Figures

(Figure 1.1) Major Jurassic subdivisions. [1] geological time terms [2] chronostratigraphical (time-rock) terms Harland *et al.* (1990) * Gradstein and Ogg (1996) (95% confidence level).

(Figure 1.2) (a)–(c), (e) Palaeogeographical reconstructions for the British area during the late Mid and Late Jurassic (based on Cope and Rawson in Bradshaw *et al.,* 1992; Cope, 1995b). In many cases, the extent of land areas is uncertain. (d) Main structural elements affecting sedimentation in the British area in the Mid-Late Jurassic (terminology as used in this volume). The 'London Platform' is a structural high, the limits of which remained generally constant. The emergent part of the Platform, the position and limits of which varied, is referred to as the 'London Landmass'. (Compiled from various sources.)

(Figure 1.3) Simplified sketch map showing occurrences of Oxfordian–Kimmeridgian rocks in Britain (onshore area only).

(Figure 1.4) Chronostratigraphical subdivisions and ammonite biohorizons recognized in the Oxfordian and Kimmeridgian stages in Britain (for sources, see text). AmC = Ampthill Clay Formation; KC = Kimmeridge Clay Formation; WWF = West Walton Formation. In Dorset, where the Kimmeridgian succession is more complete, additional 'beds' (KC50–63) up to the base of the overlying Portland Group (Portlandian) have been detailed by Gallois (2000). (See the Tyneham Gap–Hounstout GCR site report, this volume.)

(Figure 2.1) Map of southern England showing the outcrop of the Oxfordian–Kimmeridgian beds, and the principal structural and palaeogeographical features (based on Scotchman, 1991a, fig. 1; Bristow *et al.,* 1995, fig. 6 and Newell, 2000, fig. 6).

(Figure 2.2) Correlation of Oxfordian strata in Dorset, Wiltshire and Oxfordshire.

(Figure 2.3) Cross-section of north Dorset, showing the effect of syndepositional faulting on the thicknesses of the Corallian beds (after Bristow *et al.,* 1995, fig. 38).

(Figure 2.4) Locations of Oxfordian and Kimmeridgian GCR sites in southern England.

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(Figure 2.8) Log of the Corallian Group at Osmington, (after Sun, 1989, figs 6, 7, 10 and 13).

(Figure 2.9) View of the Corallian limestones in the cliffs west of Bran Point. Alternations of marl and concretionary limestone in the base of the cliff and rock platform (Upton Member, A) are overlain by Shortlake Member oolite (B), with Nodular Rubble (C) and Clavellata Formation (D) in the cliff behind. (Photo: J.K. Wright.)

(Figure 2.10) Sequence stratigraphical interpretation of the Corallian sequence at the Osmington GCR site (after Newell, 2000, fig. 2).

(Figure 2.11) Selection of Oxfordian ammonites from the Dorset coast Oxfordian exposures. (A) *Ringsteadia evoluta* Salfeld, Osmington Mills Ironstone, Black Head, J44969, x0.95. (B) *Amoeboceras glosense* (Bigot and Brasil), Clavellata Member, Black Head, D/C/25, x0.95. (C) *Perisphinctes (Perisphinctes) uptonensis* Arkell, Clavellata Member, Black Head, DC42, x0.80. (D) *P. (Pseudarisphinctes) pachachii* Arkell, Clavellata Member, Black Head, D/C/46, x0.48. (E) *Amoeboceras ilovaiskii* (M. Sokolov), Clavellata Member, Black Head, D/C/29, x1. (F) *Cardioceras (Subvertebriceras)*

zenaidae Ilovaiski, Preston Grit, Redclig D/C/90, x 1. (G, H) *Cardioceras (Vertebriceras) quadrarium* S. Buckman. Red Nodule Bed, Furzy Cliff, D/O/35, x 1. (I) *Cardioceras (Cardioceras) costicardia* S. Buckman, Red Nodule Bed, Furzy Cliff, D/O/20, x 1. (J) *Perisphinctes (Dichotomosphinctes)* sp. Weymouth Member, Bowleaze Clay, Furzy Cliff, D/O/41, x0.58. (K) *Cardioceras (Scarburgiceras) praecordatum* Douvillé, East Fleet section, just north-west of the Lynch Cove GCR site, D/O/1, x 1. (Photos: (A, C, D) K. D'Souza; (F), K. Denyer; (B, E, G–K), J.K. Wright. Collections: Prefix 'D', J.K. Wright collection; prefix , Sedgwick Museum Collection, Cambridge.)

(Figure 2.12) Kimmeridge Clay outcrops in the Dorset type area (after Cox and Gallois, 1981, fig. 1).

(Figure 2.13) a. Graphic sections of the lower part of the Kimmeridge Clay at Black Head–Osmington Mills [SY 7239 8195], [SY 7259 8192]–[SY 7258 8200], [SY 7336 8186] and [SY 7342 8174]. (After Cox and Gallois, 1981, pp. 33–4.). b. Graphic section of the lower part of the Kimmeridge Clay at Osmington Mills [SY 7342 8174]. (After Cox and Gallois, 1981, pp. 33–4.)

(Figure 2.14) Correlation between the main sections of Kimmeridge Clay on the Dorset coast. Youngest zones not shown. (After Cox and Gallois, 1981, fig. 5.)

(Figure 2.15) Graphic section of the Eudoxus–Pectinatus zonal interval at Ringstead Bay [SY 7619 8147], [SY 7606 8147] and [SY 765 813]. (After Cox and Gallois, 1981, p. 35.)

(Figure 2.16) Sketch map of the solid geology in the vicinity of the Sandsfoot GCR site.

(Figure 2.17) The complete stratal succession at the Sandsfoot GCR site.

(Figure 2.18) Weathering profile of the Redcliff Formation between Nothe and Rodwell (after Wright, 1986a, figs 2 and 3).

(Figure 2.19) Preston Grit exposed in the rock platform just east of Nothe Fort. (Photo: J.K. Wright.)

(Figure 2.20) Weathering profile of the Sandsfoot Grit in the cliff section beneath Sandsfoot Castle (after Wright, 1986a, fig. 5)

(Figure 2.21) Massive Sandsfoot Grit of Unit III below Sandsfoot Castle, showing the intense *Thalassinoides* bioturbation of the harder bands weathering out in the foreground blocks. (Photo: J.K. Wright.)

(Figure 2.22) Geological map for the Small Mouth, East Fleet and Lynch Cove GCR sites.

(Figure 2.23) Correlation of the basal beds of the Kimmeridge Clay exposed at Wyke Regis, Sandsfoot, Black Head, Osmington Mills and Ringstead Bay (based on Cox and Gallois, 1981, fig. 6 and unpublished borehole data, R.W. Gallois, pers. comm.).

(Figure 2.24) Log of the Corallian succession at East Fleet, after Wright (1986a, fig. 4). Note that Bed 7 is only 0.9 m thick — the thickness of 3.5 m given in Wright (1986a) is a misprint.

(Figure 2.25) Sketch map of the solid geology of the Kimmeridge area, (based on Cox and Gallois, 1981, fig. 7 and Gallois, 2000, fig. 1).

(Figure 2.26) Geological sketch sections of the Kimmeridge Clay exposed in the cliffs between Brandy Bay and Chapman's Pool (based on Cox and Gallois, 1981, fig. 8 and Gallois, 2000, fig. 2).

(Figure 2.27) Generalized vertical section through the upper part of the Kimmeridge Clay exposed in the cliffs east of Clavell's Hard (based on Cox and Gallois, 1981, fig. 13 and Gallois, 2000, figs 4 and 6).

(Figure 2.28) Looking east from Clavell's Hard to Rope Lake Head and St Alban's Head (far distance). The lower part of the cliff face comprises alternating mudstones and ribs of oil shale including the Blackstone, Rope Lake Head Stone Band and Short Joint Coal. The upper part comprises a thick succession of pale calcareous mudstones including,

towards the top, the Basalt Stone Band. The cliff is capped by further alternations of mudstone and oil shale including the White Stone Band. (Photo: W.A. Read.)

(Figure 2.29) Exposure of Abbotsbury Ironstone at Blind Lane, Abbotsbury. (Photo: A6478, reproduced with kind permission of the Director, British ,Geological Survey ©NERC.)

(Figure 2.30) Locality map for sites around Westbury. Geological information from BGS Sheet 281 (Frome) (1965).

(Figure 2.31) Locality map for the Steeple Ashton GCR site. Geological information from BGS Sheet 281 (Frome) (1965).

(Figure 2.32) Log of the Corallian succession at Steeple Ashton (after Negus and Beauvais, 1979, fig. 1).

(Figure 2.33) Locality map for the Seend Cleeve GCR site. Outcrop of the Corallian sandstones from BGS Sheet 281 (Frome) (1965).

(Figure 2.34) Weathering profile of the Corallian succession at Seend Cleeve Quarry as seen by J.K. Wright in 1978.

(Figure 2.35) Sketch map of the cutting on the former Midland and South Western Junction Railway. The line is now dismantled. The section south-west of Westlecot Road bridge constitutes the Kimmeridgian GCR site. (Geology based on Arkell, 1948, fig. 1 and British Geological Survey Sheet SU 18 SE.)

(Figure 2.36) The type specimen of *Pectinatites (P.) eastlecottensis* (Salfeld) as figured by Salfeld (1913) but enlarged to natural size.

(Figure 2.37) Locality map for the Shellingford Crossroads GCR site. Outcrop of the Stanford Formation (mapped as 'Corallian limestone glib') from BGS Sheet 253 (Abingdon) (1971).

(Figure 2.38) Log of the Corallian succession at Shellingford Crossroads Quarry (after Goidring *et al.,* 1998b, fig. 3).

(Figure 2.39) Locality map for the Lamb and Flag Inn Quarry. Corallian outcrops from Arkell (1939a, plate 30).

(Figure 2.40) Weathering profile of the Lamb and Flag Inn Quarry as seen by J.K. Wright in 1983.

(Figure 2.41) Correlation of sections at Shellingford Crossroads Quarry, Lamb and Flag Quarry, and Dry Sandford Quarry (after Johnson, 1983, fig. 2).

Figure 2.42 Locality map for Dry Sandford Quarry. Outcrop of Stanford Formation from BGS Sheets 253 (Abingdon) (1971) and 236 (Witney) (1982).

(Figure 2.43) Log of the Corallian succession at Dry Sandford Quarry (after Johnson, 1983, fig. 1B).

(Figure 2.44) View of the main north–south face at Dry Sandford Quarry, showing the Lower Trigonia Bed (Bed 6) and Upper Trigonia Bed (Bed 8) separated by shelly sand (Bed 7) marked by the hammer (shaft length, 30 cm). (Photo: J.K. Wright.)

(Figure 2.45) Locality map for the Cumnor GCR site. Outcrop of Wheatley Limestone and Coral Rag from BGS Sheet 236 (Witney) (1982).

(Figure 2.46) View of the Cumnor site in 1998, showing the 1.2 m high face in flaggy-weathering Wheatley Limestone. (Photo: J.K. Wright.)

(Figure 2.47) Locality map for Cross Roads Quarry and Magdalen Quarry. Outcrop of the Corallian limestones from BGS Sheet 237 (Thame) (1994).

(Figure 2.48) View of the central face at Cross Roads (Rock Edge) Quarry, showing the regular bedding in coralliferous calcarenite of the Wheatley Limestone. The coral clasts rarely exceed 10 mm in diameter. Hammer shaft is 30 cm long.

(Photo: J.K. Wright.)

(Figure 2.49) Correlation of sections in Magdalen Quarry, Cross Roads Quarry and Windmill Quarry (after Arkell, 1927, fig. 11), showing the transition from Coral Rag reef facies on the right into Wheatley Limestone facies on the left.

(Figure 2.50) View of the main east–west face at Magdalen Quarry showing the irregularly bedded Wheatley Limestone. The 'First Headington Hard' (Bed 5, 0.35 m) is just below the level of the mapcase (36 cm long). (Photo: J.K. Wright.)

(Figure 2.51) The type specimen of *Pectinatites (Virgatosphinctoides) wheatleyensis* (Neaverson) as figured by Neaverson (1925, p1.1, fig. 1). Natural size.

(Figure 2.52) Graphic sections showing the Kimmeridgian stratigraphy at the Littleworth Brick Pit and other sections in Oxfordshire and Buckinghamshire, after Horton *et al.* (1995, fig. 17). AmC, Ampthill Clay; CB, Crussoliceras Band; ES, Elmhurst Silt; HBS, Holman's Bridge Shale; HwS, Hartwell Silt; KC, Kimmeridge Clay; LGS, Lower Greensand; LLB, Lower Lydite Bed; Pl, Portland Formation; PS, Pectinatus Sand; SwC, Swindon Clay; TS, Thame Sand; ULB, Upper Lydite Bed; WC, Watermead Clay; WNB, Wheatley Nodule Bed; WS, Wheatley Sand; VL, Virgula Limestone.

(Figure 3.1) Geological sketch map showing the location of the GCR sites described in Chapter 3. Extensive drift deposits are omitted for clarity 1, Upware South Pit; 2, Upware; 3, Warboys Clay Pit; 4, Roslyn Hole, Ely; 5, South Ferriby.

(Figure 3.2) Lithostratigraphical classification of Oxfordian–Kimmeridgian strata in the East Midlands.

(Figure 3.3) Locality map of quarries in the Upware inlier. Outcrop of the Upware Limestone (mapped as 'West Walton Beds'), Ampthill and Kimmeridge clays from BGS Sheet 188 (Cambridge) (1981) and Wright *et al.* (2000).

(Figure 3.4) Log of the 'Corallian' succession in Dimmock's Cote Quarry (after Wright *et al.,* 2000, fig. 4).

(Figure 3.5) View of the central part of the eastern face of Dimmock's Cote Quarry. Blocks of the tough Crinoid Bed are in the foreground, with the manly limestones of Bed 7 and Bed 9 being excavated in the distance. (Photo: J.K. Wright.)

(Figure 3.6) Log of the Oxford Clay succession in Warboys Pit (after Callomon, 1968).

(Figure 3.7) View of the upper part of Warboys Pit showing Cordatum Zone Oxford Clay overlain by West Walton Formation, beds 9–12, with the Warboys Rock', the distinctive pale band, close to the top of the section. (Photo: J.K. Wright.)

(Figure 3.8) View of a degraded section of Lower Kimmeridge Clay at Roslyn Hole showing the prominent marker band (arrowed) formed by a line of cementstone nodules in Bed 23 (KC30). Ely Cathedral is seen in the background. (Photo: A13722, reproduced by kind permission of the Director, British Geological Survey © NERC.)

(Figure 3.9) Graphic section of the Kimmeridge Clay at Roslyn Hole and borehole sections in Norfolk showing the southwards attenuation towards Ely (after Gallois,1988, fig. 14).

(Figure 3.10) General view of the South Ferriby GCR site in 1987. (Photo: A14379, reproduced by kind permission of the Director, British Geological Survey ©NERC.)

(Figure 3.11) Correlation between the Oxfordian–Kimmeridgian boundary beds at South Ferriby and those in Dorset and Skye (after Page and Cox, 1995, fig. 2). A. = *Amoeboceras, P. = Pictonia, Ra. = Rasenia, Ri. = Ringsteadia.*

(Figure 4.1) Map showing the solid geology of the Oxfordian and Kimmeridgian beds in the Cleveland Basin, with the principal stuctural and geographical features. (Based on Versey, 1929, fig. 1; BGS 1:250 000 Solid Sheet 54N 02W (Tyne-Tees) (1981); BGS 1:1 500 000 Tectonic map of Britain, Ireland and adjacent areas (1996) and BGS 1:50 000 Sheet 54 (Scarborough) (1998)). In the Vale of Pickering there is a thick cover of Quaternary lacustrine deposits.

(Figure 4.2) Zones of the Oxfordian and Kimmeridgian stages, showing the stratigraphical ages of each of the formations present in the Cleveland Basin, and the age range of the exposure at each GCR site.

(Figure 4.3) Stratigraphical cross-section of the Yorkshire Corallian Group on the north side of the Vale of Pickering from Helmsley to Filey (after Rawson and Wright, 1995, fig. 15).

(Figure 4.4) Stratigraphical cross-section of the Yorkshire Corallian Group on the south-west side of the Vale of Pickering from the I Iambleton Hills to Malton.

(Figure 4.5) P Selection of ammonites from the Corallian Group of the Cleveland Basin. (A) *Amoeboceras nunningtonense* Wright (holotype), Spaunton Sandstone, Leysthorpe Quarry, m27, x 1. (B) A. *glosense* (Bigot and Brasil), Newbridge Member, Leysthorpe Quarry, U/1/14, x 1. (C) *A. transitorium* Spath, Newbridge Member, Leysthorpe Quarry, U/1/5, x 1. (D) A. *ilovaiskii* (M. Sokolov), Spaunton Sandstone, Newbridge Quarry, U/2/38, x1. (E) *A. newbridgense* Sykes and Callomon, Spaunton Sandstone, Newbridge Quarry, U/2/20, x 1. (F) *Perisphinctes (Pseudarisphinctes) pachachii* Arkell, Spaunton Sandstone, Spaunton Moor Quarry, U/3/63, x0.33. (G) *P. (Dichotomosphinctes)* sp. Newbridge Beds, Leysthorpe Quarry, U/1/103, x0.7. (H) *Cardioceras* (*Cardioceras*) *persecans* S. Buckman, Birdsall Calcareous Grit, Filey Brigg, YM1983/45F, x 1. (I) C. (C.) *cordatum* (J. Sowerby), Birdsall Calcareous Grit, Flassen Gill, YM1983/36F, x 1. (1) *C.* (*Vertebriceras*) aff. *dorsale* S. Buckman, Hambleton Oolite, Spikers Hill Quarry, C/2/17, x 1. (K) *C.* (*Plasmatoceras*) *popilaniense* Boden, Hambleton Oolite, Spikers Hill Quarry, C/2/59, x 1. (L) *C.* (*Scarburgiceras*) *harmonicum* Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/17F, x 1. (M) *C.* (*S.*) *reesidei* Maire, Tenants' Cliff Member, Tenants' Cliff, YM1983/20F, x 1. (N) *C.* (*Vertebriceras*) aff. *phillipsi* Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/23F, x 1. (O) *C.* (*S.*) *praecordatum* (Douvillé), Weymouth Member, Cayton Bay Waterworks, YM1983/9F, x 1. (P) *C.* (*S.*) *scarburgense* (Young and Bird), Weymouth Member, Cornelian Bay, YM1983/3F, x 1. (Photos: (A-E), (H, I), (L–P), J.K Wright; (F, G), K. D'Souza; (J, K) K. Denyer. Collections: Prefixes 'U', 'C', J.K. Wright Collection; 'YM', Yorkshire Museum Collection, York; 'm', Woodend Museum, Scarborough.)

(Figure 4.6) Map showing the locations of Oxfordian and Kimmeridgian GCR sites in north-east Yorkshire, and other localities mentioned in the text.

(Figure 4.7) The type specimen of *Subdichotomoceras lamplughi* Spath, type species of the genus, from the Eudoxus Zone at Speeton, as figured by Pavlow and Lamplugh (1892, p. 111). Approximately natural size.

(Figure 4.8) Sketch map of the geology of Filey Brigg (after Rawson and Wright, 2000, fig. 33).

(Figure 4.9) Log of the Corallian succession at Filey Brigg (after Rawson and Wright, 2000, fig. 34).

(Figure 4.10) View of the southern side of Filey Brigg showing fossiliferous Hambleton Oolite (Upper Leaf) overlying Birdsall Calcareous Grit in the rock platform. The junction is where the figure is pointing with the hammer. (Photo: J.K. Wright.)

(Figure 4.11) Locality map of the Tenants' Cliff and Cornelian Bay GCR sites. Outcrop of the Oxford Clay and Lower Calcareous Grit from Wright (1968, fig. 9).

(Figure 4.12) Log of the Lower Calcareous Grit succession at Tenants' Cliff; as measured by J.K. Wright in 1982.

(Figure 4.13) Exceptionally well-preserved ammonites from the Tenants' Cliff Member. (A) *Mirosphinctes frickensis* (Moesch) (Tethyan), LG744; (B) *Neocampylites delmontanus* (Oppel) (Tethyan), LG742; (C) *Cardioceras (Scarburgiceras) bukowskii* Maire (Boreal), LG736. (Photos: K. D'Souza. Specimens in the J.K. Wright Collection. Natural size.)

(Figure 4.14) General view of the southern end of Cornelian Bay showing the Middle Jurassic Ravenscar Group (on the left) faulted against easterly dipping Osgodby Formation sandstones (Callovian) overlain by Weymouth Member Oxford Clay. (Photo: J.K. Wright.)

(Figure 4.15) Log of the Upper Callovian–Lower Oxfordian sequence at Cornelian Bay (after Wright, 1969, fig. C4).

(Figure 4.16) Locality map for Hackness Head showing the outcrop of the Coral–Sponge Bed (Subdivision 3). (After Wilson, 1949, fig. 43.)

(Figure 4.17) Cross-section of Hackness Head showing the two quarry sections, as measured by J.K. Wright in 1991.

(Figure 4.18) View of the eastern quarry at Hackness Head, showing the massive, bioclastic limestones of Subdivision 2 overlain by coral rubble (Subdivision 3) just below the grass at the top. Hammer shaft (mid-left of picture) is 30 cm. (Photo: J.K. Wright.)

(Figure 4.19) Facies distribution across the central and eastern parts of the Cleveland Basin during deposition of the Hackness Coral–Sponge Bed (after Wright, 1992, fig. 10).

(Figure 4.20) Locality map of the Betton Farm and Spikers Hill GCR sites. Geological outcrops from BGS Sheet 54 (Scarborough) (1998).

(Figure 4.21) View of Betton Farm Quarry (north) showing rounded masses of Thamnasterian reef coral above the hammer (30 cm) resting on oolite (Mahon Oolite). (Photo: J.K. Wright.)

(Figure 4.22) The main east–west face in the Hambleton Oolite at Spikers Hill Quarry. The dark, pisoidal 'Blue Band' (Bed 2) is clearly seen towards the top of the quarry, overlain by beds 3 to 7, which are more thinly bedded than those below. Since this photo was taken, the quarry has been deepened to reveal part of the Passage Beds, Bed '0'. (Photo: J.K. Wright.)

(Figure 4.23) Log of the Corallian succession at Spikers Hill Quarry, as measured by J.K. Wright in 1991.

(Figure 4.24) Locality map of Newbridge Quarry. Outcrop of the Upper Calcareous Grit from BGS Sheet 53 (Pickering) (1973).

(Figure 4.25) Log of the Upper Calcareous Grit at Newbridge Quarry, as measured by J.K. Wright in 1998.

(Figure 4.26) Simplified geological drift sketch map of the Vale of Pickering showing localities cited in the text (based on Geological Survey 1:50 000 sheets 53 and 54). The Green Lane Pit and Golden Hill Pit GCR sites are located at Marton. *Other drift deposits are omitted for clarity.

(Figure 4.27) Composite graphic log of the section at which weathers to form a prominent overhang. Golden Hill Pit (after Wignall, 1993, fig. 3).

(Figure 4.28) Locality map of Shaw's Gate Quarry. Outcrop of the Hambleton Oolite from BGS Sheet 52 (Thirsk) (1992).

(Figure 4.29) Log showing the slump structures at Shaw's Gate Quarry (after Powell *et al*.,1992).

(Figure 4.30) View of Shaw's Gate Quarry showing a slump fold in oobiosparite (Bed 5). The flanks of the fold are filled with laminated sandy limestone (Bed 6). A load ball in Bed 3 is visible on the lower right. Height of face 1.5 m. (Photo: J.K. Wright.)

(Figure 4.31) Local ty map of Snape Hill Quarry. Geological information from BGS Sheet 52 (Thirsk) (1992).

(Figure 4.32) North Grimston Cementstone (Bed 1) at Snape Hill Quarry. Alternations of limestone and calcareous mudstone are overlain by massive, flaggy weathering limestone. Mapcase 35 cm. (Photo: J.K. Wright.)

(Figure 4.33) Sketch of the main north–south face at Snape Hill Quarry showing the two separate successions, as seen by J.K. Wright in 1997.

(Figure 4.34) Map showing the locations of the principal exposures WSW of Nunnington. Geological information from BGS Sheet 53 (Pickering) (1973).

(Figure 4.35) Log of the CoraRine Oolite Formation in Leysthorpe Quarry, as measured by Mr D. Sharp and J.K. Wright, 1991–1992.

(Figure 4.36) View of the northern face at Leysthorpe Quarry, showing the thick Malton Oolite sequence, with, at the top, a thin development of Coral Rag overlain by thin-bedded, flaggy Upper Calcareous Grit. (Photo: J.K. Wright.)

(Figure 4.37) Locality map of the Wath Quarries. Outcrop of the Coralline Oolite from BGS Sheet 53 (Pickering) (1973).

(Figure 4.38) Weathering profile of the upper Malton Oolite and Coral Rag at Wath Old Quarry, as measured by J.K. Wright in 1997.

(Figure 4.39) Wath Old Quarry, showing the irregular, erosive junction of Coral Rag resting on Malton Oolite. The lower rubbly coral–shell bed of the Coral Rag and the upper coralliferous micritic limestone are easily distinguished. Hammer shaft is 32 cm long. (Photo: J.K. Wright.)

(Figure 4.40) View of the eastern face of Wath New Quarry showing, near the base, Mahon Oolite dipping gently north (to the left), overlain by giant cross-sets of Malton Oolite dipping south, and at the top of the quarry, Coral Rag dipping gently north. (Photo: J.K. Wright.)

(Figure 5.1) Map of northern Scotland, showing the principal Jurassic sedimentary basins and their structural controls, and the locations of Oxfordian and Kimmeridgian GCR sites. Based on BGS 1:1 500 000 Tectonic Map of Britain, Ireland and Adjacent Areas (1996) and BGS 1:1 000 000 Geological Map of the United Kingdom, Ireland and the Adjacent Continental Shelf (1991).

(Figure 5.2) Schematic cross-section to show the relations of the near-shore and distal members in the Hebrides and Inner Moray Firth Basins. Beds such as the Brora Sandstone and the Ardassie Limestone originally extended eastwards over the Scottish landmass but have been removed by Kimmeridgian erosion. The Helmsdale Boulder Beds continue up into the Portlandian Stage.

(Figure 5.3) Locality map of the Balintore GCR site. Geological information from BGS Sheet 94 (Cromarty) (1973).

(Figure 5.4) Stratigraphical log of the Balintore section (after Sykes, 1975, fig. 4).

(Figure 5.5) Ammonites from the Balintore Formation of eastern Scotland. (A) *Cardioceras (Subvertebriceras) densiplicatum* Boden. Bed 4, Port-an-Righ Ironstone Member, Balintore, ES3, x1. (B) *C. (Plasmatoceras) tenuicostatum* Nikitin. Ardassie Limestone, Brora, ES2, x 1. (Photos: K. D'Souza. Specimens in the J.K. Wright Collection.)

(Figure 5.6) Locality map of the Brora GCR site. Geological information from BGS Sheet 103E (Helmsdale) (1998).

(Figure 5.7) Stratigraphical log of the Brora section (after Sykes, 1975, *fig.* 3).

(Figure 5.8) Diagram showing possible post-Jurassic movement on the Great Glen Fault (after Sykes, 1975, fig. 2).

(Figure 5.9) Sketch map of the mainly Kimmeridgian outcrop between (a) Kintradwell and Lothbeg Point, and (b) Lothbeg Point and Dun Glas (after Wignall and Pickering, 1993, figs 10 and 17).

(Figure 5.10) Schematic sections showing the main stratal units of the Helmsdale GCR site (based on Macdonald and Trewin, 1993, fig. 2 and Wignall and Pickering, 1993, fig. 15).

(Figure 5.11) Kintradwell Boulder Beds at Kintradwell showing compaction features around the large boulders. (Photo: C1980, reproduced by kind permission of the Director, British Geological Survey ©NERC.)

(Figure 5.12) The 'fallen stack' in the Helmsdale Boulder Beds near Portgower. (Photo: C1975, reproduced by kind permission of the Director, British Geological Survey ©NERC.)

(Figure 5.13) Simplified reconstruction of depositional conditions adjacent to the Helmsdale Fault during the Kimmeridgian (after Wignall and Pickering, 1993, fig. 21).

(Figure 5.14) Locality map of the Staffin and Kildorais GCR sites (after Cox and Sumbler, in press).

(Figure 5.15) General log of the Staffin Shale succession (after Morton and Hudson, 1995, table 4).

(Figure 5.16) Map of the foreshore at Digg, with detailed logs (after Morton and Hudson, 1995, figs 39, 40).

(Figure 5.17) Map of the foreshore at Flodigarry, with detailed log (after Morton and Hudson, 1995, fig. 42).

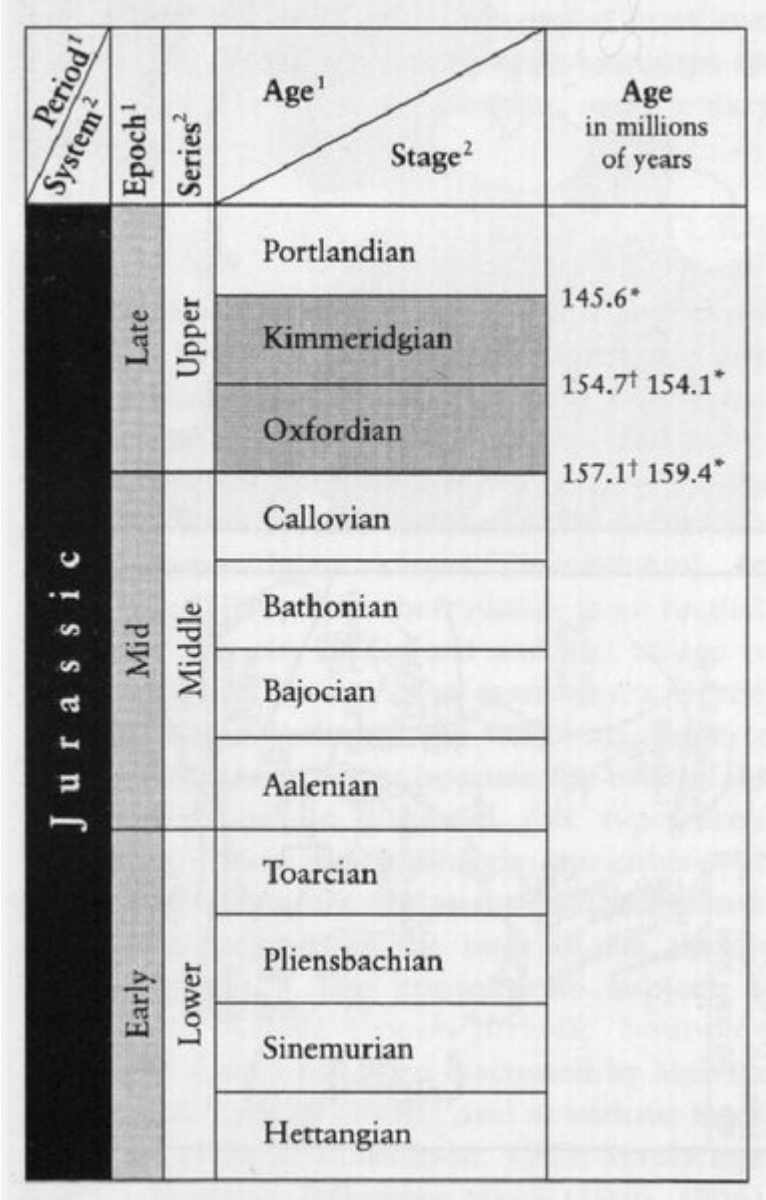
(Figure 5.18) View looking north along the beach at Flodigarry, showing the 0.3–0.4 m limestone of Bed 40 dipping steeply west, and curving round under the large boulder in the middle distance. The large boulder is the one in the middle of (Figure 5.17). (Photo: J.K. Wright.)

(Figure 5.19) Graphic section of the Kimmeridgian and uppermost Oxfordian parts of the Staffin Shale Formation, Flodigarry Shale Member, at Kildorais.

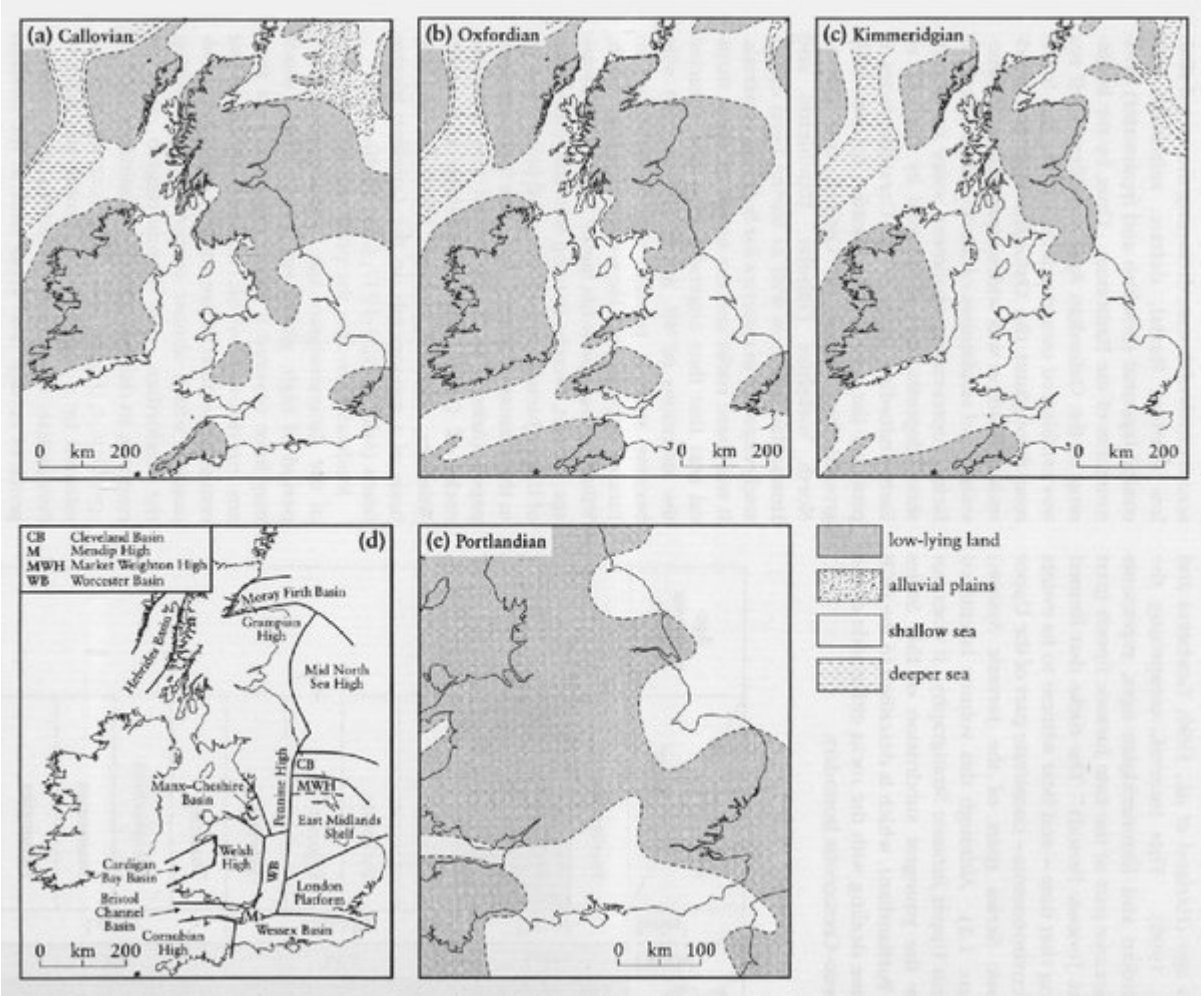
(Figure 5.20) Locality map of the North Elgol Coast GCR site. Outcrop of the Oxfordian beds from BGS Sheet 71W (Broadford) (1976).

(Figure 5.21) Stratigraphical log of the Elgol section (after Sykes, 1975, fig. 6).

References

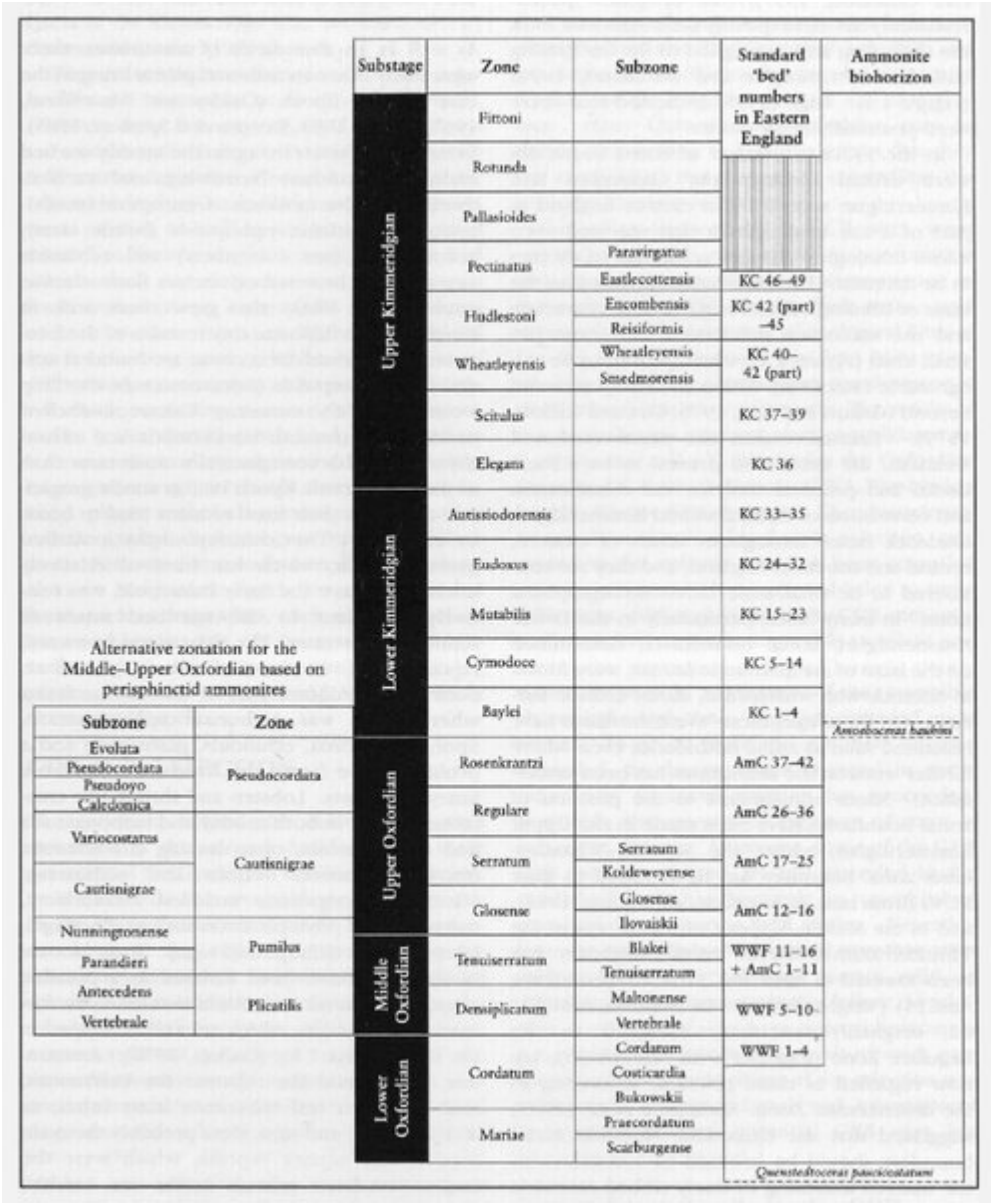


*(Figure 1.1) Major Jurassic subdivisions. [1] geological time terms [2] chronostratigraphical (time-rock) terms Harland et al. (1990) * Gradstein and Ogg (1996) (95% confidence level).*



(Figure 1.2) (a)–(c), (e) Palaeogeographical reconstructions for the British area during the late Mid and Late Jurassic (based on Cope and Rawson in Bradshaw et al., 1992; Cope, 1995b). In many cases, the extent of land areas is uncertain. (d) Main structural elements affecting sedimentation in the British area in the Mid-Late Jurassic (terminology as used in this volume). The 'London Platform' is a structural high, the limits of which remained generally constant. The emergent part of the Platform, the position and limits of which varied, is referred to as the 'London Landmass'. (Compiled from various sources.)

(Figure 1.3) Simplified sketch map showing occurrences of Oxfordian–Kimmeridgian rocks in Britain (onshore area only).

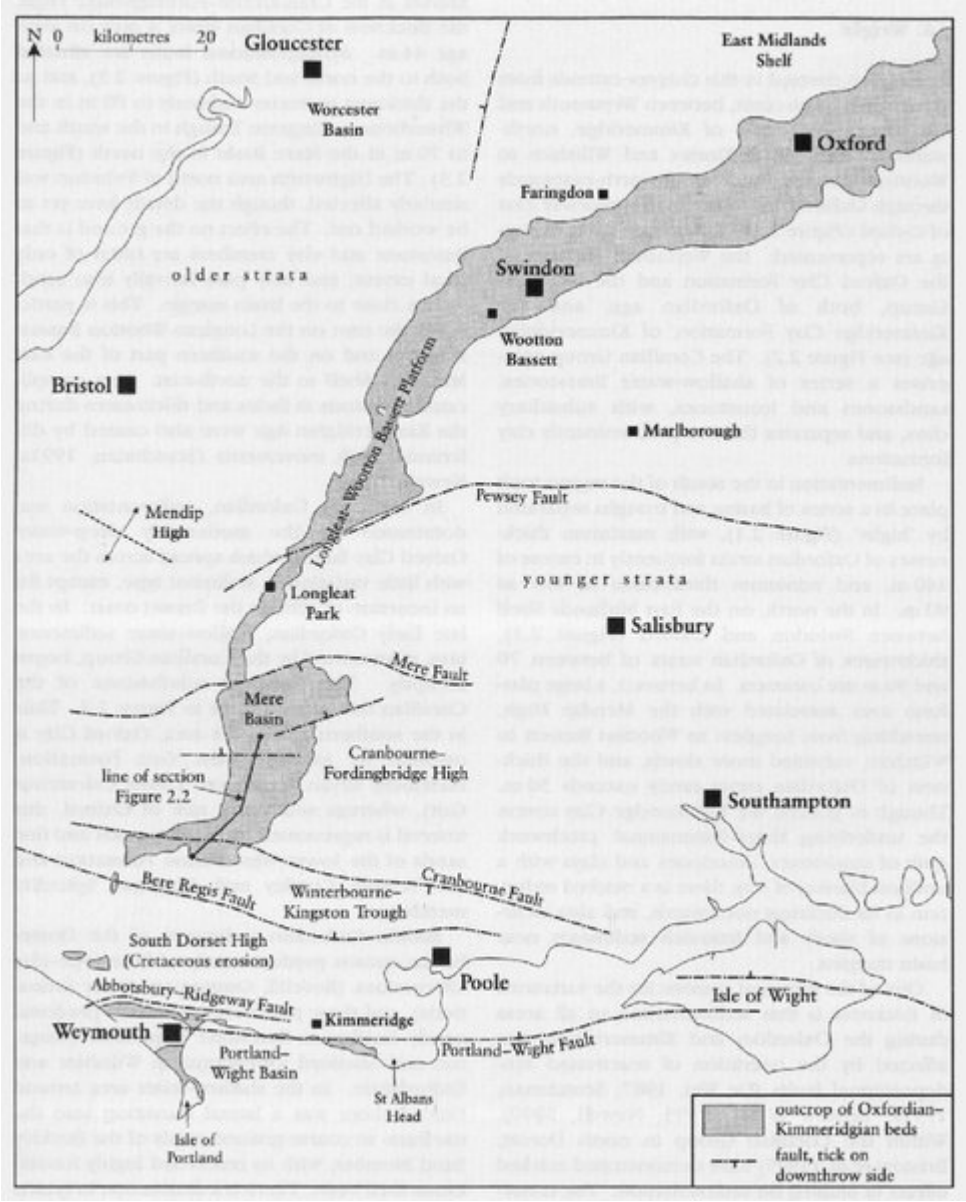


Substage	Zone	Subzone	Standard 'bed' numbers in Eastern England	Ammonite biohorizon
Upper Kimmeridgian	Fittoni			
	Rotunda			
	Pallasioides			
	Pectinatus	Paravirgatus		
		Eastlecottensis	KC 46–49	
	Hudlestoni	Encombensis	KC 42 (part) –45	
		Reisiformis		
	Wheatleyensis	Wheatleyensis	KC 40–42 (part)	
		Smedmorensis		
	Scitulus		KC 37–39	
	Elegans		KC 36	
Lower Kimmeridgian	Autissiodorensis		KC 33–35	
	Eudoxus		KC 24–32	
	Mutabilis		KC 15–23	
	Cymodoce		KC 5–14	
	Baylei		KC 1–4	*Amoeboceras haubrini*
Upper Oxfordian	Rosenkrantzi		AmC 37–42	
	Regulare		AmC 26–36	
	Serratum	Serratum	AmC 17–25	
		Koldeweyense		
	Glosense	Glosense	AmC 12–16	
		Ilovaiskii		
Middle Oxfordian	Tenuiserratum	Blakei	WWF 11–16 + AmC 1–11	
		Tenuiserratum		
	Densiplicatum	Maltonense	WWF 5–10	
		Vertebrale		
Lower Oxfordian	Cordatum	Cordatum	WWF 1–4	
		Costicardia		
		Bukowskii		
	Mariae	Praecordatum		
		Scarburgense		
				Quenstedtoceras paucicostatum

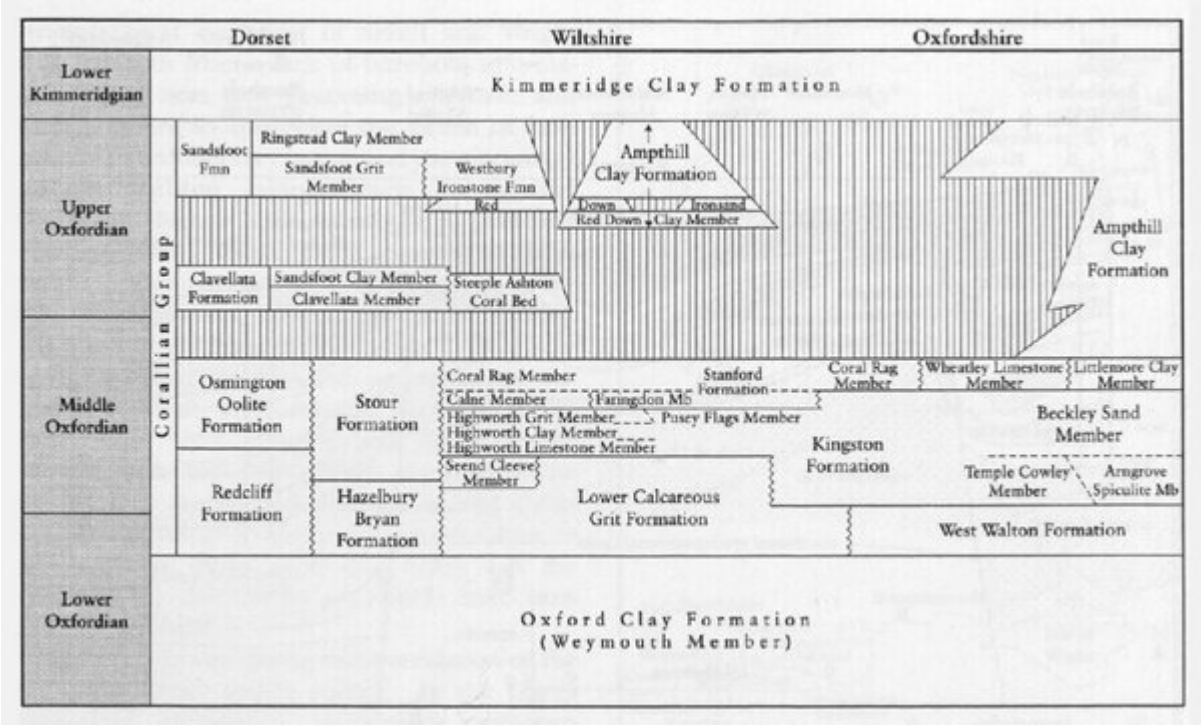
Alternative zonation for the Middle–Upper Oxfordian based on perisphinctid ammonites

Subzone	Zone
Evoluta	Pseudocordata
Pseudocordata	
Pseudoyo	
Calculomica	
Variocostatus	Cautisnigrae
Cautisnigrae	
Nunningtonense	Pumilus
Parandieri	
Antecedens	Plicatilis
Vertebrale	

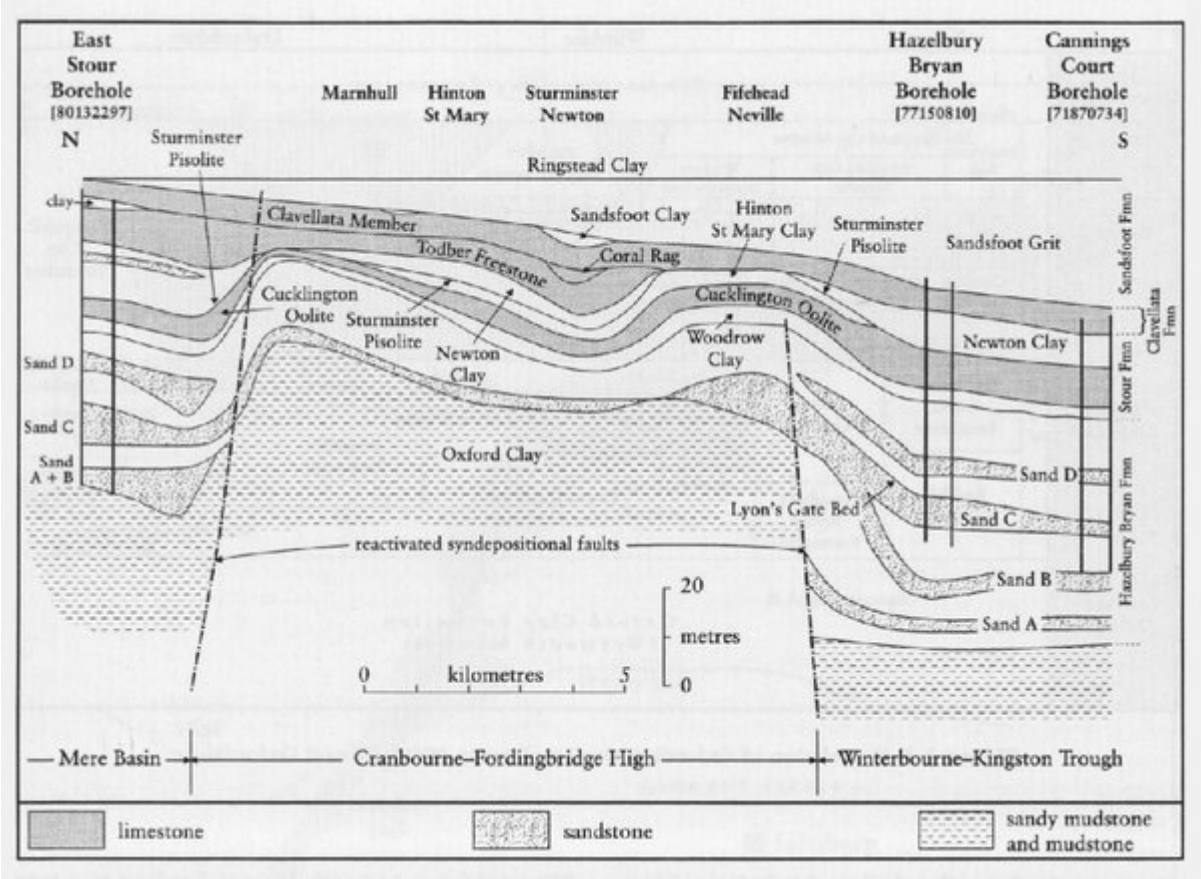
(Figure 1.4) Chronostratigraphical subdivisions and ammonite biohorizons recognized in the Oxfordian and Kimmeridgian stages in Britain (for sources, see text). AmC = Ampthill Clay Formation; KC = Kimmeridge Clay Formation; WWF = West Walton Formation. In Dorset, where the Kimmeridgian succession is more complete, additional 'beds' (KC50–63) up to the base of the overlying Portland Group (Portlandian) have been detailed by Gallois (2000). (See the Tyneham Gap–Hounstout GCR site report, this volume.)



