Late Cretaceous: The Chalk

The Late Cretaceous Chalk facies (Figure 13.11) of Britain (Cenomanian–Maastrichtian) have produced abundant fossil fish material from many British localities. Apart from areas such as the Welsh landmass and parts of Scotland, the Chalk seas covered most of the British Isles. The present outcrop stretches from south Devon through the English Midlands and South Downs to Norfolk, Lincolnshire and Yorkshire. The lithological and faunal differences between the Chalk of Lincolnshire and Yorkshire and that from southern England have led to the establishment of two provinces ('Northern' and 'Southern') for the English Chalk succession (Mortimer, 1878; Wood and Smith, 1978; (Figure 13.11)).

Although the Chalk sequence in the British Isles is fairly uniform in sedimentary character, enough variation exists for a lithostratigraphical classification. The Chalk has traditionally been split into three informal lithological groupings, the 'Lower', 'Middle' and 'Upper' Chalk based on the presence of certain marker bands, such as glauconitic marls, hardground horizons and flints. This broad lithostratigraphical tripartite division of the Chalk was recognized as early as 1822 by John Phillips (*in* Conybeare and Phillips, 1822) and has been used subsequently by many authors. However, by far the most satisfactory subdivision of the Chalk is by zone fossils, for example echinoids or nannofossils. Jukes-Browne and Hill (1903, 1904) provided a classic review of the stratigraphy of the British Chalk, and their work has been revised by Kennedy (1969), Rawson *et al.* (1978) and Wright and Kennedy (1984). (Figure 13.11) shows the lithological and biostratigraphical subdivisions of the Chalk (after Owen, 1975).

Chalk fishes are commonly represented by fragmentary specimens, but whole uncrushed fish are also known from several localities in the 'Lower' and 'Middle' Chalk. They were first noticed in the 'Lower' and 'Middle' Chalk succession of the South Downs (Sussex and Kent) in the early part of the 19th century by Gidean Mantell, who subsequently made a large collection of fossil fishes there (Mantell, 1822). The writings of Mantell and Louis Agassiz (1833–1845) aroused the interest in south-cast England of several local collectors, which led to a series of papers in the mid- and late 19th century on the Chalk and its fossils. Important references of that time include Dixon (1850), Barrois (1876), Newton (*in* Dixon, 1878), Jukes-Browne and Hill (1903, 1904) and culminating in the monograph of Chalk fishes by A.S. Woodward (1902–1912). Although more recent reviews of the certain elements of the fish fauna have been completed and several taxa renamed or redescribed, Woodward's monograph is still the most complete account of Chalk fishes. A more recent summary was completed by the Palaeontological Association (Longbottom and Patterson, 1987) and this includes the modern classification and terminology.

Fish remains are widely distributed in the Chalk, but apart from microvertebrate remains recovered from acid digestion of the soft limestone, they are quite rare at outcrop. Most of the large collections of partial and complete fish specimens were made in the 19th century when the Chalk was worked by hand at many pits throughout the country; today only fragmentary remains are usually found. The Lower Chalk and in particular the old *subglobosus* Zone (equivalent to the Upper Cenomanian; (Figure 13.11)) is of special interest for the number of vertebrate fossils it has yielded. Fifty-five named species of fish are recorded by Woodward (1902–1912) from the Lower Chalk. The Middle Chalk is also remarkably rich in fossil fish remains and Woodward (1902–1912) recorded 23 species from these rocks. Fish material has been recovered from the Upper Chalk, but is much rarer than in the underlying strata. Several large collections of fossil fishes made in the South Downs area are housed in the BMB, NHM, BGS(GSM), CAMSM and MAIDM. In contrast, fish remains are very rare in the northern Chalk province above the Hunstanton Formation, although marl bands have yielded sporadic finds. The Middle Cenomanian 'primus event' marl exposed at Speeton contains specimens of *Notorhynchus aptiensis,* scylio-rhinids and *Squatina,* and small scyliorhinid and orectolebid teeth have also been recovered from the Black Band in the Upper Cenomanian Chalk at South Ferriby (C. Underwood, pers. comm., 1996). These assemblages are more similar in composition to those of the Early Cretaceous in these parts though, and bear little resemblance to those of the southern province, with its abundant anacoraxid sharks, large lamnid sharks, the hybodont *Ptychodus* and abundant holostean and teleost remains.

