Frith Quarry, Gloucestershire

[SO 867 082]

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Introduction

The section at Frith Quarry, near Painswick, Gloucestershire, was first described by Buckman (1895) and parts of his section were repeated by Richardson (1904). Subsequent to these accounts, the quarry seems to have been largely overlooked, and is not recorded again in the literature, although the lower part of the succession (Birdlip Limestone Formation, Scottsquar Member) is figured by Baker (1981, fig. 2). The quarry is the source of numerous type and cited specimens of fossil taxa. It should not be confused with the smaller quarry [SO 866 083] immediately to the north-west of the GCR site, also referred to as the Frith Quarry by some authors, in which beds lower in the Inferior Oolite Group succession have been recorded.

Description

The following section is based on an account of the quarry (by C.F. Parsons) held on file by English Nature, with revised lithostratigraphical classification by the present author.

	Thickness (m)
Aston Limestone Formation	
Gryphite Grit Member	
18: Limestone, brown, thin-bedded, sandy, bioclastic, interbedded with brown, sandy marl; *Gryphaea bilobata* J. de C. Sowerby	1.0
17: Limestone, brown, massive, sandy, bioclastic, in three to four courses; highly irregular base; *Gryphaea bilobata*	0.80–0.90
16: Sand, yellow, fine grained, becoming brown and marly downwards	0.30–0.35
15: Limestone, hard, shelly, ferruginous, bioclastic; highly fossiliferous, with *Gryphaea* and abundant *Ctenostreon* on bedding surfaces	0.70–0.90
Lower Trigonia Grit Member	
14: Marl, brown; impersistent, sandy, nodular limestone towards middle; *Sonninia* (*Fissilobiceras*)*, Pholadomya*	0.10–0.28
13c: Limestone (oobiomicrite), rubbly, ferruginous, finely 'iron-shot', highly bioturbated, mixed with soft marl; highly fossiliferous with abundant bivalves, including *Trigonia costata* Parkinson, *Ctenostreon pectiniforme* (Schlotheim), *Pholadomya* and *Trichites,* with shells replaced by limonite; *Hyperlioceras* (*H.*) *rudidiscites* S.S. Buckman	0.37–0.60
13b: Marl, brown, impersistent	0–0.05
13a: Limestone, similar to Bed 13c, but harder and slightly less fossiliferous	0.20–0.30
12b: Marl, pale orange-brown, rubbly, slightly 'iron-shot', calcareous; paler towards top where there are numerous yellow-stained pebbles	0.15–0.20

12a: Limestone (oomicrite), pale orange-brown, burrowed, similar to Bed 12b though more indurated; fissure infill with *Trichites* fragments and limonite-stained pebbles deeply penetrating Bed 11 below	0.18–0.22
Birdlip Limestone Formation	
Scottsquar Member	
11: Limestone (oobiomicrite), brown, hard; undulating, bored, oyster-encrusted hardground top surface; very shelly in lower part with sparse, orange-coloured, limonitic pisoids; bioturbated with soft, white, micritic burrow-fills	up to 0.35
10: Marl, orange-brown, soft, laminated, ooidal; dark-brown, with common shell-fragments in basal 0.05 m; abundant *Homoeorhynchia cynomorpha* (*S.S.* Buckman)	0.66–0.72
9: Limestone (micrite), white, weathering pale pink-grey, marl seam 0.03 m thick, 0.24 m below top; species of the ammonite *Brasilia* in lower part; *Blastinoidea fritbica* Richardson and Thacker	0.90
8: Clay, yellow becoming brown in lower part, soft, sticky	0.10–0.13
7d: Limestone (micrite), pale pink-grey, soft with sparse, orange-coloured limonitic pisoids; *Globirhynchia tatei* (Davidson)	0.30
7c: Marl, pale-brown	0.05–0.10
7b: Limestone (oomicrite), pale-grey, soft, with small yellow-orange ooids; *Plectothyris*	0.10–0.15
7a: Limestone (oomicrite), orange-brown, moderately hard; bioturbated with densely packed ooids interspersed with patches of grey micrite; gradational base; abundant *Plectothyris fimbria* (J. Sowerby), also *Globirhynchia* and poorly preserved bivalves	0.15–0.20
6: Limestone (oobiomicrite), cream, hard, massive, nodular, shelly, with small well-packed ooids; softer and more sparsely ooidal towards base where there are sporadic *Plectothyris*	1.20–1.40
5: Limestone (oomicrite) and marl, pale pink-grey, soft, rubbly with small orange-coloured ooids; indurated towards top, softer and browner near base; *Plectothyris fimbria, Epithyris*	0.50–0.80
4: Limestone (micrite), pale pink-grey, moderately hard, with small, sparse, pale orange-coloured ooids and limonite-stained patches; sparsely burrowed; poorly fossiliferous; *Plectothyris*	1.40
3: Limestone (oomicrite), pale grey-brown, soft, orange-stained with small, sparse, pink ooids; more indurated at the top; softer, more marly towards base; *Plectothyris* cf. *fimbria, Epithyris, Globirhynchia* aff. *subobseleta* (Davidson)	1.80–1.85
2: Clay, blue and orange-streaked, limonite-stained	0.05–0.10
Cleeve Cloud Member	
1: Limestone (oobiosparite), hard, shelly, massive, densely ooidal freestone; flat, limonite-stained, bored hardground at top	seen to 2.60