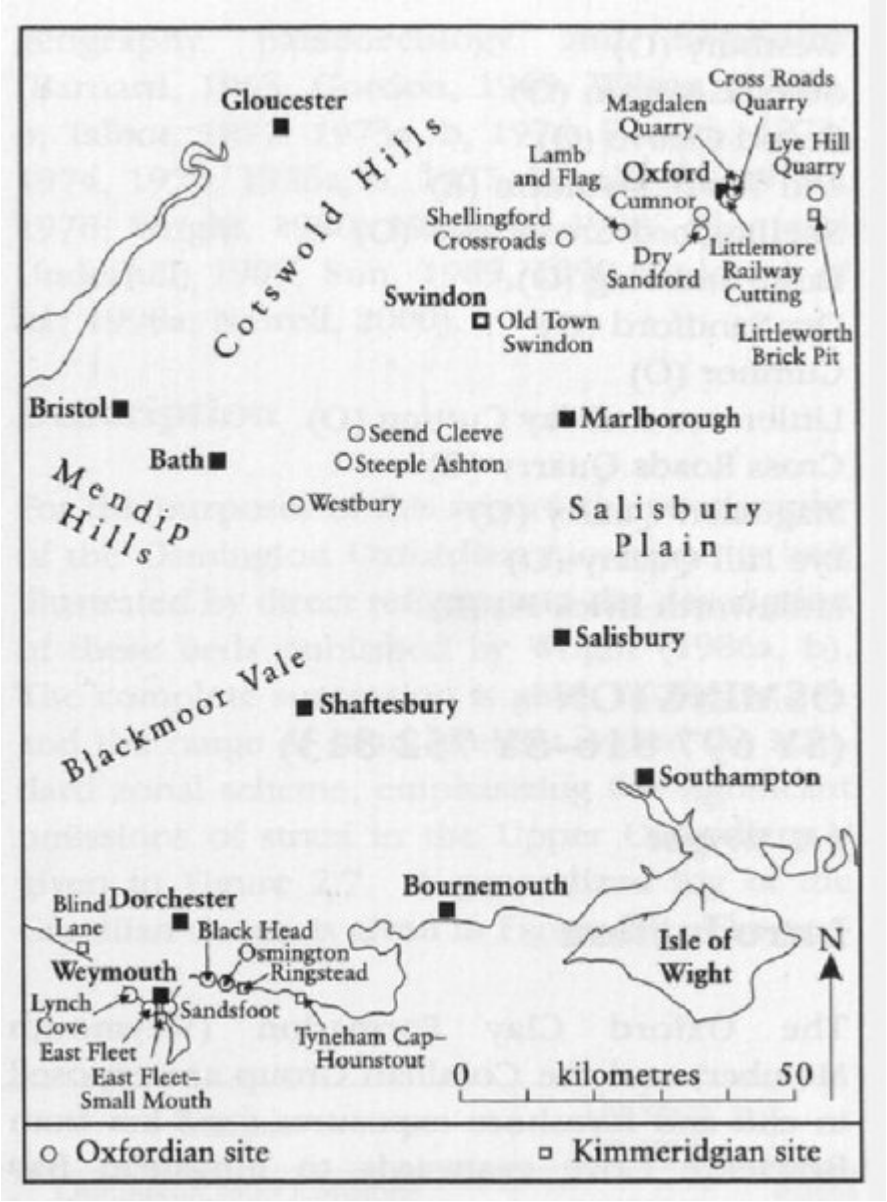
(Figure 2.1) Map of southern England showing the outcrop of the Oxfordian–Kimmeridgian beds, and the principal structural and palaeogeographical features (based on Scotchman, 1991a, fig. 1; Bristow et al., 1995, fig. 6 and Newell, 2000, fig. 6).



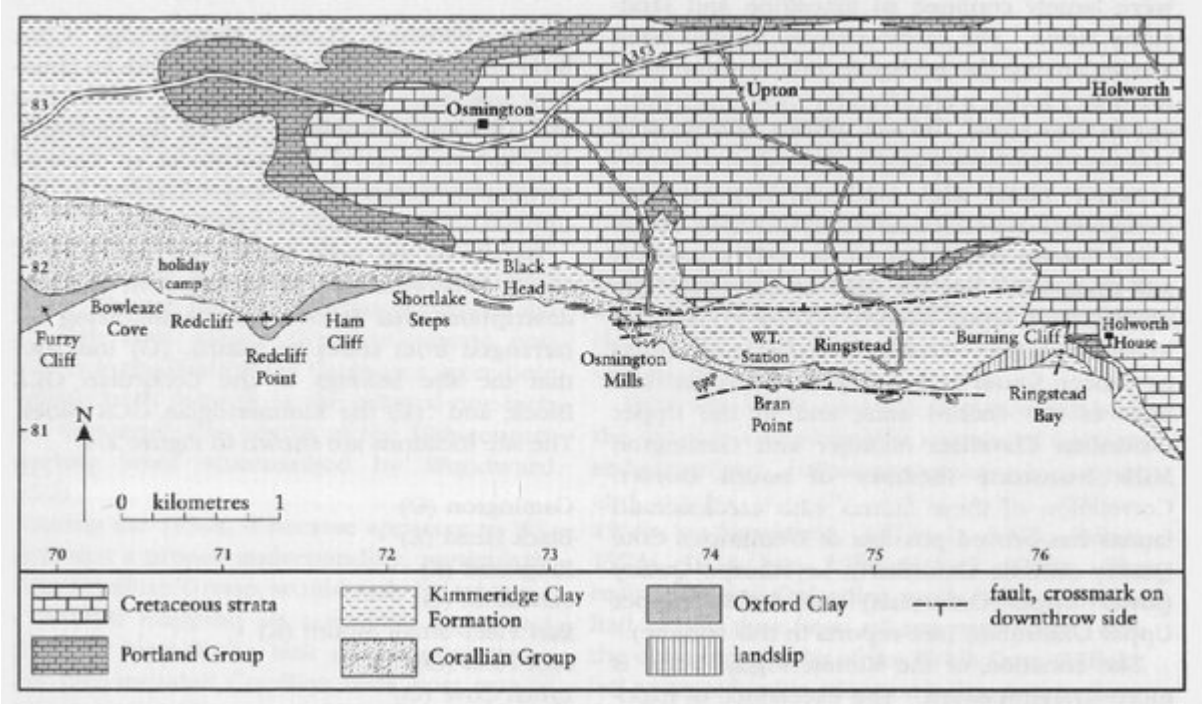
(Figure 2.2) Correlation of Oxfordian strata in Dorset, Wiltshire and Oxfordshire.



(Figure 2.3) Cross-section of north Dorset, showing the effect of syndepositional faulting on the thicknesses of the Corallian beds (after Bristow et al., 1995, fig. 38).



(Figure 2.4) Locations of Oxfordian and Kimmeridgian GCR sites in southern England.

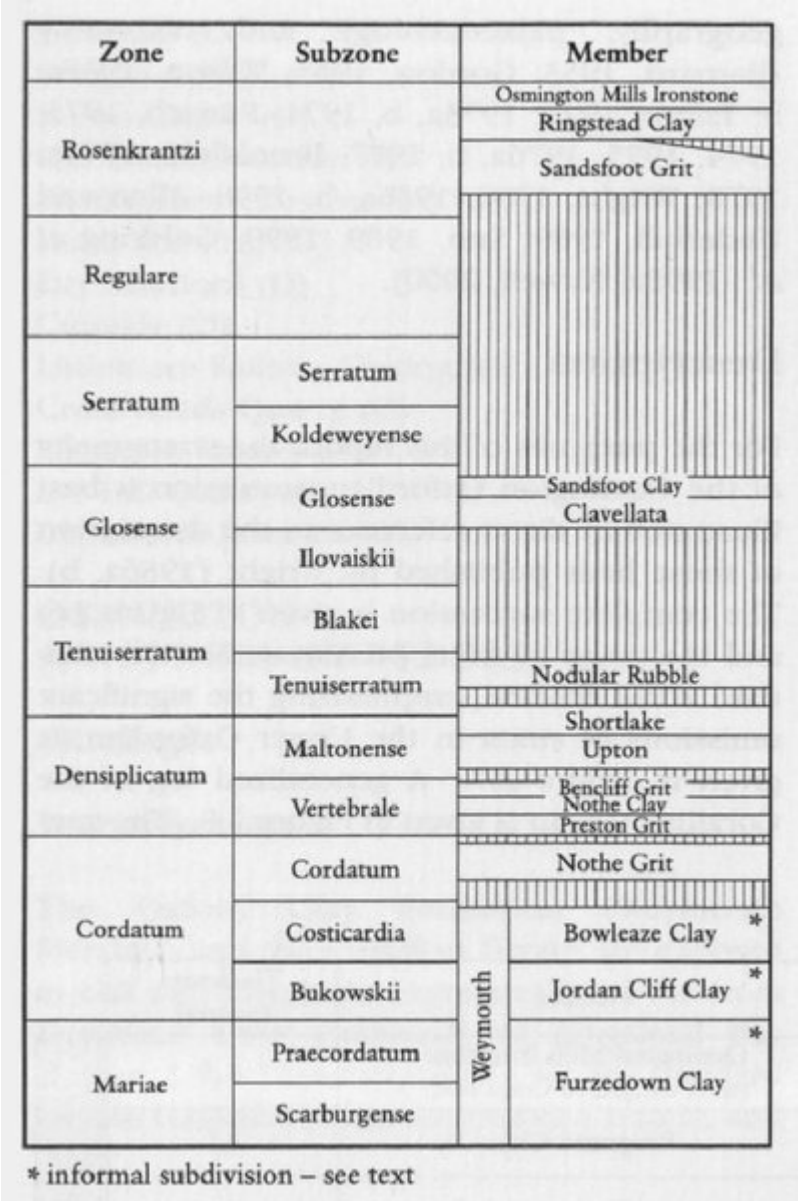


(Figure 2.5) Sketch map of the solid geology of the Furzy Cliff–Ringstead Bay area (based on Cox and Gallois, 1981, fig. 5 and BGS Sheet 341/342' (West Fleet and Weymouth) 1976).

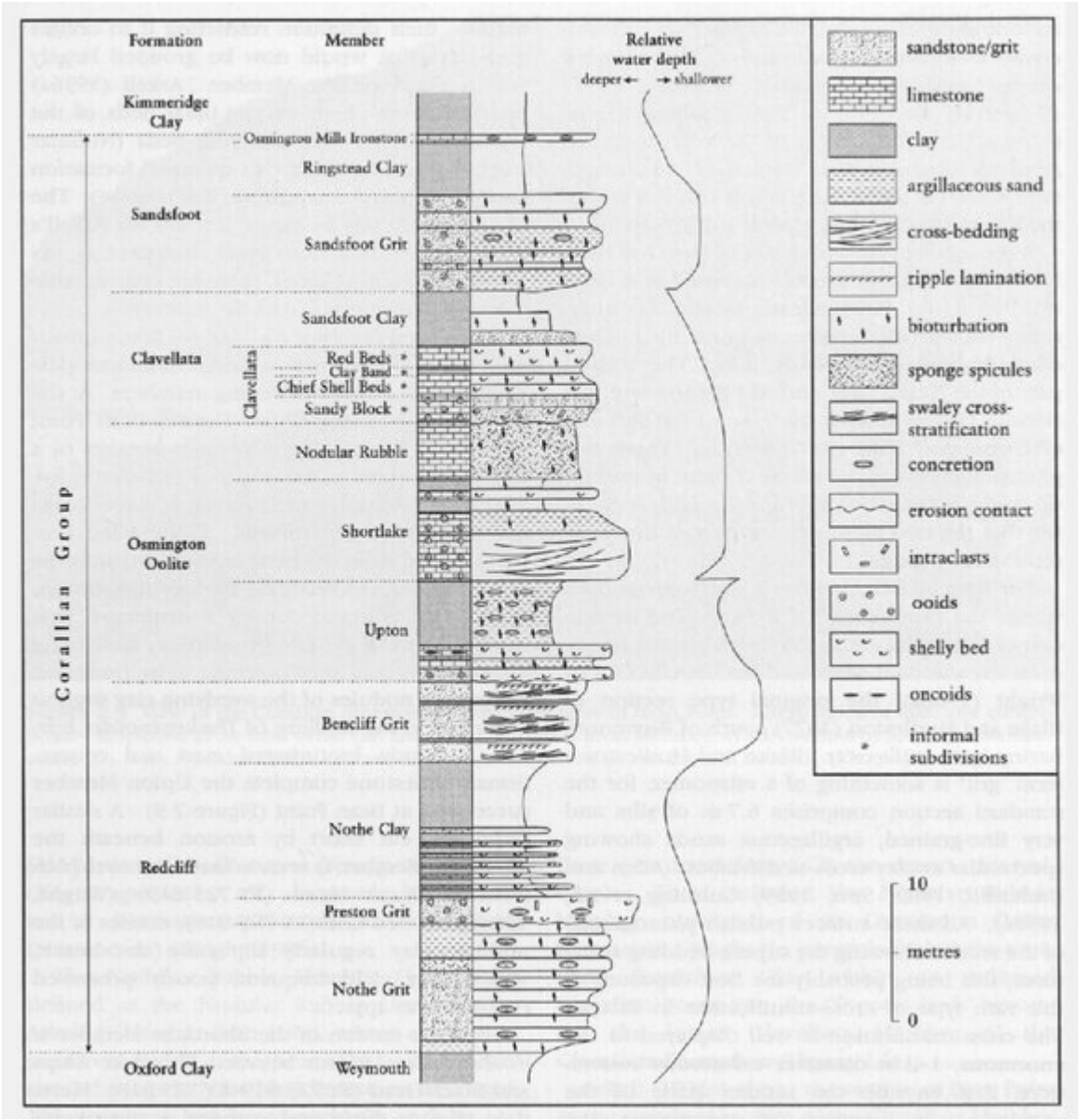
Substage	Formation	Member		Thickness (metres)	
Upper Oxfordian	Sandsfoot	Osmington Mills Ironstone (with Ringstead Coral Bed)		0.5	Corallian Group
		Ringstead Clay		3.5	
		Sandsfoot Grit		7.35	
	Clavellata	Sandsfoot Clay		3.9	
		Clavellata	Red Beds *	2.0	
			Clay Band *	0.6	
			Chief Shell Beds *	2.1	
			Sandy Block *	2.4	
Middle Oxfordian	Osmington Oolite	Nodular Rubble		3.2	
		Shortlake		5.1	
		Upton		8.3	
	Redcliff	Bencliff Grit		6.7	
		Nothe Clay		12.0	
		Preston Grit		1.5	
		Nothe Grit		9.0	
Lower Oxfordian	Oxford Clay	Weymouth Member	Bowleaze Clay * (containing Red Nodule Bed)	14.5	
			Jordan Cliff Clay *	9.0	
			Furzedown Clay *	18.0	

* informal subdivisions (see text)

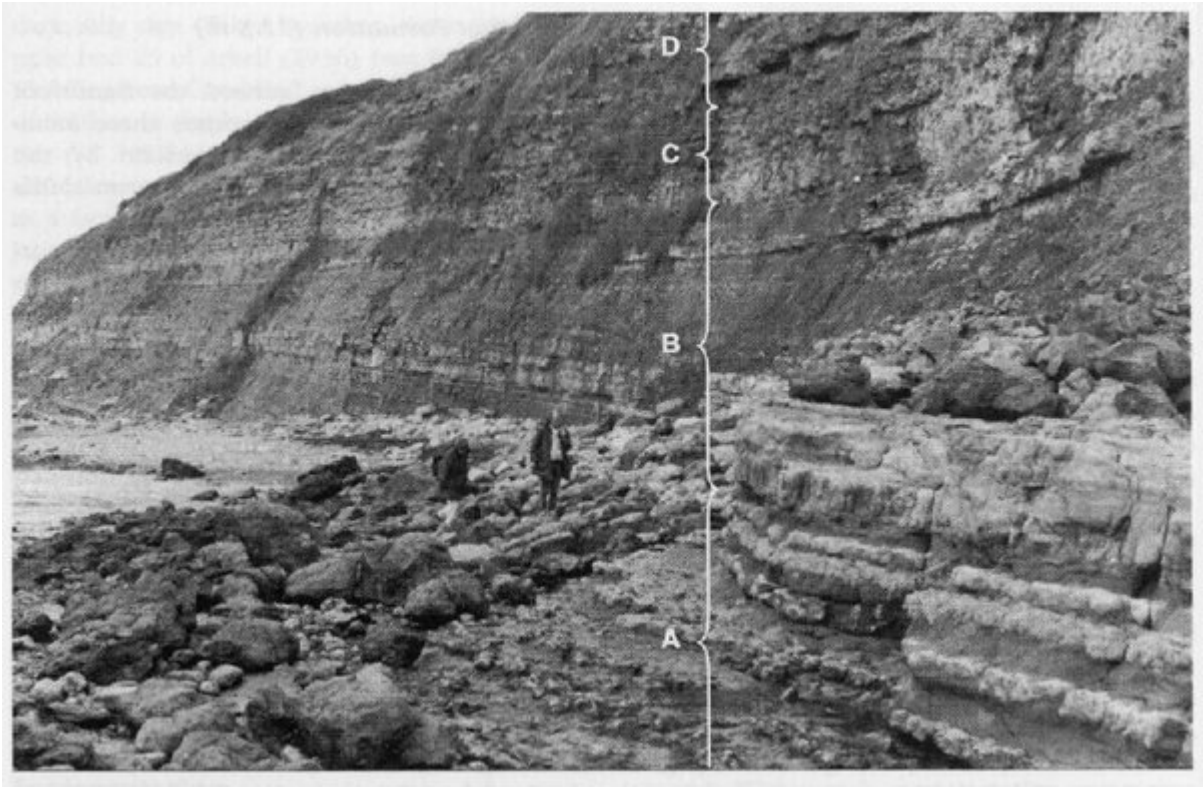
(Figure 2.6) The complete stratal succession at the Osmington GCR site.



(Figure 2.7) The ammonite zones and subzones of the Oxfordian Stage showing the zonal range of the strata present at the Osmington GCR site.



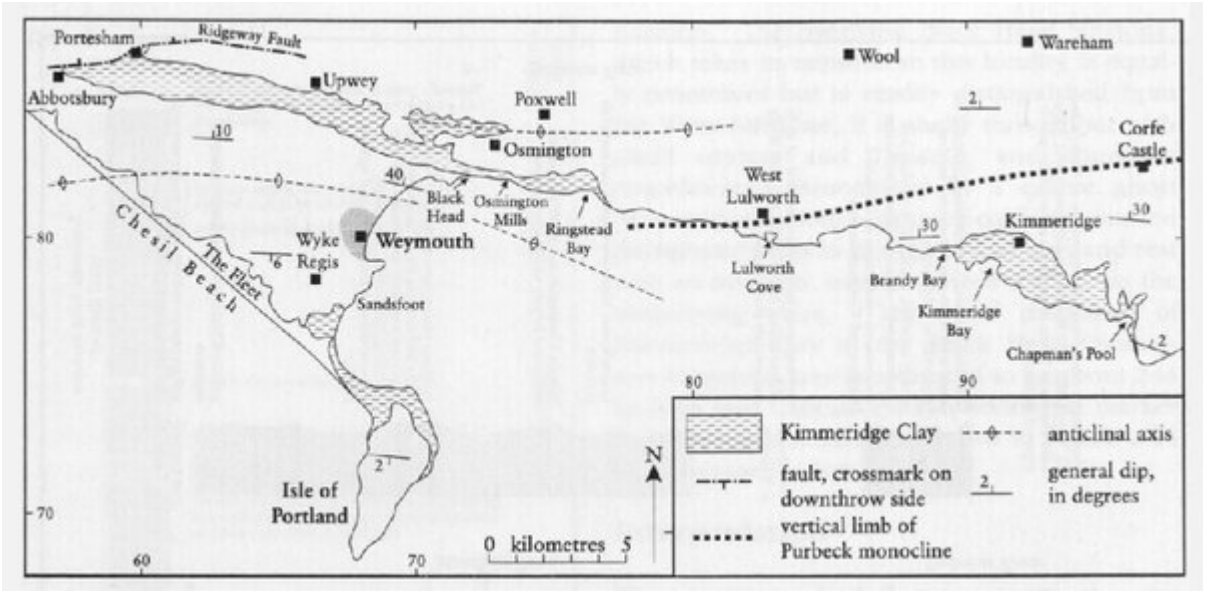
(Figure 2.8) Log of the Corallian Group at Osmington, (after Sun, 1989, figs 6, 7, 10 and 13).



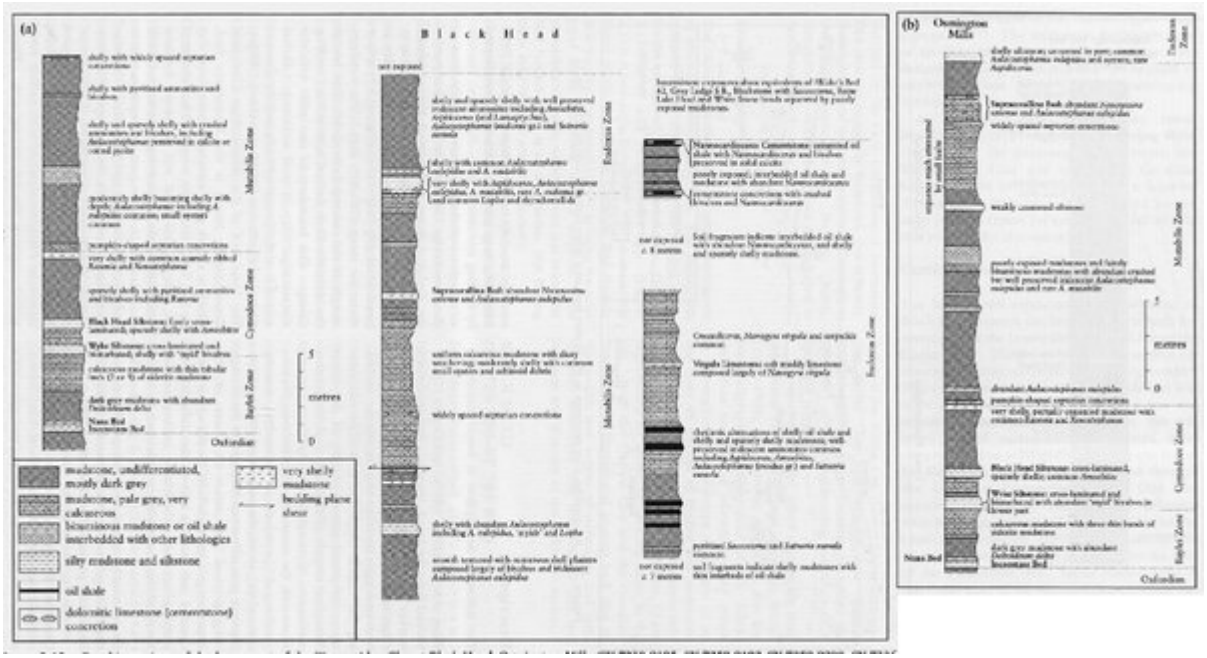
(Figure 2.9) View of the Corallian limestones in the cliffs west of Bran Point. Alternations of marl and concretionary limestone in the base of the cliff and rock platform (Upton Member, A) are overlain by Shortlake Member oolite (B), with Nodular Rubble (C) and Clavellata Formation (D) in the cliff behind. (Photo: J.K. Wright.)

(Figure 2.10) Sequence stratigraphical interpretation of the Corallian sequence at the Osmington GCR site (after Newell, 2000, fig. 2).

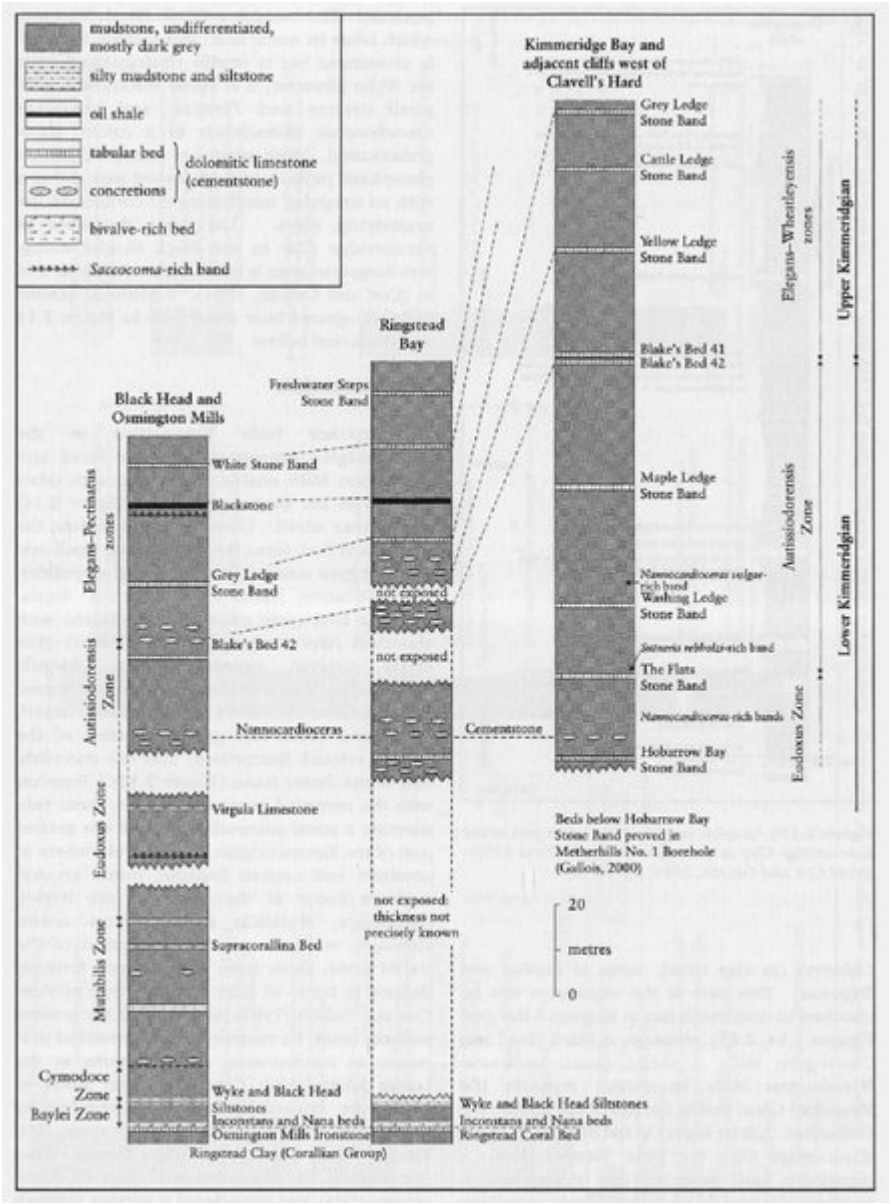
(Figure 2.11) Selection of Oxfordian ammonites from the Dorset coast Oxfordian exposures. (A) Ringsteadia evoluta Salfeld, Osmington Mills Ironstone, Black Head, J44969, x0.95. (B) Amoeboceras glosense (Bigot and Brasil), Clavellata Member, Black Head, D/C/25, x0.95. (C) Perisphinctes (Perisphinctes) uptonensis Arkell, Clavellata Member, Black Head, DC42, x0.80. (D) P. (Pseudarisphinctes) pachachii Arkell, Clavellata Member, Black Head, D/C/46, x0.48. (E) Amoeboceras ilovaiskii (M. Sokolov), Clavellata Member, Black Head, D/C/29, x1. (F) Cardioceras (Subvertebriceras) zenaidae Ilovaiski, Preston Grit, Redclig D/C/90, x 1. (G, H) Cardioceras (Vertebriceras) quadrarium S. Buckman. Red Nodule Bed, Furzy Cliff, D/O/35, x 1. (I) Cardioceras (Cardioceras) costicardia S. Buckman, Red Nodule Bed, Furzy Cliff, D/O/20, x 1. (J) Perisphinctes (Dichotomosphinctes) sp. Weymouth Member, Bowleaze Clay, Furzy Cliff, D/O/41, x0.58. (K) Cardioceras (Scarburgiceras) praecordatum Douvillé, East Fleet section, just north-west of the Lynch Cove GCR site, D/O/1, x 1. (Photos: (A, C, D) K. D'Souza; (F), K. Denyer; (B, E, G–K), J.K. Wright. Collections: Prefix 'D', J.K. Wright collection; prefix , Sedgwick Museum Collection, Cambridge.)



(Figure 2.12) Kimmeridge Clay outcrops in the Dorset type area (after Cox and Gallois, 1981, fig. 1).



(Figure 2.13) a. Graphic sections of the lower part of the Kimmeridge Clay at Black Head–Osmington Mills [SY 7239 8195], [SY 7259 8192]–[SY 7258 8200], [SY 7336 8186] and [SY 7342 8174]. (After Cox and Gallois, 1981, pp. 33–4.). b. Graphic section of the lower part of the Kimmeridge Clay at Osmington Mills [SY 7342 8174]. (After Cox and Gallois, 1981, pp. 33–4.)



(Figure 2.14) Correlation between the main sections of Kimmeridge Clay on the Dorset coast. Youngest zones not shown. (After Cox and Gallois, 1981, fig. 5.)

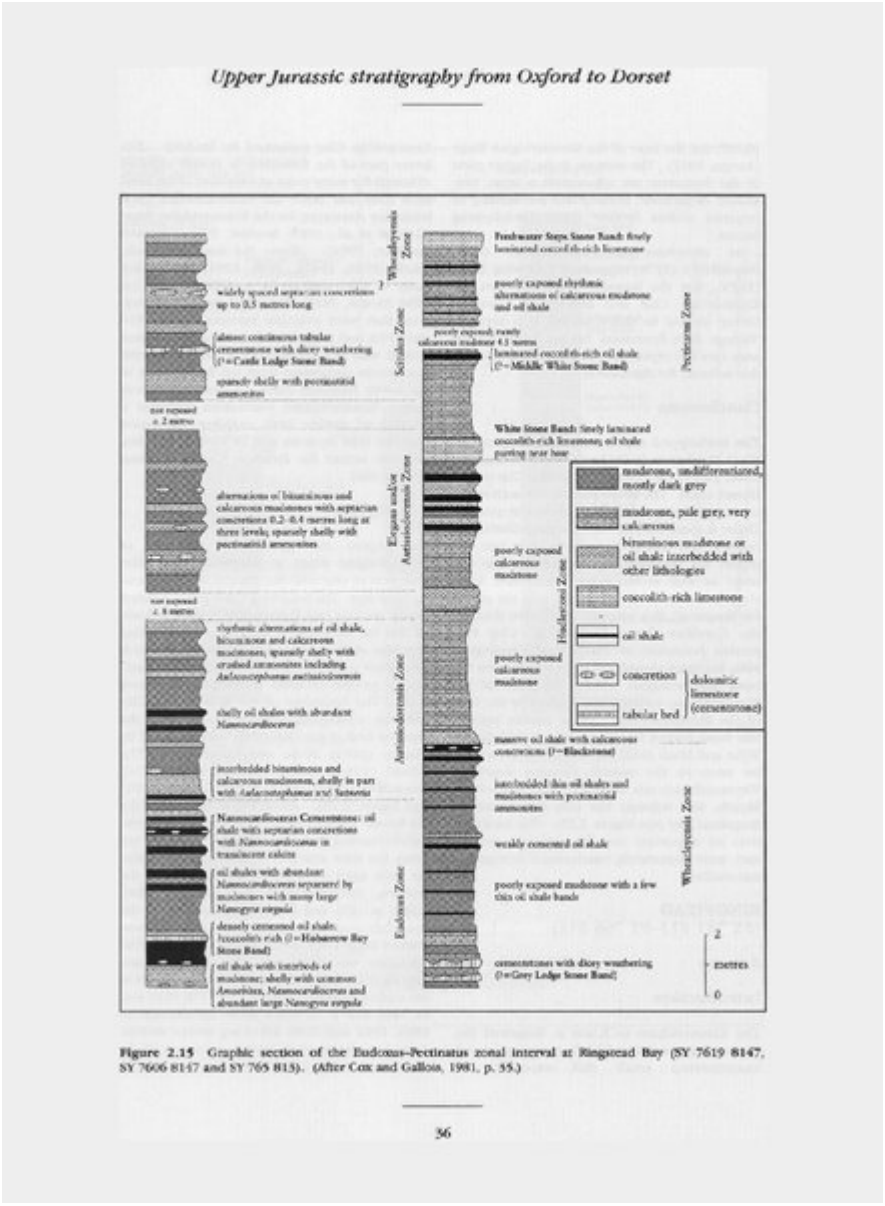


Figure 2.15 Graphic section of the Eudoxus–Pectinatus zonal interval at Ringstead Bay (SY 7619 8147, SY 7606 8147 and SY 765 813). (After Cox and Gallois, 1981, p. 35.)

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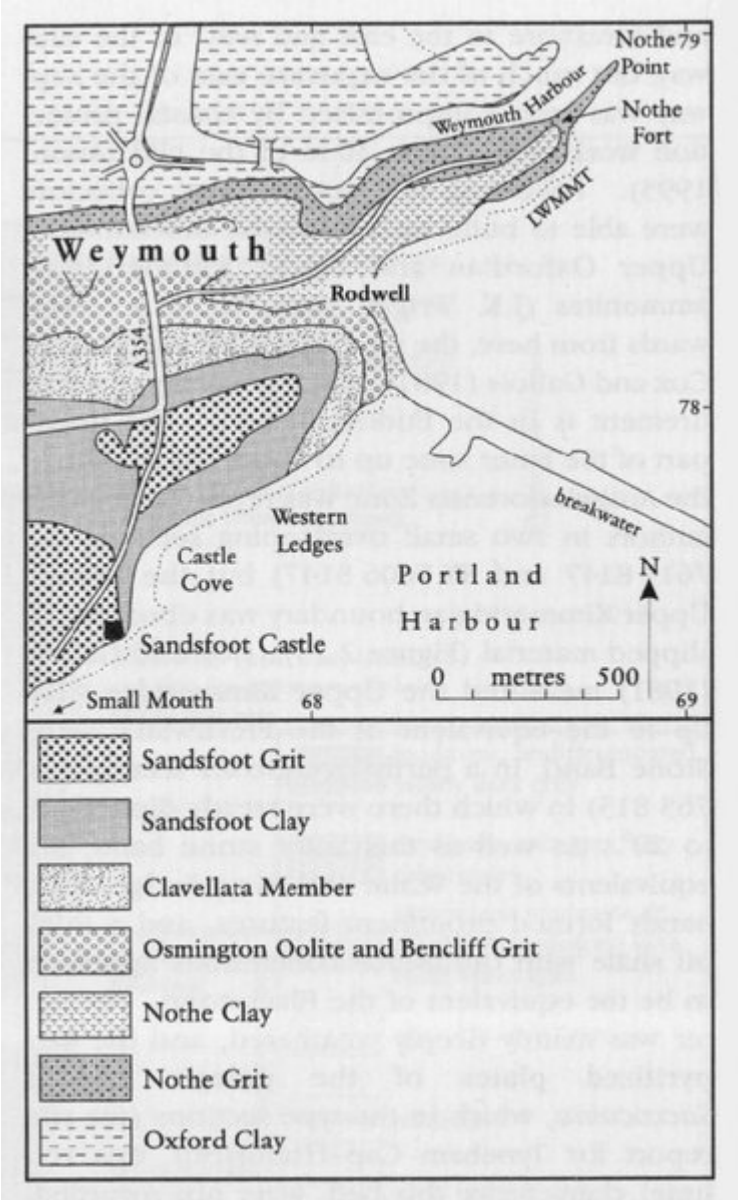
(Figure 2.15) Graphic section of the Eudoxus–Pectinatus zonal interval at Ringstead Bay [SY 7619 8147], [SY 7606 8147] and [SY 765 813]. (After Cox and Gallois, 1981, p. 35.)

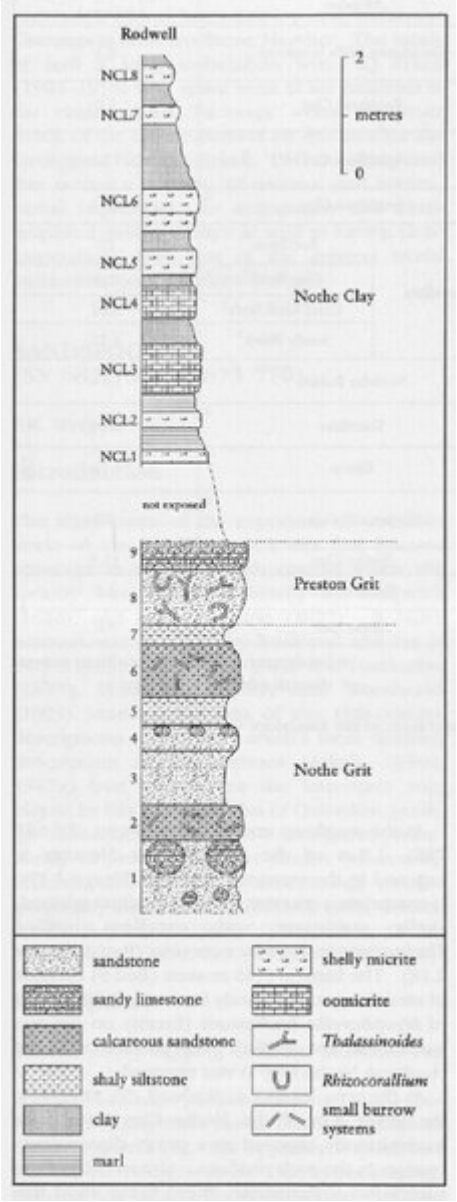


(Figure 2.16) Sketch map of the solid geology in the vicinity of the Sandsfoot GCR site.

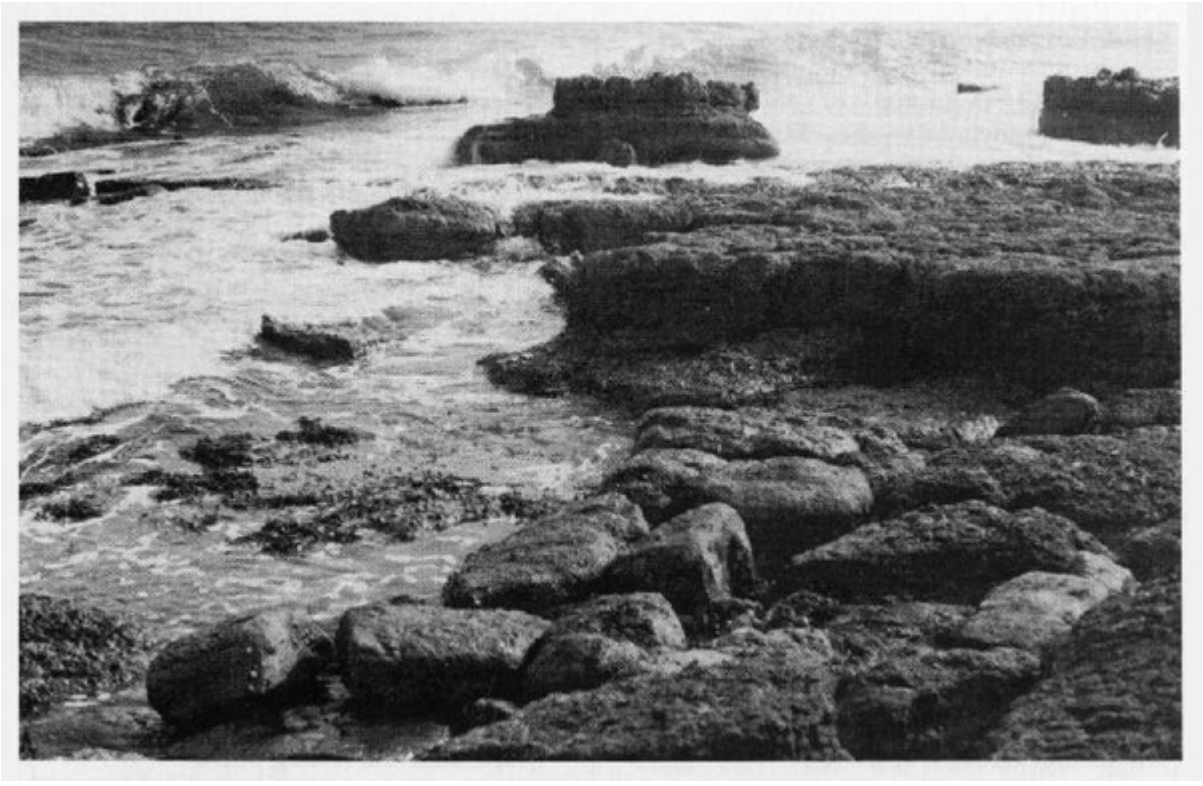
Substage	Formation	Member		Thickness (metres)
Upper Oxfordian	Sandsfoot	Osmington Mills Ironstone *		0.3
		Ringstead Clay *		5.0
		Sandsfoot Grit		11.3
	Clavellata	Sandsfoot Clay *		15.5
		Clavellata	Red Beds† *	1.5
			Clay Band† *	1.0
			Chief Shell Beds†	2.02
			Sandy Block†	1.57
Middle Oxfordian	Osmington Oolite	Nodular Rubble		1.8+
		Shortlake *		6.1+
		Upton *		4.5+
	Redcliff	Bencliff Grit *		4.0
		Nothe Clay		13.5
		Preston Grit		1.8
Lower Oxfordian		Nothe Grit		9.0

* largely not exposed or inaccessible at present
† informal subdivision – see text

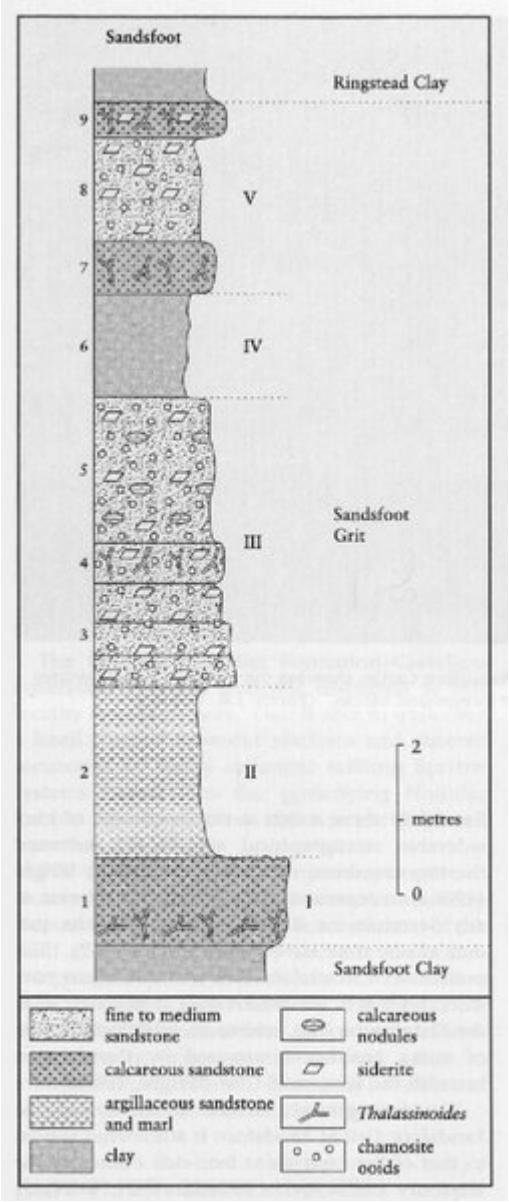
(Figure 2.17) The complete stratal succession at the Sandsfoot GCR site.



