Napton Hill Quarry, Warwickshire

[SP 457 613]

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Introduction

The Napton Hill Quarry GCR site is a disused brickpit at Napton-on-the-Hill. It is one of the few remaining inland exposures of the Upper Pliensbachian (Middle Lias) succession in Britain, comprising the top of the Dyrham Formation and the base of the Marlstone Rock Formation. Napton Hill Quarry forms an outlier of Upper Pliensbachian strata within a small fault-bounded block (Figure 5.11) west of the main outcrop in east Warwickshire. The quarry formerly exposed the entire Upper Pliensbachian (Middle Lias) succession, and the upper part of the underlying Lower Pliensbachian (Lower Lias) succession, consisting of the base of the Dyrham Formation and the top of the Charmouth Mudstone Formation, which was worked for brick-making. Today only the Upper Pliensbachian succession remains exposed (Figure 5.12), and the lower part of the quarry has been back-filled. This is one of a series of key sites that together reveal lateral facies changes across the Upper Pliensbachian outcrop. Strata formerly exposed here yielded rich Lower Pliensbachian ammonite assemblages, which contributed to the development of ideas on ammonite evolution and biostratigraphy.

The biostratigraphical succession was summarized by Trueman (1918) although his description lacked lithological detail or bed thicknesses. Howarth (1958) described the Upper Pliensbachian succession; a fuller section, extending down into the top of the Lower Pliensbachian succession, was described by Callomon (in Hallam, 1968a). It was described again briefly in Lord's (1974) study of Upper Pliensbachian (= Domerian) and Toarcian ostracods. The section, as currently exposed, was described by Old *et al.* (1987). In the past the site was an important source of liparoceratid ammonites that formed the basis of phylogenetic and taxonomic research undertaken by Trueman (1918) and Spath (1938).

Description

The most complete section of the site was published by Callomon (in Hallam, 1968a). The biostratigraphical succession published by Trueman (1918) implies that older parts of the succession may have been exposed at one time. However, it has been suggested J.H. Callomon, pers. comm.) that the lower parts of Trueman's section may have been based on material from the immediate neighbourhood rather than from the pit itself. The section described by Callomon was almost 53 m thick and divided almost equally between the Lower and Upper Pliensbachian substages. The former comprised 26 m of grey and blue-grey silty clays and shales with bands of nodules, 0.05–0.2 m thick, at irregular intervals. The Lower and Upper Pliensbachian (= Lower and Middle Lias) junction was identified by Howarth (1958) at a level 26.5 m (86 ft 2 in.) below the top of the Marlstone Rock Formation. Much of the Upper Pliensbachian comprises typical Dyrham Formation facies, mostly siltstones and silty mudstones together with several horizons of large sandstone 'doggers' and a 0.5 m-thick fossiliferous sandstone. The Upper Pliensbachian succession is capped by the Marlstone Rock Formation, here divisible into a lower sandstone unit and an upper limestone unit, with a basal pebble bed. Old *et al.* (1987) report that in this area the Lower Pliensbachian becomes more silty and micaceous upwards towards the Upper Pliensbachian, and is a paler grey than the clays lower in the succession. The upper part of the Lower Pliensbachian also is more ferruginous in parts, with mudstone and ferruginous nodules forming a significant component of this part of the succession.

The following Upper Pliensbachian section is based largely on the description of Old *et al.* (1987), with some additional data from Howarth (1958). The Lower Pliensbachian succession is that of Callomon (in Hallam, 1968a).

Marlstone Rock Formation	Thickness (m)

