DRY SANDFORD

J.K. Wright

OS Grid Reference: SU468996

Introduction

Dry Sandford Quarry lies within a nature reserve immediately south-east of the village of Cothill (Figure 2.42). Arkell (1936b, 1947b) referred to this quarry as 'Dry Sandford Quarry', but as Dry Sandford lies almost 1 km to the north, this can cause confusion, and 'Cothill' is usually given in the full title. This is a well-documented locality that, as a newly opened exposure, was first officially visited by geologists in 1930 (Arkell, 1933). The 150 m long preserved quarry face currently represents the best available section in the district for the examination of Middle Oxfordian strata below the Coral Rag.

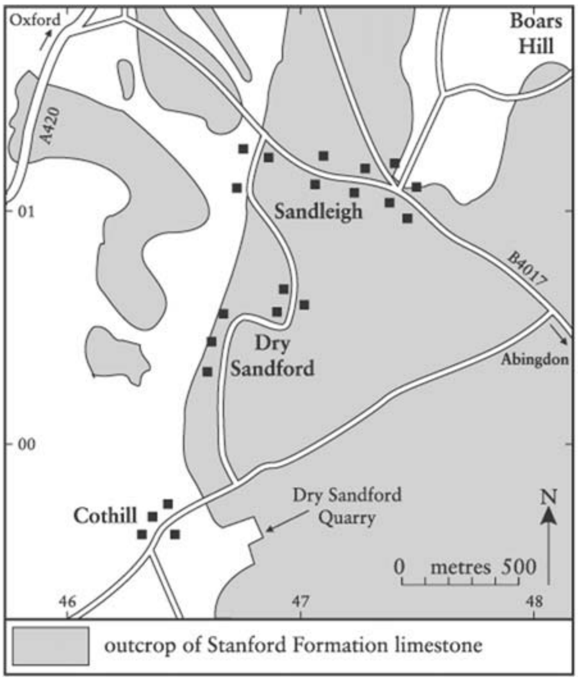

Figure 2.42: Locality map for Dry Sandford Quarry. Outcrop of Stanford Formation from BGS Sheets 253 (Abingdon) (1971) and 236 (Witney) (1982).

Since its earliest documentation, the site has figured strongly in accounts of the Oxfordian Stage in southern England, being particularly well known through the works of Arkell (1936b, 1947b, 1935–1948). Callomon (1960) has produced a definitive account, and the sequence has also been described by McKerrow and Baden Powell (1953), McKerrow (1958) and McKerrow and Kennedy (1973). Talbot (1971) discussed the carbonate cements, and Talbot (1973a) and Johnson (1983) discussed the erosion surfaces and palaeoenvironment.

Description

The succession in the quarry is predominantly arenaceous and totals 7.5 m in thickness. An updated section is as follows (bed numbers and data on beds no longer exposed (in brackets) taken from Arkell (1936b)).

		Thickness (m)
Stanford Formation		
Coral Rag Member		
10b	Flaggy, micritic limestone containing *Thecosmilia annularis* (Fleming) and *Thamnasteria concinna* (Goldfuss) in a fine-grained, slightly shelly matrix	seen to 0.25
10a	Tough, flaggy, bioclastic limestone containing well-preserved large bivalves in a bioclastic matrix with many coral fragments	0.30
Kingston Formation		
Beckley Sand Member		
9	Soft, calcareous, fine- to medium-grained sand	approx. 1.0
8c	*Upper Trigonia Bed*: shelly, calcareous sandstone passing up into extremely sandy, shelly bioclastic limestone	0.40
8b	Poorly cemented sand	0.10
8a	*Upper Trigonia Bed*: shelly, medium-grained, very sandy limestone with only scattered, abraded shell fragments	0.50–0.60
7	Iron-rich, shelly sand	0.40–0.80
6	*Lower Trigonia Bed*: medium- to coarse-grained, shelly, very sandy limestone, sporadically ooidal, with well-preserved bivalves	0.20
5	Poorly sorted, fine- to medium-grained, shelly sandstone	0.70
(4	Gritstone, poorly fossiliferous	0–0.45)
(3	Interlaminated shelly sand and clay	0.15–0.30)
2	Sand with large calcareous concretions containing *Nanogyra nana* (J.Sowerby) and *Lima* sp.	1.50
(1	*Natica Band*: extremely fossiliferous, decalcified gritstone	1.55)
(seam of clay, underlain by white sand)		