(Figure 2.18) Weathering profile of the Redcliff Formation between Nothe and Rodwell (after Wright, 1986a, figs 2 and 3).

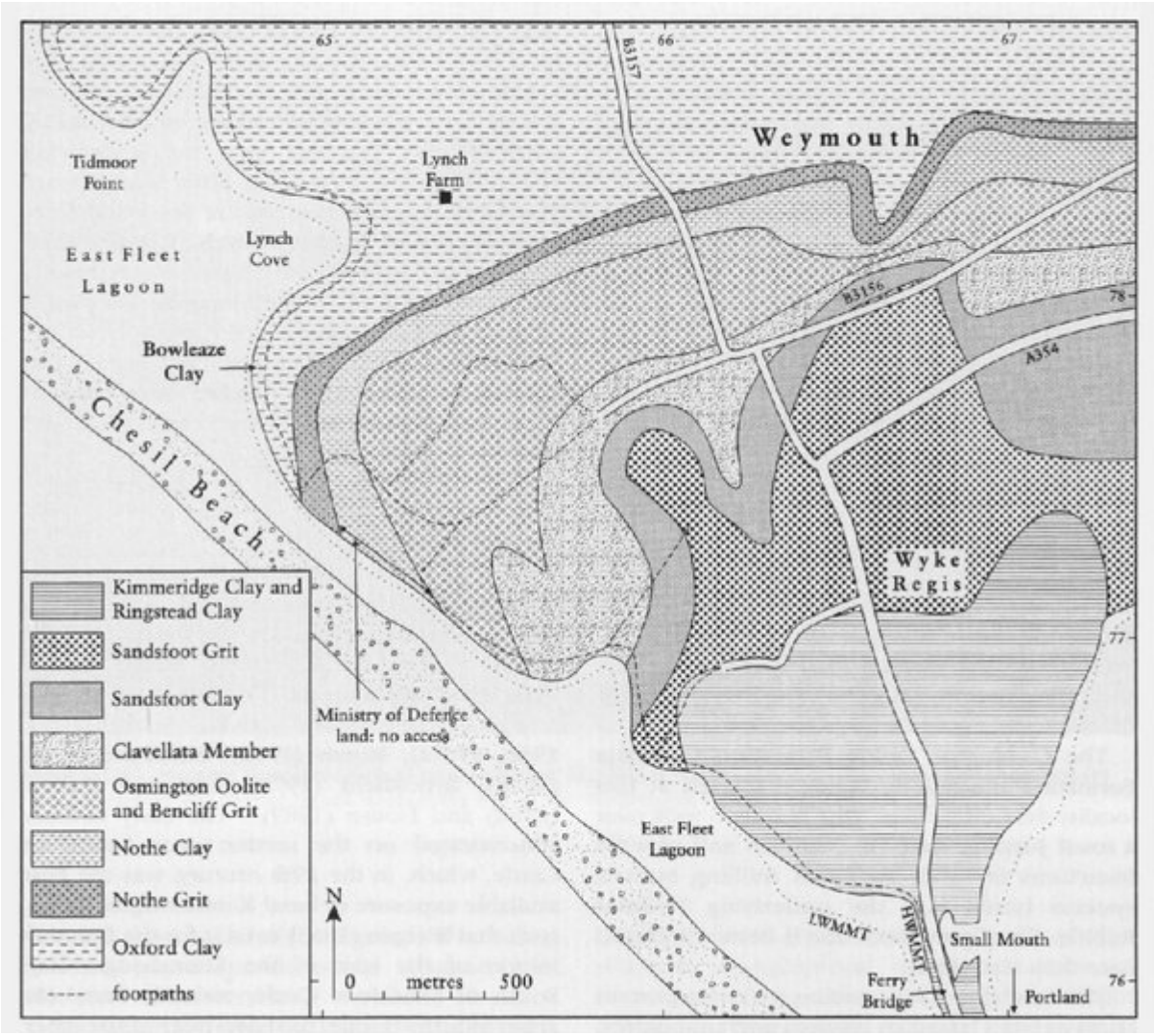


(Figure 2.19) Preston Grit exposed in the rock platform just east of Nothe Fort. (Photo: J.K. Wright.)

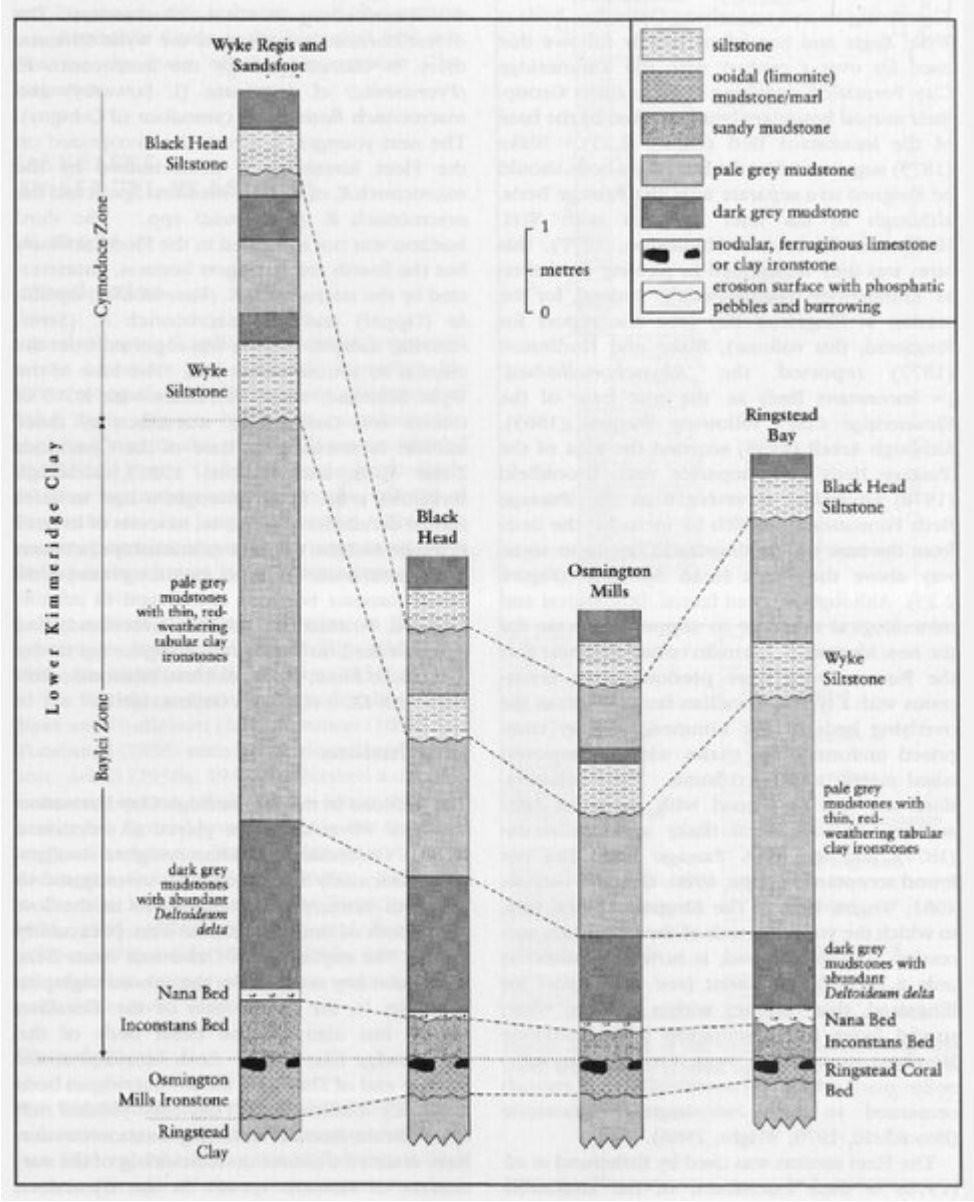


(Figure 2.20) Weathering profile of the Sandsfoot Grit in the cliff section beneath Sandsfoot Castle (after Wright, 1986a, fig. 5)

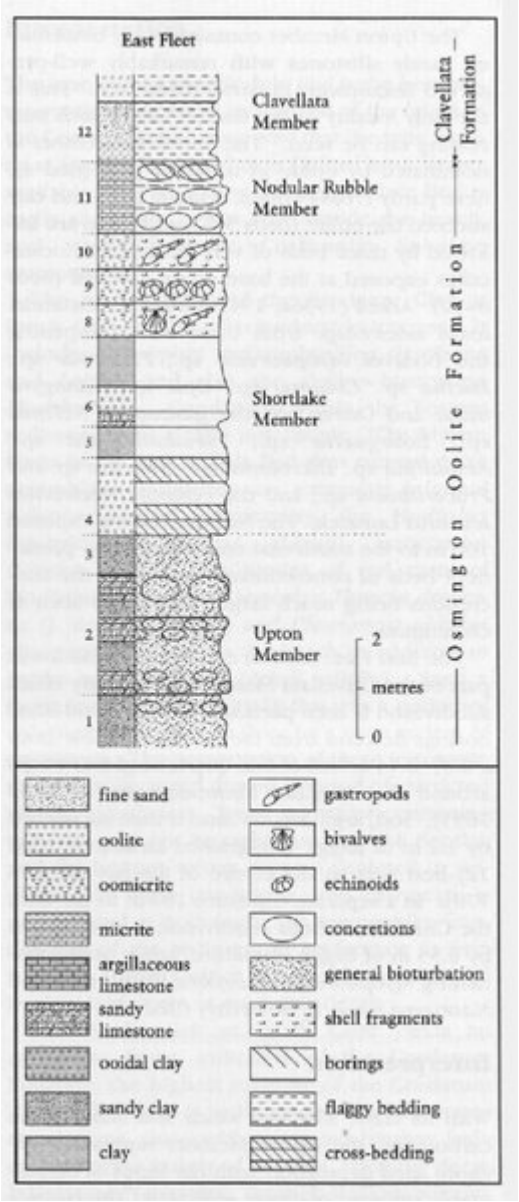
(Figure 2.21) Massive Sandsfoot Grit of Unit III below Sandsfoot Castle, showing the intense Thalassinoides bioturbation of the harder bands weathering out in the foreground blocks. (Photo: J.K. Wright.)



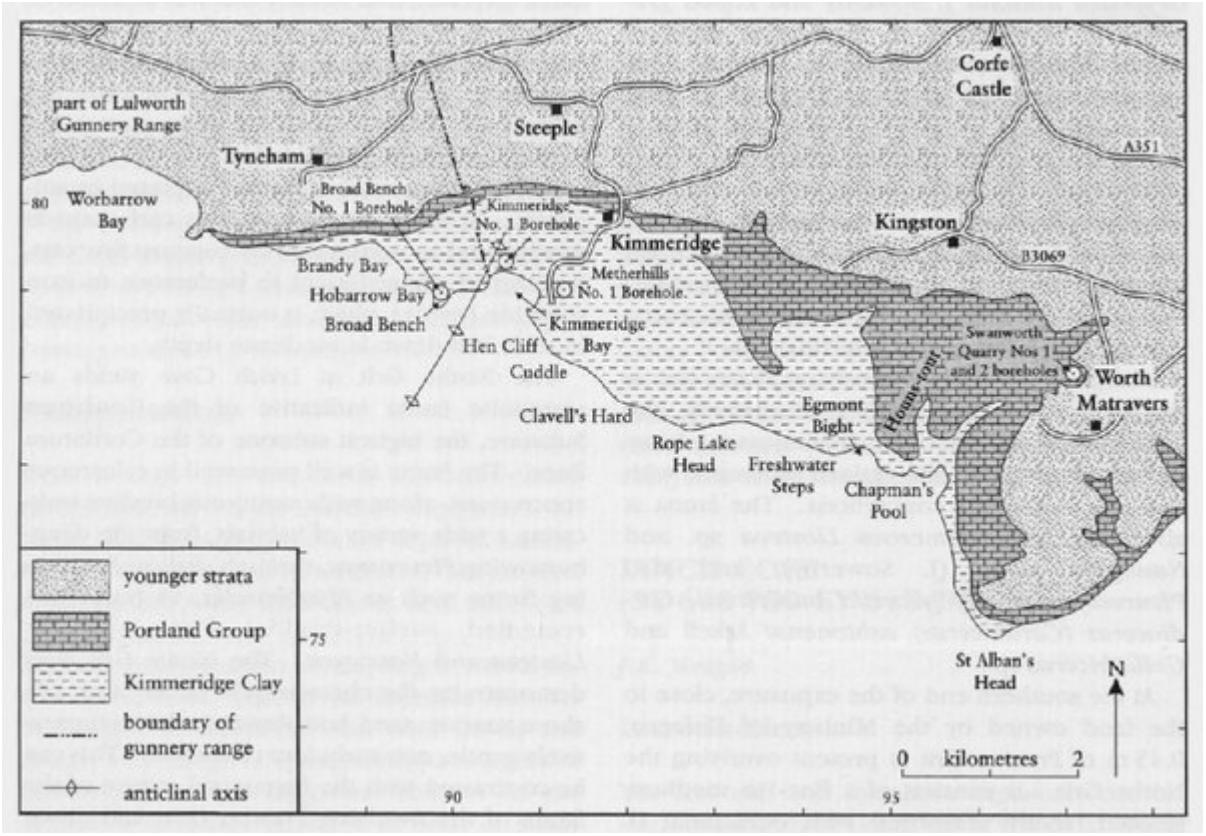
(Figure 2.22) Geological map for the Small Mouth, East Fleet and Lynch Cove GCR sites.



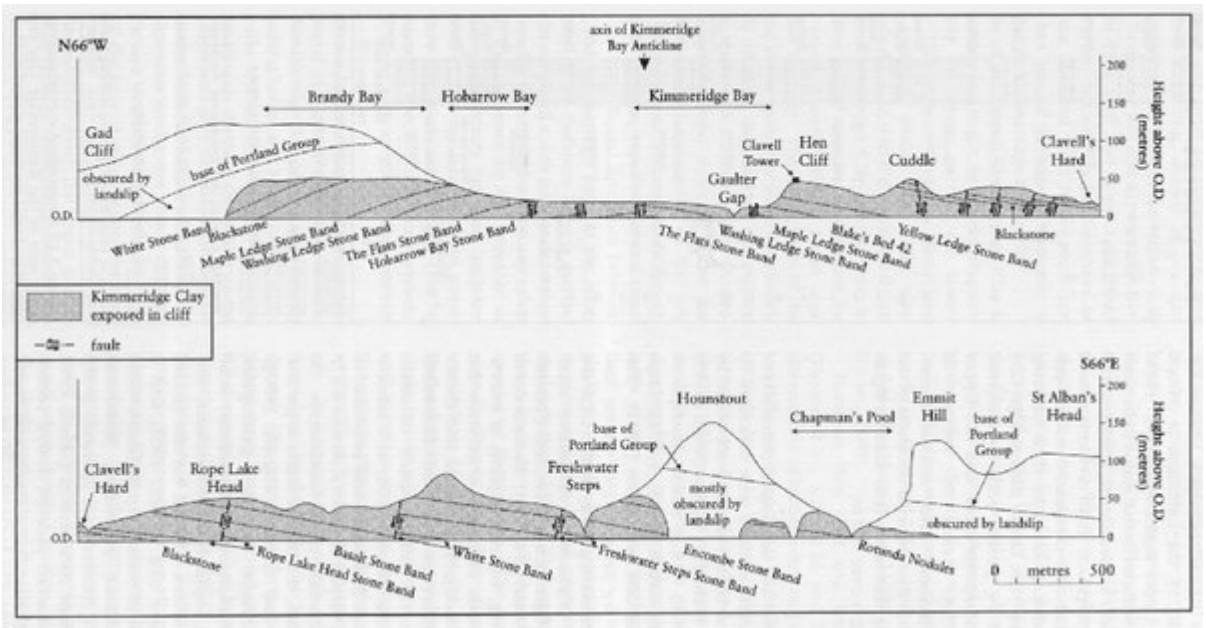
(Figure 2.23) Correlation of the basal beds of the Kimmeridge Clay exposed at Wyke Regis, Sandsfoot, Black Head, Osmington Mills and Ringstead Bay (based on Cox and Gallois, 1981, fig. 6 and unpublished borehole data, R.W. Gallois, pers. comm.).



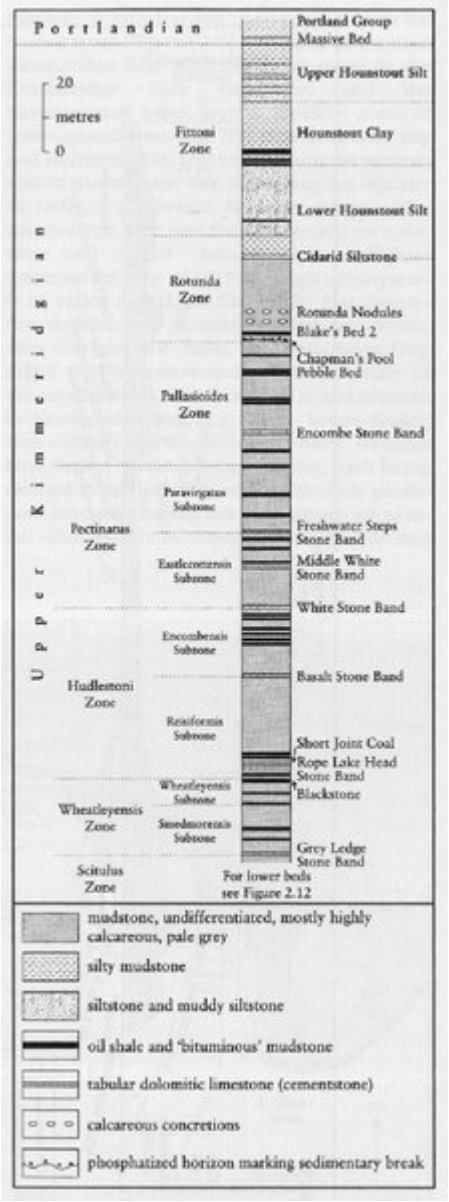
(Figure 2.24) Log of the Corallian succession at East Fleet, after Wright (1986a, fig. 4). Note that Bed 7 is only 0.9 m thick — the thickness of 3.5 m given in Wright (1986a) is a misprint.



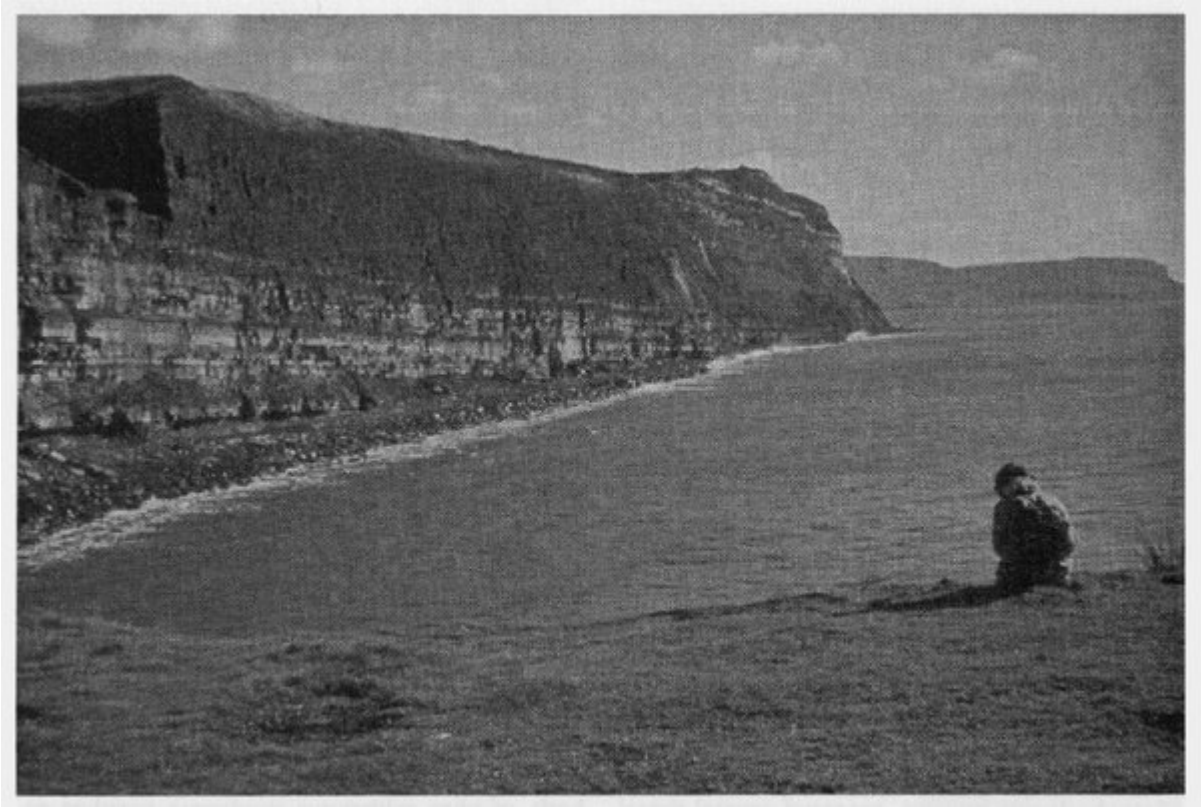
(Figure 2.25) Sketch map of the solid geology of the Kimmeridge area, (based on Cox and Gallois, 1981, fig. 7 and Gallois, 2000, fig. 1).



(Figure 2.26) Geological sketch sections of the Kimmeridge Clay exposed in the cliffs between Brandy Bay and Chapman's Pool (based on Cox and Gallois, 1981, fig. 8 and Gallois, 2000, fig. 2).

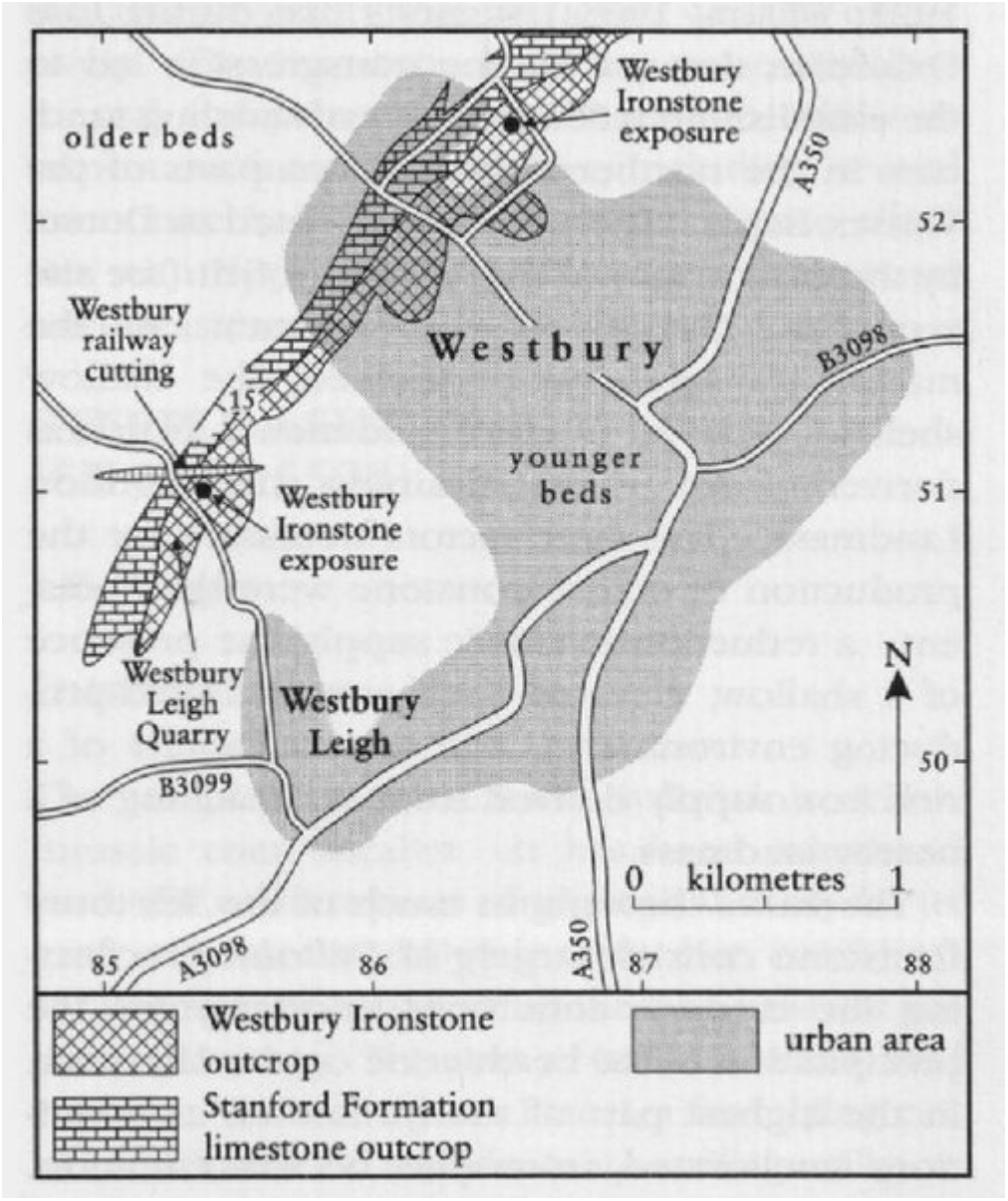


(Figure 2.27) Generalized vertical section through the upper part of the Kimmeridge Clay exposed in the cliffs east of Clavell's Hard (based on Cox and Gallois, 1981, fig. 13 and Gallois, 2000, figs 4 and 6).

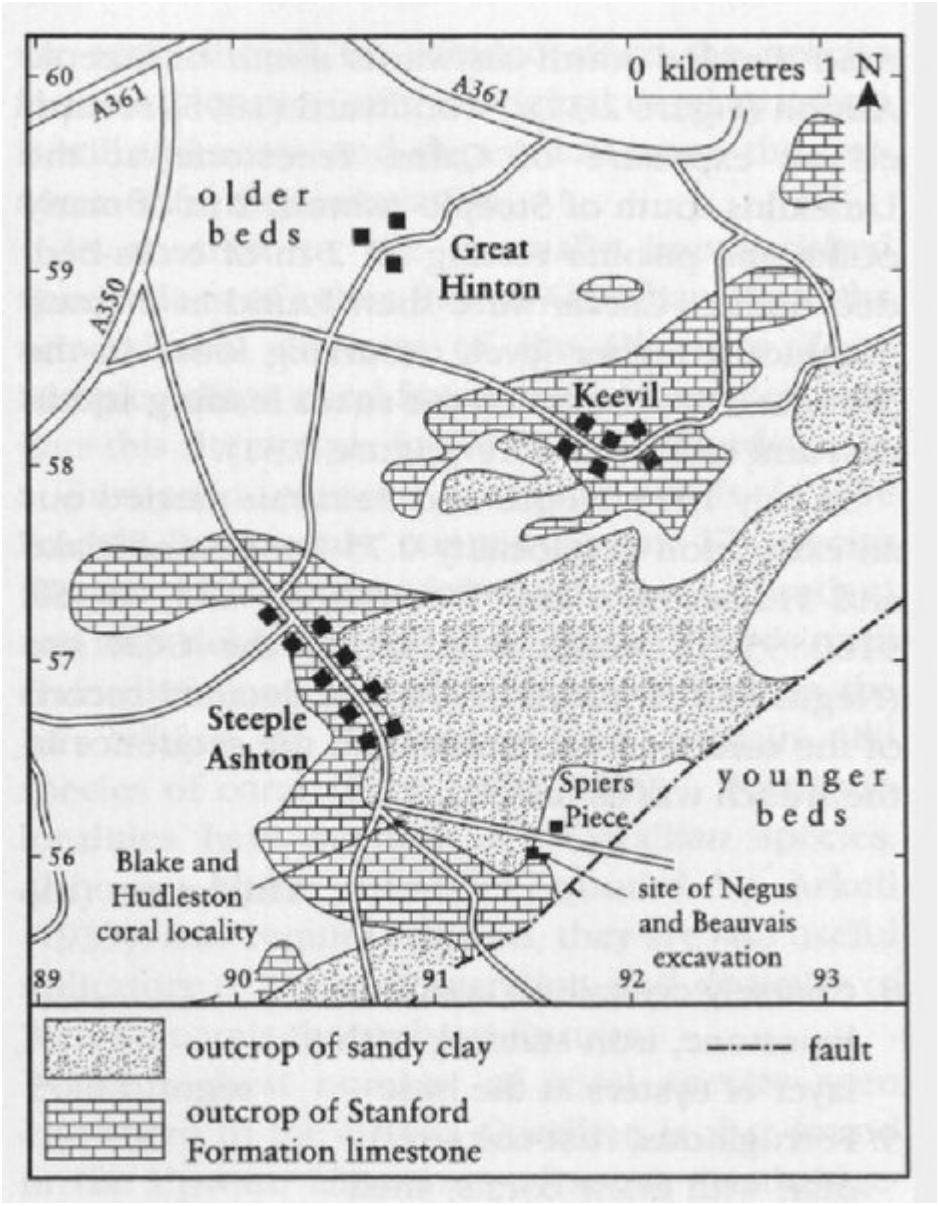


(Figure 2.28) Looking east from Clavell's Hard to Rope Lake Head and St Alban's Head (far distance). The lower part of the cliff face comprises alternating mudstones and ribs of oil shale including the Blackstone, Rope Lake Head Stone Band and Short Joint Coal. The upper part comprises a thick succession of pale calcareous mudstones including, towards the top, the Basalt Stone Band. The cliff is capped by further alternations of mudstone and oil shale including the White Stone Band. (Photo: W.A. Read.)

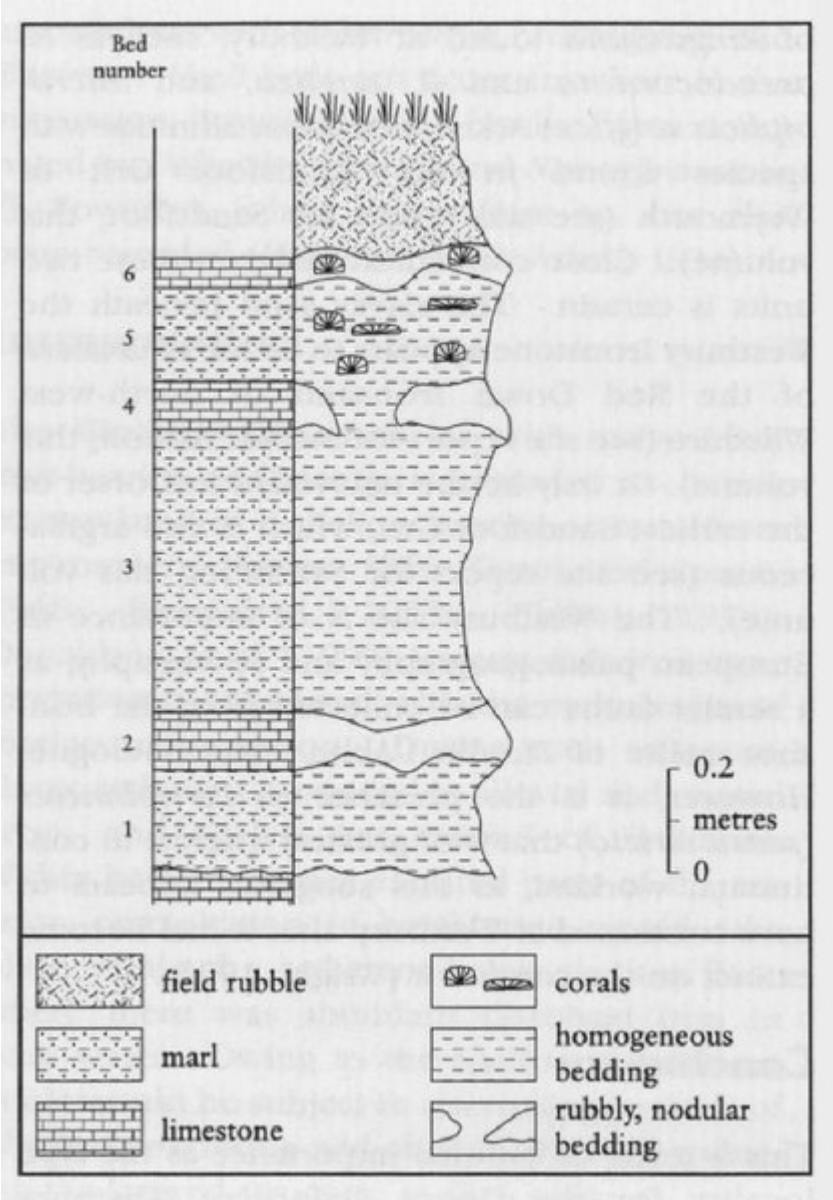
(Figure 2.29) Exposure of Abbotsbury Ironstone at Blind Lane, Abbotsbury. (Photo: A6478, reproduced with kind permission of the Director, British ,Geological Survey ©NERC.)



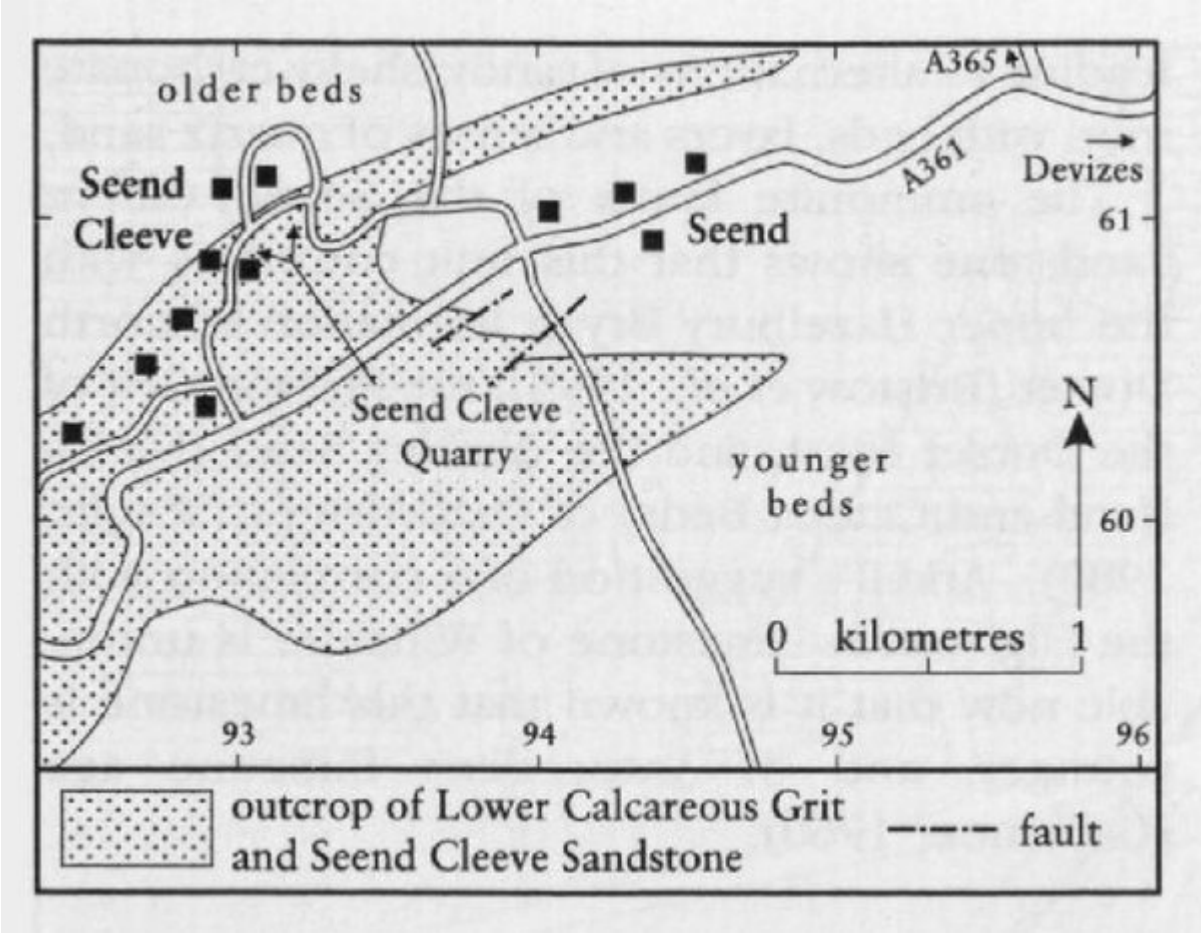
(Figure 2.30) Locality map for sites around Westbury. Geological information from BGS Sheet 281 (Frome) (1965).



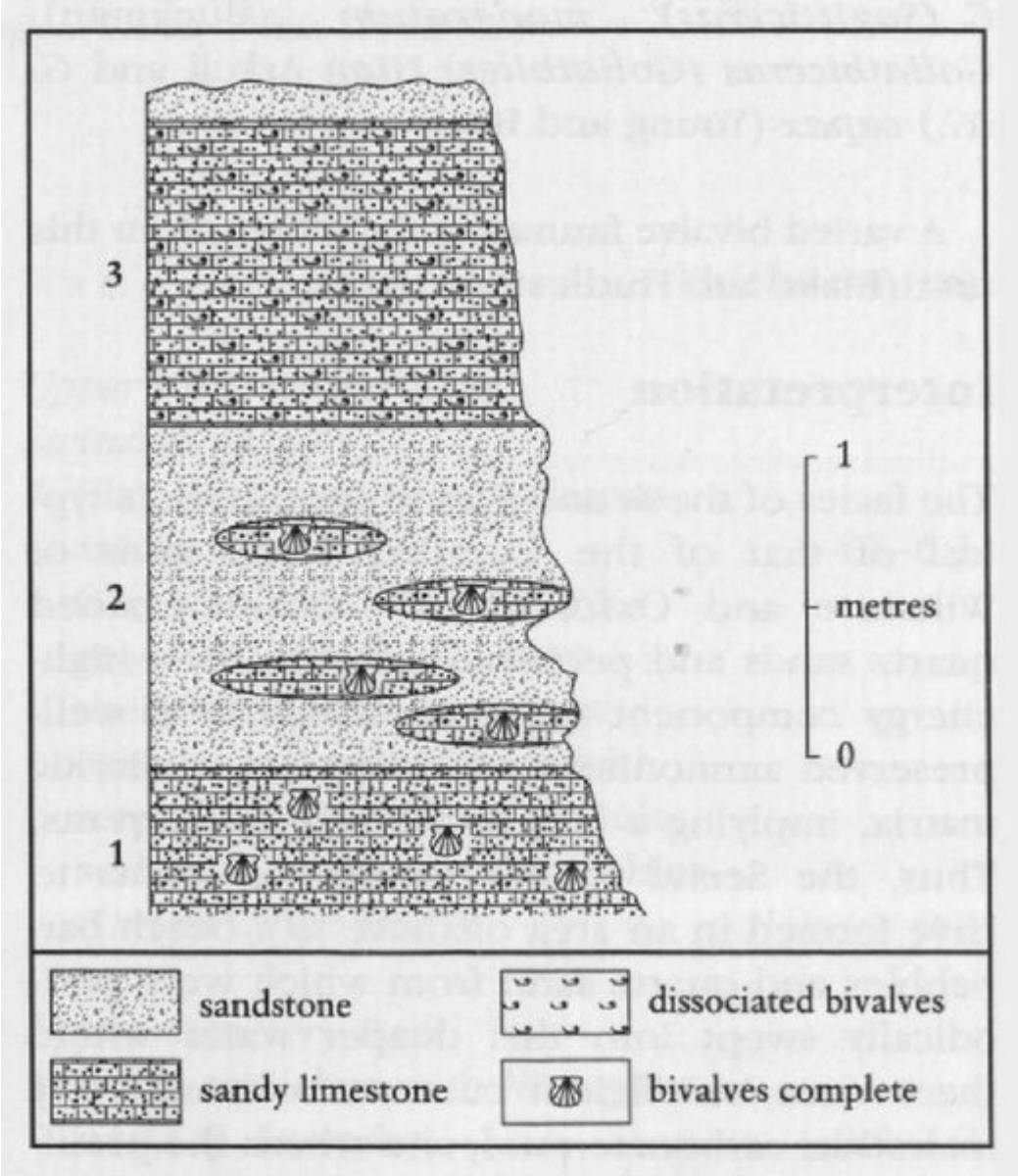
(Figure 2.31) Locality map for the Steeple Ashton GCR site. Geological information from BGS Sheet 281 (Frome) (1965).



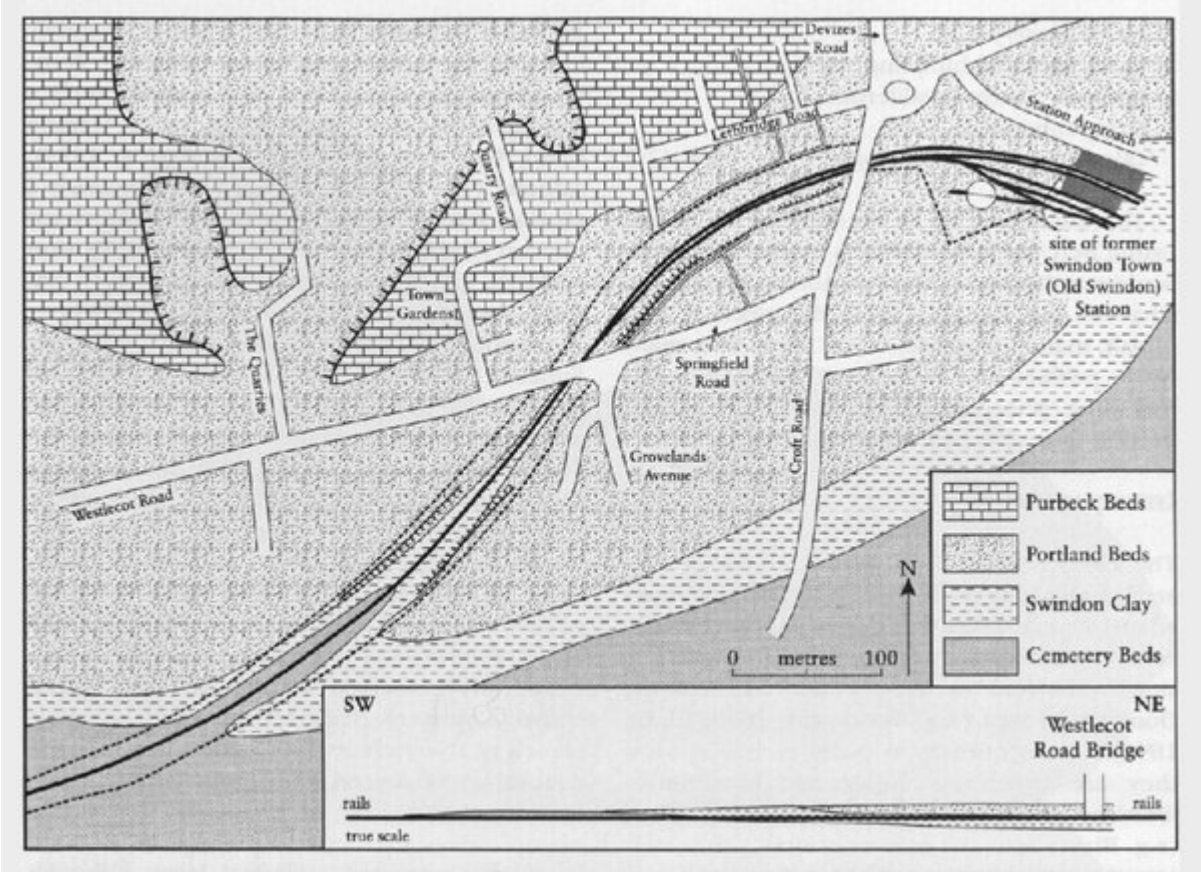
(Figure 2.32) Log of the Corallian succession at Steeple Ashton (after Negus and Beauvais, 1979, fig. 1).



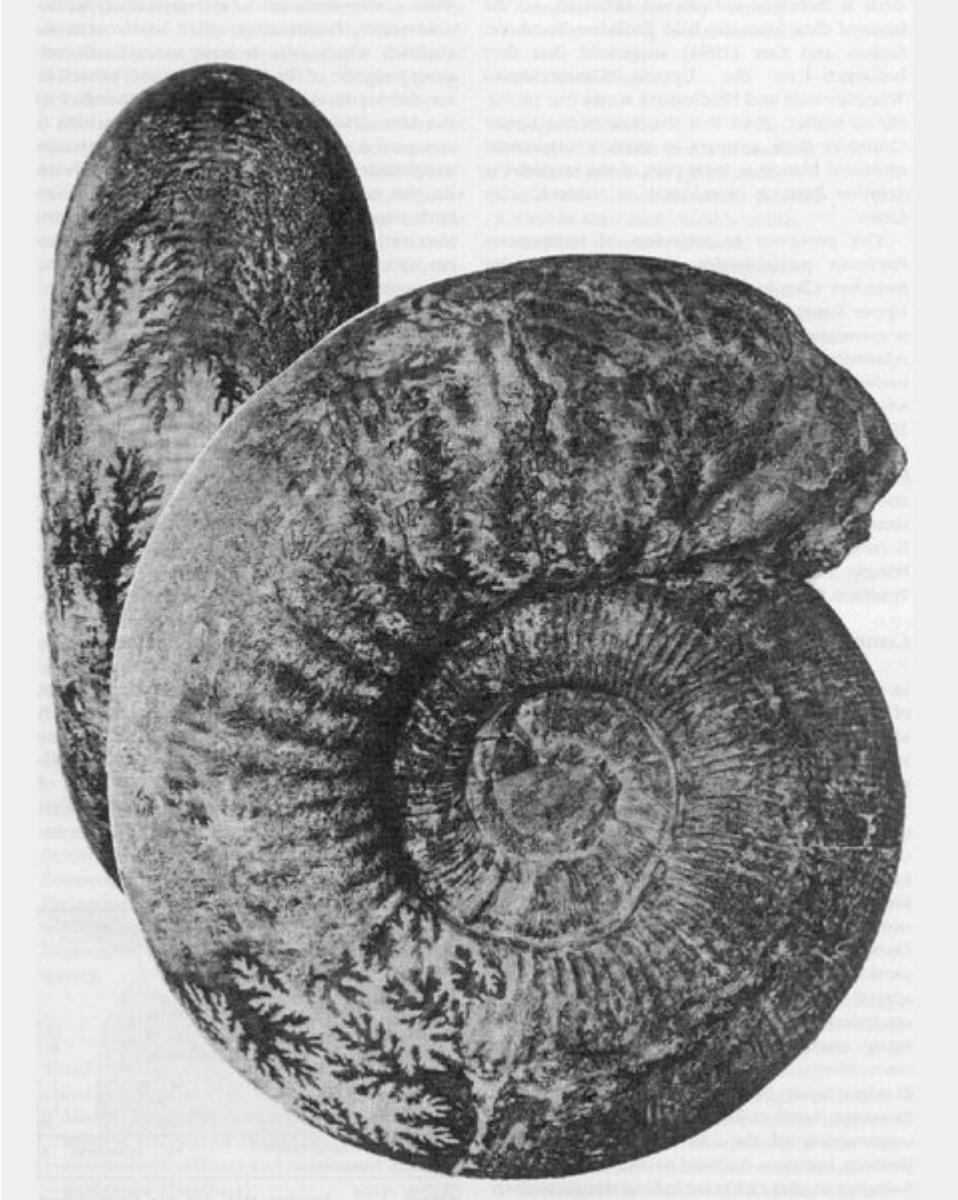
(Figure 2.33) Locality map for the Seend Cleeve GCR site. Outcrop of the Corallian sandstones from BGS Sheet 281 (Frome) (1965).