The above section (as measured in the 1970s) is comparable with that described by Buckman (1895), although slightly more of the Cleeve Cloud Member (i.e. Lower Freestone, Buck-man's Bed 31) was then exposed and there is difficulty in recognizing some of Buckman's finer bed divisions in the overlying succession. The strata are disturbed by cambering effects, with associated minor faults and fissures (gulls), which makes correlation of beds across the face somewhat problematic.

Interpretation

Frith Quarry (Figure 3.30) shows the middle part of the Inferior Oolite Group within the so-called 'Painswick Syncline' (Buckman, 1901) in which a largely complete succession of the Birdlip Limestone Formation (Lower Inferior Oolite) and the Aston Limestone Formation (Middle Inferior Oolite), comparable with that developed near Cheltenham, is preserved. Only the lower part of the Aston Limestone Formation is exposed; higher parts can be seen at Swift's Hill (see GCR site report, this volume), *c.* 2 km to the southeast.

The Cleeve Cloud Member at the base of the section is capped by a planed and bored hard-ground as is generally the case (e.g. see Leckhampton Hill GCR site report, this volume). The section of the succeeding Scottsquar Member, *c.* 7.8 m thick, is one of the best in the Cotswolds. This unit (Barron *et al.,* 1997), which combines the Oolite Marl and Upper Freestone of previous accounts, is here entirely of Oolite Marl facies, comprising pale chalky marls and micritic limestones. This low-energy facies is quite distinct from the high-energy oolite shoal facies of the Upper Freestone, better developed at sites such as Leckhampton Hill (see GCR site report, this volume). It has been interpreted as accumulating in relative lows or troughs in the sea floor (Baker, 1981). According to Baker (1981), there is an irregular scour or possibly karstic surface 3.2 m above the base of the member, i.e. probably at the top of Bed 4 of the section given above. The succession is highly fossiliferous at some levels, and is particularly rich in brachiopods. The marly Bed 10 of the above section (which incorporates Buckman's (1895) Bed 18) yields abundant *Homoeorhynchia cynomorpha* and is the source of the type specimens figured by Buckman (1895) (Figure 3.31). *Plectothyris fimbria* and *Globirhynchia tatei* are also common. The member here has yielded a number of ammonites; Buckman (1895) recorded several species 'aff. *Ludwigia Murchisonae*'from amongst Edwin Witchell's collection (see Swift's Hill GCR site report, this volume) and Bed 9 (= Buckman's Bed 20) has yielded *Brasilia* cf. *bradfordensis* (S.S. Buckman) and *B.* aff. *baylii* (S.S. Buckman) suggestive of the Aalenian Bradfordensis Zone (Parsons, 1980a, emend.). The Scottsquar Member at Frith Quarry has also yielded a number of species of sponges, including the type specimens of *Blastinoidea frithica* (Richardson and Thacker, 1920).

The eroded, bored hardground at the top of the Scottsquar Member (Bed 11) represents the Aalenian denudation' of Buckman (1901); locally, the erosion surface is highly irregular and it apparently extends down in crevices into the underlying bed. Owing to inadequate exposure, the pattern of erosion is somewhat difficult to establish, but there may be a second period of erosion represented within Bed 11. If so, this could conceivably represent that seen elsewhere beneath the Harford Member (the youngest part of the Birdlip Limestone Formation; Barron *et al.,* 1997), and remnants of that member may be preserved locally close to the axis of the 'Painswick Syncline'. The Harford Member is otherwise known only in the area of the analogous 'Cleeve Hill Syncline' (see Leckhampton Hill GCR site report, this volume) and north Cotswolds.

The Lower Trigonia Grit Member, at the base of the Aston Limestone Formation, comprising 'iron-shot' limestones and marls, has yielded a large number of often well-preserved ammonites, in marked contrast to the rest of the Inferior Oolite Group of the Cotswolds where ammonites are generally rare and poorly preserved. They most probably come from Bed 13 (= Buckman's Bed 8), and were first described by Witchell (1882a), although he mistakenly assigned them to the Gryphite Grit Member (see Buckman, 1895). Witchell's extensive collection, now in the Natural History Museum, London, was utilized by Buckman (1887–1907) in his substantial monograph on Inferior Oolite Group ammonites and, together with other specimens from the site (in Stroud Museum and elsewhere), make up one of the most extensive faunas from the Lower Bajocian Discites Zone in England. The topmost bed of the member (Bed 14) has yielded *Sonninia* (*Fissilobiceras*) aff. *fissilobata* (Waagen) indicating the succeeding Ovalis Zone (Parsons, 1980a, emend.).

