Upper Inferior Oolite, Middle Jurassic, Bristol and Gloucester region


A Horizontal diagrammatic section through the Inferior Oolite Group of the Cotswolds. B Horizontal diagrammatic section through the Inferior Oolite Group of the Mendip-Crewkerne region. (P948991)

Isopach map of the Inferior Oolite Group. (P948982)
Classification of the Inferior Oolite Group.
(P948997)

**Upper Inferior Oolite**

As a result of the widespread warping and erosion that took place prior to its deposition, the Upper Inferior Oolite rests on formations ranging from the Middle Inferior Oolite to the Lias and, in the eastern Mendips, directly overlies *Triassic and Palaeozoic rocks* (P948991). In the main Dorset-Wessex Basin, the western edge of which lies in the south-eastern corner of the present region, there is only a minor break below the Upper Inferior Oolite (P948997, col. 3). Outside the basinal area, along the marginal belt to the west and south, the Upper Inferior Oolite, in common with the underlying divisions, becomes attenuated. At the same time, the break at the base becomes more important and, locally on the Yeovil ‘High’, the beds come to rest directly on the Upper Lias.

**Dundry and Cotswold area**

**Upper Trigonia Grit**

Over the Cotswold area, the Upper Trigonia Grit forms the basal member of the Upper Inferior Oolite and consists of 1 to 2.5 m of grey, splintery, shelly ragstone resting on a bored and eroded surface of Lower or Middle Inferior Oolite. Ammonites are rare in the Cotswolds, but brachiopods are abundant and include Stiphrothyris tumida and Acanthothiris spinosa; the bivalves Trichites and Trigonia are also common, the latter in the form of casts, which are so numerous as to give the rock its name.

At Dundry, the equivalent beds, where present, are no more than 0.3 m, thick but they are fossiliferous and yield Rhactorhynchia subtetrahedra. In the neighbourhood of the Mendips, as at Maes Knoll and Timsbury Sleight, the Upper Trigonia Grit is represented by a thin conglomerate, while it is missing over the Mendip and Vale of Moreton ‘axes’.

**Dundry Freestone**

At Dundry Hill, above the equivalent of the Upper Trigonia Grit, there is a local development of massive limestone, known as the Dundry Freestone. This deposit is only 1 m thick in the eastern part of the hill, but in the western part it reaches 8 m. St Mary Redcliffe and other Bristol churches were built wholly or partly of this freestone, but the quarries are now abandoned, much of the best stone having been long since worked out.
Overlying the Dundry Freestone are coralline beds up to 6 m thick whose top is not seen. These distinctive deposits of crystalline and siliceous rubbly limestone and marl contain Isastraea and other corals, as well as echinoderms and brachiopods such as Zeilleria waltoni and Aulacothyris carinata. Many of the fossils are beekitised, and small irregular wisps and patches of chalcedony investing geodes lined with small quartz crystals are common both in the coralline beds and the upper part of the underlying Freestone.

Upper Coral Bed

Along the main outcrop in the Bath area as far south as Writhlington and northwards to around Tormarton, coralline limestones very similar to those on Dundry Hill form a distinctive stratum, either resting directly on the Upper Trigonia Grit or separated from it by a metre or so of shelly limestone (? Dundry Freestone equivalent, but see below). In either case, the immediately underlying bed is strongly bored and often oyster covered. The thickness varies from around 0.3 m to locally as much as about 4 m. The upper surface is also strongly bored. Northwards from Tormarton, discontinuous occurrences of apparently similar limestones have been recorded, mainly from the more westerly outcrops in the Wotton-under-Edge–Dursley area.

Doulting Stone–Anabacia Limestone

North of the Mendips and extending into the south Cotswolds, the main mass of the Inferior Oolite above the Upper Trigonia Grit, or Upper Coral Bed if present, comprises white and cream-coloured oolites some 7 to 10 m thick. In good exposures they can be divided into two members, the Doulting Stone below and the Anabacia Limestone above, usually separated by a bored surface. The former consists of massive, more or less current-bedded freestone and the latter, which measures some 3 m or so, is flaggy below and rubbly above. The Anabacia Limestone is so named after the common occurrence in it of the button coral Chomatoseris [Anabacia] porpites, although this form is not confined to these beds.

