Abstract

A new section is described through the Ovale Bed in the Middle Inferior Oolite at the western end of the outlier on Dundry Hill, south of Bristol. It provides new insights into the biostratigraphy of the ammonites of the Ovale Zone of the Lower Bajocian, still one of the least well-known parts of that Stage and of its succession of faunal horizons. The lower part of the bed is assigned to the horizon Bj-5, that of *Witchellia romanoides* (DOUVILLE). The upper part represents at least in part the former horizon Bj-6, that of *’Sonninia’ ovalis* sensu BUCKMAN, which is in need of revision. Some of the more important ammonites are illustrated, including the lectotypes, here designated, of *’Ludwigia’ romanoides* DOUVILLE and *Witchellia sayni* HAUG. A neotype is designated for *Strigoceras compressum* BUCKMAN, whose original type series came from the Ovale Zone of Dundry.

Keywords: Ammonites, biostratigraphy, Dundry, Inferior Oolite, Jurassic, Lower Bajocian.

Zusammenfassung

1. Introduction

The outcrops of Inferior Oolite (Aalenian and Bajocian Stages) on Dundry Hill (near Bristol, Somerset) are of exceptional importance for Middle Jurassic stratigraphy more generally, especially for that of the Lower Bajocian. Fossils from the most famous localities (e.g. South Main Road Quarry and North Main Road Quarry) are to be found in nearly every museum collection. Descriptions of the sections and fossils occur in many classical works (for details see Buckman & Wilson (1896) and Parsons (1979)), going back to the days of William Smith. The lectotype of the index-species of the Lower Bajocian Laeviuscula Zone, *Ammonites laeviusculus*, comes from Dundry Hill as does the lectotype of *Ammonites sowerbyi*, index-species of the former Sowerby Zone.

The first modern description of the stratigraphy of Dundry Hill is by Buckman & Wilson (1896), who described the available sections very carefully bed by bed. They were classified in terms of the scheme of ‘hemerae’ (‘moments’, marking ‘the acmes of ammonite species’) introduced in his classical publication of 1893 by Buckman, and thence correlated with the rocks of the Cotswolds, Dorset and Somerset that had already been described in this way. Subsequent detailed investigations were undertaken by Parsons (1974, 1979, 1980) who classified and resolved the Inferior Oolite of Dundry in terms of the then standard Jurassic chronostratigraphical zonation taken down to the level of Zones and Subzones. The first interpretation of the succession at the highest achievable biostratigraphical resolution, that of ammonite faunal horizons, was given by Callomon & Chandler (1990); and the biostratigraphy of the particular case of the South Main Road Quarry (Du-SMR) was described in detail by Chandler et al. (2006). The focus was on the Laeviuscula and Sauzei Zones, especially on the boundary between them, but there remained some major uncertainties in the interpretation of the beds below, those of the Ovale Zone. These are encompassed by the so-called Ovale Bed (sensu Parsons), and the purpose here is to describe in detail the ammonites and stratigraphy of this bed at a new locality, Little Down Wood (Du-LDW), which lies 2.5 km NW of Du-SMR.

Figured material is from collections made by the authors and supported by additional material collected by one of us (JHC) in the 1970s. Photographs are by RBC. Specimens will be deposited in the Sedgwick Museum (Cambridge).
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>Du-LDW</td>
<td>Dundry, Little Down Wood</td>
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<td>Du-SMR</td>
<td>Dundry, South Main Road (CHANDLER et al. 2006)</td>
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<tr>
<td>+</td>
<td>single specimen</td>
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<tr>
<td>++</td>
<td>2 or 3 specimens</td>
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<tr>
<td>+++</td>
<td>4 or more specimens</td>
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<tr>
<td>[m]</td>
<td>microconch ammonite species</td>
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<tr>
<td>[M]</td>
<td>macroconch ammonite species</td>
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<tr>
<td>*</td>
<td>an asterisk before the name of a species indicates the type species of its genus</td>
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<td>TA</td>
<td>Buckman’s (1909–1930) Type Ammonites</td>
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<tr>
<td>BSPG</td>
<td>Bayerische Staatssammlung für Paläontologie und Geologie München, Germany</td>
</tr>
<tr>
<td>SM</td>
<td>Sedgwick Museum, Cambridge, United Kingdom</td>
</tr>
<tr>
<td>STL</td>
<td>Dépt. des Sciences de la Terre, geological collections, Université Claude Bernard, Lyon, France</td>
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</table>

Acknowledgements

We extend grateful thanks to A. England (London), W. Etter (Basel), J. Hanna (UPM, Tilhill), D. Hurford & J. & M. Williams (Dundry), J. Huxtable (Taunton), Dr. J. Larwood (Natural England, UK), H. Mader (Heilbronn), S. McKay (Woodland Trust, UK), C. Parsons (London), Dr. A. Prieur (Lyon), H. Sanders (Chippenham), for their help and guidance. Dr. G. Schweigert (Stuttgart) and S. Fernández-López (Madrid) are thanked for acting as referees. We thank Dr. R. Böttcher (Stuttgart) for carefully reading and commenting on the proof manuscript.