A log of the section as seen by Johnson (1983) is given in Figure 2.43. The nomenclature is not that of Johnson, however, as, following Horton *et al*. (1995), all the medium- to coarse-grained sands and sandy limestones lying between the fine-grained Temple Cowley Member (formerly Lower Calcareous Grit (pars)) and the Coral Rag are placed in the Beckley Sand Member. Arkell (1936b) recorded many corals in both beds 6 and 8, along with a large number of bivalve species. However, it is the remarkable number of ammonites collected here that gives the quarry its chief interest. Callomon (1960) lists 41 species of ammonite from Dry Sandford Quarry. The numbers of perisphinctid, cardioceratid and *Aspidoceras* species found in each bed are as follows:

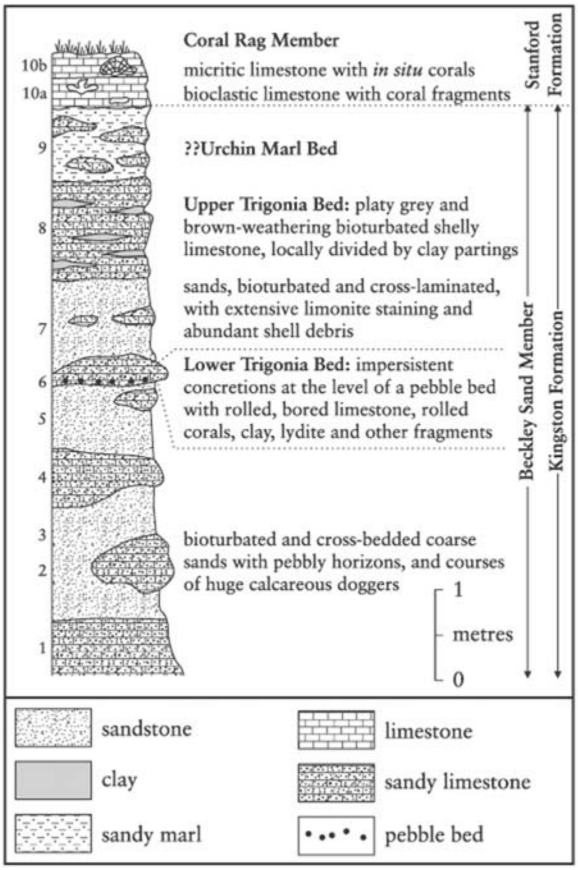

Figure 2.43: Log of the Corallian succession at Dry Sandford Quarry (after Johnson, 1983, fig. 1B).

Bed 8: 6 *Perisphinctes* spp., 1 *Cardioceras* sp., 1 *Goliathiceras* sp.

Bed 7: ?3 *Perisphinctes* spp., 5 *Cardioceras* spp., 3 *Goliathiceras* spp.

Bed 6: 6 *Perisphinctes* spp., 3 *Cardioceras* spp., 3 *Goliathiceras* spp., 2 *Aspidoceras* spp.

Bed 5: 3 *Perisphinctes* spp., 3 *Cardioceras* spp., 1 *Goliathiceras* sp., 4 *Aspidoceras* spp.

Bed 4: 2 *Cardioceras* spp.

Beds 3, 2: 2 *Cardioceras* spp., 2 *Goliathiceras* spp., 2 *Aspidoceras* spp.

Bed 1: 1 *Aspidoceras*. sp.

The fauna of Bed 8, with its great preponderance of perisphinctids, indicates the Antecedens Subzone of the Sub-Boreal Province, whereas the faunas of beds 1 to 7 are typical of the Vertebrale Subzone.

The Coral Rag, which here represents the Stanford Formation, is poorly exposed at the top of the quarry.