Clypeus Grit

The name Clypeus Grit is derived from the local profusion of the large sea-urchin Clypeus sinuatus, which characterises the formation. Around Stow-on-the-Wold, this fossil is so abundant that when fields are cleaned the heaps of stones are found to be largely made up of damaged specimens. The rock itself is highly distinctive, being almost a pisolite with large yellow granules set in a buff chalky matrix. In the Stroud area and southwards, the echinoid is rarer and the rock has been informally divided into a more marly lower part, which is oolitic rather than pisolitic, a middle member descriptively named the White Oolite Beds, and an upper rubbly part. The formation appears to pass laterally into the Doulting–Anabacia limestones southwards from Horton.

Correlation between The Cotswolds and the area to the South

Ammonite evidence proves that the uppermost parts of the Clypeus Grit and the Anabacia Limestones are of earliest Bathonian age. Also that the remainder of the Clypeus Grit is of bomfordi subzonal age and hence, by implication, much of the Anabacia Limestone is too. The Upper Coral Bed at Wotton-under-Edge is considered to be of truelei subzonal age and the Upper Trigonia Grit belongs to the garantiana Zone, probably the acris Subzone. It follows that the Clypeus Grit, for the most part, sits unconformably on the Upper Trigonia Grit and that truelei times were mainly marked by nondeposition or erosion in the more northerly areas. On the south side of the Mendips, the lower third of the Doulting Stone appears to be of garantiana Zone age, and as there is no evidence of major sedimentary interruption in the beds above, it may be assumed that the overlying beds are
largely attributable to the truelei Subzone. North of the Mendips, sedimentation during garantiana times was much reduced compared to farther south, with relatively thin Upper Trigonia Grit only being represented. Its upper surface represents a nonsequence and the Upper Coral Bed formed as an irregular sheet upon it in the Bath area, but probably only as discontinuous patches farther north. After a further hiatus, probably accompanied by erosion, the spread of detrital and oolitic rocks proceeded slowly northwards reaching over the whole area during later parkinsoni Zone times only.

The correlation of the Dundry succession with the main outcrop is uncertain. Recent opinion favours equating the Doulting and Dundry freestones; thus the coralline beds of Dundry would be separate from, and older than the Upper Coral Bed of Bath. The older view equates the Dundry and Bath coralline beds, thus making the Dundry Freestone older than the Doulting Stone.

**Area south of the Cotswolds**

*Mendip-Doulting-Castle Cary*

When traced southwards from Bath the lower part of the Upper Inferior Oolite becomes thinner and eventually disappears (see P948991). Only the Doulting Stone and higher beds cross the Mendip Axis, and where these are seen in the deep valleys west of Frome they rest unconformably upon the Carboniferous Limestone of the eastern Mendips.

Magnificent sections showing almost horizontal Upper Inferior Oolite resting on a bored and planed surface of steeply dipping Carboniferous Limestone are exposed at Vallis Vale near Frome. Traces of Lower Lias and Trias occur in some places between the Inferior Oolite and the Carboniferous Limestone. Southwards from Doulting to Batcombe, the surface of the Palaeozoic rocks falls away steeply and higher beds of the Lias appear beneath the Doulting Stone (P948991).

Near Doulting, the railway cutting and quarries show typical Doulting Stone consisting of shelly and oolitic limestone and freestone, in which crinoid fragments and oolite grains are embedded in a matrix of crystalline calcite. Considerable lateral variation may be seen in the exposed rock faces and there is much current-bedding. Though not so readily carved as Bath or Ham Hill Stone, Doulting Stone is very durable. It was used in the construction of many fine mediaeval buildings, Wells Cathedral being the most outstanding example.

Together with the overlying Anabacia Limestone, the Upper Inferior Oolite succession measures about 20 m in thickness. Ammonite evidence for the age of the rocks now shows that the uppermost part of the Anabacia Limestone is of earliest Bathonian age, whilst the lowest third of the Doulting Stone, which comprises about 5 m of thinner-bedded more ‘raggy’ beds than the overlying freestones, is of garantiana Zone age. The thickness is exceptional for this zone and may represent a western continuation of the downwarping associated with the Vale of Pewsey Growth Fault (P948982). Farther south, the garantiana Zone reverts to a more normal thickness of around 1.5 to 3 m. Southwards from Castle Cary, the lower beds pass into a pleasing brown, ferruginous building stone measuring up to 3 m in thickness, locally known as the ‘Hadspen Stone’. The overlying limestones are poorly known, but appear to include no economic building stone comparable to the Doulting Stone farther north.

