

British Upper Cretaceous Stratigraphy

R.N. Mortimore

Applied Geology Research Unit,
School of the Environment,
University of Brighton, UK

C.J. Wood

Scops Geological Services Ltd,
20 Temple Road, Croydon, UK,
formerly of the British Geological Survey

and

R.W. Gallois

92 Stoke Valley Road,
Exeter UK
formerly of the British Geological Survey,

GCR Editor: **D. Skevington**

**JOINT
NATURE
CONSERVATION
COMMITTEE**



Appendix

Definition of the Upper Cretaceous stages and substages

INTRODUCTION

The Upper Cretaceous Series is divided into six stages by international agreement. These stages are further divided into substages, zones and subzones. For parts of the succession, such as the Upper Turonian Substage and the Campanian Stage, there is no currently agreed subdivision. This appendix reviews the current definitions of the various stages and substages, their boundaries and their application to the UK succession.

CENOMANIAN STAGE

The Cenomanian Stage is the lowest division of the Upper Cretaceous Series (Figure 1.2, Chapter 1; Figure 2.10, Chapter 2). D'Orbigny's Cenomanian Stage (1847) is divided by international agreement into Lower, Middle and Upper substages (see Tröger and Kennedy, 1996). The base of the Cenomanian Stage is taken at the first occurrence (FO) of the planktonic foraminifer *Rotalipora globotruncanoides* Sigal at Mont Risou in the Vocontian Basin in south-eastern France, the candidate Global boundary Stratotype Section and Point (GSSP) for the Cenomanian Stage (Tröger and Kennedy, 1996). This datum is situated a short distance beneath the FO of the basal Cenomanian zonal index ammonite, *Mantelliceras mantelli* (J. Sowerby), together with those of the heteromorph ammonites *Neostlingoceras oberlini* (Dubourdieu) and *Sciponoceras roto* (Cieslinski). These latter species are elements of the lowest subzone (*Neostlingoceras carcitanense* Subzone) of the basal Cenomanian *Mantelliceras mantelli* Zone. The base of the Cenomanian Stage, thus defined, actually falls in the top part of the terminal *Arraphoceras briacensis* (ammonite) Subzone of the Upper Albian *Stoliczkaia dispar* (ammonite) Zone. In addition, the boundary falls between two well-marked peaks of the carbon stable isotope curve (Tröger and Kennedy, 1996, fig. 4).

In the Southern Province, as in many areas of northern Europe, there is a hiatus representing perhaps 1 to 2 million years of sedimentation, between the Albian and Cenomanian stages. At Abbot's Cliff, Folkestone (**Folkestone to Kingsdown** GCR site), this hiatus is marked by the burrowed contact between the Upper Albian Gault (mudstone) Formation and the Glauconitic Marl Member at the base of the

Chalk Group. Here the Cenomanian age of the Glauconitic Marl, in the absence of ammonites, is given by the bivalve *Aucellina* and by benthic foraminifera (see Mörter and Wood, 1983, and references therein). The top of the Glauconitic Marl is marked by a thin limestone that has yielded a single specimen of *Neostlingoceras carcitanense* (Matheron) (Gale, 1989). Near Lewes, Sussex, the *N. carcitanense* ammonite subzonal assemblage is also found in a limestone at the top of the Glauconitic Marl (Kennedy, 1969). In the south of the Isle of Wight, the assemblage, including the subzonal index fossil and *Sciponoceras roto*, occurs as phosphatized internal moulds in the Glauconitic Marl (Kennedy, 1969, 1970).

In the Northern Province, for example at **Hunstanton Cliffs** and correlative sites on the East Midlands Shelf, such as **Melton Bottom Chalk Pit**, the hiatus between the Albian and Cenomanian stages lies between the Hunstanton Red Chalk Formation and the Paradoxica Bed at the base of the revised Ferriby Chalk Formation (see Mitchell, 1995a, figs 11, 12). In the expanded section at Speeton Cliff (**Flamborough Head** GCR site), in the Cleveland Basin, there is an apparently continuous succession, albeit without ammonites, but with *Aucellina*, across the boundary. The base of the Cenomanian Stage can be extrapolated directly from the Mont Risou basal boundary stratotype using the carbon stable isotope curve (Mitchell, 1995a, fig. 11; see Figure 5.21, Chapter 5). Speeton Cliff may therefore provide an additional European reference section for this stage boundary.

The base of the Middle Cenomanian Substage is taken at the FO of *Cunningtoniceras inerme* (Pervinquière), the eponymous ammonite of the basal zone, with the first occurrences of *Inoceramus schoendorfi* Heinz and the planktonic foraminifer *Rotalipora reicheli* Mornod being used as subsidiary and/or proxy taxa. The candidate GSSP is in the Grey Chalk Subgroup succession at **Southerham Grey Pit**, Lewes (Tröger and Kennedy, 1996). In the Southern Province, the FO of *C. inerme* is approximately coincident with the base of the middle of the three *Orbirhynchia mantelliana* bands. In the expanded Northern Province section at Speeton Cliff (**Flamborough Head** GCR site), the position of the base of the Middle Cenomanian Substage can be inferred to fall at a major erosion surface (sequence boundary) below the complex Totternhoe Stone. Elsewhere in the

province where thin platform successions are developed (e.g. **Hunstanton Cliffs, Melton Bottom Chalk Pit**), the *C. inerme* Zone is missing, and the thin Totternhoe Stone (*Turrilites costatus* Subzone, *Acanthoceras rhotomagensense* Zone) rests with erosive contact directly on the Lower Cenomanian *Mantelliceras dixonii* Zone.

There is no international agreement on the basal boundary marker for the Upper Cenomanian Substage: both the lower and upper limits of the zonal index fossil of the *Acanthoceras jukesbrownei* Zone are currently under consideration, with the latter being favoured (Tröger and Kennedy, 1996). The base of this ammonite zone is more or less coincident with the first occurrence of the inoceramid bivalve *Inoceramus atlanticus* (Heinz), which lies a short distance below Jukes-Browne Bed 7 in the Southern Province. The range of *I. atlanticus* (Figure 2.14, Chapter 2) overlaps with the first occurrence of the typically Upper Cenomanian *Inoceramus pictus* J. de C. Sowerby (Figure 2.14, Chapter 2) in the oyster-rich event at the base of Jukes-Browne Bed 7 and the correlative Nettleton Stone in the Southern and Transitional + Northern provinces respectively. This *Pycnodonte* event of European event stratigraphy (Ernst *et al.*, 1983; Ernst and Rehfeld, 1997; Kaplan *et al.*, 1998); the Nettleton *Pycnodonte* Marl of the Northern Province, lies just below the acme-occurrence of the index ammonite. The last occurrence (LO) of *A. jukesbrownei* (Spath) lies several marl–limestone couplets above the top of Jukes-Browne Bed 7.

All of these key datums are present at **Southerham Grey Pit** (Figure 3.108, Chapter 3). Hancock (1959) suggested *Calycoceras* (*C.*) *naviculare* (Mantell) as the index species for the next (Upper Cenomanian) ammonite zone above the *jukesbrownei* Zone, but the entry of this species is well above the top of the range of *A. jukesbrownei*, and its type horizon and acme is actually in the lower part of the Plenus Marls Member, in the overlying *Metoicoceras geslinianum* Zone. The interval from the top of the *A. jukesbrownei* Zone to the base of the *M. geslinianum* Zone is currently assigned to the Upper Cenomanian *Calycoceras guerangeri* Zone (Tröger and Kennedy, 1996) although the zonal index species appears some way up in the interval between the top of the *jukesbrownei* Zone and the base of the Plenus Marl Member (base of the *M. geslinianum* Zone).

TURONIAN STAGE

As in the case of the Cenomanian Stage, the Turonian Working Group has recommended a subdivision of d'Orbigny's (1850, 1852) Turonian Stage (Figure 1.2, Chapter 1; Figure 2.9, Chapter 2) into Lower, Middle and Upper substages.

The basal boundary marker is the first occurrence (FO) of the ammonite *Watinoceras devonense* Wright and Kennedy at the base of the *W. devonense* Zone in the Rock Canyon Anticline section, Pueblo, Colorado, USA, (Bengtson, 1996; Kennedy *et al.*, 2000). As the name implies, this species occurs in, and was first described from, the condensed sections in south-east Devon (Wright and Kennedy, 1981), where it occurs immediately on top of the Haven Cliff Hardground and/or the terminal Cenomanian *Neocardioceras* Pebble Bed. It also occurs in the expanded basal Turonian sections at Holywell and Beachy Head, Eastbourne, where the base of the Turonian Stage is recognized by the extinction of the terminal Cenomanian *Neocardioceras juddii* Zone ammonites in the interval between Meads Marls 4 and 5 in the Holywell Nodular Chalk Formation

The base of the Turonian Stage is marked worldwide by a major change in the inoceramid bivalve assemblage: the relatively thin-shelled genus *Mytiloides* enters at or immediately below the boundary, replacing the *Inoceramus pictus*-dominated assemblages of the terminal Cenomanian Stage. *Mytiloides* undergoes rapid speciation in the Lower Turonian Substage, following which the Middle Turonian inoceramid assemblages are dominated by the genus *Inoceramus* itself, with *Mytiloides* (or a closely related genus) again dominating the assemblages towards the top of the stage.

The base of the Middle Turonian Substage is defined by the FO of the ammonite *Collignonicerias woollgari* (Mantell) (Figure 2.10, Chapter 2) in the Rock Canyon Anticline section, Pueblo, Colorado, USA (Bengtson, 1996; Kennedy *et al.*, 2000). This species was originally described by Mantell (1822) from the Lewes pits, Sussex, where its lowest record is in the basal New Pit Chalk Formation at Glyndebourne Pit (Mortimore and Pomerol, 1991a, 1996). In the Southern, Transitional and Northern provinces and in the Paris Basin there is a significant faunal and sedimentary change

just below this level, from the *Mytiloides* shell-detrital chalks of the Holywell Nodular Chalk Formation, to the characteristically smooth chalks of the New Pit Chalk Formation, with poorly preserved large *Mytiloides subbercynicus* (Seitz) and related forms. This level is additionally marked by the conspicuous appearance of medium- to large-sized terebratulid brachiopods (*Concinnithyris* sp.), a datum that has also been recognized in northern Germany (cf. Ernst *et al.*, 1998). The echinoid *Conulus subrotundus* (Mantell) also occurs commonly in the basal beds of the Middle Turonian Substage.

There is no agreement on a basal marker taxon for the Upper Turonian Substage, and no section was suggested at Brussels as a candidate GSSP. However, a section at Lengerich, Westphalia, northern Germany is currently under investigation (Wiese and Kaplan, 2001). The Turonian Working Group has considered using the FO of either of two ammonite species, *Romaniceras deverianum* (d'Orbigny) and *Subprionocyclus neptuni* (Geinitz) (Bengtson, 1996), both of which occur in the UK. There are considerable problems in using either or both of these taxa because of uncertainty regarding potential discrepant ranges and first occurrences in various parts of Europe (cf. Wiese, 1997). Inoceramid bivalves have been considered as a possible better alternative to ammonites, and the FO of *Mytiloides costellatus* (*sensu lato non* Woods) (including forms close to or conspecific with *Inoceramus perplexus* Whitfield – see discussion in Walaszczyk and Wood, 1999b) has been proposed and is under review (Bengtson, 1996). In the limestone facies of northern Germany, the FO of *I. costellatus sensu lato* approximates to that of *S. neptuni*, in the so-called (*Inoceramus*) *costellatus*/(*Sternotaxis*) *plana* event (Ernst *et al.*, 1983; Kaplan and Kennedy, 1996), which is taken there to mark the base of the Upper Turonian Substage.

The first occurrences of *Subprionocyclus* in the Southern and Transitional provinces are situated in the lower part of the Lewes Nodular Chalk Formation, just above the lower of the two Southerham Marls at Dover (*S. bitchenensis* (Billingshurst)) and just below the Fognam Marl (the inferred equivalent of the same marl) at **Fognam Quarry** (*Subrinocyclus* intermediate between *S. neptuni* and *S. branereri* (Anderson)) respectively (see discussion in Gale, 1996). On stable isotope correlation data (Voigt and Hilbrecht, 1997; Wiese and

Wilmsen, 1999; Voigt and Wiese, 2000) these levels are significantly below the inferred position of the German *costellatus/plana* event. This latter event is believed to lie just below the Caburn Marl, at a level which has yielded sporadic *Romaniceras deverianum* in Sussex (Mortimore, 1986a; Mortimore and Pomerol, 1987, 1996) and in the Chiltern Hills (Gale, 1996). The inferred equivalent of this event in the Northern Province lies just below the Deepdale Lower Marl and has yielded a single specimen of *S. neptuni* (Wood, 1992).

Using the FO of *R. deverianum* in Sussex as the basal marker, the base of the Upper Turonian Substage would lie between the Glynde Marls and the Southerham Marls, i.e. within the interval that includes the FO of *Subprionocyclus neptuni* in the Transitional Province. *R. deverianum* actually ranges throughout this interval and up to the Caburn Marl (Mortimore, in prep.). *S. neptuni* has generally been found higher up-section, in the Kingston Beds, and is relatively common in the ammonite assemblages of the pebble bed of the terminal (Hitch Wood) hardground of the Chalk Rock.

Parallel to the ammonite zonal scheme, there is a provisional inoceramid bivalve zonation (Figures 2.9, 2.21, 2.22 and 2.27, Chapter 2) used in northern Europe (Ernst *et al.*, 1983; Tröger, 1989), which is currently under review. The penultimate Upper Turonian zone in Europe, the *Mytiloides scupini* Zone, is dominated by a poorly understood assemblage of *Mytiloides*, including forms such as the zonal index and *M. herbichi* (Atabekian), characterized by a distinctive, widely splayed posterior wing (Walaszczyk and Wood, 1999b; Figure 2.18, Chapter 2). Some elements of this assemblage are represented in the basal beds of the upper Lewes Nodular Chalk in the Southern Province, particularly in the expanded sections at **Southerham Pit**, Lewes. The highest part of the Turonian Stage is marked by the entry, in flood abundance, of *Cremnoceramus waltersdorfensis* (Andert) (Figure 2.19, Chapter 2).

CONIACIAN STAGE

Coquand's (1857) Coniacian Stage is the shortest Cretaceous stage, lasting about 2.4 million years (Figure 1.2, Chapter 1; Figure 2.21, Chapter 2). The original concept was based on the largely unfossiliferous, glauconitic, sandy sediments exposed at the Richemont Seminary,

Appendix

near Cognac, Charente, in the Aquitaine Basin, south-west France.

The base of the Coniacian Stage is taken at the FO of the basal marker taxon, the inoceramid bivalve *Cremnoceramus rotundatus sensu Troger non Fiege* (Figure 2.19, Chapter 2) (correctly *C. deformis erectus* (Meek) – see Walaszczyk and Wood, 1999b; Walaszczyk and Cobban, 2000) in the candidate GSSP, the Salzgitter-Salder limestone quarry, Lower Saxony, Germany (Kauffman *et al.*, 1996). This datum is a short distance above a flood occurrence of *C. waltersdorfensis*, an event bed with *C. waltersdorfensis* and the thin-shelled bivalve *Didymotis costatus* (Fritsch) and another event bed with *C. waltersdorfensis* (Walaszczyk and Wood, 1999b). The ammonite criterion used to define the base of the stage, the FO of *Forresteria petrocoriensis* (Coquand) has not been identified there, but is known from Westphalia, at a horizon significantly higher than the level of the base recognized using inoceramid bivalves (Kauffman *et al.*, 1996).

In England, the Coniacian Stage is developed entirely in chalk facies with common *Cremnoceramus*, but with only rare and poorly preserved ammonites. The basal marker taxon, associated with *C. waltersdorfensis*, has been collected 0.2 m above the Navigation Hardground at Shoreham Cement Works, Sussex (Mortimore, 1986a), and at a slightly higher horizon at Dover. A juvenile ammonite, either a *Forresteria*, or possibly a *Barroisiceras*, was collected from inside a broken *Micraster* incorporated in the top Navigation Hardground at Langdon Stairs, Dover (Folkestone to Kingsdown GCR site) (Gale and Woodroof, 1981), and a single poorly preserved *Didymotis* was found in soft chalk in the group of Navigation Hardgrounds at Ness Point, St Margarets Bay. Neither of these records helps with the placing of the base of the Coniacian Stage in the extremely condensed successions in the Southern Province, but this datum is usually placed, on no particularly good evidence, at the base of the Navigation Hardgrounds (e.g. Bailey *et al.*, 1983, 1984). In the Northern Province, basal Coniacian *Cremnoceramus*, associated with poorly preserved *Didymotis*, occur just below the second of the three Kiplingcotes Marls, the inferred correlative of the Navigation Marls.

Inoceramid bivalves are common in the Coniacian chalks of the UK and, fortunately, they are currently used internationally in preference

to ammonites to define the Lower, Middle and Upper substages. The base of the Middle Coniacian Substage is taken at the FO of *Volvicceramus koeneni* (Müller) (Kauffman *et al.*, 1996). This species is not common in the UK, but has been identified in the Southern Province at the base of the Belle Tout Beds (base of the Seaford Chalk Formation), above Shoreham Marl 2, in Upper Beeding Quarry, Shoreham, Sussex and at the equivalent horizon at Dover. It has also been found at Titchwell Chalk Pit on the Norfolk coast in the indefinite boundary zone between the Transitional and Northern provinces. In the Northern Province proper, *V. koeneni* is found just above the Little Weighton marls, the equivalent of the Shoreham Marls (Wood, 1992). The *koeneni* Zone here has yielded *Inoceramus gibbosus* Schlüter and a unique specimen of the belemnite *Actinocamax bohemicus* Stolley, which is generally rare throughout Europe (Christensen, 1982).

The base of the Middle Coniacian Substage in the Southern Province approximates to the FO of the benthic foraminiferal species *Stensioeina granulata granulata* (Olbertz) (Figure 2.41, Chapter 2), which is closely followed by that of *S. exsculpta exsculpta* (Reuss) (Figure 2.42, Chapter 2) (Bailey *et al.*, 1983).

The base of the Upper Coniacian Substage is taken internationally (Kauffman *et al.*, 1996) at the FO of *Magadiceramus subquadratus* (Schlüter), an inoceramid bivalve that is generally absent from chalk facies, but is relatively common in marlstones. In the Cuckmere Beds of the Seaford Chalk Member of the Southern Province there is an interval informally referred to as the 'Barren Beds' because of the scarcity of macrofossils (e.g. Mortimore *et al.*, 1990). A band of *Volvicceramus* has been recorded towards the top of these beds and a possible *Magadiceramus* occurring as very thin sheets has also been recorded (Mortimore; Reports for Channel Tunnel Rail Link). This interval is inferred to correspond, in part, to the lower part of the *subquadratus* Zone in Europe, which is characterized by the co-occurrence of the last *Volvicceramus* and the first *Magadiceramus*.

SANTONIAN STAGE

Coquand's (1857) Santonian Stage (Figure 1.2, Chapter 1; Figure 2.22, Chapter 2) is named after Saintes, in the northern Aquitaine Basin of

south-west France, where a glauconitic nodular limestone with Coniacian exogyrine oysters is overlain by soft micaceous chalk of the Santonian Stage (Lamolda and Hancock, 1996).

The Working Group on the Santonian Stage identified the FO of the inoceramid bivalve *Cladoceramus undulatoplicatus* (Roemer) (Figure 2.23, Chapter 2) as the basal boundary marker. One of the sections chosen as a candidate GSSP for the Santonian Stage is Seaford Head (**Cuckmere to Seaford** GCR site), Sussex (Lamolda and Hancock, 1996), and a formal proposal to validate this is in preparation. The FO of *C. undulatoplicatus* here is on the top surface of the Michel Dean Flint, but this marker taxon is most abundant in and above the Bedwell's Columnar Flint (Mortimore, 1986a, 1997). In the Northern Province, one or more *Cladoceramus* events are found near the top of the (Burnham Chalk Formation) at Selwicks Bay (**Flamborough Head** GCR site), Yorkshire.

Division of the Santonian into Lower, Middle and Upper substages has been generally accepted, but there has been no agreement on index taxa or basal substage boundary stratotype sections. The last occurrence (LO) of *Cladoceramus undulatoplicatus* or the FO of *Cordiceramus cordiformis* (J. de C. Sowerby) have both been suggested for defining the base of the Middle Santonian Substage. At Seaford Head (see **Cuckmere to Seaford** GCR site report, this volume), the LO of *C. undulatoplicatus* is some 4 m above the Bedwell's Columnar Flint Band/Flat Hill Flint, in a shell bed of mixed *Cladoceramus* and *Platyceramus* shells. The same event can also be identified in the **Thanet Coast** succession and in cored boreholes in the London Basin for the Channel Tunnel Rail Link. In the Northern Province, an interval with relatively common *Cordiceramus cordiformis*, 3 m (see Figures 5.29 and 5.31, Chapter 5) beneath the top of the Burnham Chalk Formation near Selwicks Bay (**Flamborough Head** GCR site), can provisionally be taken to mark the base of the Middle Santonian Substage.

The base of the Upper Santonian Substage is generally taken at the entry of the crinoid *Uintacrinus socialis* Grinnell (Lamolda and Hancock, 1996). In the Southern Province, this datum coincides with Buckle Marl 1 at the base of the Newhaven Chalk Formation at Seaford Head (**Cuckmere to Seaford** GCR site). It also approximates to the entry of the benthic foraminifer *Stensioeina granulata*

perfecta. In the Northern Province, the FO of *Uintacrinus* in the **Flamborough Head** GCR site (Mitchell, 1994) lies 30 m (see Figure 5.31, Chapter 5) above the base of the Flamborough Chalk.

The Upper Santonian Substage of this account comprises the successive zones of the crinoids *Uintacrinus socialis* and *Marsupites testudinarius* (Schlotheim). In the **Thanet Coast** succession there is a small gap between the LO of *Uintacrinus* and the FO of *Marsupites*. The biostratigraphically important benthic foraminifer *Bolivinoidea strigillatus* (Chapman) enters here at or not far below the top of the range of *Uintacrinus*. As elsewhere, two stratigraphically successive morphotypes can be distinguished in the calyx plates of *Marsupites*, which may eventually need to be assigned to different species.

CAMPANIAN STAGE

Coquand's (1857) Campanian Stage (Figure 1.2, Chapter 1; Figure 2.27, Chapter 2) in the northern Aquitaine Basin at Grande Champagne near Aubeterre-sur-Dronne in south-west France, comprises shallow-water chalks which contain virtually no planktonic foraminifera, ammonites or bivalves.

Ever since de Grossouvre (1901) suggested that the LO of the crinoid *Marsupites testudinarius* (Schlotheim) should be used to define the Santonian–Campanian boundary, this datum has been widely accepted. Both the Copenhagen (Birkelund *et al.*, 1984) and Brussels (Hancock and Gale, 1996) Cretaceous Stage Boundary symposiums supported this view. The LO of *Marsupites* is approximately coincident with the first evolutionary appearance of the belemnite *Gonioteuthis granulataquadrata* (Stolley). A candidate GSSP for the Campanian Stage is the succession at Splash Point, Seaford Head (**Cuckmere to Seaford** GCR site), where the LO of *M. testudinarius* is at Friars Bay Marl 1 in the Newhaven Chalk Formation. In the Northern Province, this datum is situated 70 m above the base of the Flamborough Chalk Formation.

A basal Campanian zone defined by the total range of the crinoid *Uintacrinus anglicus* Rasmussen has been recommended by some workers (e.g. Bailey *et al.*, 1983, 1984) for the Southern Province and is formally recognized in the Northern Province by Mitchell (1995b).

Contrary to recent practice in the Southern Province, whereby the total range of *U. anglicus* is included in the *Offaster pilula* Zone, we recognize a basal Campanian *U. anglicus* Zone in this account. The FO of the eponymous echinoid, *Offaster pilula* (Lamarck), is at the Black Rock Marl, which is well above the base of the Campanian Stage as defined by the extinction of *Marsupites* and also significantly above the top of the range of *U. anglicus*. The FO of *U. anglicus* is invariably separated from the LO of *Marsupites* by a small gap. In the Southern Province, *U. anglicus* occurs between the Friars Bay Marls at Seaford Head (**Cuckmere to Seaford** GCR site), and at Friars Bay and Black Rock in the **Newhaven to Brighton** GCR site. *U. anglicus* has also been recognized in the **Thanet Coast** GCR site at Margate and at **Flamborough Head**, Yorkshire. An interval characterized by *U. anglicus*, above the LO of *Marsupites*, has now been identified almost worldwide, notably in Australia, Kazakhstan and Texas (Hancock and Gale, 1996).

The Campanian Stage is the longest of the Upper Cretaceous Stages (12.2 million years) and the least well understood. No agreement on its subdivision has been reached, although the idea that the existing bipartite subdivision into Lower and Upper substages should be replaced by a subdivision into Lower, Middle and Upper substages was accepted at Brussels (Hancock and Gale, 1996). The traditional twofold division is used in this book, with the boundary being taken between the belemnite zones of *Goniatites quadrata* and *Belemnella mucronata sensu anglico*. This boundary presents problems because the two index belemnites co-occur in the highest beds of the *quadrata* Zone, in the so-called 'overlap Zone' (Schmid, 1953, 1959) of belemnite stratigraphers. The base of the Upper Campanian Substage is marked in northern European chalk facies by the LO of *Goniatites*, a datum that is difficult to recognize, in view of the rarity of *Goniatites* near the upper limit of its range.

The base of the Upper Campanian Substage and base of the *B. mucronata* Zone *sensu anglico* is taken in the UK at the lower of the paired Farlington Marls at Farlington Quarry, Portsdown and at **Whitecliff** and Scratchell's Bay, Isle of Wight. This datum does not necessarily coincide with the LO of the terminal Lower Campanian zonal index belemnite *Goniatites quadrata* (Blainville) at the top of the 'overlap

Zone', which is difficult to identify satisfactorily. It is also probable that some of the belemnites from the 'overlap Zone' in the British Geological Survey collections include *Belemnella praecursor* Stolley, as in the case of the succession near Hannover in northern Germany (cf. Christensen, 2000). It approximates to the FO of the small echinoid *Echinocorys subconicula* Brydone and of the benthic foraminifer *Gavelinella monterelensis* (Marie). In East Anglia (Transitional Province) this may equate with the thick marls associated with *Echinocorys* ex gr. *conica* (Agassiz) a short distance above the phosphatized hardground marking the Peine tectonic event (Mortimore *et al.*, 1998) in the British Geological Survey Trunch cored borehole (Wood *et al.*, 1994).

MAASTRICHTIAN STAGE

The Maastrichtian Stage of Dumont (1849) is present as chalk facies in the UK only in Norfolk (e.g. **Overstrand to Trimingham Cliffs** GCR site) and Northern Ireland (Wood, 1967, 1972; Fletcher, 1977; Fletcher and Wood, 1978). The original type locality for the Maastrichtian was near Maastricht, Limburg, Netherlands, but the sections here are not continuous across the Campanian–Maastrichtian boundary, and the stratotype section at the ENCI Quarry actually corresponds to the Upper Maastrichtian Substage of the modern classification. Several sections have been considered as the basal boundary stratotype. In the Boreal Realm, the chalk section at Krons Moor (Saturn Quarry), north of Hamburg, Schleswig-Holstein, Germany (Schönfeld and Schulz, 1996) is used as the standard. In this section, the FO of the belemnite *Belemnella lanceolata* (Schlotheim) is taken as the basal boundary datum, but this taxon is restricted to the Boreal Realm (Figure 2.13, Chapter 2). The Maastrichtian Working Group take the Tethyan Realm section at Tercis, Landes, south-west France, as the candidate GSSP, with the FO of the ammonite *Pachydiscus neubergicus* (von Hauer) as the basal boundary marker (Odin, 1996). It was believed that this datum was approximately coincident with the FO of *Belemnella lanceolata* in the Boreal Realm chalks of northern Europe. It is now thought that the entry of *P. neubergicus* is significantly higher and *Belemnella* can no longer be considered an exclusively Maastrichtian genus.

Maastrichtian Stage

The Maastrichtian Working Group recommended a subdivision into Lower and Upper substages. However, the highest preserved Maastrichtian Zone in the UK (*Belemnella sumensis* (belemnite) Zone) does not even reach the top of the Lower Maastrichtian Substage. Both in Norfolk and in Northern Ireland it is possible to apply the Boreal northern Europe belemnite zonal scheme introduced by Schulz, (1982; see also Christensen, 1996). The base of the Maastrichtian Stage in the UK is provisionally taken on a microfaunal (foraminiferal) basis in the succession exposed in the glaciotectionic 'Overstrand Hotel Lower Mass' at Overstrand (**Overstrand to Trimingham Cliffs** GCR site), Norfolk (Bailey *et*

al., 1983, 1984). This datum (the 'Overstrand Upper Marl' of this account) is marked by the LO of the foraminifer *Globorotalites biltermanni* Kaever and a flood occurrence of the foraminifera *Reussella szajnochae szajnochae* (Grzybowski), closely followed by the FO of the benthic foraminifer *Neoflabellina reticulata* (Reuss). This bundle of foraminiferal bio-events is recognizable in offshore successions in the Southern North Sea Basin. The first *Belemnella*, including *B. lanceolata*, associated at Overstrand with *Belemnitella*, appear higher up-section, several metres above the Sidestrand Marl. A new definition of the base of the stage, using foraminifera in combination with nannofossils, is currently under review.

References

In this reference list the arrangement is alphabetical by author surname for works by sole authors and dual authors. Where there are references that include the first-named author with others, the sole-author works are listed chronologically first, followed by the dual author references (alphabetically) followed by the references with three or more authors listed *chronologically*. Chronological order is used within each group of identical authors.

- Adams, C.G., Knight, R.H. and Hodgkinson, R.L. (1973) An unusual agglutinating foraminifer from the Upper Cretaceous of England. *Palaeontology*, **16**, 637–43.
- Ali, M.T. (1976) The significance of a mid-Cretaceous cobble conglomerate, Beer District, south Devon. *Geological Magazine*, **113**, 151–8.
- Allan, T. (1823) Observations on the formation of the Chalk strata, and on the structure of the Belemnite. *Transactions of the Royal Society of Edinburgh*, **9**, 393–418.
- Allen, P. (1975) Wealden of the Weald: a new model. *Proceedings of the Geologists' Association*, **86**, 389–437.
- Allen, P. (1981) Pursuit of Wealden models. *Journal of the Geological Society, London*, **138**, 375–406.
- Allen, P.A. and Allen, J.R. (1990) *Basin Analysis. Principles and Applications*, Blackwell Science Limited, Oxford, 451 pp.
- Ameen, M.S. (1990) Macrofaulting in the Purbeck–Isle of Wight Monocline. *Proceedings of the Geologists' Association*, **101**, 31–46.
- Ameen, M.S. and Cosgrove, J.W. (1990) A kinematic analysis of meso-fractures from Studland Bay, Dorset. *Proceedings of the Geologists' Association*, **101**, 303–14.
- Ameen, M.S. and Cosgrove, J.W. (1992) An upper strain detachment model for the Ballard Fault: reply. *Proceedings of the Geologists' Association*, **102**, 315–20.
- Andert, H. (1911) Die Inoceramen des Kreibitz-Zittauer Sandsteingebirges. *Festschrift des Humboldtvereins zur Feier seines 50 jährigen Bestehens am 22 Oktober 1911*, pp. 33–64.
- Arthurton, R.S., Booth, S.J., Morigi, A.N., Abbott, M.A.W. and Wood, C.J. (1994) *Geology of the country around Great Yarmouth*, Memoir of the British Geological Survey (England and Wales), Sheet 162, HMSO, London, 131 pp.
- Badley, M.E., Price, J.D. and Backshall, L.C. (1989) Inversion, reactivated faults and related structures: seismic examples from the southern North Sea. In *Inversion Tectonics*, (eds M.A. Cooper and G.D. Williams), *Geological Society of London, Special Publication*, No. 44, pp. 201–19.
- Bailey, E.B. (1922). In *Summary of Progress of the Geological Survey of Great Britain for 1922*, pp. 96–97.
- Bailey, E.B. (1924) The desert shores of the Chalk sea. *Geological Magazine*, **61**, 102–16.
- Bailey, E.B., Clough, C.T., Wright, W.B., Richey, J.E. and Wilson, G.V. (1924) *Tertiary and Post-Tertiary Geology of Mull, Loch Aline, and Oban*, Memoir of the Geological Survey of

References

- Great Britain (Scotland), HMSO, Edinburgh, 445 pp.
- Bailey, H.W. (1975) A preliminary microfaunal investigation of the Lower Senonian at Beer, South-east Devon. *Proceedings of the Ussher Society*, **3**, 280–5.
- Bailey, H.W., Gale, A.S., Mortimore, R.N., Swiecicki, A. and Wood, C.J. (1983) The Coniacian–Maastrichtian Stages in the United Kingdom, with particular reference to southern England. *Newsletters on Stratigraphy*, **12**, 19–42.
- Bailey, H.W., Gale, A.S., Mortimore, R.N., Swiecicki, A. and Wood, C.J. (1984) Biostratigraphical criteria for recognition of the Coniacian to Maastrichtian stage boundaries in the Chalk of north-west Europe, with particular reference to southern England. *Bulletin of the Geological Society of Denmark*, **33**, 31–9.
- Barchi, P. (1995) Géochimie et magnetostratigraphie du campanien de l'Europe nord-ouest. Thèse de Doctorat de l'Université Pierre et Marie Curie (Paris IV).
- Barker, R.D., Lloyd, J.W. and Peach, D.W. (1984) The use of resistivity and gamma logging in lithostratigraphical studies of the Chalk in Lincolnshire and South Humberside. *Quarterly Journal of Engineering Geology*, *London*, **17**, 71–80.
- Barrois, C. (1875) Description géologique de la craie de l'île de Wight. *Annales des sciences géologiques, Series 4*, **6**, (Article 3), 30 pp.
- Barrois, C. (1876) *Recherches sur le terrain Crétacé Supérieur de l'Angleterre et de l'Irlande*, Mémoire de la Société Géologique du Nord, 232 pp.
- Bartlett, P.B. and Scanes, J. (1916) Excursion to Mere and Maiden Bradley in Wiltshire, April 20th–26th, Easter, 1916. *Proceedings of the Geologists' Association*, **27**, 117–34.
- Bathurst, R.G.C. (1976) *Carbonate Sediments and their Diagenesis. Developments in Sedimentology*, No. 12, 2nd edn, Elsevier, Amsterdam, 658 pp.
- Bedwell, F.A. (1874) The Isle of Thanet. The Ammonite Zone, the depth of the Chalk in section, and the continuity of its flint floorings. *Geological Magazine, New Series, Decade II*, **1**, 16–22.
- Bell, B.R. and Jolley, D.W. (1997) Application of palynological data to the chronology of the Palaeogene lava fields of the British Province: implications for magmatic stratigraphy. *Journal of the Geological Society, London*, **154**, 701–8.
- Bell, B.R. and Jolley, D.W. (1998) Reply to discussion of 'Application of palynological data to the chronology of the Palaeogene lava fields of the British Province: implications for magmatic stratigraphy'. *Journal of the Geological Society, London*, **155**, 733–5.
- Bengtson, P. (compiler) (1996) The Turonian Stage and substage boundaries. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, **66** (supp.), pp. 69–79.
- Berridge, N.G. and Pattison, J. (1994) *Geology of the Country around Grimsby and Patrington*, Memoir of the British Geological Survey (England and Wales), Sheets 81, 82, 90, and 91, HMSO, London, 96 pp.
- Birkelund, T., Hancock, J.M., Hart, M.B., Rawson, P.F., Remane, J., Robaszynski, F., Schmid, F. and Surlyk, F. (1984) Cretaceous stage boundaries – Proposals. *Bulletin of the Geological Society of Denmark*, **33**, 3–20.
- Black, M. (1953) The constitution of the Chalk. *Proceedings of the Geological Society, London*, **1499**, 81–6.
- Blackmore, H.B. (1896) Some notes on the aptychi from the Upper Chalk. *Geological Magazine, New Series, Decade IV*, **3**, 529–83.
- Blake, J.F. (1878) On the Chalk of Yorkshire. *Proceedings of the Geologists' Association*, **5**, 232–70.
- Bloomfield, J.P., Brewerton, L.J. and Allen, D.J. (1995) Regional trends in matrix porosity and bulk density of the Chalk of England. *Quarterly Journal of Engineering Geology, London*, **28**, 131–42.
- Bone, D. and Bone, A. (2000) Lavant Stone: a late Roman and medieval building stone from the Chalk (Upper Cretaceous) of West Sussex. *Proceedings of the Geologists' Association*, **111**, 193–203.
- Boswell, P.G.H. (1913) Notes on the Chalk of Suffolk. *Journal of the Ipswich and District Field Club*, **4**, 17–26 [together with separate geological map].
- Bower, C.R. and Farmery, J.R. (1910) The zones of the Lower Chalk of Lincolnshire. *Proceedings of the Geologists' Association*, **21**, 333–59.
- Bown, P.R. (ed) (1998) *Calcareous Nannofossil Biostratigraphy*, Chapman and Hall, London, 314 pp.

References

- Braley, S. (1990) The sedimentology, palaeoecology and stratigraphy of Cretaceous rocks in N.W. Scotland. PhD thesis, Polytechnic South West.
- Bristow, H.W. (1889) *The Geology of the Isle of Wight*, 2nd edn (revised and enlarged by C. Reid and A. Strahan), Memoir of the Geological Survey of Great Britain, HMSO, London, 349 pp.
- Bristow, C.R. (1990) *Geology of the Country around Bury St. Edmunds*, Memoir of the British Geological Survey (England and Wales), Sheet 189, HMSO, London, 99 pp.
- Bristow, C.R., Barton, C.M., Freshney, E.C., Wood, C.J., Evans, D.J., Cox, B.M., Ivimey-Cook, H.C. and Taylor, R.T. (1995) *Geology of the Country around Shaftesbury*, Memoir of the British Geological Survey (England and Wales), Sheet 313, HMSO, London, 182 pp.
- Bristow, C.R., Mortimore, R.N. and Wood, C.J. (1997) Lithostratigraphy for mapping the Chalk of southern England. *Proceedings of the Geologists' Association*, **108**, 293–315.
- Bristow, C.R., Barton, C.M., Westhead, R.K., Freshney, E.C., Cox, B.M. and Woods, M.A. (1999) *The Wincanton District – a Concise Account of the Geology*, Memoir of the British Geological Survey (England and Wales), Sheet 297, The Stationery Office, for the British Geological Survey, London, 110 pp.
- Bristow, C.R., Mortimore, R.N. and Wood, C.J. (1999) Reply to discussion on 'Lithostratigraphy for mapping the Chalk of southern England'. *Proceedings of the Geologists' Association*, **110**, 68–71.
- British Museum (Natural History) (1962) *British Mesozoic Fossils*, British Museum (Natural History), London.
- Bromley, R.G. (1965) Studies on the lithology and conditions of sedimentation of the Chalk Rock and comparable horizons. PhD thesis, University of London.
- Bromley, R.G. (1967) Some observations on burrows of thalassinidean Crustacea in chalk hardgrounds. *Quarterly Journal of the Geological Society of London*, **123**, 157–82.
- Bromley, R.G. (1975a) Trace fossils at omission surfaces. In *The Study of Trace Fossils*, (ed. R. Frey), Springer-Verlag, New York, pp. 399–428.
- Bromley, R.G. (1975b) Hardground diagenesis. In *The Encyclopedia of Sedimentology* (eds R.W. Fairbridge and J. Bourgeois), *Encyclopedia of Earth Sciences Series*, No. 6, Dowden, Hutchinson and Ross, Stroudsburg, pp. 397–400.
- Bromley, R.G. (1990) *Trace Fossils: Biology and Taphonomy*, Unwin Hyman, London, 280 pp.
- Bromley, R.G. (1996) *Trace Fossils, Biology, Taphonomy and Applications*, 2nd edn, Chapman and Hall, London, 361 pp.
- Bromley, R.G. and Ekdale, A.A. (1984a) Trace fossil preservation in flint in the European Chalk. *Journal of Paleontology*, **58**, 298–311.
- Bromley, R.G. and Ekdale, A.A. (1984b) *Chondrites*: A trace fossil indicator of anoxia in sediments. *Science*, **224**, 872–4.
- Bromley, R.G. and Ekdale, A.A. (1986) Flint and fabric in the European Chalk. In *The Scientific Study of Flint and Chert*, (eds G. de G. Sieveking and M.B. Hart), Cambridge University Press, Cambridge, pp. 71–82.
- Bromley, R.G. and Gale, A.S. (1982) The lithostratigraphy of the English Chalk Rock. *Cretaceous Research*, **3**, 273–306.
- Bromley, R.G., Schulz, M.-G. and Peake, N.B. (1975) Paramoudras: giant flints, long burrows and early diagenesis of chalks. *Det Kongelige Danske Videnskabernes Selskab, Biologiske Skrifter*, **20**, 1–130.
- Brydone, R.M. (1900) *The Stratigraphy and Fauna of the Trimmingham Chalk*, Dulau and Co. Ltd, London, 16 pp.
- Brydone, R.M. (1906) Further Notes on the the Stratigraphy and Fauna of the Trimmingham Chalk. *Geological Magazine, New Series, Decade V*, **3**, 13–22, 72–8, 124–31, 289–300.
- Brydone, R.M. (1908) On the Subdivisions of the Chalk of Trimmingham (Norfolk). *Quarterly Journal of the Geological Society of London*, **54**, 401–12.
- Brydone, R.M. (1912) *The Stratigraphy of the Chalk of Hants*, Dulau and Co. Ltd., London, 108 pp.
- Brydone, R.M. (1914) The Zone of *Offaster pilula* in the south English Chalk. Parts I–IV. *Geological Magazine, New Series, Decade VI*, **1**, 359–69, 405–11, 449–57, 509–13.
- Brydone, R.M. (1915) The *Marsupites* Chalk of Brighton. *Geological Magazine, New Series, Decade VI*, **2**, 12–5.
- Brydone, R.M. (1917) The base of the Chalk Zone of *Holaster planus* in the Isle of Wight. *Geological Magazine, New Series, Decade VI*, **4**, 245–9.
- Brydone, R.M. (1922) *Epiaster* and *Micraster* in the Weybourne Chalk. *Geological Magazine*, **59**, 480.