37: Limestone, bioclastic, rubbly and flaggy, ferruginous, orange-brown, sandy; green when fresh. *Camptonectes mundus, Modiolus scalprum, Protocardia truncata, Pseudolimea* sp., crinoid debris.	3.00
36: Sandstone; fine grained and micaceous, soft and poorly cemented. Small rounded pebbles of sandstone and siltstone at the base.	0.50
Dyrham Formation	
35: Siltstone; sandy and ferruginous, with shell debris. Belemnites near base.	0.64
34: Siltstone; grey, ochreous and micaceous. Poorly cemented, with iron-stained fractures and surfaces.	2.20
33: Sandstone; orange, poorly cemented and calcareous, with iron-stained fractures. Many bivalves and other fossils; *Modiolus scalprum, Protocardia truncata, Unicardium cardioides, Camptonectes* sp., *Ceratomya* sp., *Pseudolimea* sp., *Pseudopecten* sp., *Amaltheus subnodosus, A. margaritatus* and *A. striatus.*	0.54
32: Mudstone; pale grey, silty with sandy wisps and ferruginous doggers up to 1 m across.	2.20
31: Limestone; grey-green, weathering reddishorange. Sandy and ferruginous with Shelly cementstone doggers. *Protocardia truncata, Pholadomya* sp., *?Pleuromya, Amaltheus* cf. *subnodosus.*	0–0.88
30: Mudstone; pale grey to brown, increasingly silty towards top with shell debris and ironstone nodules. A row of scattered doggers 3.1 m from the top. *Liparoceras* (*Becheiceras*) *bechei* in lowest 1.5 m.	4.8
29: Sandstone; poorly cemented, with patches of silt and abundant doggers up to 1.5 m thick and 5 m across, of medium-grained calcareous sandstone, blue-hearted but weathering green-brown or orange. Abundant fossils, particularly pectinids and other bivalves, crinoid debris and large specimens of *Amaltheus stokesi* and *Protogrammoceras nitescens.* Scattered grey phosphatic nodules weathering red-brown. Very sharp boundary with underlying mudstones.	1.5
28: Mudstone; pale grey, weathering brown, with a little silt towards the top and more towards the base. Ferruginous bands and small doggers are common in the top 1.0 m and a row of scattered doggers occur 9.2 m from the top. Junction with Charmouth Mudstone Formation at base (Howarth, 1958). The top 4.0 m of this unit form the lowest part of the succession now seen in the quarry (Figure 5.12).	9.62
Charmouth Mudstone Formation	
Davoei Zone, Figulinum Subzone	
27: Clays, dark blue-grey.	0.23
26: Mudstone nodule band, impersistent, ferruginous.	0.05
25: Clays, blue-grey.	0.40
24: Sandstone band, ferruginous, nodular.	0.05–0.13
23: Clays, shaly, dark blue-grey	1.70

22: Line of brown, ferruginous mudstone nodules with ammonites.	0.10–0.20
21: Clays, shaly, blue-grey.	0.45
20: Brown ferruginous sandy mudstone nodule band.	0.13
19: Clays, shaly, blue-grey.	0.45
18: Mudstone nodule band, ferruginous.	0.15
Capricornus Subzone	
17: Clays with median nodule band; ammonites.	0.92
16: Nodules.	0.15
15: Clays, grey.	0.77
14: Mudstone nodules.	0.15
13: Clays.	1.08
12: Nodule band.	0.15
11: Clays and shales.	5.38
10: Seam of nodules.	0.08
9: Clays.	0.45
Maculatum Subzone	
8: Nodules.	0.08
7: Clays, dark.	0.23
6: Line of nodules.	0.08
5: Clays, grey.	1.54
4: Mudstone nodules.	0.10
3: Clays.	0.69
2: Nodules.	0.15
1: Clays below	seen to 10.15

Considerably less than half of this total thickness is visible today. The Lower Pliensbachian succession, consisting predominantly of the Charmouth Mudstone Formation has long since been obscured by back-filled material as has the base of the Upper Pliensbachian Dyrham Formation. The top 4 m of Bed 28 are the lowest part of the succession that can be seen clearly at present: the Marlstone Rock Formation is still well-exposed at the top of the face (Figure 5.12).

Ammonites have figured prominently in all descriptions of the site, either for their biostratigraphical value (Howarth, 1958; Callomon in Hallam, 1968a) or for their significance in interpreting the phylogeny of the liparoceratids (Trueman, 1918; Spath, 1938; Callomon, 1963). Spath (1938) cited examples of nine species of liparoceratid from here, including the holotype of *Liparoceras naptonense.* Other macrofossils have received little attention. Palmer (1975) cited the bivalve *Cardinia attenuata* as occurring in the Ibex Zone, while Woods (1925–1931) figured a chela of the crustacean *Eryma* sp. from the Marlstone Rock Formation here, but otherwise there appear to be no published accounts of other elements of the macrofauna. Lord (1974) recovered a limited microfauna of ostracods and foraminifera from only one of 17 samples; the productive level was a shelly sandstone (Bed 29) 13 m below the Marlstone Rock Formation.

Interpretation

The biostratigraphy of the main part of the recorded section is fairly well-established through the investigations of Howarth (1958) and Callomon (in Hallam, 1968), but is not fully resolved at some levels.

