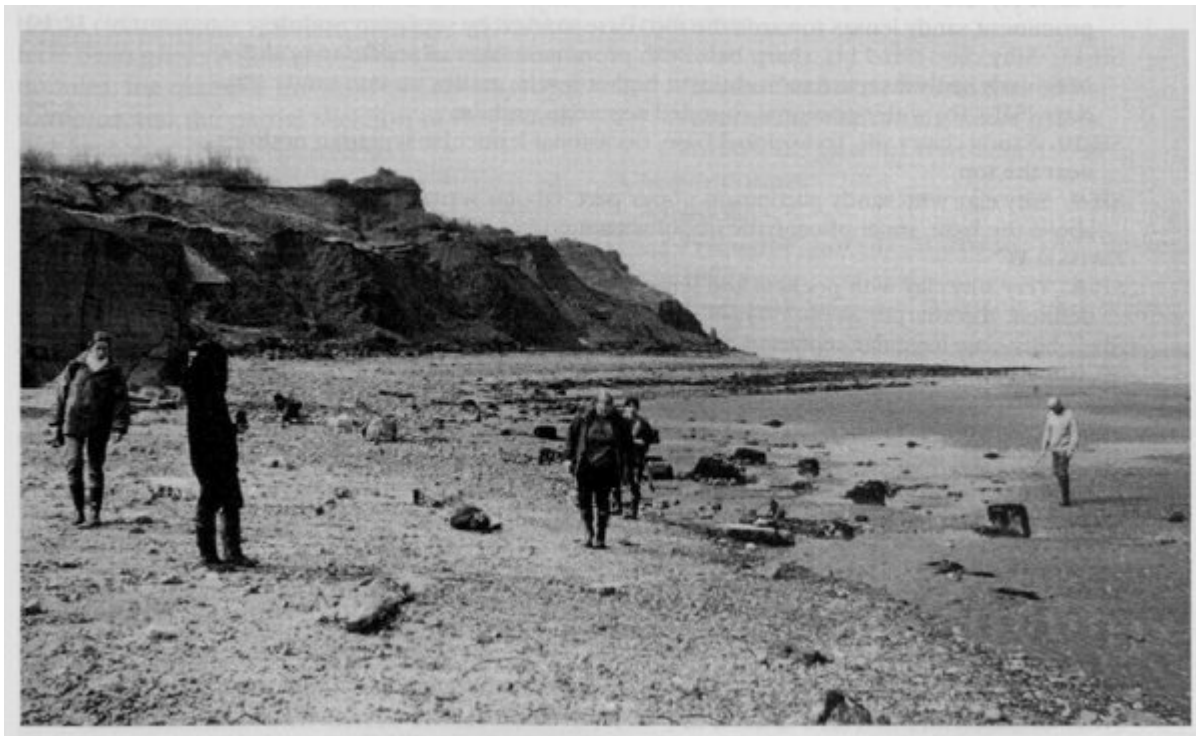
The coastline at Bognor Regis is one of the few sites in Britain where the lower section of the London Clay Formation (divisions A–C) is exposed (Venables, 1962). The vertebrate fauna is abundant and diverse and includes seven species of Early Eocene birds, five of them having type specimens from the site. The site is exposed and undergoes erosion, so fresh finds will always be possible. It is probable that continued use of bulk sampling techniques will further our knowledge of the vertebrates from this locality.



(Figure 4.6) The fossiliferous London Clay Formation at Bognor Regis. (Photo: Dave Evans.)

	Thickness (m)
London Clay Formation	
Division C (of King, 1981)	
5. Upper Clay (of Venables, 1962)	
Undescribed deposits	6.1
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2. Bognor Rock Group (of Venables, 1962).	
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Bognor Rock Bed. Interbedded unconsolidated grey sand and partially cemented, fine glauconitic sandstone	6.7
Sandy Clay and soft sandstone	3.0
1. Lower Clay (of Venables, 1962)	
Septarian band, with white clay, iron stained	0.6
<i>Cypripa</i> Bed	5.5
Starfish Bed	1.8
Clay	1.2
<i>Astarte</i> Bed	2.4
Division A2, Walton Member (of King, 1981)	
Frable clay	2.7
Clay with occasional pyritized plant remains	2.7
Sandy layer	0.3
Clay, partly described	4.6
Septarian band, with white clay, iron stained	0.3
Dark-grey, silty clay	0.6+
Oldhaven Formation (of King, 1981)	
Decalcified glauconitic sandy silts obscured by alluvium	3.0+

(Table 4.3) Succession of the London Clay Formation at Bognor Regis after King (1981) and Venables (1962)



(Figure 4.7) Specimens of fossil birds from the London Clay Formation of Bognor Regis. (a—c) The swift *Primapus lacki*; humerus in palmar view (a), and coracoid in ventral (b) and dorsal (c) views. (d,e) Distal end of the left humerus of the charadriiform *Praecursor parvus* in anconal (d) and palmar (e) views. (f,g) distal end of the right tarsometatarsus of the cuckoo *Procuculus minutus* in posterior (f) and anterior (g) views. (h,i) Carpometacarpus of the postulated songbird *Primoscens minutus* in proximal (h) and palmar (i) views. (After Harrison, 1973, 1982b,c; and Harrison and Walker, 1977a.)