The Cenomanian and Santonian successions of Lebanon have yielded extremely important fish faunas, in which whole fish specimens have been recovered. These include sharks, rays and bony fish material comparable to that of the British Chalk.

Fish sites

Fish material has been recovered from at least 100 Chalk localities spread throughout the whole outcrop (based on literature references and museum specimens). However, most of these sites have only yielded fragmentary remains of one or two fish species, and thus only the more significant ones are listed below by county from the south-west to north-east, with zones indicated, where known (taken mainly from Jukes-Browne and Hill, 1903; 1904; Woodward, 1902–1912):

WILTSHIRE: Porton Railway Cutting (Upper Chalk, *coranguinum* Zone; [SU 19 36]; six species); Harnham Quarries (Upper Chalk, *quadrata* Zone; ?[SU 14 28]; 18 species); Highfield (Upper Chalk, *marsupites* Zone; ?[SU 00 38]; 13 species); Witherington Railway Cutting (Upper Chalk, *coranguinum* Zone; six species); Whaddon Railway Cutting (Upper Chalk, *quadrata* Zone; [SU 19 26]; 11 species).

HAMPSHIRE: Bar End Pit (Lower Chalk, '*H. subglobosus*'Zone; ten species); Hursley Pits (Upper Chalk, *quadrata* Zone; [SU 42 25]; seven species); Stoke Hill (Middle Chalk, *lata* Zone; [SU 40 51]; seven species); Winchester (Middle Chalk, *labiatus* and *lata* Zones and Upper Chalk, *coranguinum* Zone; [SU 48 30]; 14 species).

BERKSHIRE: Boxford Chalk Pit (Upper Chalk, Turonian–Santonian; [SU 431 719]; 12 species, see report).

SUSSEX: Amberley Station Quarry (Lower Chalk, Chalk Marl, *dixoni* Zone and Middle Chalk, *labiatus* and *lata* Zones; [TQ 027 118]; 15 species, including the type specimen of *Lophiostomus dixoni* Egerton, 1852); Beachy Head (Middle and Upper Chalk, Turonian; [TV 58 96]; 17 species); Clayton Limeworks and Railway Tunnel (Lower Chalk, Ccnomanian; [TQ 29 13]; 12 species, including the type specimens of *Berycopsis elegans* Dixon, 1850, *Pletbodus oblongus* Dixon, 1850 and *Squatina cranei* Woodward, 1888); Eastbourne coastal outcrop (Lower Chalk, Chlorite and Chalk Marls, *mantelli* and *dixoni Zones; [TV 61 92]*; 13 species); Glynde Station Quarry (Lower Chalk, Chalk Marl, *dixoni* Zone and Middle Chalk, *labiatus* and *lata* Zones; [TQ 460 085]; 30 species, including type specimens: *Anomoeodus willetti* Woodward, 1893, *Dercetis latiscutatus* Woodward, 1903, *Edaphodon reedi* Newton, 1878, *Enchelurus anglicus* Woodward, 1901, *Protelops anglicus* Woodward, 1888); Houghton (Middle Chalk, *labiatus* and *lata* Zones; ?[TQ 014 110]; ten species, including type specimens: *Anomoeodus augustus* (Agassiz, 1837–1844), *Plicatolamna* (*Oxyrhina*) *crassidens* (Dixon, 1850), *Urenchelys anglicus* Woodward, 1901); Southerham (Machine Bottom) (Lower Chalk, Chalk Marl, *dixoni* Zone and Middle Chalk, Melbourn Rock, *labiatus* and *lata* Zones; [TQ 432 091]; 53 species, including 33 type specimens, see report); Southerham Grey Pit (Lower Chalk, Chalk Marl and Grey Chalk, *dixoni* and *rbotomagense* Zones; [TQ 427 090]; 14 species, see report); Southerham (Lime Kiln Quarries) (Middle Chalk, 'Strahan's Hardground': Ranscombe Member, *?labiatus* Zone; [TQ 426 096]; nine species, see report).