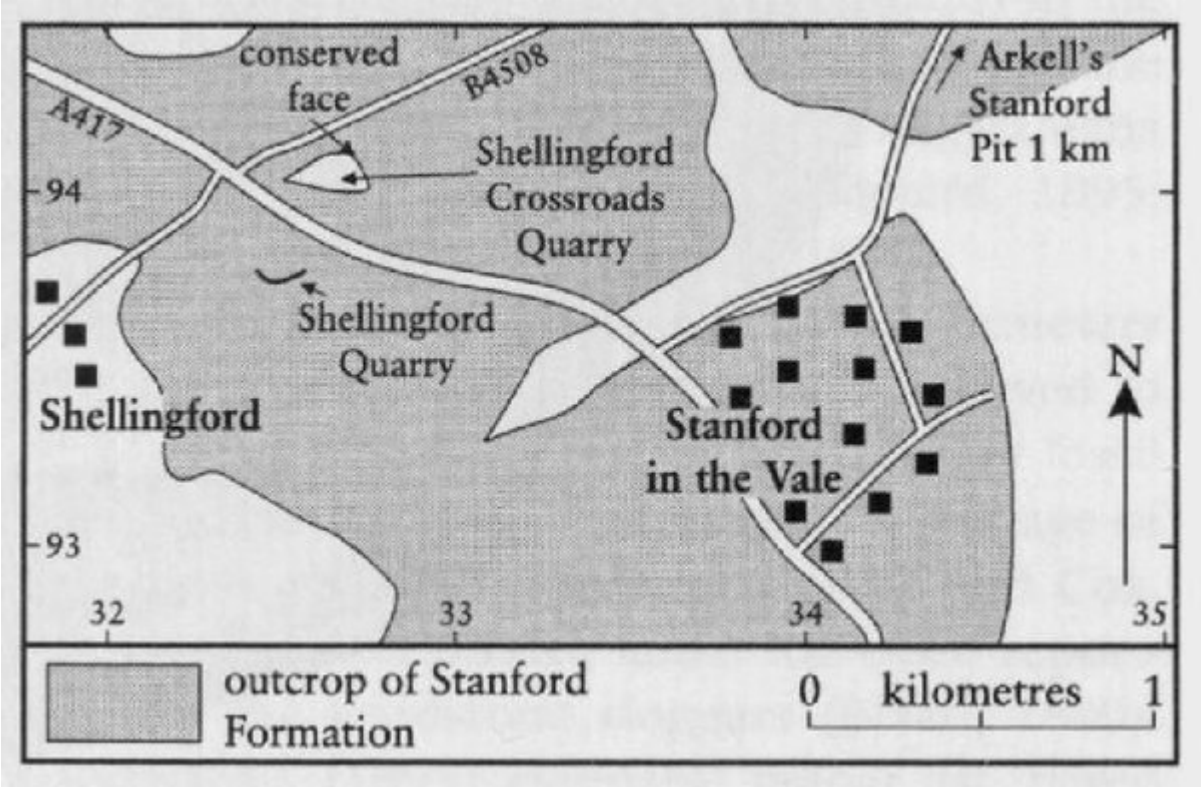
(Figure 2.34) Weathering profile of the Corallian succession at Seend Cleeve Quarry as seen by J.K. Wright in 1978.



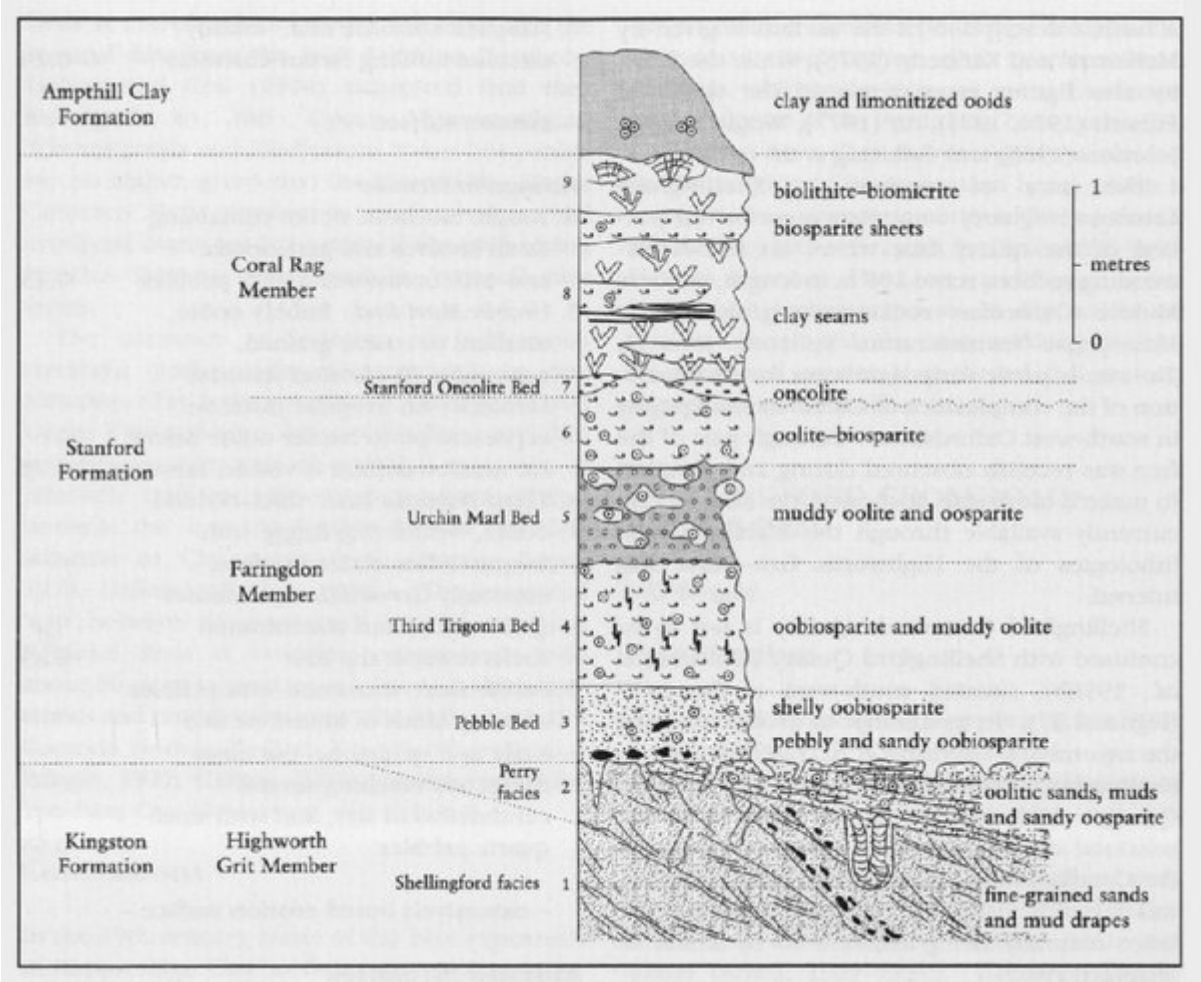
(Figure 2.35) Sketch map of the cutting on the former Midland and South Western Junction Railway. The line is now dismantled. The section south-west of Westlecot Road bridge constitutes the Kimmeridgian GCR site. (Geology based on Arkell, 1948, fig. 1 and British Geological Survey Sheet SU 18 SE.)



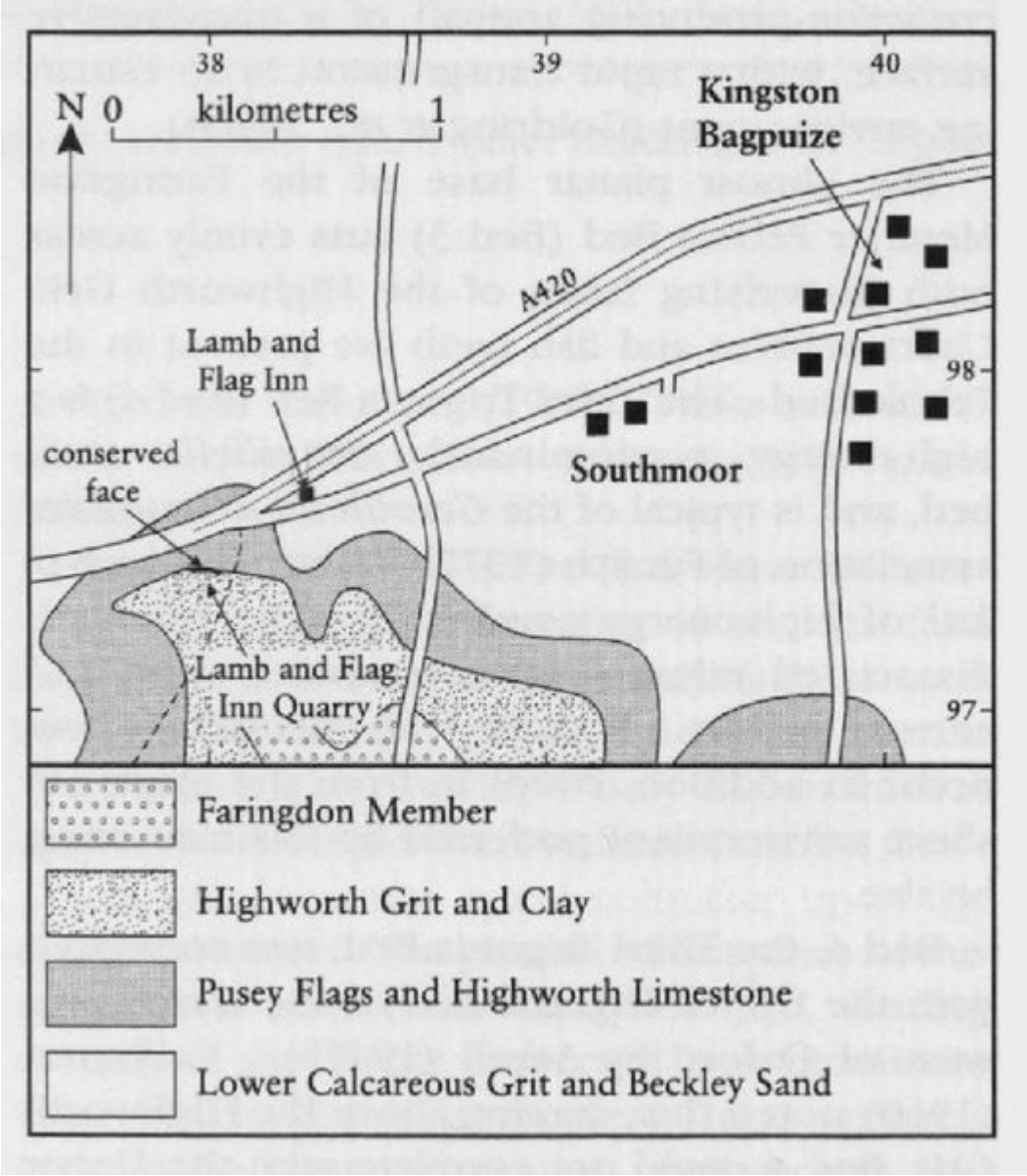
(Figure 2.36) The type specimen of Pectinatites (P.) eastlecottensis (Salfeld) as figured by Salfeld (1913) but enlarged to natural size.



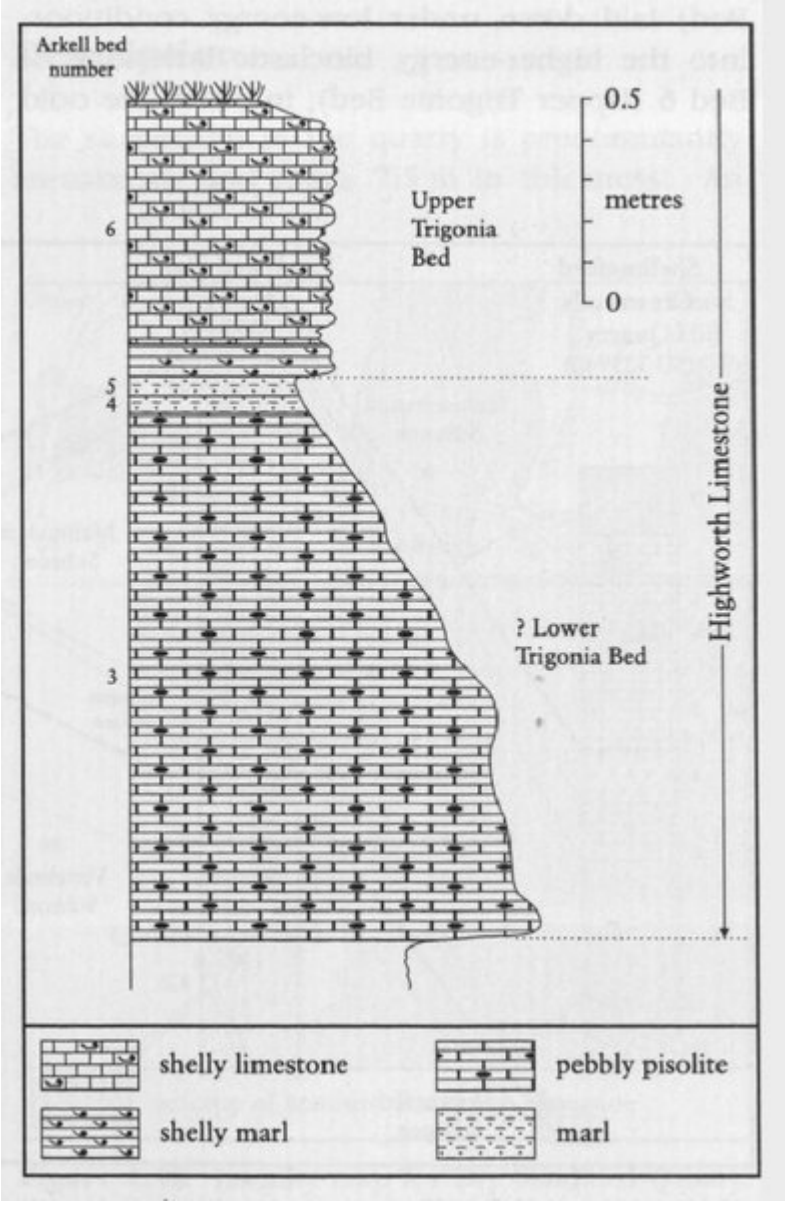
(Figure 2.37) Locality map for the Shellingford Crossroads GCR site. Outcrop of the Stanford Formation (mapped as 'Corallian limestone glib') from BGS Sheet 253 (Abingdon) (1971).



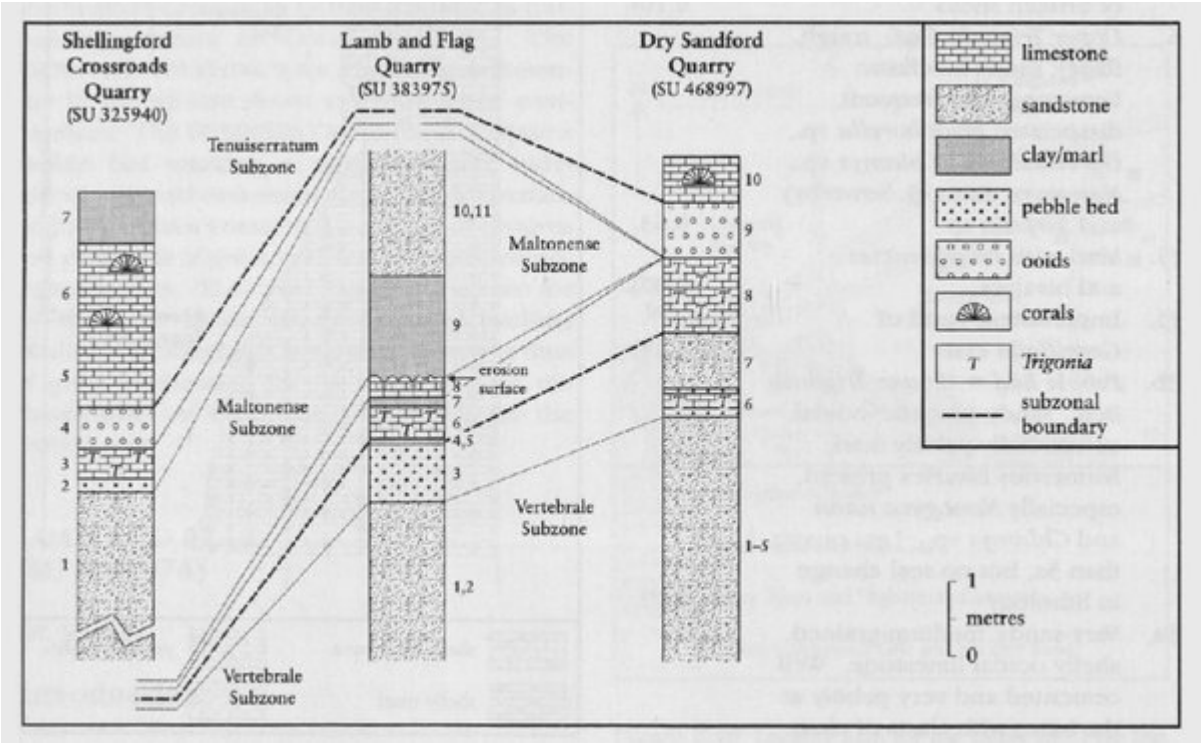
(Figure 2.38) Log of the Corallian succession at Shellingford Crossroads Quarry (after Goidring et al., 1998b, fig. 3).



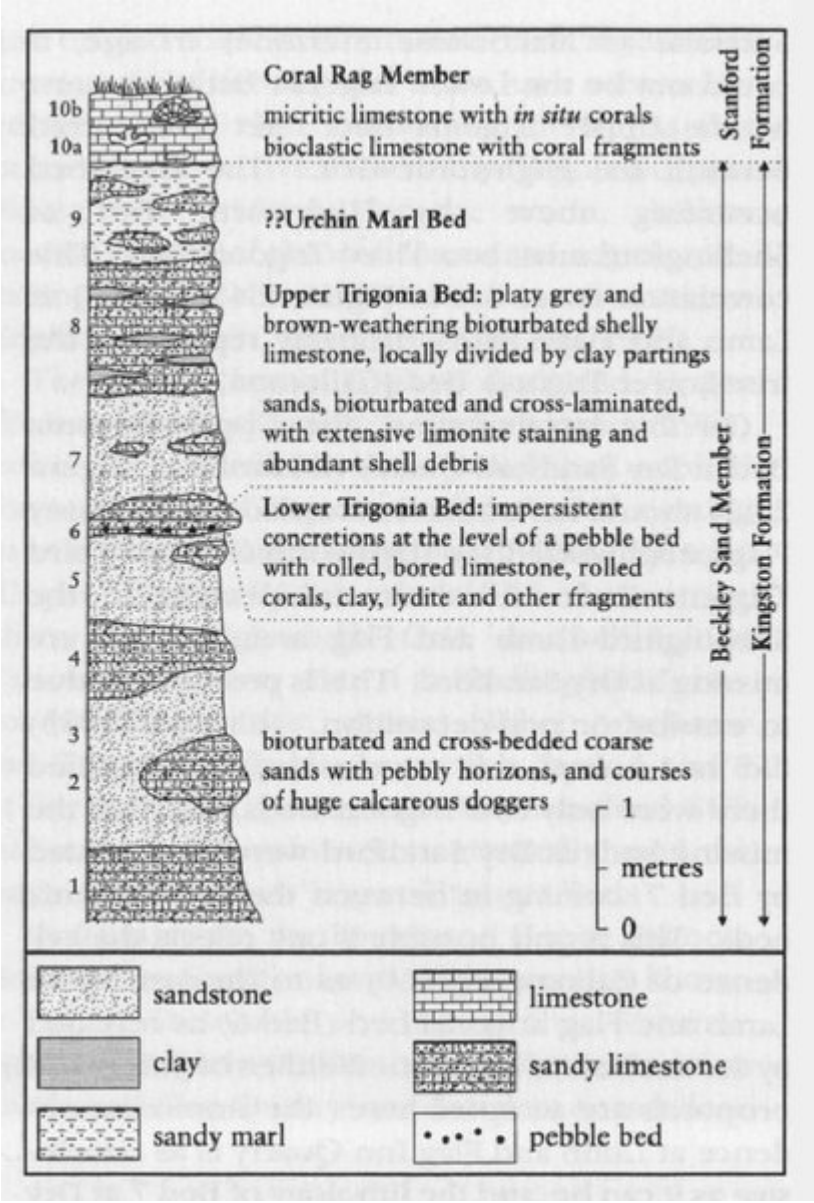
(Figure 2.39) Locality map for the Lamb and Flag Inn Quarry. Corallian outcrops from Arkell (1939a, plate 30).



(Figure 2.40) Weathering profile of the Lamb and Flag Inn Quarry as seen by J.K. Wright in 1983.

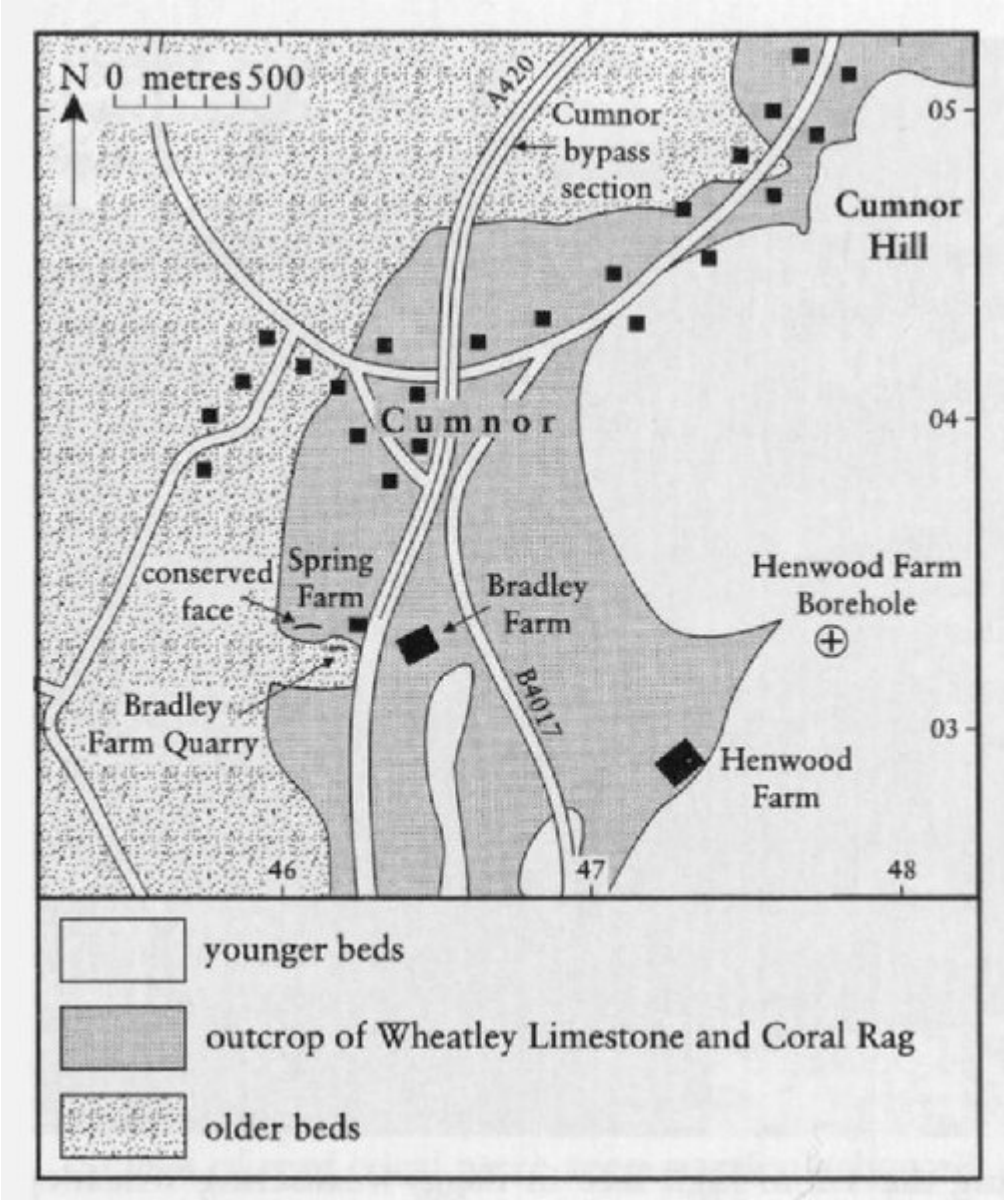


(Figure 2.41) Correlation of sections at Shellingford Crossroads Quarry, Lamb and Flag Quarry, and Dry Sandford Quarry (after Johnson, 1983, fig. 2).

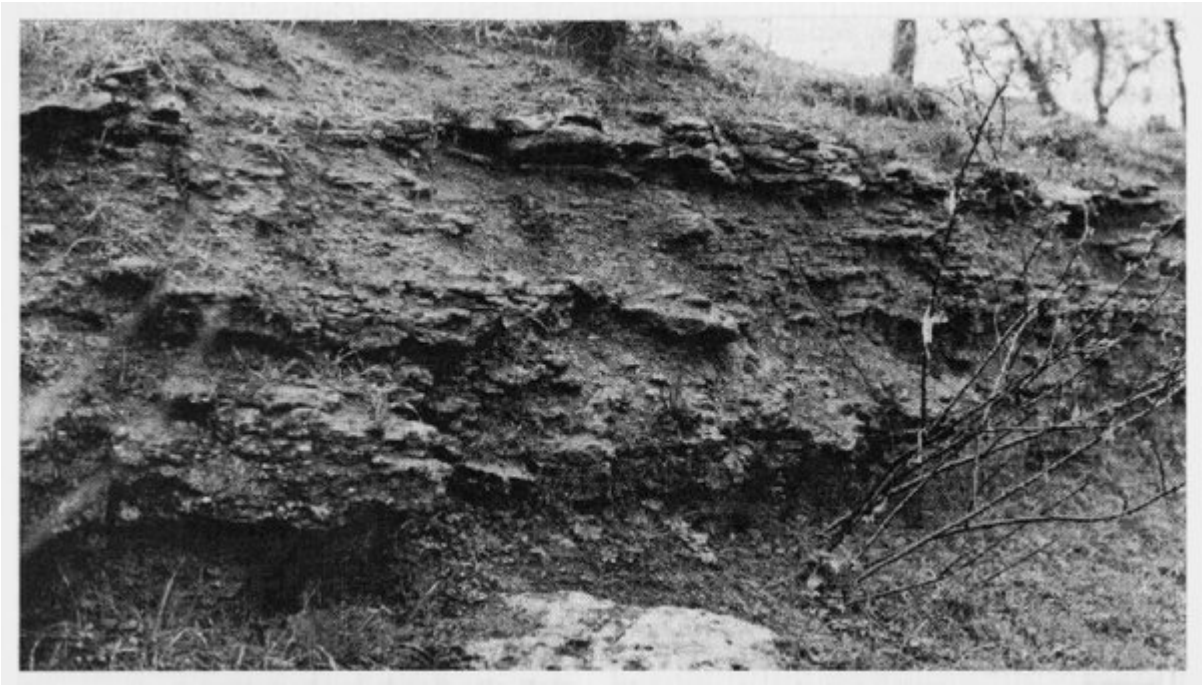


(Figure 2.43) Log of the Corallian succession at Dry Sandford Quarry (after Johnson, 1983, fig. 1B).

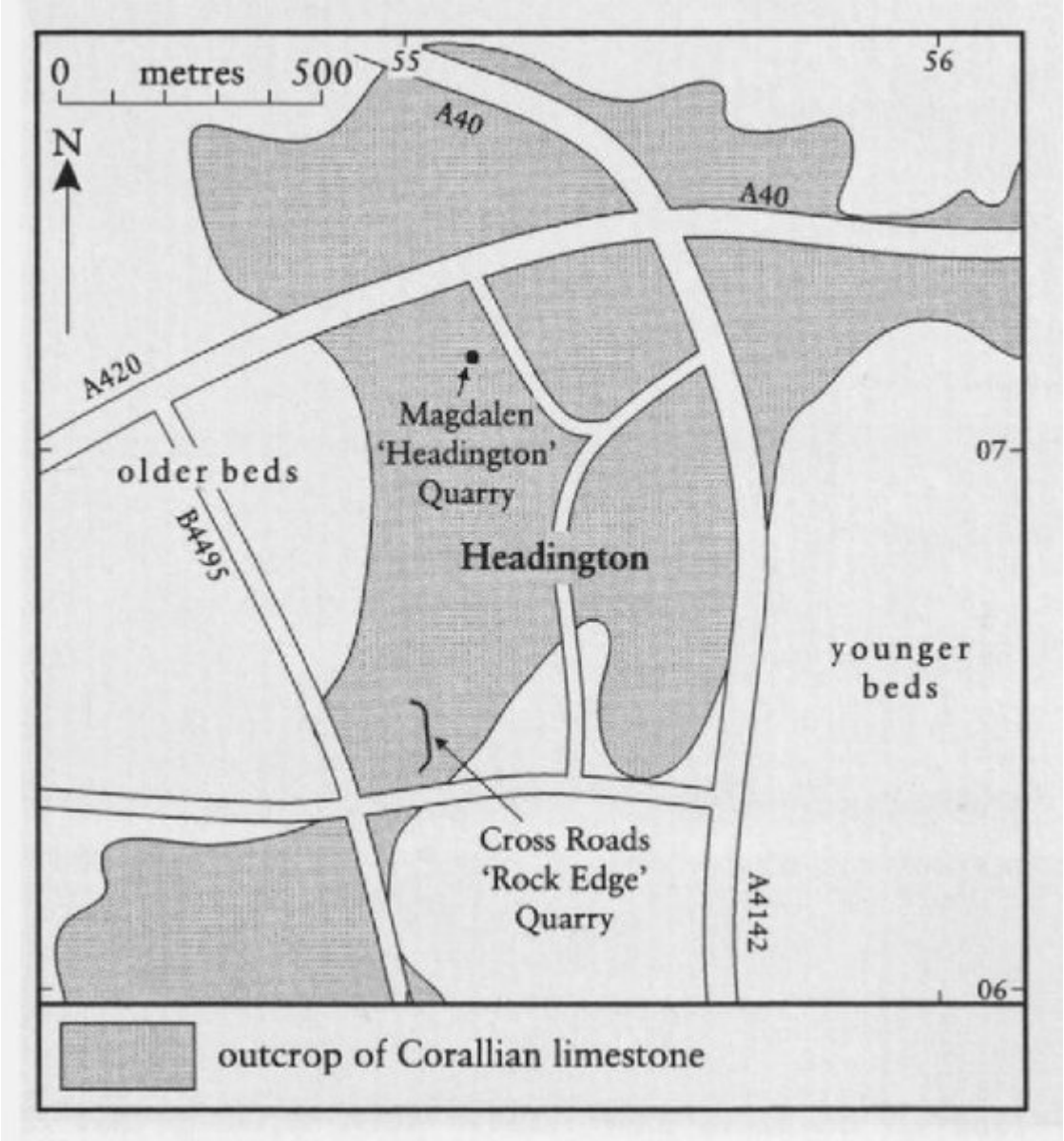
(Figure 2.44) View of the main north–south face at Dry Sandford Quarry, showing the Lower Trigonia Bed (Bed 6) and Upper Trigonia Bed (Bed 8) separated by shelly sand (Bed 7) marked by the hammer (shaft length, 30 cm). (Photo: J.K. Wright.)



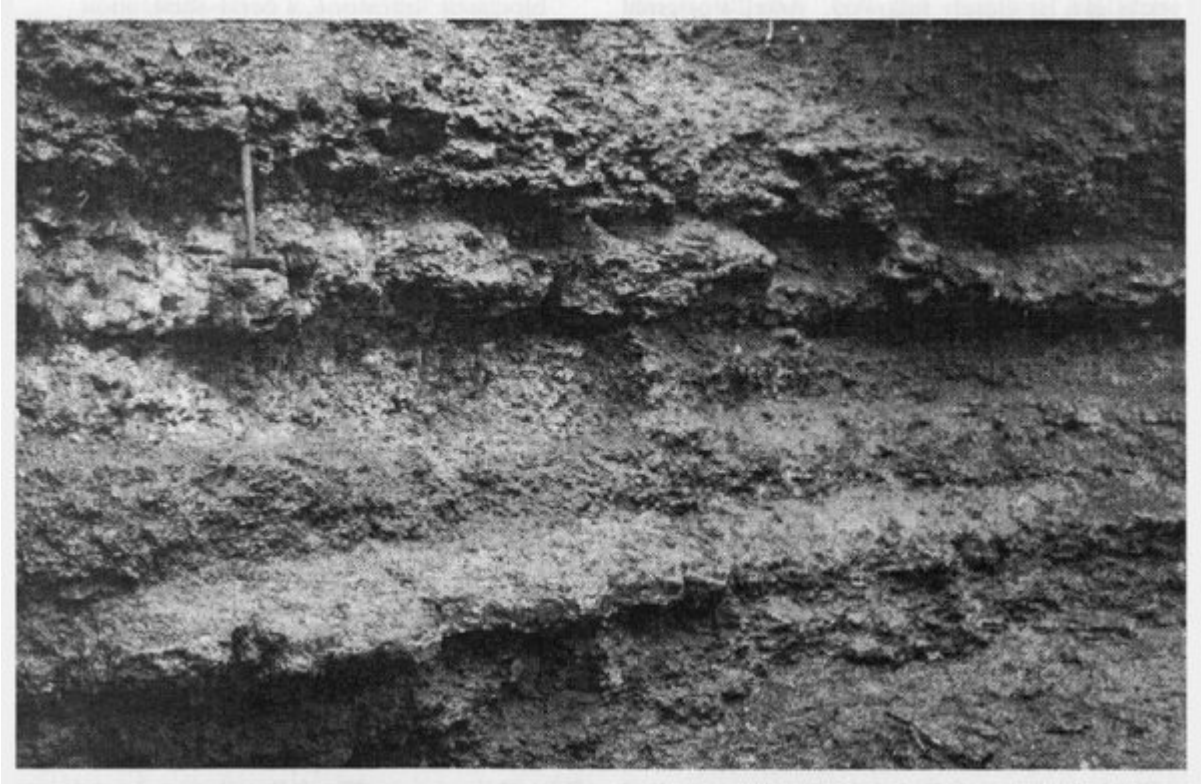
(Figure 2.45) Locality map for the Cumnor GCR site. Outcrop of Wheatley Limestone and Coral Rag from BGS Sheet 236 (Witney) (1982).



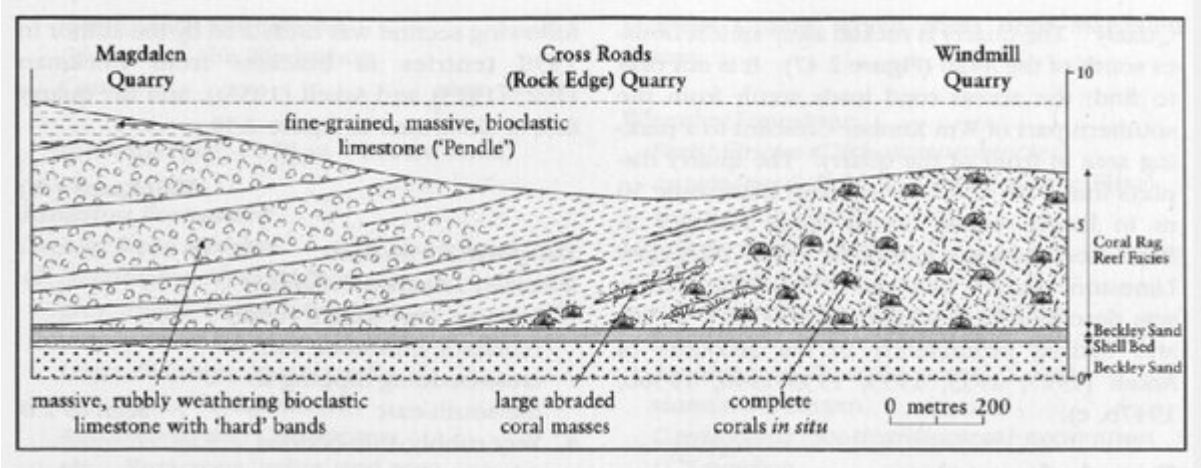
(Figure 2.46) View of the Cumnor site in 1998, showing the 1.2 m high face in flaggy-weathering Wheatley Limestone. (Photo: J.K. Wright.)



(Figure 2.47) Locality map for Cross Roads Quarry and Magdalen Quarry. Outcrop of the Corallian limestones from BGS Sheet 237 (Thame) (1994).

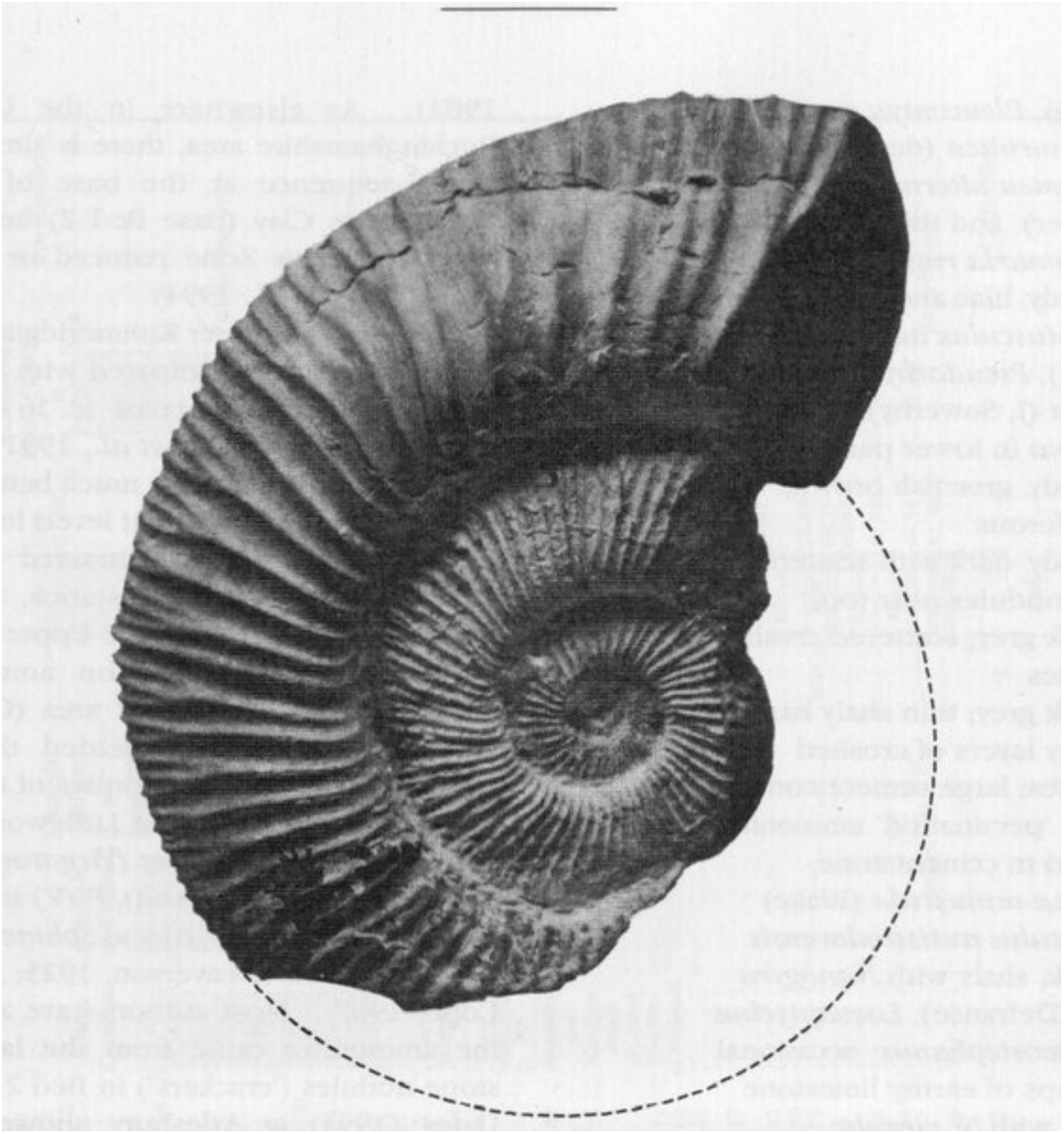


(Figure 2.48) View of the central face at Cross Roads (Rock Edge) Quarry, showing the regular bedding in coralliferous calcarenite of the Wheatley Limestone. The coral clasts rarely exceed 10 mm in diameter. Hammer shaft is 30 cm long. (Photo: J.K. Wright.)

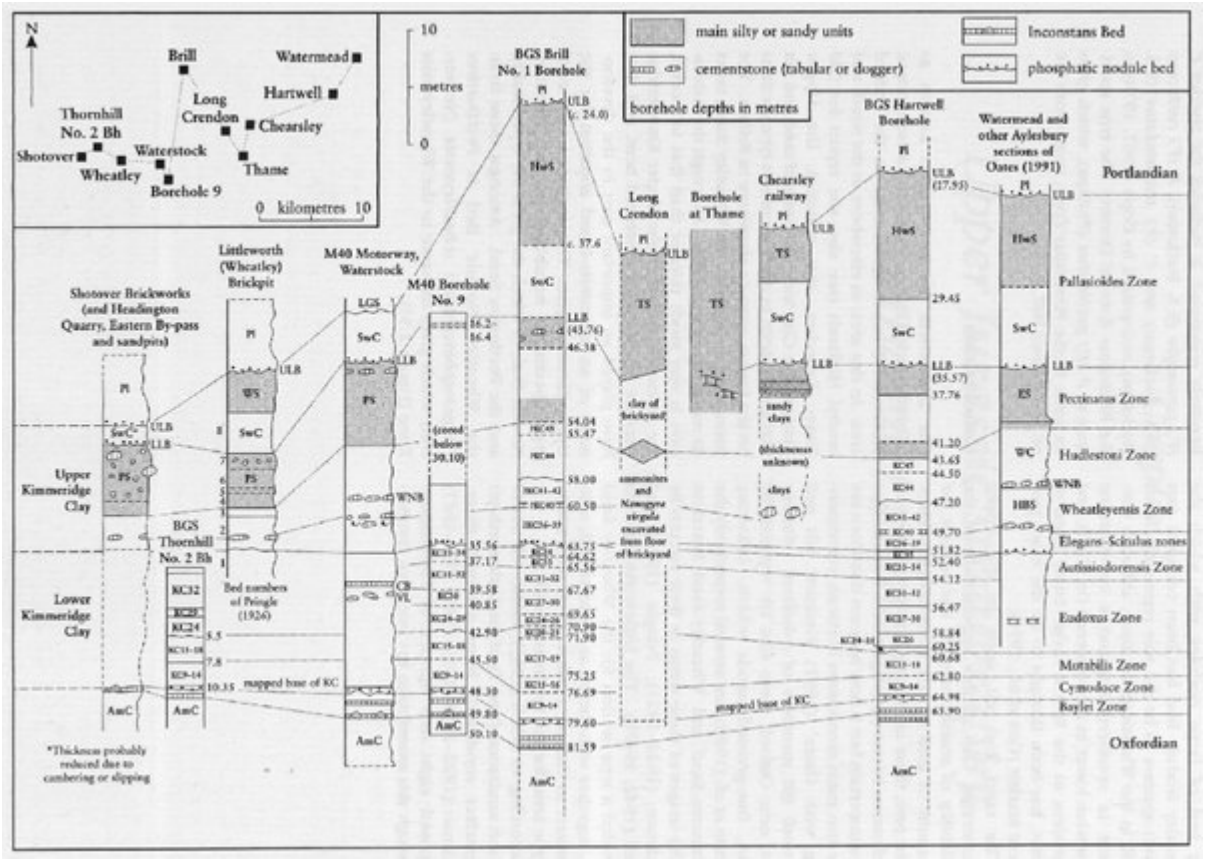


(Figure 2.49) Correlation of sections in Magdalen Quarry, Cross Roads Quarry and Windmill Quarry (after Arkell, 1927, fig. 11), showing the transition from Coral Rag reef facies on the right into Wheatley Limestone facies on the left.

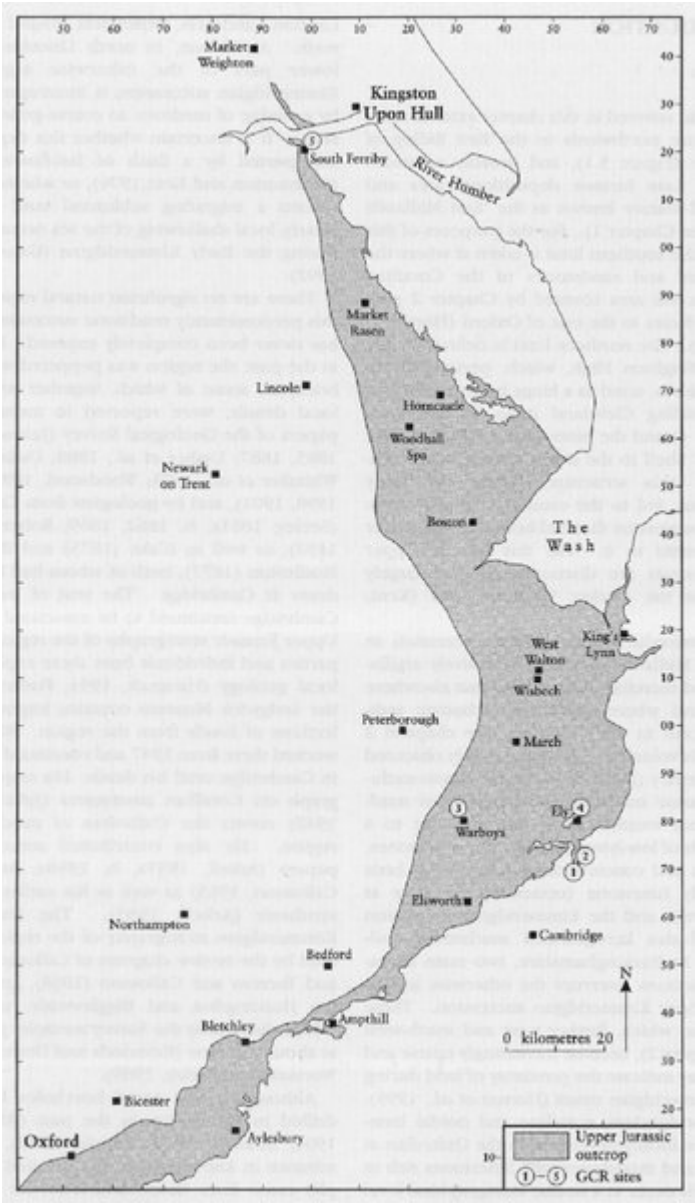
(Figure 2.50) View of the main east–west face at Magdalen Quarry showing the irregularly bedded Wheatley Limestone. The 'First Headington Hard' (Bed 5, 0.35 m) is just below the level of the mapcase (36 cm long). (Photo: J.K. Wright.)