2. The section at Dundry, Little Down Wood

The new section lies immediately above an old quarry, at ST 5492 6750, about 12 m east of Buckman & Wilson’s “Section I. Western End, near Castle Farm” (1896) and also close to the “Grove Farm” section of Parsons (1979). Following trial excavations by hand we opened the new section in the early summer of 2006 using a machine. Due to restricted time and the position of the site being close to a cultivated area, we focused our attention on the top beds beneath the prominent regional erosion plane that marks the “Vesulian transgression” and the boundary between the Middle and Upper Inferior Oolite (Lower and Upper Bajocian respectively). The beds and the levels of ammonites within them are recorded as measurements downwards from the surface of the erosion plane taken as 0 cm. The section is described from above. It is shown diagrammatically in Fig. 1. The numbering of the beds is taken over from the generalized succession of Parsons (1979). Names of ammonites are in a morphospecific sense, discussed further below.

Upper Inferior Oolite, Dundry Freestone (seen about 1 m)
(Parkinsoni Zone, Acris and ?Truellei Subzones)

Limestone, soft, marly, massive freestone showing little sign of bedding; very sparsely fossiliferous. Maes Knoll Conglomerate at the base, thickening up to 0.15 m, with small limonitic pebbles in the lower part (not investigated in detail). Rare specimens of the ammonite Parkinsonia rarecostata in the Maes Knoll Conglomerate show its equivalence to the Astarte Bed of Dorset, indicating the Acris Sub-
zone of the Parkinsoni Zone (Upper Bajocian). A loose fragmentary specimen of *P. parkinsoni* either from the Maes Knoll Conglomerate or the Freestone above is typical of the Truellei Subzone of the Parkinsoni Zone.

– Sharp boundary, marked by the very flat Vesulian erosion-plane, with encrustations of small oysters.

**Fig. 1.** Section at Dundry, Little Down Wood.
Middle Inferior Oolite, Elton Farm Limestone (seen about 0.80 m)
(Ovale and Discites Zones)

– Bed 8 (= ovalis bed of Parsons)
(Ovale Zone)
Limestone, hard, sparsely finely ironshot oosparitic in the upper part, oolitic with sparse cream ooliths lower down, intensely bioturbated and burrowed, the burrows mostly of *Thalassinoides* type. Subdivisible with difficulty into courses with undulating boundaries but no changes in lithology, weathered locally into pockets or lenticles of limonitic marl. Variably fossiliferous, notably with large bivalves, both of entire endofaunal burrowers and thick-shelled ectofauna, the oysters and pectinids with test preserved. Large ammonites, especially *Fissilobiceras*, with body-chambers preserved, mainly lying flat at random levels throughout the bed but particularly common at –0.10/–0.15 m; small ammonites preserved at all angles, tending to be concentrated mainly at two levels (–0.10/–0.15 and –0.30 m), microconchs sometimes with lappets preserved. Many rotted patches due to superficial weathering. Nautiloids are represented by *Cenoceras obesum* (J. Sowerby), belemnites are abundant and there are small solitary corals.

The bed yields a rich fauna of well-preserved bivalves, the calcitic forms with test preserved. Prominent among them are:

- *Plagiostoma hersilia* (d'Orbigny) [up to 17 cm in diameter]
- *Ctenostreon pectiniformis* (Schlotheim)
- *Coelastarte excavata* (J. Sowerby) [= *Astarte obliqua* auctt.]
- *Trigonia costata* J. de C. Sowerby
- *T. cf. spinulosa* Young & Bird
- *Gervillella* sp.
- 'Ostrea' sp.
- *Pholadomya* cf. *lirata* (J. Sowerby)
- *Ph. deltoidea* (J. Sowerby)
- *Ph. fidicula* (J. Sowerby)
- *Pleuromya uniformis* (J. Sowerby)

– Bed 8 b(iii) (0.00 m to –0.10 m)
The bed is heavily bioturbated. Ammonites sparse, mostly fragmentary and distorted.