Interpretation

The soft sands in the lower part of the Beckley Sand Member with concretions up to 0.6 m thick and 1–2 m in diameter (Bed 2) are still well exposed. These coarse, shelly, cross-bedded sands with numerous bivalves and ammonites suggest rapid accumulation in a beach environment. The underlying Natica Band, a decalcified gritstone largely composed of the casts of the eponymous gastropod, is unfortunately no longer exposed. It is an excellent marker horizon traceable locally over several kilometres at the base of the Vertebrale Subzone.

The sequence in the upper part of the Beckley Sand Member consists of alternations of very sandy, shelly limestones with medium- or even coarse-grained, slightly shelly sands (Figure 2.44). Remarkably, all previous descriptions of this quarry (Arkell, 1936b; Callomon, 1960; McKerrow, 1958; Johnson, 1983) have failed to note the extremely sandy nature of the Trigonia Bed limestones (beds 6 and 8). These are so distinctive, and so markedly different in facies from that of the Highworth Formation limestones seen to the west, that they are included here within the Beckley Sand Member of the Kingston Formation. The danger of attempting to correlate these condensed, pebbly shell beds on lithology alone over even short distances is illustrated by Arkell's attempted correlation of Bed 6 at Dry Sandford with Bed 6 at Lamb and Flag Inn Quarry. These were both labelled the ‘Shell-Pebble Bed', and Arkell regarded them as equivalent. Callomon (1960) showed the ammonite faunas of these two beds to be very different, Bed 6 at Dry Sandford belonging to the Vertebrale Subzone, and Bed 6 at Lamb and Flag Inn Quarry to the Antecedens Subzone. Bed 8 at Dry Sandford, with its excellent Antecedens Subzone fauna, almost certainly correlates with Bed 6 at Lamb and Flag Inn Quarry (see Figure 2.41).