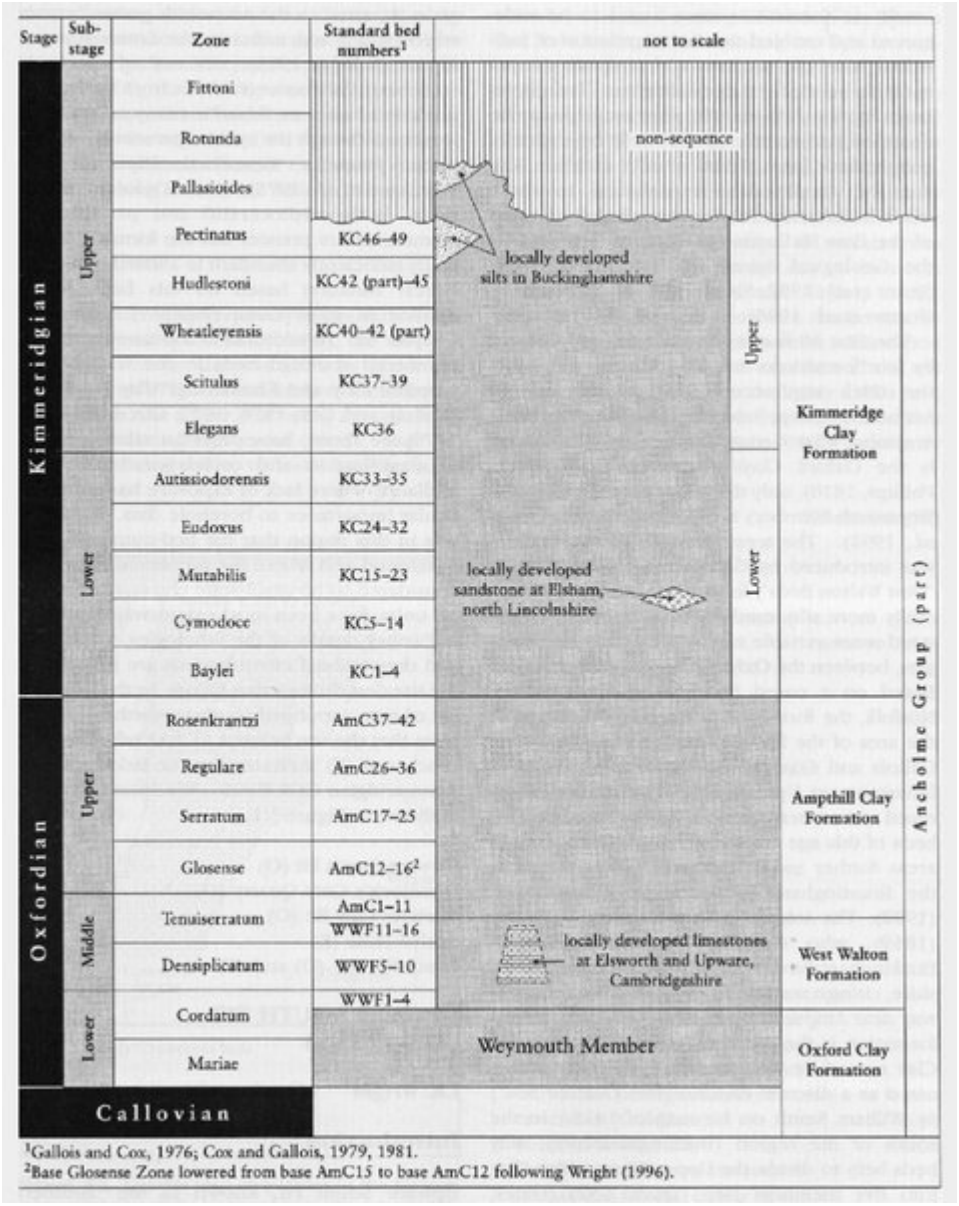
(Figure 2.51) The type specimen of Pectinatites (Virgatosphinctoides) wheatleyensis (Neaverson) as figured by Neaverson (1925, p1.1, fig. 1). Natural size.



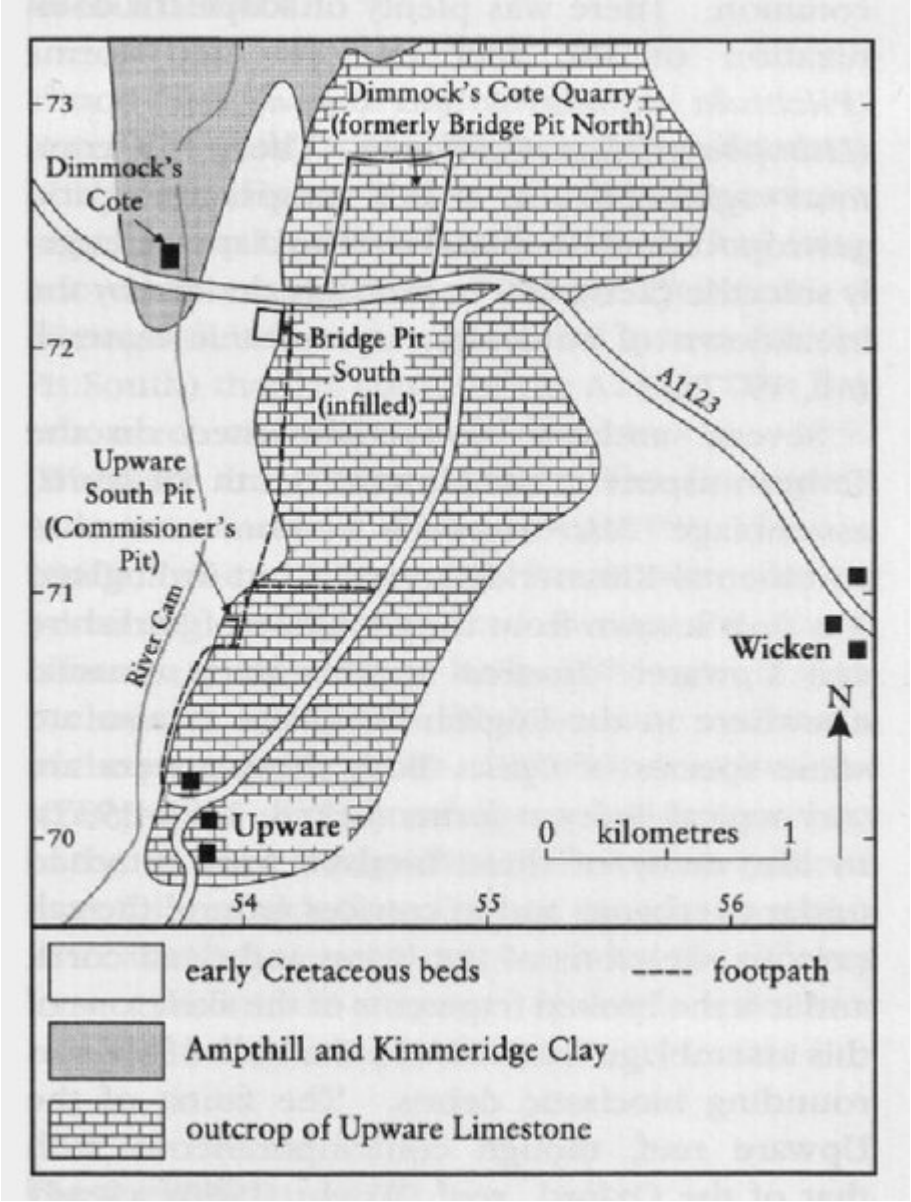
(Figure 2.52) Graphic sections showing the Kimmeridgian stratigraphy at the Littleworth Brick Pit and other sections in Oxfordshire and Buckinghamshire, after Horton et al. (1995, fig. 17). AmC, Ampthill Clay; CB, Crussoliceras Band; ES, Elmhurst Silt; HBS, Holman's Bridge Shale; HwS, Hartwell Silt; KC, Kimmeridge Clay; LGS, Lower Greensand; LLB, Lower Lydite Bed; Pl, Portland Formation; PS, Pectinatus Sand; SwC, Swindon Clay; TS, Thame Sand; ULB, Upper Lydite Bed; WC, Watermead Clay; WNB, Wheatley Nodule Bed; WS, Wheatley Sand; VL, Virgula Limestone.



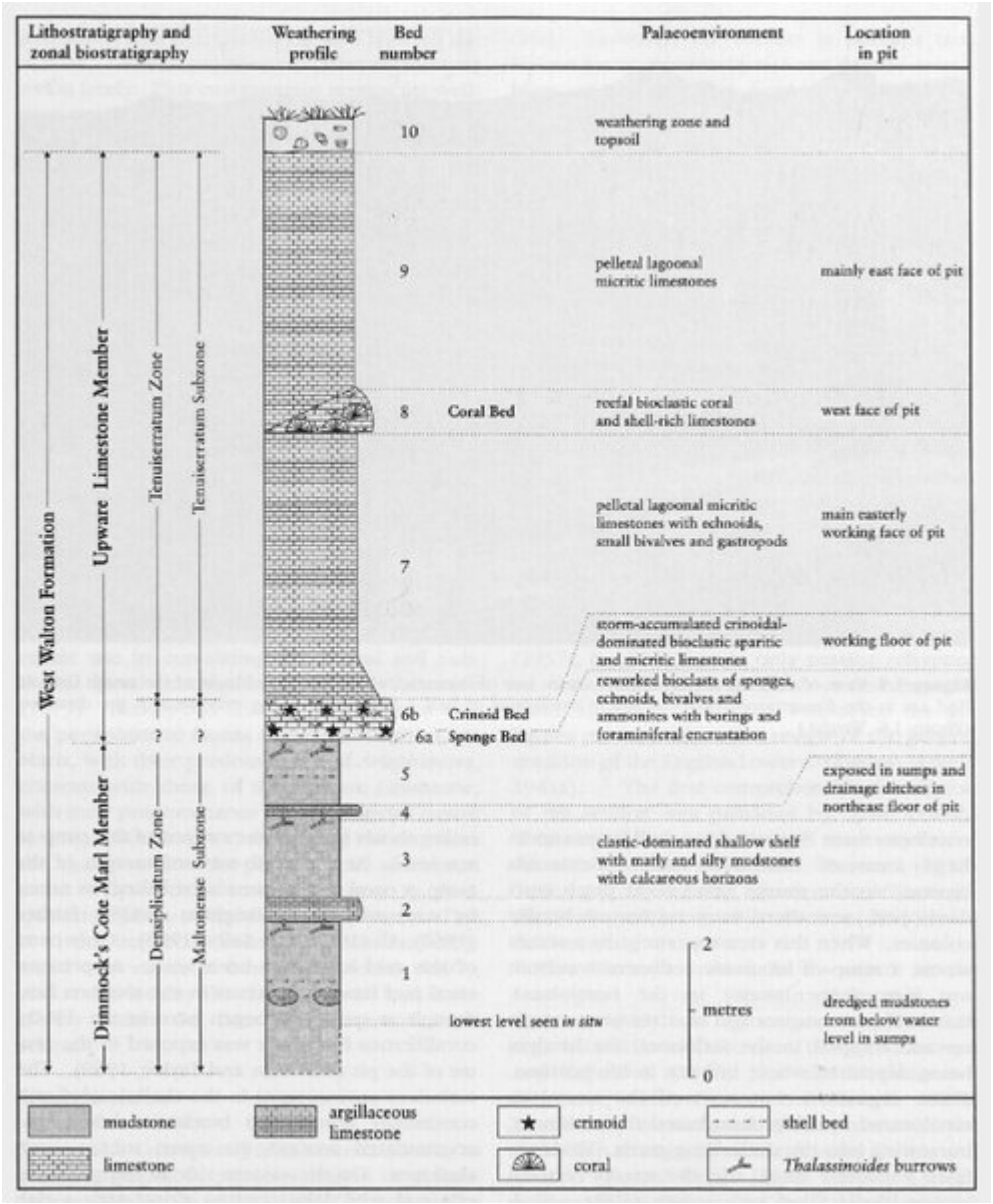
(Figure 3.1) Geological sketch map showing the location of the GCR sites described in Chapter 3. Extensive drift deposits are omitted for clarity 1, Upware South Pit; 2, Upware; 3, Warboys Clay Pit; 4, Roslyn Hole, Ely; 5, South Ferriby.



(Figure 3.2) Lithostratigraphical classification of Oxfordian–Kimmeridgian strata in the East Midlands.

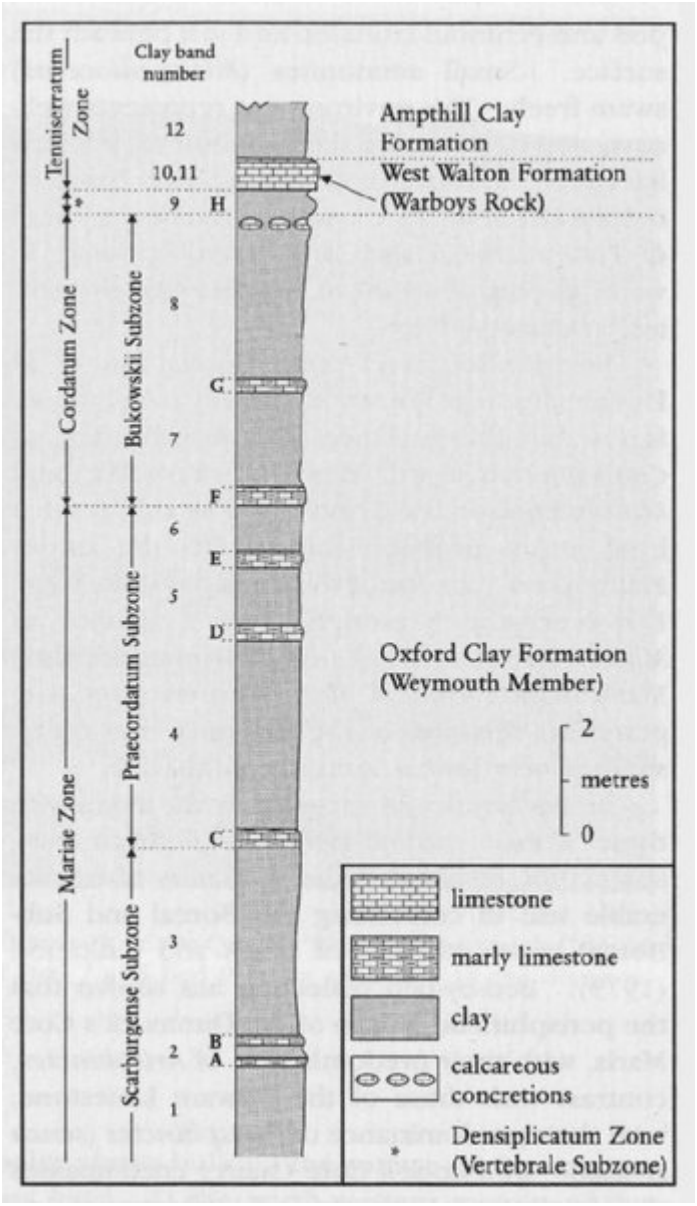


(Figure 3.3) Locality map of quarries in the Upware inlier. Outcrop of the Upware Limestone (mapped as 'West Walton Beds'), Ampthill and Kimmeridge clays from BGS Sheet 188 (Cambridge) (1981) and Wright et al. (2000).



(Figure 3.4) Log of the 'Corallian' succession in Dimmock's Cote Quarry (after Wright et al., 2000, fig. 4).

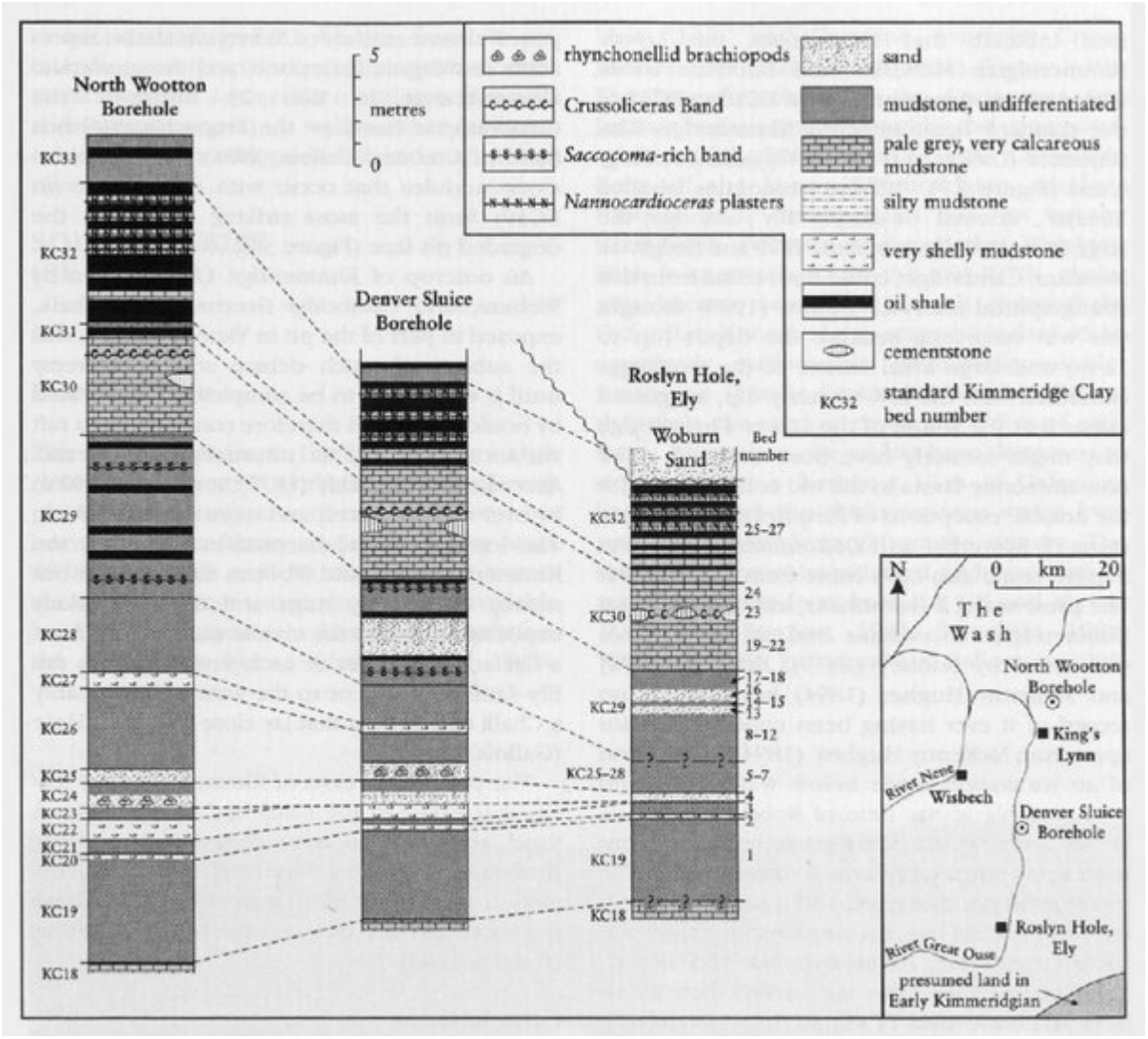
(Figure 3.5) View of the central part of the eastern face of Dimmock's Cote Quarry. Blocks of the tough Crinoid Bed are in the foreground, with the manly limestones of Bed 7 and Bed 9 being excavated in the distance. (Photo: J.K. Wright.)



(Figure 3.6) Log of the Oxford Clay succession in Warboys Pit (after Callomon, 1968).

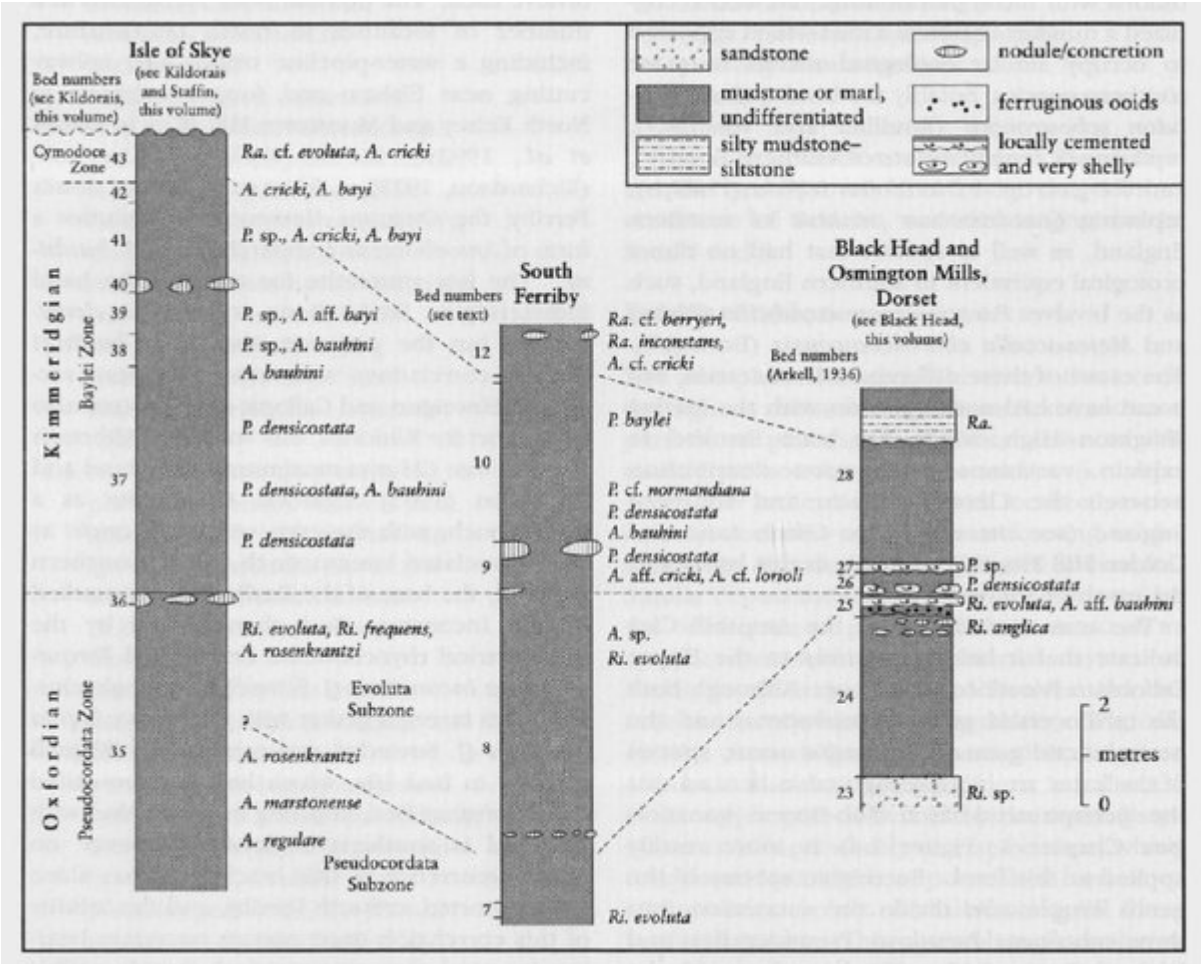
(Figure 3.7) View of the upper part of Warboys Pit showing Cordatum Zone Oxford Clay overlain by West Walton Formation, beds 9–12, with the Warboys Rock', the distinctive pale band, close to the top of the section. (Photo: J.K. Wright.)

(Figure 3.8) View of a degraded section of Lower Kimmeridge Clay at Roslyn Hole showing the prominent marker band (arrowed) formed by a line of cementstone nodules in Bed 23 (KC30). Ely Cathedral is seen in the background. (Photo: A13722, reproduced by kind permission of the Director, British Geological Survey © NERC.)

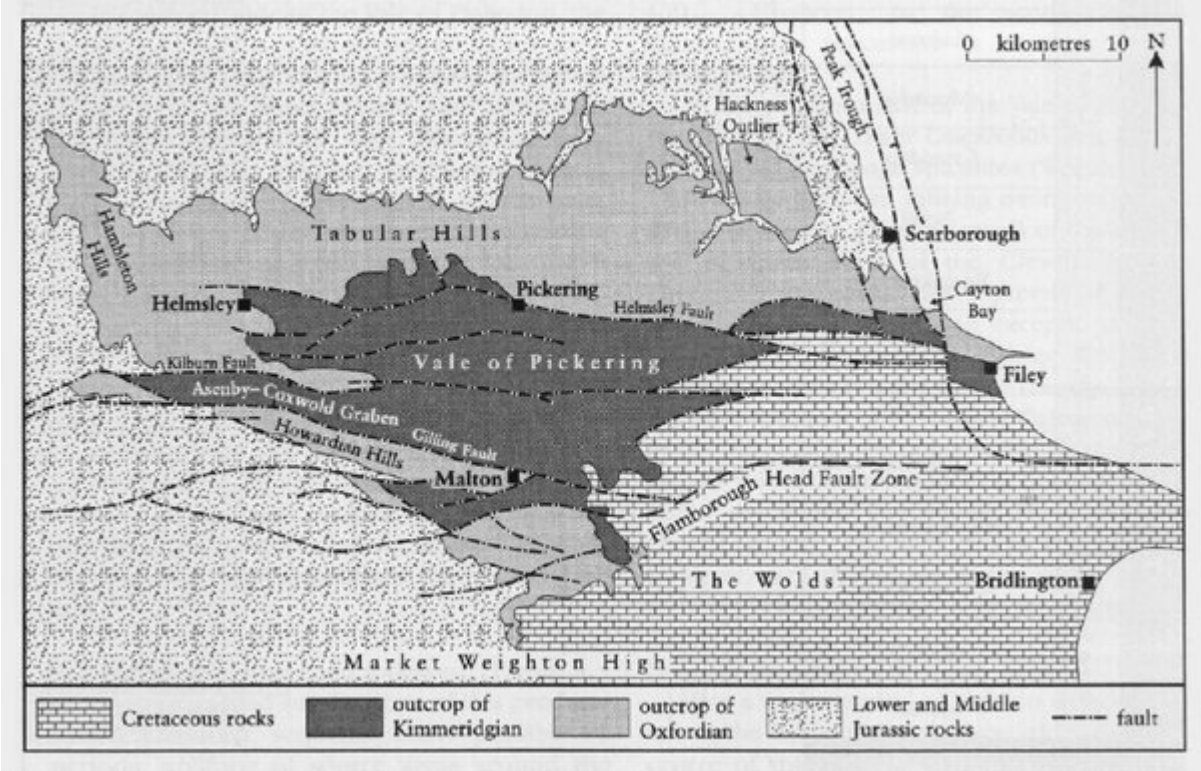


(Figure 3.9) Graphic section of the Kimmeridge Clay at Roslyn Hole and borehole sections in Norfolk showing the southwards attenuation towards Ely (after Gallois,1988, fig. 14).

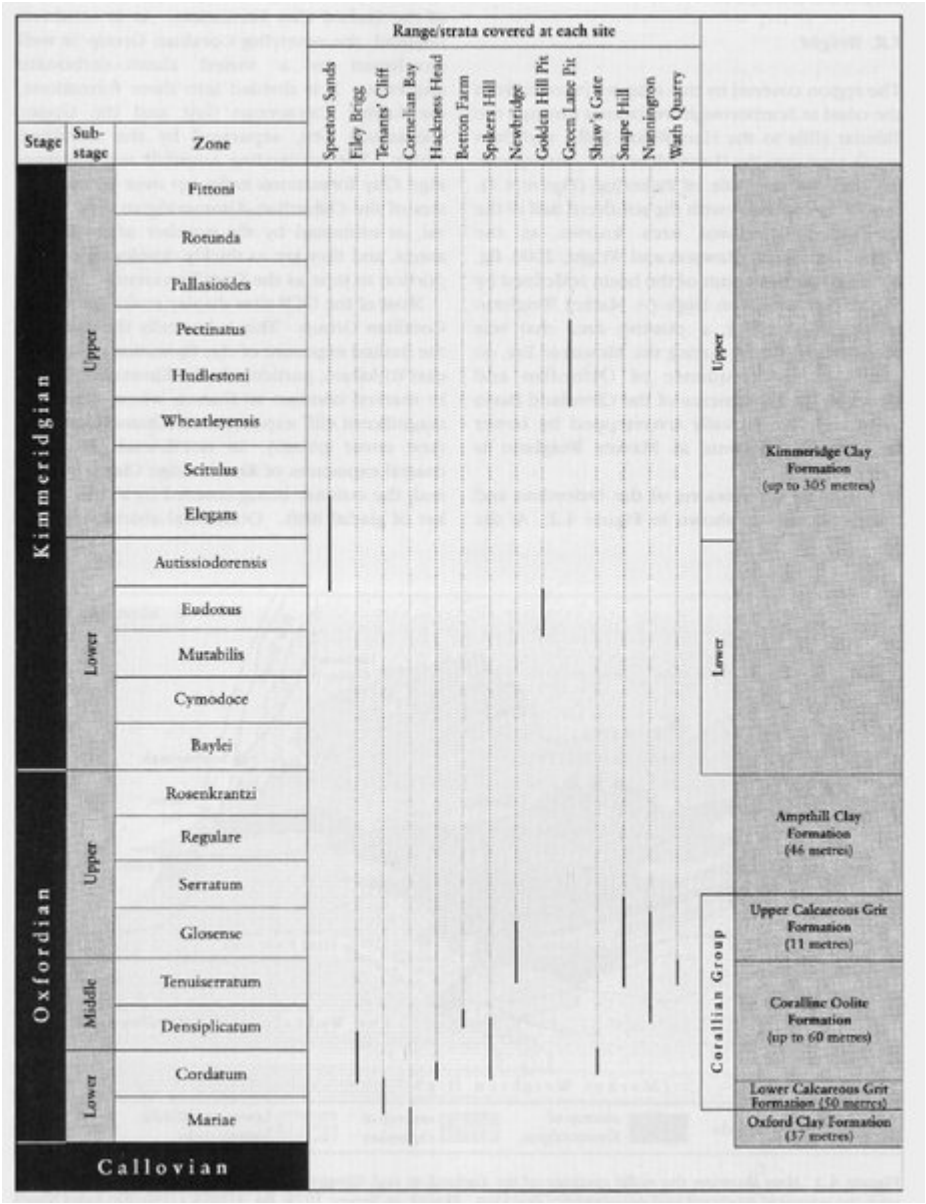
(Figure 3.10) General view of the South Ferriby GCR site in 1987. (Photo: A14379, reproduced by kind permission of the Director, British Geological Survey ©NERC.)



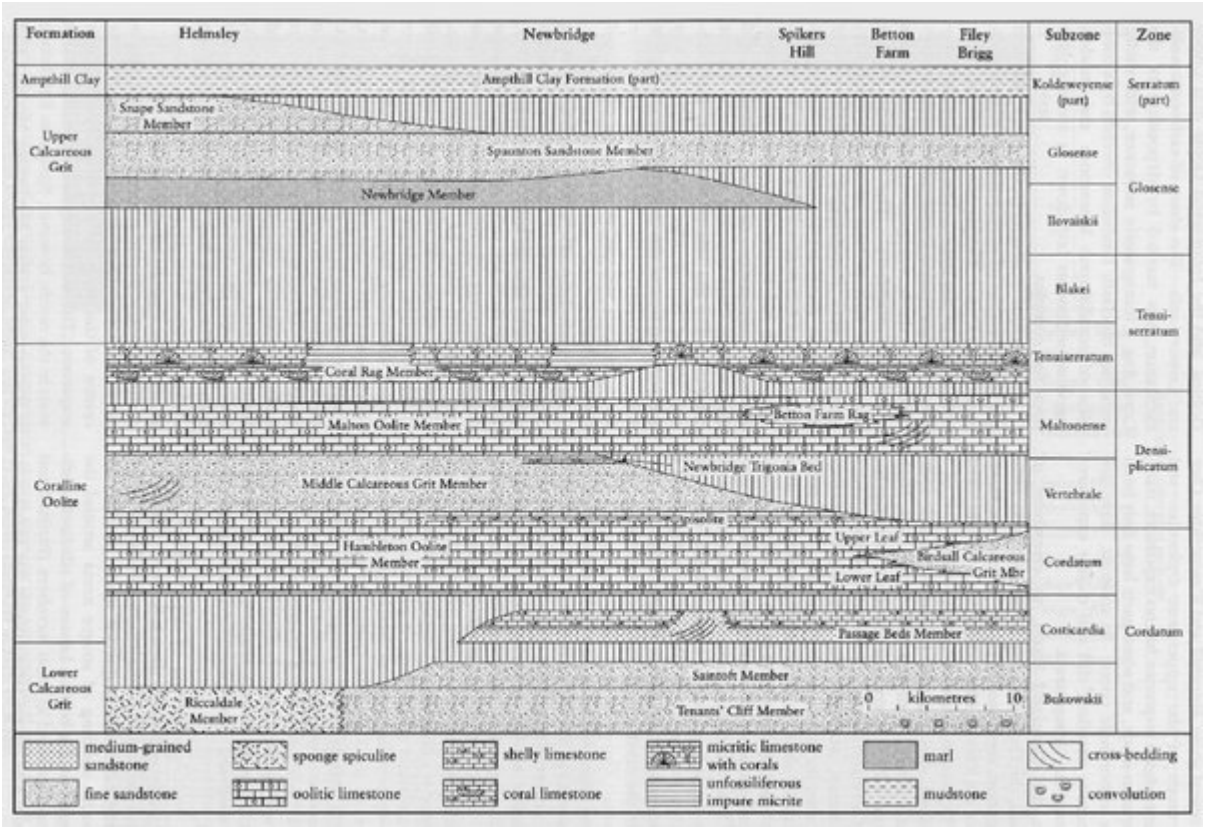
(Figure 3.11) Correlation between the Oxfordian–Kimmeridgian boundary beds at South Ferriby and those in Dorset and Skye (after Page and Cox, 1995, fig. 2). A. = Amoeboceras, P. = Pictonia, Ra. = Rasenia, Ri. = Ringsteadia.



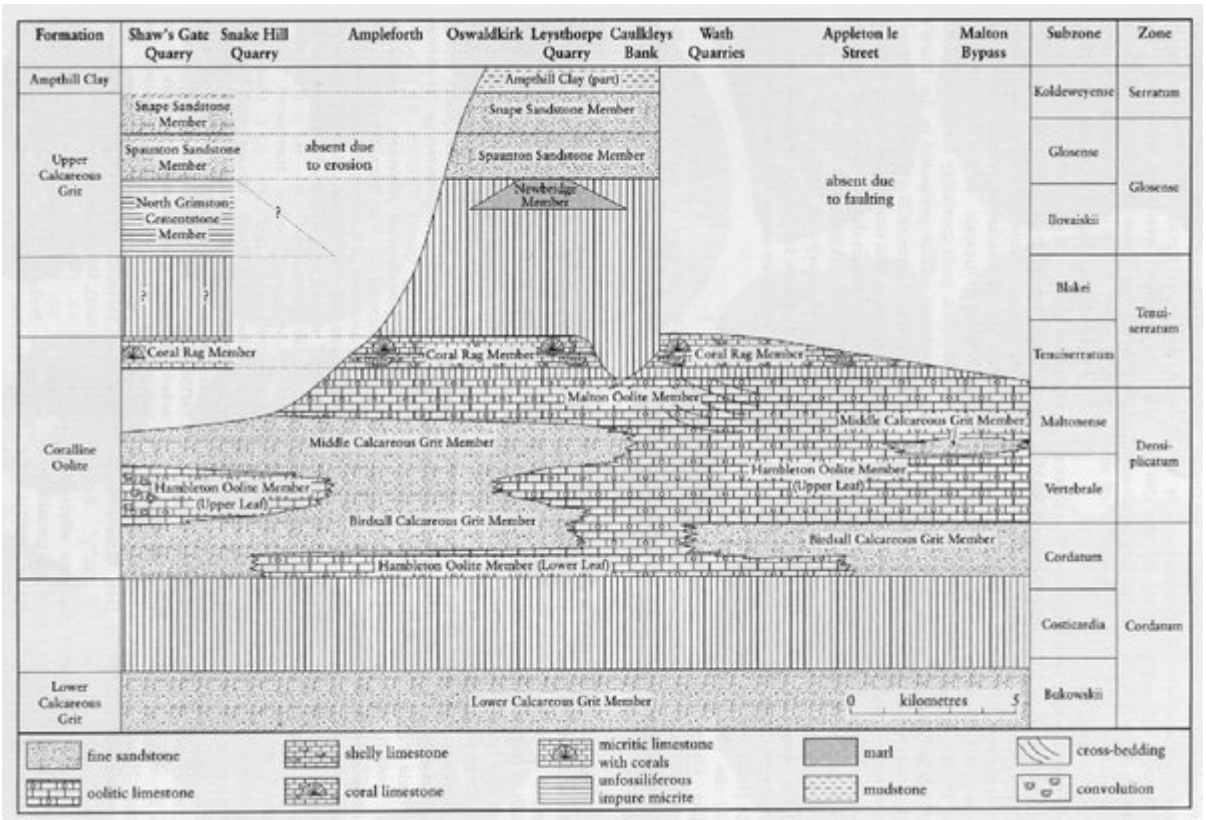
(Figure 4.1) Map showing the solid geology of the Oxfordian and Kimmeridgian beds in the Cleveland Basin, with the principal stuctural and geographical features. (Based on Versey, 1929, fig. 1; BGS 1:250 000 Solid Sheet 54N 02W (Tyne-Tees) (1981); BGS 1:1 500 000 Tectonic map of Britain, Ireland and adjacent areas (1996) and BGS 1:50 000 Sheet 54 (Scarborough) (1998)). In the Vale of Pickering there is a thick cover of Quaternary lacustrine deposits.



(Figure 4.2) Zones of the Oxfordian and Kimmeridgian stages, showing the stratigraphical ages of each of the formations present in the Cleveland Basin, and the age range of the exposure at each GCR site.

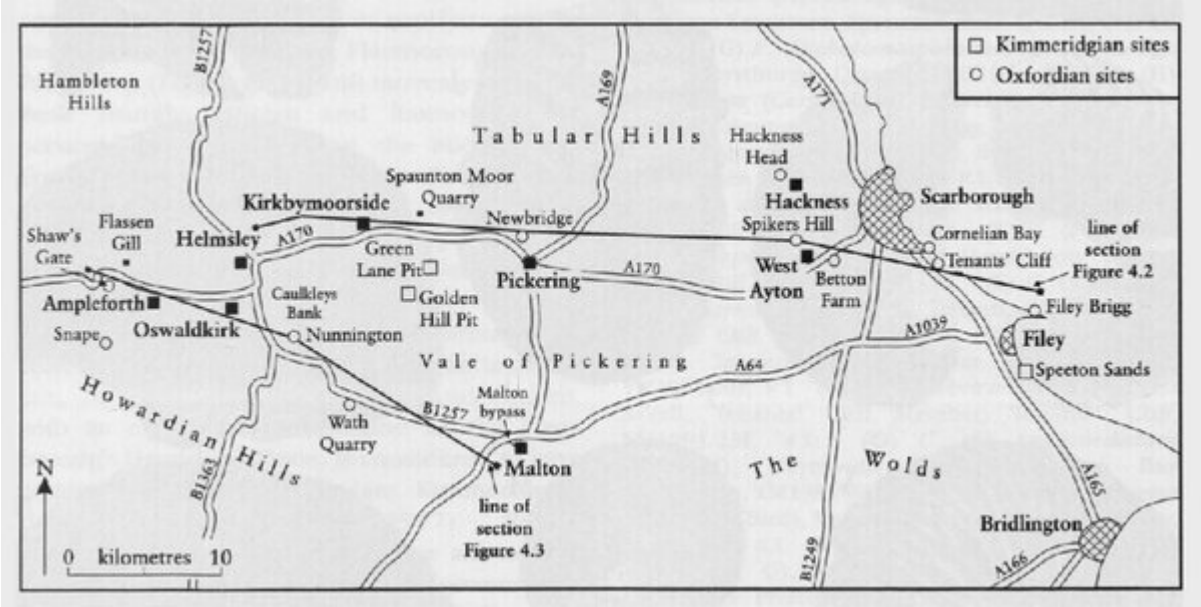


(Figure 4.3) Stratigraphical cross-section of the Yorkshire Corallian Group on the north side of the Vale of Pickering from Helmsley to Filey (after Rawson and Wright, 1995, fig. 15).

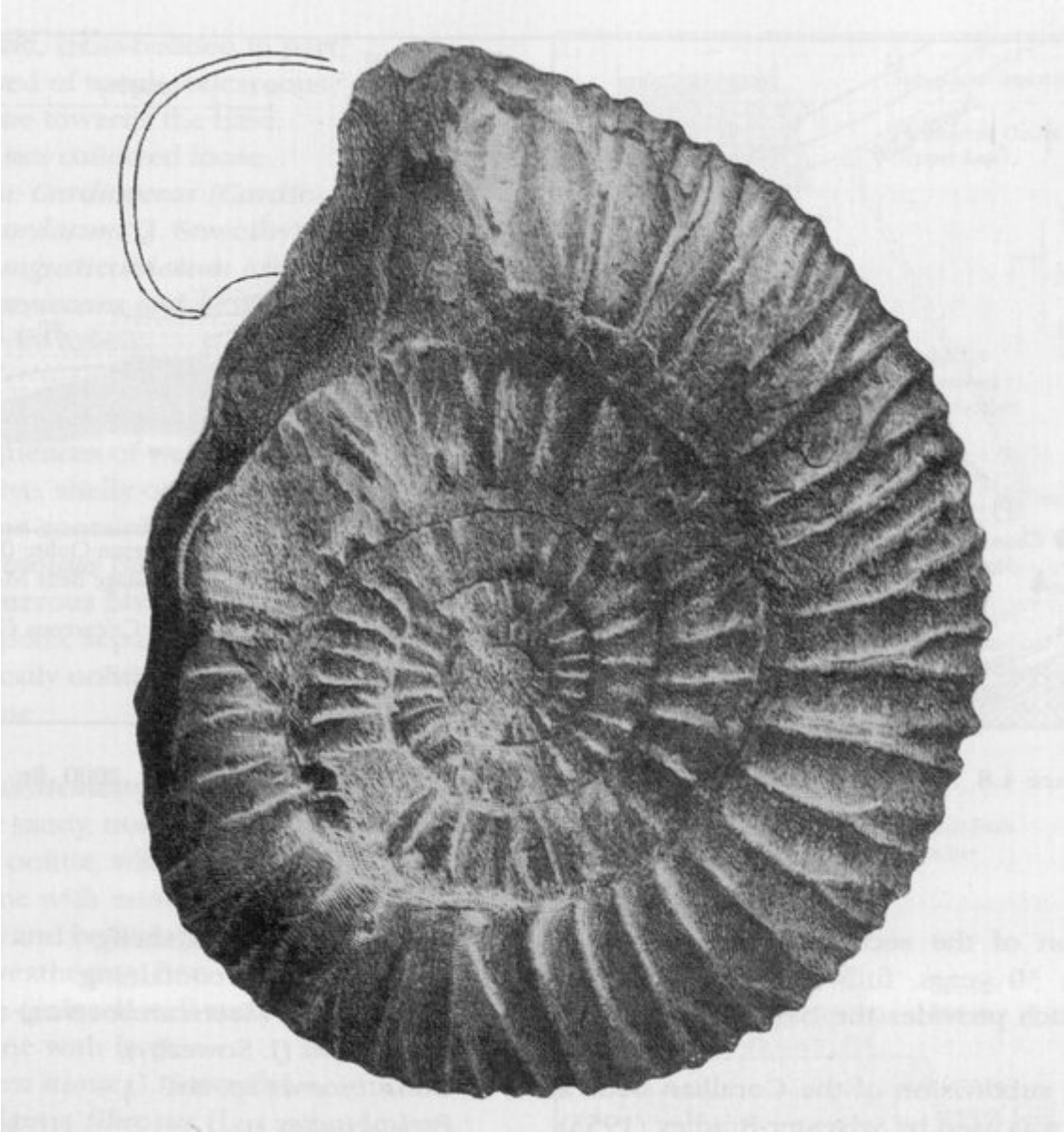


(Figure 4.4) Stratigraphical cross-section of the Yorkshire Corallian Group on the south-west side of the Vale of Pickering from the I Iambleton Hills to Malton.

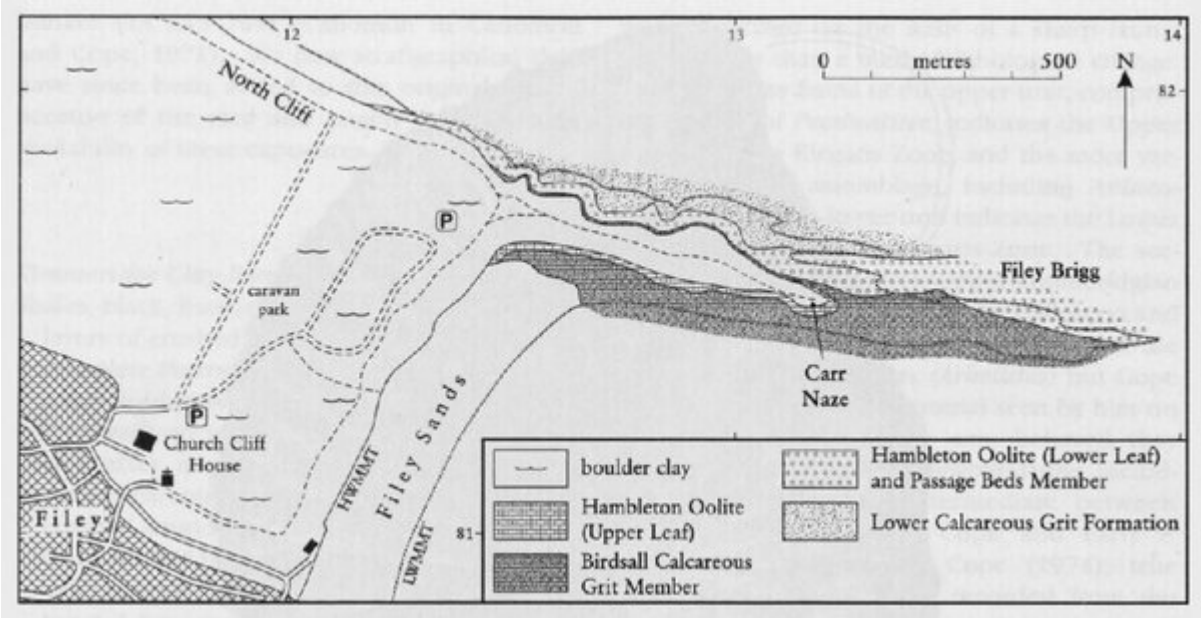
(Figure 4.5) P Selection of ammonites from the Corallian Group of the Cleveland Basin. (A) Amoeboceras nunningtonense Wright (holotype), Spaunton Sandstone, Leysthorpe Quarry, m27, x 1. (B) A. glosense (Bigot and Brasil), Newbridge Member, Leysthorpe Quarry, U/1/14, x 1. (C) A. transitorium Spath, Newbridge Member, Leysthorpe Quarry, U/1/5, x 1. (D) A. ilovaiskii (M. Sokolov), Spaunton Sandstone, Newbridge Quarry, U/2/38, x1. (E) A. newbridgense Sykes and Callomon, Spaunton Sandstone, Newbridge Quarry, U/2/20, x 1. (F) Perisphinctes (Pseudarisphinctes) pachachii Arkell, Spaunton Sandstone, Spaunton Moor Quarry, U/3/63, x0.33. (G) P. (Dichotomosphinctes) sp. Newbridge Beds, Leysthorpe Quarry, U/1/103, x0.7. (H) Cardioceras (Cardioceras)persecans S. Buckman, Birdsall Calcareous Grit, Filey Brigg, YM1983/45F, x 1. (I) C. (C.) cordatum (J. Sowerby), Birdsall Calcareous Grit, Flassen Gill, YM1983/36F, x 1. (1) C. (Vertebriceras) aff. dorsale S. Buckman, Hambleton Oolite, Spikers Hill Quarry, C/2/17, x 1. (K) C. (Plasmatoceras)popilaniense Boden, Hambleton Oolite, Spikers Hill Quarry, C/2/59, x 1. (L) C. (Scarburgiceras) harmonicum Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/17F, x 1. (M) C. (S.)reesidei Maire, Tenants' Cliff Member, Tenants' Cliff, YM1983/20F, x 1. (N) C. (Vertebriceras) aff. phillipsi Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/23F, x 1. (O) C. (S.)praecordatum (Douvillé), Weymouth Member, Cayton Bay Waterworks, YM1983/9F, x 1. (P) C. (S.)scarburgense (Young and Bird), Weymouth Member, Cornelian Bay, YM1983/3F, x 1. (Photos: (A-E), (H, I), (L–P), J.K Wright; (F, G), K. D'Souza; (J, K) K. Denyer. Collections: Prefixes 'U', 'C', J.K. Wright Collection; 'YM', Yorkshire Museum Collection, York; 'm', Woodend Museum, Scarborough.)