SURREY: South Croydon (Upper Chalk, *coranguinum* Zone; 12 species); Hailing (Upper Chalk, *coranguinum* Zone; [TQ 70 63]; 12 species).

KENT: Folkestone (Lower Chalk, Chloritic Marl and Chalk Marl, *mantelli* and *dixoni* Zones; [TR 243 812]; 11 species, including type specimen: *KLepidotes*' *pustulatus* Woodward, 1895a); Dover (Middle and Upper Chalk, *labiatus–socialis* Zones; [TR 31 41]; 26 species, including type specimens: *Ichthyodectes elegans* Newton, 1877, *Saurodon intermedius* (Newton, 1878), *Scyliorhinus* (*Scyllium*)*dubium* (Woodward, 1889), *Synechodus dubriensis* (Mackie, 1863)); Gravesend (Upper Chalk, *coranguinum* Zone; ?[TQ 64 74]; ten species including type specimen: *Pholidophorus disjectus*)*;* Hailing (Lower and Middle Chalk, '*H. subglobosus*' and *labiatus* Zones; [TQ 70 64], various quarries; 17 species including type specimens: *Coelodus fimbriatus* Woodward, 1888, *Neorhombolepis excelsus* Woodward, 1888); Cuxton (Lower and Middle Chalk, '*H. subglobosus*' and *labiatus* Zones; ?[TQ 70 66]; 12 species); Blue Bell Hill, Burham (Lower Chalk–Upper Chalk, Cenomanian–Turonian; [TQ 738 617]; 58 species, including 13 type specimens, see report); Chatham (Upper Chalk, *plana* and *cortestudinarium* Zones; ?[TQ 76 04]; nine species).

BEDFORDSHIRE: Totternhoe Chalk Pit (Lower Chalk, Totternhoe Stone, *rhotomagense* and *jukesbrowni* Zones; [SP 982 222]; 19 species, see report).

HERTFORDSHIRE: Arlesey Quarry, Hitchin (Lower Chalk, Totternhoe Stone, *rhotomagense* and *jukesbrowni* Zones; [TL 19 36]; seven species); Hitchin Station Quarry (Middle Chalk, *labiatus* and *lata* Zones; [TL 19 29]; five species).