*Wincanton-Crewkerne*

The Upper Inferior Oolite increases in thickness southwards from the Mere Fault more dramatically than the Lower and Middle subdivisions. The Wincanton Borehole, sited immediately adjacent to the Mere Fault, lies some 6 km to the south-south-east of the Bruton Borehole, which proved a total thickness of 6.8 m of Upper Inferior Oolite. At Wincanton, the total thickness can hardly be less than 45 m and may even approach 50 m. The uppermost 4.7 m comprise oolites, which are presumed to be equivalent to the Anabacia Limestone of farther north, whereas the remainder of the sequence is
akin to that in the Dorset-Wessex Basin to the south.

The north-western edge of the main basin is seen in the country around Sherborne and Milborne Port. There, up to 6 m of ‘Sherborne Building Stone’ is overlain by up to 13 m of rubbly limestone and marl. Garantiana garantiana, Nautilus and ‘nests’ of Spheeroidothyris sphaeroidalis occur, the last being known to the older quarrymen as ‘gooseberries’. Among other interesting fossils, the Sherborne Building Stone has yielded the remains of the dinosaur Megalosaurus bucklandi; cones of the conifer Araucaria cleminshawii are also thought to have come from these beds.

Above the Sherborne Building Stone and Rubbly Beds lie the Crackment Limestones, a formation which is typically developed in the Milborne Port area. It is composed of pale grey or dirty white, fine-grained limestone with clay partings and is over 11 m thick in its fullest development. The fossils include Zigzagiceras and other typical early Bathonian ammonites.

Farther towards the centre of the basin, the Stowell Borehole proved similar facies to those noted at outcrop, but with a total thickness for the Upper Inferior Oolite of about 33 m; the thickness may have increased by a further 4 to 5 m in the Stalbridge Borehole.

To the west of the basin, the thickness variations of the Upper Inferior Oolite closely follow those of the lower beds, with minimum values on the Yeovil ‘High’ and a thickening towards the western edge of the Inferior Oolite outcrop. The Sherborne Building Stone and the overlying rubbly limestones become more and more attenuated, and at Halfway House are represented by the ‘Fossil Bed’ and Astarte Bed — two condensed fossiliferous limestones which together total only 0.46 m. Around Yeovil the garantiana Zone and truellei Subzone are seldom more than 0.2 m thick and can only be recognised with great difficulty.

A similar westerly thinning can be observed in the case of the Crackment Limestones, which are only 1.5 m thick near Yeovil. At Haslebury Mill, near Haslebury Plucknett, it is represented by about 0.1 m of rubbly white limestone and clay with Morphoceras. In this condition it is known as the Zigzag Bed and constitutes a useful datum in the Crewkerne and Bridport districts.

The thickest recorded Upper Inferior Oolite in the western area is in a quarry near Hinton St. George. Here the garantiana Zone consists of hard conglomeratic limestone, of which 0.46 m is seen, overlain by 1.37 m of massive, brown, ferruginous limestone similar to the Hadspen Stone of the Castle Cary area. This is overlain by limestones with marly partings attributed to the parkinsoni Zone, giving a total exposed thickness of about 5 m.

**Sedimentation in the inferior Oolite of the Dorset-south Somerset area**

The sedimentation pattern of this and adjacent areas was one of ‘swells’ or ‘highs’, on which sedimentation was slow and interrupted, and ‘sags’ or basins, in which sedimentation was faster and more continuous. It seems probable that the Yeovil ‘High’ passes southwards into the South Dorset ‘High’ (Rhys et al., 1982) south of the present region. In the opposite direction, it is possible, though unproven, that the Yeovil ‘High’ extended north-eastwards to encompass the attenuated successions of the Bruton area and, if so, defined the western edge of the Dorset Basin. The westward thickening of the Inferior Oolite on the western flank of this ‘High’ may signify that a basin existed to the west of the present outcrop, possibly a northern arm of the Portland Basin (Penn et al., 1980).

Successions in the ‘highs’ are characterised by conglomerates, erosion planes, evidence of reworking of the sediments, strongly ferruginised coated particles and grains of various sorts,
including algal stromatolites, and a general lack of clastic debris. Sediments in the basins are characterised by abundant bioclastic and intraclastic debris, with or without sand grains and glauconite. Oolites are common to both associations but are ferruginised ('ironshot') in the condensed deposits that characterise the 'highs'. In a paper on limonitic concretions, Gattrall et al. (1972) suggested that the ironshot facies were formed on shallow submarine swells on a marginal shelf, in which there was a minimal supply of sediment that allowed slow concentration of authigenic iron over long periods of time. The lack of clastic debris in the condensed sequences was accounted for by the intervening basins acting as sediment traps. It must be noted, however, that during much of the Middle Inferior Oolite, for instance, the ironshot facies was widespread, even extending across the Cotswolds.

References


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Variants