Uncertainty surrounds the age of the Marlstone Rock Formation since it has not yielded any ammonites at this site. Howarth (1980) demonstrated the presence of Tenuicostatum Zone ammonites in the upper part of the formation at numerous sites, from Dorset to the East Midlands Shell; but no such evidence has been found here although this zone is proven in the top of the Marlstone Rock Formation at Byfield, less than 10 km to the south-east (Howarth, 1978). The lower part of the Marlstone Rock Formation is assumed to be at least partly of Spinatum Zone age, although again no ammonites have been found here. Within the underlying Dyrham Formation the Stokesi Subzone (beds 28–29) and the Subnodosus Subzone (beds 30–33) are proven by the presence of the index species, although Howarth (1958) and Old *et al.* (1987) failed to find any age-diagnostic fauna between the base of the Marlstone Rock Formation, and the highest occurrence of *Amaltheus subnodosus* little more than 2 m below. The lower, sandy part of the Marlstone Rock Formation at Napton Hill draws comparison with the Tilton Sandrock Member of Leicestershire, and similar facies below the Marlstone Rock Formation at the Robin's Wood Hill Quarry GCR site in Gloucestershire. At both sites these are at least partly of Subnodosus Subzone age. The Gibbosus Subzone is present elsewhere on the margins of the London Platform (Hallam, 1968) and in the Severn Basin (Simms, 1990a) but remains unproven here.

The Lower Pliensbachian succession at Napton Hill Quarry was famed for its ammonites, and Trueman (1919) recorded a series of distinct faunas. The lowest of these, described as 'Beds with *Tragophylloceras ibex*' succeeded by 'Beds with *Acanthopleuroceras valdani*', correspond to the Valdani Subzone of the Ibex Zone. Above this a succession of 'capricom' and 'involute' liparoceratids suggests the presence of higher parts of the Valdani Subzone and the succeeding Luridum Subzone. No thickness or lithological information was cited in Trueman's (1919) account of the ammonite succession, while Callomon (in Hallam, 1968) did not recover any ammonites from more than 12 m of clay below Bed 6. Hence it remains unclear if the Ibex Zone faunas described by Trueman (1919) came from beds 1–5 of the Charmouth Mudstone Formation, described by Callomon (in Hallam, 1968), or were from a lower stratigraphical level that was no longer exposed when Callomon visited the site. It is even possible that Trueman's Ibex Zone material came from other localities in the area.

The succession at Napton Hill Quarry presents interesting comparisons with other inland sites at a similar stratigraphical level. For example, the calcareous sandstone of Bed 33 within the Dyrham Formation at Napton Hill Quarry, of proven Subnodosus Subzone age, may represent a correlative of the Subnodosus Sandstone Bed of the Severn Basin (Simms, 1990a), which occurs at a similar depth below the Marlstone Rock Formation. The Marlstone Rock Formation itself is markedly less oolitic at Napton Hill Quarry than at the Neithrop Fields Cutting GCR site, 20 km to the south. The ooliths at Napton Hill occur only in patches suggesting that the site lay outside of the main chamositic oolite shoals and that ooliths were transported to the area only during storm events.

The Upper Pliensbachian at Napton Hill Quarry is 25.88 m thick (Old *et al.,* 1987), similar to that at Robin's Wood Hill Quarry where it is 28.42 m thick. This is in marked contrast to the Lower Pliensbachian, where correlative units at Napton Hill appear to be much thinner. The Figulinum Subzone is estimated to be 6.33 m thick at Robin's Wood Hill and 3.81 m thick at Napton Hill Quarry, with corresponding figures for the Capricomus Subzone being 11.18 m and 9.13 m respectively. However, it has been suggested that more than 11 m of the Upper Pliensbachian Dyrham Formation may have been removed by erosion at Robin's Wood Hill Quarry prior to deposition of the Marlstone Rock Formation (Palmer, 1971; Simms, 1990a). Hence the original thickness of the Upper Pliensbachian succession at Robin's Wood Hill Quarry may have been close to 40 m, a figure broadly in line with that for other sites in the Severn Basin, such as Bredon Hill where it reaches 41.2 m in thickness (Whittaker and Ivimey Cook, 1972). The Upper Pliensbachian succession at Napton Hill may also contain hiatuses, with the sharp contact between beds 28 and 29 perhaps being the best indication of this Q.C. Callomon, pers. comm.). The current evidence indicates only that the thickness of the Upper Pliensbachian, as for the Lower Pliensbachian, is significantly greater in the Severn Basin that at Napton Hill Quarry.