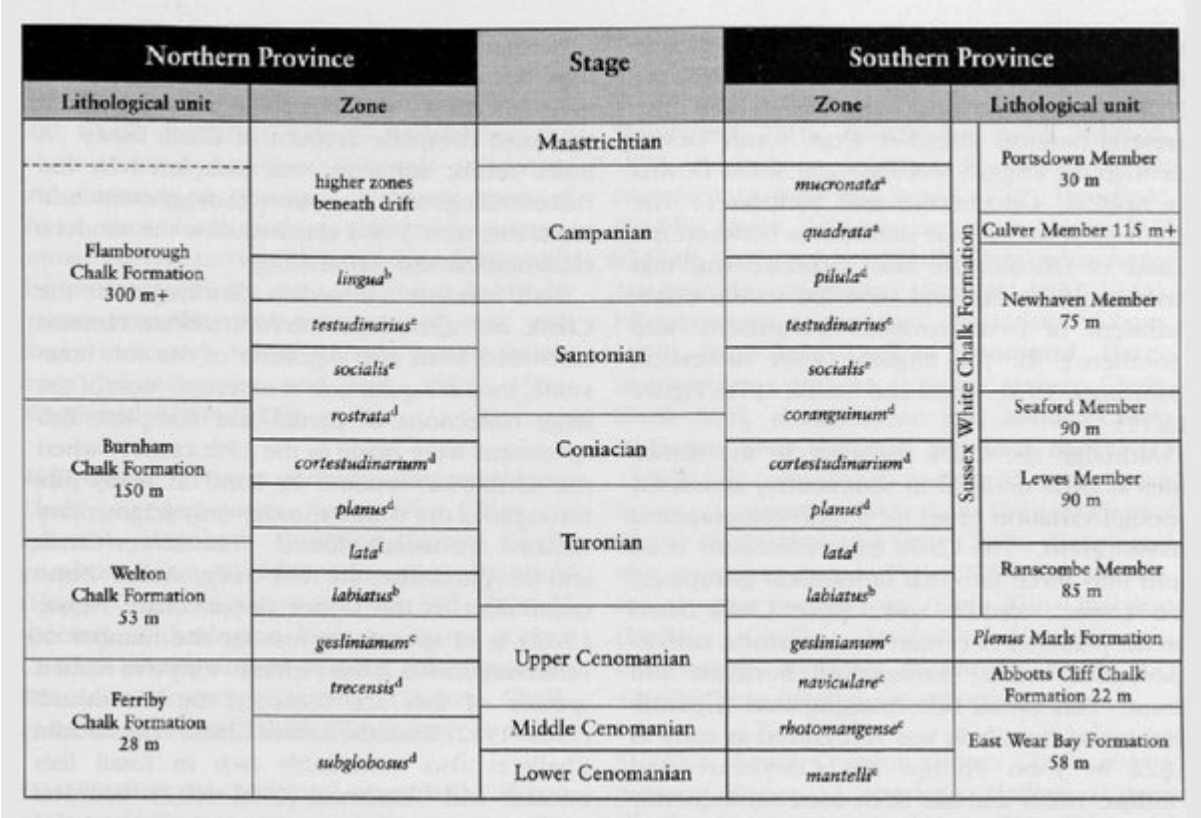
CAMBRIDGESHIRE: Cherry Hinton (Lower Chalk, Totternhoe Stone, *rhotomagense* and *jukesbrowni* Zones and Upper Chalk, Chalk Rock, *plana* Zone; [TL 483 557], [TL 485 558]; 15 species, including type specimen: *Pachyrhizodus subulidens* (Owen, 1842)).

NORFOLK: Hunstanton Cliffs (Lower Chalk, Totternhoe Stone *rhotomagense* and *jukes-browni* Zones and Upper Chalk, Norwich Chalk, *mucronata* Zone [TF 672 413]; seven species, including type specimen: *Plicatolamna* (*Lamna*) *arcuata* (Woodward, 1894)).

Six sites are selected as GCR sites on the basis of their important Cretaceous fish faunas:

1. Blue Bell Hill Pits, Burham, Kent [TQ 738 617]. Late Cretaceous (Cenomanian–Turonian), Lower Chalk–Upper Chalk.
2. Totternhoe (Chalk Pit), Totternhoe, Bedfordshire [SP 982 222]. Late Cretaceous (Cenomanian), Lower Chalk (Totternhoe Stone).
3. Southerham (Machine Bottom Pit), Southerham, Lewes, East Sussex [TQ 432 091]. Late Cretaceous (Cenomanian–Turonian), Lower Chalk (Chalk Marl, Grey Chalk and *Plenus* Marl) and Middle Chalk (Melbourn Rock).
4. Southerham Grey Pit, Southerham, Lewes, East Sussex [TQ 427 090]. Late Cretaceous (Cenomanian), Lower Chalk (Chalk Marl and Grey Chalk).
5. Southerham (Lime Kiln Quarries), Southerham, Lewes, East Sussex [TQ 426 096]. Late Cretaceous (Turonian–Coniacian), Middle Chalk ('Strahan's Hardground': Ranscombe Member).
6. Boxford Chalk Pit, Berkshire [SU 431 719]. Late Cretaceous (Turonian– Santonian) Upper Chalk.

References



(Figure 13.11) The Upper Cretaceous Chalk Group succession, northern and southern provinces (Wood and Smith, 1978; Owen, 1975). Correlation is provisional because of uncertainties in the biostratigraphical scales: a, belemnite; b, bivalve, c, ammonite; d, echinoid; e, crinoid; f, brachiopod.