References

- Brydone, R.M. (1930) The 'Norwich Chalk'. *Transactions of the Norfolk and Norwich Naturalists' Society*, **13**, 47–9.
- Brydone, R.M. (1932a) The lower beds of the Chalk near Ipswich. *Journal of the Ipswich and District Natural History Society*, **1**, 153–7.
- Brydone, R.M. (1932b) *Uintacrinus* in North Suffolk. *Journal of the Ipswich and District Natural History Society*, **1**, 158–61.
- Brydone, R.M. (1933) The Zone of granulated *Actinocamax* in East Anglia. *Transactions of the Norfolk and Norwich Naturalists' Society*, **13**, 285–93.
- Brydone, R.M. (1938) *On Correlation of some of the Norfolk Exposures of Chalk with Belemnitella mucronata*, Dulau and Co. Ltd, London.
- Brydone, R.M. (1939) *The Chalk Zone of Offaster pilula*, Dulau and Co. Ltd, London.
- Burnaby, T.P. (1962) The palaeoecology of the Foraminifera of the Chalk Marl. *Palaeontology*, **4**, 599–608.
- Burnett, J.A. (1998) Chapter 6, Upper Cretaceous. In *Calcareous Nannofossil Biostratigraphy*, (ed. P.R. Bown), Chapman and Hall, London, pp. 132–99.
- Carter, D.C. (1992) An upper strain detachment model for the Ballard Fault: discussion. *Proceedings of the Geologists' Association*, **102**, 309–15.
- Carter, D.J. and Hart, M.B. (1977a) Aspects of mid-Cretaceous stratigraphical micropalaeontology. *Bulletin of the British Museum (Natural History)*, *Geology Series*, **29**, 1–135.
- Carter, D.J. and Hart, M.B. (1977b) Micropalaeontological investigations for the site of the Thames Barrier, London. *Quarterly Journal of Engineering Geology*, *London*, **10**, 321–38.
- Casey, R. (1965) In *Geology of the Country around Huntingdon and Biggleswade* (E.A. Edmonds, C.H. Dinham, R. Casey and J.B.W. Day), Memoir of the Geological Survey of Great Britain (England and Wales) – New Series, Sheets 187 and 204, HMSO, London, pp. 54–5.
- Chadwick, R.A. (1985) Cretaceous sedimentation and subsidence. In *Atlas of Onshore Sedimentary Basins in England and Wales: Post-Carboniferous Tectonics and Stratigraphy*, (ed. A. Whitaker), Blackie, Glasgow, pp. 57–60.
- Chadwick, R.A. (1986) Extension tectonics in the Wessex Basin, southern England. *Journal of the Geological Society, London*, **143**, 465–88.
- Christensen, W.K. (1974) Morphometric analysis of *Actinocamax plenus* from England. *Bulletin of the Geological Society of Denmark*, **23**, 1–26.
- Christensen, W.K. (1975) Upper Cretaceous belemnites from the Kristianstad area in Scania, Sweden. *Fossils and Strata*, **7**, 69 pp.
- Christensen, W.K. (1982) Late Turonian–Early Coniacian belemnites from western and central Europe. *Bulletin of the Geological Society of Denmark*, **31**, 63–79.
- Christensen, W.K. (1984) The Albian to Maastrichtian of Southern Sweden and Bornholm, Denmark: a review. *Cretaceous Research*, **5**, 313–327.
- Christensen, W.K. (1986) Upper Cretaceous belemnites from the Vomb Trough in Scania, Sweden. *Sveriges Geologiska Undersökning*, **Ca57**, 57 pp.
- Christensen, W.K. (1990) *Actinocamax primus* Arkhangelsky (Belemnitellidae; Upper Cretaceous). Biometry, comparison and biostratigraphy. *Paläontologische Zeitschrift*, **64**, 75–90.
- Christensen, W.K. (1991) Belemnites from the Coniacian to Lower Campanian chalks of Norfolk and southern England. *Palaeontology*, **34**, 695–747.
- Christensen, W.K. (1992) *Belemnocamax boweri* Crick, an unusual belemnite from the Cenomanian of northwest Germany and eastern England. *Bulletin of the Geological Society of Denmark*, **40**, 157–66.
- Christensen, W.K. (1995) *Belemnitella* from the Upper Campanian and Lower Maastrichtian Chalk of Norfolk, England. *Special Papers in Palaeontology*, **51**, 84 pp.
- Christensen, W.K. (1996) A review of the Upper Campanian and Maastrichtian belemnite biostratigraphy of Europe. *Cretaceous Research*, **17**, 751–66.
- Christensen, W.K. (1997) Palaeobiogeography and migration in the Late Cretaceous belemnite family Belemnitellidae. *Acta Palaeontologica Polonica*, **42**, 457–95.
- Christensen, W.K. (1999) Upper Campanian and Lower Maastrichtian belemnites from the Mons Basin, Belgium. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, **69**, 97–131.
- Christensen, W.K. (2000) Gradualistic evolution in *Belemnitella* from the Middle Campanian

References

- of Lower Saxony, NW Germany. *Bulletin of the Geological Society of Denmark*, **47**, 135–63.
- Clayton, C.J. (1986) The chemical environment of flint formation in Upper Cretaceous chalks. In *The Scientific Study of Flint and Chert*, (eds G. de G. Sieveking and M.B. Hart), Cambridge University Press, Cambridge, pp. 43–54.
- Collins, J.I. (1970) The Chelonian *Rhinobelys* Seeley from the Upper Cretaceous of England and France. *Palaeontology*, **13**, 355–78.
- Conybeare, W.D. (1840) [in Buckland, J.J. (1840), compiler] *Ten Plates Comprising a Plan, Section, and Views, Representing the Changes Produced on the Coast of East Devon, between Axmouth and Lyme Regis by the Subsidence of the Land and the Elevation of the Bottom of the Sea, on 26th December, 1839, and 3rd of February 1840, from drawings by W. Dawson, Esq. Civil Engineer and Surveyor, Exeter, the Rev. W.D. Conybeare and Mrs Buckland. With a geological memoir and sections descriptive of these and similar phenomena, by the Rev. W.D. Conybeare. The whole revised by Professor Buckland*, John Murray, London, p. 8.
- Conybeare, W.D. and Phillips, W. (1822) *Outlines of the Geology of England and Wales*, Phillips, London.
- Coquand, H. (1856) Notice sur la formation crétacée du département de la Charante. *Bulletin de la Société géologique de France*, **2nd Series**, **14**, 55–98.
- Coquand, H. (1857) Position des *Ostrea columba* et *biauriculata* dans le groupe de la craie inférieure. *Bulletin de la Société géologique de France*, **2nd Series**, **14**, 745–66.
- Coquand, H. (1858) *Description physique, géologique, paléontologique et minéralogique de Département de la Charante*, Volume 1, Diodovers and Co., Besançon, 542 pp.
- Coquand, H. (1861) Sur la convenance d'établir dans le groupe inférieur de la formation crétacée un nouvel étage entre le Néocomien proprement dit (couches à *Toxaster complanatus* et à *Ostrea couloui*) et le Néocomien Supérieur (étage Urgonien de d'Orbigny). *Mémoires de la Société d'Emulation de Provence*, **1**, 127–139.
- Cox, F.C., Gallois, R.W. and Wood, C.J. (1989) *Geology of the country around Norwich*, Memoir of the British Geological Survey (England and Wales), Sheet 161, HMSO, London, 38 pp.
- Crampton, J.S. (1996) *Biometric Analysis, Systematics and Evolution of Albian Actinoceramus (Cretaceous Bivalvia, Inceramidae)*, Institute of Geological and Nuclear Sciences monograph 15, Lower Hutt, New Zealand, 80 pp.
- Crick, G.C. (1910a) On *Belemnocamax boweri*, n. g. et sp. A new cephalopod from the Lower Chalk of Lincolnshire. *Proceedings of the Geologists' Association*, **21**, 360–5.
- Crick, G.C. (1910b) Note on two Cephalopods (*Pachydiscus farmeryi*, n. sp. and *Heteroceras reussianum* (D'Orbigny)) from the Chalk of Lincolnshire. *Geological Magazine*, **New Series**, **Decade V**, **7**, 345–48.
- Croll, J. (1875) *Climate and Time in their Geological Relations: a Theory of Secular Change in the Earth's Climate*, Daldy and Isbister, London, 577 pp.
- Cuvier, G. and Brongniart, A. (1822) *Description géologique des environs de Paris*, Dufour and D'Ocagne, Paris 428 pp.
- Curry, D. and Smith, A.J. (1975) New discoveries concerning the geology of the central and eastern parts of the English Channel. *Philosophical Transactions of the Royal Society London. Series A*, **279**, 155–68.
- Cvijic, J. (1893) Das Karstphänomen. *Penck's Geographische Abhandlungen*, **5**.
- Davidson, T. (1852–1854) *A Monograph of British Cretaceous Brachiopoda*, **2**, Monograph of the Palaeontographical Society, London, 117 pp.
- Davidson, T. (1874). *A Monograph of the Fossil Brachiopoda*, **4(1)**, Supplement to the Recent, Tertiary and Cretaceous Species, Monograph of the Palaeontographical Society, London, 72 pp.
- Davis, J.W. (1885) On the contortions in the Chalk at Flamborough Head. *Proceedings of the Yorkshire Geological and Polytechnic Society*, **9**, 43–9.
- d'Archiac, A. (1847) Rapport sur les fossiles du Tourtia. *Mémoires de la Société Géologique de France*, **2**, 291–351.
- d'Hallo, d'O., J.-J. (1822) Observations sur un essai de carte géologique de la France, des Pays-Bas, et des contrées voisines. *Annales des Mines*, **7**, 353–76.
- d'Orbigny, A. (1847) *Paléontologie française. Terrains Crétacés IV. Brachiopodes*, Victor Masson, Paris.
- d'Orbigny, A. (1850) *Prodrome de paléontologie*

References

- stratigraphique universelle des animaux mollusques & rayonnés faisant suite au cours élémentaire de paléontologie et de géologie stratigraphiques*, Volume 2, Victor Masson, Paris, 427 pp.
- d'Orbigny, A. (1852) *Cours élémentaire de paléontologie et de géologie stratigraphiques*, Volume 2, Victor Masson, Paris, pp. 383–847.
- De la Beche, H.T. (1826) On the Chalk and sands beneath it (usually called Green-sand) in the vicinity of Lyme Regis, Dorset, and Beer, Devon. *Transactions of the Geological Society of London, Series 2*, 1, 109–18.
- DeConto, R.M., Hay, W.W. and Bergengren, J.C. (1998) Modeling late Cretaceous climate and vegetation. *Zentralblatt für Geologie und Paläontologie*. Teil 1, 1996, (11/12), 1433–44.
- de Lapparent, A. (1900) *Traité de Géologie* (4th edn), Masson, Paris.
- de Grossouvre, A. (1901) Recherches sur la craie supérieure 1: stratigraphie générale. *Mémoires pour servir à l'explication de la carte géologique détaillée de la France*, 1013 pp.
- de Mercey, M.N. (1896) On the Existence of Rich Phosphate of Lime in the London Basin. *Geological Magazine, New Series, Decade IV*, 3, 342–3.
- Desor, E. (1854) Quelques mots sur l'étage inférieur du groupe néocomien (étage valanginien). *Bulletin Société des Sciences Naturelles de Neuchâtel*, 3, 172–180.
- Destombes, J.P. and Shephard-Thorn, E.R. (1971) Geological results of the Channel Tunnel site investigation 1964–65. *Report of the Institute of Geological Sciences*, 71/11, 12 pp.
- Dibley, G.E. (1906) Excursion to Lewes. *Proceedings of the Geologists' Association*, 19, 451–3.
- Ditchfield, P.W. and Marshall, J.D. (1989) Isotopic variation in rhythmically bedded chalks: Palaeotemperature variation in the Upper Cretaceous. *Geology*, 17, 842–5.
- Dixon, F. (1850) *The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex*, Richard and John Edward Taylor, London, 422 pp.
- Donato, J.A. (1993) A buried granite batholith and the origin of the Sole Pit Basin, UK Southern North Sea. *Journal of the Geological Society, London*, 150, 255–8.
- Donato, J.A. and Megson, J.B. (1990) A buried granite batholith beneath the East Midland Shelf of the Southern North Sea Basin. *Journal of the Geological Society, London*, 147, 133–40.
- Dowker, G. (1870) On the Chalk of Thanet, Kent, and its connection with the Chalk of east Kent. *Geological Magazine, New Series, Decade II*, 7, 466–72.
- Doyle, P. and Bennett, M.R. (1998) *Unlocking the Stratigraphical Record: Advances in Modern Stratigraphy*, John Wiley and Sons Ltd, Chichester, 532 pp.
- Drummond, P.V.O. (1967) The Cenomanian Palaeogeography of Dorset and Adjacent Counties. PhD thesis, University of London.
- Drummond, P.V.O. (1970) The Mid-Dorset Swell. Evidence of Albian–Cenomanian movements in Wessex. *Proceedings of the Geologists' Association*, 81, 679–714.
- Drummond, P.V.O. (1983) The *Micraster* biostratigraphy of the Senonian White Chalk of Sussex, southern England. *Geologie Méditerranéenne*, X, 177–82.
- Dumont, A.H. (1849) Rapport sur la carte géologique du Royaume. *Bulletin de l'Académie Royal des Sciences, des Lettres et des Beaux-Arts de Belgique*, 16, 351–73.
- Edmunds, F.H. (1938) A contribution on the physiography of the Mere district, Wiltshire. With Report of Field Meeting Whitsun, 1937. *Proceedings of the Geologists' Association*, 49, 174–96.
- Ekdale A.A. and Bromley, R.G. (1984) Comparative ichnology of shelf-sea and deep-sea chalk. *Journal of Paleontology*, 58, 322–32.
- Ekdale A.A. and Mason, T.R. (1988) Characteristic trace-fossil associations in oxygen-poor sedimentary environments. *Geology*, 16, 720–3.
- Elder, W.P. (1991) *Mytiloides battini* n. sp.: A guide fossil for the base of the Turonian in the Western Interior of North America. *Journal of Paleontology*, 65, 234–41.
- Ellis, N.V., Bowen, D.Q., Campbell, S. et al., (1996) *An Introduction to the Geological Conservation Review*, Geological Conservation Review Series, No.1, Joint Nature Conservation Committee, Peterborough, 131 pp.
- Elsden, J.V. (1909) On the Geology of the neighbourhood of Seaford (Sussex). *Quarterly Journal of the Geological Society of London*,

References

- 65, 442–61.
- Emeleus, C.H. (1997) *Geology of Rum and the Adjacent Islands*, Memoir of the British Geological Survey of Great Britain (Scotland), Sheet 60, HMSO, London, 171 pp.
- Ernst, G. (1963) Stratigraphische und gesteinschemische Untersuchungen im Santon und Campan von Lägerdorf (SW-Holstein). *Mitteilungen aus dem Geologischen Staatsinstitut in Hamburg*, **32**, 71–127.
- Ernst, G. (1964) Ontogenie, Phylogenie und Stratigraphie der Belemnitenengattung *Gonioteuthis* BAYLE aus dem nordwestdeutschen Santon/Campan. *Fortschritte in der Geologie von Rheinland und Westfalen*, **7**, 487–94.
- Ernst, G. (1966) Zur Belemniten-Stratigraphie des Santon und Campan im Münsterländer Becken. *Zeitschrift der deutschen geologischen Gesellschaft*, **115**, 922.
- Ernst, G. (1971) Biometrische Untersuchungen über die Ontogenie und Phylogenie der *Offaster/Galeola*-Stammesreihe (Echin.) aus der nordwesteuropäischen Oberkreide. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **139**, 169–225.
- Ernst, G. (1972) Grundfragen der Stammesgeschichte bei irregulären Echiniden der nordwesteuropäischen Oberkreide. *Geologisches Jahrbuch, Reihe A*, **4**, 63–175.
- Ernst, G. and Rehfeld, U. (1997) The transgressive development in the Lower and Middle Cenomanian of the Salzgitter area (N-Germany) recorded by sea level-controlled eco- and litho-events. *Freiberger Forschungsbefte, Reihe C*, **468**, 79–107.
- Ernst, G. and Schulz, M.-G. (1974) Stratigraphie und Fauna des Coniac und Santon im Schreibkreide-Richtprofil von Lägerdorf (Holstein). *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, **43**, 5–60.
- Ernst, G., Schmid, F. and Seibert, E. (1983) Event-Stratigraphie im Cenoman und Turon von NW-Deutschland. *Zitteliana*, **10**, 531–54.
- Ernst, G., Wood, C.J. and Hilbrecht, H. (1984) The Cenomanian–Turonian boundary problem in NW-Germany with comments on the north–south correlations to the Regensburg area. *Bulletin of the Geological Society of Denmark*, **33**, 103–13.
- Ernst, G., Niebuhr, B., Wiese, F. and Wilmsen, M. (1996) Facies development, basin dynamics, event correlation and sedimentary cycles in Upper Cretaceous of selected areas of Germany and Spain. In *Global and Regional Controls on Biogenic Sedimentation. II. Cretaceous Sedimentation. Research Reports*, (eds J. Reitner, F. Neuweiler and F. Gunkel), *Göttinger Arbeiten in Geologie und Paläontologie*, **Sb3**, pp. 87–100.
- Ernst, G., Wood, C.J. and Rehfeld, U. (1998) C 2.10: Cenomanian–Turonian of Söhlde. In *Key Localities of the Northwest European Cretaceous*, (eds J. Mutterlose, A. Bornemann, S. Rauer, C. Spaeth and C.J. Wood), *Bochumer Geologische und Geotechnische Arbeiten*, **48**, 102–19.
- Evans, C. (1870) *On Some Sections of Chalk between Croydon and Oxstead, with Observations on the Classification of the Chalk*, Geo. P. Bacon, Lewes, for the Geologists' Association, 40 pp.
- Evans, D.J. and Hopson, P.M. (2000) The seismic expression of synsedimentary channel features within the Chalk of southern England. *Proceedings of the Geologists' Association*, **111**, 219–30.
- Eyles, N., Eyles, C.H. and McCabe, A.M. (1989) Sedimentation in an ice-contact subaqueous setting: the mid-Pleistocene 'North Sea Drifts' of Norfolk, U.K. *Quaternary Science Reviews*, **8**, 57–74.
- Fairbridge, R.W. (1968) *The Encyclopedia of Geomorphology*, Rheinhold Book Corporation, New York, 1295 pp.
- Felder, P.J. (1981) Onderzoek van de meso-fossielen in de Krijt-afzettingen van Limburg Een nieuwe mogelijkheid tot het correleren en dateren van de Krijt-afzettingen. *Natuurhistorisch Maandblad*, **70**, 69–75.
- Fitton, W.H. (1836) Observations on the strata between the Chalk and the Oxford Oolite in the South-East of England. *Transactions of the Geological Society of London*, **2nd Series**, **4**, 103–324.
- Fletcher, T.P. (1977) Lithostratigraphy of the Chalk (Ulster White Limestone Formation) in Northern Ireland. *Report of the Institute of Geological Sciences*, **77/24**.
- Fletcher, T.P. and Wood, C.J. (1978) Chapter 15. Cretaceous Rocks. In *Geology of the Causeway Coast*, Volume 2 (H.E. Wilson), Memoir of the Geological Survey of Northern Ireland, Sheet 7, HMSO, Belfast, pp. 84–115.
- Fletcher, T.P. and Wood, C.J. (1982) Chapter 8. Cretaceous. In *Geology of the Country around Carrickfergus and Bangor*, 2nd edn,

References

- (eds. A.E. Griffith and H.E. Wilson), Memoir of the Geological Survey of Ireland, Sheet 29, HMSO, Belfast, pp. 44–54.
- Fritsen, A., Bailey, H.W., Gallagher, L., Hampton, H. *et al.* (2000) A joint Chalk Stratigraphic Framework. *JCR Symposium, Brighton*, 21–24 March 2000, 1–2.
- Gale, A.S. (1980) Penecontemporaneous folding, sedimentation and erosion in Campanian Chalk near Portsmouth, England. *Sedimentology*, **27**, 137–51.
- Gale, A.S. (1989) Field meeting at Folkestone Warren, 29th November, 1987. *Proceedings of the Geologists' Association*, **100**, 73–80.
- Gale, A.S. (1990a) A Milankovitch scale for Cenomanian time. *Terra Nova*, **1**, 420–5.
- Gale, A.S. (1990b) Excursion E. Sedimentary facies of the Chalk of the western London Platform. In *Field Excursion Guides, British Sedimentological Research Group Annual Meeting, Reading University, December 1990*, (ed. J.R.L. Allen), Postgraduate Research Institute for Sedimentology, The University, Reading, pp. 53–9.
- Gale, A.S. (1995) Cyclostratigraphy and correlation of the Cenomanian Stage in Western Europe. In *Orbital Forcing Timescales and Cyclostratigraphy*, (eds M.R. House and A.S. Gale), *Geological Society of London, Special Publication*, No. 85, pp. 177–97.
- Gale, A.S. (1996) Turonian correlation and sequence stratigraphy of the Chalk in southern England. In *Sequence Stratigraphy in British Geology*, (eds S.P. Hesselbo and D.N. Parkinson), *Geological Society of London, Special Publication*, No. 103, pp. 177–95.
- Gale, A.S. (1998) Chapter 7: Cyclostratigraphy. In *Unlocking the Stratigraphical Record: Advances in Modern Stratigraphy*, (eds P. Doyle and M.R. Bennett), John Wiley and Sons Ltd, Chichester, pp. 195–220.
- Gale, A.S. and Cleevely, R.J. (1989) Arthur Rowe and the Zones of the White Chalk of the English coast. *Proceedings of the Geologists' Association*, **100**, 419–31.
- Gale, A.S. and Friedrich, S. (1989) Occurrence of the ammonite *Sharpeiceras* in the Lower Cenomanian Chalk Marl of Folkestone. *Proceedings of the Geologists' Association*, **100**, 80–2.
- Gale, A.S. and Hancock, J.M. (1999) Discussion on 'Lithostratigraphy for mapping the Chalk of southern England'. *Proceedings of the Geologists' Association*, **110**, 65–8.
- Gale, A.S. and Smith, A.B. (1982) The palaeobiology of the Cretaceous irregular echinoids *Infulaster* and *Hagenowia*. *Palaeontology*, **25**, 11–42.
- Gale, A.S. and Woodrooff, P.B. (1981) A Coniacian ammonite from the 'Top Rock' in the Chalk of Kent. *Geological Magazine*, **118**, 557–60.
- Gale, A.S., Wood, C.J. and Bromley, R.G. (1988) The Lithostratigraphy and Marker Bed Correlation of the White Chalk (Late Cenomanian–Campanian) in Southern England. *Mesozoic Research*, **1**, 107–18.
- Gale, A.S., Jenkyns, H.C., Kennedy, W.J. and Corfield, R.M. (1993) Chemostratigraphy versus biostratigraphy: data from around the Cenomanian–Turonian boundary. *Journal of the Geological Society, London*, **150**, 29–32.
- Gale, A.S., Young, J.R., Shackleton, N.J., Crowhurst, S.J. and Wray, D.S. (1999) Orbital tuning of Cenomanian marly chalk successions: towards a Milankovitch time-scale for the Late Cretaceous. *Philosophical Transactions of the Royal Society of London. Series A*, **357**, 1815–29.
- Gale, A.S., Smith, A.B., Monks, N.E.A., Young, J.R., Howard, A., Wray, D.S. and Huggett, J.M. (2000) Marine biodiversity through the Late Cenomanian–Early Turonian: palaeoceanographic controls and sequence stratigraphic biases. *Journal of the Geological Society, London*, **157**, 745–57.
- Gallois, R.W. (1994) *Geology of the Country around King's Lynn and The Wash*, Memoir of the British Geological Survey (England and Wales), Sheet 145 and part of 129, HMSO, London, 210 pp.
- Gaster, C.T.A. (1920) An undescribed species of *Trochiliopora*. *Geological Magazine*, **57**, 526.
- Gaster, C.T.A. (1924) The Chalk of the Worthing District of Sussex. *Proceedings of the Geologists' Association*, **35**, 89–110.
- Gaster, C.T.A. (1928) Excursion to Newhaven and Brighton. *Proceedings of the Geologists' Association*, **39**, 198–201.
- Gaster, C.T.A. (1929) Chalk Zones in the neighbourhood of Shoreham, Brighton and Newhaven, Sussex. *Proceedings of the Geologists' Association*, **39**, 328–40.
- Gaster, C.T.A. (1939) The stratigraphy of the Chalk of Sussex. Part II. Eastern area – Seaford to Cuckmere Valley and Eastbourne, with zonal map. *Proceedings of the Geologists' Association*, **50**, 510–526.

References

- Gaster, C.T.A. (1941) The Chalk Zones of *Offaster pilula* and *Actinocamax quadratus*. *Proceedings of the Geologists' Association*, **52**, 210–15.
- Gaster, C.T.A. (1951) The stratigraphy of the Chalk of Sussex. Part IV. East Central Area – between the valley of the Adur and Seaford. *Proceedings of the Geologists' Association*, **62**, 31–64.
- Gilbert, G.K. (1895) Sedimentary measurement of geological time. *Journal of Geology*, **3**, 121–5.
- Glasser, L.S.D. and Smith, D.N. (1986) Siliceous coatings on fossil coccoliths – how did they arise? In *The Scientific Study of Flint and Chert*, (eds G. de G. Sieveking and M.B. Hart), Cambridge University Press, Cambridge, pp. 105–9.
- Godwin, M. (1998) Palaeoenvironments and cyclicity of the Beeston Chalk (Upper Campanian) in Norfolk and their possible links with the nektonic palaeoecology of *Belemnites*. *Bulletin of the Geological Society of Norfolk*, **47**, 23–60.
- Gosselet (1896) Note sur les gîtes de Phosphate de Chaux d'Hem-Monacu, d'Etaves, du Ponthieu, etc. *Annales de la Société Géologique du Nord*, **24**, 109–34.
- Gradstein, F.M., Agterberg, F.P., Ogg, J.G., Hardenbol, J. and Backstrom, S. (1999) On the Cretaceous time scale. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **212**, 3–14.
- Grant, S.F., Coe, A.L. and Armstrong, H.A. (1999) Sequence stratigraphy of the Coniacian succession of the Anglo-Paris Basin. *Geological Magazine*, **136**, 17–38.
- Gray, D.A. (1965) The stratigraphical significance of electrical resistivity marker bands in the Cretaceous strata of the Leatherhead (Fetcham Mill) Borehole, Surrey. *Bulletin of the Geological Survey, Great Britain*, **23**, 65–115.
- Griffith, C. and Brydone, R.M. (1911) *The Zones of the Chalk in Hants*, Dulau and Co. Ltd, London, 31 pp.
- Hamblin, R.J.O. and Wood, C.J. (1976) The Cretaceous (Albian–Cenomanian) stratigraphy of the Haldon Hills, south Devon, England. *Newsletters on Stratigraphy*, **4**, 135–49.
- Hancock, J.M. (1959) Les Ammonites du Cénomanien de la Sarthe. *Comptes Rendus du Congrès des Sociétés savantes, Dijon*, 1959. *Colloque sur le Crétacé supérieur français*, pp. 249–59.
- Hancock, J.M. (1969) Transgression of the Cretaceous sea in south-west England. *Proceedings of the Ussher Society*, **2**, 61–83.
- Hancock, J.M. (ed.) (1972) *Lexique Stratigraphique International* (International Stratigraphical Lexicon) *Volume 1: Europe – Angleterre, Pays de Galle, Écosse. Fascicule 3a XI Crétacé*. CNRS, Paris, 162 pp.
- Hancock, J.M. (1975a) The Petrology of the Chalk. *Proceedings of the Geologists' Association*, **86**, 499–535.
- Hancock, J.M. (1975b) The sequence of facies in the Upper Cretaceous of northern Europe compared with that in the Western Interior. In *The Cretaceous System in the Western Interior of North America*, (ed. W.G.E. Caldwell), *The Geological Association of Canada Special Paper*, No. 13, pp. 83–118.
- Hancock, J.M. (1980) The significance of Maurice Black's work on the Chalk. In *Andros Island, Chalk and Oceanic Oozes*, (eds C.V. Jeans and P.F. Rawson), *Yorkshire Geological Society Occasional Publication*, No. 5, pp. 86–100.
- Hancock, J.M. (1990) Sea level changes in the British region during the Late Cretaceous. *Proceedings of the Geologists' Association*, **100**, 565–94.
- Hancock, J.M. and Gale, A.S. (1996) The Campanian Stage. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, **66** (supp.), pp. 103–9.
- Hancock, J.M. and Kauffman, E.G. (1979) The great transgressions of the Late Cretaceous. *Journal of the Geological Society, London*, **136**, 175–86.
- Hancock, J.M. and Scholle, P.A. (1975) Chalk of the North Sea. In *Petroleum and the Continental Shelf of Northwest Europe. Volume 1 Geology*, (ed. A.W. Woodland), Institute of Petroleum, Great Britain, pp. 413–25, 427.
- Haq, B.U., Hardenbol, J. and Vail, P.R. (1987) Chronology of fluctuating sea levels since the Triassic (250 million years ago to present). *Science*, **235**, (4793), 1156–67.
- Haq, B.U., Hardenbol, J. and Vail, P.R. (1988) Mesozoic and Cenozoic chronostratigraphy and cycles of sea-level change. In *Sea-level Change: An Integrated Approach*, (eds C.K. Wilgus et al.), *Society of Economic Paleontologists and Mineralogists Special*

References

- Publication*, No. 42, pp. 71–108.
- Harries, P.J., Kauffman, E.G. and Crampton, J.S. (1996) Lower Turonian Euramerican Inoceramidae: a morphologic, taxonomic, and biostratigraphic overview. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, 77, 641–71.
- Harris, C.S., Hart, M.B., Varley, P.M. and Warren, C.D. (eds) (1996a) *Engineering Geology of the Channel Tunnel*, Thomas Telford, London, 526 pp.
- Harris, C.S., Hart, M.B. and Wood, C.J. (1996b) Chapter 26. A revised stratigraphy. In *Engineering Geology of the Channel Tunnel*, (eds C.S. Harris, M.B. Hart, P.M. Varley and C.D. Warren), Thomas Telford, London, pp. 398–420.
- Hart, M.B. (1973) Foraminiferal evidence for the age of the Cambridge Greensand. *Proceedings of the Geologists' Association*, 84, 65–82.
- Hart, M.B. (1975) Microfaunal analysis of the Membury Chalk succession. *Proceedings of the Ussher Society*, 3, 271–9.
- Hart, M.B. (1982) Turonian foraminiferal biostratigraphy of Southern England. *Mémoires du Museum national d'Histoire Naturelle Nouvel Series*, 49, 203–7.
- Hart, M.B. (1983) Planktonic Foraminifera from the Cenomanian of the Wilmington quarries (S.E. Devon). *Proceedings of the Ussher Society*, 5, 406–10.
- Hart, M.B. (1991) The Late Cenomanian calcisphere global bioevent. *Proceedings of the Ussher Society*, 7, 413–7.
- Hart, M.B. (1993) *Labyrinthidoma* Adams, Knight & Hodgkinson; an unusually large foraminiferal genus from the Chalk facies (Upper Cretaceous) of southern England and northern France. In *Proceedings of the Fourth International Workshop on Agglutinated Foraminifera, Krakow, Poland, September 12–19, 1993*, (eds M.A. Kaminski, S. Geroch and M.A. Gasinski), *Grzybowski Foundation Special Publication*, No. 3, pp. 123–30.
- Hart, M.B. (1997) The application of micropalaeontology to sequence stratigraphy; an example from the chalk succession of south-west England. *Proceedings of the Ussher Society*, 9, 158–63.
- Hart, M.B. and Johnson, K. (1984) *Ceripora ramulosa* (MICHELIN); an aberrant bryozoan from the Cenomanian of S. E. Devonshire. *Proceedings of the Ussher Society*, 6, 25–8.
- Hart, M.B. and Weaver, P.P.E. (1977) Turonian microbiostratigraphy of Beer, SE Devon. *Proceedings of the Ussher Society*, 4, 87–93.
- Hart, M.B., Bailey, H.W., Crittenden, S., Fletcher, B.N., Price, R.J. and Swiecicki, A. (1989) Chapter 7. Cretaceous. In *Stratigraphical Atlas of Fossil Foraminifera*, 2nd edn, (eds D.G. Jenkins and J.W. Murray), Ellis Horwood Ltd, Chichester, pp. 273–371.
- Hart, M.B., Dodsworth, P., Ditchfield, P.W., Duane, A.M. and Orth, C.J. (1991) The Late Cenomanian event in eastern England. *Historical Biology*, 5, 339–54.
- Hattin, D.E. (1971) Widespread, synchronously deposited burrow-mottled limestone beds in Greenhorn Limestone (Upper Cretaceous) of Kansas and South Eastern Colorado. *Bulletin of the American Association of Petroleum Geologists*, 55, 412–31.
- Hawkes, L. (1943) The erratics of the Cambridge Greensand – their nature, provenance and mode of transport. *Quarterly Journal of the Geological Society of London*, 99, 93–104.
- Hawkins, H.L. (1918) Notes on the geological structure of the Vale of Kingsclere. *Proceedings of the Hampshire Field Club*, 8, 191–212.
- Hawkins, H.L. (1924) Excursion to Newbury and Boxford. *Proceedings of the Geologists' Association*, 35, 395–400.
- Hawkins, H.L. (1948) 8. – British phosphates. Part 1. Phosphatic chalk of Taplow. *Wartime Pamphlets of the Geological Survey of Great Britain*, Geological Survey and Museum, London.
- Hays, J.D. and Pitman, W.C. III. (1973) Lithospheric plate motions, sea-level changes and climatic and ecological consequences. *Nature*, 246, 18–22.
- Hébert, E. (1863) Note sur la craie blanche et la craie marneuse dans le bassin de Paris, et sur la division de ce dernier étage en quatre assises. *Bulletin de la Société géologique de France*, 2nd series, 20, 605–31.
- Hébert, E. (1866) De la craie dans le nord du Bassin de Paris. *Comptes-rendus hebdomadaire, Seance Académie des Sciences, Paris*, 62, 1401–5; 63, 308–11.
- Hébert E. (1874) Comparaison de la craie des côte d'Angleterre avec celle de la France. *Bulletin de la Société géologique de France*, 3rd series, 2, 416–28.
- Hébert E. (1875) Classification du terrain crétacé

References

- supérieur. *Bulletin de la Société géologique de France*, 3rd series, 3, 595–9.
- Heinz, R. (1932) Aus der neuen Systematik der Inoceramen (Inoceramen XIV). *Mitteilungen aus dem Mineralogisch-Geologischen Staatsinstitut in Hamburg*, 13, 1–26.
- Hewitt, H.D. (1924) Notes on some Chalk Sections in the District around Thetford, Norfolk. *Proceedings of the Geologists' Association*, 35, 220–44.
- Hewitt, H.D. (1935) Further Notes on the Chalk of the Thetford District, Norfolk. *Proceedings of the Geologists' Association*, 46, 18–37.
- Hilbrecht, H. and Dahmer, D.-D. (1994) Sediment dynamics during the Cenomanian–Turonian (Cretaceous) Oceanic Anoxic Event in northwestern Germany. *Facies*, 30, 63–84.
- Hill, W. (1886) On the beds between the Upper and Lower Chalk of Dover, and their comparison with the Middle Chalk of Cambridgeshire. *Quarterly Journal of the Geological Society of London*, 42, 232–48.
- Hill, W. (1888) On the lower beds of the Upper Cretaceous Series in Lincolnshire and Yorkshire. *Quarterly Journal of the Geological Society of London*, 44, 320–67.
- Hill, W. and Jukes-Browne, A.J. (1886) The Melbourn Rock and the zone of *Belemnites plena* from Cambridge to the Chiltern Hills. *Quarterly Journal of the Geological Society of London*, 42, 216–31.
- Holdaway, H.K. and Clayton, C.J. (1982) Preservation of shell microstructure in silicified brachiopods from the Upper Cretaceous Wilmington Sands of Devon. *Geological Magazine*, 119, 371–82.
- Honjo, S. (1975) Dissolution of suspended coccoliths in the deep-sea water column and sedimentation of coccolithic ooze. In *Dissolution of Deep-sea Carbonates*, (eds W.V. Sliter, A.W.H. Be and W.H. Berger), *Cushman Foundation Special Publications*, No. 14, pp. 114–28.
- Hopson, P.M. (1995) Chalk rafts in Anglian till in north Hertfordshire. *Proceedings of the Geologists' Association*, 106, 151–8.
- Hopson, P.M., Aldiss, D.T. and Smith, A. (1996) *Geology of the Country around Hitchin*, Memoir of the British Geological Survey (England and Wales), Sheet 221, HMSO, London, 153 pp.
- Horton, A., Sumbler, M.G., Cox, B.M. and Ambrose, K. (1995) *Geology of the Country around Thame*, Memoir of the British Geological Survey (England and Wales), Sheet 237, HMSO, London, 169 pp.
- House, M. (1993) *Geology of the Dorset Coast*, 2nd edn, *Geologists' Association Field Guide* No. 22, Geologists' Association, London, 164 pp.
- Huxley, T. H. (1868) *On a Piece of Chalk*. Presidential address to the British Association at Norwich. A lecture given to a meeting of workmen of Norwich. Republished by Oriole Chapbooks, New York, pp. 1–36.
- Jarvis, I. (1980a) *The Initiation of Phosphatic Chalk Sedimentation – the Senonian (Cretaceous of the Anglo-Paris Basin)*. *The Society of Economic Paleontologists and Mineralogists Special Publication*, No. 29, 167–92.
- Jarvis, I. (1980b) Palaeobiology of Upper Cretaceous belemnites from the phosphatic chalk of the Anglo-Paris basin. *Palaeontology*, 23, 889–914.
- Jarvis, I. (1980c) Genesis and diagenesis of Santonian to early Campanian (Cretaceous) phosphatic chalks of the Anglo-Paris Basin. PhD thesis, University of Oxford.
- Jarvis, I. (1992) Sedimentology, geochemistry and origin of phosphatic chalks: the Upper Cretaceous deposits of NW Europe. *Sedimentology*, 39, 55–97.
- Jarvis, I. and Tocher, B.A. (1987) Field Meeting: the Cretaceous of SE Devon, 14–16 March, 1986. *Proceedings of the Geologists' Association*, 98, 51–66.
- Jarvis, I. and Woodroof, P.B. (1981) The phosphatic chalks and hardgrounds of Boxford and Winterbourne, Berkshire – two tectonically controlled facies in the late Coniacian to early Campanian (Cretaceous) of southern England. *Geological Magazine*, 118, 175–87.
- Jarvis, I. and Woodroof, P.B. (1984) Stratigraphy of the Cenomanian and basal Turonian (Upper Cretaceous) between Branscombe and Seaton, SE-Devon, England. *Proceedings of the Geologists' Association*, 95, 193–215.
- Jarvis, I., Carson, G.A., Hart, M.B., Leary, P.N. and Tocher, B.A. (1988a) The Cenomanian–Turonian (late Cretaceous) anoxic event in SW England: evidence from Hooken Cliffs near Beer, SE Devon. *Newsletters on Stratigraphy*, 18, 147–64.
- Jarvis, I., Carson, G.A., Cooper, M.K.E., Hart, M.B., Leary, P.N., Tocher, B.A., Horne, D. and