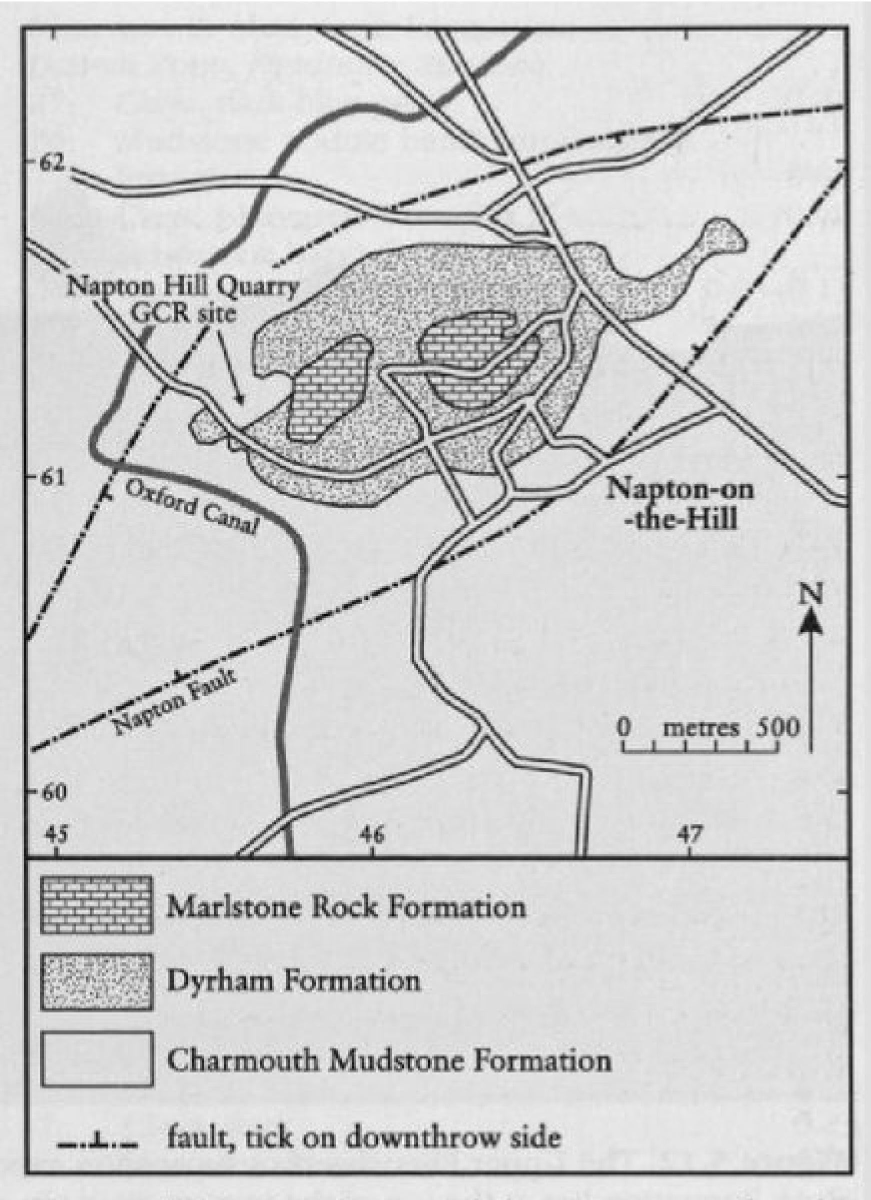
Within the Lower Pliensbachian succession nodule bands are frequent both at Napton Hill Quarry and at the Robin's Wood Hill Quarry GCR site. However, the 'Capricornus Sandstone Bed', a prominent maker band at Robin's Wood Hill and elsewhere in the Severn Basin, appears to be absent at Napton Hill. Temporary exposures at [SP 455 616], just below the site of the old pit, exposed several metres of silty clay, with *Liparoceras cheltiense, Ragophylloceras ibex* and *Acanthopleuroceras valdani,* capped by a coarsely bioclastic *Gyrphaea*-rich muddy limestone. This limestone may be the '85' Marker Member of Horton and Poole (1977) Q. Radley, pers. comm.), which is known to crop out only a few kilometres to the east, although there is no evidence from published accounts for the presence higher in the succession at Napton Hill of the '100' Marker Member.