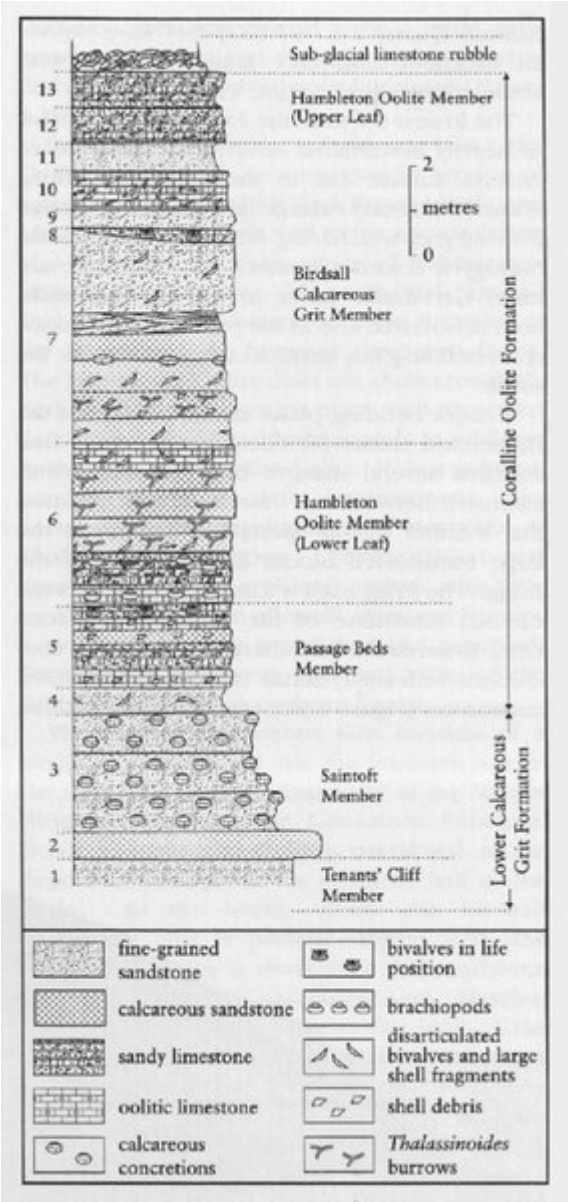
(Figure 4.6) Map showing the locations of Oxfordian and Kimmeridgian GCR sites in north-east Yorkshire, and other localities mentioned in the text.



(Figure 4.7) The type specimen of Subdichotomoceras lamplughi Spath, type species of the genus, from the Eudoxus Zone at Speeton, as figured by Pavlow and Lamplugh (1892, p. 111). Approximately natural size.

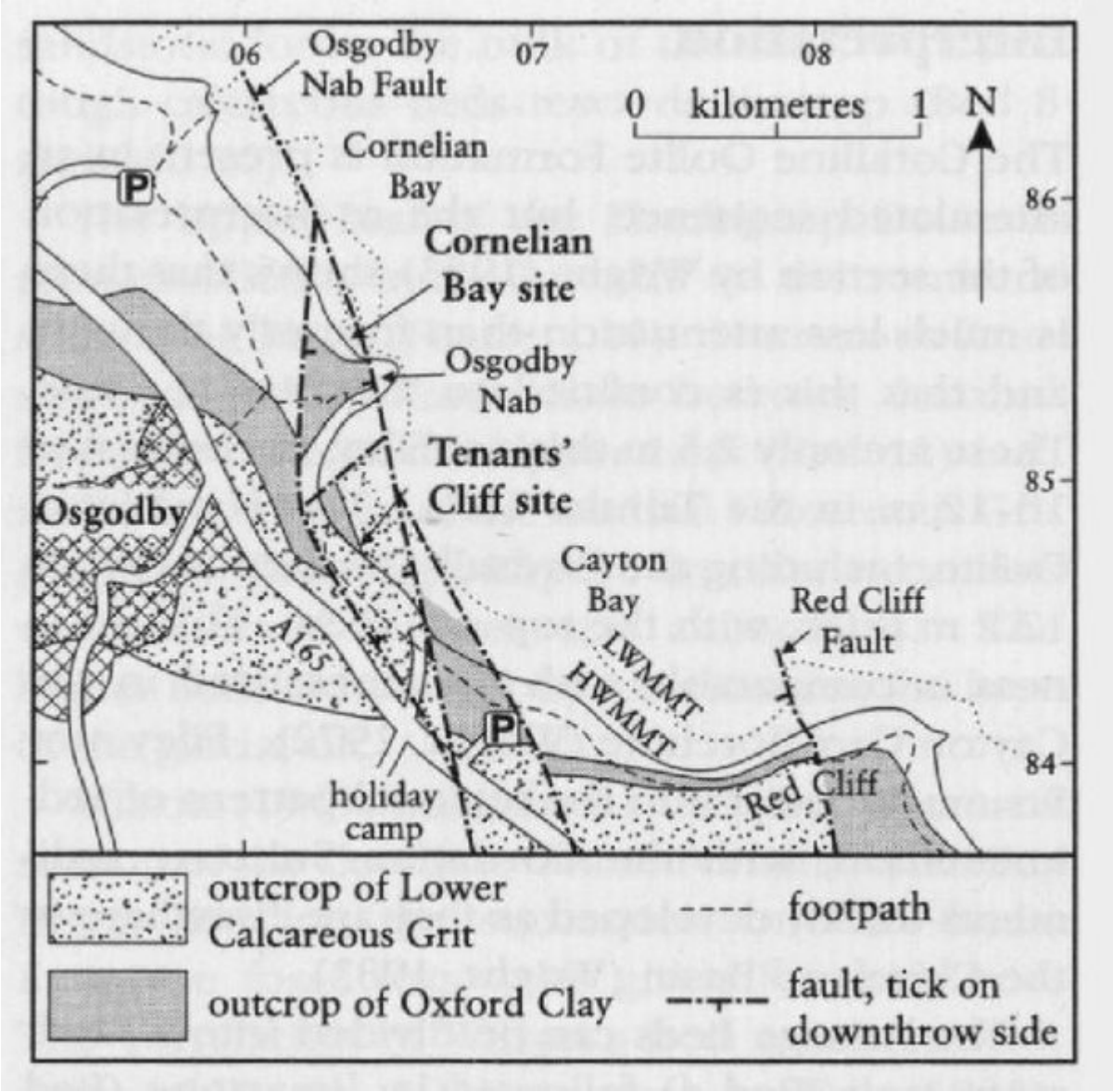


(Figure 4.8) Sketch map of the geology of Filey Brigg (after Rawson and Wright, 2000, fig. 33).

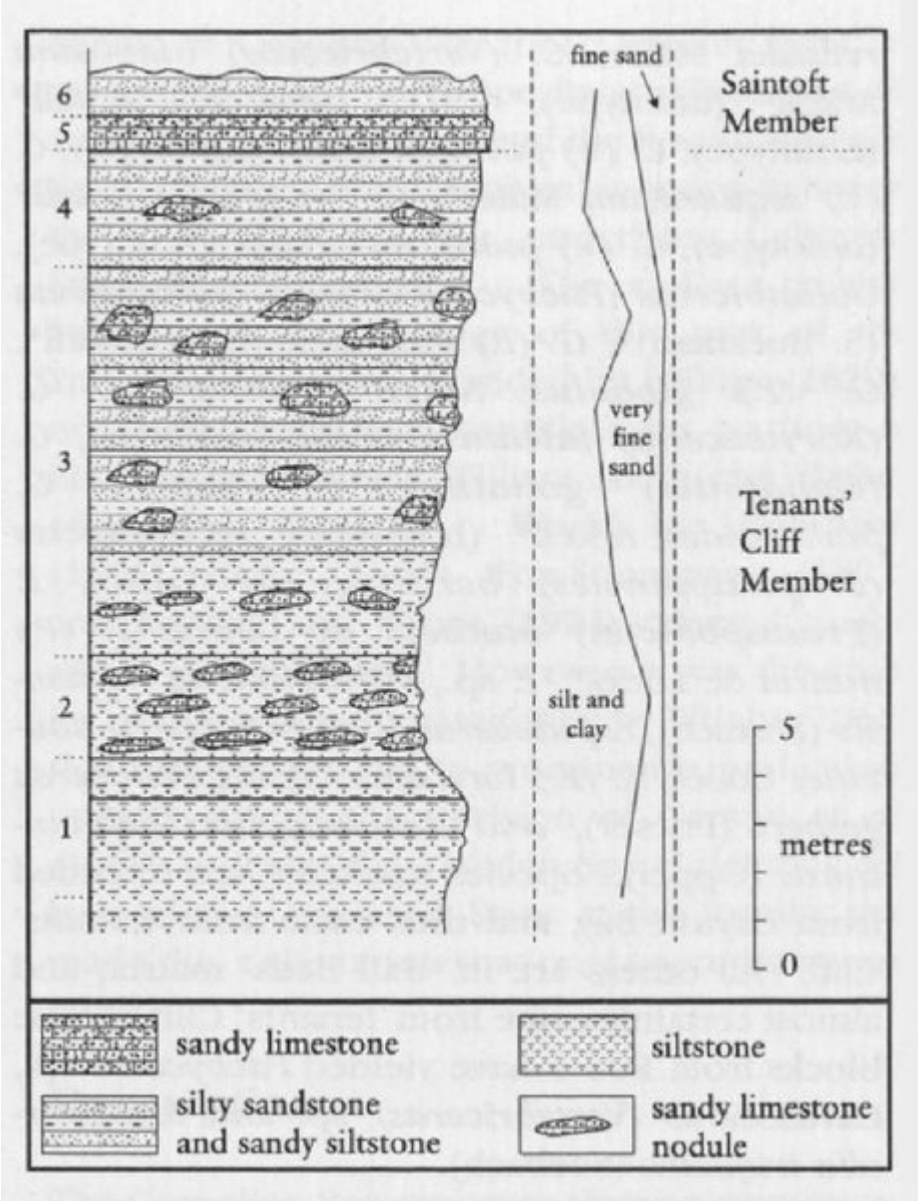


(Figure 4.9) Log of the Corallian succession at Filey Brigg (after Rawson and Wright, 2000, fig. 34).

(Figure 4.10) View of the southern side of Filey Brigg showing fossiliferous Hambleton Oolite (Upper Leaf) overlying Birdsall Calcareous Grit in the rock platform. The junction is where the figure is pointing with the hammer. (Photo: J.K. Wright.)

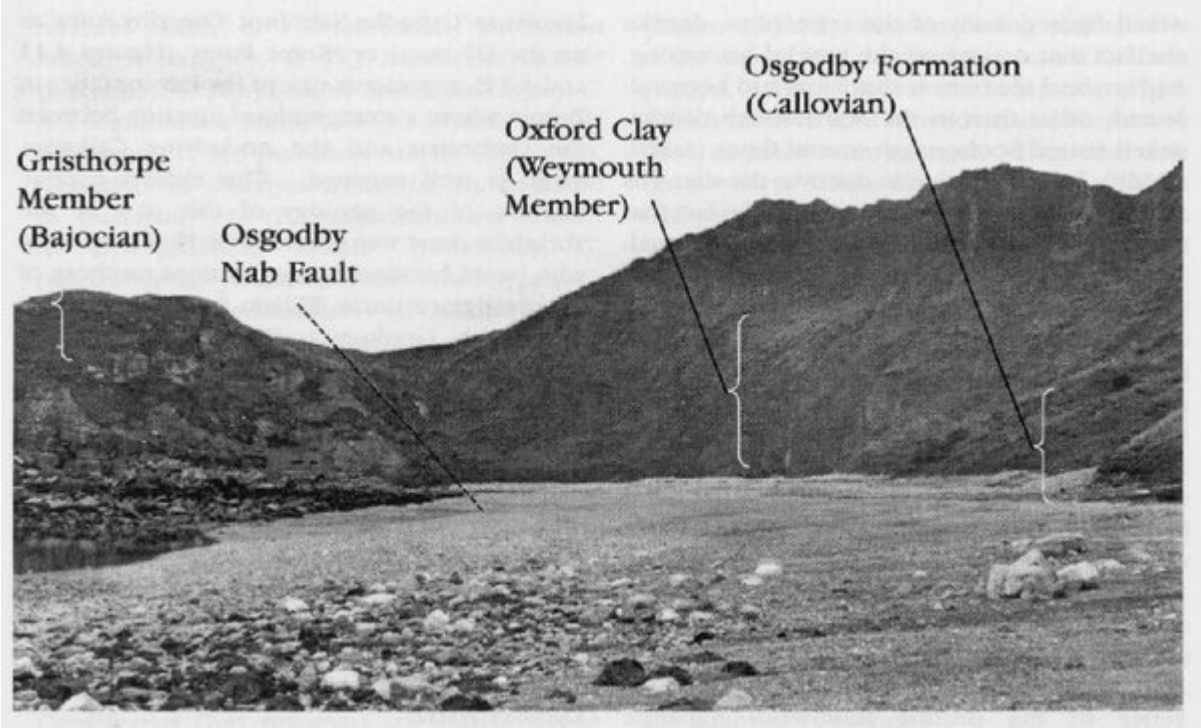


(Figure 4.11) Locality map of the Tenants' Cliff and Cornelian Bay GCR sites. Outcrop of the Oxford Clay and Lower Calcareous Grit from Wright (1968, fig. 9).

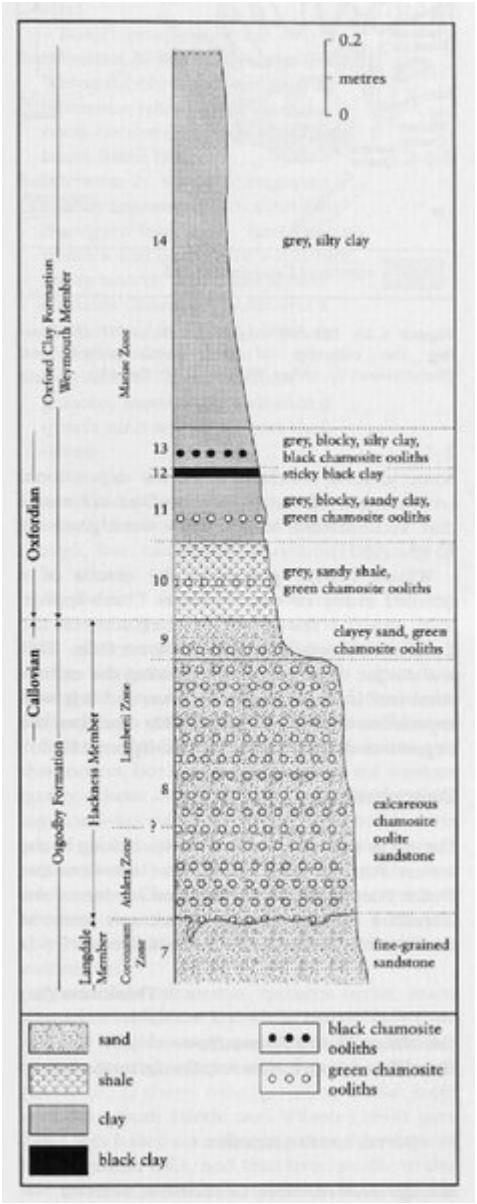


(Figure 4.12) Log of the Lower Calcareous Grit succession at Tenants' Cliff; as measured by J.K. Wright in 1982.

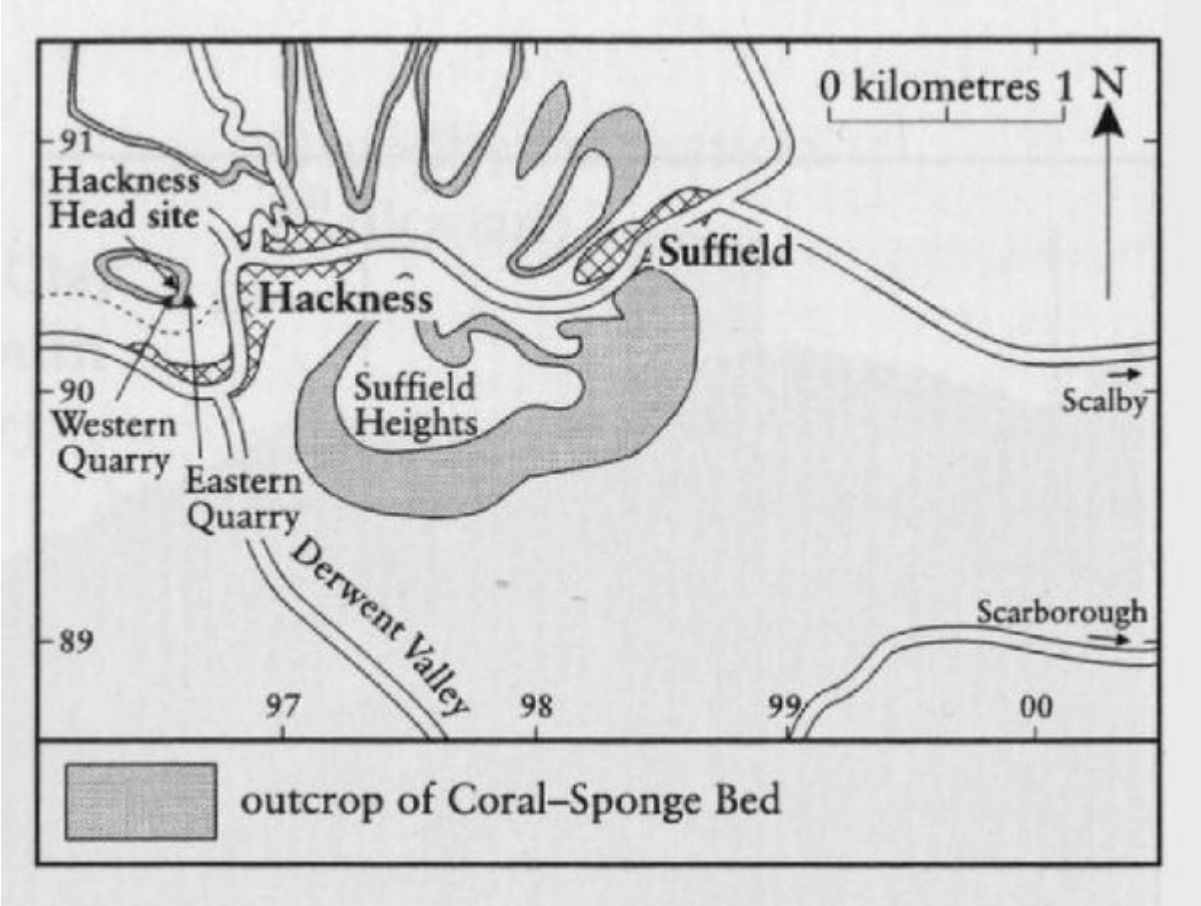
(Figure 4.13) Exceptionally well-preserved ammonites from the Tenants' Cliff Member. (A) Mirosphinctes frickensis (Moesch) (Tethyan), LG744; (B) Neocampylites delmontanus (Oppel) (Tethyan), LG742; (C) Cardioceras (Scarburgiceras) bukowskii Maire (Boreal), LG736. (Photos: K. D'Souza. Specimens in the J.K. Wright Collection. Natural size.)



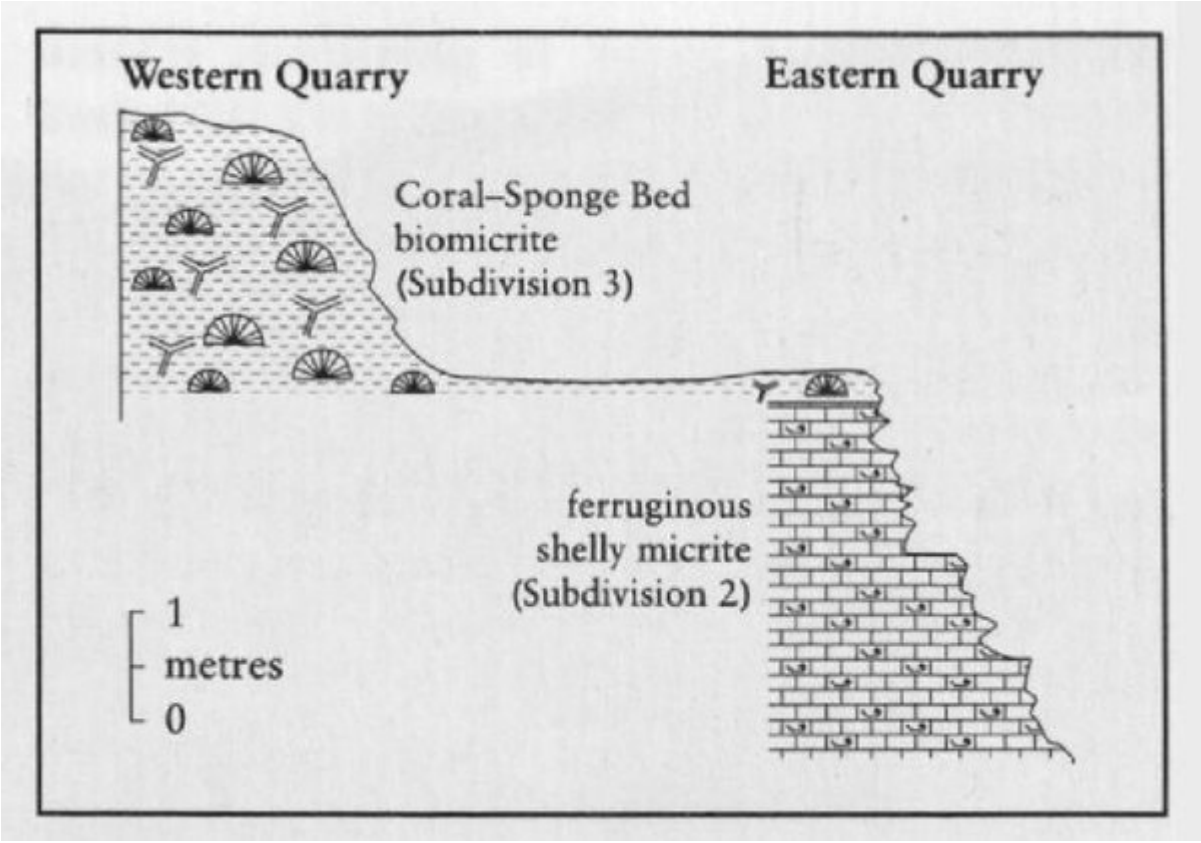
(Figure 4.14) General view of the southern end of Cornelian Bay showing the Middle Jurassic Ravenscar Group (on the left) faulted against easterly dipping Osgodby Formation sandstones (Callovian) overlain by Weymouth Member Oxford Clay. (Photo: J.K. Wright.)



(Figure 4.15) Log of the Upper Callovian–Lower Oxfordian sequence at Cornelian Bay (after Wright, 1969, fig. C4).

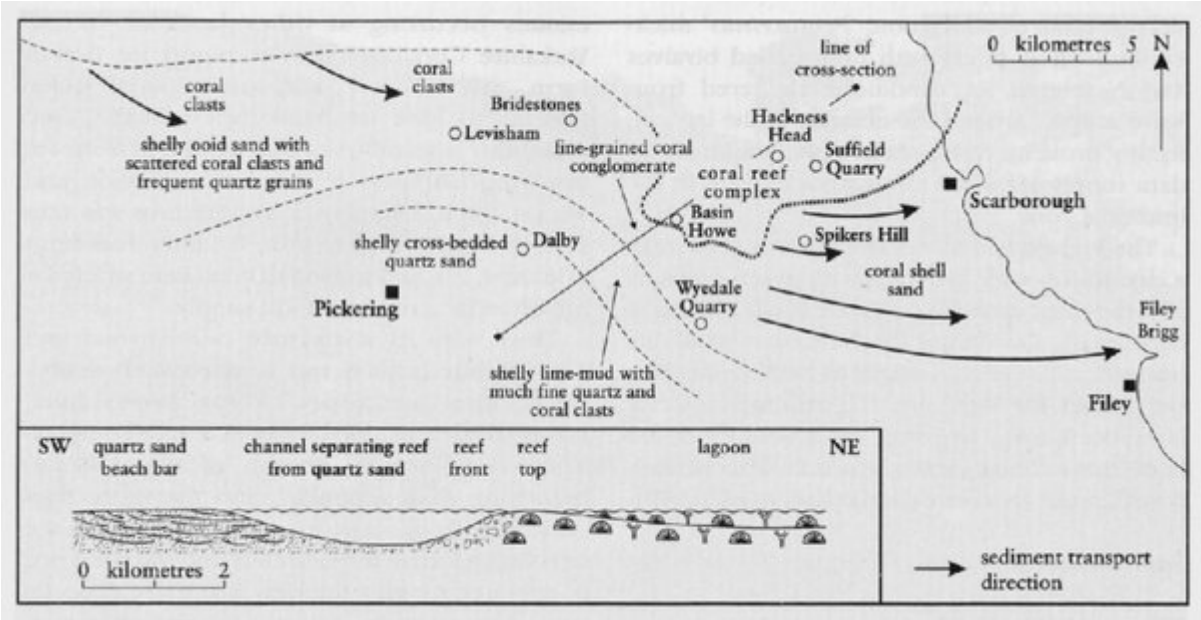


(Figure 4.16) Locality map for Hackness Head showing the outcrop of the Coral–Sponge Bed (Subdivision 3). (After Wilson, 1949, fig. 43.)

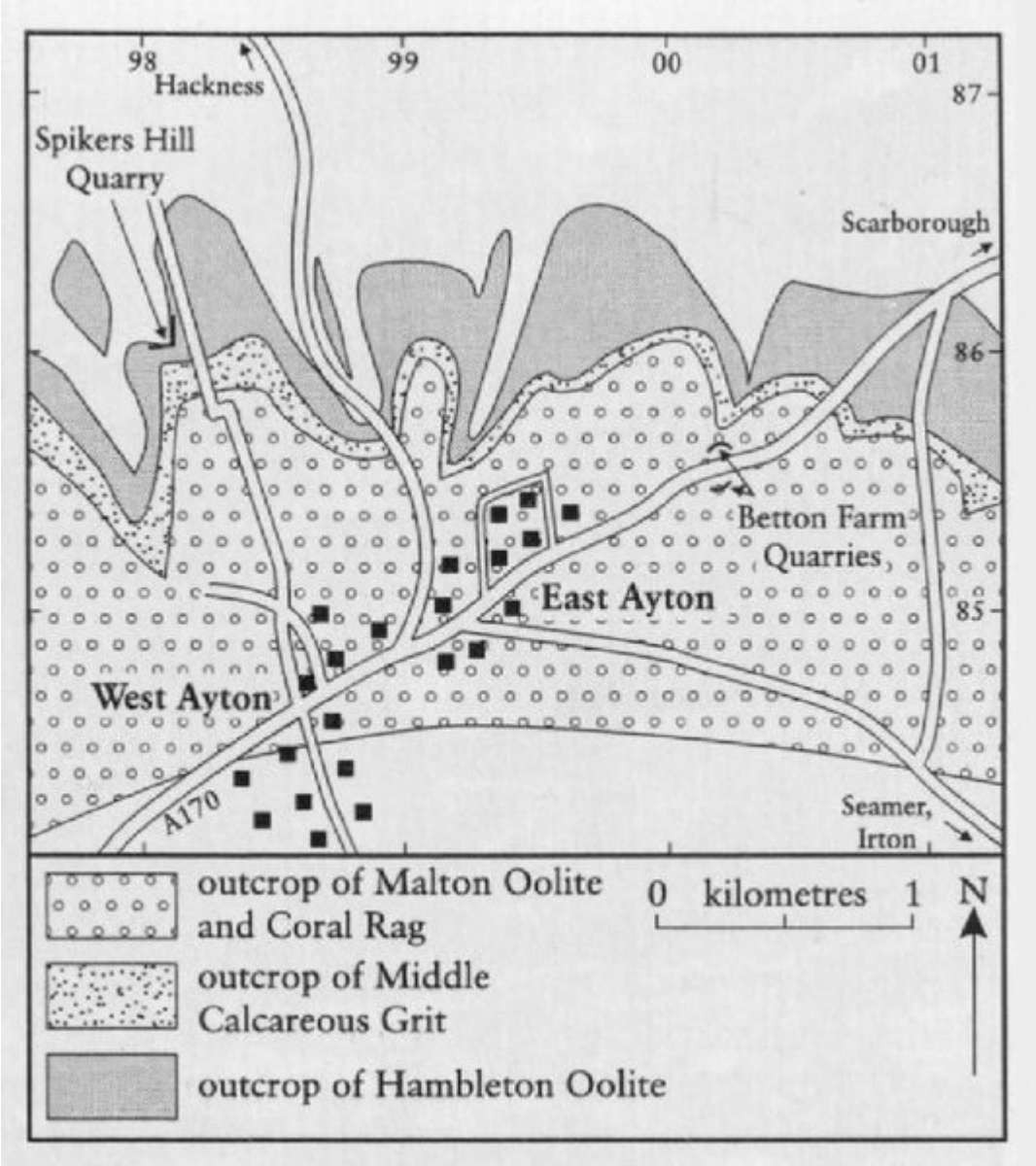


(Figure 4.17) Cross-section of Hackness Head showing the two quarry sections, as measured by J.K. Wright in 1991.

(Figure 4.18) View of the eastern quarry at Hackness Head, showing the massive, bioclastic limestones of Subdivision 2 overlain by coral rubble (Subdivision 3) just below the grass at the top. Hammer shaft (mid-left of picture) is 30 cm. (Photo: J.K. Wright.)



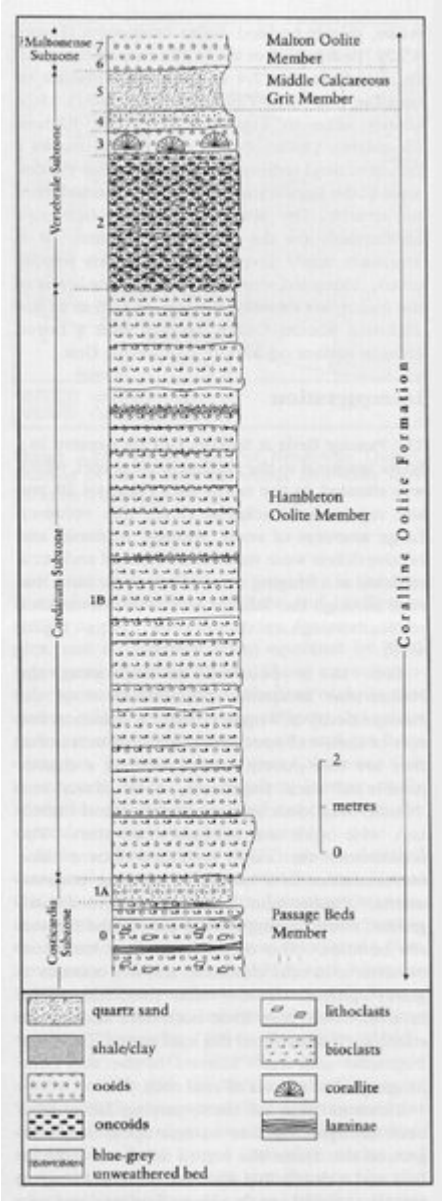
(Figure 4.19) Facies distribution across the central and eastern parts of the Cleveland Basin during deposition of the Hackness Coral–Sponge Bed (after Wright, 1992, fig. 10).



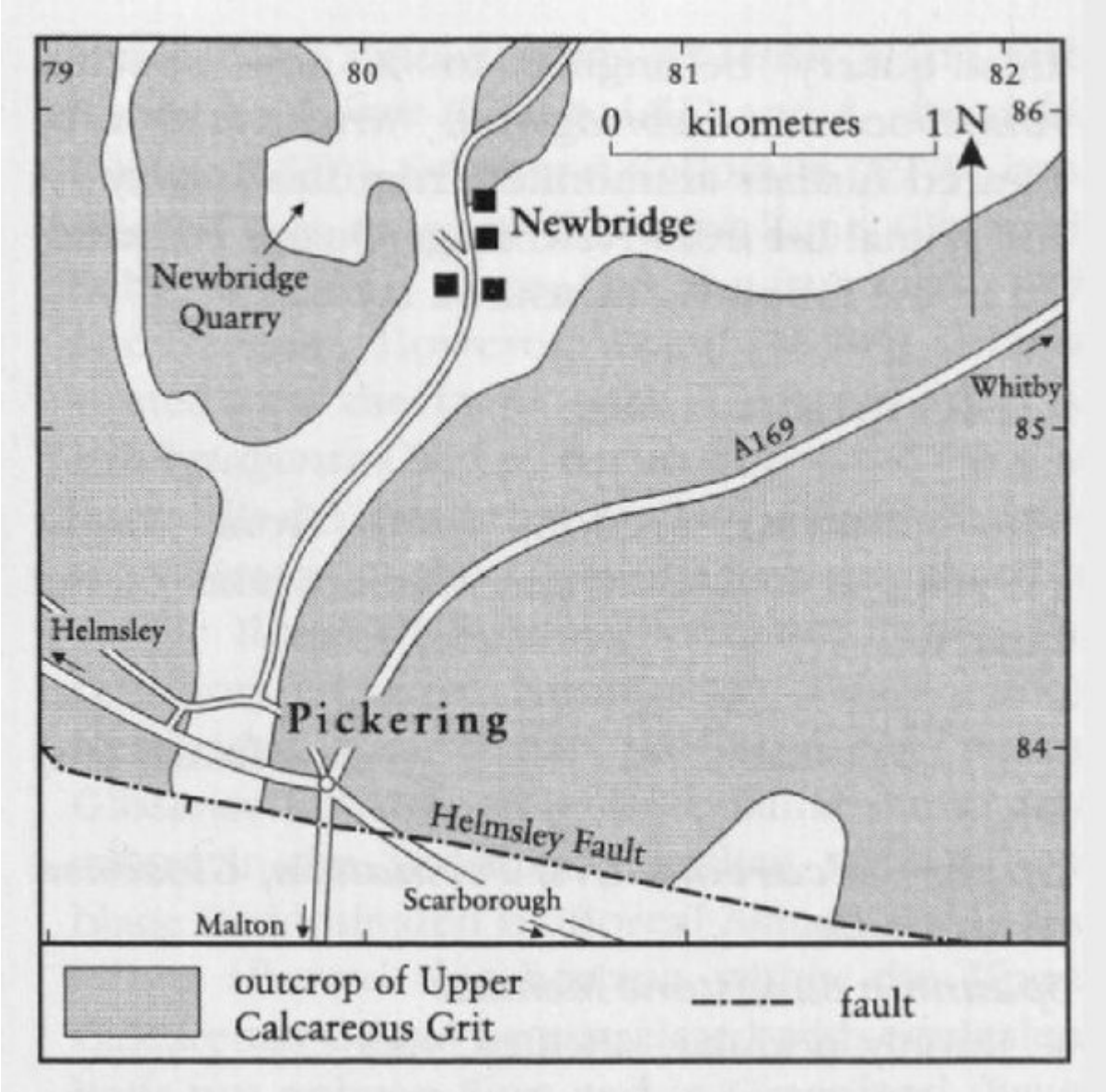
(Figure 4.20) Locality map of the Betton Farm and Spikers Hill GCR sites. Geological outcrops from BGS Sheet 54 (Scarborough) (1998).

(Figure 4.21) View of Betton Farm Quarry (north) showing rounded masses of Thamnasterian reef coral above the hammer (30 cm) resting on oolite (Mahon Oolite). (Photo: J.K. Wright.)

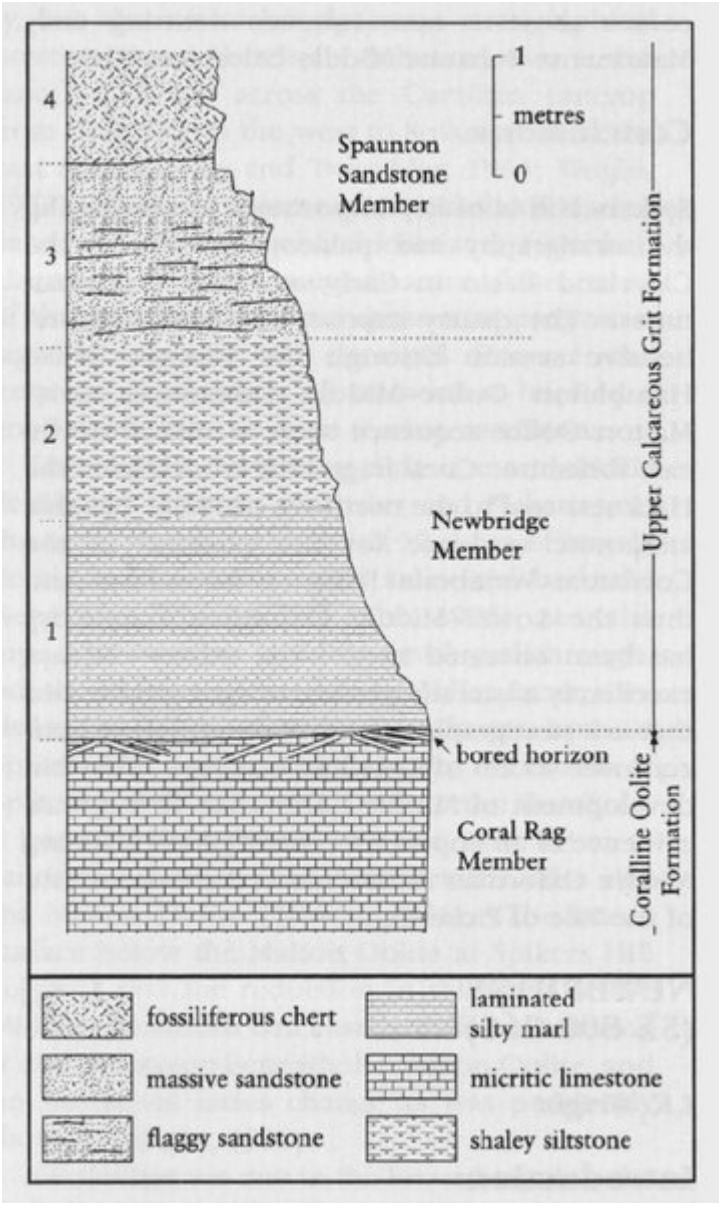
(Figure 4.22) The main east–west face in the Hambleton Oolite at Spikers Hill Quarry. The dark, pisoidal 'Blue Band' (Bed 2) is clearly seen towards the top of the quarry, overlain by beds 3 to 7, which are more thinly bedded than those below. Since this photo was taken, the quarry has been deepened to reveal part of the Passage Beds, Bed '0'. (Photo: J.K. Wright.)



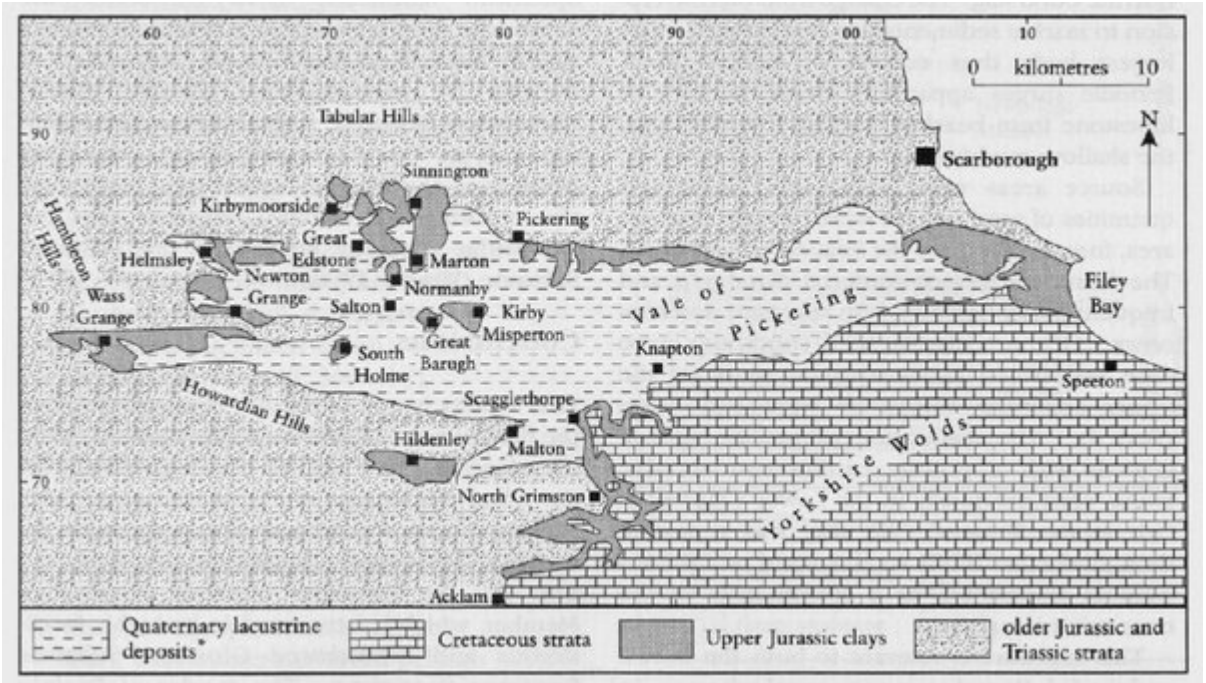
(Figure 4.23) Log of the Corallian succession at Spikers Hill Quarry, as measured by J.K. Wright in 1991.



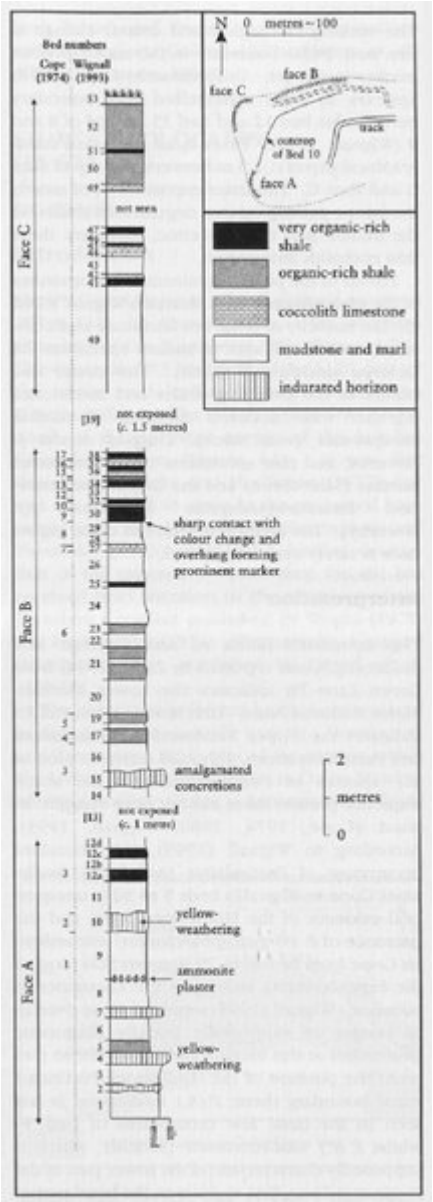
(Figure 4.24) Locality map of Newbridge Quarry. Outcrop of the Upper Calcareous Grit from BGS Sheet 53 (Pickering) (1973).



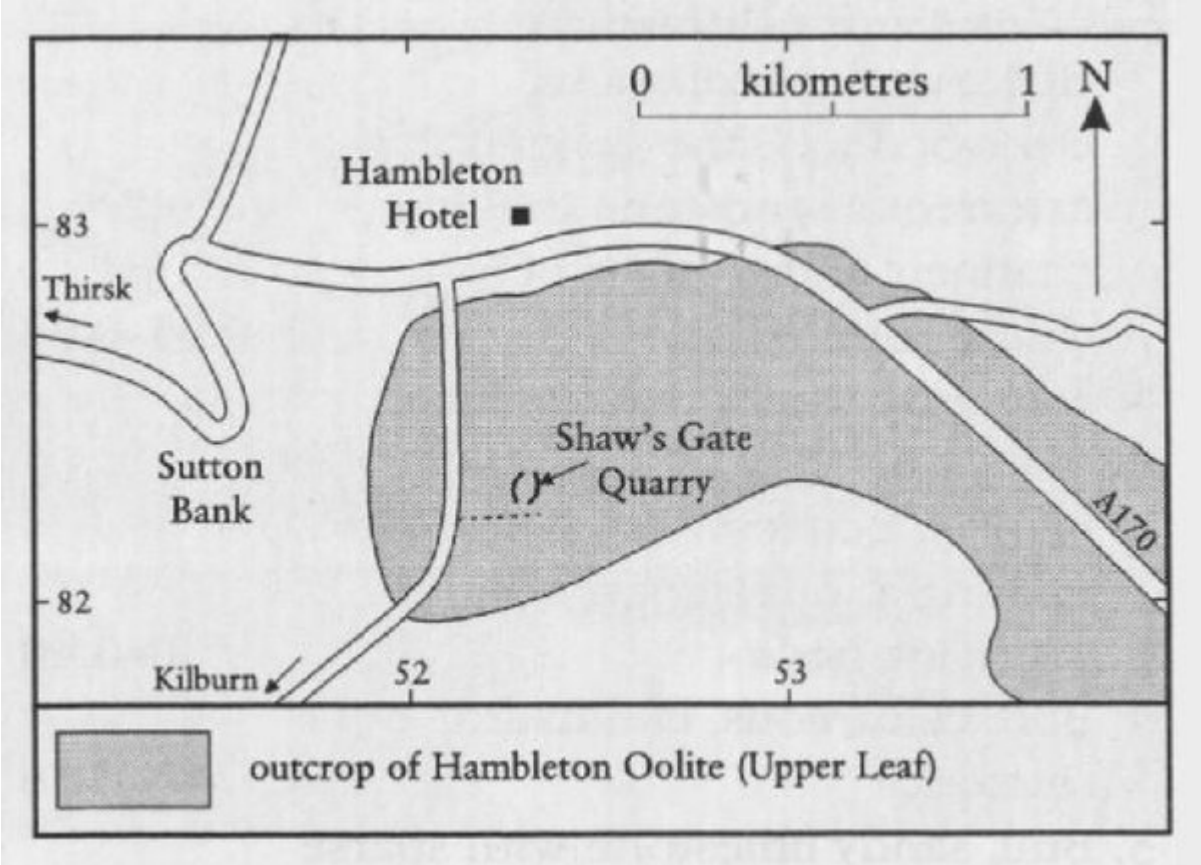
(Figure 4.25) Log of the Upper Calcareous Grit at Newbridge Quarry, as measured by J.K. Wright in 1998.