References

- Rosenfeld, A. (1988b) Microfossil Assemblages and the Cenomanian–Turonian (late Cretaceous) Oceanic Anoxic Event. *Cretaceous Research*, **9**, 3–103.
- Jeans, C.V. (1968) The origin of the montmorillonite of the European Chalk with special reference to the Lower Chalk of England. *Clay Minerals*, **7**, 311–29.
- Jeans, C.V. (1973) The Market Weighton Structure: tectonics, sedimentation and diagenesis during the Cretaceous. *Proceedings of the Yorkshire Geological Society*, **39**, 409–44.
- Jeans, C.V. (1980) Early submarine lithification in the Red Chalk and Lower Chalk of eastern England: a bacterial control model and its implications. *Proceedings of the Yorkshire Geological Society*, **43**, 81–157.
- Jeans, C.V., Long, D., Hall, M.A., Bland, D.J. and Cornford, C. (1991) The geochemistry of the Plenus Marls at Dover, England: evidence of fluctuating oceanographic conditions and glacial control during the development of the Cenomanian–Turonian $\delta^{13}\text{C}$ anomaly. *Geological Magazine*, **128**, 603–32.
- Jefferies, R.P.S. (1962) The palaeoecology of the *Actinocamax plenus* Subzone (lowest Turonian) in the Anglo-Paris Basin. *Palaeontology*, **4**, 609–47.
- Jefferies, R.P.S. (1963) The stratigraphy of the *Actinocamax plenus* Subzone (Turonian) in the Anglo-Paris Basin. *Proceedings of the Geologists' Association*, **74**, 1–33.
- Jeletzky, J.A. (1951) The place of the Trimmingham and Norwich Chalk in the Campanian–Maestrichtian Succession. *Geological Magazine*, **88**, 197–208.
- Jeletzky, J.A. (1958) Die jüngere Oberkreide (Oberconiac bis Maastricht) Sudwestrusslands und ihr Vergleich mit der Nordwest und West Europas. *Beihfte zum Geologischen Jahrbuch*, **33**, 157 pp.
- Jenkyns, H.C. (1980) Cretaceous anoxic events: from continents to oceans. *Journal of the Geological Society, London*, **137**, 171–88.
- Jenkyns, H.C., Gale, A.S. and Corfield, R.M. (1994) Carbon- and oxygen-isotope stratigraphy of the English Chalk and Italian Scaglia and its palaeoclimatic significance. *Geological Magazine*, **131**, 1–34.
- Johansen, M.B. and Surlyk, F. (1990) Brachiopods and the stratigraphy of the Upper Campanian and Lower Maastrichtian Chalk of Norfolk, England. *Palaeontology*, **33**, 823–72.
- Jordan, R.W., Kleijne, A., Heimdal, B.R. and Green, J.C. (1995) A glossary of the extant Haptophyta of the world. *Journal of the Marine Biological Association of the United Kingdom*, **75**, 769–814.
- Judd, J.W. (1878) The Secondary Rocks of Scotland. Third Paper. The strata of the Western Coast and Islands. With a note on the Foraminifera and other organisms in the Chalk of the Hebrides by T.R. Jones. *Quarterly Journal of the Geological Society of London*, **34**, 660–743.
- Jukes-Browne, A.J. (1896) Fossils of the Warminster Upper Greensand. *Geological Magazine, New Series, Decade IV*, **3**, 261–73.
- Jukes-Browne, A.J. (1898) On an outlier of Cenomanian and Turonian (equivalent to Lower and Middle Chalk) near Honiton, with a note on *Holaster altus* Agassiz. *Quarterly Journal of the Geological Society of London*, **54**, 239–50.
- Jukes-Browne, A.J. (1903) The Geology of the Country around Chard. *Proceedings of the Somerset Archaeological and Natural History Society*, **49**, 1–11.
- Jukes-Browne, A.J. (1904) On the Zones of the Upper Chalk in Suffolk. *Proceedings of the Geologists' Association*, **18**, 85–94; Plate XVI.
- Jukes-Browne, A.J. (1912) The recognition of Two Stages in the Upper Chalk. *Geological Magazine, New Series, Decade V*, **9**, 304–13, 360–72.
- Jukes-Browne, A.J. and Hill, W. (1896) A delimitation of the Cenomanian. *Quarterly Journal of the Geological Society of London*, **52**, 99–177.
- Jukes-Brown, A.J. and Hill, W. (1900) *The Cretaceous Rocks of Britain, volume 1: The Gault and Upper Greensand of England*, Memoir of the Geological Survey of the United Kingdom, HMSO, London, 499 pp.
- Jukes-Browne, A.J. and Hill, W. (1903) *The Cretaceous Rocks of Britain, volume 2: The Lower and Middle Chalk of England*, Memoir of the Geological Survey of the United Kingdom, HMSO, London, 568 pp.
- Jukes-Browne, A.J. and Hill, W. (1904) *The Cretaceous Rocks of Britain, volume 3: The Upper Chalk of England*, Memoir of the Geological Survey of the United Kingdom, HMSO, London, 566 pp.
- Jukes-Browne, A.J. and Scanes, J. (1901) On the Upper Greensand and Chloritic Marl of Mere

References

- and Maiden Bradley in Wiltshire. *Quarterly Journal of the Geological Society of London*, **57**, 96–125.
- Kaplan, U. and Kennedy, W.J. (1996) Upper Turonian and Coniacian ammonite stratigraphy of Westphalia, NW-Germany. *Acta Geologica Polonica*, **46**, 305–52.
- Kaplan, U., Kennedy, W.J. and Wright, C.W. (1987) Turonian and Coniacian Scaphitidae from England and Northwestern Germany. *Geologisches Jahrbuch, Reihe A*, **103**, 5–39.
- Kaplan, U., Kennedy, W.J., Lehmann, J. and Marcinowski, R. (1998) Stratigraphie und Ammonitenfaunen des westfälischen Cenoman. *Geologie und Paläontologie in Westfalen*, **51**, 236 pp.
- Kauffman, E.G. (1973) Cretaceous Bivalvia. In *Atlas of Palaeobiogeography*, (ed. A. Hallam), Elsevier, Amsterdam, pp 353–383.
- Kauffman, E.G. (1975) Dispersal and biostratigraphic potential of Cretaceous benthonic Bivalvia in the Western Interior. In *The Cretaceous System in the Western Interior of North America*, (eds W.G.E. Caldwell and R. Reymont), *Geological Association of Canada Special Paper*, No. 13, 163–194.
- Kauffman, E.G. (1976) British middle Cretaceous biostratigraphy. In *Evènements de la Partie Moyenne du Crétacé (Mid-Cretaceous Events)*, (eds G. Thomel and R. Reymont), *Annales du Museum d'Histoire Naturelle de Nice*, **4**, XVII.1–XVII.6.
- Kauffman, E.G. (1988) The case of the missing community: Low-oxygen adapted Palaeozoic and Mesozoic bivalves ('flat-clams') and bacterial symbioses in typical Phanerozoic oceans. *Geological Society of America, Abstracts with Programs*, **20**, A48.
- Kauffman, E.G. and Harries, P. J. (1992) The ecology and life habits of Cenomanian–Turonian Inoceramidae in North America. Workshop on Early Turonian Inoceramids, 5–6 October 1992, Hamburg [Abstract].
- Kauffman, E.G., Kennedy, W.J. and Wood, C.J. (1996) The Coniacian stage and substage boundaries. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, **66** (supp.), 81–94.
- Kellaway, G.A. and Welch, F.B.A. (1948) *Bristol and Gloucester District*, 2nd edn, *British Regional Geology*, HMSO, London.
- Keller, S. (1982) Die Oberkreide der Sack-Mulde bei Alfeld (Cenoman–Unter-Coniac). Lithologie, Biostratigraphie und Inoceramen. *Geologisches Jahrbuch, Reihe A*, **64**, 3–171.
- Kelly, S.R. (in press) *Marine Lower Cretaceous Rocks of Great Britain*. Geological Conservation Review Series, Joint Nature Conservation Committee, Peterborough.
- Kennedy, W.J. (1967) Burrows and surface traces from the Lower Chalk of southern England. *Bulletin of the British Museum (Natural History). Geology Series*, **15**, 125–67.
- Kennedy, W.J. (1969) The correlation of the Lower Chalk of south-east England. *Proceedings of the Geologists' Association*, **80**, 459–551.
- Kennedy, W.J. (1970) A correlation of the uppermost Albion and the Cenomanian of South-West England. *Proceedings of the Geologists' Association*, **81**, 613–77.
- Kennedy, W.J. (1971) Cenomanian ammonites from southern England. *Special Papers in Palaeontology*, **8**, 133 pp.
- Kennedy, W.J. and Garrison, R.E. (1975) Morphology and genesis of nodular chalks and hardgrounds in the Upper Cretaceous of southern England. *Sedimentology*, **22**, 311–86.
- Kennedy, W.J. and Kaplan, U. (1995a) *Pseudojacobites farmeryi* (CRICK, 1905), ein seltener Ammonit des westfälischen und englischen Ober-Turon. *Berliner geowissenschaftliche Abhandlungen, Reihe E*, **16**, (1), 25–43.
- Kennedy, W.J. and Kaplan, U. (1995b) *Parapuzosia (Parapuzosia) seppenradensis* (LANDOIS) und die Ammonitenfauna der Dülmener Schichten, unteres Unter-Campan, Westfalen. *Geologie und Paläontologie in Westfalen*, **33**, 127 pp.
- Kennedy, W.J. and Klinger, H.C. (1972) A *Texanites–Spinptychus* association from the Upper Cretaceous of Zululand. *Palaeontology*, **15**, 394–9.
- Kennedy, W.J., Walaszczyk, I., and Cobban, W.A. (2000) Pueblo, Colorado, USA, candidate Global Boundary Stratotype Section and Point for the base of the Turonian Stage of the Cretaceous, and for the base of the Middle Turonian Substage, with a revision of the Inoceramidae (Bivalvia). *Acta Geologica Polonica*, **50**, 295–334.
- Kent, R.W., Thomson, B.A., Skelhorn, R.R., Kerr, A.C., Norry, M.J. and Walsh, J.N. (1998) Emplacement of Hebridean Tertiary flood basalts: evidence from an inflated pahoehoe lava flow on Mull, Scotland. *Journal of the*

References

- Geological Society, London*, **155**, 599–607.
- Kermack, K. A. (1954) A biometrical study of *Micraster coranguinum* and *M. (Isomicraster) senonensis*. *Philosophical Transactions of the Royal Society of London, Series B*, **649**, 375–428.
- Kerr, A.C. and Kent, R.W. (1998) Discussion on 'Application of palynological data to the chronology of the Palaeogene lava fields of the British Province: implications for magmatic stratigraphy'. *Journal of the Geological Society, London*, **155**, 733.
- Kirby, G.A. and Swallow, P. (1987) Tectonism and sedimentation in the Flamborough Head region of north-east England. *Proceedings of the Yorkshire Geological Society*, **46**, 301–9.
- Lake, R.D., Young, B., Wood, C.J. and Mortimore, R.N. (1987) *Geology of the Country around Lewes*, Memoir of the British Geological Survey, Sheet 319 (England and Wales), HMSO, London, 117 pp.
- Lambert, J. (1878) Notice stratigraphique sur l'étage Sénonien aux environs de Sens. In *Etudes sur les Échinides fossiles du département de l'Yonne*, (ed. G. Cotteau), J.B. Baillière, Paris, pp. 365–428.
- Lambert, J. (1882a) Note sur la Craie du département de l'Yonne. *Bulletin de la Société géologique de France, 3rd series*, **10**, 427–34.
- Lambert, J. (1882b) Notice stratigraphique sur l'étage Turonien du département de l'Yonne. *Bulletin de la Société Scientifique d'histoire naturelle de l'Yonne*, **35**, 144–73.
- Lambert, J. (1895) Essai d'une monographie du genre *Micraster* et notes sur quelques Échinides. In *Recherches sur la Craie Supérieure*, 1 (1) (A. de Grossouvre), *Mémoires pour servir à l'explication de la carte géologique détaillée de la France*, pp. 149–267.
- Lambert, J. (1901) Errata and addenda (to the above). In *Recherches sur la Craie Supérieure*, 1 (2) (A. de Grossouvre), *Mémoires pour servir à l'explication de la carte géologique détaillée de la France*, pp. 957–71.
- Lambert, J. and Thiéry, P. (1924) *Essai de nomenclature raisonnée des Échinides*, Ferrière, Chaumont. 1909–1925.
- Lamolda, M.A., Gorostidi, A. and Paul, C.R.C. (1994) Quantitative estimates of calcareous nannofossil changes across the Plenus Marls (latest Cenomanian), Dover, England: implications for the generation of the Cenomanian–Turonian Boundary Event. *Cretaceous Research*, **15**, 143–64.
- Lamolda, M.A. and Hancock, J.M. (1996) The Santonian Stage. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, **66** (supp.), 95–102.
- Lamont-Black, J., and Mortimore, R. N. (2000) Dissolution tubules: A new karst structure from the English Chalk. *Zeitschrift der Geomorphologie*, **44**, 469–89.
- Lamplugh, G.W. (1880) On a fault in the Chalk of Flambro' Head, with some notes on the Drift of the locality. *Proceedings of the Yorkshire Geological and Polytechnic Society*, **7**, 242–5.
- Lamplugh, G.W. (1894) Notes on the coast between Bridlington and Filey. *Proceedings of the Yorkshire Geological and Polytechnic Society*, **12**, 424–31.
- Lamplugh, G.W. (1895) Notes on the White Chalk of Yorkshire. Parts I and II. *Proceedings of the Yorkshire Geological and Polytechnic Society*, **13**, 65–87.
- Lamplugh, G.W. (1896) Notes on the White Chalk of Yorkshire. Part III. The geology of Flamborough Head, with notes on the Yorkshire Wolds. *Proceedings of the Yorkshire Geological and Polytechnic Society*, **13**, 171–91.
- Lee, G.W. and Bailey, E.B. (1925) *The Pre-Tertiary Geology of Mull, Loch Aline, and Oban*, Memoir of the Geological Survey of Great Britain (Scotland), HMSO, Edinburgh.
- Lohmann, H. (1909) Die Gehäuse und Gallertblasen der Appendicularien und ihre Bedeutung für die Erforschung des Lebens im Meer. *Verhandlungen Deutsche Zoologische Gesellschaft*, **19**, 200–39.
- Lord, J.A., Clayton, C.R.I. and Mortimore, R.N. (2001) *The Engineering Properties of Chalk*, CIRIA, London.
- Lott, G.K., Ball, K.C. and Wilkinson, I.P. (1985) Mid-Cretaceous stratigraphy of a cored borehole in the western part of the Central North Sea Basin. *Proceedings of the Yorkshire Geological Society*, **47**, 139–47.
- Lott, G.K. and Knox, R.W.O'B. (1994) *Lithostratigraphical nomenclature of the UK North Sea, Volume 7. Post Triassic of the Southern North Sea*, British Geological Survey, Keyworth, 153 pp.
- Lowden, B., Braley, S., Hurst, A. and Lewis, J. (1992) Sedimentological studies of the Cretaceous Loch Aline Sandstone, NW Scotland. In *Basins on the Atlantic Seaboard: Petroleum Geology, Sedimentology and Basin*

References

- Evolution*, (ed. J. Parnell), *Geological Society of London, Special Publication*, No. 62, pp.159–62.
- Lyell, C. (1833). *Principles of Geology*, John Murray, London.
- Lyell, C. (1852). *A Manual of Elementary Geology*, 4th edn, John Murray, London.
- McKerrow, W.S. and Kennedy, W.J. (1973) *Geology around the University Towns: The Oxford District*, 2nd edn, Geologists' Association Field Guide No. 3, Geologists' Association, London, 19 pp.
- MacLennan, R.M. (1949) Starfish from the Glass Sand of Lochaline. *Geological Magazine*, **86**, 94–6.
- Mantell, G.A. (1822) *The Fossils of the South Downs or Illustrations of the Geology of Sussex*, Lepton Relfe, London, 327 pp.
- Mantell, G.A. (1827) *Illustrations of the Geology of Sussex*, Lepton Relfe, London, 92 pp.
- Markham, R. (1967) Fossils recorded from the Gipping Valley Chalk. *Bulletin of the Geological Group, Ipswich*, **2**, 1–4.
- Matsumoto, T. and Noda, M. (1986) Some inoceramids (Bivalvia) from the Cenomanian (Cretaceous) of Japan. 1. New or little known four species from Hokkaido and Kyushu. *Transactions and Proceedings of the Palaeontological Society of Japan, N.S.*, **71**, 317–27.
- Meyer, C.J.A. (1874) On the Cretaceous rocks of Beer Head and the adjacent cliff sections, and on the relative horizons therein of the Warminster and Blackdown fossiliferous deposits. *Quarterly Journal of the Geological Society of London*, **30**, 369–93.
- Milankovitch, M. (1941) *Kanton der Erdbestrahlung und seine Anwendung auf das Eiszeitenproblem*, Serbian Academy of Sciences, Belgrade.
- Mimran, Y. (1978) The induration of Upper Cretaceous Yorkshire and Irish chalks. *Sedimentary Geology*, **20**, 141–64.
- Mitchell, S.F. (1994) New data on the biostratigraphy of the Flamborough Chalk Formation (Santonian, Upper Cretaceous) between South Landing and Danes Dyke, North Yorkshire. *Proceedings of the Yorkshire Geological Society*, **50**, 113–8.
- Mitchell, S.F. (1995a) Lithostratigraphy and biostratigraphy of the Hunstanton Formation (Red Chalk, Cretaceous) succession at Speeton, North Yorkshire, England. *Proceedings of the Yorkshire Geological Society*, **50**, 285–303.
- Mitchell, S.F. (1995b) *Uintacrinus anglicus* Rasmussen from the Upper Cretaceous Flamborough Chalk Formation of Yorkshire: implications for the Santonian–Campanian boundary. *Cretaceous Research*, **16**, 745–756.
- Mitchell, S.F. (1996) Foraminiferal assemblages from the late Lower and Middle Cenomanian of Speeton (North Yorkshire, UK): relationships with sea-level fluctuations and watermass distribution. *Journal of Micropalaeontology*, **15**, 37–54.
- Mitchell, S.F. (2000) The Welton Formation (Chalk Group) at Speeton, NE England: implications for the late Cretaceous evolution of the Market Weighton Structure. *Proceedings of the Yorkshire Geological Society*, **53**, 17–24.
- Mitchell, S.F. and Carr, I.T. (1998) Foraminiferal response to mid-Cenomanian (Upper Cretaceous) palaeoceanographic events in the Anglo-Paris Basin (Northwest Europe). *Palaeogeography, Palaeoclimatology, Palaeoecology*, **137**, 103–25.
- Mitchell, S.F. and Veltkamp, C.J. (1997) *Schackoina moliniensis* Reichel from the Lower Cenomanian of north-east England and its stratigraphical significance. *Proceedings of the Yorkshire Geological Society*, **51**, 367–72.
- Mitchell, S.F., Paul, C.R.C. and Gale, A.S. (1996) Carbon isotopes and sequence stratigraphy. In *High Resolution Sequence Stratigraphy: Innovations and Applications*, (eds J.A. Howell and J.F. Aitken), *Geological Society of London, Special Publication*, No. 104, pp. 11–24.
- Mitchell, S.F., Ball, J.D., Crowley, S.F., Marshall, J.D., Paul, C.R.C., Veltkamp, C.J. and Samir, A. (1997) Isotope data from Cretaceous chalks and foraminifera: Environmental or diagenetic signals? *Geology*, **25**, 691–4.
- Moghadam, H.V. and Paul, C.R.C. (2000) Micropalaeontology of the Cenomanian at Chinnor, Oxfordshire, and comparison with the Dover–Folkestone succession. *Proceedings of the Geologists' Association*, **111**, 17–39.
- Montgomery, P., Hailwood, E.A., Gale, A.S. and Burnett, J.A. (1998) The magnetostratigraphy of the Coniacian–Late Campanian chalk sequences in southern England. *Earth and Planetary Science Letters*, **156**, 209–24.
- Morter, A.A. and Wood, C.J. (1983) The

References

- biostratigraphy of Upper Albian–Lower Cenomanian *Aucellina* in Europe. *Zitteliana*, **10**, 515–29.
- Mortimer, R. (1878) On the flints of the Chalk of Yorkshire. *Proceedings of the Geologists' Association*, **5**, 344–54.
- Mortimore, R.N. (1977) A reinterpretation of the Chalk of Sussex. Field Meeting for the Geologists' Association on a revision of the stratigraphy and new aspects of the sedimentology 14–15 May, 1977. [Unpublished Handout.]
- Mortimore, R.N. (1979) The relationship of stratigraphy and tectonofacies to the physical properties of the White Chalk of Sussex. PhD thesis, Brighton Polytechnic.
- Mortimore, R.N. (1983). The stratigraphy and sedimentation of the Turonian–Campanian in the Southern Province of England. *Zitteliana*, **10**, 27–41.
- Mortimore, R.N. (1986a) Stratigraphy of the Upper Cretaceous White Chalk of Sussex. *Proceedings of the Geologists' Association*, **97**, 97–139.
- Mortimore, R.N. (1986b) Controls on Upper Cretaceous sedimentation in the South Downs with particular reference to flint distribution. In *The Scientific Study of Flint and Chert*, (eds G. de G. Sieveking and M.B. Hart), Cambridge University Press, Cambridge, pp. 21–42.
- Mortimore, R.N. (1987) Upper Cretaceous White Chalk in the North and South Downs, England: a correlation. *Proceedings of the Geologists' Association*, **98**, 77–86.
- Mortimore, R.N. (1988) Upper Cretaceous Chalk in the Anglo-Paris Basin: a discussion of lithostratigraphical units. *Proceedings of the Geologists' Association*, **99**, 67–70.
- Mortimore, R.N. (1990) Chalk or chalk. In *Chalk*, (eds J.B. Burland, R.N. Mortimore, L.D. Roberts, D.L. Jones and B.O. Corbett), Thomas Telford, London, pp. 15–46.
- Mortimore, R.N. (1997) *The Chalk of Sussex and Kent*, Geologists' Association Field Guide No. 57, Geologists' Association, London, 193 pp.
- Mortimore, R.N. and Fielding, P. (1990) The relationship between texture, density and strength of Chalk. In *Chalk*, (eds J.B. Burland, R.N. Mortimore, L.D. Roberts, D.L. Jones and B.O. Corbett), Thomas Telford, London, 109–32.
- Mortimore, R.N. and Pomerol, B. (1987) Correlation of the Upper Cretaceous White Chalk (Turonian to Campanian) in the Anglo-Paris Basin. *Proceedings of the Geologists' Association*, **98**, 97–143.
- Mortimore, R.N. and Pomerol, B. (1990) Les silex du Turonien: niveaux repères et corrélation de part et d'autre de la Manche. In *Le Silex de sa genèse à l'outil. Proceedings of the 5th International Flint Symposium, Cahiers de Quaternaire*, **17**, 85–94.
- Mortimore, R.N. and Pomerol, B. (1991a) Upper Cretaceous tectonic disruptions in a placid Chalk sequence in the Anglo-Paris Basin. *Journal of the Geological Society, London*, **148**, 391–404.
- Mortimore, R.N. and Pomerol, B. (1991b) Stratigraphy and Eustatic Implications of Trace Fossil Events in the Upper Cretaceous Chalk of Northern Europe. *Palaïos*, **6**, 216–31.
- Mortimore, R.N. and Pomerol, B. (1996) A revision of Turonian litho- and biostratigraphy in the Anglo-Paris Basin. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, **77**, 423–41.
- Mortimore, R.N. and Pomerol, B. (1997) Upper Cretaceous tectonic phases and end Cretaceous inversion in the Chalk of the Anglo-Paris Basin. *Proceedings of the Geologists' Association*, **108**, 231–55.
- Mortimore, R.N. and Pomerol, B. (1998) Basin analysis in engineering geology: Chalk of the Anglo-Paris basin. In *Proceedings of the Eighth International Congress International Association for Engineering Geology and the Environment, 1998, Vancouver*, (eds D. Moore and G. Hung), Balkema, Rotterdam, pp. 3249–68.
- Mortimore, R.N. and Wood, C.J. (1986) The distribution of flint in the English Chalk, with particular reference to the 'Brandon Flint Series' and the high Turonian flint maximum. In *The Scientific Study of Flint and Chert*, (eds G. de G. Sieveking and M.B. Hart), Cambridge University Press, Cambridge, pp. 7–20.
- Mortimore, R.N. and Young, B. (1980) Field meeting for the Geologists' Association at Lewes, Shoreham and Eastbourne, August 1980. [Unpublished handout and report.]
- Mortimore, R.N., Pomerol, B. and Foord, R.J. (1990) Engineering stratigraphy and palaeogeography for the Chalk of the Anglo-Paris Basin. In *Chalk*, (eds J.B. Burland, R.N.

References

- Mortimore, L.D. Roberts, D.L. Jones and B.O. Corbett), Thomas Telford, London, pp. 47–62.
- Mortimore, R.N., Roberts, L.D. and Jones, D.L. (1990) Logging of chalk for engineering purposes. In *Chalk*, (eds J.B. Burland, R.N. Mortimore, L.D. Roberts, D.L. Jones and B.O. Corbett), Thomas Telford, London, pp. 133–52.
- Mortimore, R.N., Pomerol, B. and J. Lamont-Black. (1996) Chapter 28. Examples of structural and sedimentological controls on chalk engineering behaviour. In *Engineering Geology of the Channel Tunnel*, (eds C.S. Harris, M.B. Hart, P.M. Varley and C.D. Warren), Thomas Telford, London, pp. 436–43.
- Mortimore, R.N., Wood, C.J., Pomerol, B. and Ernst, G. (1998) Dating the phases of the Subhercynian tectonic epoch: Late Cretaceous tectonics and eustatics in the Cretaceous basins of northern Germany compared with the Anglo-Paris Basin. *Zentralblatt für Geologie und Paläontologie, Teil 1*, 1996, (11/12), 1349–1401.
- Murray, K.H. (1986) Correlation of electrical resistivity marker bands in the Cenomanian and Turonian Chalk from the London Basin to East Yorkshire. *British Geological Survey Report*, 17, (8).
- Mussett, A.F. (1986) ^{40}Ar – ^{39}Ar step-heating ages of the Tertiary igneous rocks of Mull, Scotland. *Journal of the Geological Society, London*, 143, 887–96.
- Neale, J.W. (1976) Cretaceous. In *The Geology and Mineral Resources of Yorkshire*, (eds D.H. Rayner and J.E. Hemingway), Yorkshire Geological Society, Leeds, pp. 225–43.
- Neugebauer, J. (1973) The diagenetic problem of chalk. The role of pressure solution and pore fluid. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, 143, 223–45.
- Neugebauer, J. (1974) Some aspects of cementation in chalk. In *Pelagic Sediments: on Land and under the Sea*, (eds K.J. Hsü and H.C. Jenkyns), *Special Publication of the International Association of Sedimentologists*, No. 1, pp. 149–76.
- Nichols, D. (1959) Changes in the heart-urchin *Micraster* interpreted in relation to living forms. *Philosophical Transactions of the Royal Society of London. Series B*, 242, 347–437.
- Niebuhr, B. (1995) Fazies-Differenzierungen und ihre Steuerungsfaktoren in der höheren Oberkreide von S-Niedersachsen/Sachsen-Anhalt (N-Deutschland). *Berliner geowissenschaftliche Abhandlungen, Reihe A*, 174, 1–131.
- Niebuhr, B., Volkmann, R. and Schönfeld, J. (1997) Das Obercampane *polyplacum*-Event der Lehrter Westmulde (Oberkreide, N-Deutschland): Bio- /Litho- /Sequenzstratigraphie, Fazies-Entwicklung und Korrelation. *Freiberger Forschungsheft, Reihe C*, 468, 211–43.
- Noda (1975) Succession of *Inoceramus* in the Upper Cretaceous of southwest Japan. *Memoir of the Faculty of Sciences of Kyushu University, Series D (Geology)*, 23, 22–261.
- Noda, M. (1984) Notes on *Mytiloides incertus* (Cretaceous, Bivalvia) from the Upper Turonian of the Pombets area, central Hokkaido. *Transactions and Proceedings of the Palaeontological Society of Japan, N.S.*, 136, 455–73.
- Obradovitch, J. (1993) A Cretaceous time scale. In *Evolution of the Western Interior Basin*, (eds W.G.E. Caldwell and E.G. Kauffman), *Geological Association of Canada, Special Paper*, No. 39, pp. 379–96.
- Odin, G.S. (1996) Definition of a Global Boundary Stratotype Section and Point for the Campanian/Maastrichtian boundary. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, 66 (supp.), pp. 111–7.
- Owen, E.F. (1962) The brachiopod genus *Cyclothyris*. *Bulletin of the British Museum (Natural History). Geology Series*, 7, 39–63.
- Owen, E.F. (1968) A further study of some Cretaceous rhynchonelloid brachiopods. *Bulletin of the Indian Geologists Association*, 1, 17–32.
- Owen, E.F. (1970) A revision of the brachiopod subfamily Kingeninae Elliott. *Bulletin of the British Museum (Natural History). Geology Series*, 19, 27–83.
- Owen, E.F. (1977) Evolutionary trends in some Mesozoic Terebratulaceae. *Bulletin of the British Museum (Natural History). Geology Series*, 28, 208–53.
- Owen, E.F. (1988) Cenomanian brachiopods from the Lower Chalk of Britain and northern Europe. *Bulletin of the British Museum (Natural History). Geology Series*, 44.
- Owen, E.F. and Smith, A.B. (1987) *Fossils of the Chalk*, Palaeontological Association Field

References

- Guides to fossils No. 2, Palaeontological Association, London, 159 pp.
- Owen, H.G. (1995) The upper part of the Carstone and the Hunstanton Red Chalk (Albian) of the Hunstanton Cliff, Norfolk. *Proceedings of the Geologists' Association*, **106**, 171–81.
- Owen, M. (1970) Turonian Foraminifera from Southern England. PhD thesis, University of London.
- Parkinson, J. (1819) Remarks on the Fossils collected by Mr. William Phillips, near Dover and Folkstone. *Transactions of the Geological Society*, **5**, 52–9.
- Pattison, J., Berridge, N.G., Allsop, J.M. and Wilkinson, I.P. (1993) *Geology of the Country around Sudbury (Suffolk)*, Memoir of the British Geological Survey (England and Wales), Sheet 206, HMSO, London, 72 pp.
- Paul, C.R.C., Mitchell, S.F., Marshall, J.D., Leary, P.N., Gale, A.S., Duane, A.M. and Ditchfield, P.W. (1994) Palaeoceanographic events in the Middle Cenomanian of Northwest Europe. *Cretaceous Research*, **15**, 707–38.
- Paul, C.R.C., Mitchell, S.F., Vaziri, M.R., Gorostidi, A. and Marshall, J.D. (1999) The Cenomanian–Turonian boundary at Eastbourne (Sussex, UK): a proposed European reference section. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **150**, 83–121.
- Peake, N.B. (1967) The coastal Chalk of North-East Thanet. In *The London Region (South of the Thames)*, (ed. W.S. Pitcher), Geologists' Association Field Guide No. 30B, Geologists' Association, London, pp. 14–19.
- Peake, N.B. and Hancock, J.M. (1961) The Upper Cretaceous of Norfolk. *Transactions of the Norfolk and Norwich Naturalists' Society*, **19**, 293–339.
- Peake, N.B. and Hancock, J.M. (1970) The Upper Cretaceous of Norfolk [reprinted with corrigenda and addenda with new map]. In *The Geology of Norfolk*, (eds G.P. Larwood and B.M. Funnell), Soman-Wherry Press Ltd, Norwich, pp. 293–339 a–j.
- Penning, W.H. and Jukes-Browne, A.J. (1881) *Geology of the Neighbourhood of Cambridge*, Memoir of the Geological Survey of Great Britain (England and Wales) Old Series, HMSO, London.
- Pettitt, N.E. (1949) *A Monograph on the Rhynchonellidae of the British Chalk, I*, Monograph of the Palaeontographical Society, London, 26 pp.
- Pettitt, N.E. (1954) *A Monograph on the Rhynchonellidae of the British Chalk, II*, Monograph of the Palaeontographical Society, London, pp. 27–52.
- Phillips, W. (1818) *A Selection of Facts from the Best Authorities Arranged so as to form an Outline of the Geology of England and Wales*, William Phillips, London, 240 pp.
- Phillips, W. (1819) Remarks on the Chalk Cliffs in the neighbourhood of Dover, and on the Blue Marle covering the Green Sand near Folkstone. *Transactions of the Geological Society*, **5**, 16–47.
- Phillips, J. (1829) *Illustrations of the Geology of Yorkshire, or a Description of the Strata and Organic Remains of the Yorkshire Coast*, Thomas Wilson and Sons, York, 192 pp.
- Pitchford, A. (1991) A summary of the stratigraphy of current exposures of *Belemnitella mucronata* Zone Chalk (Campanian, Upper Cretaceous) in Norfolk. *Bulletin of the Geological Society of Norfolk*, **40**, 3–24.
- Pomerol, B. (1976) Géochimie des craies du Cap d'Antifer (Haute Normandie). *Bulletin de la Société géologique de France*, **7**, (18), 1051–60.
- Pomerol, B. (1983) Geochemistry of the Late Cenomanian–Early Turonian Chalks of the Paris Basin: Manganese and Carbon Isotopes in Carbonates as Palaeoceanographic Indicators. *Cretaceous Research*, **4**, 85–93.
- Pomerol, B. and Mortimore, R.N. (1993) Lithostratigraphy and correlation of the Cenomanian–Turonian boundary sequence. *Newsletters on Stratigraphy*, **28**, 59–78.
- Pomerol, B., Bailey, H.W., Monciardini, C. and Mortimore, R.N. (1987) Lithostratigraphy and Biostratigraphy of the Lewes and Seaford Chalks: A Link across the Anglo-Paris Basin at the Turonian–Senonian boundary. *Cretaceous Research*, **8**, 289–304.
- Pratt, L.M., Force, E.R. and Pomerol, B. (1991) Coupled manganese and carbon-isotopic events in marine carbonates at the Cenomanian–Turonian boundary. *Journal of Sedimentary Petrology*, **61**, 370–83.
- Price, F.G.H. (1874) On the Gault of Folkestone. *Quarterly Journal of the Geological Society of London*, **30**, 342–66.
- Price, F.G.H. (1877) On the beds between the Gault and the Upper Chalk near Folkestone. *Quarterly Journal of the Geological Society of London*, **33**, 431–48.

References

- Rasmussen, H.W. (1961) A monograph on the Cretaceous Crinoidea. *Det Kongelige Danske Videnskabernes Selskab, Biologiske Skrifter*, **12**, 1–248.
- Rawson, P.F., Curry, D., Dilley, F.C., Hancock, J.M., Kennedy, W.J., Neale, J.W., Wood, C.J. and Worssam, B.C. (1978) *A Correlation of Cretaceous Rocks in the British Isles*, Geological Society of London, Special Report, No. 9, Scottish Academic Press, Edinburgh.
- Rawson, P.F., Dhondt, A.V., Hancock, J.M. and Kennedy, W.J. (1996) Proceedings 'Second International Symposium on Cretaceous Stage Boundaries', Brussels 8–16 September 1995. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, **66** (supp.), 117 pp.
- Rawson, P.F., Allen, P. and Gale, A.S. (2001) The Chalk Group – a revised lithostratigraphy. *Geoscientist*, **11**, 21.
- Rawson, P.F. and Whitham, F. (1992a) Itinerary XI. Thornwick Bay and North Landing, Flamborough. In *The Yorkshire Coast*, (eds P.F. Rawson and J.K. Wright), Geologists' Association Field Guide No. 34, Geologists' Association, London, pp. 94–9.
- Rawson, P.F. and Whitham, F. (1992b) Itinerary XII. Flamborough Head. In *The Yorkshire Coast*, (eds P.F. Rawson and J. K. Wright), Geologists' Association Field Guide No. 34, Geologists Association, London, pp. 100–3.
- Reid, C. (1882) *The Geology of the Country around Cromer*, Memoir of the Geological Survey of Great Britain (England and Wales) Old Series, HMSO, London.
- Reid, C. (1897) *The Geology of the Country around Bognor*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, HMSO, London, 52 pp.
- Reid, C. (1898) *The Geology of the Country around Eastbourne*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, HMSO, London, 15 pp.
- Reid, C. [with contributions from G.W. Lamplugh and A.J. Jukes-Browne] (1903) *The Geology of the Country near Chichester*, Memoirs of the Geological Survey of Great Britain (England and Wales) New Series, HMSO, London, 52 pp.
- Reid, C. and Strahan, A. (1889) *The Geology of the Isle of Wight*, 2nd edn, Memoir of the Geological Survey of Great Britain, HMSO, London.
- Reid, R.E.H. (1958) Remarks on the Upper Cretaceous Hexactinellida of County Antrim (Part 2). *The Irish Naturalists' Journal*, **12**, 263–8.
- Reid, R.E.H. (1962) Sponges and the Chalk Rock. *Geological Magazine*, **99**, 273–8.
- Reid, R.E.H. (1968) Hexactinellid faunas in the Chalk of England and Ireland. *Geological Magazine*, **105**, 15–22.
- Reid, R.E.H. (1973) The Chalk Sea. *The Irish Naturalists' Journal*, **17**, 357–75.
- Reid, R.E.H. (1976) Late Cretaceous climatic trends, faunas and hydrography in Britain and Ireland. *Geological Magazine*, **113**, 115–28.
- Renevier, E. (1874) Tableau des terrains sédimentaires. *Bulletin de la Société vaudoise des sciences naturelles*, **13**, 218–52.
- Richey, J.E., MacGregor, A.G. and Anderson, F.W. (1961) *Scotland: The Tertiary Volcanic District*, *British Regional Geology*, No. 3, HMSO, Edinburgh.
- Riedel, L. (1937) Über Transgressionserscheinungen im hohen Senon Hannovers und das Aufsteigen der Salzstöcke von Hänigsen-Wathlingen und Wienhausen-Sandlingen. *Zeitschrift der deutschen geologischen Gesellschaft*, **89**, 1–64.
- Riedel, L. (1940) Über eine tektonische Phase an der Wende Quadraten-Mucronaten-Senon (Peine Phase) in Nordwestdeutschland. *Zeitschrift der deutschen geologischen Gesellschaft*, **92**, 253–8.
- Riedel, L. (1942) *Das Mesozoikum in Niedersachsen – Obere Kreide*. Schriften der Wirtschaftswissenschaftlichen Gesellschaft zum Studium Niedersachsens E. V., *Neue Folge*, **2**, Oldenburgh, 52 pp.
- Robaszynski, F., Caron, M., Dupuis, C., Amédéo, F., González Donoso, J.-M., Linares, D., Hardenbol, J., Gartner, S., Calandra, F. and Deloffre, R. (1990) A tentative integrated stratigraphy in the Turonian of central Tunisia: formations, zones and sequential stratigraphy in the Kalaat Senan area. *Bulletin des Centres de Recherches Exploration et Production Elf-Aquitaine*, **14**, 213–384.
- Robaszynski, F., Gale, A.S., Juignet, P., Amédéo, F. and Hardenbol, J. (1998) Sequence stratigraphy in the Upper Cretaceous Series of the Anglo-Paris Basin: exemplified by the Cenomanian Stage. In *Mesozoic and Cenozoic Sequence Stratigraphy of European Basins*, (eds J. Hardenbol, J. Thierry, M.B. Farley, Th. Jaquin, P.-C. de Graciansky and P.R. Vail),

References

- Society of Economic Paleontologists and Mineralogists Special Publication*, No. 60, pp. 363–86.
- Robinson, N.D. (1986) Lithostratigraphy of the Chalk Group of the North Downs, southeast England. *Proceedings of the Geologists' Association*, 97, 141–70.
- Rowe, A.W. (1899) An analysis of the genus *Micraster*, as determined by rigorous zonal collecting from the Zone of *Rhynchonella cuvieri* to that of *Micraster coranguinum*. *Quarterly Journal of the Geological Society of London*, 55, 494–547.
- Rowe, A.W. (1900) The Zones of the White Chalk of the English Coast. I. Kent and Sussex. *Proceedings of the Geologists' Association*, 16, 289–368.
- Rowe, A.W. (1901) The Zones of the White Chalk of the English Coast. II. Dorset. *Proceedings of the Geologists' Association*, 17, 1–76.
- Rowe, A.W. (1903) The Zones of the White Chalk of the English Coast. III. Devon. *Proceedings of the Geologists' Association*, 18, 1–51.
- Rowe, A.W. (1904) The Zones of the White Chalk of the English Coast. IV. Yorkshire. *Proceedings of the Geologists' Association*, 18, 193–296.
- Rowe, A.W. (1908). The Zones of the White Chalk of the English Coast. V. The Isle of Wight. *Proceedings of the Geologists' Association*, 20, 209–352.
- Rowe, A.W. (1929 posthumous) The Zones of the White Chalk of Lincolnshire. *Naturalist*, 875, 411–39.
- Sahni, M.R. (1929) *A Monograph of the Terebratulidae of the British Chalk*, Monograph of the Palaeontographical Society, London, 62 pp.
- Sainty, J.E. (1949) The Trimingham Chalk. *Proceedings of the Geologists' Association*, 60, 216–8.
- Scanes, J. (1916) In *Excursion to Mere and Maiden Bradley in Wiltshire, April 20th–26th, Easter, 1916* (P.B. Bartlett and J. Scanes). *Proceedings of the Geologists' Association*, 27, pp. 117–25.
- Schlanger, S.O. and Jenkyns, H.C. (1976) Cretaceous oceanic anoxic events: causes and consequences. *Geologie en Mijnbouw*, 55, 179–84.
- Scholle, P.A. (1974) Diagenesis of Upper Cretaceous chalks from England, Northern Ireland and the North Sea. In *Pelagic Sediments: on Land and under the Sea*, (eds K.J. Hsü and H.C. Jenkyns), *Special Publication of the International Association of Sedimentologists*, No. 1, pp. 177–210.
- Schönfeld, J. and Burnett, J. (1991) Biostratigraphical correlation of the Campanian–Maastrichtian boundary: Lägerdorf–Hemmoor (northwestern Germany), DSDP Sites 548A, 549 and 551 (eastern North Atlantic) with palaeobiogeographical and palaeoceanographical implications. *Geological Magazine*, 128, 479–503.
- Schönfeld, J. and Schulz, M.-G. (coord.) (1996) New results on biostratigraphy, palaeomagnetism, geochemistry and correlation from the standard section for the Upper Cretaceous white chalk of northern Germany (Lägerdorf–Kronsmoor–Hemmoor). *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, 77, 545–75.
- Schulz, M.-G. (1982) Morphometrisch-variationsstatistische Untersuchungen zur Phylogenie der Belemniten-Gattung *Belemnella* im Untermaastricht NW-Europas. *Geologisches Jahrbuch, Reihe A*, 47, 3–157.
- Scott, J.F. (1928) General geology and physiography of Morvern, Argyll. *Transactions of the Geological Society of Glasgow*, 18, 149–89.
- Schmid, F. (1953) Schlüsselprofile der Oberen Kreide NW-Deutschlands. *Paläontologische Zeitschrift*, 27, 234–5.
- Schmid, F. (1959) Biostratigraphie du Campanien-Maastrichtien du NE de la Belgique sur la base des Belemnites. *Annales de la Société Géologique de Belgique*, 82, 235–56.
- Seeley, H.G. (1869) *Index to the Fossil Remains of Aves, Ornithosauria, and Reptilia, from the Secondary System of Strata arranged in the Woodwardian Museum of the University of Cambridge (with a Prefatory Note by the Rev. Prof. A. Sedgwick)*, Deighton, Bell, and Co., Cambridge; Bell and Daldy, London, 143 pp.
- Seitz, O. (1934) Die Variabilität des *Inoceramus labiatus* v. Schloth. *Jahrbuch der Preussischen Geologischen Landesamt für 1934*, 55, 429–74.
- Seitz, O. (1961) Die Inoceramen des Santon von Nordwestdeutschland. Teil I. (Die Untergattungen *Platyceramus*, *Cladoceramus* und *Cordiceramus*). *Beihefte zum Geologischen Jahrbuch*, 46, 186 pp.
- Seitz, O. (1965) Die Inoceramen des Santon und