Although the limestone and sandstone bands in the Dyrham Formation are sometimes richly fossiliferous, the intervening silty mudstones are poorly fossiliferous. Lord (1974) ascribed the scarcity of fossils at most levels to secondary decalcification but correlative strata at the Robin's Wood Hill Quarry and Dorset coast GCR sites, which have an overall lithological similarity, have equally sparse faunas and it is probable that this is due to primary environmental factors rather than post-diagenetic destruction of fossil material.

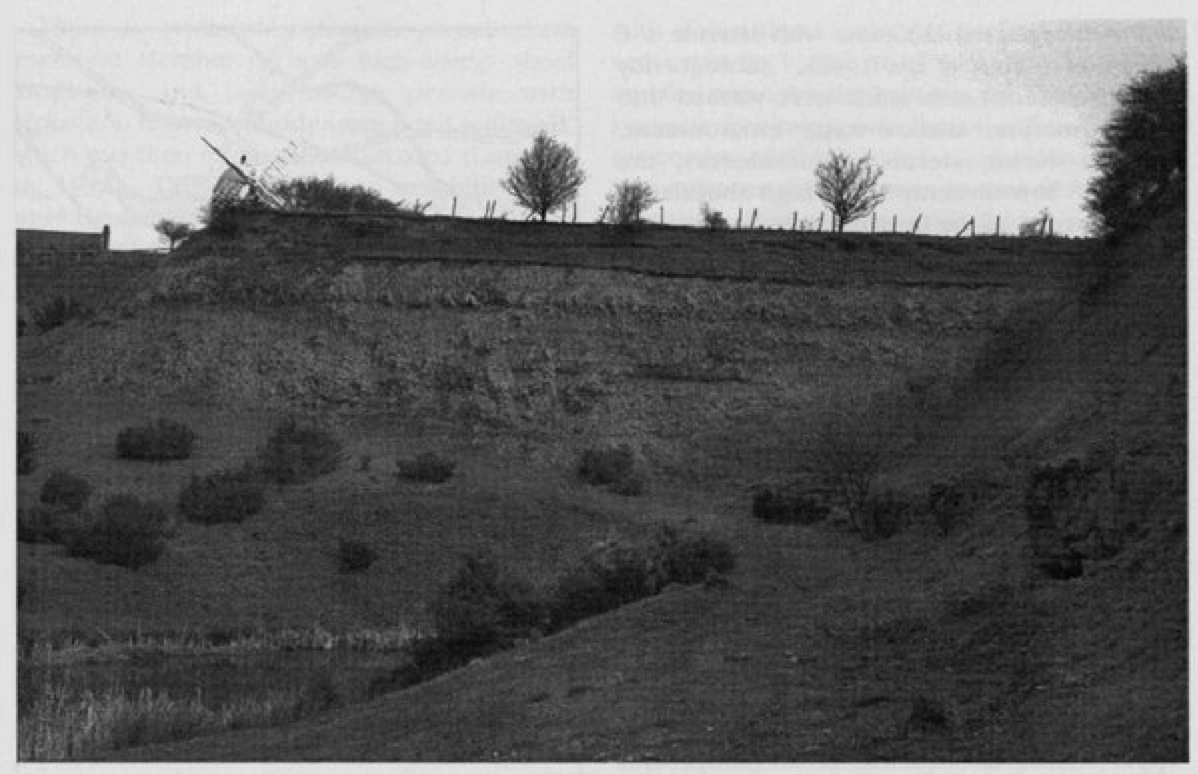
Conclusions

Napton Hill Quarry is one of very few exposures of the Upper Pliensbachian Middle Lias remaining in inland Britain. It provides a stratigraphical succession invaluable for investigating facies changes, and their implications for palaeogeographical reconstructions, across the Middle Lias outcrop of southern Britain. Lower Pliensbachian sediments formerly exposed at the site yielded a sequence of ammonites that played a critical role in the changing interpretations of the evolution of the Liparoceratidae.

[References](#)



(Figure 5.11) Geology and location map for the Napton Hill Quarry GCR site.



(Figure 5.12) The Upper Pliensbachian succession exposed at the Napton Hill Quarry GCR site. The Marlstone Rock Formation lies at the top of the section, with the sandstone of Bed 33 visible a little lower in the face. The large blocks projecting from the lower part of the right-hand face are some of the doggers that occur in Bed 29. (Photo: M.J. Simms.)