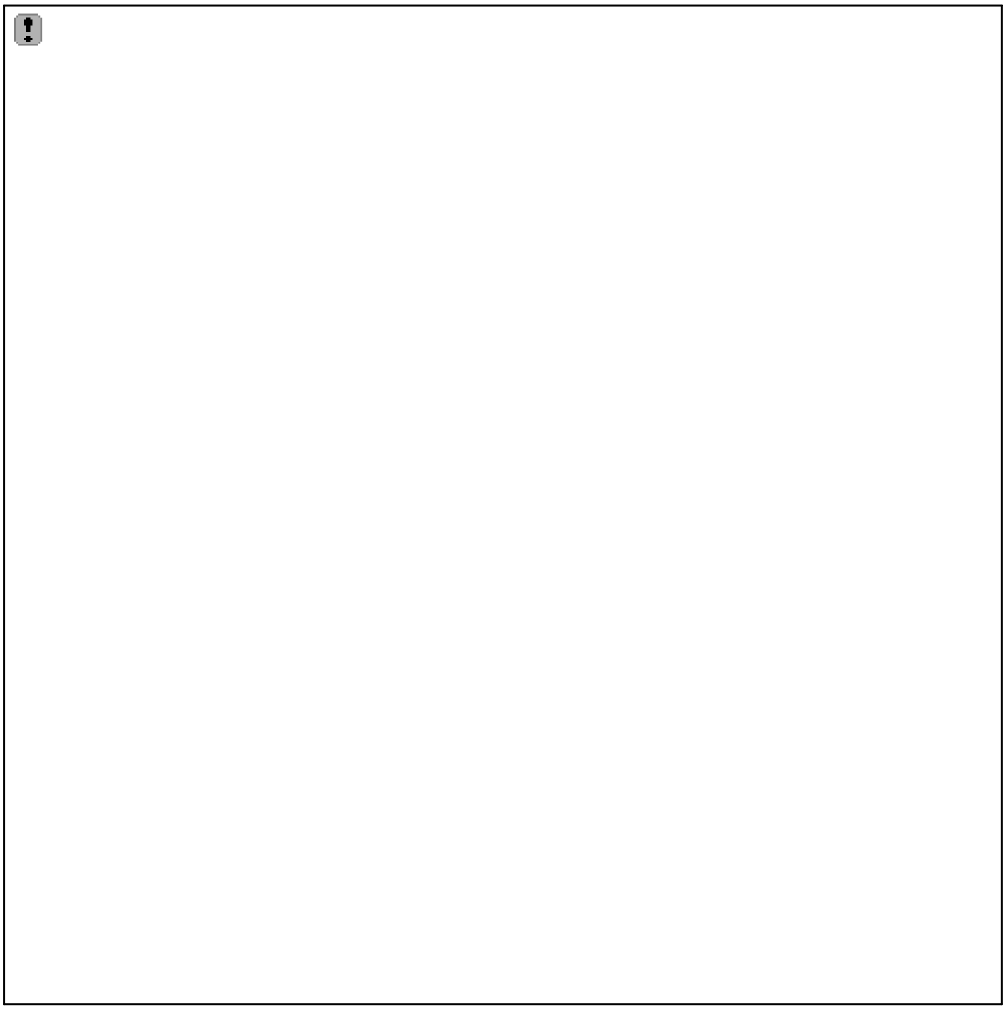

Figure 2.44: View of the main north–south face at Dry Sandford Quarry, showing the Lower Trigonia Bed (Bed 6) and Upper Trigonia Bed (Bed 8) separated by shelly sand (Bed 7) marked by the hammer (shaft length, 30 cm). (Photo: J.K. Wright.)

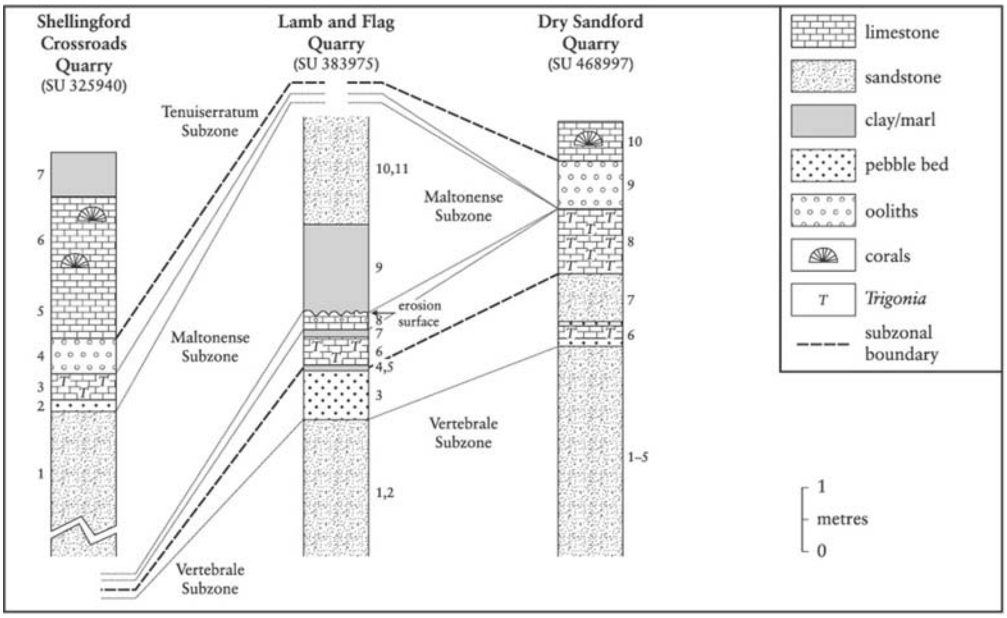

Figure 2.41: Correlation of sections at Shellingford Crossroads Quarry, Lamb and Flag Quarry, and Dry Sandford Quarry (after Johnson, 1983, fig. 2).