References

- Unter-Campan von Nordwestdeutschland. II Teil. (Biometrie, Dimorphismus und Stratigraphie der Untergattung *Sphenoceras* J. Böhm). *Beihfte zum Geologischen Jahrbuch*, 69, 194 pp.
- Seitz, O. (1967) Die Inoceramen des Santon und Unter-Campan von Nordwestdeutschland. III Teil. Taxonomie und Stratigraphie der Untergattungen *Endocostea*, *Haenleinia*, *Platyceras*, *Cladoceras*, *Selenoceras* und *Cordiceras* mit besonderer Berücksichtigung des Parasitismus bei diesen Untergattungen. *Beihfte zum Geologischen Jahrbuch*, 75, 171 pp.
- Selwood, E.B., Edwards, R.A., Simpson, S., Chesher, J.A. Hamblin, R.J.O., Henson, M.R., Riddolls, B.W. and Waters, R.A. (1984) *Geology of the Country around Newton Abbot*, Memoir of the British Geological Survey (England and Wales), Sheet 339, HMSO, London, 212 pp.
- Sharpe, D. (1853–57) *Description of the Fossil Remains of Mollusca found in the Chalk of England*, Monograph of the Palaeontographical Society, London, 68 pp.
- Shephard-Thorn, E.R. (1988) *Geology of the Country around Ramsgate and Dover*, Memoir of the British Geological Survey New Series, Sheets 274 and 290, HMSO, London.
- Shephard-Thorn, E.R., Moorlock, B.S.P., Cox, B.M., Allsop, J.M. and Wood, C.J. (1994) *Geology of the Country around Leighton Buzzard*, Memoir of the British Geological Survey (England and Wales) Sheet 220, HMSO, London, 127 pp.
- Sheppard, T. (1903) *Geologic Rambles in East Yorkshire*, A. Brown and Sons, London, Hull and York, 235 pp.
- Shepherd, W. (1972) *Flint. Its Origin, Properties and Uses*, Faber and Faber, London, 255 pp.
- Simpson, J.B. (1961) The Tertiary pollen flora of Mull and Ardnamurchan. *Transactions of the Royal Society of Edinburgh*, 64, 421–68.
- Skelhorn, R.R. (1969) *The Tertiary Igenous Geology of the Isle of Mull*, Geologists' Association Field Guide No. 20, Benham, Colchester, 35 pp.
- Skertchly, S.B.J. (1879) *On the Manufacture of Gunflints: the Methods of Excavating for Flint, the Age of Palaeolithic Man and the Connexion between Neolithic Art and the Gun-flint Trade*, Geological Survey of Great Britain, HMSO, London, 80 pp.
- Smith, A. (1984) *Echinoid Palaeobiology. Special Topics in Palaeontology*, George Allen and Unwin, London, 190 pp.
- Smith, A.B., Paul, C.R.C., Gale, A.S. and Donovan, S.K. (1988) Cenomanian and Lower Turonian echinoderms from Wilmington, south-east Devon, England. *Bulletin of the British Museum (Natural History). Geology Series*, 42, 245 pp.
- Smith, A.G. and Briden, J.C. (1977) *Mesozoic and Cenozoic Palecontinental Maps*, Cambridge University Press, Cambridge, 63 pp.
- Smith, A.J. and Curry, D. (1975) The structure and geological evolution of the English Channel. *Philosophical Transactions of the Royal Society of London. Series A*, 279, 3–20.
- Smith, N.J.P. (compiler) (1985) *Map. 1. Pre-Permian geology of the United Kingdom (South)*, 1:1 000 000, Ordnance Survey for British Geological Survey, Southampton.
- Smith, W.E. (1957a) The Cenomanian Limestone of the Beer District, South Devon. *Proceedings of the Geologists' Association*, 68, 115–35.
- Smith, W.E. (1957b) Summer Field Meeting in South Devon and Dorset. *Proceedings of the Geologists' Association*, 68, 136–52.
- Smith, W.E. (1961) The Cenomanian Deposits of South-East Devonshire. *Proceedings of the Geologists' Association*, 72, 91–134.
- Smith, W.E. and Drummond, P.V.O. (1962) Easter Field Meeting: The Upper Albian and Cenomanian Deposits of Wessex. *Proceedings of the Geologists' Association*, 73, 335–52.
- Smith, W. (1815a) *Geological Map of England and Wales*, J. Cary, London.
- Smith, W. (1815b) *A Memoir to the Map Delineation of the Strata of England and Wales, with Part of Scotland*, J. Cary, London.
- Smith, W. (1819) *Geological Map of Norfolk*, J. Cary, London.
- Sollas, W.J. and Jukes-Browne, A.J. (1873) On the included Rock-fragments of the Cambridge Upper Greensand. *Quarterly Journal of the Geological Society of London*, 29, 11–16.
- Sorby, H.C. (1861) On the organic origin of the so-called 'Crystalloids' of the Chalk. *Annals and Magazine of Natural History, Series 3*, 45, (vol. VIII), 193–200.
- Sorby, H.C. (1879) On the Structure and Origin of Limestones. *Proceedings of the Geological Society of London*, 35, 56–95.
- Sornay, J. (1966) *Ideées actuelles sur les*

References

- inocérames d'après divers travaux récents. *Annales de Paléontologie (Invertébrés)*, **52**, 57–92.
- Spath, L.F. (1926) On New Ammonites from the English Chalk. *Geological Magazine*, **63**, 77–83.
- Spath, L.F. (1943) *A Monograph of the Ammonoidea of the Gault, part 16*, Monograph of the Palaeontographical Society (London), pp. 748–50.
- Starmer, I.C. (1995a) Deformation of the Upper Cretaceous Chalk at Selwicks Bay, Flamborough Head, Yorkshire: its significance in the structural evolution of north-east England and the North Sea Basin. *Proceedings of the Yorkshire Geological Society*, **50**, 213–28.
- Starmer, I.C. (1995b) Contortions in the Chalk at Staple Nook, Flamborough Head. *Proceedings of the Yorkshire Geological Society*, **50**, 271–5.
- Stille, H. (1924) *Grundfragen der vergleichenden Tektonik*, Borntraeger, Berlin, 443 pp.
- Stokes, R.B. (1975) Royaumes et provinces faunistiques du Crétacé établis sur la base d'une étude systématique du genre *Micraster*. *Memoire du Museum national d'Histoire naturelle, Series C*, **31**, 94 pp.
- Stokes, R.B. (1977) The echinoids *Micraster* and *Epiaster* from the Turonian and Senonian chalk of England. *Palaeontology*, **20**, 805–21.
- Strahan, A. (1891) On a phosphatic chalk with *Belemnitella quadrata* at Taplow. *Quarterly Journal of the Geological Society of London*, **47**, 356–67.
- Strahan, A. (1895) Phosphatic chalk at Taplow, Berks. *Geological Magazine, New Series, Decade IV*, **2**, 336.
- Strahan, A. (1896) On a phosphatic chalk with *Holaster planus* at Lewes. *Quarterly Journal of the Geological Society of London*, **52**, 463–473.
- Strahan, A. (1898) *The Geology of the Isle of Purbeck and Weymouth*, Memoir of the Geological Survey of Great Britain, Sheet 17, HMSO, London, 278 pp.
- Strahan, A. (1917) *Potash-feldspar – phosphate of lime – alum shales – plumbago or graphite – molybdenite – chromite – talc and steatite (soapstone, soap-rock and potstone) – diatomite*, 2nd edn, Memoirs of the Geological Survey, *Special Reports on the Mineral Resources of Great Britain*, No. 5, p. 15.
- Suess, E. (1883–8) *Das Antlitz der Erde*, Prague and Leipzig. (English edn: *The Face of the Earth*, Oxford), 1904–24.
- Sumbler, M.G. (1996) The stratigraphy of the Chalk Group in Yorkshire, Humberside and Lincolnshire. *British Geological Survey, Technical Report*, WA/96/26C.
- Sumbler, M.G. and Woods, M. A. (1992) The stratigraphy of the Lower and Middle Chalk at Chinnor, Oxfordshire. *Proceedings of the Geologists' Association*, **103**, 111–8.
- Swiecicki, A. (1980) A Foraminiferal Biostratigraphy of the Campanian and Maastrichtian Chalks of the United Kingdom. PhD thesis, Plymouth Polytechnic.
- Taitt, A.H. and Kent, P.E. (1958) *Deep Boreholes at Portsdown (Hampshire) and Henfield (Sussex)*, Technical Publication of BP Co. Ltd, London.
- Tate, T.K., Robertson, A.S. and Gray, D.A. (1971) Borehole logging investigations in the Chalk of the Lambourn and Winterbourne valleys of Berkshire. *Water Supply Papers of the Institute of Geological Sciences, Research Report 5*.
- Taylor, R. (1823) Geological section of Hunstanton cliff, Norfolk. *Philosophical Magazine*, **61**, 81–3.
- Taylor, R.C. (1824) On the Alluvial Strata and on the Chalk of Norfolk and Suffolk, and on the Fossils by which they are accompanied. *Transactions of the Geological Society of London, 2nd Series*, **1**, (2), 374–8.
- Tocher, B.A. and Jarvis, I. (1987) Chapter 9. Dinoflagellate cysts and stratigraphy of the Turonian (Upper Cretaceous) chalk near Beer, southeast [sic] Devon, England. In *Micropalaeontology of Carbonate Environments*, (ed. M.B. Hart), Ellis Horwood Ltd, Chichester, pp. 138–75.
- Townsend, J. (1813) *The Character of Moses Established for Veracity as an Historian, Recording Events from the Creation to the Deluge*, Longman, Hurst, Rees, Orme and Browne, London, 448 pp.
- Toynton, R. and Parsons, D.W. (1990) The compaction history of a composite flint. *Proceedings of the Geologists' Association*, **101**, 315–33.
- Tröger, K.-A. (1967) Zur Paläontologie, Biostratigraphie und faziellen Ausbildung der unteren Oberkreide (Cenoman bis Turon). Teil I: Paläontologie und Biostratigraphie der Inoceramen des Cenomans bis Turons.

References

- Abhandlungen des Staatlichen Museums für Mineralogie und Geologie zu Dresden*, 12, 13–208.
- Tröger, K.-A. (1989) Problems of Upper Cretaceous Inoceramid Biostratigraphy in Europe and Western Asia. In *Cretaceous of the Western Tethys, Proceedings 3rd International Cretaceous Symposium, Tübingen, 1987*, (ed. J. Wiedmann), Schweizerbart, Stuttgart, pp. 911–30.
- Tröger, K.-A. (1998) Remarks concerning morphometric parameters, biostratigraphy and palaeobiogeography of Turonian inoceramids (Bivalvia) in Europe. *Zentralblatt für Geologie und Paläontologie, Teil 1*, 1996, (11/12), 1489–99.
- Tröger, K.-A. and Kennedy, W.J. (1996) The Cenomanian stage. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Sciences de la Terre*, 66 (supp.), 57–68.
- Vail, P.R. and Mitchum, R.M. Jr. (1977) Seismic stratigraphy and global changes of sea level. Part 1. Overview. In *Seismic Stratigraphy – Application to Hydrocarbon Exploration* (ed. C.E. Payton), *American Association of Petroleum Geologists Memoir*, No. 26, pp. 51–2.
- Vail, P.R., Mitchum R.M. Jr. and Thompson, S., III. (1977a) Seismic stratigraphy and global changes of sea level. Part 3. Relative changes of sea level from coastal onlap. In *Seismic Stratigraphy – Application to Hydrocarbon Exploration*, (ed. C.E. Payton), *American Association of Petroleum Geologists Memoir*, No. 26, pp. 63–82.
- Vail, P.R., Mitchum R.M. Jr. and Thompson, S., III. (1977b) Seismic stratigraphy and global changes of sea level. Part 4. Global cycles of relative changes in sea-level. In *Seismic Stratigraphy – Application to Hydrocarbon Exploration*, (ed. C.E. Payton), *American Association of Petroleum Geologists Memoir*, No. 26, pp. 83–97.
- Varley, P.M. (1996) Chapter 9. The 1974 Channel Tunnel project. In *Engineering Geology of the Channel Tunnel*, (eds C.S. Harris, M.B. Hart, P.M. Varley and C.D. Warren), Thomas Telford, London, pp. 118–28.
- Voigt, E. (1959) Die ökologische Bedeutung der Hartgründe ('Hardgrounds') in der oberen Kreide. *Paläontologische Zeitschrift*, 33, 129–47.
- Voigt, E. (1974) Über die Bedeutung der Hartgründe (hartgrounds) für die Evertbratenfauna der Maastrichter Tuffkreide. *Naturhistorisch Maandblad*, 63e Jrg. (No. 2), 32–9.
- Voigt, E. and Häntzchel, W. (1964) Gradierte Schichtung in der Oberkreide Westfalens. *Fortschritte in der Geologie von Rheinland und Westfalen*, 7, 495–548.
- Voigt, S. and Hilbrecht, H. (1997) Late Cretaceous carbon isotope stratigraphy in Europe: Correlation and relations with sea level and sediment stability. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 134, 39–59.
- Voigt, S. and Wiese, F. (2000) Evidence for Late Cretaceous (late Turonian) climate cooling from oxygen-isotope variations and palaeobiogeographic changes in western and Central Europe. *Journal of the Geological Society, London*, 157, 737–43.
- Walaszczyk, I. (1997) Biostratigraphie und Inoceramen des oberen Unter-Campan und unteren Ober-Campan Norddeutschlands. *Geologie und Paläontologie in Westfalen*, 49, 111 pp.
- Walaszczyk, I. and Cobban, W.A. (2000) Inoceramid faunas and biostratigraphy of the Upper Turonian–Lower Coniacian of the Western Interior of the United States. *Special Papers in Palaeontology*, 64, 118 pp.
- Walaszczyk, I. and Wood, C.J. (1999a) Inoceramid record and biostratigraphy across the Turonian/Coniacian boundary and Report on the Second Inoceramid Workshop, Freiberg 1966. *Acta Geologica Polonica*, 48 (4, Special Volume), I–IV.
- Walaszczyk, I. and Wood, C.J. (1999b) Inoceramids and biostratigraphy at the Turonian/Coniacian boundary; based on the Salzgitter-Salder Quarry, Lower Saxony, Germany and the Slupia Nadbrzezna section, Central Poland. *Acta Geologica Polonica*, 48 (4, Special Volume), 395–434.
- Walaszczyk, I. and Wood, C.J. (1999c) Inoceramid stratigraphy. In *The Upper Cretaceous succession (Cenomanian–Santonian) of the Staffhorst Shaft, Lower Saxony, northern Germany: integrated biostratigraphic, lithostratigraphic and downhole geophysical log data* (B. Niebuhr, R. Baldschuhn, G. Ernst, I. Walaszczyk, W. Weiss and, C.J. Wood, 1999), *Acta Geologica Polonica*, 49, pp. 184–91.
- Ward, W.H., Burland, J.B. and Gallois, R.W. (1968) Geotechnical assessment of a site at

References

- Mundford, Norfolk, for a large proton accelerator. *Géotechnique*, **18**, 399–431.
- Westermann, G.E.G. (1990) New developments in ecology of Jurassic–Cretaceous ammonoids. In *Fossili, Evoluzione, Ambiente*, (eds G. Palling *et al.*), Atti II convegno internazionale Pergola, 1987, pp. 459–78.
- Whitaker, W. (1861) On the 'Chalk rock', the Topmost Bed of the Lower Chalk in Berkshire, Oxfordshire, Buckinghamshire. *Quarterly Journal of the Geological Society of London*, **17**, 166–70.
- Whitaker, W. (1865a) On the Chalk of the Isle of Thanet. *Quarterly Journal of the Geological Society of London*, **21**, 395–8.
- Whitaker, W. (1865b) On the Chalk of Buckinghamshire, and on the Totternhoe Stone. *Quarterly Journal of the Geological Society of London*, **21**, 398–400.
- Whitaker, W. (1865c) On the Chalk of the Isle of Wight. *Quarterly Journal of the Geological Society of London*, **21**, 400–6.
- Whitaker, W. (1871) On the Chalk of the Southern Part of Dorset and Devon. *Quarterly Journal of the Geological Society of London*, **27**, 93–100.
- Whitaker W. (1872) *The Geology of the London Basin: Part 1 The Chalk and Eocene Beds of the Southern and Western Tracts*, Memoir of the Geological Survey of Great Britain and of the Museum of Practical Geology, HMSO, London, 619 pp.
- Whitaker, W. (1889) *The Geology of London and of Part of the Thames Valley (explanation of Sheets 1, 2 and 7): volumes 1 and 2*, Memoir of the Geological Survey of Great Britain, HMSO, London, 556 pp.
- Whitaker, A. (ed) (1985) *Atlas of Onshore Sedimentary Basins in England and Wales: Post-Carboniferous Tectonics and Stratigraphy*, Blackie, Glasgow, 71 pp.
- White, H.J.O. (1907) *The Geology of the Country around Hungerford and Newbury*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheet 267, HMSO, London, 150 pp.
- White, H.J.O. (1913) *The Geology of the Country near Fareham and Havant*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheet 316, HMSO, London, 96 pp.
- White, H.J.O. (1921) *A Short Account of the Geology of the Isle of Wight*, Memoir of the Geological Survey of Great Britain, HMSO, London, 219 pp.
- White, H.J.O. (1923) *The Geology of the Country South and West of Shaftesbury*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheet 313, HMSO, London, 112 pp.
- White, H.J.O. (1924) *The Geology of the Country near Brighton and Worthing*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheets 318 and 333, HMSO, London, 114 pp.
- White, H.J.O. (1926) *The Geology of the Country near Lewes*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheet 319, HMSO, London, 97 pp.
- White, H.J.O. (1928) *The Geology of the Country near Ramsgate and Dover*, Memoir of the British Geological Survey (England and Wales), Sheets 274 and 290, HMSO, London, 98 pp.
- White, H.J.O. (1932) *The Geology of the Country near Saffron Walden*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheet 205, HMSO, London, 125 pp.
- White, H.G.O and Treacher, L. (1905) On the Age and Relations of the Phosphatic Chalk of Taplow. *Quarterly Journal of the Geological Society of London*, **61**, 461–94.
- White, H.G.O. and Treacher, L. (1906) Phosphatic Chalks of Winterbourne and Boxford (Berkshire). *Quarterly Journal of the Geological Society of London*, **62**, 499–521.
- Whitham, F. (1991) The stratigraphy of the Upper Cretaceous Ferriby, Welton and Burnham formations north of the Humber, north-east England. *Proceedings of the Yorkshire Geological Society*, **48**, 247–54.
- Whitham, F. (1992) Itinerary XIII South Landing to Sewerby. In *The Yorkshire Coast*, (eds P.F. Rawson and J.K. Wright), Geologists' Association Field Guide No. 34, Geologists' Association, London, pp. 103–9.
- Whitham, F. (1993) The stratigraphy of the Upper Cretaceous Flamborough Chalk Formation north of the Humber, north-east England. *Proceedings of the Yorkshire Geological Society*, **49**, 235–58.
- Whitham, F. (1994) 15. Jurassic and Cretaceous rocks of the Market Weighton area. In *Yorkshire Rocks and Landscape. A Field Guide*, (ed. C. Scrutton), Yorkshire Geological Society, pp. 142–9.
- Whittlesea, P.S. (1991) The Maastrichtian in

References

- Norfolk. *Bulletin of the Geological Society of Norfolk*, **40**, 33–5.
- Wiedmann, J. (1996) New developments and perspectives in Cretaceous stratigraphy. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, **77**, 13–38.
- Wiese, F. (1997) Das Turon und Unter-Coniac im Nordkantabrischen Becken (Provinz Kantabrien, Nordspanien): Faziesentwicklung, Bio-, Event- und Sequenzstratigraphie. *Berliner geowissenschaftliche Abhandlungen, Reihe E*, **24**, I–VIII, 131 pp.
- Wiese, F. (1999) Stable isotope data ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) from the Middle and Upper Turonian (Upper Cretaceous) of Liencres (Cantabria, northern Spain) with a comparison to northern Germany (Söhlde and Salzgitter-Salder). *Newsletters on Stratigraphy*, **37**, 37–62.
- Wiese, F. and Kröger, B. (1998) Evidence for a shallowing event in the Upper Turonian (Cretaceous) *Mytiloides scupini* Zone of northern Germany. *Acta Geologica Polonica*, **48**, 265–84.
- Wiese, F. and Wilmsen, M. (1999) Sequence Stratigraphy in the Cenomanian to Campanian of the North Cantabrian Basin (Cantabria, N-Spain). *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **212**, 131–73.
- Wiese, F. and Wood, C. (2001) On the hexatinellid sponge *Cystispongia bursa* (Quenstedt, 1852) from the Turonian and Lower Coniacian of northern Germany and England. *Cretaceous Research*, **22**, 377–87.
- Wiest, J. (1852) In *The Fossil Brachiopods Volume. 1. Part 2, No. 1. Cretaceous* (T. Davidson), Monograph of the Palaeontographical Society (London), p. 114.
- Wilkinson, I.P. (1988) Ostracods across the Albion–Cenomanian Boundary in Cambridgeshire and Western Suffolk, Eastern England. In *Evolutionary Biology on Ostracoda. Proceedings of the Ninth International Symposium on Ostracoda*, (eds T. Hanai, N. Ikeya and K. Ishizaki), Kodansha Ltd, Tokyo, pp. 1229–44.
- Wilkinson, I.P. and Morter, A.A. (1981) The biostratigraphical zonation of the East Anglian Gault by Ostracoda. In *Microfossils from Recent and Fossil Shelf Seas*, (eds J.W. Neale and M.D. Brasier), Ellis Horwood Ltd, Chichester, pp. 163–76.
- Willcox, N.R. (1953) The origin of beds of phosphatic chalk with special reference to those at Taplow, England. In *Origine des gisements de phosphate de chaux. Proceedings of the 19th International Geological Congress, Algiers*, pp. 119–33.
- Wilmot, R.D. and Young, B. (1985) Alumnite and other aluminium minerals from Newhaven, Sussex: the first occurrence of Nordstrandite in Great Britain. *Proceedings of the Geologists' Association*, **96**, 47–52.
- Wilson, V., Welch, F.B.A., Robbie, J.A. and Green, G.W. (1958) *The Geology of the Country around Bridport and Yeovil*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheets 312 and 327, HMSO, London, 239 pp.
- Wood, C.J. (1967) Some new observations on the Maestrichtian Stage in the British Isles. *Bulletin of the Geological Survey of Great Britain*, **27**, 271–88.
- Wood, C.J. (1972) Chapter 10. Cretaceous. In *Regional Geology of Northern Ireland*, (ed. H.E. Wilson), *British Regional Geology*, No. 20, HMSO, Belfast, pp. 51–8.
- Wood, C.J. (1988) The stratigraphy of the Chalk of Norwich. *Bulletin of the Geological Society of Norfolk*, **38**, 3–120.
- Wood, C.J. (1992) The Chalk. In *Geology of the Country around Kingston upon Hull and Brigg* (G.D. Gaunt, T.P. Fletcher and C.J. Wood), Memoir of the British Geological Survey (England and Wales) Sheets 80 and 89, HMSO, London, pp. 77–101.
- Wood, C.J. (1993) The Plenus Marls and Melbourn Rock of the Chilterns and north Hertfordshire in the context of successions in southern England. *British Geological Survey Technical Report*, **WH/93/120R**.
- Wood, C.J. (1996) Chapter 7: Upper Cretaceous: Chalk Group. In *London and the Thames Valley*, 4th edn, (compiled by M.G. Sumner), *British Regional Geology*, No. 13, HMSO, London, pp. 76–91.
- Wood, C.J. and Bristow, C.R. (1990) Chapter 3: Upper Cretaceous: Chalk. In *Geology of the country around Bury St. Edmunds* (C.R. Bristow), Memoir of the British Geological Survey (England and Wales), Sheet 189, HMSO, London, pp. 16–29.
- Wood, C.J. and Ernst, G. (1998) Cenomanian–Turonian of Wunstorf. In *Key localities of the northwest European Cretaceous*, (eds J. Mutterlose, A. Bornemann, S. Rauer, C.

References

- Spaeth and C.J. Wood), *Bochumer Geologische und Geotechnische Arbeiten*, **48**, 62–73.
- Wood, C.J. and Mortimore, R.N. (1988) Chalk biostratigraphy. In *Geology of the Country around Brighton and Worthing*, (eds B. Young and R.D. Lake), Memoir of the British Geological Survey (England and Wales) Sheets 318 and 333, HMSO, London, pp. 58–64.
- Wood, C.J. and Mortimore, R.N. (1995) An anomalous Black Band succession (Cenomanian–Turonian boundary interval) at Melton Ross, Lincolnshire, eastern England and its international significance. *Berliner geowissenschaftliche Abhandlungen, Reihe E*, **16**, (1), 277–87.
- Wood, C.J. and Smith, E.G. (1978) Lithostratigraphical classification of the Chalk in North Yorkshire, Humberside and Lincolnshire. *Proceedings of the Yorkshire Geological Society*, **42**, 263–87.
- Wood, C.J., Ernst, G. and Rasemann, G. (1984) The Turonian–Coniacian stage boundary in Lower Saxony (Germany) and adjacent areas: the Salzgitter-Salder Quarry as a proposed international standard section. *Bulletin of the Geological Society of Denmark*, **33**, 225–38.
- Wood, C.J., Morter, A.A. and Gallois, R.W. (1994) Appendix 1. Upper Cretaceous stratigraphy of the Trunch Borehole (TG 23 SE 8). In *Geology of the Country around Great Yarmouth*, (eds R.S. Arthurton, S.J. Booth, A.N. Morigi, M.A.W. Abbott. and C.J. Wood), Memoir of the British Geological Survey (England and Wales) Sheet 162, HMSO, London, pp. 105–10.
- Wood, C.J., Batten, D.J., Mortimore, R.N. and Wray, D.S. (1997) The stratigraphy and correlation of the Cenomanian–Turonian boundary interval succession in Lincolnshire, northern England. *Freiberger Forschungsheft, Reihe C*, **468**, 333–46.
- Woods, H. (1896) The Mollusca of the Chalk Rock: Part 1. *Quarterly Journal of the Geological Society*, **52**, 68–98.
- Woods, H. (1911–12) *A Monograph of the Cretaceous Lamellibranchia of England, Volume 2, Parts 7 and 8: Inoceramus*, Monograph of the Palaeontographical Society, London, pp. 262–340.
- Woods, M.A. and Bristow, C.R. (1995) A biostratigraphical review of the Gault, Upper Greensand and Chalk of the Wincanton (297) district, Wiltshire. *British Geological Survey, Onshore Geology Series, Technical Report*, **WA/95/60**, 57 pp.
- Woodward, S. (1833) *An Outline of the Geology of Norfolk*, Longman and Co., London, 54 pp.
- Worssam, B.C. and Taylor, J.H. (1969) *Geology of the Country around Cambridge*, Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheet 188, HMSO, London.
- Wray, D.S. (1995) Origin of clay-rich beds in Turonian chalks from Lower Saxony, Germany – a rare earth element study. *Chemical Geology*, **119**, 161–73.
- Wray, D.S. (1996) 8. Rare-earth elements of Campanian marls and white chalks. In *New results on biostratigraphy, palaeomagnetism, geochemistry and correlation from the standard section for the Upper Cretaceous white chalk of northern Germany (Lägerdorf–Krons Moor–Hemmoor)*, (coord. J. Schönfeld and M.-G. Schulz). *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, **77**, pp. 563–8.
- Wray, D.S. (1999) Identification and long-range correlation of bentonites in Turonian–Coniacian (Upper Cretaceous) chalks of northwest Europe. *Geological Magazine*, **136**, 361–71.
- Wray, D.S. and Gale, A.S. (1993) Geochemical correlation of marl bands in Turonian chalks of the Anglo-Paris Basin. In *High Resolution Stratigraphy*, (eds E.A. Hailwood and R.B. Kidd), *Geological Society of London, Special Publication*, No. 70, pp. 211–26.
- Wray, D.S. and Wood, C.J. (1995) Geochemical identification and correlation of tuff layers in Lower Saxony, Germany. *Berliner geowissenschaftliche Abhandlungen, Reihe E*, **16**, (1), 215–26.
- Wray, D.S. and Wood, C.J. (1998) Distinction between detrital and volcanogenic clay-rich beds in Turonian–Coniacian chalks of eastern England. *Proceedings of the Yorkshire Geological Society*, **52**, 95–105.
- Wray, D.S., Wood, C.J., Ernst, G. and Kaplan, U. (1996) Geochemical subdivision and correlation of clay-rich beds in Turonian sediments of northern Germany. *Terra Nova*, **8**, 603–10.
- Wright, C.W. (1935) The Chalk Rock Fauna in East Yorkshire. *Geological Magazine*, **72**, 441–42.
- Wright, C.W. (1979) The ammonites of the English Chalk Rock (Upper Turonian). *Bulletin of the British Museum (Natural*

References

- History*). *Geology Series*, **31**, 281–332.
- Wright, C.W. (1947) Cenomanian, Turonian and Senonian Stages: the Chalk. In *The Geology of the Country around Weymouth, Swanage, Corfe and Lulworth* (W.J. Arkell), Memoir of the Geological Survey of Great Britain (England and Wales) New Series, Sheets 341–343, HMSO, London, pp.195–214.
- Wright, C.W. and Collins, J.S.H. (1972) *British Cretaceous Crabs*, Monograph of the Palaeontographical Society, London, 114 pp.
- Wright, C.W. and Kennedy, W.J. (1981) *The Ammonoidea of the Plenius Marls and the Middle Chalk*, Monograph of the Palaeontographical Society, London, 148 pp.
- Wright, C.W. and Kennedy, W.J. (1984) *The Ammonoidea of the Lower Chalk: Part 1*, Monograph of the Palaeontographical Society, London, pp. 1–126.
- Wright, C.W. and Kennedy, W.J. (1987) *The Ammonoidea of the Lower Chalk: Part 2*, Monograph of the Palaeontographical Society, London, pp 127–218.
- Wright, C.W. and Kennedy, W.J. (1990) *The Ammonoidea of the Lower Chalk: Part 3*, Monograph of the Palaeontographical Society, London, pp 219–95
- Wright, C. W. and Kennedy, W. J. (1996) *The Ammonoidea of the Lower Chalk: Part 5*, Monograph of the Palaeontographical Society, London, pp. 320–403.
- Wright, C.W., Kennedy, W.J. and Hancock, J.M. (1984) Introduction. In *The Ammonoidea of the Lower Chalk: Part I*. (C.W. Wright and W.J. Kennedy), Monograph of the Palaeontographical Society, London, pp. 1–18.
- Wright, C.W. and Wright, E.V. (1942) The Chalk of the Yorkshire Wolds. *Proceedings of the Geologists' Association*, **53**, 112–27.
- Wright, C.W. and Wright, E.V. (1949) The Cretaceous Ammonite Genera *Discoboplites* Spath and *Hyphoplites* Spath. *Quarterly Journal of the Geological Society of London*, **104**, 477–97.
- Wright, C.W. and Wright, E.V. (1951) *A Survey of the Fossil Cephalopoda of Great Britain*, Monograph of the Palaeontographical Society, London, 40 pp.
- Wright, T. (1881) *British Fossil Echinodermata*, Monograph of the Palaeontographical Society, London.
- Young, B. and Lake, R.D. (1988) *Geology of the Country around Brighton and Worthing*, Memoir of the British Geological Survey, Sheets 318 and 333 (England and Wales), HMSO, London, 115 pp.
- Young, B. and Monkhouse, R.A. (1980) The Geology and Hydrogeology of the Lower Greensand of the Sompting Borehole, West Sussex. *Proceedings of the Geologists' Association*, **91**, 307–13
- Young, J.R., Bergen, J.A., Bown, P.R., Burnett, J.A., Fiorentino, A., Jordan, R.W., Kleijne, A., Niel, B.E. van, Romein, A.J.T. and von Salis, K. (1997) Guidelines for coccolith and nannofossil terminology. *Palaeontology*, **40**, 875–912.
- Ziegler, P.A. (1990) *Geological Atlas of Western and Central Europe*, 2nd edn, Shell Internationale Petroleum Maatschappij B.V.

Glossary

This glossary provides brief explanations of the technical terms used in the introductions to the chapters and in the 'conclusions' sections of the site reports. These explanations are not rigorous scientific definitions but are intended to help the general reader. Detailed stratigraphical terms are omitted as they are given context within the tables and figures. Words in **bold** type indicate an internal reference to another glossary entry.

In addition to the terms defined below, there is a more comprehensive list of Upper Cretaceous stratigraphical terminology used in England contained in the International Stratigraphical Lexicon on the Cretaceous edited by J.M. Hancock, 1972 (*Lexique Stratigraphique International*, Volume I: Europe – Angleterre, Pays de Galles, Écosse. Fascicule 3a XI. CRÉTACÉ). The list below includes terms either not in the Lexicon, or re-defined or introduced since the Lexicon was published.

Abundance zone (formerly 'acme zone'): a **biostratigraphical unit** characterized by the time range in which one or more **taxa** were the most abundant.

Age: a time unit, usually taken to be the smallest standard division of geological time, of shorter duration than an **epoch**.

Ammonite: an advanced group of **cephalopods** characterized by typically coiled, chambered shells that have complex sutures between the chamber walls and the outer wall of the shell.

Anglo-Brabant Massif: submerged, ancient land-mass comprising the London Platform, its northern extension beneath East Anglia and its continuation beneath the area of the present southern North Sea to join the emergent Brabant massif in Belgium. This complex structural unit exerted considerable control over **Cretaceous** sedimentation.

Anoxia (adj. anoxic): state of oxygen-depletion in sedimentary environments, including anoxia in pore waters within sediments, and in the bottom waters of a sea or ocean bed.

Aragonite: a magnesium-rich mineral form of calcium carbonate that is more soluble in cold water than in warm. Shells made of aragonite ('mother-of-pearl'), such as those of **ammonites** and **nautiloids**, scaphopods, many **bivalves** and most **gastropods** were not normally preserved in the relatively deep and, consequently, cooler water of the **Upper Cretaceous** Chalk seas, but were preserved in shallower and perhaps warmer depositional environments. For this reason, well-preserved ammonites in the **Chalk** are mostly found in **hardgrounds** and thin **condensed limestone successions**.

Assemblage zone: type of fossil **zone** (*bio-zone*) that is based on an assemblage of fossil species and not on the occurrence or range of a single species. The **index fossil** of an assemblage zone (AZ) is not necessarily restricted to that zone. Most of the traditional **macrofossil** biozones of the Chalk are assemblage zones. Contrast with *total range Zone* (TRZ), which is based on the total range of the zonal index fossil, and *partial range*

Glossary

zone (PRZ), which involves overlapping ranges of zonal index fossils. The last term is particularly used in **microfossil** and macrofossil **biostratigraphy**.

Band/Belt/Horizon: three synonyms frequently used to describe the occurrence of a fossil or a particular geological feature that is used in correlation of rock strata over a wide area. For example, the upper belt of abundant *Offaster pilula* (an irregular **echinoid** fossil occurring in Lower Campanian strata) spans more than one bed of chalk in England. This belt or horizon is traceable across northern Europe. Similarly, the horizon of the irregular echinoid *Hagenowia blackmorei* spans several beds of chalk. In the same way the three bands of the fossil **brachiopod** *Orbirhynchia mantelliana* in the Cenomanian Stage all span several beds or couplets of marl–limestone in the **Chalk**. The purely descriptive terms do not specify or imply a particular thickness of rock.

Basin/basinal sequence, basinal succession: basins are relative depressions or 'lows' in the Earth's crust in contrast to surrounding 'highs'. The **Anglo-Brabant Massif** was a 'high' during the **Late Cretaceous Epoch**. In contrast, areas to the south (e.g. Sussex and Hampshire) and to the north (North Sea) were relative 'lows' where thicker successions of sediment accumulated. Even within basins there may be further local 'highs'. The amount of sediment input to the basins and on the 'highs' was partly dependent on supply from land areas, the productivity of **coccoliths** in the oceans and seas and on sea-level fluctuations. Where there is considerable input of sediment from land areas at times of low sea level (sea-level *lowstands*), there is generally a transition from coarse-grained sediments (sands, calcarenites) near the margin of such a depositional area to fine-grained sediments (chalks, muds) in the basin centre as the heavier, coarser detritus is progressively deposited. At times of high sea level (sea-level *highstands*) with minimal supply of land-derived sediment to the basin, there may be a basinward transition from thin, **condensed limestone successions**, including **hardgrounds**, to chalks. The fauna of such a transect changes from margin to basin, leading to various **biofacies**. The concept of basinal successions is particularly

important in the Turonian Stage and the Lower Campanian Substage, where **marl** seams and volcanic clays that are preserved in the deeper environments (e.g. the Southern Province successions) are progressively lost as they are traced into the condensed **Chalk Rock** successions of local 'highs'.

Bathichnus paramoudrae: a unique **trace fossil** around which **paramoudra flints** commonly form, having a vertical shaft 20–60 mm in diameter and 5–9 m long with sub-horizontal side branches <100 mm in length (originally described by Bromley *et al.*, 1975).

Beer Stone: a local freestone from Beer quarries in south-east Devon described by De La Bèche (1826) and Jukes-Browne and Hill (1903, 1904). Unlike **coccolithic** chalk, the Beer Stone is a **calcarenite** almost entirely composed of comminuted **echinoderm** skeletal material (mainly **microcrinoid**) forming a soft, gritty limestone within the Holywell Nodular Chalk Formation (near the base of the former 'Middle Chalk').

Belemnite zone: macrofossil **biozone** with a belemnite **index species**, e.g. the *Gonioteuthis quadrata* Zone. See **cephalopod**.

Belt: see **band**.

Benthic (noun: **benthos**): Living on or near the sea bottom. Contrast with **planktonic**.

Bioclastic/bioclastic chalk: Chalk composed of detritus of organic origin, e.g. comminuted and/or fragmented **inoceramid bivalve** shell. Such chalks are typically more or less coarse-grained and gritty to the touch, e.g. the Lower and Upper Inoceramus Beds of the Ferriby Chalk Formation, the Totternhoe Stone.

Bio-event bed: a bed characterized by a fossil occurrence. The 'event' may be, for example, a fossiliferous bed within a generally unfossiliferous succession, an acme-occurrence or short-term occurrence of some particular fossil, a short-term immigration of a warm or cold-water fauna, or something distinctive such as the occurrence of **inoceramid bivalve** shells encrusted by serpulid worm-tubes (the *Filograna avita* event) in the Holywell Nodular Chalk Formation.

Biofacies: the sum total of a rocks' gross fossil faunal/floral characteristics that together reflect the particular environment in which the rock formed.