Some 2 m or so of the succeeding Gryphite Grit Member (incorporating the Gryphite Grit and Buckmani Grit of earlier accounts) are exposed. It contains common *Gryphaea bilobata* (the 'Gryphite' of the name) and Buckman (1895) also

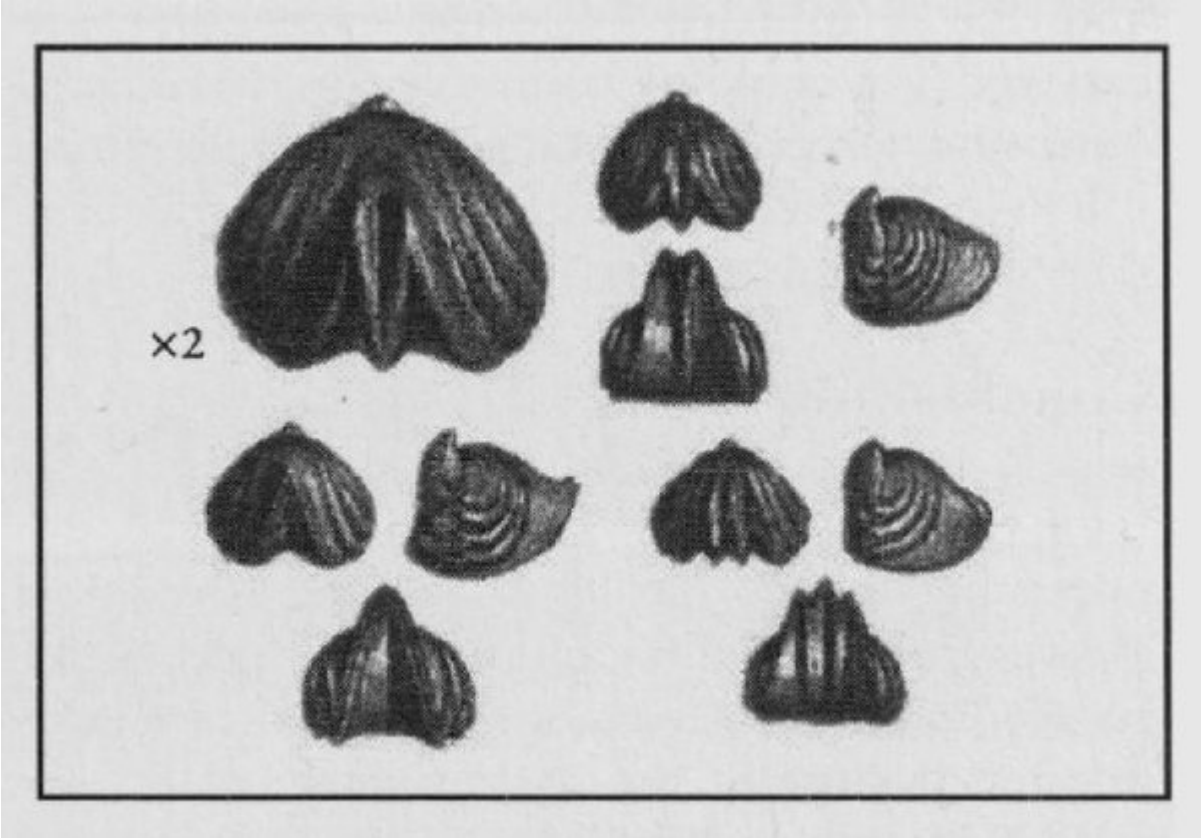
recorded *Lobothyris buckmani* (Davidson) from the basal part.

Conclusions

Frith Quarry shows a fine section through the upper part of the Birdlip Limestone Formation (Lower Inferior Oolite) and the lower part of the succeeding Aston Limestone Formation (Middle Inferior Oolite) in the axial region of the so-called Painswick Syncline. The Scottsquar Member, of 'Oolite Marl' facies, is richly fossiliferous and has yielded some of the few zonally significant ammonites known from this level. The Lower Trigonia Grit Member is also highly fossiliferous and has yielded an extensive Discites Zone ammonite fauna.

References

(Figure 3.30) Aston Limestone Formation overlying Birdlip Limestone Formation at Frith Quarry. The boundary is marked by a white arrow. (Photo: M.G. Sumbler.))



(Figure 3.31) Type material of Homoeorhynchia cynomorpha (S.S. Buckman) from Frith Quarry. (Reproduced from Buckman, 1895, pl. 14, figs 2–4.))