The difference in age of these two shell beds at Dry Sandford, separated by only 1 m of quartz sand (Figure 2.43, Bed 7), shows the slow nature of sedimentation in the area, or, given the coarse-grained nature of the sediment, the likelihood of marked gaps in the succession. Bed 7 forms a natural part of this sequence of alternations of poorly cemented sands and very sandy, shelly limestones. Johnson (1983) regarded Bed 7 as representing the Highworth Grit Member. However, the lithology of this bed is unlike that of this member at Shellingford Crossroads Quarry or Lamb and Flag Inn Quarry, and this interpretation is not accepted here. There is a marked change in facies from fine- to medium-grained quartz sand into non-sandy, bioclastic limestone at the base of the Coral Rag (Bed 10a) and, following Arkell and Callomon, it is accepted here that any representative of the Highworth Grit lay originally in this gap and has been removed by erosion. As was pointed out by McKerrow (1958), Bed 9 comprises a poorly cemented quartz sand. Arkell (1936b) noticed layers of sandy oolite in this bed, and suggested that it was equivalent to the Urchin Marl Bed, or possibly even part of the Highworth Grit.

As is often the case, the Coral Rag forms a transgressive sequence, consisting of bioclastic, coral-fragment sand laid down in shallow water, overlain by coral-rich micritic limestone. These cemented lime-mud deposits were laid down under quiet, stable lagoonal conditions, away from the marginal reef of the Oxford area, with the growth of both phaceloid or branching corals (*Thecosmilia*) and massive, encrusting corals (*Fungiastraea* and *Thamnasteria*).

Ammonite assemblages collected in the quarry have enabled substantial correlation to be achieved between the different Oxfordian faunal provinces. Ammonite faunas from this site represent both the Boreal and Sub-Boreal populations (see Chapter 1, 'Oxfordian and Kimmeridgian zones and subzones', and Figure 1.4), and have thus permitted important reassessment of ammonite zonations in Europe (Callomon, 1960; Sykes and Callomon, 1979). In addition, the faunal succession here was used by these authors to define the Plicatilis Zone of the Sub-Boreal Province, with its Vertebrale and Antecedens Subzones. The Vertebrale Subzone is recognized by the preponderance of *Cardioceras* and *Goliathiceras*, with *Aspidoceras*. In the Antecedens Subzone, *Perisphinctes* is by far the most common ammonite. The Antecedens Subzone is approximately equivalent to the Boreal Maltonense Subzone, its upper boundary probably extending above the base of the Boreal Tenuiserratum Zone (Sykes and Callomon, 1979). The subzones can only be defined in an exposure such as this where ammonite faunas are prolific.