Biostratigraphy: type of **stratigraphy** involv-

Glossary

- ing the use of fossils (**macrofossils**, **microfossils**, **nannofossils**) for the establishment of **zones** and for the correlation of rock strata.
- Biostratigraphical unit**: a stratigraphical unit, or body of rock, defined or characterized by its fossil contents without regard to lithological or other physical features or relations. The basic unit is a biozone (see **zone**) of which there are several kinds.
- Bivalve**: a type of aquatic shellfish that have their bodies enclosed by two, often mirror-image, shells (valves). Modern examples include cockles and mussels (cf. **brachiopod**).
- Boreal Realm**: reconstruction of palaeo-environments for the **Late Cretaceous** Earth split the sphere into two palaeohemispheres, a Boreal northern and an Austral southern hemisphere, separated by an equatorial Tethyan Realm. In the Boreal northern palaeohemisphere, sea-water temperatures are *generally* held to have been cooler than those of areas immediately to the south, but this is not universally true.
- Brachiopod**: a major group of shellfish superficially similar to the **bivalves** but distinguished by a different anatomy. The two shells (valves) are typically dissimilar.
- Calcarenite**: coarse, gritty limestone formed of mainly sand-sized calcareous fragments.
- Calcareous nannofossils**: all calcareous fossils smaller than 30 microns (μm), defined by Lohmann (1909) as including the **plankton** that pass through the finest plankton nets (i.e. $<63 \mu\text{m}$). This includes many organisms such as ascidian spicules, **calcispheres** and juvenile **foraminifera**, but by far the most predominant group are the haptophyte algae (golden-brown algae). Fossil calcareous haptophyte algae are the primary chalk-forming organisms (see **coccoliths** and **nannofossils**).
- Calcispheres**: round or oval-shaped calcareous grains about $500 \mu\text{m}$ in size, common at many levels in the Chalk, particularly Cenomanian and Turonian **nodular chalks** and **hard-grounds** (sphere-rocks), in which they are present in rock-building quantities. Thought to be the fossil cysts of calcareous dinoflagellates.
- Calcite**: the main mineral form consisting predominantly of calcium carbonate (CaCO_3). The calcite in the skeletons of the chalk-forming calcareous algae is composed of low-magnesium calcite, a very stable carbonate.
- Carbonate**: in geology, a synonym for limestone.
- Cephalopod**: a group of marine molluscs including the modern squid, cuttlefish and octopus and their extinct fossil relatives including belemnites (a form possessing a bullet-shaped internal calcium carbonate shell) and the **ammonites**.
- Chalk**: a very fine-grained limestone formed primarily by **coccoliths**. 'The Chalk' used as a proper noun with a capital letter, is taken to be equivalent to the **Upper Cretaceous** Series, reflecting the dominance of the chalk rock type in strata of **Late Cretaceous** age (cf. **Chalk Rock**).
- Chalk facies**: chalk is a special type of limestone formed from a rain of the calcareous skeletal material produced by marine **plankton** onto the seabed. These plankton are primarily **coccoliths**. Other types of **nannofossil** may be abundant at certain horizons in the Chalk and these produce different-shaped calcite crystals, affecting the properties of a chalk. Such nannofossils include cylindrical nannoconids and rhabdoliths, and prismatic *Micula* (see Figure 1.9, this volume). Other chalks may contain abundant **calcispheres** or **foraminifera**, which are around $500 \mu\text{m}$ in size in comparison to the $5\text{--}10 \mu\text{m}$ size of the nannofossils. Chalk is the characteristic rock of the **Upper Cretaceous** succession in north-west Europe and gives its name to the **Cretaceous System** (Creta = Latin for chalk). Chalk facies is replaced laterally towards the margins of depositional basins by coarser-grained sediments, including **calcarenites** and **calcite-cemented sandstones** (e.g. the Wilmington Sands).
- Chalk Marl**: the former lowest division of the Chalk Group in southern England. 'Chalk Marl' was the name applied to the Chalk wherever it had a soft **marly** character. The term has been superseded in part by the name 'West Melbury Marly Chalk Formation' (Bristow *et al.*, 1997; Rawson *et al.*, 2001). The former Chalk Marl is not co-extensive with this formation, but also includes the lower part of the succeeding Zig Zag Chalk Formation.
- Chalk Rock**: the Chalk Rock was defined by Whitaker (1861) and used by the [British] Geological Survey as the mapping boundary between the Middle Chalk and Upper Chalk

Glossary

(former divisions of the **Chalk**) in parts of the Chiltern Hills (Penning and Jukes-Browne, 1881; Jukes-Browne and Hill, 1903, 1904). Bromley and Gale (1982) re-defined the Chalk Rock as a formation comprising a number of **hardgrounds** that varied in intensity and number from west Wiltshire to Cambridgeshire. The Chalk Rock now forms a Member at or towards the base of the Lewes Nodular Chalk Formation in those areas where it can be defined, primarily in Wiltshire and Berkshire. The names for the various hardgrounds introduced by Bromley and Gale (1982) for the Chalk Rock are retained where they can be recognized.

Chalkstone: a term introduced by Bromley and Gale (1982) to describe the creamy, hard, well-cemented 'stony' parts of the **Chalk Rock hardgrounds**. The term can also be applied to other re-cemented chalks such as those in Northern Ireland and Yorkshire or to chalks re-cemented by Quaternary processes. The intact dry density of chalkstones is usually greater than 20 000 kg/m³

Chert: cryptocrystalline silica (SiO₂) which may be of organic or inorganic origin, occurring as layers or nodules in sedimentary rocks (mainly limestones). **Flint** is a form of chert.

Chert Beds: beds of sandstone or calcareous sandstone with seams of chert characterizing the Upper **Greensand** of Wessex (Dorset and south-east Devon).

Chronostratigraphy: 'time layer writing', the correlation and subdivision of rock units on the basis of relative age – a hierarchy of sequential units to which the layers of sedimentary rocks are allocated, through the study and interpretation of their **stratigraphy**. The hierarchy of principal chronostratigraphical units is **system**, **series** and **stage**, which are related, respectively, to the geological time units of **period**, **epoch** and **age**. Rocks of the **Jurassic System** (a chronostratigraphical unit) were laid down in the **Jurassic Period** (a geological time unit).

Clay Minerals (Hydrous Aluminium Silicates): clay minerals are formed by the chemical weathering of other silicates (e.g. some feldspar minerals convert to the clay mineral kaolinite), whilst most micas are produced by the subsequent pressure recrystallization of clay minerals (see **metamorphic rocks**). Clay minerals are the component of an engineering soil that gives it plasticity.

Clays have the properties of becoming plastic and easily moulded when wet and of becoming hard and rock-like on heating above a certain temperature. Bentonite and Fullers Earth, belong to the smectite or montmorillonite subgroup of active clays. Kaolinite is widely used for ceramics, white-ware, and refractory bricks, aggregates etc, structures. Clay minerals are significant in the Grey Chalk Subgroup and in units of chalk with significant **marl** seams such as the Newhaven Chalk and Flamborough Chalk formations.

Coccoliths: calcareous, **planktonic**, haptophyte algae.

Condensation/condensed succession: beds that are thinner in some parts of the depositional area than beds of equivalent age elsewhere, e.g. towards the margins/palaeoshoreline or over structural 'highs', are said to be 'condensed'. Simple condensation implies a smaller amount of deposition per unit time. More complex condensed successions may contain erosional hiatuses or 'non-sequences' (omission surfaces) resulting from interruptions in deposition. Longer breaks in sedimentation are commonly marked by mineralized **hardgrounds**. Good examples of condensed successions are provided by the Cenomanian Beer Head Limestone Formation of Devon and the Turonian Chalk Rock. In both cases, there is a lateral change in the type of sediment, with basinal chalks passing laterally into hard limestones.

Conjugate joint sets: two sets of **joints** believed to represent complementary shear sets in which the maximum principal stress is horizontal. Such joint sets are particularly characteristic of the Holywell Nodular Chalk, New Pit Chalk, Newhaven Chalk and Flamborough Chalk formations.

Contemporaneous: a geological event that occurs at the same time as a deposit is forming. Compare with **penecontemporaneous**.

Cored borehole: a borehole that is drilled in such a way as to recover a cylindrical core of the rocks through which the drill penetrates. This is an extremely expensive method, but one which provides the maximum amount of information, particularly **biostratigraphical** (fossil) data. Other boreholes are rock-rollered or chipped so as to produce a hole in the rocks that can be used for the

Glossary

- production of **geophysical logs**. From a study of the rock chippings and the form of the geophysical logs the nature of the succession drilled can be inferred.
- Cretaceous**: a **period** of geological time from 142–65 million years ago (see Figure 1.2).
- Cretaceous Quiet Zone**: term used in **magnetostratigraphy** to describe the long time interval in the **Late Cretaceous Epoch** without numerous magnetic reversals.
- Crinoid**: a group of **echinoderms** with a flower-like structure, hence the common name 'sea lily'.
- Cyclostratigraphy/cyclostratigraphical couplet**: type of **stratigraphy** based on the identification of couplets of **marls** and **chalks/limestones** that are inferred to result from orbital control of sedimentation owing to changes in the amount of sun (insolation) reaching the Earth's surface. Individual couplets and groups of couplets can be traced over enormous distances (cf. Gale, 1995, 1996, 1998) enabling extremely high resolution in the correlation of rock strata. In the **Chalk**, the couplets are inferred to be precession-driven, i.e. they have a periodicity of 19–23 million years. This inferred periodicity can be checked against absolute dating based on radioactive decay of elements (e.g. Potassium/Argon (K/Ar)) in sanidine grains included in volcanic beds (bentonites).
- Decollement zone/zone of decollement**: term normally applied in Alpine structural geology to describe the surface along which an upper series of **tectonically**-folded rocks has slid over an underlying packet of less-deformed or undeformed rocks. Used in this book to describe any surface in the **Chalk** along which detachment of one mass from another has occurred. This includes the **glacio-tectonic** chalk-masses of the Norfolk coast, which are inferred to have become detached, and also includes slide planes and detached masses such as those at Downend, Portsdown and Hope Gap, Seaford Head.
- Diachronous**: a continuous rock body that is a different age in different places. The Glauconitic Marl is older in Sussex and Kent than it is on the Isle of Wight and younger still on the Dorset coast (see Compton Bay and White Nothe site descriptions). Hence this sedimentary deposit 'crosses time'.
- Diagenesis**: the changes that take place in a sediment due to physico-chemical and biochemical processes at low temperature (<200°C) that convert a sediment to a sedimentary rock. These changes include early cementation on, or beneath, the seabed (formation of **nodular chalks**, **hardgrounds** and **flints**). They also include early consolidation (often effected by burrowing organisms) and mechanical compaction.
- Diastem**: small amounts of geological time not represented by sedimentation. A **hard-ground** or **nodular chalk** bed may represent a diastem.
- Dip**: rock layers are generally tilted at angles between horizontal and vertical (the angle of dip). The angle of dip is measured using an inclinometer from the horizontal downwards. Dip also has a compass direction identified as the direction of the maximum dip angle of the strata.
- Disconformity**: an erosional surface separating two sequences of parallel strata from one another. The erosional surface on which the Southerham Grey Pit channel has formed is a typical disconformity.
- Dissolution**: the dissolving of rock, particularly limestone, usually by percolating acidic groundwater. Dissolution in chalk leads to a variety of **karst** features including dolines, pipes, opening of **joints** to form fissures, and underground cavities with a range of sizes.
- Echinoderm**: a group of marine invertebrates, characterized by five-fold symmetry and calcareous skeleton. The group includes starfish, sea urchins, sea lilies and their fossil relatives.
- Echinoid**: sea urchin.
- Epigenetic**: structures formed after the lithification of a sediment into a rock.
- Epoch**: a unit of geological time, of shorter duration than a **period** and itself divisible into **ages** (e.g. the **Late Cretaceous Epoch**).
- Era**: one of the five major divisions of geological time, namely the Archean, Proterozoic, **Palaeozoic**, **Mesozoic** and **Cainozoic**, each of which comprises several **periods**.
- Erosional hiatus**: a gap in the stratal succession resulting from erosion of the underlying beds prior to the deposition of the overlying sediments, e.g. the erosional contact below the Totternhoe Stone. An erosional hiatus involves some degree of angular discordance between strata and is therefore more or less

Glossary

conspicuous, whereas a 'non-sequence' results merely from a break in sedimentation without angular discordance and may be difficult to detect.

Event horizon/stratigraphy: a **band** ('horizon') characterized by a wide-ranging, short-term event, which may be an occurrence of a fossil, a concentration of a particular mineral (e.g. iridium), a clay seam (either detrital or vulcanogenic), a 'spike' on a stable isotope curve, a distinctive sediment (e.g. a black shale). Many events are, by definition, either near- or absolutely isochronous and can be used to help construct a composite correlation framework for rock strata (event stratigraphy). Such frameworks are increasingly used in the case of the **Chalk** and coeval sediments.

Facies: the lithological and biological characteristics of a sedimentary rock that results from deposition in a particular environment.

Facies model: a general summary of a specific sedimentary environment and the biological and lithological features that result from processes of sedimentation within that environment.

Fault: a fracture in rock that has a measurable off-set of the layers of rock on either side of the fault plane (surface of fracture).

Flint: (the old English word for hardstone) a siliceous rock whose composition is about 98% pure silica (i.e. SiO_2 in a variety of crystalline forms, including chalcedony, opal and quartz). The dark black flints appear to be made of a compact mass of microscopic, needle-like crystallites of quartz. By contrast, in the case of the grey flints of Northern Ireland and the Northern Province (Lincolnshire–Yorkshire), the crystals are less fibrous, stouter and much shorter (Shepherd, 1972). Others have found that flint has replaced the original chalk to such an extent that when flint is etched with acid and viewed with a scanning electron microscope the original structure of the chalk can be seen (Clayton, 1986). Details of the original pore structure of chalk are preserved. Flint is, therefore, formed during **diagenesis**, at an early stage of burial of the chalk.

Flood event/occurrence: a super-abundant occurrence of one or a few fossils (either macro- or microfossils) over a large geographical area and typically at one

horizon, e.g. the occurrence of the **inoceramid bivalve** *Cladoceramus undulaticus* at the base of the Santonian Stage in the Seaford Chalk Formation. Flood events are of great value for long-range inter-regional correlation of rock strata as they may cross from one **facies** to another, e.g. the *Cladoceramus* event(s) are found in chalks, sandstones, siltstones and mudstones and can be traced from North America to central and southern Europe.

Foraminifera: single-celled, calcareous, aquatic micro-organisms usually less than one millimetre in diameter (a few are larger). Foraminifera from the **Chalk** are usually divided into **benthic** forms and **planktonic** forms (that lived in the top 50–60 m of the water column). Benthic/planktonic ratios and abundances of different species are used for both correlation and environmental interpretation. Detailed stratigraphies of foraminifera have been used to establish the geology along the route of the Channel Tunnel (e.g. Harris *et al.*, 1996a) and other tunnels in the UK.

Gastropod: a class of univalved molluscs, mostly characterized by helical shells made of **aragonite**.

GCR: Geological Conservation Review, in which nationally important geological and geomorphological sites were assessed and selected with a view to their long-term conservation as **SSSIs**.

Geophysical borehole log: method whereby a continuous trace of the physical characteristics of the rocks penetrated by a drill, e.g. radioactivity (gamma radiation), electrical resistivity, etc. can be obtained from an instrument lowered slowly down the borehole. Such traces (commonly called 'down-hole wireline logs') are of enormous value in inferring the nature of the rocks penetrated and, particularly, in long-range correlation. The identification of **marl** seams from low resistivity 'spikes' enables the marl seam and volcanic clay framework of field sections to be confidently recognized in the subsurface succession of rock strata (cf. Mortimore and Wood, 1986; Mortimore and Pomerol, 1987).

Glacio-tectonic: refers to the detachment and deformation of rocks by contact with a mass of moving ice, e.g. the complex folded masses of Campanian and Maastrichtian Chalk on the

Glossary

Norfolk coast, which are inferred to have been detached from the bed of the North Sea and carried bodily southwards.

Glauconite: akin to an iron-rich clay mineral, illite, with a similar structure to that of mica. Its colour ranges from olive-green, yellowish, greyish to blackish-green. The presence of glauconite in a sediment imparts a green colour (e.g. greensands and **Glauconitic Marl**), and usually indicates a shallow-water, marine origin for the deposit.

Glauconitic Marl (known as 'Chloritic Marl' in the earlier literature): a **glauconite**-rich sandy **marl** also rich in chocolate-brown phosphate nodules, constituting a member at the base of the Chalk Group in southern England.

Global boundary Stratotype Section and Point (GSSP): an internationally agreed point in a rock succession at a particular locality that is taken to mark a **stage** or substage boundary (strictly speaking, the *base* of a stage or substage).

Greensand: term loosely applied in the **Cretaceous** rock succession to units of arenaceous rocks, which are green at their type localities but which elsewhere are commonly weathered brown (e.g. Aptian-Albian Lower Greensand). Where green, the coloration is generally due to the presence of the dark green mineral **glauconite**. The basal member of the Chalk Group in the Southern and Transitional provinces is typically developed as a glauconitic sediment, e.g. the Glauconitic Marl Member, Cambridge Greensand.

Hardground: the end member in a **diagenetic** series from soft nodules, through hard **nodular chalks** to a fully mineralized hardground. **Calcitic** cement pervades the rock and the convoluted erosion surface marking the top of the hardground, as well as burrow-walls penetrating into the hardground, are coated with purple-brown calcium phosphate and green glauconite. Iron-mineralization (goethite) is common. Strictly speaking, the term refers only to the surface, although it is in general use to describe both the surface and the underlying chalkstone (see Bromley, 1975b).

Hiatus: literally a 'gap', usually referring to a gap in a sedimentary succession, caused either by erosion and/or no deposition. The time 'missing' or not represented at an **unconformity** or other break in the

stratigraphical record.

Horizon: see **band**.

Illite: a **clay mineral** intermediate in structure between the mica muscovite and the clay mineral montmorillonite.

Index fossil: see **zone**.

Inoceramid bivalve: extinct family of **Jurassic** and **Cretaceous** marine **bivalves** characterized by a hinge plate with ligament pits but without teeth, and a shell composed of an external layer of prismatic crystals of **calcite** arranged at right angles to the shell surface and an internal layer of laminar **aragonite** ('mother-of-pearl'). Both layers are commonly preserved in mudstones but only the outer layer is normally preserved in chalks.

Inoceramus atlanticus event: the wide-ranging common occurrence (**event**) of the distinctive eponymous **inoceramid bivalve** over a narrow interval in the higher part of the Middle Cenomanian Substage, immediately preceding the *Pycnodonte* event.

Interfluves: the ridges between fluvial valleys. In the **Chalk** downland, interfluves form the high ground between dry valleys.

Intraclasts: fragments of rock (clasts) contained in the same type of rock that they are derived from. Hence a fragment of chalk contained in chalk is an intraclast.

Iridium anomaly: refers to a concentration of the element iridium at a particular **horizon** in a sedimentary succession. Such concentrations are inferred to result from the impact of an extra-terrestrial body with the Earth, e.g. the widely-believed end-**Cretaceous** impact event.

Joints: fractures in rock with no measurable offsets on the layers of rock on either side of the fracture. Joints often form in sets or groups that have a statistically consistent orientation.

Jurassic: a **period** of geological time from 213–144 million years ago.

Karst: the following definition is from Fairbridge, 1968, *Geomorphology*: 'The term **karst** is derived from the German form of the Slavonic word, *krs* or *kras*, meaning rock. The word was a regional name for the area of massive limestone country north and south of the port of Rijeka in Yugoslavia, a district of many rocks, sinkholes and underground

Glossary

streams. The word is now more widely used to denote a type of terrain with a distinctive and unique assemblage of landforms...the result of one dominant erosion process, **dissolution**. The main characteristic of a karst area is the predominance of vertical and underground drainage and the complete absence of surface streams. The Adriatic coastal areas of Yugoslavia from Istria to Kotor were the first karstlands to be described in a scientific manner by European writers (Cvijic, 1893). In the **Chalk** of England karst features include ephemeral streams (winter-bo(u)rnes) and streams that flow into cave systems (Mimms valley, Hertfordshire) as well as the features described above under dissolution. Past sea levels have largely controlled the pattern of past karstic horizons.

Late Cretaceous Epoch: the youngest epoch of the **Cretaceous Period**, which is followed by the Palaeogene Period. It comprises the Cenomanian, Turonian, Coniacian, Santonian, Campanian and Maastrichtian ages

Litho-event bed: a body of sedimentary, extrusive igneous or **metamorphic** strata that is distinguished and delimited on the basis of lithological characteristics and stratigraphical position. Both the vulcanogenic and detrital **marl** seams in the Chalk are litho-event beds. Similarly, many of the sponge-beds, **hard-grounds** and marl-limestone couplets are litho-event beds.

Lithofacies: a unit of rock defined and recognized on the basis of lithological characteristics such as rock type, colour and composition.

Lithostratigraphy: a classification of sedimentary successions based on the rocks of which they are composed, and not on their included fossils. Such classifications involve a hierarchy of terms such as Supergroup, Group, Subgroup, Formation, Member, and Bed, in descending order of scale. A formation is the lowest category that can actually be mapped, although in practice it is sometimes possible to map members.

London-Anglian Platform (see **Anglo-Brabant Massif**)

Lower Chalk: formerly the lowest division of the **Chalk** in England. Now divided into two mapping units in southern England, the West Melbury Marly Chalk and Zig Zag Chalk formations. In the Northern Province, where the

succession is thinner, only one unit, the Ferriby Chalk Formation is recognized.

Listric: listric (also 'lystric') surfaces are the planes of thrust fractures in rocks that curve into more vertical **faults**.

Macrofossil: macrofossils in the **Chalk** range in size from shells around 2 mm to large **ammonites** that can be 3 m in diameter (e.g. the very large *Parapuzosia* found in the Zig Zag Chalk Formation, the Plenus Marls Member of the Holywell Nodular Chalk Formation and, commonly, in the Newhaven Chalk Formation and the Margate Chalk Member). The most important groups of macrofossils for identification of the stratigraphical level of the Chalk in field sections and in borehole cores are the **inoceramid bivalves** that are common throughout the Chalk; the ammonites, common in the Grey Chalk Subgroup; **echinoids** such as *Holaster*, *Sternotaxis*, *Micraster*, *Echinocorys*, *Conulus* and *Offaster*, common in the White Chalk Subgroup; and the belemnites, common in the higher part of the Chalk Group.

Magnetochron: a period of time defined by the remnant magnetic polarity and distinguished from adjacent magnetochrons that have different magnetic polarities.

Magnetostratigraphy: **stratigraphy** based on the **palaeomagnetic reversals** recorded in the 'fossil' remnant magnetism in rocks.

Major tectonic line: a line in the Earth's crust distinguished by the presence of a structural feature, such as a **fault**, fold or fold belt. Such faults or fold belts are not local features and usually extend hundreds of kilometres, as opposed to local features, which may be on a metre or kilometre scale.

Marker horizon: a conspicuous bed of rock such as a **flint** band or **marl** seam, or a level with an abundance of a particular species of fossil. Other marker horizons include **palaeomagnetic reversals**, volcanic ash-falls or geochemical 'spikes'.

Marl: calcareous mudstone.

Melbourn Rock: a unit of rock comprising a number of layers of hard chalkstone marking the base of the old 'Middle Chalk' in south Cambridgeshire (Melbourn), north Hertfordshire and the Chiltern Hills (Penning and Jukes-Browne, 1881). In some areas, such as Dover, the term 'Melbourn Rock' has been mistakenly applied to all the chalk with

Glossary

abundant shell-debris of the fossil **bivalve** *Mytiloides*. The Melbourn Rock of the type area underlies the main shell-rich chalks of the Holywell Nodular Chalk Formation.

Metamorphic rocks: rocks that have undergone changes in the solid state by heat and/or pressure but without melting.

Microfossils: the remains of microscopic animals and plants whose study requires the use of a microscope. The main groups of microfossils in chalk include the **foraminifera**, ostracods, dinoflagellates, sponge spicules, bryozoa and some radiolaria. Foraminifera in particular are used to zone the **Chalk** and interpret environments. Even smaller microfossils include the **nannofossils**.

Microfossil biostratigraphy: stratigraphy based on microfossils.

Milankovitch Cycles: named after the Serbian mathematician Milutin Milankovitch, who studied at Vienna in the 1920s under Alfred Wegner. Milankovitch Cycles refer to climatic changes brought about by shifts in the Earth's orbit around the Sun and the resultant changes in solar radiation reaching the Earth (Milankovitch, 1941). Within the Milankovitch waveband there are three primary cycles; (1) shifts in the Earth's orbit around the Sun from more circular to more elliptical over a period of 100 000–400 000 years (the *eccentricity* cycle); (2) variation in the tilt of the Earth's axis on a 41 000-year cycle (the *obliquity* cycle) and (3) the wobble or precession of the Earth's axis on a 19 000–23 000-year cycle (the *precession* cycle). Despite being called 'Milankovitch Cycles' these potential controls on the Earth's climate were first recognized by the Scottish Geologist James Croll (Croll, 1875), and applied to cyclically bedded **Cretaceous** sediments in the Western Interior of the USA by G.K. Gilbert (Gilbert, 1895).

Millet-seed sands: sand composed of quartz grains of millet-seed size and roundness. A term used by Bailey (1924) to describe some of the sand grains in the Scottish **Upper Cretaceous** deposits of the Inner Hebrides.

Montmorillonite: see **clay minerals**.

Mundford Grades: an engineering classification developed for the weathered and fractured state of chalk at Mundford, near Thetford, Norfolk, in the site investigation for the foundations of a large proton accelerator

(Ward *et al.*, 1968). Mundford Grades have subsequently been used for the engineering classification of chalk throughout the UK. During the 1990s a new classification system has been developed, the CIRIA Grades (Lord *et al.*, 2001) and these are now used in place of Mundford Grades.

Mytiloides (*Inoceramus*) labiatus sensu lato: *Inoceramus labiatus*, an **inoceramid bivalve**, was formerly used in a very broadly defined sense as the **index fossil** for the **assemblage zone** corresponding to the Holywell Nodular Chalk Formation (i.e. topmost Upper Cenomanian and Lower Turonian substages). However, the species *M. labiatus sensu stricto* occurs in only a very small interval in the Lower Turonian part of this formation (see **Turonian Stage**).

Nannofossils: see **calcareous nannofossils**.

Nautiloid: an almost-extinct group of **cephalopods** with straight or coiled chambered conical shells.

Nodular chalk: hard lumpy layers of chalk about 200–300 mm thick, frequently red-orange iron-stained. Individual nodules of high-density chalk are often separated by soft, low-density, grey chalks that are late-stage burrow-fills, their high porosity preserved by the skeletal framework of interconnecting nodules. Such nodular beds and **hardgrounds** are defined and illustrated by Bromley (1975b), who has demonstrated the change in seabed ecology from soft sediment burrowing to hard sediment boring as the cementation progresses. Kennedy and Garrison (1975) illustrated the sequence from weak nodular beds to the development of **hardgrounds**.

Nodular flint: a form of **flint** comprising nodules with spines or horns and an irregular shape. Nodules range widely in size from a few millimetres thick to more than 300 mm thick and metres wide, and frequently form in bands of dispersed nodules. These flints have been variously referred to as 'burrow-fill' or 'nodular horn-flints'.

Ocean floors: strictly those marine environments underlain by *oceanic crust* in a geotectonic (**Plate Tectonic**) sense. Sea floors are underlain by continental crust.

Oceanic anoxic events: periods of time when the oxygen minimum zone of the ocean floors

Glossary

- is thought to have risen on to shelf regions leading to the formation of black shales on shelves as well as ocean basins. Three such events are recognised in the **Late Cretaceous Epoch** (see Jenkyns, 1980).
- Oxic:** oxygen-rich environments (for the purposes of this book this means oxygen-rich sea-floor environments).
- Palaeogeography:** reconstruction of the past geographies of the Earth in both physical and biological terms. The past distribution of oceans, seas, land, climate and ecosystems.
- Palaeomagnetic reversals:** a reversal of the Earth's magnetic field results in the north magnetic pole becoming the south magnetic pole. The present magnetic arrangement is termed normal (N) in contrast to the reversed situation (R). Magnetic reversals have occurred regularly throughout the Earth's history and are thought to take place over very short time intervals (days/weeks/years) and are, therefore, geologically instantaneous events providing unique marker horizons.
- Paramoudra Flint:** a special type of **flint** that forms cylindrically around the trace fossil *Bathichnus paramoudrae* (Bromley *et al.*, 1975a). Paramoudra flints are generally very large (can be more than 2 m in diameter and several metres high). The flint is usually very compact and hard. The highest uniaxial compressive strengths have been obtained from such flints (around 800–1000 MPa). Paramoudra flints occur at specific stratigraphical horizons and are a feature of Bedwell's Columnar Flint in southern England, the Warren Farm Paramoudra Flints in the Spetisbury Chalk Member of the Culver Chalk Formation and, particularly, in the 'Paramoudra Chalk' of Norfolk and Northern Ireland.
- Penecontemporaneous:** a geological event such as **faulting**, folding, uplift, channel erosion or **diagenesis** that occurs broadly within the rock-forming period. For example, the uplift and resultant sliding and slump folding of the Chalk at Downend Chalk Pit, Portsdown, in the Culver Chalk Formation, occurred before the highest beds of the Culver Chalk formed but after the earlier chalks had partially consolidated.
- Periglacial:** literally *in front of* a glacier or ice-sheet. The region of tundra conditions where the tree-line stops but where no permanent ice sheet or glacier is present. Frozen ground is common. Periglacial weathering features including patterned ground, ice-wedges, intense fracturing are a feature of the chalk in England and relate to the past cold-periods of the Quaternary Period.
- Period:** a major division of geological time, of shorter duration than an **era** and itself divisible into **epochs**.
- Plankton:** generally small organisms that drift in water bodies and have limited powers of locomotion.
- Plate Tectonics:** the theory that the Earth's lithosphere (Earth's crust and upper mantle) is divided up into a series of rigid 'plates' that move relative to each other (a few centimetres per year). Over geological time the continents carried by the 'plates' can 'drift apart' or 'collide' and oceans can 'grow' and 'close' as a result. Relative movement between the plates leads to earthquake and **tectonic** activity, which is most concentrated at boundary zones between plates.
- Plenus Marls:** a division of the **Chalk**; the basal member of the Holywell Nodular Chalk Formation and the base of the White Chalk Subgroup. Named after the occurrence of the belemnite *Praeactinocamax plenus* in the higher four of the eight beds into which the member is divided.
- Rudist bivalve:** type of extinct aberrant reef-building **bivalve**, particularly characteristic of the shallow, warm water environments of the Tethyan Realm (cf. **Boreal Realm**). Rudists are rare in the **Upper Cretaceous** rocks of the UK since these were deposited in a much higher palaeolatitude, where relatively cooler and much deeper water conditions prevailed.
- Seabed:** floor of a sea on which sedimentary processes are acting. Strictly a sea not underlain by oceanic crust (see **ocean floors**).
- Sequence boundaries/stratigraphy:** **unconformity** or **disconformity** bounded sequences of strata.
- Sea-level curves:** curves of relative sea-level change through geological time. These may be global curves or more local curves for particular basins and regions.
- Sheet-flints:** distinguished from **tabular flints** by being located on both sub-horizontal and sub-vertical fracture planes. Hence these are not strictly in place stratigraphically but may

be confined broadly to a stratigraphical unit. Sheet-flints are thin (4–200 mm thick) sheets of flint, often forming two planes separated by a chalky interior. Clayton (1986) illustrated the early formation of sheet-flints and the processes that form them.

Silcrete: a silicified palaeosol ('fossil soil').

SSSI: Site of Special Scientific Interest; the designation of an area of land for statutory protection under the provisions of the *Wildlife and Countryside Act 1981*.

Stable isotope curves: curves derived from determination of the differing proportions of two of the stable isotopes of carbon, (^{12}C and ^{13}C) and two of the stable isotopes of oxygen (^{18}O and ^{16}O) in **carbonate** sediments (see Jenkyns *et al.*, 1994, Mitchell *et al.*, 1996, 1997). These determinations (referred to as $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values respectively) may be based on analysis of the rock (so-called 'bulk-rock analysis') or of specific bioclastic components of the rock such as **macrofossils** and/or **microfossils** and **nannofossils**. In the most refined determinations, separate analyses are made of macrofossils, and separations of **benthic foraminifera**, **planktonic foraminifera** and **coccoliths** (e.g. Jeans *et al.*, 1991). Sea-water palaeotemperatures can be calculated from $\delta^{18}\text{O}$ values. $\delta^{13}\text{C}$ curves are of great value in long-range correlation, particularly where no fossils are present. In addition they can be used to infer sudden changes in oceanographic parameters relating to transgressions. Stable isotope curves are a key element in the establishment and testing of integrated stratigraphical frameworks.

Stages: internationally agreed divisions of the geological series (see **chronostratigraphy**) into smaller units of time based largely on fossil assemblages. The **Upper Cretaceous** series is divided into six stages. During the 1980s, international working groups were organised to review the palaeontology, definition and subdivision of each **Cretaceous** stage (Birkelund *et al.*, 1984; Rawson *et al.*, 1996). These two publications are the primary source of information relating to stages, stage boundary definitions and stage subdivisions of the Cretaceous **System**. Updated details relating to the application of stage boundaries in the Upper Cretaceous rocks of the UK are given in the Appendix of this book. Two sites in England, Southerham Grey Pit, Lewes, Sussex and Seaford Head, Sussex, have

been nominated as candidate global basal boundary **stratotypes** and points (GSSPs) for the base of the Middle Cenomanian Substage; and for the bases of the Santonian and Campanian Stages respectively.

Sternotaxis [Holaster] plana: a fossil **echinoid** that characterizes the interval of chalk from just above the Glynde Marls to the Lewes Marl in the lower Lewes Nodular Chalk Formation. *Sternotaxis plana* was the **index fossil** of one of the traditional **assemblage zones** of the **Chalk** in England and France (see Owen and Smith, 1987; and British Museum (Natural History), 1962; also **Turonian Stage**, Appendix).

Stratigraphy: the study of the order of succession or relative position of strata (layers of rock) and the global correlation of rocks and geological events. Stratigraphy is divided broadly into lithostratigraphy, biostratigraphy, chronostratigraphy and more recently magnetostratigraphy, sequence stratigraphy, cyclostratigraphy and chemostratigraphy. Each of these topics is covered excellently by Doyle and Bennett (1998).

Stratotype: an exposure where a specific part of the stratigraphical succession is defined and acknowledged in a publication and/or by national or international agreement.

Strike: the compass direction perpendicular to the **dip** direction.

Subhercynian tectonic phases: highly misleading term introduced by Stille (1924) referring to a succession of Late **Cretaceous** phases of deformation (uplift and rotation) of the Cretaceous rocks in the area to the north of the then uplifting Harz Mountains massif in Germany – hence the name. Must be clearly distinguished from Hercynian (i.e. later Palaeozoic) structural deformation, which takes its name from the same massif. The subhercynian tectonic phases were compressive orogenic (mountain building) pulses that were initiated during the later Late Cretaceous as a result of the progressive collision of elements of the North African plate with the European platform in the initial phases of the Alpine mountain building period. The subhercynian phases of uplift and deformation are the Ilsede, Wernigerode and Peine phases, to which may be added the latest **Late Cretaceous** Laramide phase, which was first described from North America. For further details see Mortimore *et al.*

Glossary

(1998); Mortimore and Pomerol (1998).

Sub-Plenus erosion surface: erosion surface beneath the Plenus Marls Member of the Holywell Nodular Chalk Formation at the base of the White Chalk Subgroup.

Subzone: a subdivision of a **biozone** used in **biostratigraphy**.

Synsedimentary: a geological event that occurs at the time of sedimentation.

System: a **chronostratigraphical** unit comprising all the rocks formed during a geological **period**, e.g. the Jurassic System comprises all the rocks of the Jurassic **Period**.

Tabular flints: stratigraphically consistent, continuous tabular masses of flint from 5–30 mm thick. The most significant tabular flints in the English Chalk occur in the Northern Province (Lincolnshire and Yorkshire Wolds) at the boundary between the Welton Chalk and Burnham Chalk Formations (Wood and Smith, 1978).

Taxon (pl. taxa): a classification unit of organisms based on physical similarities or surmised evolutionary relationships.

Tectonism (adj. tectonic): the processes of crustal deformation (e.g. folding and **faulting**) often associated with **Plate Tectonics** and mountain building.

Terebratulina lata: a diminutive fossil **brachiopod** (lamp-shell) that characterizes part of the Turonian (see **Turonian Stage** in Appendix, this volume). *T. lata* is the **index fossil** of one of the traditional **assemblage zones** of the Chalk.

Thalassinoid flint/horn flint: **flint** reflecting the silicified sedimentary fill of a burrow of *Thalassinoides* type. Such flints are described as burrow-fill or burrow-form flints. Where there is incomplete silicification of the burrow fill, the flint takes on an irregular shape reminiscent of a horn or part of an antler.

Totternhoe Stone: a coarse, calcarenitic chalk resting on an erosion surface in the 'Lower Chalk' of the Chiltern Hills at the boundary between the West Melbury Marly Chalk and the Zig Zag Chalk formations. The Stone was originally quarried as a building freestone. The Totternhoe Stone was first described by Whitaker (1865b).

Trace fossils: many animals, some of unknown origin, lived on and in the chalk sediment forming the Late **Cretaceous** sea floor. These

animals left behind the crawling, burrowing, boring or feeding traces of their existence, now fossilized in rock (hence *trace fossils*). The shapes and sizes of the traces, such as branching, vertical pipes, spiral or U-shaped are classified and given names including *Thalassinoides*, *Chondrites*, *Skolithos*, *Bathichnus*, *Zoophycos*. These names do not indicate the animal that created the trace. For example large (20–30 mm diameter) branching traces (*Thalassinoides*), are thought to have been produced by callianassid shrimps such as the present-day *Callianassa say* or *Callianassa major* (Bromley, 1967). In contrast, the small branching traces of *Chondrites* are of unknown origin. The trace fossils of the Chalk are illustrated by Bromley (1975a); Bromley and Ekdale (1984a,b); Ekdale and Bromley, (1984) and Bromley (1990, 1996). Burrowing activity was a prime control on **diagenesis** (e.g. dewatering, redox shifts) leading to the development of nodular chalks and **hardgrounds** and to the formation of flint. The suite of trace fossils in a chalk sample greatly influences its porosity and permeability. Variation in physical properties, such as density and porosity in a laboratory sample, are in part a reflection of the original trace fossil fabric of the chalk.

Transgression: the landward migration of shorelines. This may result from a rise in sea level, an increase in crustal subsidence or reduction in sediment input to a shelf area.

Tubular flints: characteristically slender (20–30 mm diameter) cylindrical, branching **flints** that can extend continuously through more than 3 m of chalk. The tube is formed by an outer annulus of flint separated from an inner flint core by a chalky layer. Frequently the inner-core is missing, forming a tube. There are several horizons of tubular flints that are stratigraphically continuous over vast distances. These include the Lewes Tubular Flints, Shoreham Tubular Flints, Old Nore Tubular Flints and Isle of Wight Tubular Flints (see Mortimore, 1986a; Mortimore and Pomerol, 1991b).

Type locality: a place or area containing the **stratotype** section. This can apply to both **lithostratigraphy** and **biostratigraphy**. For example, Holywell, Eastbourne, is the stratotype section for the Holywell Nodular Chalk Formation. (See also **stratotype** and **GSSP**).

Glossary

Also refers to the locality from which a particular fossil species was first named and described.

Unconformity: a break in the relationship between successive strata resulting from a lack of deposition during an intervening phase of **tectonism** and erosion; the unrepresented time interval may be substantial and there is often an angular discordance in the layers either side of the unconformity surface.

Upper Cretaceous: the upper series of the **Cretaceous** Period from the base of the Cenomanian Stage to the base of the Palaeocene (base of Danian Stage) spanning the time interval from 98.5–65.4 million years ago (see Table 1.2, this volume). In ascending order, the upper Cretaceous is divided into the Cenomanian, Turonian, Coniacian, Santonian, Campanian and Maastrichtian stages (see Appendix, this volume).

Variscan structures: term referring to structural elements initiated during the Variscan Orogeny (mountain building period); commonly described as 'Hercynian' because they relate to the orientation of the

Harz Mountains massif of Palaeozoic rocks in Germany. Hercynian structures must be clearly differentiated from **subhercynian** structures.

Zone: a subdivision of a **Stage** based on the occurrence of a defining fossil (*index fossil*) or an assemblage of fossils, for example, the occurrence of the free-swimming fossil **crinoid** (sea lily) *Marsupites testudinarius* in a given interval of the Chalk on the Sussex coast defines that zone in those cliffs. The same fossil may occur in another type of rock elsewhere in the world. A zone is, therefore, independent of rock type and is a **biostratigraphical** concept. Other zones are defined by the entry of a particular fossil **taxon**, which may range beyond the interval of the zone.

Zoophycos Flints: flints formed around the spiralling trace fossil *Zoophycos* (see Bromley and Ekdale, 1984a). There are several conspicuous horizons of *Zoophycos* flints in the **Chalk** including the Cuilfail *Zoophycos*, Beachy Head *Zoophycos* and the Tavern Flints (Mortimore, 1986a; Mortimore and Pomerol, 1991b).