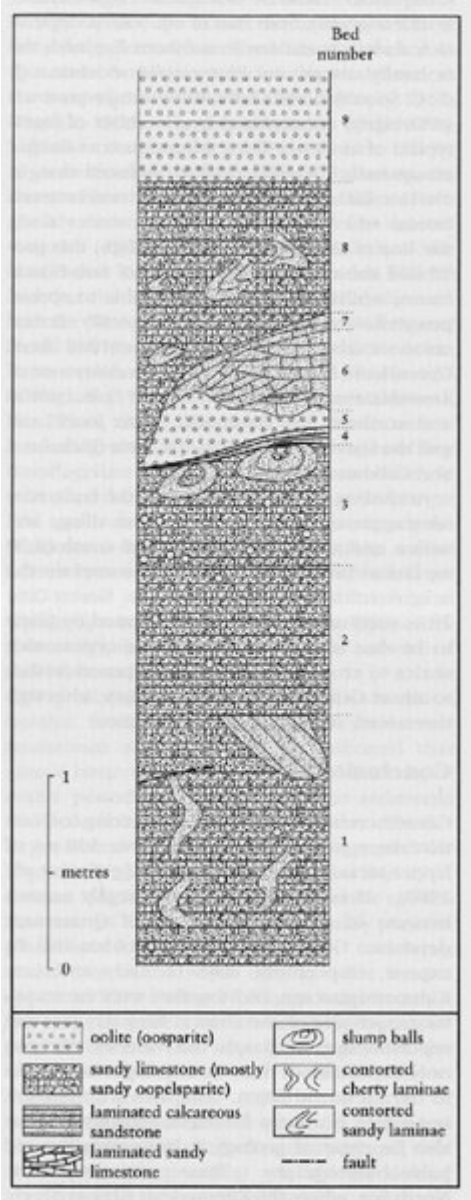
*(Figure 4.26) Simplified geological drift sketch map of the Vale of Pickering showing localities cited in the text (based on Geological Survey 1:50 000 sheets 53 and 54). The Green Lane Pit and Golden Hill Pit GCR sites are located at Marton. *Other drift deposits are omitted for clarity.*



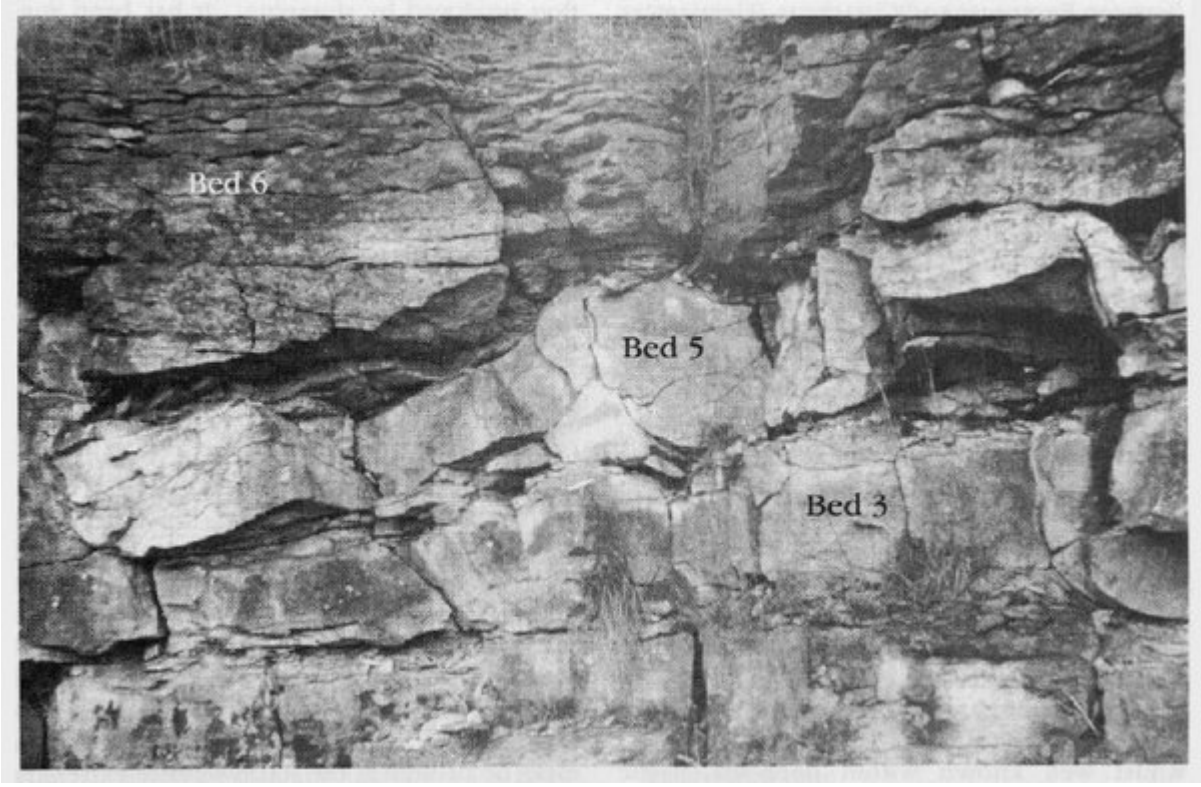
(Figure 4.27) Composite graphic log of the section at which weathers to form a prominent overhang. Golden Hill Pit (after Wignall, 1993, fig. 3).



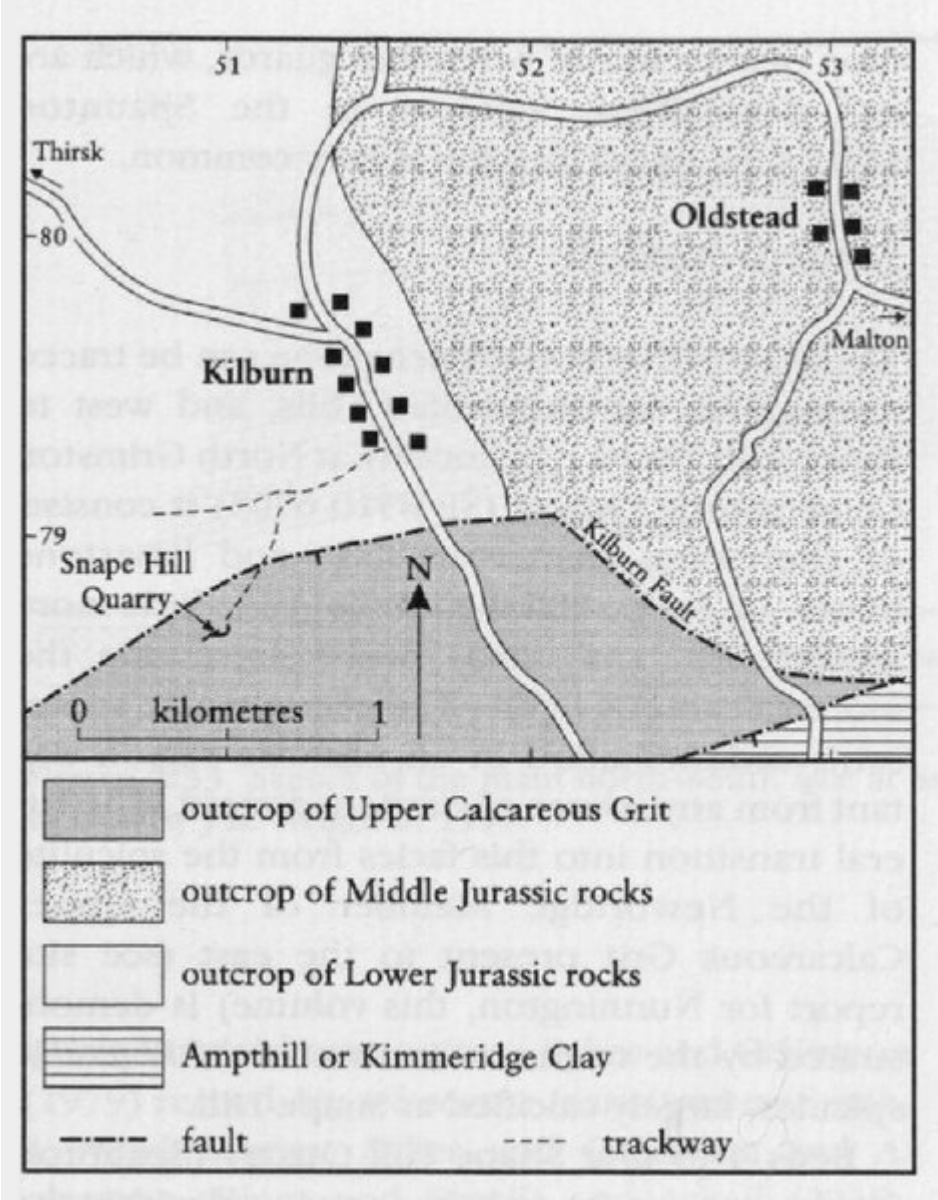
(Figure 4.28) Locality map of Shaw's Gate Quarry. Outcrop of the Hambleton Oolite from BGS Sheet 52 (Thirsk) (1992).



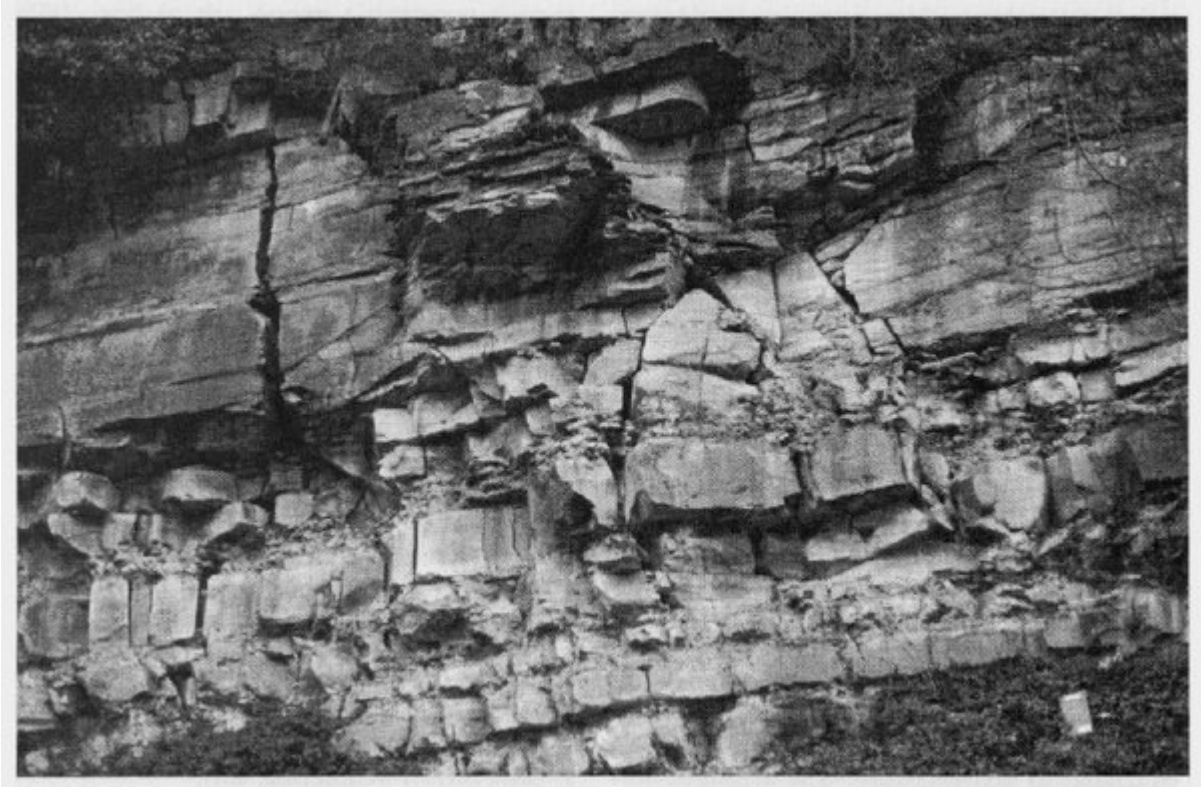
(Figure 4.29) Log showing the slump structures at Shaw's Gate Quarry (after Powell et al.,1992).



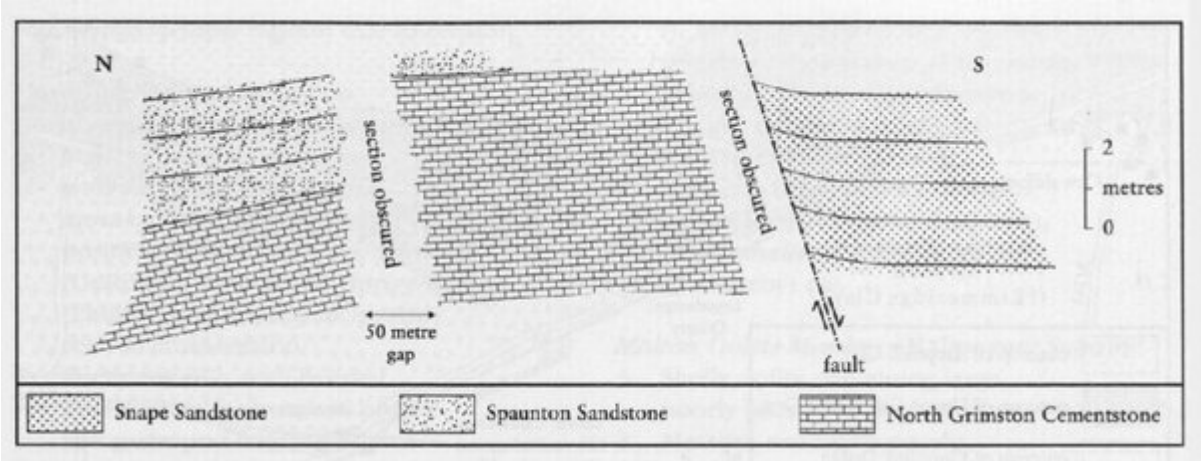
(Figure 4.30) View of Shaw's Gate Quarry showing a slump fold in oobiosparite (Bed 5). The flanks of the fold are filled with laminated sandy limestone (Bed 6). A load ball in Bed 3 is visible on the lower right. Height of face 1.5 m. (Photo: J.K. Wright.)



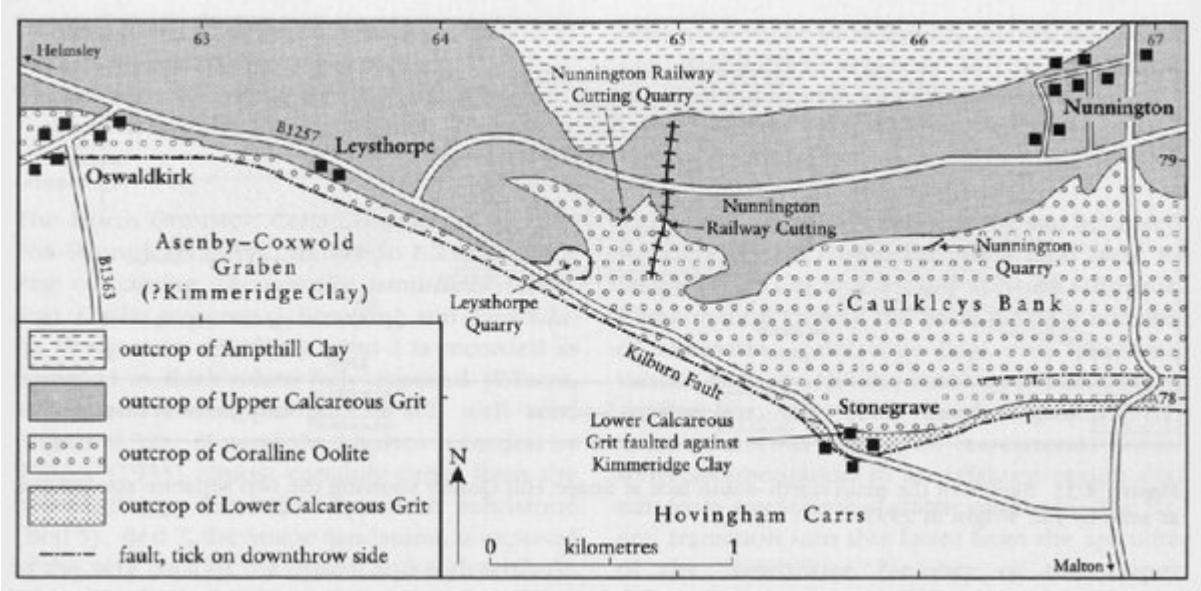
(Figure 4.31) Local ty map of Snape Hill Quarry. Geological information from BGS Sheet 52 (Thirsk) (1992).



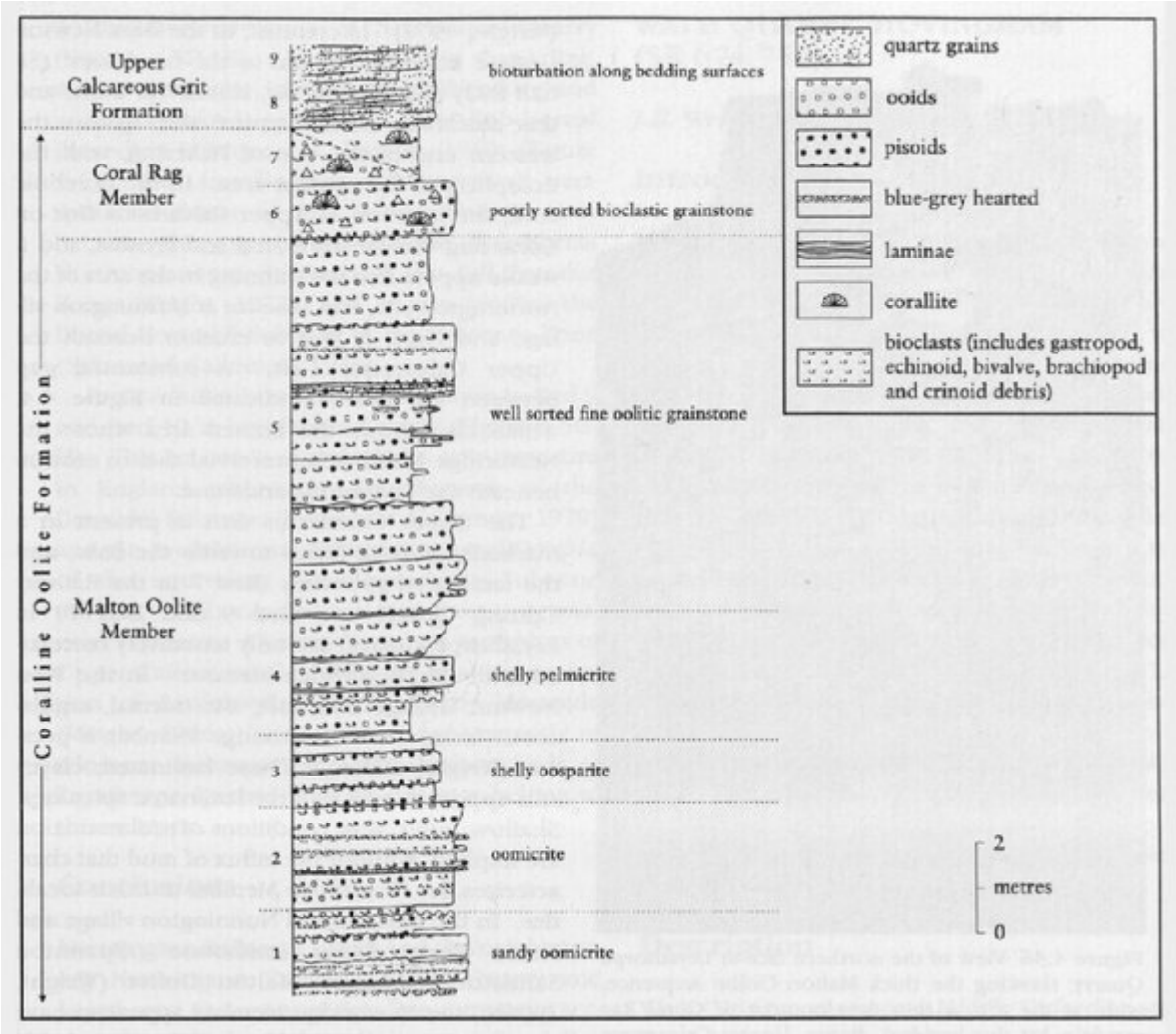
(Figure 4.32) North Grimston Cementstone (Bed 1) at Snape Hill Quarry. Alternations of limestone and calcareous mudstone are overlain by massive, flaggy weathering limestone. Mapcase 35 cm. (Photo: J.K. Wright.)



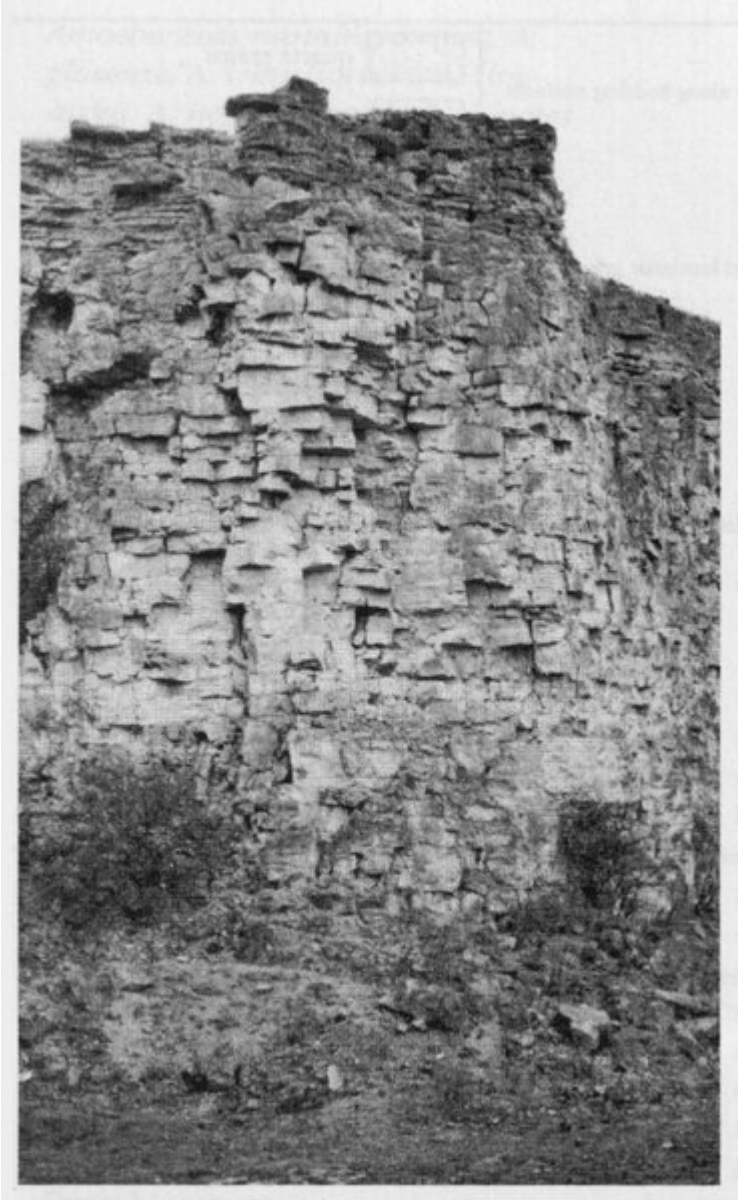
(Figure 4.33) Sketch of the main north–south face at Snape Hill Quarry showing the two separate successions, as seen by J.K. Wright in 1997.



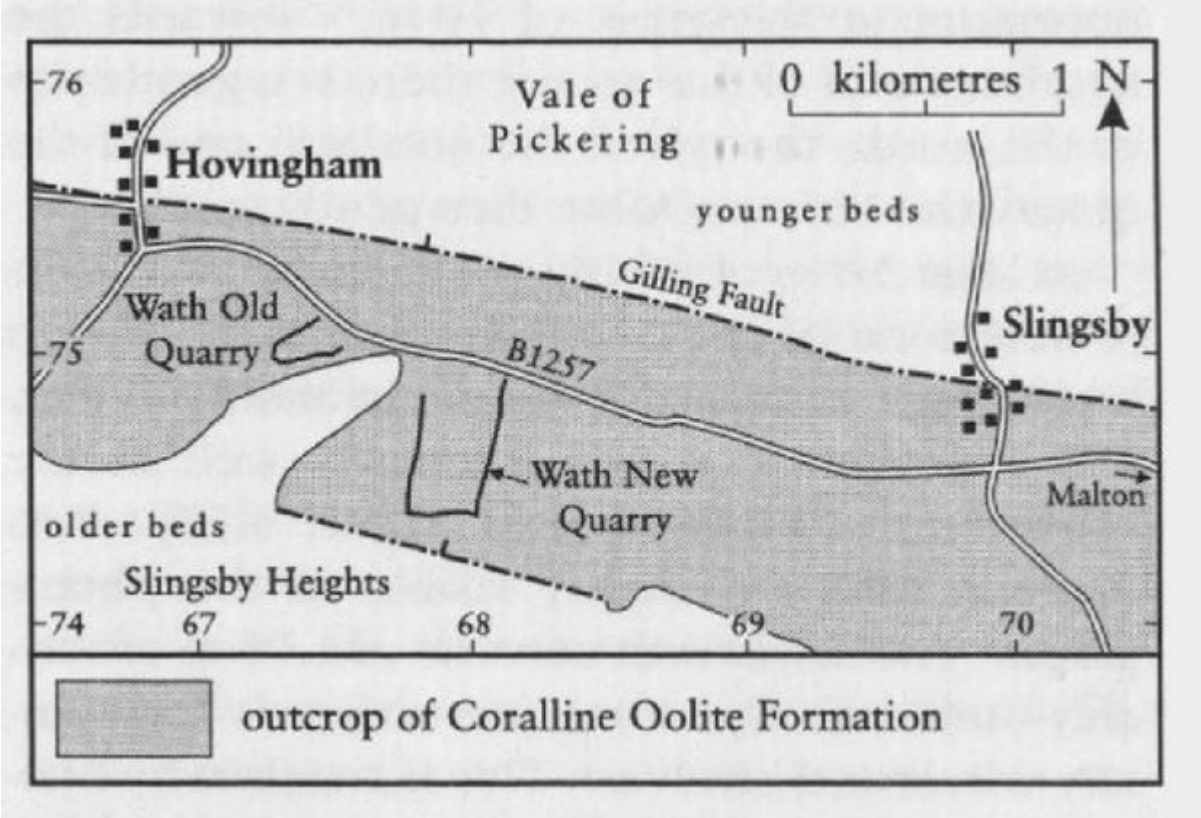
(Figure 4.34) Map showing the locations of the principal exposures WSW of Nunnington. Geological information from BGS Sheet 53 (Pickering) (1973).



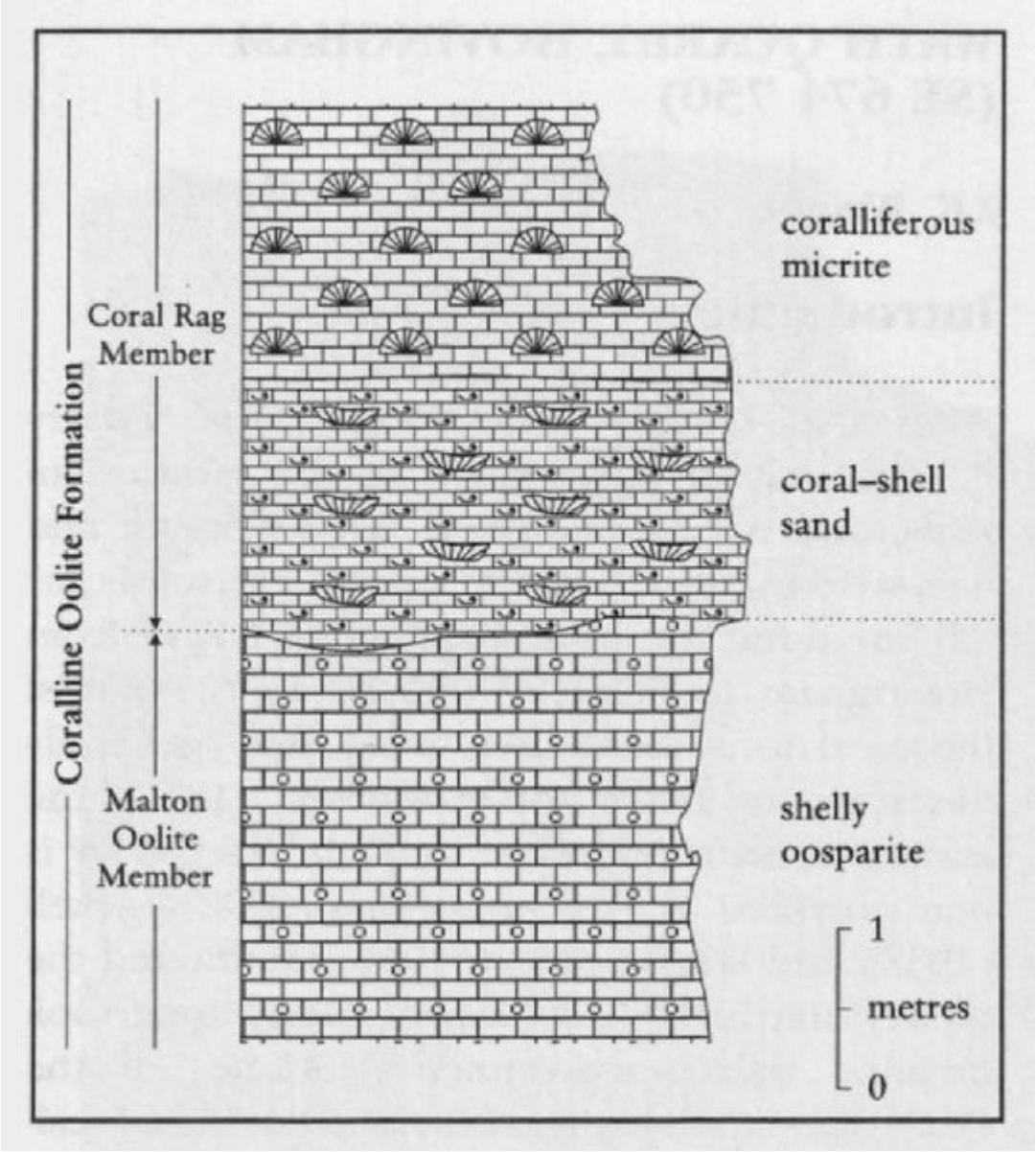
(Figure 4.35) Log of the CoraRine Oolite Formation in Leysthorpe Quarry, as measured by Mr D. Sharp and J.K. Wright, 1991–1992.



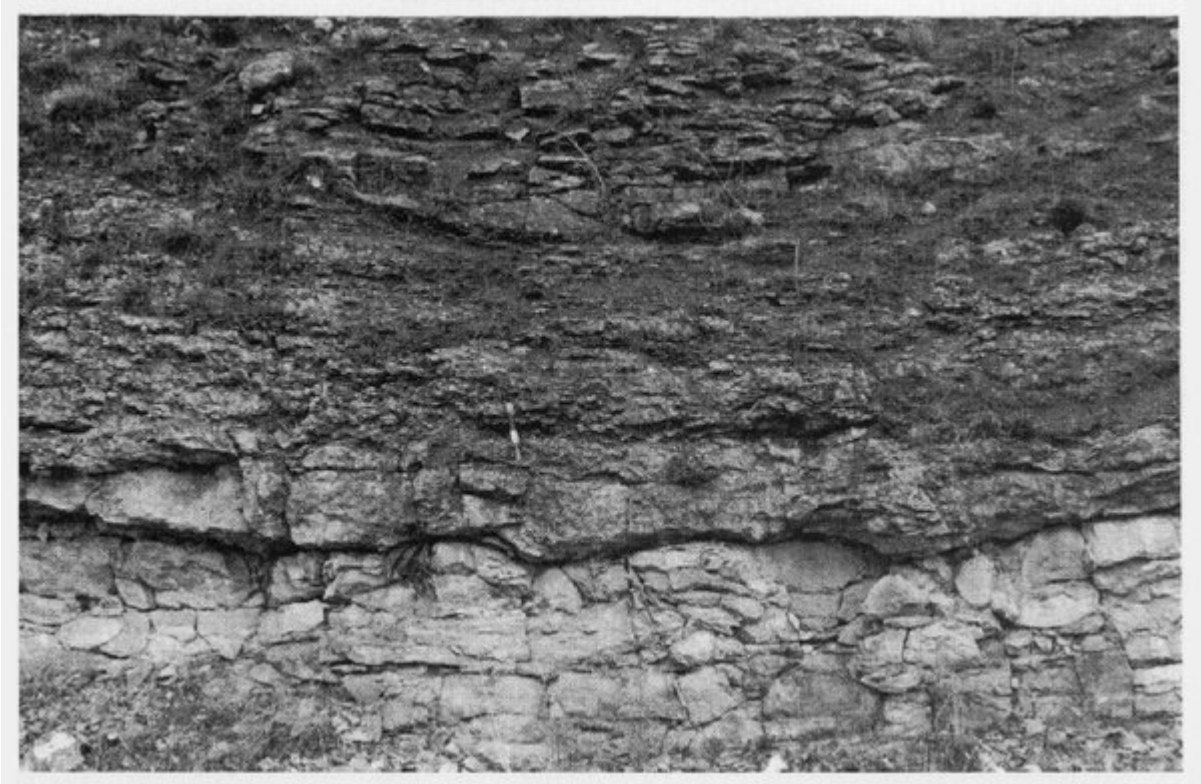
(Figure 4.36) View of the northern face at Leysthorpe Quarry, showing the thick Malton Oolite sequence, with, at the top, a thin development of Coral Rag overlain by thin-bedded, flaggy Upper Calcareous Grit. (Photo: J.K. Wright.)



(Figure 4.37) Locality map of the Wath Quarries. Outcrop of the Coralline Oolite from BGS Sheet 53 (Pickering) (1973).

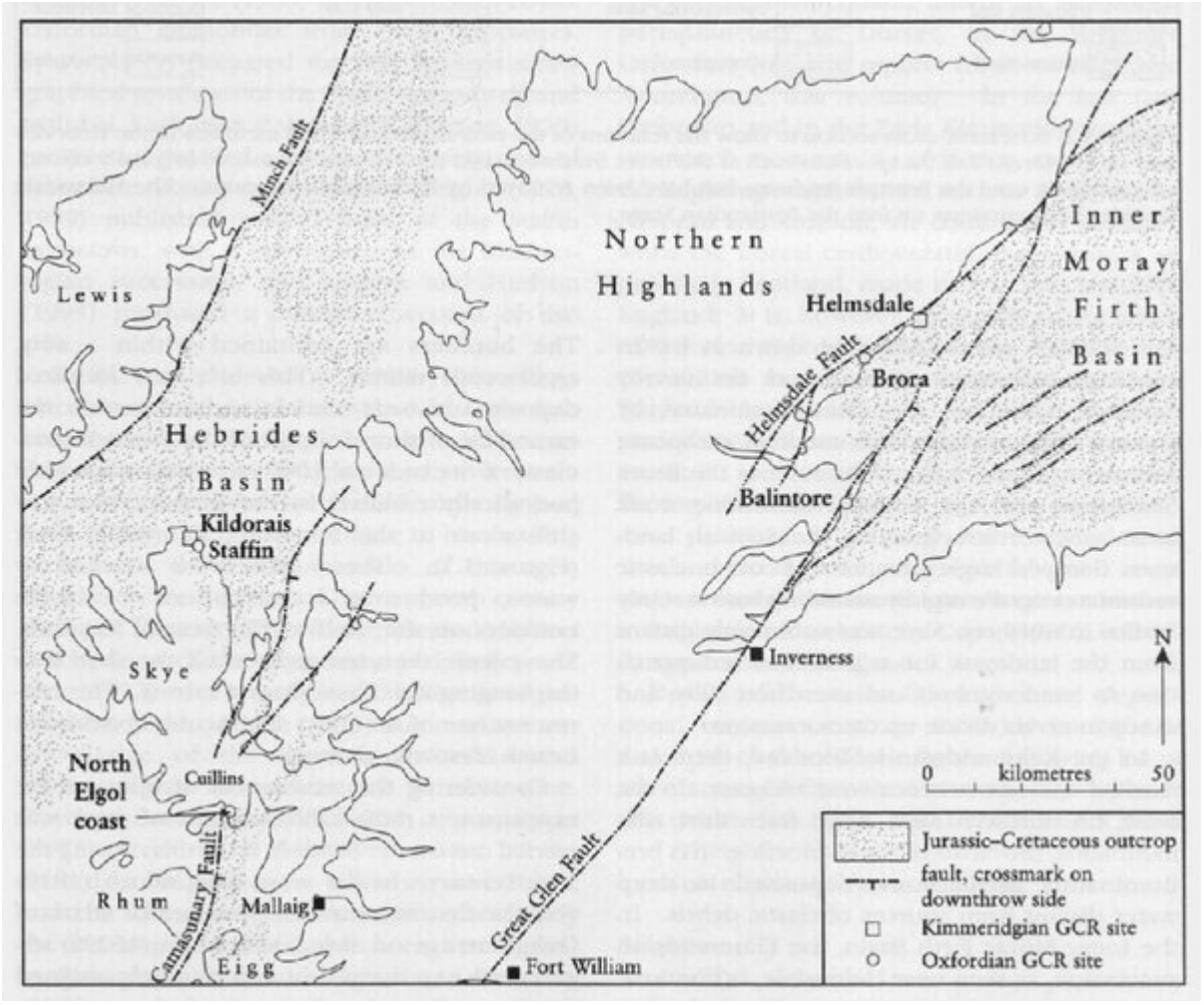


(Figure 4.38) Weathering profile of the upper Malton Oolite and Coral Rag at Wath Old Quarry, as measured by J.K. Wright in 1997.

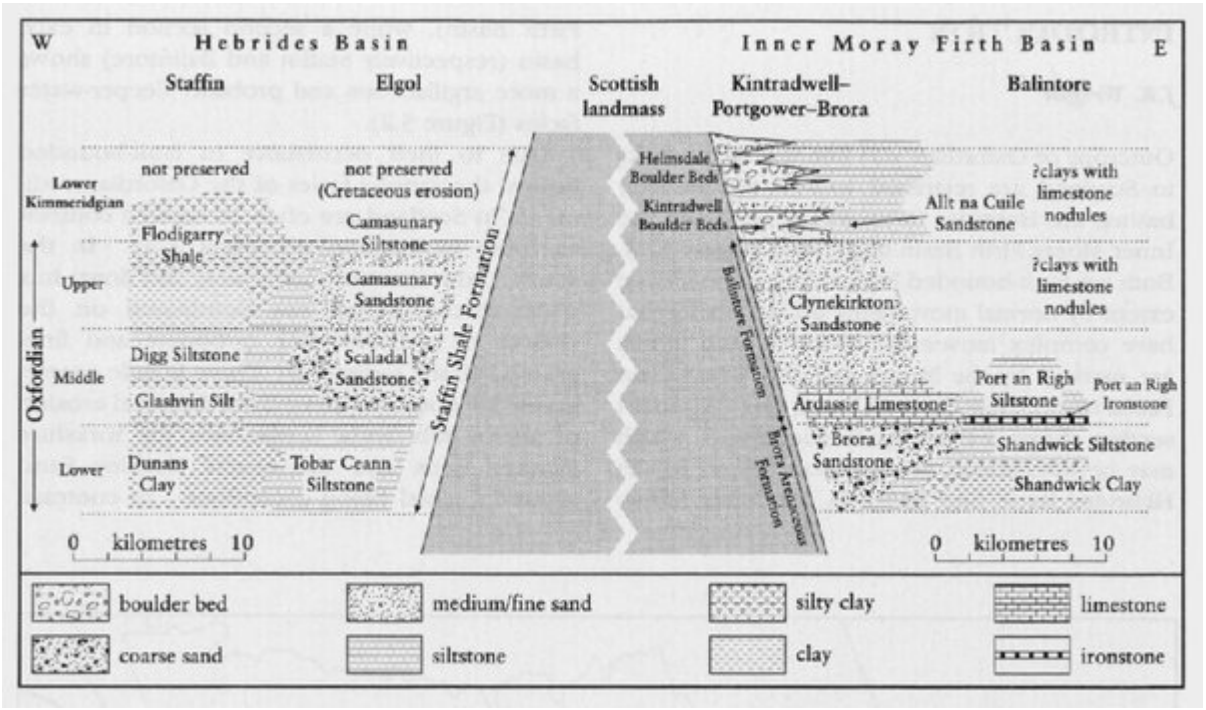


(Figure 4.39) Wath Old Quarry, showing the irregular, erosive junction of Coral Rag resting on Malton Oolite. The lower rubbly coral–shell bed of the Coral Rag and the upper coralliferous micritic limestone are easily distinguished. Hammer shaft is 32 cm long. (Photo: J.K. Wright.)

(Figure 4.40) View of the eastern face of Wath New Quarry showing, near the base, Mahon Oolite dipping gently north (to the left), overlain by giant cross-sets of Malton Oolite dipping south, and at the top of the quarry, Coral Rag dipping gently north. (Photo: J.K. Wright.)

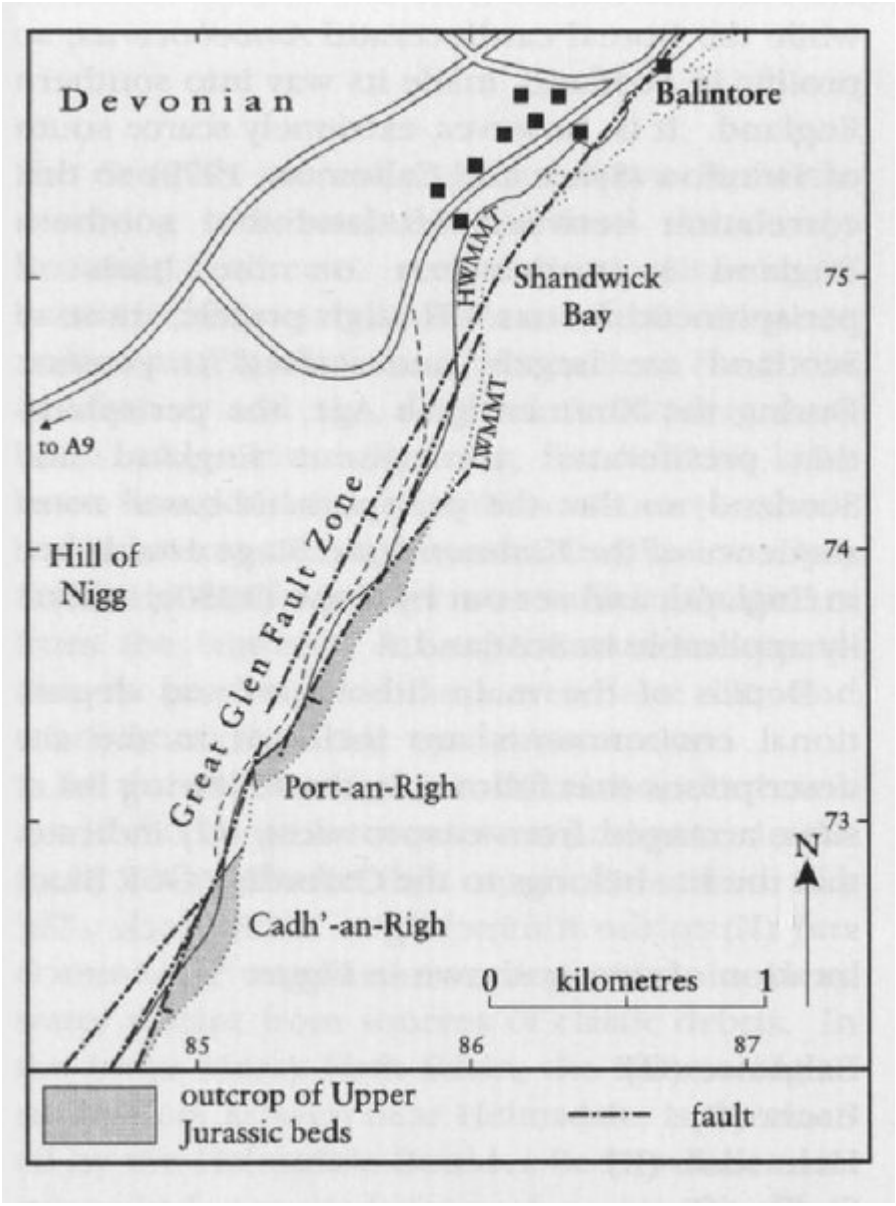


(Figure 5.1) Map of northern Scotland, showing the principal Jurassic sedimentary basins and their structural controls, and the locations of Oxfordian and Kimmeridgian GCR sites. Based on BGS 1:1 500 000 Tectonic Map of Britain, Ireland and Adjacent Areas (1996) and BGS 1:1 000 000 Geological Map of the United Kingdom, Ireland and the Adjacent Continental Shelf (1991).

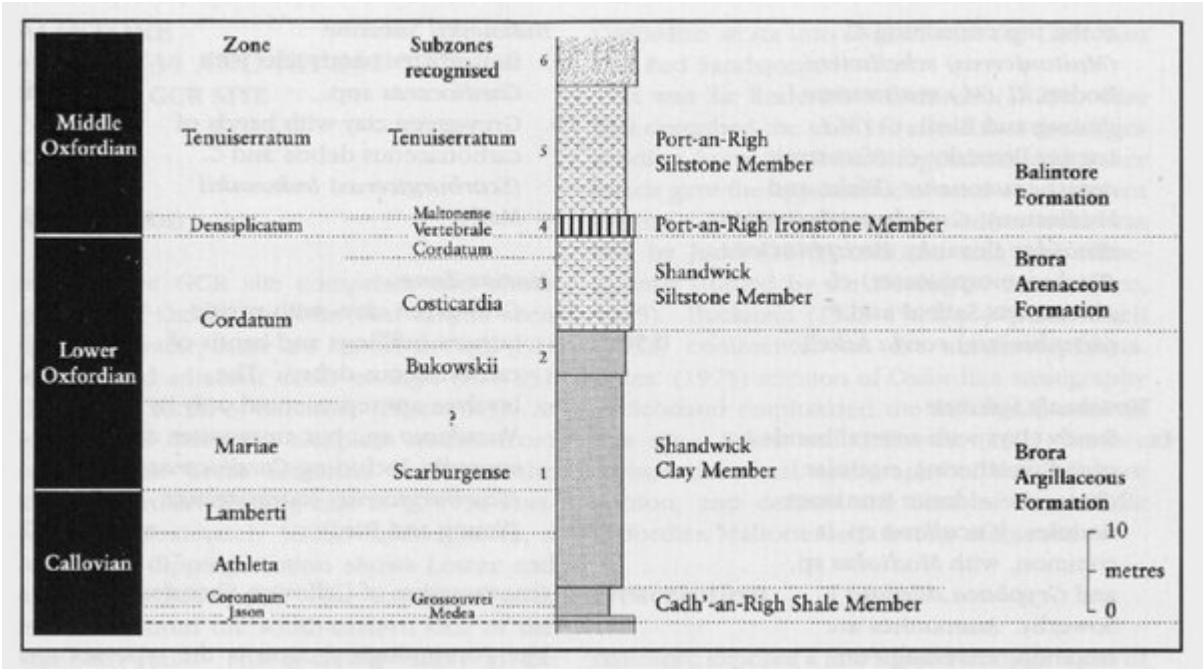


(Figure 5.2) Schematic cross-section to show the relations of the near-shore and distal members in the Hebrides and Inner Moray Firth Basins. Beds such as the Brora Sandstone and the Ardassie Limestone originally extended eastwards over the Scottish landmass but have been removed by Kimmeridgian erosion. The Helmsdale Boulder Beds continue up

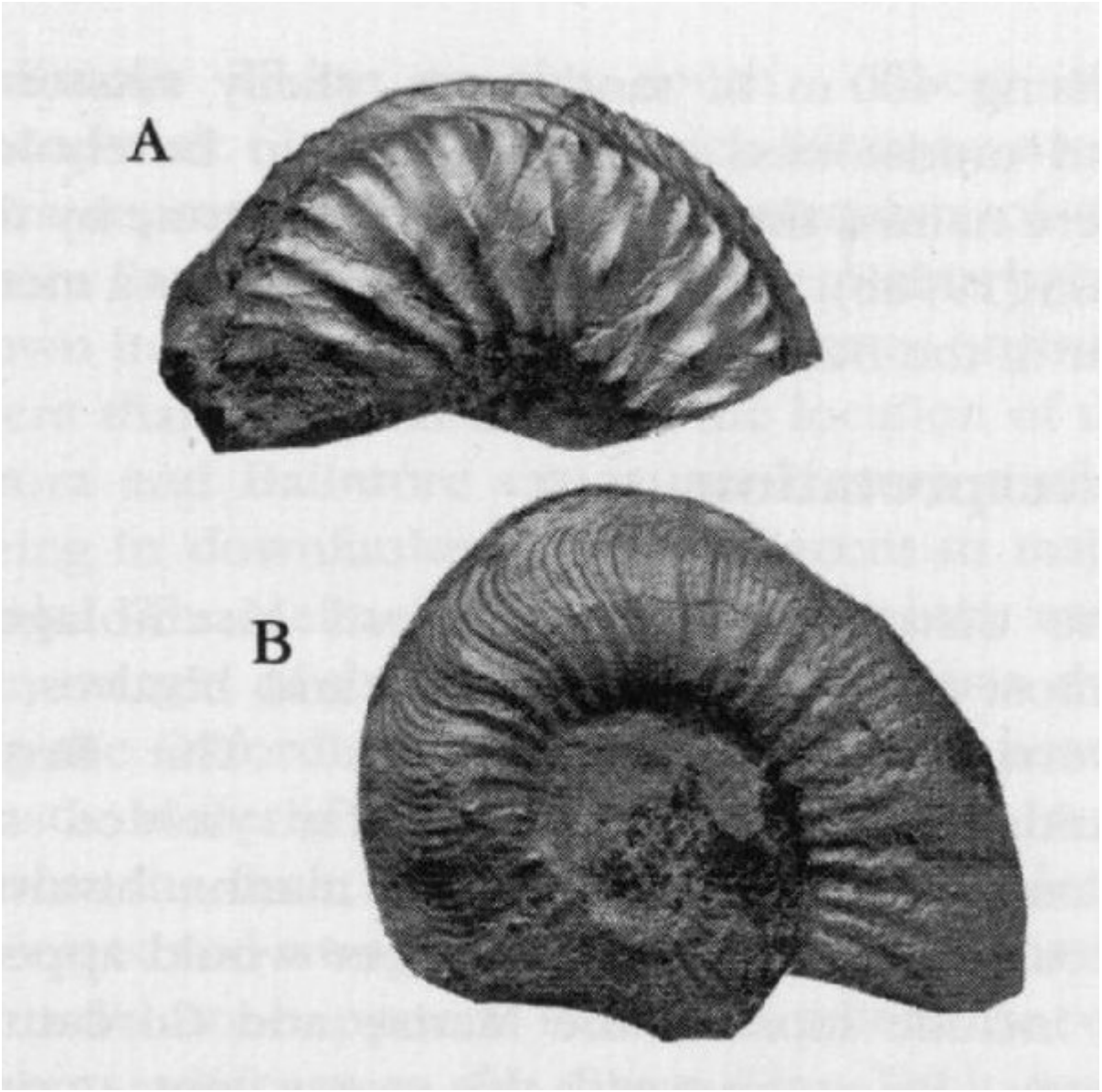
into the Portlandian Stage.