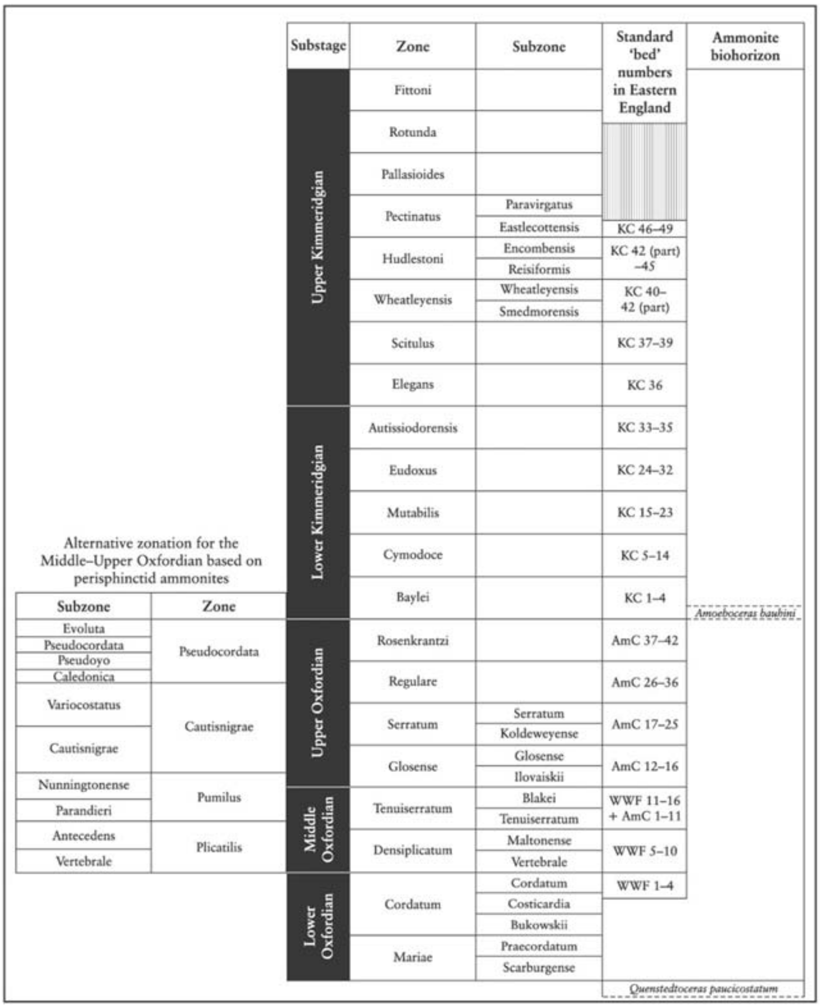

Figure 1.4: Chronostratigraphical subdivisions and ammonite biohorizons recognized in the Oxfordian and Kimmeridgian stages in Britain (for sources, see text). AmC = Ampthill Clay Formation; KC = Kimmeridge Clay Formation; WWF = West Walton Formation. In Dorset, where the Kimmeridgian succession is more 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.)

Conclusions

This site is the most important of those described by Arkell (1936b, 1947b) and Callomon (1960) in their establishment of the sequence of ammonite faunas in the Middle Oxfordian of the Oxford District. The abundance of stratigraphically useful ammonites at Dry Sandford Quarry, Cothill, led to this being defined as the formal standard succession for the Plicatilis Zone by Callomon (1960). Though it is no longer possible to collect ammonites, the excellence of the exposure coupled with a detailed knowledge of the ammonite faunas makes the site invaluable in any study of Oxfordian stratigraphy, palaeogeography, or palaeoecology.

Reference list

Arkell, W.J. (1933) *The Jurassic System in Great Britain*, Clarendon Press, Oxford.

Arkell, W.J. (1935) On the nature, origin and climatic significance of the coral reefs near Oxford. *Quarterly Journal of the Geological Society of London*, **91**, 77–110.

Arkell, W.J. (1936b) The ammonite zones of the Upper Oxfordian of Oxford.*Quarterly Journal of the Geological Society of London*, **92**, 146–87.

Arkell, W.J. (1947b) *The Geology of Oxford*, Clarendon Press, Oxford.

Callomon, J.H. (1960) New sections in the Corallian Beds around Oxford and the subzones of the *plicatilis* Zone. *Proceedings of the Geologists' Association*, **71**, 177–208.

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

Johnson, A.L.A. (1983) Field Meeting on the Corallian of Oxfordshire – report by the director. *Proceedings of the Geologists' Association*, **94**, 177–80.

McKerrow, W.S. (1958) *Geology Around the University Towns*: *the Oxford District*, 1st edn, Geologists' Association Guide No. 3, Geologists' Association, London.

McKerrow, W.S. and Baden Powell, D.F.W. (1953) Easter Field Meeting 1952. The Jurassic rocks of Oxfordshire and their superficial deposits. *Proceedings of the Geologists' Association*, **64**, 86–98.

McKerrow, W.S. and Kennedy, W.J. (1973) *Geology around the University Towns*: *the Oxford district*, 2nd edn, Geologists' Association Guide No. 3, Geologists' Association, London.

Sykes, R.M. and Callomon, J.H. (1979) The *Amoeboceras* zonation of the Boreal Upper Oxfordian. *Palaeontology*, **22**, 839–903.

Talbot, M.R. (1971) Calcite cements in the Corallian beds (Upper Oxfordian) of southern England. *Journal of Sedimentary Petrology*, **41**, 261–73.

Talbot, M.R. (1973a) Major sedimentary cycles in the Corallian Beds (Oxfordian) of southern England. *Palaeogeography*, *Palaeoclimatology*, *Palaeoecology*, **14**, 293–317.