Fossil index

Note: Page numbers in **bold** and *italic* type refer to **tables** and *figures* respectively

- Acanthoceras* 31, 168, 339, 394
A. jukesbrownei 118, 135, 139, 174, 184, 247, 253, 480
A. rhotomagense 37, 118, 128, 135, 138, 184, 247, 277, 338, 398, 418
Acanthoceratidae 31
Acanthochaetetes ramulosus 115, 118, 126, 129, 131, 132
Acompsoceras 246, 338
A. inconstans 126, 130
Actinocamax 303
A. bobemicus 387, 482
A. plenus see *Praeactinocamax plenus*
A. quadratus 168
A. verus 45, 290, 291, 321, 327
Actinoceramus tenuis 47, 246
Agerostrea lunata 46, 61, 371
Algerites 34, 300, 395
A. ellipticum 130, 133
A. sayni 130, 133
Allocrioceras angustum 42, 386
A. annulatum 119
ammonites 23, 29, 31, 32–33, 34, 35–41, 79, 117, 199, 212, 240, 289, 312, 465
Amphidonte 127, 339, 341, 448, 453, 455, 458, 458, 465, 469, 473, 474
Amphorometra 427
Anagaudryceras involvulum 138
Ancistrocrania 57
A. parisiensis 354
Angulogavelinella bettenstaedti 369
Anisoceras 130
A. plicatile 135, 138
Aphrocallistes cylindrodactylus 357
Apiotrigonia sulcataria 132
Applinocrinus cretaceus 105
Aptychus leptophyllus 160
Archaeoglobigerina cretacea 75, 77
Arcuatothyris arcuata 127
Arenaciarcula beaumonti 127
Atreta 321, 324
A. nilssoni 348
Aucellina 24, 277, 300, 339, 350, 395, 396, 417, 418, 479
A. gryphaeoides 152, 350, 392
A. uerpmanni 392
Austiniceras 132, 394
Austinocrinus 354
A. bicoronatus 360, 364
Baculites 204, 357
B. undulatus 346
Barroisiceras 482
Baskaniceras deshayesitoides 126, 130
B. smithi 130, 131
Bathicynus 32, 275
B. paramoudrae 69, 71, 252
Bathrotomaria perspectiva 42, 259
Belemnella 45, 310, 364, 367, 368, 485
B. lanceolata 310, 364, 372, 484, 485
B. obtusa 369, 371
B. sumensis 366, 371
Belemnelloamax 45, 161
B. blackmorei 160, 161
B. grossouvrei 283, 291, 293
Belemnitella 43, 45, 161, 204, 207, 222, 353, 364, 388, 429, 465, 485
B. lanceolata 160, 310, 370, 484
B. 'langei' 353, 354, 357
B. minor 1 357
B. mucronata 33, 45, 370, 462, 468
B. najdini 353
B. pauli 353
B. plenus 247
B. praecursor 160, 222, 468, 484
B. praecursor mucronatiformis 159
B. woodi 357
belemnites 7, 31, 43, 43, 44, 45, 160, 222, 283, 293, 353, 355, 371–2, 465

Fossil index

- Belemnocamax boweri* 43, 45, 394, 398, 418
- Bicavea rotaformis* 184, 261
- bivalves 6, 23–25, 29, 31, 45–6, 47–53, 56–59, 69, 78, 85, 117–18, 120, 123–4, 126–9, 132–3, 136–7, 139, 141, 145–6, 149–50, 152, 155–7, 161, 167–8, 182, 184, 186–8, 190–1, 196, 198–9, 204, 207, 219, 223, 228, 230–1, 234–7, 239, 246–7, 253, 258–60, 263–4, 269, 275, 277–82, 289–90, 292–3, 300, 304, 307–9, 313, 315, 317–19, 324, 327–9, 333, 338–9, 341–2, 345–8, 350–1, 353–5, 357, 369, 371, 381, 386–8, 392, 394, 397–8, 402, 406, 417–19, 422–3, 426–7, 429, 444, 459, 465, 474–5
- see also inoceramids
- Bolivina incrassata* 76, 77, 358, 365
- Bolivinaoides culverensis* 292
- B. draco miliaris* 76, 77
- B. miliaris* 354, 358
- B. paleocenicus* 369
- B. peterssoni* 364
- B. sidestrandensis* 76, 77, 354, 358
- B. strigillatus* 291, 483
- Bourgueticrinus* 193, 222, 236, 289
- B. papilliformis* 168
- Broinsonia parca parca* 237
- brachiopods 57, 62, 127, 168, 184, 290, 304, 371,
- Burrirhynchia devoniana* 127
- Calcisphaerula* 13
- Calliboplites vraconensis* 151
- Calycoceras* 31, 168, 174, 247
- C. (Calycoceras) bathyomphalum* 135, 138
- C. (C.) naviculare* 128, 135, 480
- C. (Gentoniceras) gentoni* 138
- C. (G.) subgentoni* 138
- C. (Newboldiceras) asiaticum asiaticum* 118, 135, 138
- C. (N.) a. hunteri* 138
- C. (N.) a. spinosum* 135, 138, 139
- C. (N.) hippocastanum* 128
- C. (N.) planecostatum* 118
- C. (N.) tunetatum* 118, 139
- C. (N.) vergonense* 139
- C. (Proeucalycoceras) guerangeri* 128, 132
- C. (P.) picteti* 128, 135, 139
- Camerogalerus cylindricus* 119, 174, 304
- C. minimus* 119, 128
- '*Cardiaster ananchytis*' 358
- Cardiaster cordiformis* 357
- C. granulatus* 371
- C. pilula* 225
- C. pygmaeus* 119, 128
- C. truncatus* 119, 128
- Cardiotaxis* 62
- C. aequituberculatus* 236, 289
- C. cretacea* 119, 128
- C. heberti* 357
- Carneithyrus carnea* 354, 357
- Cataceramus* 46
- C. dariensis* 196, 204, 206, 207
- Catopygus columbarius* 118, 138, 150
- cephalopods 31, 32–3, 35–8, 41, 43, 160, 241
- see also ammonites; belemnites
- Ceriopora* 118
- C. ramulosa* 109
- Chatwinothyris* 371
- Chlamys aspera* 132
- Chondrites* 32, 69, 71, 292
- Cibicides beaumontianus* 290
- C. ribbingi* 290
- cidarids 62, 293
- Cladoceramus* 275, 289, 319, 483
- C. undulatoplicatus* 56, 168, 188, 192, 198, 229, 236, 237, 289, 290, 318, 388, 426, 483
- coccolithophorids 10
- coccoliths 9, 10, 12, 13, 29
- Collignoniceras* 128
- C. woollgari* 32, 34, 41, 145, 184, 260, 263, 312, 313, 315, 480, 483
- Collignoniceratidae 34
- Concinnithyrus* 57, 345, 386
- C. subundata* 62, 168, 174, 247, 278, 339, 418
- Conulus* 62, 64, 20, 290, 318, 327, 328, 474
- C. albogalerus* 64, 192, 236, 289, 291, 388
- C. castanea* 118, 119, 128, 132
- C. raulini* 64, 280, 474
- C. subrotundus* 64, 128, 145, 259, 260, 400
- corals 353
- Cordiceramus* 236, 388, 426
- C. cordiformis* 56, 289, 290, 388, 426, 483
- Cordiceramus?* 59, 161
- Coscinopora infundibuliformis* 327
- Coskinophragma* 120, 136, 145, 261
- crabs 123
- Crania* 324
- Cremnoceramus* 32, 46, 120, 235, 280, 345, 482
- C. crassus* 78, 145, 406
- C. c. crassus* 53, 156, 168, 184, 192, 235, 280, 333, 347, 387
- C. c. inconstans* 51, 307, 387, 406
- C. deformis erectus* 52, 184, 234, 280, 347, 406, 482
- C. rotundatus* 406, 482
- C. schloenbachi* 145, 406
- C. waltersdorfensis* 46, 145, 156, 184, 191, 234, 259, 280, 308, 333, 345, 347, 481, 482
- C. w. bannouvrensis* 52, 347, 406, 407
- C. w. waltersdorfensis* 52, 406
- Cretirhynchia* 57, 236, 279
- C. arcuata* 354, 357
- C. cuneiformis* 259, 279, 345, 387, 406
- C. exsculpta* 219, 236, 293
- C. limbata* 371
- C. magna* 369

Fossil index

- C. minor* 62, 168, 259, 279
C. norvicensis 354, 357
C. plicatilis 236, 291
C. retracta 369
C. robusta 474
C. subplicata 275, 280, 308, 347, 474
C. woodwardi 357
Cretolamna appendiculata 338
 crinoids 31, 68, 128, 168
Cunningtoniceras 31, 338
 C. cunningtoni 474
 C. inerme 36, 241, 246, 277, 479
Cyclothyris difformis 127
 C. schloenbachii 118, 138, 140
Cystispongia bursa 387
Cytherelloidea 358

Dereta pectita 127, 174
Desmoceras latidorsatum 139
Desmophyllum 369
Diaulax oweni 128
Didymotis 16, 279, 482
 D. costatus 406, 482
Discoidea dixonii 119, 128
Discoidea subuculus 128, 138
Discoscaphites binodosus 429

Echinocorys 31, 32–3, 62, 64, 105, 145, 155, 160, 168, 169, 174, 184, 186, 191, 193, 196, 204, 206, 214, 219, 221, 222, 235, 236, 237, 259, 290, 291, 293, 308, 309, 313, 321, 327, 328, 333, 359, 386, 388, 472, 474
 E. belgica 364, 369
 E. conica 174, 196, 484
 E. conoidea 354
 E. gravesi 234, 308, 347, 406
 E. limburgica 371
 E. pyramidata 360
 E. scutata 219
 E. s. cincta 160, 202, 220
 E. s. depressula 160, 220, 236, 328
 E. s. elevata 219, 290, 291, 321
 E. s. tectiformis 219, 236, 237, 292, 321, 323
 E. s. truncata 220, 237
 E. subconicula 175, 196, 204, 207, 484
 E. turrita 204, 207
 echinoderms 123, 127–8
 echinoids 31, 62, 63, 64, 65, 66, 67, 68, 119, 123, 128, 174, 175, 279, 293, 299, 307, 327, 371, 387, 388
Entobia cretacea 78
Entolium 474
 E. orbiculare 247, 277, 339, 394, 418
Eoscapites chardensis 139
 'Epiaster' 245, 357
Eponides beisseli 76, 77, 358
Eubostrychoceras saxonicum 42, 279
Eucalycoceras 31
 E. gothicum 139
 E. pentagonum 128, 132
 E. rowei 128
Euomphaloceras 31
 E. euomphalum 128, 132
 E. septemseriatum 119, 145, 253

Fagesia catinus 34, 119, 264, 278
Filograna avita 120, 260, 278
 foraminifera 13, 29, 71, 72–6, 77, 289–90
Forbesiceras 246
 F. beaumontianum 131
 F. bicarinatum 128
 F. lagilliertianum 131, 139
 F. obtectum 139
Forresteria 482
 F. petrocoriensis 279, 482

Galeola 31, 62
Galerites 369
 G. roemeri 354, 358
Gauthieria princeps 371
 G. radiata 62, 174, 279
Gavelinella arnagerensis 290
 G. baltica 72, 77
 G. cenomanica 72, 77
 G. cristata 74, 77, 291
 G. lorneiana 75, 77
 G. monterelensis 364, 484
 G. stelligera 291
 G. thalmani 455

Gibbithyris 57, 290, 313, 388, 426
 G. ellipsoidalis 168, 236, 289
 G. subrotunda 279, 345, 387, 406
Glaessneria kennedyi 131
Glandifera rustica 394
Glenotremites 128
Globigerina 441
Globigerinelloides rowei 292
Globorotalites biltermanni 358, 364, 365, 485
 G. micheliana 358
Globotruncana bulloides 75, 77
Glyptoxoceras 204
Goniotentis 43, 45, 161, 204, 222, 291, 292, 321, 427, 484
 G. granulata 291, 321, 328, 329
 G. granulataquadrata 223, 292, 321, 329, 483
 G. prae-westfalica 290
 G. quadrata 33, 45, 169, 202, 309, 321, 484
 G. quadrata gracilis 204
 G. westfalica 290, 427
Grasirhynchia grasiana 127, 138, 174, 277
 G. martini 247, 277, 394
Gryphaeostrea canaliculata 371
 G. canaliculata var. *striata* 328

Haenleinia inordinata 160
Hagenowia 64, 64, 68, 69, 78, 293, 387
 H. anterior 291, 388, 427
 H. blackmorei 68, 105, 159, 221
 H. rostrata 105, 290
Hamites subvirgulatus 139
Haplophragmium 120
Hauericeras 222
 H. pseudogardeni 34
Hedbergella prae-helvetica 459
 H. simplex 72, 77
Helvetoglobotruncana helvetica 73, 77, 136
Hemiaster 62
 H. minimus 398
 H. nasutus 119, 128

Fossil index

- Hepteris* 438, 455
Hirudocidaris birudo 119, 128, 339
Holaster 31, 62, 118, 168, 169, 174, 398
 H. altus 128, 132
 H. bischoffi 128, 132, 384, 392
 H. laevis 132
 H. nodulosus 128, 132
 H. planus 259, 261
 H. subglobosus 115, 118, 128, 132, 168, 169, 174, 259, 384, 394
Hyphantoceras reussianum 42, 279, 386
Hyboplites 118, 140, 151, 246
 H. campichei 131
 H. curvatus 138
 H. c. arausionensis 126, 131, 135
 H. c. curvatus 131
 H. c. pseudofalcatus 131
 H. falcatus 126, 138
Hypoturrites 34, 118, 151, 277, 392
 H. betraitensis 131
 H. collignoni 131
 H. gravesianus 35, 127, 135
 H. mantelli 131
 H. tuberculatus 35, 127
Idiobamites 34
 I. alternatus 131, 133
Infulaster 62, 307, 386, 406
 I. infulasteroides 290, 388, 426
Inoceramidae 45
inoceramids 23, 31, 39–40, 45–6, 47–60, 78–9, 119–20, 127, 168, 184, 386, 387–8, 406, 408, 417, 468
Inoceramus 45, 46, 120, 436, 480
 I. anglicus 32, 417
 I. annulatus 406
 I. apicalis 49
 I. atlanticus 46, 47, 247, 248, 253, 303, 474, 480
 I. balticus pteroides 59
 I. brongniarti 422
 I. comancheanus 395
 I. conicus 127, 132
 I. crippsi 46, 47, 152, 277, 300, 338, 392, 417
 I. c. boppenstedtensis 392
 I. cuvieri 45, 46, 49, 120, 145, 146, 156, 185, 260, 313, 315, 327, 345, 386
 I. digitatus 387, 474
 I. gibbosus 387, 482
 I. labiatus 136
 I. lamarcki 46, 49, 120, 264, 278, 279, 386
 I. l. stuemkei 50
 I. lusitiae 51
 I. perplexus 279, 345, 481
 I. pictus 46, 47, 145, 168, 174, 184, 247, 253, 339, 341, 480
 I. schoendorfi 46, 246, 277, 417, 418, 479
 I. subsarumensis 159, 160
 I. tenuistriatus 351
 I. virgatus 46, 118, 127, 129, 132, 133, 151, 152, 246, 301, 338, 393, 417
 I. v. scalprum 47
 I. websteri 50, 155
Isocrania 57
Isocrinus dixonii 68, 166
 I. granulatus 182
 I. ? undulatus 128
Kamerunoceras puebloensis 119
 K. turoniense 119
Kingena 354
 K. arenosa 127
 K. blackmorei 159
 K. concinna 247, 277, 394
 K. lima 327
Kingenella 354
Labyrinthidoma 136, 148, 223
 L. dumptonensis 289, 290
 L. southerhamensis 120, 145, 146, 260, 345
Lechites gaudini raricostatus 135
Lecointricerus fleuriausianum 119
Lepidospongia rugosa 357
Leptophragma striatopunctata 357
Lewesiceras 34
 L. mantelli 34, 41, 386
 L. peramplum 34, 119, 259, 278, 313, 398
Limea 394
Lingulogavelinella globosa 72, 77
 L. cf. vombersis 290
Linotrigonia (Oistrigonia) vicaryana 132
Lotzeites 135, 139
 L. aberrans 128
Loxostomum eleyi 74, 77
Lucianorhabdus cayeuxii 437, 472
Lyropecten (Aequipecten) arlesiensis 246, 277, 397, 474
 L. (A.) pulchellus 371
Magadiceramus 482
 M. subquadratus 482
Magas chitoniformis 62, 174, 175, 371
 M. pumilus 174
Mammites 31
 M. nodosoides 32, 34, 38, 119, 260, 264, 278, 386, 398
Mantelliceras 31, 118, 135, 140, 150, 151, 246, 277, 395
 M. cantianum 36, 118, 127, 184
 M. coultoni 131, 133
 M. dixonii 46, 118, 127, 129, 150, 151, 242, 246, 301, 417
 M. lymense 118, 127, 131
 M. mantelli 24, 35, 127, 184, 245, 474, 479
 M. saxbii 131, 135, 138, 245, 338
Marginotruncana coronata 278, 281
 M. pseudolinneiana 73, 77, 278
 M. sigali 136, 278
Mariella 34, 150, 151, 184, 245, 392
 M. cenomanensis 118
 M. dorsetensis 131
 M. lewesiensis 127, 338
 M. quadrituberculata 131
 M. torquatus 131

Fossil index

- Marsupites* 31, 68, 222, 236, 291, 292, 327, 328, 329, 429, 483, 484
M. testudinarius 68, 168, 218, 219, 321, 328, 429, 483
Menuites portlocki 357
Merklinia aspera 118, 127, 129, 132
Mesoturrilites boerssumensis 138, 140, 151, 246
Metaptychoceras smithi 42
Metasigaloceras 31
M. rusticum 38, 119, 260, 278
Metoicoceras 31
M. geslinianum 38, 119, 174, 253
Metopaster parkinsoni 290
M. uncatus 290
Micrabacia coronula 277, 278
Micraster 31, 62, 78, 119, 184, 220, 226, 258, 259, 279, 281, 290, 291, 293, 307, 308, 313, 318, 327, 333, 347, 424, 482
M. bucailli 387, 406
M. ciplensis 359
M. coranguinum 33, 219, 236, 290, 318, 327, 388
M. corbovis 120, 259, 261, 263, 279, 345, 387, 406, 422
M. cortestudinarium 280, 308, 345, 421, 422
M. decipiens 32, 156, 184, 235, 280
M. gibbus 168, 236, 289, 290, 388
M. glyphus 357
M. aff. grimmensis 359
M. leskei 120, 145, 153, 155, 156, 166, 168, 182, 184, 259, 279, 345, 387
M. michelini 32, 261, 279, 345, 346, 386
M. normanniae 32, 120, 155, 156, 168, 184, 191, 234, 259, 279, 387, 406
M. praecursor 155, 184, 259
M. rogalae 236, 290
M. rostratus 321
M. schroederi 388
M. stolleyi 357
M. turonensis 235, 238, 280
microfossils 7, 71, 106, 120, 198, 214, 219, 237, 239, 253, 265, 293, 342, 345, 354, 372, 373, 430
Micula 231
M. staurophora 437
Mimachlamys mantelliana 357
Modestella geinitzi 247, 277, 394
Monticlairella? rectifrons 338
Morrowites wingi 34, 260, 386, 398
M. w. reveliereoides 119
M. w. wingi 119, 278
Mytiloides 29, 31, 32, 45, 46, 144, 168, 182, 184, 247, 253, 259, 260, 278, 304, 305, 339, 398, 399, 480, 481
M. columbianus 48
M. costellatus 50, 279, 345, 481
M. battini 48, 119
M. herbichi 46, 51, 481
M. incertus 50, 279, 345
M. kossmati 46, 48
M. labiatoidiformis 50
M. labiatus 46, 48, 119, 128, 136, 145, 386, 398, 399
M. mytiloides 46, 48, 119, 145, 386, 398
M. opalensis 48
M. puebloensis 46, 48
M. striatoconcentricus 46, 50, 259, 279
M. subbercynicus 46, 49, 145, 146, 174, 185, 400, 481
Nannoconus 12
nannofossils 4, 71, 78, 437, 453, 472
nautiloids 259
Neancyloceras bipunctatum 354
Necrocarcinus labeschei 128
Neocardioceras 31, 128
N. juddii 34, 128, 253
Neocrioceras (Schlueterella) 354
Neoflabellina praereticulata 358, 365
N. reticulata 365, 485
Neobibolites praeultimus 350, 419
N. ultimus 43, 392
Neolithyrina obesa 354, 371
Neostlingoceras 34
N. carcitanense 35, 126, 131, 133, 152, 277, 479
N. oberlini 131, 133, 479
N. virdenense 128
Nigericeras gignouxii 119
Nostoceras (Bostrychoceras) polyplacum 357
Notidanus 338
Notopocorystes ornatus 128
Offaster 31, 62, 160
O. pilula 31, 33, 105, 160, 169, 186, 217, 220, 221, 221, 222, 225, 237, 238, 321, 328, 429, 484
O. p. nana 33, 236
O. p. planatus 64, 160, 217, 221, 221, 222, 237, 238
Orbirhynchia 57, 120, 184, 354, 406
O. bella 159
O. cuvieri 62, 145, 259, 304
O. dispansa 62, 279
O. granum 159
O. mantelliana 32, 57, 62, 130, 174, 184, 245, 247, 278, 303, 339, 340, 394, 417, 418
O. multicostata 62, 119, 304, 339, 400
O. pisiformis 236, 289, 427
O. reedensis 62, 259, 279
O. wiesti 119, 128, 168
O. wilmingttonensis 127, 130
Ornatothyris 304
O. latissima 304
O. sulcifera 341
?Ostlingoceras 184
ostracods 71
Ostrea lunata 370
Ovatathyris ovata 127

Fossil index

- Oxytoma seminudum* 246,
 247, 277, 394
 oysters 46, 61, 223, 277
- Pachydiscus neubergicus* 367,
 484
- Parabibolites tourtiaie* 43
- Paranecrocarcinus biscissus*
 128
P. digitatus 128
P. foesteri 128
- Parapuzosia* 29, 29, 222
P. (Austiniceras) 135, 139,
 303, 339, 398
P. (A.) austeni 29, 34, 37,
 139, 247, 394, 398
P. (P.) leptophylla 34, 291,
 427
- 'Parasmilia'* 290
- Pecten asper* 118
P. cretosus 321
- Periaulax* 357
- Peroniaster nasutulus* 398
- Phymosoma koenigi* 290
- Pithonella* 13
- Pithonoton cenomanense* 128
- Plagiophthalmus oviformis*
 128
P.? nodulosus 128
- Plagiostoma globosum* 338,
 339
P. marrotianum 357
- Planolaterus* 357
- Platyceramus* 53, 78, 120, 168,
 184, 192, 228, 229, 236,
 290, 318, 387, 424, 474,
 475, 483
P. mantelli 235, 280, 309
- Plicatula inflata* 338, 339
- Porosphaera* 369, 370, 442,
 444, 445, 447, 447
P. globularis 370, 427, 444
- Praeactinocamax plenus* 43,
 43, 119, 121, 128, 135, 140,
 145, 174, 247, 303, 400
P. primus 43, 43, 247, 278,
 339, 394, 397, 418, 474
- Praebulimina reussi* 74, 77
- Prediscosphaera serrata* 437
- Prionocidaris granulostriata*
 128
- Prionocyclus germari* 32
- Protacanthoceras* 31, 132
P. arkelli verrucosum 139
- P. bunburianum* 128
P. proteus baylissi 128
P. p. proteus 128
P. p. vascoceratoides 128
P. tuberculatum devo-
nense 119, 128
P. t. tuberculatum 139
- Pseudaspidoceras footeanum*
 278
- Pseudocalycoceras angolaense*
 119
- Pseudojacobites farmeryi* 386
- Pseudoperna boucheroni* 46,
 61, 223, 236, 328, 429
- Pterotriconia crenulifera* 132
- Ptychodus* 338
P. mammilaris 400
- Pullenia quaternaria* 76, 77
- Puzosia* 139
P. mayoriana 139
P. muelleri 346
P. odiensis 119
- Pycnodonte* 61, 303, 339, 341,
 418
P. vesiculare 328, 371
- Rastellum colubrinum* 61, 277,
 392
- Rectithyris wrightorum* 127
- Rehacythereis bemerodensis*
 419
- Reussella szajnochae praecur-*
sor 291
R. szajnochae szajnochae
 76, 77, 358, 364, 485
R. kelleri 75, 77
- Rhizopoterion* 327
R. cribrorum 468
- Rhynchonella pilicatilis* 321
- Rhynchonellidae* 57
- Rhynchostreon* 448, 468
R. suborbiculatum 474
- Romaniceras* 16, 31
R. (Yubariceras) ornatissi-
mum 261, 312, 313, 315
R. deverianum 34, 41, 261,
 281, 346, 481
- Rostrogalerus rostratus* 128
- Rotalipora cushmani* 72, 77
R. globotruncanoides 24,
 479
R. reicheli 479
- Roveacrinus* 278
- Rutitrigonia* 132
- R. affinis* 132
R. dunscombensis 132
- Saccocoma cretacea* 105
- Salenia* 444
- Scaphites* 34, 184, 246, 313
S. binodosus 388, 409, 429
S. equalis 128, 132, 135,
 139, 168
S. geinitzii 42, 279
S. hippocrepsis 204
S. obliquus 139
- Schloenbachia* 118, 132, 151,
 168, 174, 246, 300, 338,
 392, 395, 469, 474
S. coupei 34, 135, 139, 338
S. intermedia 468
S. lymense 128, 135
S. varians 34, 35, 127,
 131, 135, 151, 245, 277,
 458
- Schlueterella* 354
- Sciponoceras* 34, 119, 128, 281
S. baculoides 128, 139,
 184, 247, 338, 418
S. bohemicum 42, 313
S. bohemicum anterius
 128, 145, 339
S. gracile 119
S. roto 131, 133, 479
- sea lilies and feather stars 68
 see also crinoids
- sea urchins 62
 see also echinoids
- serpulids 438, 475
- Sharpeiceras* 31
S. laticlavium 277
S. schlueteri 36, 277, 392
- Spathites (Jeanrogericeras)*
subconciliatus 128
- Sphaeroceramus sarumensis*
 59, 159, 160, 161
- Sphenoceramus* 46, 223, 290,
 429
S. angustus 388, 429
S. cardissoides 290, 388,
 426
S. lingua 58, 429
S. pachti 58
S. p. pachti 58
S. patootensiformis 58,
 388, 429
S. pinniformis 57
S. tuberculatus 57

Fossil index

- Spinaptychus spinosus* 289
Spondylus 321, 324
 S. latus 46, 321
 S. spinosus 46, 78, 78, 231, 290, 313, 345
 sponges 29, 30, 388, 458, 474
Spongia paradoxica 300
Squalicorax 338
Stauronema carteri 277
Stensioeina exsculpta exsculpta 74, 77, 482
 S. gracilis 455
S. granulata granulata 73, 77, 482
 S. g. perfecta 291, 483
 S. g. polonica 74, 77, 289, 291
 S. pommerana 76, 77
Sternotaxis 62, 289
 S. gregoryi 339, 341
 S. placenta 64, 145, 155, 156, 184, 259, 279, 313, 333, 406, 424
 S. plana 64, 120, 259, 261, 279, 313, 345, 386, 421
Stoliczkaia (Lamnayella) juigneti 131
Subprionocyclus 16, 312, 313, 315, 481
 S. branneri 42, 313, 315, 481
 S. hitchinensis 279, 281, 315, 481
 S. neptuni 16, 32, 34, 42, 281, 313, 315, 345, 386, 481
 S. normalis 346
Tappanina selmensis 371
Tarrantoceras (Sumitoceras) cautisalbae 119
Teichichnus 337, 340
Temnocidaris sceptrifera 327
 Terebratulidae 57
Terebratulina chrysalis 354
 T. gracilis 371
 T. lata 120, 259, 261, 279, 313, 386, 399
 T. protostriatula 168
 T. rowei 168
Terebrirostra lyra 127
Teredo amphiboena 318
Tethyoceras 406, 407
Texanites 289
Thalassinoides 32, 69, 69, 70, 113, 115, 227, 228, 255, 269, 300, 320, 321, 324, 327, 436, 437, 437, 448, 458, 458, 468, 469, 473, 474
 T. suevicus 71
Thomasites gongilensis lautus 119
 T. g. tectiformis 119
Thomelites 31
 T. serotinus 119, 253
 T. sornayi 118, 128
 trace fossils 15, 17, 18, 31, 32-3, 69, 70, 71, 227, 235, 238, 275
Trigonosemus pulchellus 371
Trochiliopora gasteri 105, 228
Tropeothyris carteri 277
Turcica? schlueteri 42
Turrilites acutus 35, 135, 139
 T. costatus 35, 118, 135, 174, 184, 246, 247, 338, 418
 T. scheuchzerianus 35, 127, 130, 246, 338, 340
 T. wiestii 246
Tylocidaris clavigera 62, 290, 327
 T. sorigneti 119
Uintacrinus 31, 327, 483
 U. anglicus 68, 218, 219, 222, 236, 292, 411, 429, 483, 484
 U. socialis 68, 168, 188, 193, 236, 291, 327, 429, 483
Utaturiceras vicinale 277
Vaginulinopsis scalariformis 74, 77
 Vascoceratidae 34
Ventriculites 327
Volviceras 46, 120, 168, 184, 192, 229, 318, 319, 388, 424, 482
 V. involutus 53, 235, 238, 280, 293, 387, 474
 V. koeneni 235, 280, 309, 387, 482
Watinoceras 31, 136
 W. amaduriense 253
 W. devonense 34, 119, 128, 253, 480
Whiteinella baltica 73, 77
Wilmingtonia satyricea 128
Worthoceras 139
 W. compressum 128
Xanthosia fossa 128
Yezoites bladenensis 279
Zoophycos 32, 69, 70, 157, 223, 227, 244, 248, 252, 259, 345, 347, 406, 444

General index

Note: Page numbers in **bold** and *italic* type refer to **tables** and *figures* respectively

- Abbot's Cliff–Lydden Spout
Middle Cenomanian biostratigraphy 277
rhythmicity 270
- Acanthoceras jukesbrownei*
Zone 480
Island Magee Siltstones 474
Little Beach Member 118
Southerham Grey Pit 245, 247
- Acanthoceras rhotomagense*
Zone 480
- Actinocamax quadratus* Zone
see Gonioteuthis quadrata Zone
- Aker's Steps section 278, 281
- Albian–Cenomanian boundary
282, 479
Northern Province 384
in Hunstanton Red Chalk Formation 384, 411, 412
Speeton Cliff 410, 417–418
- Allt na Teangaidh
Amphidonte basal green-sands 453, 455
Gribun Chalk, inoceramid shell beds 455
lithostratigraphy 448, 449, 450, 451, 452, 455, 475
- Allt Strollamus, Skye, lime-stones 436
- Alum Bay 198
- ammonite zones 19, 23, 34, 40
see also named ammonite zones
- Amphidonte* events 341, 415, 418, 458
- Anglian Trough 300
- Anglo-Brabant Massif 11, 19, 264, 280, 297–8
- Angulogavelinella bettenstaedti* flood event 361, 369, 372
- Trimingham Sponge Beds Member 372
- Annis' Knob/Breaky Bottom Flint 114
- Ardtun Leaf Beds, 476
- Arlesiensis Bed 39, 246, 266, 393, 397, 414
Abbot's Cliff 266, 277
Speeton Cliff 417
- Arme *rhotomagense* Schichten 418
- Arraphoceras briacensis* (ammonite) Subzone 479
- Arreton Down Marl 196
- Arreton Down Pit 198
- Arreton Down Triple 196
- Arundel Sponge Bed 99
base of *Gonioteuthis quadrata* Zone 237
- Newhaven to Brighton 214–15, 222
- West Harnham Chalk Pit 157, 159, 160
- Asham Marls 243, 250
- Asham Pits 248–9
- Asham Zoophycos Beds 178, 243, 244, 248, 250
- ashfall events 15, 16
- Ashwell Section, Melbourn Rock 304
- Aston Marl 305
- Aston Rowant Cutting 330–5
Beachy Head Zoophycos Beds 334
biostratigraphy 333
Chalk Rock 330, 334, 334, 335
Fognam Marl 331, 334
Hitch Wood Hardground 332, 333
lithostratigraphy 330–3
Shoreham Marls 333, 334
Top Rock 330, 332, 335
- Atlantic Ocean 6–7
- Aucellina Beds 300, 302, 339
- Auchnacraig 476
expanded section 437, 458
variation in stratigraphy 438
- Austinocrinus Bed 353, 354
- Baculites Bed 353, 354
- Baily's Hill Flint Band 99, 229
- Ballard Cliff Member 171
- Ballard Fault 170–1, 172, 175
Shide Marl 170, 175
- Balmeanach boulders 448, 449, 450
- The Bank (limestone) 178, 179, 180, 393
Southerham Grey Pit 243, 246, 250
- Barrington Chalk Pit 347–51

General index

- biostratigraphy 348
 Cambridge Greensand
 Member 347–50
 lithostratigraphy 348
 Totternhoe Stone 347, 349, 351
 West Melbury Marly Chalk
 Formation 347, 351
 Barrois' Sponge Bed 282, 283, 284, 288, 290, 292, 293, 308, 318, 327
 Barrow Flints 403, 405
 Barton Marls 25, 382, 399, 401, 420
 Bastion Step Beds 216, 219, 232, 232, 234
 Beachy Head 251
 biostratigraphy 253
 compared to Cuckmere to Seaford 238
 Glauconic Marl 249, 250
 Gun Gardens section 253
 Ogbourne surface 314
 Cenomanian–Turonian
 boundary 249, 252, 253
 Plenus Marls, basal beds 252
 Beachy Head Sponge Beds 227, 274
 Beachy Head Zoophycos Beds 97, 98, 227, 238, 267, 274, 275, 344, 345, 405
 Aston Rowant Cutting 334, 335
 Beacon Hill Farm Marls 428
 Beacon Hill Grey Chalk
 Member 311, 312, 368, 371
 Little Marl Point 370
 Mundesley Borehole 372–3
 Beacon Hill Marl 399, 420
 Bedhampton Marls 100, 196, 209
 Bedwell Line 284, 288, 291
 Bedwell's Columnar Flint Band 88, 97, 99, 266, 267
 South Foreland 275
 Thanet coast 282, 284, 285–6, 289–90
 White Nothe 167, 167
 Beeding Beds 274
 Beeding Flint Band 227, 257
 Beeding Hardgrounds 167, 227, 274
 Beer Head Limestone Formation 102
 Hooken Cliff 110, 113, 115, 121
 Wilmington Quarry 123, 126, 129
 Beer Roads Section 137
 Beer Roads Member 111
 Beer Stone 103, 107, 112, 116, 122, 124, 125, 129
 Beeston Chalk Formation 310, 311
 Caistor St Edmund Chalk Pit 351, 352, 353, 354
 Catton Grove Chalk Pit 355–7
 Beinn Iadain and Beinn na h-Uamha 462, 463–9, 464, 473, 475
 Beinn Iadain Mudstone
 Formation 437, 439, 463, 465, 470
 Allt na Teangaidh 451
 Carsaig 457, 459, 460
 Clachandhu boulders 447
 Coire Riabhach stream section 464, 467
 Gribun Stream Boulder 442
 Beinn Iadain section 1 462–3, 465, 467
Belemnella lanceolata Zone 310, 311, 363, 364, 372
Belemnella obtusa Zone 311, 371
 Porosphaera Beds 369
Belemnella pseudobtusa Zone, *Porosphaera* Beds 311, 369
Belemnella sumensis Zone 311, 371, 485
 belemnite 'Overlap Zone' 60, 199, 204, 210, 484
 belemnite zones, comparison across Europe 44
Belemnitella minor I Zone 44, 311, 351, 353, 357, 364
Belemnitella minor II Zone 44, 311, 364
Belemnitella mucronata Zone 87, 484
 Norwich 310
 Caistor St Edmund 353
 Catton Grove Chalk Pit 357
 Downend Chalk Pit 199
 Farlington Pit, base of 207
 Handfast Point to Ballard Point 170, 174, 175
 Whitecliff, base of 196, 196
Belemnitella woodi Zone 44, 311
Belemnitella woodi–*Belemnitella minor* zone boundary, Catton Sponge Bed 357
 Belfast Marls 472, 474
 Belle Tout Beds (Marls) 167, 168, 235, 238, 309, 318
 Compton Bay 183–4
 Cuckmere to Seaford 228, 228
 Folkestone to Kingsdown 276, 275, 280
 Langdon Stairs 272
 Southerham Pit 255
 Whitecliff 187, 190
 Belle Tout–Cuckmere beds boundary 228
 Bempton Cliffs, basal Burnham Chalk Formation 421
 Bempton Fault 420–1
 Berkshire Downs–Chiltern Hills structural high 297–9
Bicavea rotaformis event 261
 bio-events 365, 384
 bio-event horizons 23–4, 339
 Southern Province 39–40, 54–5, 175, 247, 291
 biostratigraphical indices 7, 31–71, 237–8
 bivalves, inoceramids 45–6, 47–53, 56–7
 brachiopods 57, 62
 cephalopods
 ammonites 31–4, 35–42
 belemnites 43, 44, 45
 echinoids 62–8
 microfossils 71, 72–7
 trace fossils 69, 70, 71
 see also bio-events
 Birling Gap syncline 238
 Black Band 377, 380, 384, 385
 Melton Bottom Chalk Pit 397, 398, 400
 Speeton–Buckton Cliffs 413, 415
 Welton Wold Quarry 398
 Black Band lithologies 6
 Black Rabbit Marls 158, 193, 232
 black shales, recording oceanic

General index

- anoxic events 6, 78, 249
Bolivinooides decoratus
 Interval Zone 358
Bolivinooides paleocenicus ben-
 thitic foraminiferal Zone 369,
 371
 Bopeep Flints 95, 183, 262,
 271, 272
 Boreal Realm 5, 6, 7
 belemnite subprovinces 43
 Bovey Basin 85, 86
 Boxford Chalk Pit 170, 315–19,
 323
 biostratigraphy 318
 lithostratigraphy 316–18
 Boxford Paired Hardgrounds
 316, 316, 317, 318
 Boxford–Winterbourne area,
 chalk succession 322
 Boyne Hollow Cherts Member
 148, 149
 Stoliczkaia dispar Zone 149
 Brading Marls 196
 Brandon Flints 95, 307
 Branscombe Hardground 103,
 112, 113
 Hooken Cliff 114, 115, 122
 Brasspoint Flint 229, 230, 236
 Breaky Bottom Flint 181
 Southerham Pit 257, 257,
 258
 Bridgewick Flints 95, 181, 183,
 262
 Folkestone to Kingsdown
 267, 271, 272, 279
 Bridgewick Marl 94, 95, 173,
 181, 255, 262
 Compton Bay 182, 183, 185
 Folkestone to Kingsdown
 267, 271, 272, 273
 Bridgewick Pit 261
 Bridgewick–Bopeep Flints 114
 Bridlington Sponge Beds *see*
 Flamborough Sponge Beds
 Brighton Chalk Block 211
 Brighton Five 230, 231, 238
 Brighton Marl 216, 223, 233
 Old Nore Point 222
 Brixton Anticline 175, 176
 Buckinghamshire Rag 302
 Buckle Flint Band 225, 231
 Buckle Marl 1 98, 229, 231,
 236
 Buckton Cliffs–Stottle Bank
 Little Thornwick Bay–Great
 Thornwick Bay–North
 Landing 421–2
 North Landing–Stottle Bank
 422–4
 Staple Nook 419–21
 Welton Chalk and Burnham
 Chalk formations 419–24
 Burnham Chalk Formation 21,
 307, 378, 382, 424, 426
 base of 95, 386
 Enthorpe Railway Cutting
 403–5
 Flamborough Head 410–11,
 426
 Great Thornwick Bay 422
 Market Weighton area 379,
 380
 Melton Bottom Chalk Pit
 400
 Sanwick Bay 419
 Speeton Cliff 412
 Stottle Bank and Sewerby
 Cliff 426, 428
 Burnham–Welton formation
 boundary 382, 383, 400
 Caburn Beds 272
 Caburn Flints 271, 272
 costellatus/plana event 281
 Caburn group of Chalk Pits,
 Lewes 240
 Caburn Marl 94, 95, 114, 117,
 167, 173, 262, 344
 Compton Bay 182, 183, 184,
 185
 Folkestone to Kingsdown
 267, 271, 272, 273
 Kensworth Chalk Pit 343,
 344, 345
 Langdon Stairs 271
 Southerham Pit 255, 256
 Caburn Pit 261
 Caburn Sponge Bed 256, 262,
 271, 272
 Caburn Syncline, Southerham
 Pit 253
 Caisteal Sloc nam Ban
 biostratigraphy 455
 lithostratigraphy 451, 453,
 454
 Caistor St Edmund Chalk Pit
 351–4, 352, 353
 biostratigraphy 353–4
 fauna 355
 lithostratigraphy 351–3
 calcispheres 13, 29
 see also Furley Chalk Pit
Calycoceras guerangeri Zone
 140, 480
 Camasunary Fault 433, 435,
 440
 Cambridge Greensand Member
 302
 Barrington Chalk Pit 347,
 348, 350, 351
 Campanian Stage 23, 237,
 483–4
 biostratigraphy
 Cuckmere to Seaford
 236–7
 Northern Province 388
 Thanet Coast 292
 Campanian–Maastrichtian
 boundary 384
 Overstrand masses 365, 367
 Carsaig
 greensands 455, 457, 458,
 459, 460
 lignite beds 457
 oyster shell-beds 461
 sections 457–460
 Carstone 390
 Cast Bed 88, 91, 92, 179, 268,
 302, 303, 393, 414
 Abbot's Cliff 266
 Barrington Chalk Pit 351
 brachiopod assemblage 39,
 57, 184, 277
 Compton Bay 179, 182, 184
 Southerham Grey Pit 247,
 250
 Castle Hill Beds 232
 Cuckmere to Seaford 224,
 232
 Castle Hill Flint Bands 99,
 157–60, 207, 212, 217, 218,
 232, 235
 Echinocorys bands 232, 235
 Newhaven to Brighton 213,
 216, 219, 220
 Castle Hill Marls 157, 158, 193,
 215, 232
 Newhaven to Brighton 215,
 216, 220,
Catopygus columbaris
 Subzone, Dead Maid Quarry
 151