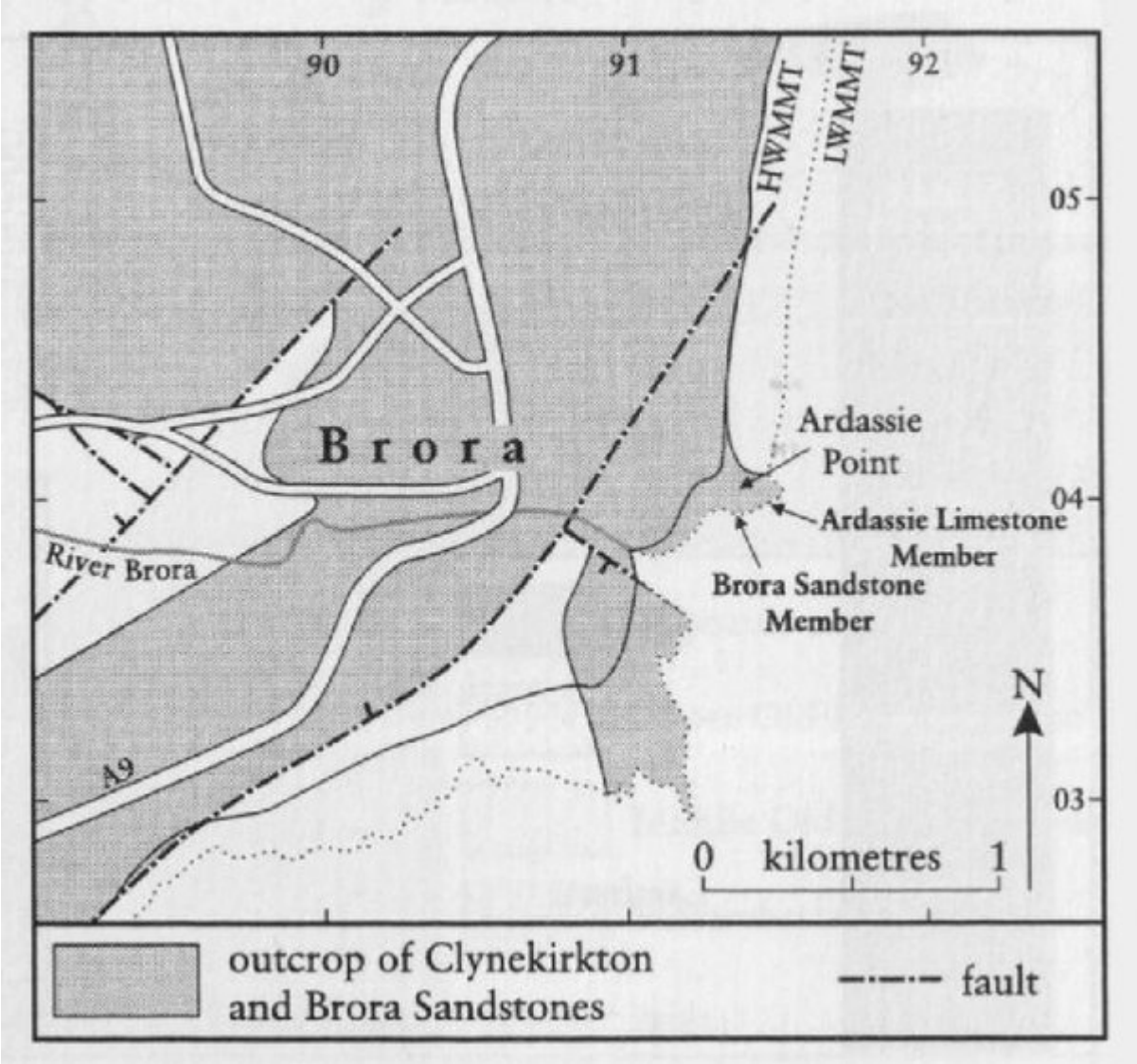
(Figure 5.3) Locality map of the Balintore GCR site. Geological information from BGS Sheet 94 (Cromarty) (1973).



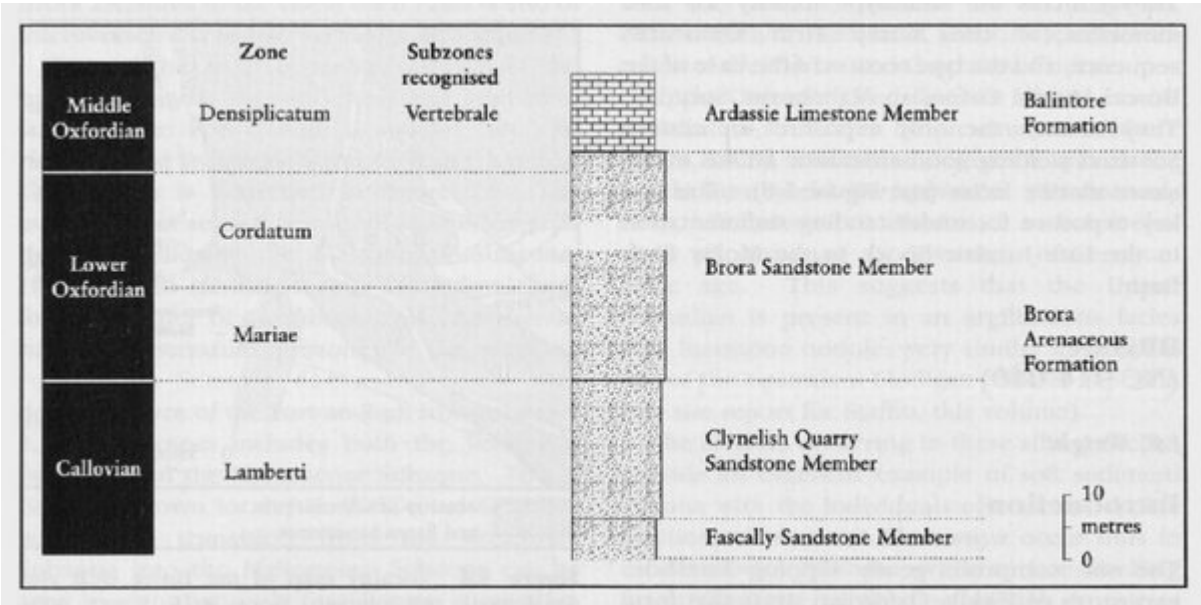
(Figure 5.4) Stratigraphical log of the Balintore section (after Sykes, 1975, fig. 4).



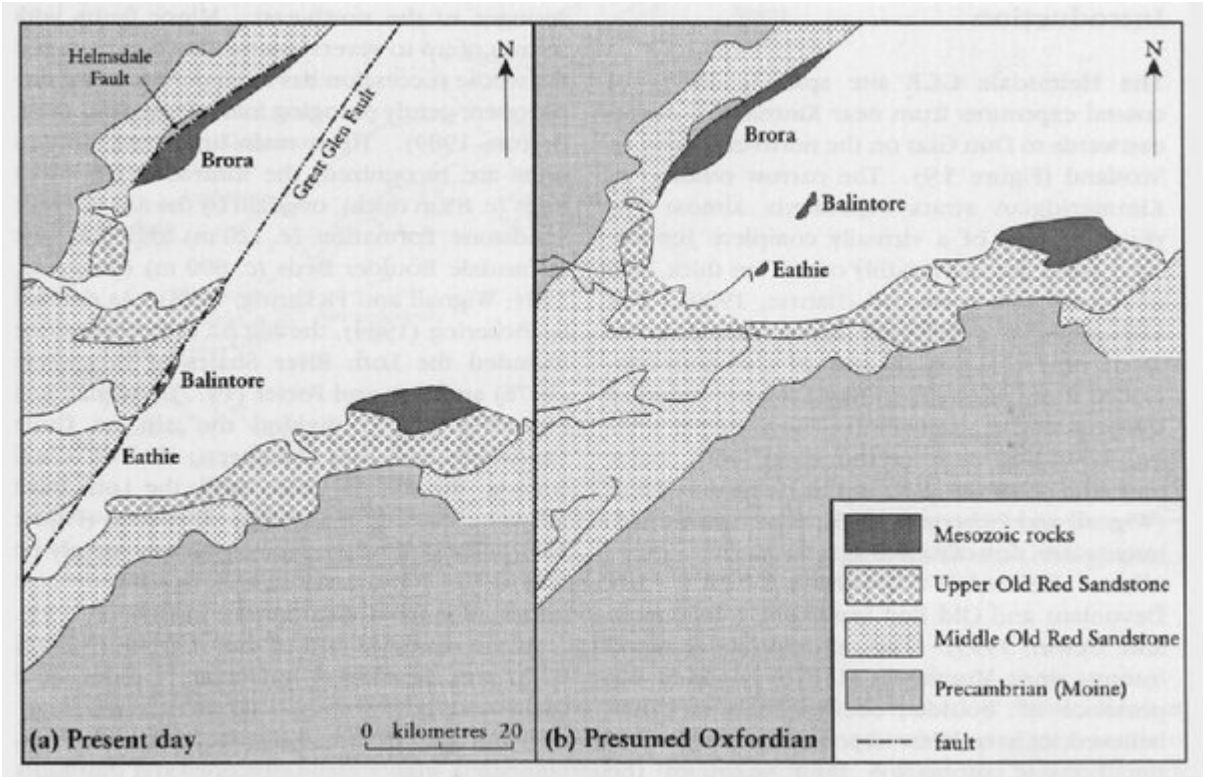
(Figure 5.5) Ammonites from the Balintore Formation of eastern Scotland. (A) Cardioceras (Subvertebriceras) densiplicatum Boden. Bed 4, Port-an-Righ Ironstone Member, Balintore, ES3, x1. (B) C. (Plasmatoceras) tenuicostatum Nikitin. Ardassie Limestone, Brora, ES2, x 1. (Photos: K. D'Souza. Specimens in the J.K. Wright Collection.)



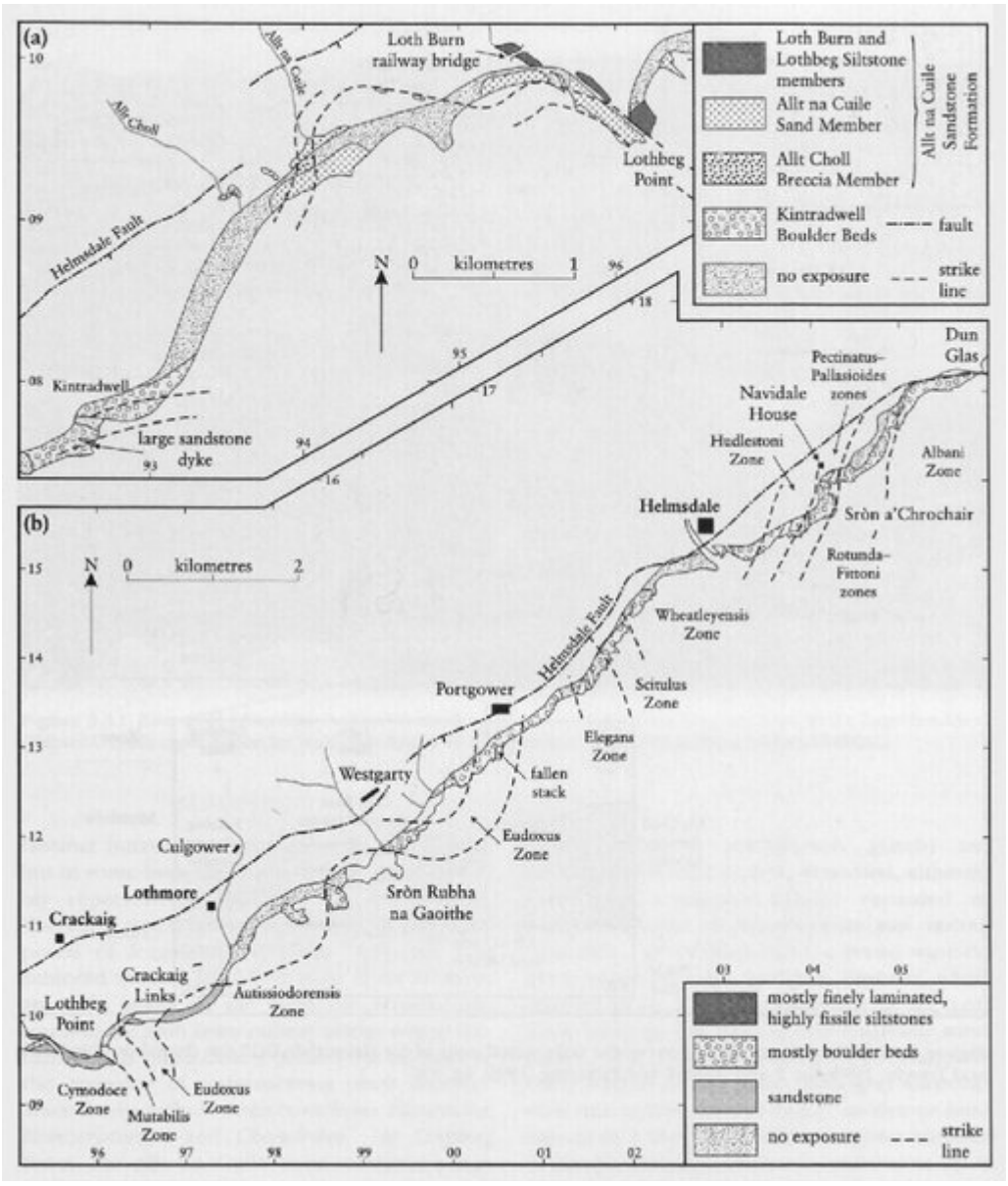
(Figure 5.6) Locality map of the Brora GCR site. Geological information from BGS Sheet 103E (Helmsdale) (1998).



(Figure 5.7) Stratigraphical log of the Brora section (after Sykes, 1975, fig. 3).



(Figure 5.8) Diagram showing possible post-Jurassic movement on the Great Glen Fault (after Sykes, 1975, fig. 2).



(Figure 5.9) Sketch map of the mainly Kimmeridgian outcrop between (a) Kintradwell and Lothbeg Point, and (b) Lothbeg Point and Dun Glas (after Wignall and Pickering, 1993, figs 10 and 17).

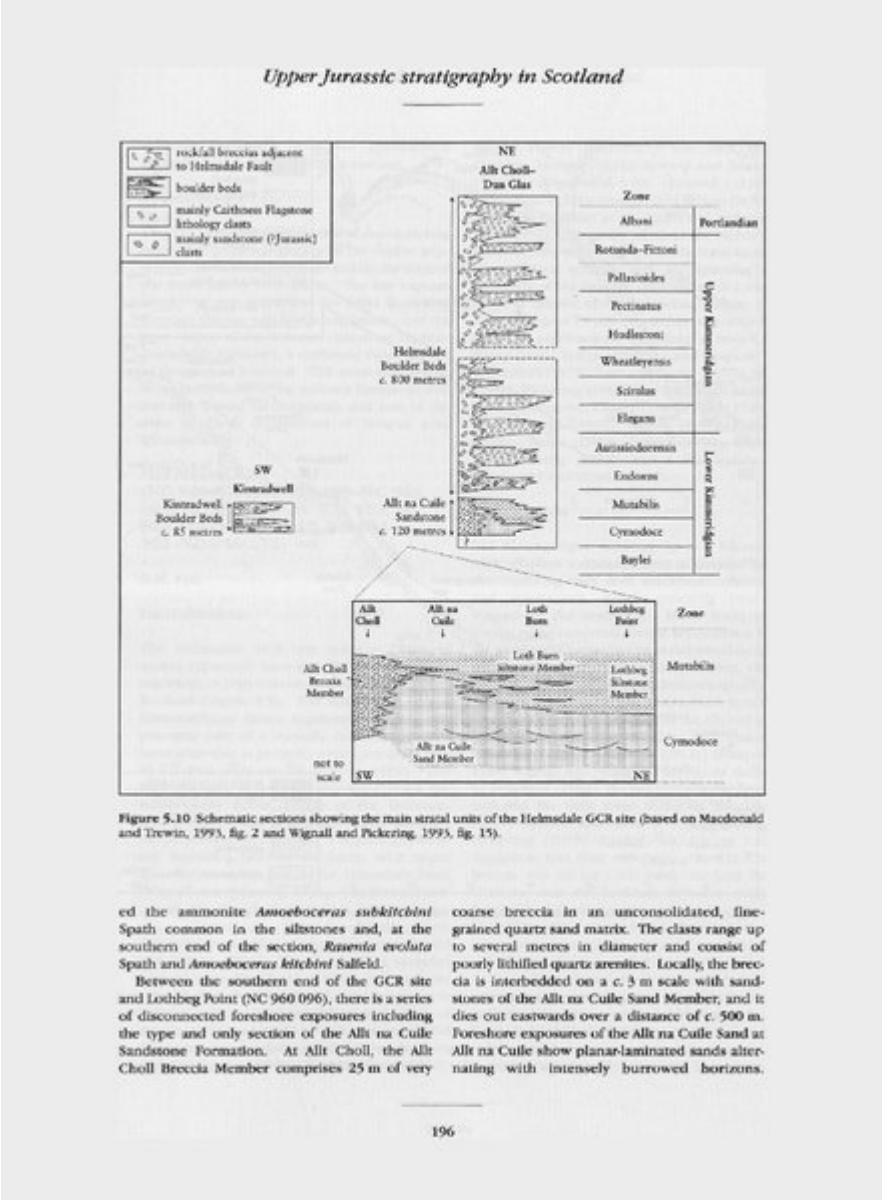


Figure 5.10 Schematic sections showing the main stratal units of the Helmsdale GCR site (based on Macdonald and Trewin, 1993, fig. 2 and Wignall and Pickering, 1993, fig. 15).

ed the ammonite *Amoeboceras subkeltcbini* Spath common in the siltstones and, at the southern end of the section, *Rasenia evoluta* Spath and *Amoeboceras kitchini* Salfield.

Between the southern end of the GCR site and Lothbeg Point (NC 960 096), there is a series of disconnected foreshore exposures including the type and only section of the Allt na Cuile Sandstone Formation. At Allt Choll, the Allt Choll Breccia Member comprises 25 m of very coarse breccia in an unconsolidated, fine-grained quartz sand matrix. The clasts range up to several metres in diameter and consist of poorly lithified quartz arenites. Locally, the breccia is interbedded on a c. 3 m scale with sandstones of the Allt na Cuile Sand Member, and it dies out eastwards over a distance of c. 500 m. Foreshore exposures of the Allt na Cuile Sand at Allt na Cuile show planar-laminated sands alternating with intensely burrowed horizons.

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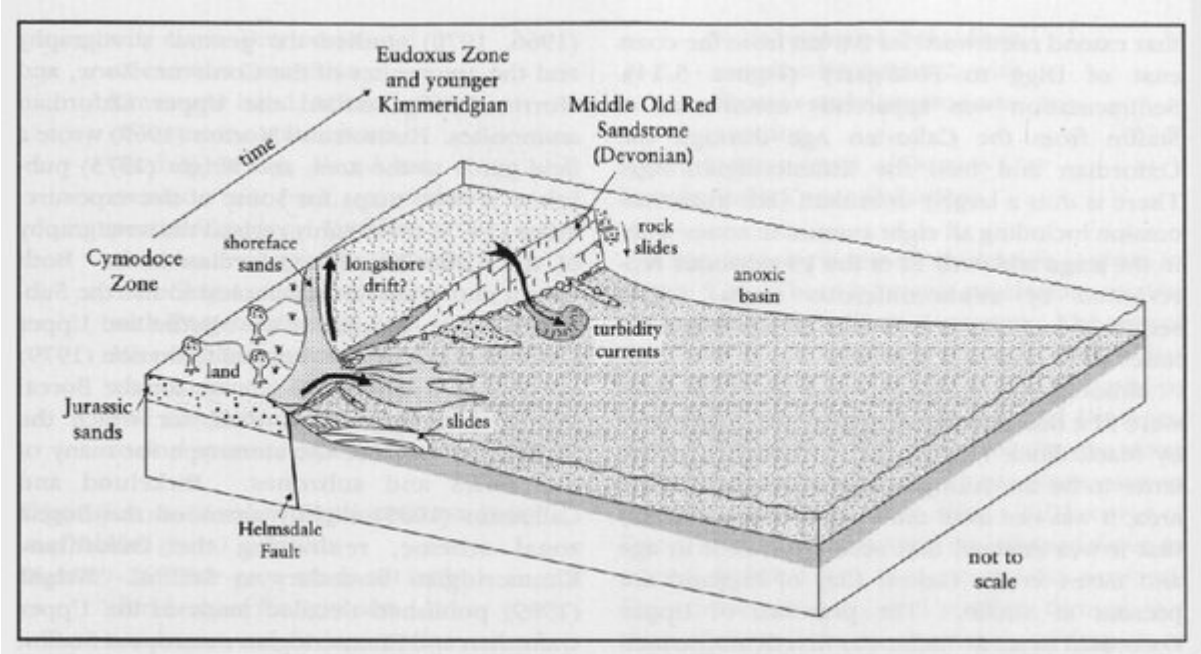
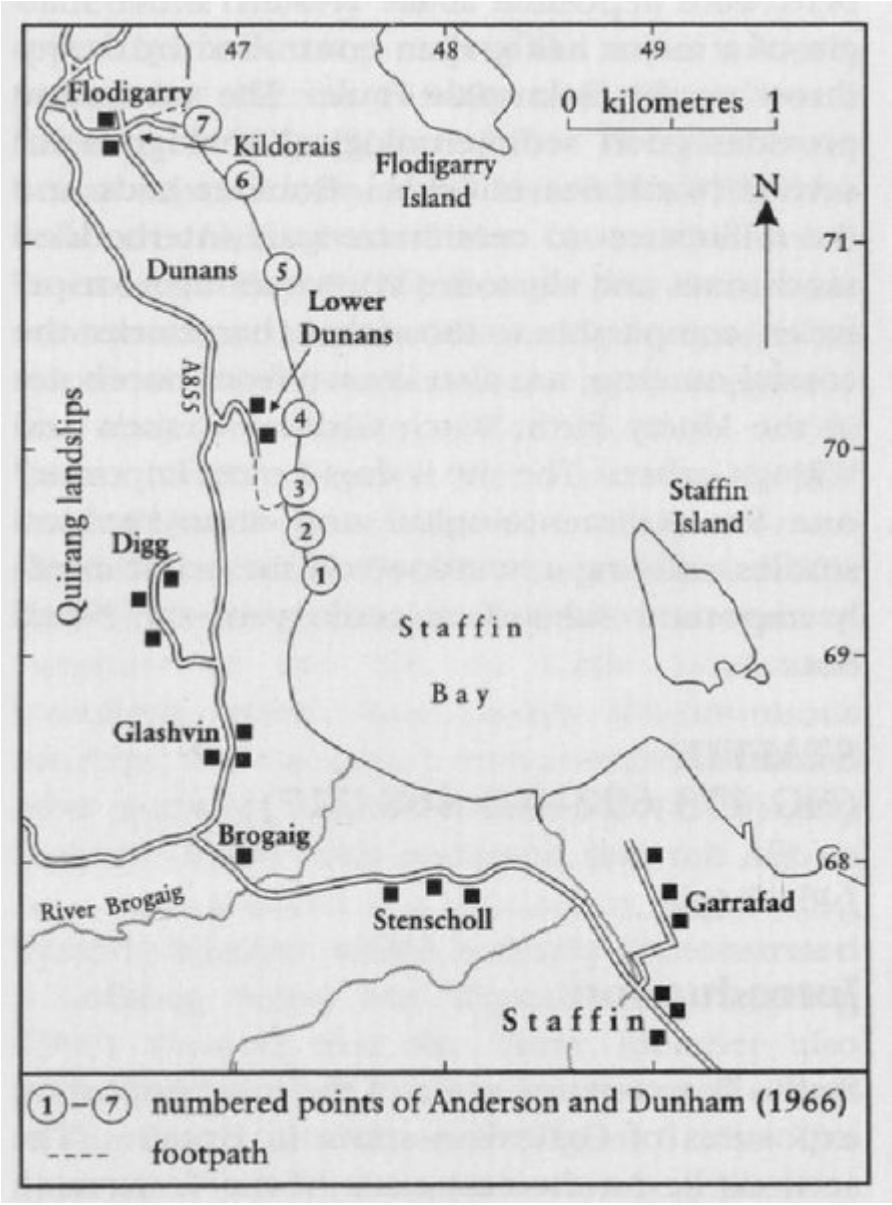
(Figure 5.10) Schematic sections showing the main stratal units of the Helmsdale GCR site (based on Macdonald and Trewin, 1993, fig. 2 and Wignall and Pickering, 1993, fig. 15).

(Figure 5.11) Kintradwell Boulder Beds at Kintradwell showing compaction features around the large boulders. (Photo: C1980, reproduced by kind permission of the Director, British Geological Survey ©NERC.)

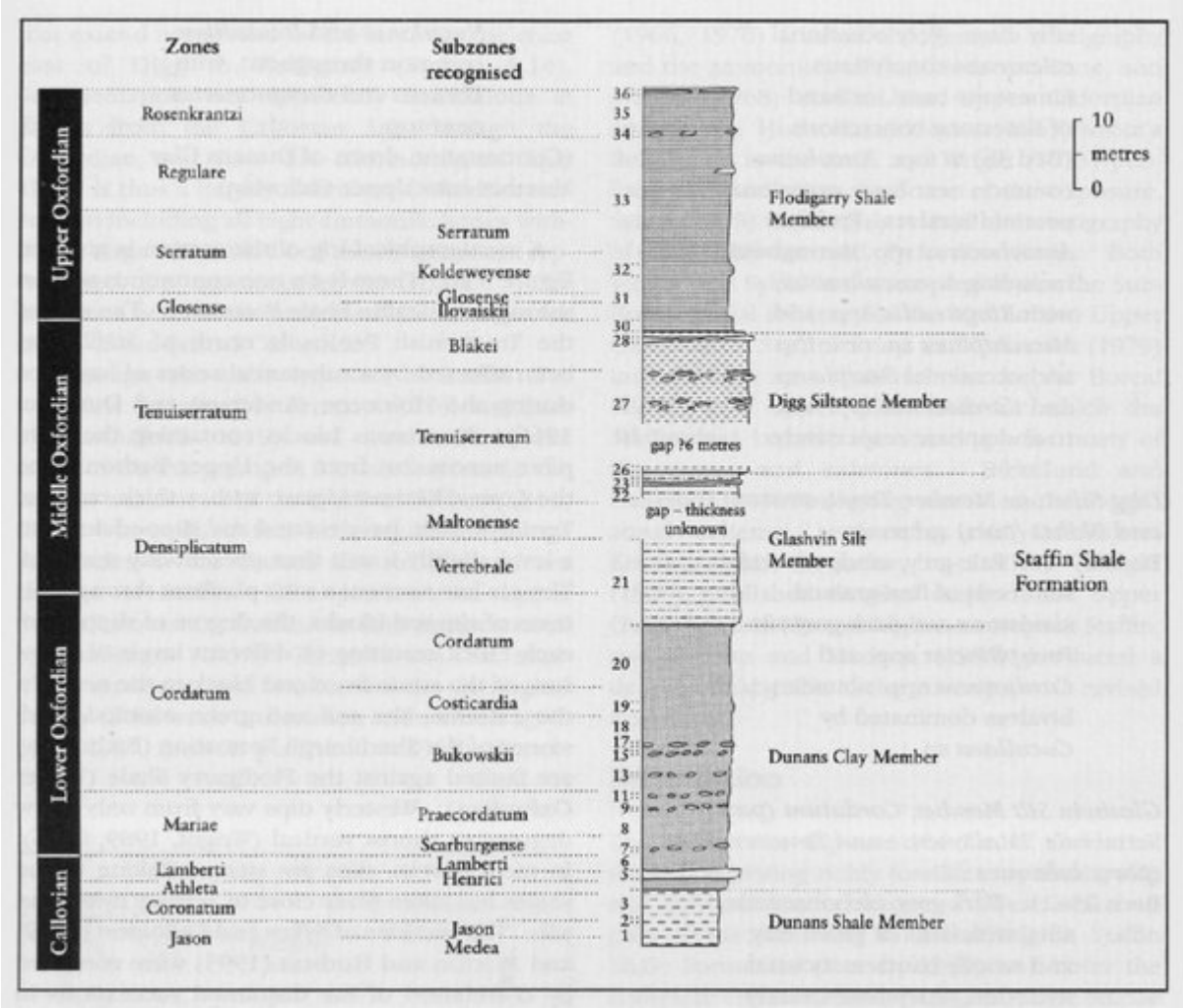
(Figure 5.12) The 'fallen stack' in the Helmsdale Boulder Beds near Portgower. (Photo: C1975, reproduced by kind permission of the Director, British Geological Survey ©NERC.)



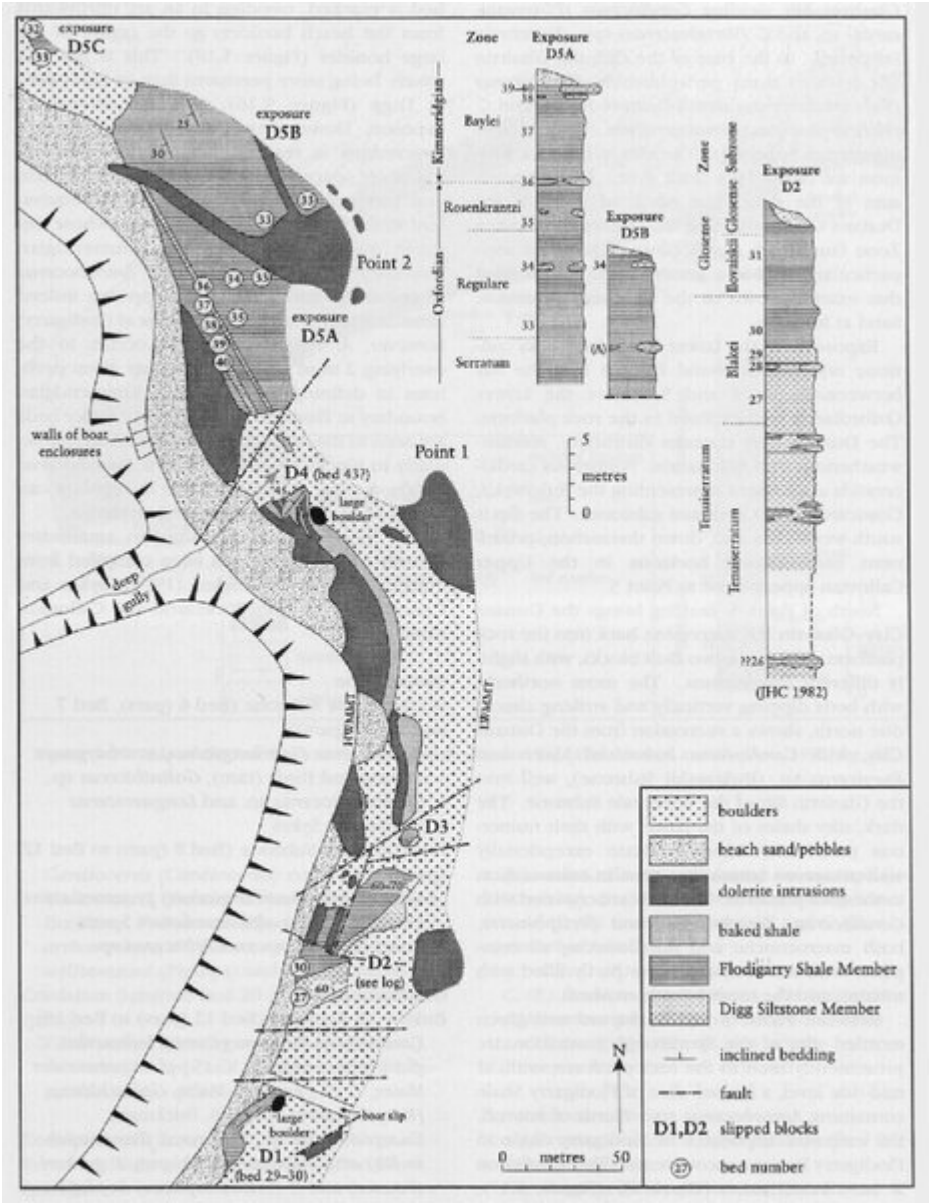
(Figure 5.13) Simplified reconstruction of depositional conditions adjacent to the Helmsdale Fault during the Kimmeridgian (after Wignall and Pickering, 1993, fig. 21).



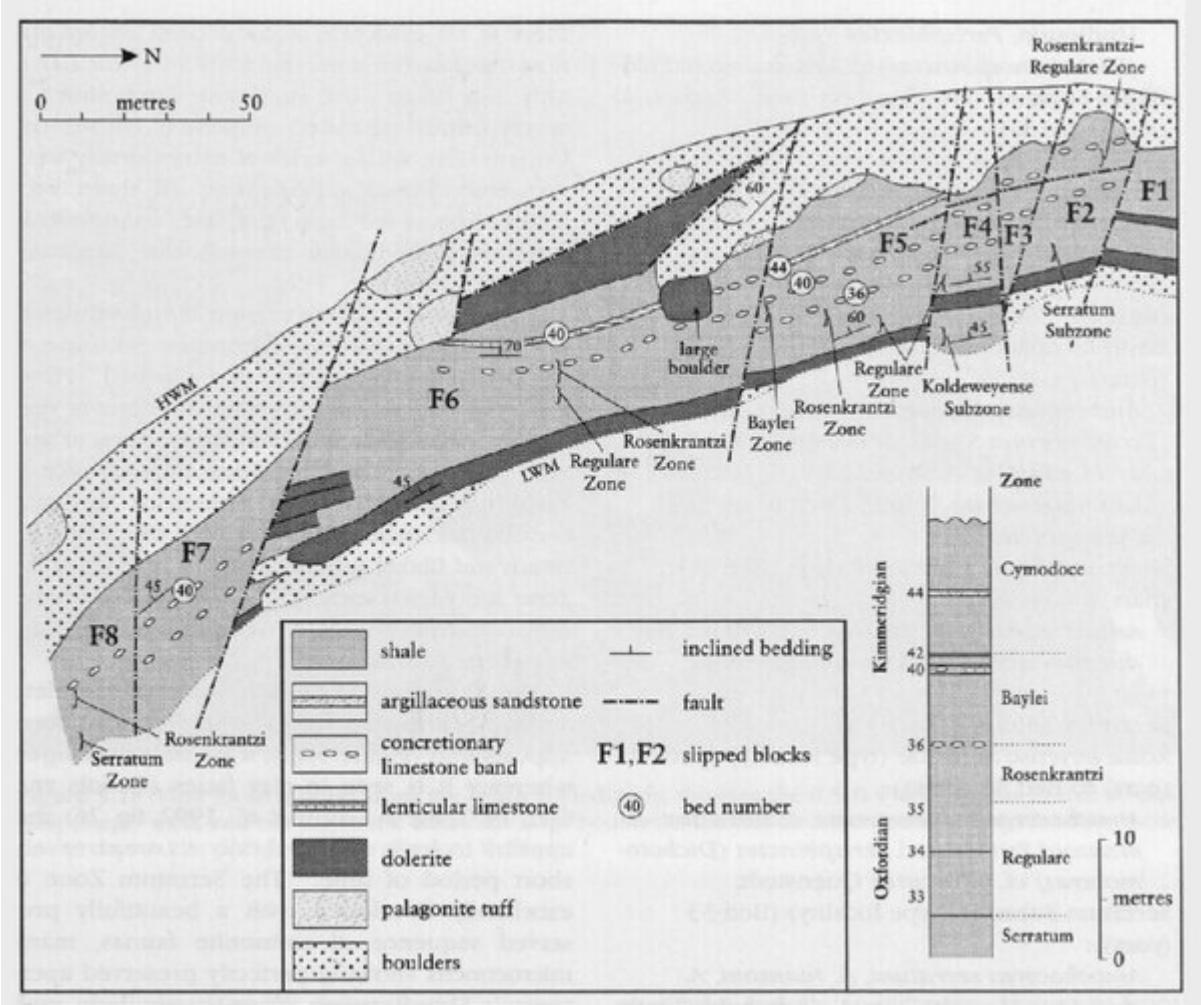
(Figure 5.14) Locality map of the Staffin and Kildorais GCR sites (after Cox and Sumbler, in press).



(Figure 5.15) General log of the Staffin Shale succession (after Morton and Hudson, 1995, table 4).

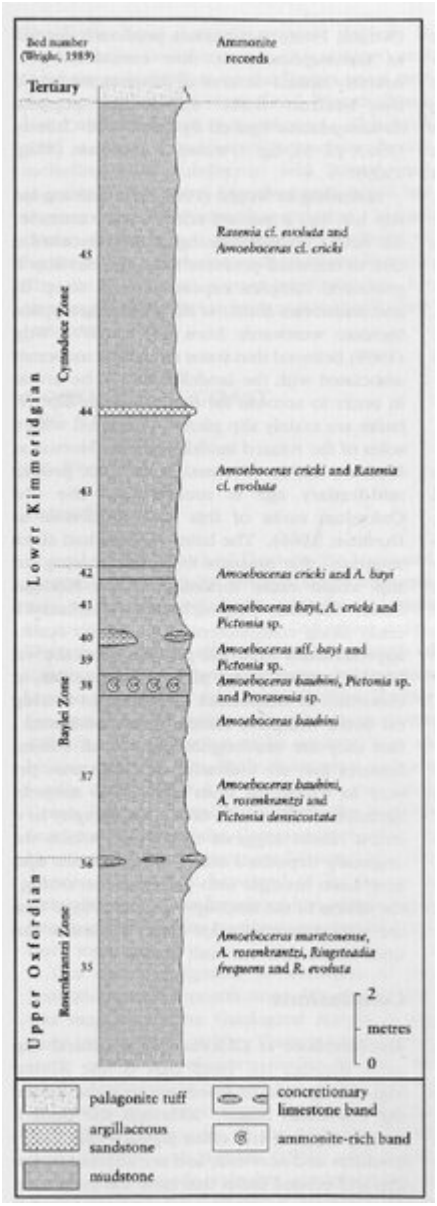


(Figure 5.16) Map of the foreshore at Digg, with detailed logs (after Morton and Hudson, 1995, figs 39, 40).

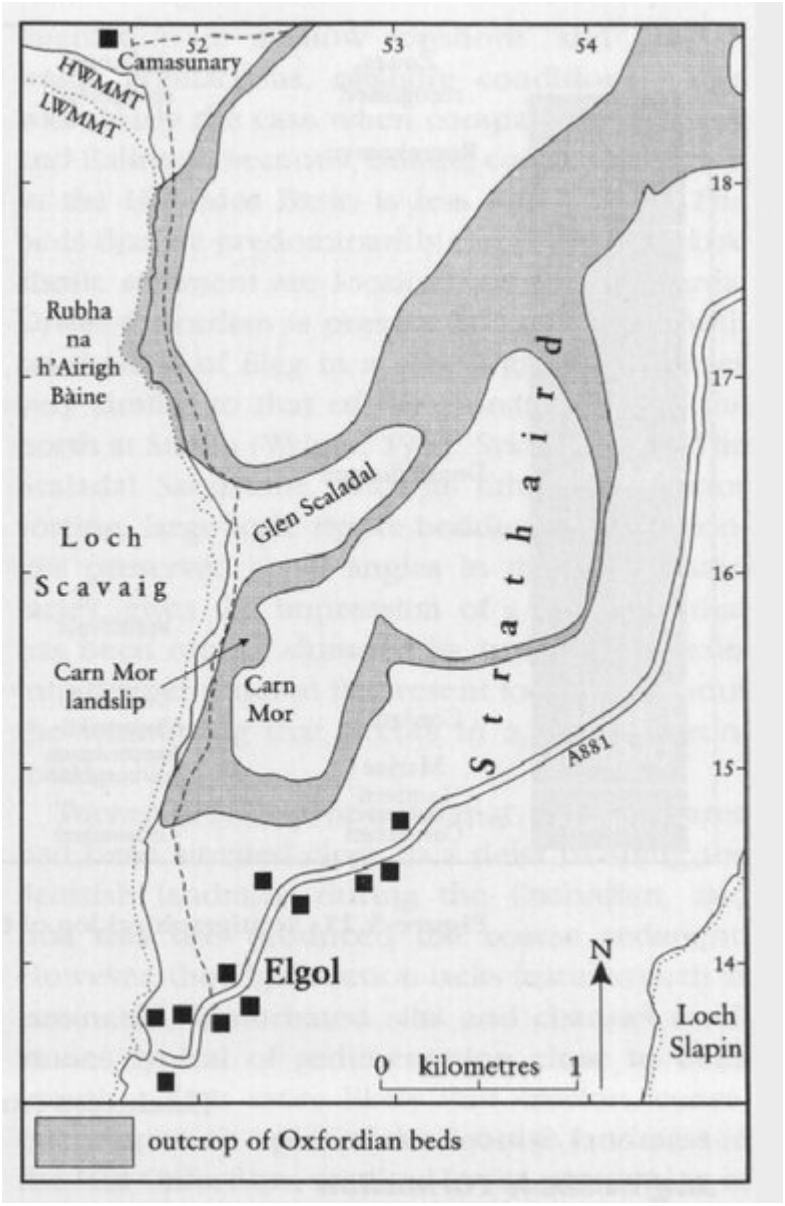


(Figure 5.17) Map of the foreshore at Flodigarry, with detailed log (after Morton and Hudson, 1995, fig. 42).

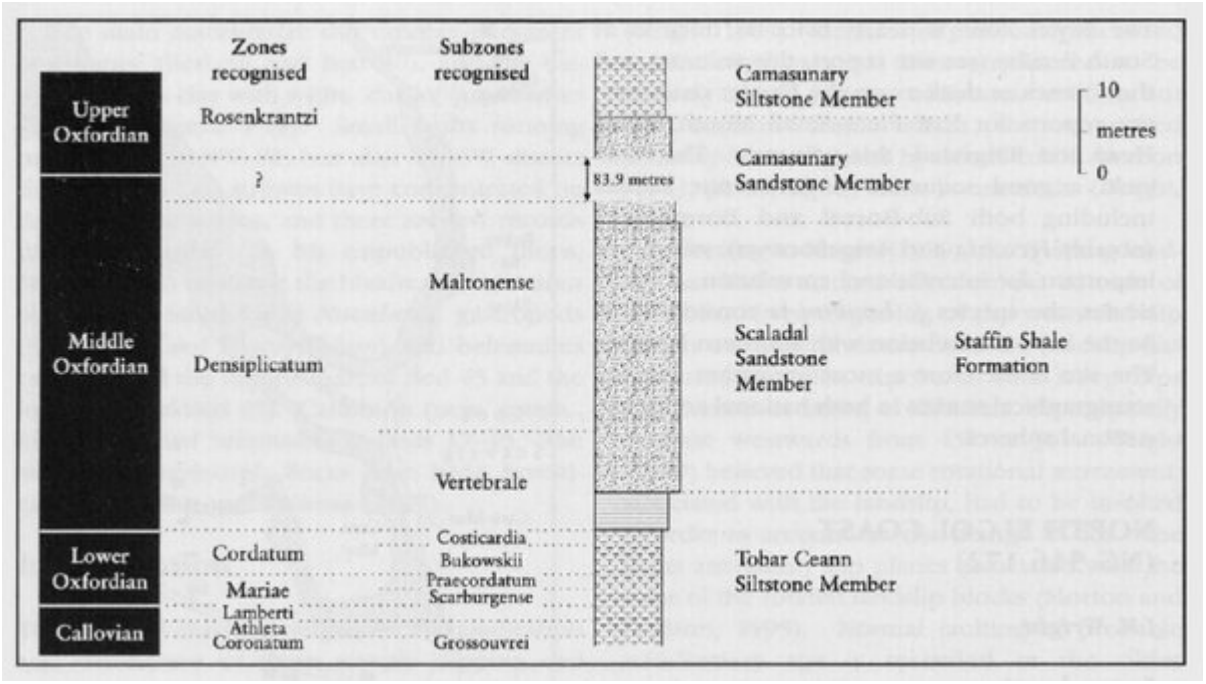
(Figure 5.18) View looking north along the beach at Flodigarry, showing the 0.3–0.4 m limestone of Bed 40 dipping steeply west, and curving round under the large boulder in the middle distance. The large boulder is the one in the middle of (Figure 5.17). (Photo: J.K. Wright.)



(Figure 5.19) Graphic section of the Kimmeridgian and uppermost Oxfordian parts of the Staffin Shale Formation, Flodigarry Shale Member, at Kildorais.



(Figure 5.20) Locality map of the North Elgol Coast GCR site. Outcrop of the Oxfordian beds from BGS Sheet 71W (Broadford) (1976).



(Figure 5.21) Stratigraphical log of the Elgol section (after Sykes, 1975, fig. 6).