General index

- Catton Grove Chalk Pit 355–9
 Beeston Chalk Formation 356, 357
 biostratigraphy 357–8
 Catton Sponge Bed 355–7
 lithostratigraphy 356–7
 Catton Sponge Bed 311, 358
 Catton Grove Chalk Pit 355, 356, 357
 Cenomanian Limestone 21, 90, 106, 110
 Beer Head to Beer Roads 121
 Reeds Farm Pit 130
 Cenomanian Stage 24, 184, 479–80
 cyclostratigraphy 265
 Folkestone to Kingsdown 264, 282
 biostratigraphy 277–8
 Furley Chalk Pit 134, 136
 hiatus at base 184
 Northern Ireland 472, 474
 Northern Province 377
 biostratigraphy 384, 385
 Speeton Cliff 418–19
 Cenomanian strata
 arenaceous facies, Beer Quarry 107, 121
 Hooken Cliff 117
 Cenomanian–Turonian boundary
 Beachy Head 249, 252, 253
 biostratigraphical study 278
 Black Band, Northern Province 384
 Chinnor Chalk Pit 335
 Compton Bay 184
 Melton Bottom Chalk Pit 400
 Ocean Anoxic Event 6, 249, 251
 Ceriopora Limestone *see* Pounds Pool Sandy Limestone Member
 ‘Chalk with Flints’, divided into two units 381
 Chalk Group 20–2, 169, 130
 Chalk Hill Marls 381, 399, 401
 Chalk Rock 31, 89, 305–7
 Aston Rowant Cutting 330, 334, 334
 Berkshire Downs–Chiltern Hills 299
 bottom hardground suite 313
 Charnage Down Chalk Pit 153, 154, 155
 Cley Hill 306–7
 Fognam Quarry 312–313
 hardgrounds 147
 Henley 307
 Kensworth Chalk Pit 343, 344
 Ogbourne Maizey 305–7
 Shillingstone Quarry 141, 145–6
 southern East Anglia 307
Subprionocyclus neptuni Zone (Kensworth Chalk Pit) 34
 Taplow region 330
 Transitional Province 298
 Chalk seas, ecology of 71–9
 Chalk, the 7, 8, 23, 24–6
 base in Southern Province 91
 fossils 29, 31, 35–8, 41–2, 47–53, 56–9, 61, 70–8
 biostratigraphy of 23–4
 rhythmic couplets 22–3, 29, 30
 Transitional Province 298
 chalkstones 15
 channels, in subsurface chalks, East Anglia 299
see also Mundford
 Chapel Rock Hardground 117
 Chardstock Fault 109
 Charmandean Flint 195
 Charnage Down Chalk Pit 152–6
 biostratigraphy 155–6
 lithostratigraphy 153–6
 Chartham Flint, fauna 289
 Chiltern Hills 297, 298
 Chinnor Chalk Pit 335–42
 biostratigraphy 338–9
 Grey Chalk Subgroup 335, 336, 337
 Holywell Nodular Chalk Formation 335, 336
 Lewes Nodular Chalk and New Pit Chalk formations 336
 lithostratigraphy 337–8
 Plenus Marls Member 337–8, 339
 Totternhoe Stone 335, 337, 338–40
 West Melbury Marly Chalk Formation 336
 Zig Zag Chalk Formation 336
 Clach Alasdair Conglomerate Member 436, 436, 439, 442, 463, 465, 470, 472
 Allt na Teangaidh 451
 Clachandhu boulders 447
 Caisteal Sloc nam Ban section 453
 Coire Riabhach stream section 464, 467
 Clachandhu boulders 445–8, 455
Cladoceramus events 483
 Thanet Coast 289
Cladoceramus undulaticus flood occurrence 290
Cladoceramus undulaticus Zone 426
 Clandon Hardground 308–9, 318, 327
 Cleveland Basin, subsidence 380
 Cley Hill 306–7
 Cliffe Flint Band 227, 257, 274
 Cliffe Beds 227, 234, 274
 Cliffe Hardground 95, 167, 173, 184, 227, 253, 274
 Southerham Pit 255, 257
 Whitecliff 186, 187, 187
 Cloghfin Sponge Beds 473, 474
 Coire Riabhach Phosphatic Formation 465, 467
 Coire Riabhach stream section 464–8, 466, 467
 White Sandstone 467
 Colinwell Sand Member 473, 474
Collignoniceras woollgari Zone, Kensworth Chalk Pit 342
Collignoniceras woollgari–*Subprionocyclus neptuni* zones boundary, Fognam Quarry 315
 Colonsay Basin 11
 Colonsay Fault 435
 Compton Bay, Isle of Wight 175–86

General index

- biostratigraphy 184
 Coniacian, base of 184
 Freshwater Bay 175, 176, 176
 lithostratigraphy
 Grey Chalk Subgroup 178, 180–1, 182
 White Chalk Subgroup 182–4
 marl–chalk couplet
 cyclostratigraphy 177, 178, 182
 Military Road cuttings 175–6
 Plenus Marls 177
 Seaford Chalk Formation 183–4
 concretionary sandstones 474
 Coniacian Stage 23, 225, 481–2
 Northern Province, biostratigraphy 387–8
 Coniacian–Santonian boundary 225, 229, 230, 267
 Connett's Hole Member 111
 Cornubian Ridge 11
costellatus/plana event 281, 481
 Cotentin Line 87
 Cotes Bottom Flint 195, 209
 Crag 365
 Cranborne Fault 11, 21, 86
Cremnoceramus assemblage, Northern Province 387
Cremnoceramus waltersdorfensis hannovrensis inoceramid Zone 407
Cremnoceramus waltersdorfensis waltersdorfensis inoceramid Zone 407
Cremnoceras crassus-deformis inoceramid Zone 406
 Cretaceous overstep 169, 175
 Cretaceous series and stages 5
 see also Appendix
 Cretaceous–Palaeogene boundary, Inner Hebrides 6, 476
 Cromer Memoir 370–1
 Crowe's Shoot Member 412, 413, 416–8
 Crown Point Pit, Chalk raft 354
 Croxton Marl 399, 401, 420
 Cuckmere Beds 228–9, 228, 275, 276
 Cuckmere Flint Bands 228, 275, 276, 280
 Cuckmere Sponge Bed 225, 228, 238
 Cuckmere to Seaford 224–39, 483, 484
 biostratigraphy
 Campanian 236–7
 Coniacian 234–5
 Santonian 236
 Coniacian–Santonian boundary 225
 Lewes Nodular Chalk Formation 226
 lithostratigraphy
 Lewes Nodular Chalk Formation 226–8
 Newhaven Chalk Formation 229–34
 Seaford Chalk Formation 228–9
 Santonian–Campanian boundary 225, 233, 237
 Turonian–Coniacian boundary 225, 234
 Culfail Zoophycos Beds 98, 173, 274, 275, 279, 334
 Aston Rowant Cutting 334, 335
 Cuckmere to Seaford 227
 South Foreland 275
 Southerham Pit 253, 257, 258, 259
 Whitecliff 187, 190
 Cullum Sands-with-Cherts 85, 96
 Culver Chalk Formation 15, 33, 89, 99, 101, 186
 Downend Chalk Pit 201
 Newhaven to Brighton 210, 212, 214, 215–16, 218
 paramoudra flints in 99, 102, 103, 186, 190
 Paulsgrove Pit 207
 Seaford Head 232, 232, 235
 Warren Farm Quarry 205
 West Harnham Chalk Pit 157, 159
 Whitecliff 186, 188, 190, 195
 Culver Down Marls 196
Cunningtoniceras inerme Zone 39, 90, 118, 243
C. inerme Zone, missing
 Chinnor Chalk Pit 338
 Hunstanton Cliffs 394, 395
 Hunstanton and Melton Bottom 480
 Southerham Grey Pit 241
 Speeton Cliffs 419
 cuvettes 299, 323, 329
 cyclostratigraphy 22–3, 30
 Cenomanian succession 265
 Plenus Marls basal beds 252
 see also rhythmic couplets
 Danes Dyke Lower Marl 428
 Danes Dyke Member 411, 428
 Daneswood Marls 428
 Dead Maid Quarry 148–52
 biostratigraphy 149–51
 Glauconitic Marl 148
 glauconitic sandstone 149, 150
 lithostratigraphy 148–9
 Popple Bed 148–152
 petrified coniferous tree 151
 see also Rye Hill Farm Farm
 Dean Hill Anticline 85, 99, 161
 debris flows 440, 476
 Deepdale Flint 399, 420
 Deepdale Lower Marl 399
 Deepdale (Paired) Marls 386, 419, 420, 421
 Deepdale Upper Marl 399
 desert conditions, evidence for 476
Didymotis horizon 404, 405
 disconformity, base of Chalk Group, White Nothe 169
Discoscaphites binodosus Subzone 410
 Sewerby Steps 388, 429
 dissolution 15
 see also stylolites
 dissolution pipes 298
dixoni event 179
 Dixoni Limestone 301, 301, 302, 303, 393
 Chinnor Chalk Pit 338
 Doolittle Limestone 277, 300, 302, 339
 Dover 94, 95, 271, 281
 East Cliff 273
 'Dover Chalk Rock' 95, 264, 271, 272, 274, 279, 281
 Folkestone to Kingsdown 272, 272, 274, 282
 Dover and Ramsgate Sheet Memoir (BGS) 283

General index

- 'Dover Top Rock' 274
- Dowlands Marl *see* Glynde Marl
- Downend Chalk Pit 199–210
 biostratigraphy 202, 204
 correlation 208–9
 Culver Chalk Formation 200, 200, 201
 growth structures and slump folding 85, 88
 lithostratigraphy 199–202
 Portsdown Chalk 200
 Upper Downend Beds 203, 204
 see also Main Downend
 Hardground; Upper
 Downend Hardground
- Dowsing Fault 11, 21, 424, 430
- Dowsing Fault Zone 21
- Dulcey Dock Member 412
- Dumpton Gap Fault 282
- East Anglia
 Chalk outcrop 297
 Chalk Rock 307
 Mundford
 Grey Chalk Subgroup 305
 Top Rock 308
- East Grimstead Quarry 161
- East Midlands Shelf 378
- East Nook Marls 428
- East Sussex Downs 210
- Eastbourne erosion surface 90
- Eastbourne Sponge Bed 39, 119, 251
- Easthorpe Tabular Flint 404, 405, 406
- Eaton Chalk Member 310, 311
- Echinocorys Bed 353, 354
- Echinocorys depressula*
 Subzone 429
- echinoid zones 54–5
- Eggardon Grit 137, 138
- Eigg
 Allt Ceann à Gharaidh 472
 Clach Alasdair 472
 Laig Gorge 472
- Ely-Ouse (Mildenhall) Bore-hole 350
- Enthorpe Marls 402, 420, 422
 Enthorpe Railway Cutting 404, 405, 405
 stratotype section 402, 403, 405
- Enthorpe Oyster Bed
 Enthorpe Railway Cutting 405, 406
- Enthorpe Railway Cutting 402–8
 Burnham Chalk Formation 403, 404, 405
 Kiplingcotes Marls 402–3, 406
 lithostratigraphy 403–8
 Turonian–Coniacian boundary 387, 402–3, 406
 see also Enthorpe Marls;
 Enthorpe Oyster Bed
- Eppleworth Flint 387
- Exceat Flint Band 225, 229, 230, 236
- Extinction event, end-Cretaceous 6
- facies changes, Transitional Province 298
- Fagesia catinus* Zone 122, 341
 Folkestone to Kingsdown 278
- Falling Sands Member 244, 247
- Farlington Marls 100, 196, 206, 209
- Farlington Pit 207, 208–9
 Portsdown Marl 207
- faults 255
 along White Horse Marl 189, 190
 Aston Rowant Cutting 333
 Chinnor Chalk Pit 336
 conjugate 423
 deep-seated 85, 88
 horizontal 423
 intra-Chalk 222
 N–S
 south-east Devon 21, 121
 south-west region 87–8
 NE-trending, Cuckmere Valley 226
 re-activated Late Cretaceous 319
 re-activated, Inner Hebrides 437
 Selwicks Bay 424, 426
 Shear 201, 207, 222, 333
 strike-slip 7
 south-west England 21
 synsedimentary, Warren Farm Pit 206
- thrust
 Ballard Fault 170, 172
 Glacio-tectonic 360–7, 365
 Selwicks Bay,
 Flamborough Head 423, 424
 Welton Chalk over Black Band 419
 Totternhoe Stone,
 Barrington Chalk Pit 347
 see also named faults
- Feorlin Sandstone Formation 460, 463
 Caisteal Sloc nam Ban section 453
 Carsaig 458
 reworked Gribun Chalk in 459
- Ferriby Chalk Formation 21, 240, 248, 340, 378, 381
 basal Red Chalk component 381
 Crowe's Shoot Member 416
 Hidra Formation 381
 Hunstanton Cliffs 389, 390, 392, 395
 Melton Bottom Chalk Pit 396, 397
 Speeton Cliff 381, 412, 412, 413, 416–19
- Ferruginous Flint 386, 399, 400
 Little Thornwick Bay–Great Thornwick Bay–North Landing 421, 422
- Filograna avita* event 120, 260, 278, 280–1, 301, 305, 342
- Flamborough Chalk Formation 21, 377, 378, 382
 biostratigraphy 427, 429
 Flamborough Head–Sewerby Steps 410, 427, 428
 Stottle Bank–Selwicks Bay 424
- Flamborough Fault Zone 11, 21
- Flamborough Head 380, 408–30, 479, 483, 484
 entire Northern Province
 Upper Cretaceous succession 430
 Flamborough Chalk,

General index

- Whitham 411
 Flamborough Head (High Stacks) to Sewerby Steps 427–30
 Santonian–Lower Campanian succession 430
 Speeton Cliff 411–19
 Ferriby Chalk Formation (Speeton–Buckton Cliffs) 416–19
 Hunstanton Red Chalk Formation 412, 416
 Stottle Bank–Selwicks Bay–Flamborough Head 424–7
 Welton Chalk and basal Burnham Chalk 410–11
 Welton Chalk and Burnham Chalk formations (Buckton Cliffs–Stottle Bank) 419–24
 Welton–Burnham Chalk boundary 383
 Flamborough Head (High Stacks) to Sewerby Steps 427–30
 biostratigraphy 427, 429
 lithostratigraphy 427, 428
 Flamborough Sponge Beds 388, 410, 428, 429
 Flannan Trough 435
 Flat Hill Flint 99, 229, 236
 correlation with Bedwell's Columnar Flint Band 236
 flint bands 333
 persistent, Southern Province 94
 Seaford Chalk Formation 99
 flint shatter-beds 238
 Flintless Belt
 limited lithology 198
 Whitecliff, Isle of Wight 186, 188, 188, 192, 193, 194, 196, 197
 flints
 box-folded 199
 distribution may reflect basin geology 94
 form consistent in the basin 292
 mobilized, Telscombe Marls 194
 nodular and sheet flints in chalk 17
 Northern Province, features attributed to deeper-water deposition 378
 semi-tabular 229, 380–1
 showing signs of synsedimentary movement 198
 tabular 381, 422
 and trace fossil stratigraphy 15
 Zoophycos flints, Whitecliff 196
 see also sheet-flints, named
 Flint bands
 Fognam Farm Hardground 154, 155, 332, 335
 Fognam Quarry 306, 313, 314
 Fognam Marl 155, 306, 335
 Aston Rowant Cutting 331, 334
 Fognam Quarry 306, 313
 Fognam Quarry 312–15, 481
 biostratigraphy 313
 Chalk Rock Member 312
 chalk succession 306
 Fognam Marl 306, 313
 lithostratigraphy 312–13
 New Pit Chalk Formation 312–13
 Ogbourne Hardground 313–315
 Pewsey Hardground 313–315
 folding 85, 201, 202
 intra-Chalk
 Downend Chalk Pit 200, 200
 Overstrand Mass 4 361
 slump folding 88, 201, 210, 238, 308
 intraformational 199, 202, 204–5
 Folkestone to Kingsdown 263–82, 479, 482
 Abbot's Cliff–Lydden Spout 270
 Sparpeiceras schlueteri Subzone 277
 biostratigraphy 276–80
 Coniacian 279–80
 Cenomanian 277–8
 Turonian 278–9
 Dover–Kingsdown 263–6, 281
 White Chalk Subgroup stratigraphy 264
 Folkestone–Dover 263, 264, 280
 lithostratigraphy 266–76
 Grey Chalk Subgroup 169–70, 266
 White Chalk Subgroup 270–6
Micraster evolutionary study 264
 Tenuis Limestone 266, 269
 White Chalk Subgroup 269
 Zig Zag Chalk Formation 269
 Fordingbridge–Cranborne Fault block 87
 Foreness Point 282
 flint bands 288
 Freshwater Bay 175, 176, 176
 Friars Bay Anticline 212, 214
 Castle Hill Flint Bands 212, 213, 214
 Friars Bay Flints 216, 218, 236, 284
 Friars Bay Marls 218, 222, 230, 231, 232, 233, 237
 Santonian–Campanian boundary in 219, 222
 Friars Bay Steps, stratigraphy 216, 223
 Furley Chalk Pit 133–7
 Basement Bed 136
 Cenomanian deposits 134, 136
 Holywell Nodular Chalk Formation 134, 136
 lithostratigraphy 135
 Gault Clay 39, 250, 302
 Asham Pits 249
 Barrington Chalk Pit 347
 East Wear Bay 264–5
 Glauconitic Marl Member 39, 91, 169, 179, 268, 269, 298, 300, 393
 Asham Pits 249
 Beachy Head 249, 250
 Compton Bay 178, 178, 180, 182, 184, 185
 Folkestone to Kingsdown 277, 282
 Handfast Point to Ballard Point 172, 174
 replaced by Cambridge

General index

- Greensand 298, 300
 Rye Hill Farm 152
 Glynde Beds 272
 Glynde Marls 93, 94, 112, 114, 117, 145, 262, 271, 343, 344, 382
 Inoceramus cuvieri bands 185
 Marl 1 143, 147, 167, 185
 Glynde Pit 2 260–1
 Glyndebourne Borehole (BGS) 248
 Glyndebourne Hardgrounds 255, 256, 260
 Glyndebourne Pit 1 260
 Glyndebourne Pit 2 260
 Glyndebourne Tubular and Finger Flints 147, 174, 255, 260
 Gog Magog Hills 297
Gonioteuthis granulata-quadrata Zone 322, 429
Gonioteuthis quadrata Zone 87, 309, 484
 Cuckmere to Seaford 225
 Base at Arundel Sponge Bed 237
 Downend Chalk Pit 199
 Handfast Point to Ballard Point 174
 correlation with Warren Farm Paramoudra Flint Band 173
 Newhaven to Brighton 212, 214, 219
 Telscombe Cliffs 210
 Wells 310
 West Harnham Chalk Pit 157
 Grasby Marl 399, 401, 420
 Grasby Marl–Malling Street Marl correlation 25–6
 Great Glen Fault 433, 435, 440, 460, 476
 Great Thornwick Bay, Ferruginous Flint 421
 greensands 19, 437, 475
 Inner Hebrides Group 438, 462
 south-west England 85
 see also Upper Greensand and named greensands
 Grey Beds 310, 311, 361
 Trimingham–Mundesley 370
 Grey Chalk Subgroup 91
 Asham Pits 248
 Barrington Chalk Pit 348
 Beer Head Limestone Formation 91, 115, 116
 Chalk Marl 299, 337
 Chinnor Chalk Pit 335, 336
 Totternhoe Stone (Zig Zag Chalk Formation) 337
 Compton Bay 178, 180–1, 182
 Glaconitic Marl 178
 Dead Maid Quarry 48, 151
 Dorset 87
 Grey Chalk 299
 Lower Chalk and Cenomanian Limestone 91
 Northern Province 377, 389
 Plenus Marls 299
 Shillingstone track sections 142
 Totternhoe Stone 299
 Transitional Province 297, 299–303
 tunnelling 264
 Wessex Trough 145
 West Melbury Marly Chalk 91, 165, 337
 White Nothe 165
 Zig Zag Chalk Formation 91, 337
 Gribun 438, 440–63
 biostratigraphy 453, 455
 Caisteal Sloc nam Ban section 453
 remanié Gribun Chalk 453
 lithostratigraphy 441–53
 Group I–IV exposures 441–8, 450, 451, 451, 453
 Gribun Boulders, Gribun Chalk 438, 440, 441–2, 475
 Gribun Boulder I 441–2
 Gribun Chalk Formation 437, 439, 440, 463, 465, 470, 475
 Allt na Teangaidh 448, 451
 biostratigraphy 455
 Clachandhu boulders 445, 447
 Coire Riabhach stream section 464, 467
 Gribun boulders 441–2, 475
 Gribun Stream Boulder 442, 444, 445
 Lochaline Mines, Morvern 469
 reworked 438
 Gribun mudstones 455
 Gribun sandstones 455, 457, 458, 459, 460
 Gribun Stream Boulder 442–5, 443, 444, 445
 Grobkreide facies 46, 61, 322, 428, 474, 475
 South Lodge Pit 325, 329
 Sussex 223, 231, 236
 Gun Gardens Main Marl 94, 147, 183
 Folkestone to Kingsdown 271
 Glyndebourne Pit 1 260
 Shillingstone Quarry 143, 144
 Southerham Pit 255, 256, 259
 Gun Gardens Marls 93, 94, 255, 260
Hagenowia blackmorei Subzone 64, 160
 Hall Flint 420
 Hampshire–Dieppe–Bray High 11
 Handfast Point to Ballard Point 85, 170–5
 biostratigraphy
 Cenomanian 174
 Coniacian–Campanian 174
 Turonian 174
 lithostratigraphy 171–4
 Punfield Cove 171–174, 175
 hardgrounds 15, 78, 79
 Downend Chalk Pit 200, 200
 Flintless Belt 197
 see also named hardgrounds
 Haven Brow Beds 229, 230, 231, 275, 236
 Haven Cliff Hardground 90
 Hooken Cliff 112, 113, 114, 115, 119, 125
 Wilmington Quarry 126, 128
 Hawks Brow Flint 229, 231
Hedbergella archaeocretacea Partial Range Zone 120
Helvetoglobotruncana belvetica Interval Zone
 Furley Chalk Pit 136

General index

- Hooken Cliff 120
- Henley, Chalk Rock 307
- 'Henley Rock' 307, 334
- Herring Formation 382, 384
- hiatuses 7, 472
 - base of Cenomanian 184
 - Cenomanian–Albian 24
 - Glaconitic Marl–Lower Cretaceous greensands 91
- Hooken–Little Beach members 118
- Inner Hebrides
 - early and late Campanian 476
 - Jurassic–Upper Cretaceous 470, 475
 - Turonian–Santonian 476
 - Upper Cretaceous–Tertiary 470
- Lower–Upper Cretaceous boundary, Hunstanton Cliffs 389
- Northern Ireland
 - above the Cenomanian 474
 - Middle and Upper Turonian and basal Coniacian 474
- Red Chalk–Lower Chalk 394
- sub-Totternhoe Stone, missing beds 397–8, 419
- within Pinnacles Member 121, 122
- Hibernian Greensand Formation 472
- Hydra Formation 381
- 'High Chalk' of East Anglia 309–12
- High Stacks Flint 425, 428
- High Stacks Marl 424, 425, 428
- Hitch Wood facies 307, 343
- Hitch Wood Hardground 147, 307, 332
 - Aston Rowant Cutting 333
 - Charnage Down Chalk Pit 153, 154, 155, 156
 - Fognam Quarry 306, 313
 - Kensworth Chalk Pit 343, 345, 346
 - Ogbourne Maizey 305–6
- Holaster planus* Zone 279, 419, 421
- Holaster subglobosus* Subzone, Southerham Grey Pit 241
- Hollingbury Dome 222
- holococcoliths 437, 472
- Holywell Marls 93, 94, 251, 255, 278
 - east of Hitchin, Morden Rock 305
- Holywell Nodular Chalk Formation 26, 32, 39, 92–4, 102–3, 305
 - Beer Road section 137
 - Chilterns 299, 304–5
 - Chinnor Chalk Pit 335, 338, 341–2
 - Compton Bay 182
 - east of Hitchin 305
 - Folkestone–Dover 264, 304
 - Folkestone to Kingsdown 270–1, 278, 280
 - Furley Chalk Pit 134, 136–7
 - Glyndebourne Pit 1 260
 - Handfast Point to Ballard Point 173, 174
 - Ballard Cliff Member 171
- Hooken Cliff 116, 119, 120, 122
- Northern Province equivalent 377
- Pinnacles Member 102
- Reeds Farm Pit 130
- Shillingstone Quarry 145
- Southerham Pit 253, 254
- White Nothe 166
- Wilmington Quarry 123, 125, 128
- Hooken Cliff 104, 106–23, 107, 108, 110, 111
 - biostratigraphy 117–20
 - Holywell Nodular Chalk 111, 122
 - lithostratigraphy 111–17
 - Grey Chalk Subgroup 115
 - White Chalk Subgroup 115–17
 - micropalaeontology 120
- Hooken Nodular Limestone Member 110, 115
 - ammonite fauna 118
 - Wilmington Quarry and Reeds Farm Pit 121–2
- Hooken–Wilmington trough 106, 107, 111, 112, 116, 121, 129
- Wilmington Quarry 123
- Hope Gap Beds 62, 238, 227, 274
 - Cuckmere to Seaford 224, 234
- Hope Gap Flint 274
- Hope Gap Hardground 95, 154, 167, 227, 280
- Charnage Down Chalk Pit 156
- Hope Gap and Beeding Beds 234
- boundary between *Micraster normanniae* and *Micraster decipiens* zones 234
- Cuckmere to Seaford 226
- Whitecliff 186, 187, 187, 190
- Hope Gap Marl 183
- Hope Gap Sheet Flint 227
- Hope Gap slides 238
- Hope Gap Steps section 226, 228
- Hope Point, Belle Tout Beds 275
- Howardian–Flamborough Fault Zone 380
- Humble Point Hardground 90, 121, 125, 125, 131
- Hunstanton Cliffs 385, 389–95, 479, 480
 - biostratigraphy 392–4
 - Ferriby Chalk Formation 389, 390, 392, 395
 - lithostratigraphy 390–2
 - Lower Inoceramus Bed 389, 390, 391, 392
 - Paradoxica Bed 360, 389, 390, 391–2, 391, 392, 395
 - Red Chalk–Paradoxica Bed contact 391
 - Totternhoe Stone 389, 390, 391, 392, 394
 - Upper Inoceramus Bed 391, 392–3
- Hunstanton Red Chalk Formation 377, 381
 - hiatus at base 395
 - Hunstanton Cliffs 389, 390, 390, 394
 - Red Cliff Hole Member 416
 - Speeton Cliff 409, 411–16
 - Speeton–Buckton Cliffs 413
 - see also Red Chalk
- Hyphantoceras* Event 279

General index

- IIsede Tectonic Phase 226, 238,
 407, 474, 476
see also tectonism
Infulaster rostratus Zone 410
 Inner Hebrides 7, 10, 471–6
 comparison with Northern
 Ireland 474–6
 Inner Hebrides Basin/Province
 433
 Inner Hebrides Group 433,
 437, 464, 470–6
 stratigraphy 433, 436–8,
 439
 Inner Hebrides Trough 11, 435
 inoceramid zones 40, 54–5
Inoceramus atlanticus erosion
 surface 90
Inoceramus atlanticus flood
 event 243, 413
 Inoceramus Beds 350
Inoceramus lingua Zone 410
Inoceramus Pebble Bed 398–9
Inoceramus virgatus acme-
 event 129, 133, 417
 Hunstanton Cliffs 391, 393
 Speeton Cliff 417
 Island Magee Siltstones 473,
 474
 Islay–Donegal Platform 11, 435
 Isle of Wight Tubular Flints
 188, 191, 196, 197

 Jukes Formation 382
 Jukes-Browne Bed 7 91, 92,
 265, 302, 303, 341, 393
 Abbot's Cliff 266
 Beachy Head 251
 Compton Bay 178, 178, 179,
 182
 Southerham Grey Pit 243,
 244, 250
 Speeton Cliff 418
 Junction Limestone 245, 251

 Kemptown Flint 230, 231
 Kemptown Marl 231
 Kensworth Chalk Pit 342–7
 biostratigraphy 345
 Chalk Rock 342, 344
 Lewes Nodular Chalk
 Formation 344–5
 lithostratigraphy 343–6
 sub-Chalk Rock marl seams
 343, 344, 345–6
 Great Chesterford Chalk
 Pit 345
 Top Rock 343, 344, 346–347
 Zoophycos flints 343, 344
 Kensworth Nodular Chalk
 Member 308, 335, 342,
 343–4, 347
 Kilcoan Sands Member 473,
 474
 Kings Hole Hardground 90,
 113, 115, 125
 Kingsdown, Seaford Chalk 275
 Kingston Anticline 240, 248
 Kingston Beds 257, 258, 272,
 345
 Kiplingcotes Carious Flint 404,
 405
 Kiplingcotes Flints 405
 Kiplingcotes Lensoid Flint 404
 Kiplingcotes Marls 387, 407
 Enthorpe Railway Cutting
 404, 405, 405, 406–8
 Turonian–Coniacian
 boundary 402–3, 406
 Kiplingcotes Pappy Flint 404,
 405
 Kiplingcotes Station Pit 407
 Kirkella Marl 406
 Kishorn Thrust 433
 'Kit Pape's Spot' 419

 Lamplugh Formation 382
 Lancing Flint 195, 217
 Lancing Marls 100, 192, 195
 Langdon Stairs 272, 274
 Caburn Marl–Belle Tout
 Beds 271
 Cuilfail *Zoophycos* 275
 Lewes Nodular Chalk 275
 Seaford Chalk Formation
 275, 276
 Lavant Stone 207
 Leigh Hill Hardground 155,
 332
 Fognam Quarry 306, 313
 Lewes Flint 257
 Lewes Marl 62, 94, 96, 117,
 143, 166, 167, 168, 253, 308,
 407
 Compton Bay 181, 182, 183,
 185
 Southerham Pit 255, 257
 Whitecliff 186, 187, 187, 190
 Lewes Nodular Chalk Form-
 ation 15, 32, 89, 94–5, 95, 96,
 169, 306
 Aston Rowant Cutting 330,
 333
 Basal Complex 94–5, 187
 Bridgewick Pit 261
 Chilterns–East Anglia 305
 Chinnor Chalk Pit 336
 Compton Bay 181–4, 181
 Cuckmere to Seaford, litho-
 stratigraphy 226–8
 Dover–Kingsdown 94, 95,
 265, 266, 271–5
 Folkestone–Dover 264
 Handfast Point to Ballard
 Point 173
 Hooken Cliff 117, 120
 Kensworth Chalk Pit 344–5
 Lower Lewes Nodular Chalk
 Formation 257, 258
 Shillingstone Quarry 141,
 143
 Southerham Pit 253, 257
 White Nothe 163–8
 Whitecliff 187, 197
 see also Spurious Chalk
 Rock
 Lewes Phosphatic Chalk 254,
 255, 256
 Lewes Tubular Flints 94, 96,
 143, 144, 147, 275
 Compton Bay 181, 182, 183
 Handfast Point to Ballard
 Point 173
 Lower Lewes Tubular Flints
 166, 167, 190, 257, 258,
 259
 Southerham Pit 253, 259
 Upper Lewes Tubular Flints
 190, 258, 258
 Whitecliff 186, 187
 Light Point Beds 274
 Light Point Hardground 95,
 167, 227, 238, 335
 Langdon Steps 274, 275
 Lilley Bottom Structure 9, 21,
 297–300, 349
 Lincolnshire Wolds 377, 380
 Little Beach Bioclastic
 Limestone Member
 Hooken Cliff 110, 115, 118
 Reeds Farm Pit 132
 Snowdon Hill Quarry 140
 Wilmington Quarry 124–8

General index

- Little Marl Point Chalk Member 311, 312, 361, 368, 371
 Little Marl Point, Trimmingham 366, 369, 370
 Little Minch Trough 435
 Little Thornwick Bay–Great Thornwick Bay–North Landing 421–2
 Little Weighton Marls 407, 408
 Lochaline Mines, Morvern 468, 469, 470
 Beinn Iadain Mudstone Formation 469
 Gribun Chalk Formation 468–9, 469
 Morvern Greensand Formation 469
 Rhynchostreon beds 468
 Lochaline Sands 3
 Lochaline White Sandstone Formation 437, 438, 439, 440, 463, 465, 468, 470, 475
 Allt na Teangaidh 448, 451
 Carsaig 457, 458, 460
 Coire Riabhach stream section 464, 466, 467
 Long Cretaceous Quiet Zone 26, 32–3
 Lower Chalk
 Gale's divisions 269
 and Middle Chalk, Isle of White 177
 Northern Province 380
 see also Grey Chalk Subgroup
 Lower Downend Marl 199, 202, 203, 208
 Lower Inoceramus Bed 300, 393, 396, 397, 412, 414, 417
 Hunstanton Cliffs 389, 390, 391, 392
 Lower Pink Band 396
 Lower White Chalk, South Lodge Pit 324
 Lower–Middle Cenomanian Boundary, Speeton Cliff 419
 Ludborough Flint 383, 420
 Maastrichtian Chalk, East Anglia 310, 311, 312
 Overstrand 363–4
 Maastrichtian Stage 23, 484–5
 Maidlands Lower Marls 428
 Maidlands Tilestone 428
 Maidlands Upper Marls 428
 Main Downend Hardground 34, 198, 200, 202–5, 208
 fossils 204, 207
 Farlington Pit 207
 Malling Street Marls 94, 255, 256, 259
Mammites nodosoides
 ammonite Zone 386
 Hooken Cliff 119–20
 Welton Wold Quarry 398
 manganese and iridium spikes 81, 249
mantelli Zone 151
Mantelliceras dixonii Zone 129, 133, 280, 414, 480
 Chinnor Chalk Pit 338, 340
 Hunstanton Cliffs 393, 394
 Southerham Grey Pit 243, 246
 virgatus 'bank' 39, 46
 see also *dixonii* event
Mantelliceras mantelli Zone 479
Mantelliceras saxbii flood event bed 245
 Chinnor Chalk Pit 338, 339–40
Mantelliceras saxbii Subzone
 Dead Maid Quarry 151
 Hooken Cliff 118
 Southerham Grey Pit 245
 Margate Chalk Member 265, 269
 Barrois' Sponge Bed equivalent 276, 283
 Thanet Coast 283, 287, 288, 292
Marginotruncana pseudolineana Interval Zone 120
 marker beds 15, 16, 19, 88, 92–4, 99, 144, 222
 Compton Bay 173, 178, 182, 183
 Cuckmere to Seaford 226
 Folkestone Warren and Abbot's Cliff 269
 Grey Chalk Subgroup 178, 393
 Holywell Nodular Chalk Formation 166–7, 166, 167, 280
 Hooken Cliff 110, 113, 114, 117
 Lewes Nodular Chalk Formation 94, 117, 173, 182, 183, 226
 New Pit Chalk Formation 92, 93, 94, 95
 Shillingstone Quarry 148
 Southerham Pit 257
 Southern Province 39–40, 54–5
 Thanet Coast 292
 Welton–Burnham Chalk boundary 383
Marginotruncana sigali Zone 136–7
 Market Weighton High 378–80, 407
 marl seams 12–16, 14, 16, 25–6
 as marker beds 92–4, 110
 Lewes Nodular Chalk 94, 117, 182, 183
 Middle and Upper Turonian 185
 Mundford 305
 Newhaven Chalk Formation 99
 marls
 chemical fingerprinting 13
 stylolitic 189
 vulcanogenic 13, 15
Marsupites calyx plates 236, 291
Marsupites flood events 428
Marsupites testudinarius Zone 87, 212, 298, 330, 410, 483
 Cuckmere to Seaford 225, 229, 236
 Flamborough Head 411, 427, 429
 Flamborough–Sewerby 410
 Handfast Point to Ballard Point 173, 174
 Margate 288
 Newhaven to Brighton 210, 219
 Northern Province 388
 South Lodge Pit 329
 Thanet Coast 289, 292
 Winterbourne Chalk Pit 322
Marsupites Zone, maximum peak 5
 Marton Hall Marl 428
 Meads Marls 93, 94
 Beachy Head 251, 253

General index

- Compton Bay 182, 183
Southerham Grey Pit 245, 351
White Nothe 168
Medmenham Chalk Pit 334–5
Meeching Beds 222, 232, 234
Meeching Flint Zone 232
Meeching Marls 99, 157, 158, 159, 192
 Newhaven to Brighton 214, 216, 218, 220, 220
 Telscombe Cliffs 216, 217
Seaford Head 231, 232, 234
Meeching Triple Marls 232
Meeching–Telscombe Marls interval 62
Melbourn Rock 147, 251, 297, 299, 341
 Asham Pits 249
 Chilterns 301
 Compton Bay 182
 Folkestone to Kingsdown 271
 Handfast Point to Ballard Point 173
 marl–limestone rhythms 304
 Shillingstone Quarry 143, 143, 145
 south Cambridgeshire 304
 White Nothe 168
Melbury Sandstone Member 150
 Dead Maid Quarry 148
Melton Bottom Chalk Pit 396–400, 401, 479, 480
 biostratigraphy 396–8
 Ferriby Chalk Formation 396, 397
 lithostratigraphy 396
 Welton Chalk Formation 400
 Welton Wold Quarry 398–400
 Inoceramus Pebble Bed 398–9
 lithostratigraphy 398
 Welton Chalk Formation 398
Melton Ross Marl 386, 399, 420
 Thornwick Nab 421
Melton Ross Marl–Southerham Marl 1 correlation 25
Melton Ross Quarry, Welton Chalk Formation 398, 401
Membury Fault 109, 133
Membury outlier 133, 133, 134
 no Lower Chalk 137
Mere Fault 11, 21, 85, 149, 152
 Late Turonian sedimentation 155, 156
Metoiceras geslinianum Zone 119, 341, 381, 480
Michel Dean Flint Band 99, 228, 229, 236, 237, 275
Micrabacia Band 278
Micraster
 important studies 62
 stratigraphy and possible phylogeny 54, 55, 63
Micraster coranguinum Zone 87, 212, 298, 330
 below Taplow Hardground 328
 Boxford Chalk Pit 318
 Cuckmere to Seaford 225
 East Anglia 309
 Flamborough Chalk Formation 382, 427
 Handfast Point to Ballard Point, Seaford Chalk Formation 173
 Hooken Cliff 117
 North Landing, Flamborough 424
 Northern Province 387, 388
 Thanet Coast 289
Micraster coranguinum–Micraster cortestudinarium zonal boundary 280, 424
 Barrois' revision 176
Micraster cortestudinarium Zone 307, 387
 Aston Rowant Cutting 333, 335
 Buckton Cliffs–Stottle Bank 419
 Cuckmere to Seaford 225
 Enthorpe Railway Cutting 406
 Kensworth Chalk Pit 342
 North Landing, Flamborough 424
 Top Rock 308
Micraster decipiens Zone, Cuckmere to Seaford 234
Micraster normanniae Zone, Cuckmere to Seaford 234
Mid-Dorset Swell 87, 91
Shillingstone Quarry 144, 146
Middle Chalk, Northern Province, base of 380
Middle Turonian Chalk zonation schemes 260
Midlands Microcraton 21, 297, 349
Milankovitch cycles 248
millet-seed sand grains, Inner Hebrides Group 442, 444, 455, 469
Minch Fault 435
Moine Thrust Zone 433, 435, 440
Morden Rock 205
Mortoniceras rostratum Subzone 350
Morvern Greensand Formation 437, 439, 460, 463, 465
 Allt na Teangaidh 448, 451
 Belfast Marls correlative 474
 Carsaig 457, 458, 460
 Caisteal Sloc nam Ban section 453
 Coire Riabhach stream section 465, 466, 467
 Lochaline Mines, Morvern 468–9, 469
Mount Caburn Chalk Block 254
Mull, Isle of
 Cenomanian Greensand 436, 464
 lignites 476
 Loch Don (Auchnacraig) sections 438, 458
 Torosay sections 458–9
 see also Carsaig; Gribun
Mundesley Borehole, calcarenitic chalk 372–3
Mundford
 Channels 299
 standard stratigraphy for East Anglia 305
 marl seam correlation 305
 Grades 523
Mytiloides Beds 174, 182, 271
Mytiloides scupini (inoceramid) Zone 40, 54, 407, 481
Mytiloides spp. Zone 136, 386, 398

General index

- nannoliths 12
- Navigation Beds 227, 274
 'knobbly' hardgrounds 226
- Navigation Hardground(s) 95, 143, 167, 187, 190, 226, 259, 274, 275
- Navigation Marls 98, 117, 143, 167, 173, 274
 Compton Bay 183, 183
 Cuckmere to Seaford 224, 226, 227, 234
 Southerham Pit 255, 257, 258, 259
 Whitecliff 187, 190
- Neocardioceras juddii* Zone 119, 145, 341, 480
 Folkestone to Kingsdown 281
- Neocardioceras* Pebble Bed 119, 125
- Neobibolites ultimus/Aucellina gryphaeoides* event 277, 350
- Neostlingoceras carcitanense* Subzone 350, 479
 assemblage 249
 Compton Bay 184
 Hooken Cliff 117, 118
 Hunstanton Cliffs 392, 395
 Reeds Farm Pit 133
 Wilmington Quarry 129
- Nettleton Marl 391
- Nettleton Pycnodonte Marl 303, 391, 413, 415
- Nettleton Stone 303, 391, 397, 413, 414, 415
 Speeton Cliff, Jukes-Browne Bed 7 418
- New Pit Chalk Formation 32, 89, 122, 175, 260
 Beer Road Section 137
 Charnage Down Chalk Pit 154, 154
 Chinnor Chalk Pit 336
 Compton Bay 182
 Dover 281
 Fognam Quarry 312–13
 pre-Ogbourne erosion 314
 inoceramid bivalves 120
 lithostratigraphy 114, 116, 117
 marker beds in 92, 93, 94, 271
 Shillingstone Quarry 145
 sub-Chalk correlation 305
- New Pit Depot
- New Pit Chalk–Lewes Nodular Chalk boundary 263
 type locality for New Pit Marls 261
- New Pit Marls 26, 93, 94, 117, 261, 262, 271, 344
- Newhaven Chalk Formation 15, 33, 88, 89, 99
 basal boundary marker 99, 229
 Bats Head 164, 165
 Cuckmere to Seaford 235
 Campanian 236–7
 lithostratigraphy 229–34
 marl seams at top 100
 Newhaven to Brighton 210, 212, 213–16, 222
 Chalk zones 213–14
 Paulsgrove Pit 206–7
 Portsdown 205
 Scratchell's Bay 198
 Telescombe Cliffs 217
 West Harnham Chalk Pit 85, 157
 Whitecliff
 change to Culver Chalk Formation 188, 192, 193, 195
- Newhaven Syncline 212, 214, 216
- Newhaven to Brighton 210–24, 484
 Barrois' 'Craie de Brighton' 212
 biostratigraphy 219–22
 Castle Hill 212, 213, 222
 Culver Chalk Formation 210, 212, 214, 215–16
 Gaster, zonal revision 213
 lithostratigraphy 211–19, 214
 Newhaven Chalk Formation 210, 212, 213–15, 222
 Seaford Chalk Formation 212
- nodular chalks 15
 see also Holywell Nodular Chalk Formation; Lewes Nodular Chalk Formation
- North Antrim Hardgrounds 358
- North Ormsby Marl 383, 416, 420, 421
- North Sea 282, 355, 372, 373
- North Landing, Flamborough Head
 Paramoudra flints 410, 416
 Sternotaxis plana Zone 410
- North Landing–Stottle Bank 422–4
- Northern Ireland
 Cenomanian Stage 472, 474
 Hebridean succession 437, 472, 473
 Inner Hebrides comparison 474–6
 Uintacrinus socialis Zone 472
 Upper Santonian 475
- Northern Province 7, 8, 9, 11, 15, 377, 378, 379, 380–1, 429, 479
 biostratigraphy 384–8
 formations and marker beds 19, 21, 22, 378, 379, 418
 GCR sites 377
 lithostratigraphy 20
 Burnham Chalk Formation 372
 Ferriby Chalk Formation 381
 Flamborough Chalk Formation 382
 Rowe Formation 382, 384
 Welton Chalk Formation 381–2
 tectonic setting 378–80
 east Midlands Shelf 378
 Lincolnshire Chalk 380
 Market Weighton High 378–80
- Norwich Chalk 310, 311
- Oceanic Anoxic Events 6, 78, 249, 251
- Offaster pilula* belts, Sussex and Germany 223
- Offaster pilula* Zone 87, 105, 298, 309, 388, 427, 429, 484
 Newhaven to Brighton 210, 213, 219
 Thanet Coast 289, 292
 West Harnham Chalk Pit 157, 160
 White Nothe 169

General index

- Offaster pilula* Zone Handfast Point to Ballard Point 173
- Ogbourne Hardground 153, 154, 155
- Compton Bay 182, 185
- Fognam Quarry 306, 313, 314
- Ogbourne Maizey, Chalk Rock 306
- Okeford Fitzpaine Fault 144
- Old Dor fold 421
- Old Nore Beds 207, 216, 218
- Cuckmere to Seaford 230, 231, 232, 234
- Old Nore Flints 216, 232
- Old Nore Marl 192, 193, 207, 210, 213, 216, 220, 232, 310
- Old Nore Point 214, 218
- Old Nore Sheet Flints 232
- Old Steine Anticline 212, 214
- Orbirhynchia Bed 110, 353, 354
- Orbirhynchia cuvieri* bands 145
- Orbirhynchia mantelliana* bands 57, 130, 174, 268, 303, 479
- Abbot's Cliff 266, 277, 278
- Barrington Chalk Pit 351
- Chinnor Chalk Pit 340
- Hunstanton Cliffs 391, 394
- Southerham Grey Pit 243, 246, 247
- Speeton Cliff 417, 418
- orbital forcing, Cenomanian marl-limestone couplets 23
- Ornatothyris hardground 302
- Ostrea lunata* Chalk masses, Trimingham 366, 367
- Outer Hebrides Platform 435
- 'Overlap Zone' *see* belemnite 'Overlap Zone'
- Overstrand
- foreshore exposures 359–60
- 'Pyramidata Hardground' 360
- glacio-tectonic masses of Chalk 360–7, 372, 373, 468
- biostratigraphy 363–5
- lithostratigraphy 363
- Overstrand Hotel lower mass (Mass 1) 360–1, 362, 365
- paramoudra flint horizon 360, 361
- Reussella szajnochae szajnochae* flood event 372
- thrust slice theory 365
- Overstrand Hotel upper mass (Mass 2) 361, 362
- Overstrand Lower Marl 360, 361
- Overstrand Mass 3 361, 362
- Overstrand Mass 4 361
- Overstrand Upper Marl 360, 361
- microfauna 364
- Overstrand to Trimingham Cliffs 359–73, 484, 485
- Trimingham–Mundesley 368–73
- Overstrand–Sidestrand 360–8
- Lower Maastrichtian succession and Ulster White Limestone Formation 372
- origin of Overstrand masses 365, 372, 373
- Ovingdean Marl 231
- oxygen isotope data, cyclostratigraphy 22–3
- Oxytoma seminudum* flood events 246, 247, 277
- P/B break 340, 393
- Southerham Grey Pit 247
- Speeton–Buckton Cliffs 413, 415, 418
- palaeomagnetic reversal
- magnetochron 34N to 33R 26
- proxy for base of Campanian Stage 237
- Palm Bay Echinoid Band 284, 291
- Paradoxa Bed 300, 397, 416
- Hunstanton Cliffs 360, 389, 390, 391, 391–2
- ultimus/Aucellina* Event correlation (northern Germany) 392
- passage into Porcellaneous Beds 395
- Paramoudra Chalk Member 310, 311, 352
- paramoudra flints 15, 18, 190, 209, 275–6, 286
- Culver Chalk Formation 99, 102, 103, 186, 190
- Giant Paramoudra
- North Landing, Flam-borough 410, 416, 421
- Sidestrand Western Mass 365, 368, 369
- Overstrand Mass 1 361
- Spetisbury Member 99, 102, 103
- Thanet coast 286
- Warren Farm Pit 173, 190, 207, 208
- Whitecliff 99, 190, 209
- Yaverland Flint Paramoudra 195, 209
- Paulsgrove Pit 206–7, 207
- Culver Chalk Formation 207
- Newhaven Chalk Formation 206–7
- Peacehaven Beds 214, 216, 220, 237
- Seaford Head 231, 232, 234
- Peacehaven Steps 223
- Old Nore Marl to Castle Hill Flints 216
- Peake's Sponge Bed 284, 288
- Pegwell Inoceramid Band 289
- Peine Tectonic Event 199, 201, 202, 202, 204–5, 310, 476
- Pepperbox Hill 85, 86
- Pepperbox Marls 157, 158, 182, 193
- Pepperbox Quarry 161
- periclinal
- control of sedimentation, Grey Pit Channel 253
- Southern Province 204
- Petrockstowe Basin 86
- Pewsey Fault 11, 86, 87, 297
- Pewsey Hardground 155
- Fognam Quarry 306, 313
- Pewsey, Vale of 85, 297
- faults 21
- phosphate, pelletal, Winterbourne Chalk Pit 321
- phosphatic chalk 260, 298, 299, 308, 309
- Boxford Chalk Pit 316, 316, 317
- Lewes Phosphatic Chalk 254, 255, 256
- Newhaven Chalk Formation 309
- Santonian–Campanian 322–3

General index

- Scratchell's Bay 198
 South Lodge Pit 323, 329, 330
 Southerham Pit 254
 Upper Santonian–Lower Campanian 320
 Winterbourne Chalk Pit 320, 323
 phosphatic concretions, Clach Alasdair 436
 phosphatic sponge beds 473
 Beinn Iadain 475
 The Pinnacles 108, 109
 New Pit Chalk 116, 117
 Pinnacles Glauconitic Limestone Member *see* Pinnacles Member
 Pinnacles Member 110
 ammonites 118–19
 Beer Head 121
 co-extensive with Plenius Marls Member 112–13
 Holywell Nodular Chalk 102
 lithostratigraphy 112–16, 121
 Shapwick Grange Quarry 119
 White Chalk Subgroup 91, 112
 Snowdon Hill Quarry 140
 Wilmington Quarry 125–6, 128
 Planktonic/Benthic Break *see* P/B break
 planktonic foraminiferal events 278
 see also named foraminiferal events
 Plenius Marls Bed 90
 Plenius Marls Member 6, 39, 92, 93, 112–13, 147, 265, 301, 391
 Abbot's Cliff 266, 270
 Asham Pits 249
 Beachy Head 252
 Chiltern Hills 303–4
 Chinnor Chalk Pit 337–8, 339
 Compton Bay 177, 178, 182, 183
 Handfast Point to Ballard Point 173, 174
 Machine Bottom Pit 249, 251
 Melton Bottom Chalk Pit 400
 near Chard 140
 Northern Province, represented by Black Band 380
 Shakespeare Cliff 264, 265
 Shillingstone Quarry 142, 142–3, 143, 145
 Southerham Grey Pit 241, 249, 251
 stratotype at Holywell 88
 White Nothe 168
 polyplacum regression 358
 Porcellaneous Beds
 absent at Barrington Chalk Pit 350
 and Paradoxica Bed 300, 395
 Porosphaera Beds 310, 311, 360
 Sidestrand Western Mass 367–9
 Trimingham–Mundesley 369
 Portobello Site 216, 221
 Portobello–Saltdean
 fracturing in Newhaven Chalk Formation 218
 Old Nore Beds 218
 Saltdean Cliffs 216, 218
 Portrush Chalk 474, 475
 Portsdown
 field sections 205–7
 Newhaven Chalk Formation 205
 Portsdown Anticline (Pericline) 204, 204
 thinning of Newhaven Chalk Formation 207
 Portsdown Chalk Formation 33, 89, 99, 102
 Ballard Thrust Fault 170
 Downend Chalk Pit 203
 Whitecliff 186, 190–1, 196, 197
 Portsdown Fault 11
 Portsdown Marl 207, 209
 Portsdown Pair of Marls 100, 188, 195, 209
 Portsdown–Middleton Fault 21
 potstones
 Caistor St Edmund Chalk Pit 353, 354
 Whitecliff, Seven Sisters Flint Band 186, 187, 187
 Pounds Pool Sandy Limestone Member 110, 115, 118
 see also Wilmington Sands (facies), Basement Bed
 pre-Ilse Tectonic Phase 474
 pre-*Porosphaera* Beds 312, 363
 pre-Weybourne Chalk 310, 311, 352
 Précý Zoophycos Beds 205
primus event 247, 278, 394, 418
 Purbeck–Wight Fault 175
 Pycnodonte Bed (P/B Break) 413
 Pycnodonte event 341
 Pycnodonte Marl 393
 Pyramidata Hardground 360, 367, 372
 Quantocks Fault 86
 Quarlestone Borehole, Grey Chalk 142
 Rathlin Trough 11, 435
 Ravendale Flint 383, 399, 420
 Reading Formation 320, 325, 330
 Red Chalk *see also* Hunstanton Red Chalk Formation
 Buckton Cliffs 414
 Gault equivalent 380
 red chalk cliffs 377
 Red Chalk–Paradoxica Bed 24, 391
 Red Cliff Hole Member 412, 413, 416, 417
 Reed facies 307
 Reeds Farm Pit, Wilmington 130–3
 biostratigraphy 130–2
 correlation with Wilmington Quarry 130, 132
 lithostratigraphy 130, 131
 remanie Cretaceous concept 453, 455, 462, 469
Reussella szajnochae szajnochae flood event 364–5
 Campanian–Maastrichtian boundary 365
 Overstrand Hotel lower mass (Mass 1) 372
 Trunch Borehole 372
 reussianum fauna 307, 386

General index

- Aston Rowant Cutting 333
 Bridgewick Pit 261
 Fognam Quarry 313
 Hitch Wood Hardground 305–6, 313, 333, 345, 346
 Kensworth Chalk Pit 343–6
 Ogbourne Maizey 305–6
 Top Rock 308
 rhythmic couplets 22–3, 29, 30
 Glauconic Marl Member, Compton Bay 182
 Hope Gap Steps section 226
 Marl–limestone
 Cenomanian 23, 277
 Chinnor Chalk Pit 337
 climate control 248
 Southerham Grey Pit, Speeton Cliff 418
 marl–chalk
 below Spurious Chalk Rock 175
 Gale 177, 178, 182
 rhythmicity 4, 15
 Abbot's Cliff–Lydden Spout 270
 Malcolm's Point, Mull 455
 see also rhythmic couplets; Milankovitch cycles
 The Rib (limestone) 179, 246, 393, 414
 Southerham Grey Pit 243, 248, 250
 Riby Marl 399, 420
 Ringmer Beds 272
 Roedean Triple Marls 207, 216, 216, 218, 230, 231
Romaniceras ornatissimum Zone/Subzone 315
 Rottingdean Pair of Marls 216, 218, 218, 220, 230, 231
 Rough Brow Flint 229, 230, 236
 Round Down Marl 314, 315
 Rowe Chalk Formation 378, 382, 384
 Campanian–Maastrichtian boundary 384
 Holderness wells 382
 Rowe Formation 22
 Angulogavelinella bettenstaedti flood event 369, 372
 Rowe's Echinoid Band 284, 288, 291
Rugia acutirostris–*Rugia spinosa* microbrachiopod Zone 364
Rugia spinosa–*Trigonosemus pulchellus* microbrachiopod Zone 364, 372
 Rye Hill Farm/Shute Farm 151–2
 Rye Hill Sands 152
 St Margaret's Bay Member 111
 St Valéry–Bembridge line 87
 Saltdean Marl 216, 231
 Santonian Stage 23, 225, 482–3
 biostratigraphy
 Cuckmere to Seaford 236
 Northern Province 388
 Thanet Coast 289–91
 Whitecliff 192–3
 Santonian–Campanian boundary 453
 Cuckmere to Seaford 225, 233, 237
 Flamborough Head 430
 Friars Bay Marls 219, 222
 Seaford Head 233
 Sanwick Bay, basal Burnham Chalk Beds 419
 Scalpa Sandstone (Jurassic) 458
 Scaphitenschichten, northern Germany 386
 Scratchell's Bay
 Newhaven Chalk Formation 198
 correlation with Downend Main Hardground 198
 Scratchell's Flint 196, 209
 Scratchell's Marls 100, 188, 195, 196, 209
 Scratchell's Pair of Marls 100, 188, 195, 196
 Seaford Chalk Formation 15, 33, 89, 98, 100, 115, 235
 Beer Head 116
 Compton Bay 183–4
 Cuckmere to Seaford 228–9, 228, 229
 Folkestone to Kingsdown 275–6
 Handfast Point to Ballard Point 173
 Hooken Cliff 120
 Shillingstone Quarry 142
 East Anglia 309
 Transitional Province 308
 Newhaven to Brighton 212
 Thanet Coast 282, 283, 286, 288, 292
 White Nothe 164, 166, 167–8, 167
 Whitecliff 187, 189, 190
 see also Belle Tout Beds
 Seaford Head 232, 227
 Coniacian–Santonian boundary 229, 230
 Culver Chalk Formation 235
 Lewes Nodular Chalk Formation 226, 227, 228
 microfossils 237
 Newhaven Chalk Formation 234, 235
 Santonian–Campanian boundary 233
 Santonian Stage, stratotype candidate 293
 Seaford Head Anticline 226
 Seaton Chalk Formation 111, 229, 282, 283, 286, 288
 Seaton Fault 109
 Second Inoceramid Workshop 46, 50–2
 sedimentary structures
 Allt na Teangaidh 448
 Auchnacraig (Loch Don) 438, 458
 Culver Chalk Formation 186
 Selwicks Bay, Flamborough Head 423, 424–5, 425, 426
 Senonian Stage 23
 sequence boundaries 121, 248, 314
 tectonically enhanced 7
 Seven Sisters Flint Band 99, 167, 173, 184
 Birling Gap 238
 Cuckmere to Seaford 224, 228, 229
 Folkestone to Kingsdown 267, 275, 276, 280
 Southerham Pit 253
 Whitecliff 190
 potstones 186, 187, 187
 Sewerby Hall Marl 428
 Sewerby Member 411, 428
 Sewerby Steps
 Discoscaphites binodosus Subzone 388, 429

General index

- Flamborough Chalk 427
 Sewerby Steps Marl 409, 428
Sharpeiceras schlueteri
 Subzone 270, 277, 300–1,
 350, 392, 396
 Speeton Cliff 417
 Sheepcote Valley Flints 220,
 230, 231
 sheet-flints 17, 154, 222
 Aston Rowant Cutting 333
 Charnage Down Chalk Pit
 154, 154
 Lewes Nodular Chalk
 Formation 226–7
 related to low-angle sliding
 238
 Rottingdean 212
 Seaford Chalk Formation
 190
 Sheringham 355
 Catton Sponge Bed Hard-
 grounds 358
 Shide Marl 170, 175, 196, 209
 Shillingstone Massive Flint 143
 Shillingstone Quarry 141–8,
 144
 biostratigraphy
 Cenomanian 145
 Coniacian 145
 Turonian 145
 Seaford Chalk Formation
 144
 lithostratigraphy 142–4, 143
 Shoreham Marls 95, 97, 183,
 274
 Aston Rowant Cutting 333
 Charnage Down Chalk Pit,
 Marl 1 154, 155
 Cuckmere to Seaford 224,
 225, 226, 228
 Seaford Head 227, 228
 Marl 2 98
 Southerham Pit 255, 257
 Shoreham Tubular Flints 95,
 154, 155, 274
 Cuckmere to Seaford 227,
 228, 228, 238
 Short Brow Flint 229, 230, 236
 Sidestrand, glacio-tectonic
 masses 367–8
 Sidestrand Chalk Member 311,
 312, 361, 363, 369
 Sidestrand Marl 360, 361, 361,
 362, 365
 Sidestrand Western Mass 360,
 364, 365
 Overstrand masses correla-
 tion 468
 Porospaera Beds 367, 369
 Trimingham Sponge Beds
 Member 367–8
sigali Zone *see* *Margino-*
truncana sigali Zone
 six (6) band group of lime-
 stone 413, 414
 Inoceramus virgatus-acme
 417
 slump beds 188, 194, 299
 slumping 7, 88, 188, 194, 299
 Castle Hill Flints 232, 234
 Cuckmere to Seaford 227
 Downend Chalk Pit 199,
 200, 204–5
 Lewes Nodular Chalk
 Formation 226
 Overstrand masses 372, 373
 plastic flow deformation 238
 Small Cove Hardground 91,
 114, 115
 Snowdon Caves 137
 Snowdon Hill Quarry 137–41,
 139
 Basement Bed
 (Cenomanian) 137
 Little Beach Member 140
 relationship to Upper
 Greensand 139
 biostratigraphy 138–9
 lithostratigraphy 138
 Middle Cenomanian 140
 Upper Greensand 138,
 139–40
 Pounds Pool Member cor-
 relation 140
 Whitecliff Chert and
 Eggardon Grit 137
 Pinnacles Member correla-
 tion 140
 Zig Zag Chalk Formation
 138
 Snowdrop Flints 258, 258
 Solent marine seismic lines 88
 Solent Marls 100, 195
 South Downs axis 87
 South Hewett Fault Zone 21
 South Landing Member 411,
 428
 South Lodge Pit 323–30
 contact with Reading Beds
 330
 biostratigraphy 327–8
 Brown Chalk 324,
 Lower Brown Chalk 324,
 325
 Upper Brown Chalk 324,
 325
 lithostratigraphy 324–7
 Lower White Chalk 324, 327
 Middle White Chalk 327
 Upper White Chalk 324, 325
 Marsupites testudinarius
 Zone 329
 South Street Beds 258
 South Street Flints 258, 258,
 344
 South Street Marls (Beds) 258,
 258, 259
 south-west England 102–3
 Beer Head Limestone
 Formation 102
 Cenomanian deposits 102
 Cenomanian faunas 106
 greensands 85
 structural control on sedi-
 mentation 141
 marginal facies 86
 small Upper Cretaceous out-
 liers 85, 86
 Southerham Finger and Tube
 Flints 262
 Southerham Flints 256
 Southerham Grey Pit 239–53,
 241, 245, 479, 480
 biostratigraphy 245–7
 Lower Cenomanian 245–6
 Middle Cenomanian
 246–7
 Middle Cenomanian strato-
 type candidate 239, 253
 cored boreholes 248–9
 correlation with Beachy
 Head 250
 Grey Chalk Subgroup 248
 Grey Pit Channel 244–5,
 247, 248
 lithostratigraphy 242–5
 West Melbury Marly Chalk
 Formation 242–4, 243
 Zig Zag Chalk Formation
 243, 244–5
 P/B break 247
 Plenus Marls 241, 249, 251

General index

- rhythmicity of 'Chalk Marl' 248
 Cenomanian cyclostratigraphy 239, 241–2
 Tenuis Limestone 239, 242, 243, 244, 246–7
 Southerham Marls 94, 95, 117, 167, 173, 183, 185, 344
 Aston Rowant Cutting 335
 Folkestone to Kingsdown 272, 272, 278–9
 Kensworth Chalk Pit 343, 344, 345
 New Pit 262
 Shillingstone Quarry 143, 144, 145, 147
 Southerham Pit 253, 255, 256
 Southerham Pit 253–63, 481
 Holywell Nodular Chalk Formation 253
 Navigation Pit and Chandlers Yard 253, 254, 255, 257–63
 Seven Sisters Flint Band 253
 Southerham Works Pit 253, 254–5, 259
 Glyndebourne Hardgrounds correlative 260
 Holywell Nodular Chalk–Beeding Beds 254
 Turonian–Coniacian boundary 234
 Upper Turonian–Lower Coniacian succession 253
 Southerham Tubular Flints 272
 Southern Province 7, 8, 9, 11, 87
 biostratigraphy and chronostratigraphy 103–6
 Cenomanian 39
 Offaster pilula Zone 105
 Turonian 40
 unified, Upper Cretaceous 89
 formations and members 20, 21, 22
 GCR localities 86
 lithostratigraphy 19, 20, 20, 21, 88–102
 Grey Chalk Subgroup 91
 White Chalk Subgroup 91–102
 south-west England 85
 tectonic structure and sedimentation history 87–8
 Speeton Cliff
 Albian–Cenomanian boundary 410, 412, 416, 418–9
 Burnham Chalk Formation 412
 Cenomanian Stage 418–19
 Ferriby Chalk Formation 412, 412, 416–19
 Hunstanton Red Chalk Formation 394, 409, 411–16, 430
 lithostratigraphy 412, 416
 Lower Cretaceous successions 380
 Welton Chalk Formation 412
 Spetisbury Member 89, 99
Spheoceramus patootensisformis inoceramid Zone 388, 429
 Splash Point Beds 216, 229, 231, 238
 Sponge Beds 310, 311
 Spurious Chalk Rock 147, 167
 Compton Bay 178, 181, 183, 185
 Handfast Point to Ballard Point 173, 175
 Lewes Nodular Chalk Formation 94
 Shillingstone Quarry 141, 143, 145, 146, 148
 Whitecliff 187
 Staple Nook zone of deformation 419–21
 Start–Cotentin Ridge 11
 steinkerns 34, 207, 338
Sternotaxis plana Zone 264, 307
 Buckton Cliffs–Stottle Bank 419
 Burnham Formation 386
 Cuckmere to Seaford 234
 Enthorpe Railway Cutting 406
 Fognam Quarry 313
 Kensworth Chalk Pit 345
 North Landing, Flamborough 410, 422
 Sticklepath Fault 11, 86
Stoliczkaia dispar (ammonite) Zone 149, 479
Stoliczkaia dispar Zone, Boyne Hollow Cherts 149
 Storridge Hill 141
 Stottle Bank–Selwicks Bay–Flamborough Head 424–7, 425
 lithostratigraphy and tectonic structures 424–6
 biostratigraphy 426–7
 Stottle Bank–Sewerby Cliff, Burnham Chalk Formation and Flamborough Chalk Formation 426, 428
 Strahan's Hardground 88
 Southerham Pit 255, 256, 259, 261–3
 Stratigraphy 7
 Southern Province
 Cenomanian 39
 Coniacian 54
 Santonian 55
 Turonian 40
 Transitional Province 299–312
 Grey Chalk Group 299–303
 White Chalk Group 303–12
 Stratotypes 19, 24, 88, 91, 94, 106, 122, 207, 224–6, 237, 239, 253, 255, 259, 293, 304, 310, 34–3, 347, 355–6, 381–2, 396, 398, 399, 400, 402, 405, 407, 410–11, 427, 430
 stromatolites 391
 Studland Bay 170
 Studland Chalk Member, Handfast Point to Ballard Point 173
 stylolites 15
 northern chalk 378
 Selwicks Bay 423
 sub-Plenus erosion surface 90, 91, 121, 179, 251, 302, 381, 393
 Southerham Grey Pit 245, 248
 White Chalk Subgroup 92, 182
Subprionocyclus neptuni Zone base 312
 Kensworth Chalk Pit 346
 Sudbury 309
 Sutton Stone *see* Beer Stone

General index

- Swaffham Railway Cutting 307
- Taplow Lower Hardground 324–8, 326
correlation with Barrois' Sponge Bed/Clandon Hardground 327
and Lower Phosphatic Chalk 324, 325
- Taplow Phosphatic Chalk Member 325
- Taplow Pit *see* South Lodge Pit
- Taplow Upper Hardground 326
Winterbourne Phosphatic Chalk Hardground correlative 329
and Upper Phosphatic Chalk 324, 325, 326, 327, 328
- Tarrant Chalk Member 89, 99
Newhaven to Brighton 214
- Tarrant–Spetisbury members boundary 99
- Tavern Flints 214, 220, 232
Zoophycos 57, 217
- tectonic highs 169
affecting marl seams and flint beds 99
Inner Hebrides 472, 475
intermittent, Berkshire Downs–Chiltern Hills 298–9
Northern Ireland 474
see also Mid-Dorset Swell
- tectonic reworking 472, 476
- tectonism 7, 82, 161, 162, 165, 175, 198, 249, 424–6, 433
and debris flows 440, 476
glacio-tectonic masses 359–73
intra-Chalk 88, 198, 222, 224, 238,
Coniacian 226
- Laramide 87
- Northern Province 378–80
- Peine Tectonic Event 199, 201, 202, 202, 204–5, 310, 476
pulsed 238, 476
- Southern Province 87–8
- Stottle Bank–Selwicks Bay 424–6
- Transitional Province 298–9
see also Ilsede Tectonic Phase and Wernigerode Tectonic Phase
- Telscombe Cliffs
Goniotenthis quadrata Zone 210
Meeching Marls and Tavern Flints 216
Newhaven–Culver Chalk boundary 217
- Telscombe Marls 1 and 2 157, 158, 220, 223
Marl 1 194, 214, 216, 223, 231–2, 232, 238,
Whitecliffe 188, 192, 193
- Tenuis Limestone 39, 91, 144, 182, 269, 393
Abbot's Cliff 266
Quarleston Borehole 142
Southerham Grey Pit 239, 242, 243, 244, 246–7
- tephro-event stratigraphy 6, 25, 40
- Terebratulina gracilis (lata)* Zone
Fognam Quarry 313
Handfast Point to Ballard Point, Spurious Chalk Rock 173
- Terebratulina lata* Zone 306, 381
Aston Rowant Cutting 333
Charnage Down Chalk Pit 155
Compton Bay 185
Great Thornwick Bay 422
Kensworth Chalk Pit 345
Swaffham Railway Cutting 307
- Tethyan Realm 5, 6, 119
ammonites and planktonic foraminifera 7
- Thanet Anticline (Pericline) 283, 286
- Thanet Coast 282–93, 483, 484
biostratigraphy 293
Campanian 292
Santonian 289–91
lithostratigraphy 286–8
Margate Chalk Member 283, 287, 288, 292
Seaford Chalk Formation 282, 283, 286, 288
- Thornwick Nab
Ferruginous Flint and Barton Marls 421
Melton Ross Marl 421
- Thorpe Mass *see* Overstrand
- Three Inch Flint Band 88
- Top Rock
Aston Rowant Cutting 330, 332, 335
Berkshire Downs–Chiltern Hills 299
Cliffe or Hope Gap or Navigation hardground correlative 308
Kensworth Chalk Pit 343, 344
- Transitional Province
base of Lewes Nodular Chalk 307–8
Micraster cortestudinarium Zone 308
- Torosay 458–9, 476
- Torosay Limestone 476
- Totternhoe Stone 45, 299, 301, 302, 303, 351, 397
Arlesey (Green Lagoon Pit) channel facies 340
Arlesey (Blue Lagoon Pit) shelf facies 340
Barrington Chalk Pit 347, 349, 351
Chinnor Chalk Pit 335, 337–40
Turrilites costatus Subzone 338
east of Hitchin, Cast Bed 303
Hunstanton Cliffs 389, 390, 391, 392, 394
Speeton–Buckton Cliffs 413, 417
Totternhoe Stone Pit 340
- 'Tourtia', Ardennes, terebratulid brachiopod from, Hunstanton Cliffs 392
- Transitional Province 7, 8, 9, 11, 298
GCR sites 297
Grey Chalk Subgroup 299–303
mapping units 20
stratigraphy 299
tectonic structure and sedimentation history 298–9
White Chalk Subgroup 303–12

General index

- Trigonosemus pulchellus*
microbrachiopod Zone 371
- Trimingham Chalk 310
- Trimingham Sponge Beds
Member 31, 311, 312, 361,
368, 369
*Angulogavelinella betten-
staedti* flood event 372
- Trimingham–Mundesley, glacio-
tectonic Chalk masses
368–73
biostratigraphy 369–1
Chalk rib 369
Grey Beds 369
lithostratigraphy 379
Lower Maastrichtian 371
Porosphaera Beds 369
White Chalk 370
see also Overstrand
- Triple Marls 244, 250, 399, 413
- Triple Sheet Flints 143
- Triple Tabular Flints 383, 420
- Trochiliopora* bed 105
- Trunch Borehole 205, 310, 372
glauconitized hardground
308
- Turonian Stage 480–1
biostratigraphy
Aker's Steps 278, 281
Folkestone to Kingsdown
278–9
Handfast Point to Ballard
Point 174
Shillingstone Quarry 145
Northern Province, bio-
stratigraphy 386–7
- Turonian–Coniacian boundary
267, 279
Cuckmere to Seaford 225
Enthorpe Railway Cutting
387, 402–3, 406
Southerham Pit 234
- Turrilites acutus* Subzone 136,
394
Handfast Point to Ballard
Point 174
Little Beach Member 118
- Turrilites costatus* Subzone
174, 303, 394, 418, 480
Chinnor Chalk Pit 338
- Turrilites costatus*–*Turrilites
acutus* Subzonal boundary,
Chinnor Chalk Pit 341
- Turrilites scheuchzerianus*
event 246, 338, 340
- Uintacrinus anglicus* Zone
429, 484
Flamborough Head 410, 427
Newhaven to Brighton 219
South Lodge Pit 327
Thanet Coast 289, 291, 292
- Uintacrinus socialis* Zone 410,
483
Cuckmere to Seaford 225,
229, 236
Flamborough Chalk
Formation 382, 410
Flamborough Head 411,
427, 429
Handfast Point to Ballard
Point 173, 174
Margate 288
Northern Province 388
South Lodge Pit 328, 330
Thanet Coast 289
- Ulceby Marl 419, 420
correlation with Lewes Marl
407
North Landing, Flam-
borough 421, 424
vulcanogenic origin 403,
407
- Ulceby Oyster Bed 387, 421
- Enthorpe Railway Cutting
405, 406
- Ulster Basin 11
- Ulster White Limestone Form-
ation
lithostratigraphy 19
transgressive and tectonic
re-activation events 474
- unconformities
Compton Bay,
Cretaceous–Quaternary
181
Cuckmere to Seaford, sub-
Palaeogene 225
Newhaven to Brighton, sub-
Palaeogene 210, 212, 213,
214, 222
White Nothe 161
Whitecliff, Palaeogene 186
- Upper Albian 149, 479
- Upper Chalk, Northern
Province, base of 380–1
- Upper Cretaceous 6, 7, 8,
9–15, 26, 479
- biostratigraphy
base of Cenomanian 24
D'Orbigny's stage con-
cepts 23
defined 3, 8, 25
GCR sites 10
global geological setting 3–6
lithostratigraphy 19–22
Northern Province 377, 384
stratigraphical framework 19
Transitional Province 298
White Nothe 169
see also Appendix, this vol-
ume for stratigraphical
framework
- Upper Downend Hardground
200
- Upper Downend Marl 199, 208
- Upper Greensand 39, 114, 179,
250
Chert Beds 148, 165, 166
Judd, Inner Hebrides Group
441
Snowdon Hill Quarry 138,
139
White Nothe 166
- Upper Greensand Formation
124, 129, 151
Melbury Sandstone
Member–Boyne Hollow
Cherts Member 148
Handfast Point to Ballard
Point 171–4
- Upper Greensand–Glauconitic
Marl contact, Compton Bay
180
- Upper Inoceramus Bed 300,
393, 397, 397
Hunstanton Cliffs 391,
392–3
Speeton–Buckton Cliffs 413,
414, 417
- Variscan Front 9
- virgatus* (acme) event 246
- Volvicerasmus involutus* (ino-
ceramid) Zone 117, 387
- Volvicerasmus koeneni* (ino-
ceramid) Zone 117, 387, 482
- Wallington Syncline 204
- Wardour, Vale of 85
- Warminster Greensand 151,
152

General index

- Warningcamp–Whitecliff Flint 99
- Warren Farm Pit 205–6, 206, 208–9
 Lower Downend Marl
 correlation 206
 paramoudra flints 190, 207, 208
 Peine facies changes 205
 synsedimentary faulting 206
 Upper Downend Beds 206
- Watinoceras devonense* Zone 341, 480
- Weather Castle Member 412
 Albian–Cenomanian boundary 412
- Wells 309–310
 Old Nore Marl correlation 310
- Welton Chalk Formation 21, 378, 381–2, 391
 Black Band at base 400
 Buckton Cliffs 419–24
 Flamborough Head 410–11
 Herring Formation correlation 382
 Market Weighton area 379
 Melton Bottom Chalk Pit 400
 Melton Ross Quarry 401
 Speeton Cliff 412
 Variegated Beds 381
 Welton Wold Quarry 398
- Welton Wold Quarry *see*
 Melton Bottom Chalk Pit
- Welton–Burnham Chalk boundary, Flamborough Head 383
- Wernigerode Tectonic Phase 238, 476
see also tectonism
- Wessex Basin and Shelf 87, 88
- West Ebb Marl 113, 114, 116
- West Harnham Chalk Pit 156–61
 biostratigraphy 157, 159–60
Offaster and *Echinocorys* assemblages 160
planoconvexus Bed 160
 lithostratigraphy 157, 159
 Culver Chalk Formation 157, 159
 Newhaven Chalk Formation 85, 157
- West Melbury Marly Chalk Formation 21, 32, 39, 91, 144, 298
 Quarlestone Borehole 142
 Chinnor Chalk Pit 336, 337, 339
 Dead Maid Quarry 148
 Folkestone Warren and Abbot's Cliff 269–70
 Folkestone–Dover 264, 301
 marl–limestone rhythms 91, 92, 244
 Southerham Grey Pit 242–4, 243
 Transitional Province 300–3
- West Melbury Marly Chalk–Zig Zag Chalk boundary
 Asham Pits 249
 Beachy Head 249–51
 Chiltern Hills 339
 Compton Bay 182
 Southerham Grey Pit 239, 242
- West Nook Marls 428
- Weston Hardground 90, 115, 129
- Weybourne Chalk Member 310, 311, 352
 Catton Grove Chalk Pit 356–8
- Whitaker's 3-inch Flint Band 88, 99
 Thanet Coast 282, 284, 285, 286, 288, 290
- White Bed 91, 178, 179, 183, 265, 280
 Abbot's Cliff 266
- White Chalk 310, 311, 366, 369, 368, 370
- White Chalk Subgroup 88, 91–102
 base 21
 Chinnor Chalk Pit 337–8
 Plenus Marls Member 337–8
 Compton Bay 182–4
 Plenus Marls Member 182
 Cuckmere–Seaford 224–39
 east Devon, correlation with Holywell Nodular Chalk 102–3
 Folkestone to Kingsdown 269
 formations in northern England 20, 21
- Handfast Point to Ballard Point 173–4
- lithostratigraphy 91–102, 116–17
 Culver Chalk Formation 99, 101, 102, 103, 147
 Holywell Nodular Chalk Formation/New Pit Chalk Formation 92–4, 116, 117
 Lewes Nodular Chalk Formation 94–5, 95, 96, 97, 98, 117
 Newhaven Chalk Formation 99
 Portsdown Chalk Formation 99, 102
 Seaford Chalk Formation 98
- Northern Province 377
- Pinnacles Member 91, 112
- Shillingstone Quarry 146
- Southerham Pit 253
- sub-Plenus erosion surface 92, 182
- Transitional Province 303–12
 Chalk Rock 305–7
 Clandon Hardground 308–9
 'High Chalk', East Anglia 309–12
 Holywell Nodular Chalk and New Pit Chalk formations 304–5
 Lewes Nodular Chalk Formation 305
 Melbourn Rock 304
 Plenus Marls Member 303–4
 Seaford and Newhaven Chalk formations 308
 Top Rock 307–8
- White Nothe, lithostratigraphy 166–8
- White Horse Marl 188, 188
- White Nothe 85, 161–9, 162
 biostratigraphy 168–9
 Cenomanian deposits 165, 166, 168, 169
 Holywell Nodular Chalk Formation 166
 Lewes Nodular Chalk Formation 163–4, 166–7, 169

General index

- lithostratigraphy 165–8
- New Pit Chalk Formation 166
- Seaford Chalk Formation 164, 166, 167–8, 167
- Spurious Chalk Rock 166, 167
- tectonic disturbance West and Middle Bottoms 161, 164, 165
- White Chalk Subgroup 166
- Zig Zag Chalk Formation 161, 163, 163, 165, 169
- White Nothe Flint 143, 144, 147, 156, 166, 167
- Whitecliff Beds 99
- Whitecliff Chert 137, 138
- Whitecliff Flint Band 188, 195 with Paramoudra 209
- Whitecliff, Isle of Wight 186–99, 208–9, 484
 - biostratigraphy 191–3, 196
 - Barren Beds 192
 - Santonian fauna 192–3
- Newhaven Chalk Formation 99
- Culver Chalk Formation 99, 101, 102, 103, 186, 188, 190
 - Echinocorys* horizons 195, 195
- Flintless Belt 186, 188, 192, 193, 194, 196–7
- Lewes Nodular Chalk Formation
 - base 187, 197
- Barrois' Craie Blanche 186
- lithostratigraphy 187–91
- Newhaven Chalk Formation 195, 196
- Portsdown Chalk Formation 186
- Seaford Chalk Formation 187, 188, 188, 189, 190, 197
- Spetisbury Member, Paramoudra flints 99
- Warren Farm Paramoudra Flints 190
- Whitecliff Marls 188
- Whitecliff Wispy Marls 195, 209
- Willerby Flints 406, 407
- Willerby Quarry 406–7
- Wilmington Fault 109, 129
- Wilmington 'Grizzle' 115, 124, 126, 131, 132
 - Orbirhynchia mantelliana* band correlation 130
- Wilmington Outlier 129
- Wilmington Quarry 123–30, 125
 - biostratigraphy 126–8
 - lithostratigraphy 124–6, 126
- Wilmington Sands (facies) 21, 111, 112, 115, 116, 121
 - Basement Bed
 - Reeds Farm Pit 130, 132, 133
 - Wilmington Quarry 124, 125, 126
- Hooken Member correlation 129
- Reeds Farm Pit 129–30
- Wilmington Quarry 125, 127–9
- Wilmington to Membury outliers 136
- Wincanton Memoir, Dead Maid Quarry transition beds 151
- Winterbourne Chalk Pit 320–3
 - biostratigraphy 321
 - lithostratigraphy 320–1
- Winterbourne Lower Glauc-onitic Hardground 320
- Winterbourne Phosphatic Chalk Hardground 320, 322, 329
- Winterbourne Upper Glauc-onitic Hardground 320
- Winterbourne Upper Hard-ground 320–1, 322
- Wootton Marls 383, 420
- Yarborough Marl 399
- Yarbridge Flint 191, 196
- Yaverland Flint Paramoudra 195, 209
- Yaverland Marls 195, 205, 209
- Yorkshire Chalk 15
- Yorkshire Wolds 377, 380
- Zig Zag Chalk Formation 21, 32, 39, 91, 93, 142, 144, 169
- Chinnor Chalk Pit 337, 341
- Folkestone to Kingsdown 269, 270
- Handfast Point to Ballard Point, Basement Bed 170, 172, 175
- Jukes-Brown Bed 7 and other units 91, 337
- Machine Bottom Pit
 - Asham Zoophycos Beds 244
 - Falling Sands Member 244
 - Plenus Marls 244, 245
- Snowdon Hill Quarry 138
- Southerham Grey Pit 243, 244–5
 - Chalk Marl–Grey Chalk boundary 244
- White Nothe 161, 163, 165, 166, 168
- Zig Zag Formation, base at Speeton Cliff 417–18
- Zoophycos* beds 227, 275, 405, 406, 408–9
- Zoophycos* flints 15, 223
- Kensworth Chalk Pit 343, 345
- Thanet Coast 286