Ammonite fauna:

- *Witchellia romanoides* (Douvillé) (++) and sp. aff. (+++) [M]
- *W. pavimentaria* (Buckman) [M] (+)
- *W. patefactor* Buckman [M] (+)
- *Sonninia* (Euhoploceras) sp. [M] (+)
- *Dundryites albidus* Buckman [M] (++)
- *Emileia* sp. [M] (+)

– Bed 8 b(ii) (–0.10 m to –0.15 m)

A level with many large ammonites, up to 0.30 m in diameter, lying flat, associated with small ammonites lying at all angles. Many of the small ammonites well preserved with sparitic phragmocones and shell and ornament intact, indicating minimal exposure before burial; few shells however complete, often broken off near the last septa. Detached fragments not preserved with counterparts, so some post-mortral destruction and movement is evident. Larger specimens, mainly bodychamber fragments, invariably preserved as internal moulds. Broken edges of the fragments wel-
ded into the matrix, suggesting considerable re-exhumation and destruction prior to final burial. Phragmocones of larger ammonites sometimes partially or completely replaced by limonite, the nuclei lost. Some of the specimens are heavily bored.

Ammonite fauna:

- *Witchellia romanoides* (DOUVILLE) [M] (+++ (Pl. 4, Fig. 3)
- W. cf. saynii HAUG [M] (++)
- *W. connata* (BUCKMAN) [M] (++) (Fig. 3c–d)
- W. cf. patefactor BUCKMAN [M] (+) (Pl. 7, Fig. 1)
- *W. pavimentaria* BUCKMAN [M] (+)
- *Pelekodites peleus* BUCKMAN [m] (+) (Fig. 4a–b)
- P. aff. minimus (HILTERMANN) [m] (+) (Fig. 4c)
- Sonnia aff. haugi GILLET [sp. nov.] [?m] (++)
- *S. (Euboloceras) pseudotrigonata* MAUBEUGE [M] (+) (Pl. 2, Fig. 2)
- *S. (E.) aff. adicra* (WAAGEN) [M] (+) (Pl. 2, Fig. 1)

Dundrytes aff. albidus BUCKMAN [M] (++) (Pl. 3, Fig. 1)

- *Fissilobiceras fissilobatum* (WAAGEN) [M] (++)
- *F. ovale* (QUENSTEDT) [M] (+++)

- *Shirbuirnia* sp. (cf. CALLON & CHANDLER 1990, pl. 1, fig. 1) [M] (+)
- “Emileites” [gen. nov.] liebi (MAUBEUGE) [M] (+++)
- “Trilobiticeras” [gen. nov.] cricki PARSONS [m] (+++ (Pl. 9, Fig. 7–8)
- Emileia (Emileia) dundriensis CALLON & CHANDLER. [M] (++) (Pl. 11, Fig. 1)
- Emileia (Emileites) malenotata (BUCKMAN) [M] (++) (Pl. 9, Fig. 1–2)
- Otoites tumulosus WESTERMANN [m] (++) (Pl. 10, Fig. 3)
- O. douvelli PARSONS [m] (++) (Pl. 10, Fig. 2)
- Stepheanoceras aff. richardsoni (Dietze et al.) [sp. nov.] [M] (+) (Fig. 6)
- Bradfordia cf. praeradiata (DOUVILLE) [M] (++) (Fig. 7a–b)
- B. cf. costidensa IMLAY [M] (++) (Fig. 7h)
- Strigoceras compressum BUCKMAN [M] (+) (Fig. 5c)
- S. strigifer (BUCKMAN) [M] (+) (Fig. 5a–b)
- Hebetoxyites bebes BUCKMAN [?M] (++) (Fig. 7d, i)

by preservation from this level:

- Emileia (E.) aff. dundriensis CALLON & CHANDLER [M] (+) (Pl. 10, Fig. 1; Pl. 11, Fig. 2)

– Bed 8 b(i) (~0.15 m to about ~0.20/~0.25 m)

Lithology as above, ammonites throughout but less common in the lower part.

Ammonite fauna:

- *Witchellia romanoides* (DOUVILLE) [M] (+++ (Pl. 4, Fig. 4)
- W. cf. jugifera (WAAGEN) [M] (+)
- W. connata (BUCKMAN) [M] (+)
- W. cf. zugophora (BUCKMAN) [M] (+) (Pl. 6, Fig. 3)
- *Pelekodites peleus* BUCKMAN [m] (+) (Fig. 4f–g)
- P. aff. minimus (HILTERMANN) [m] (+)
- P. cf. aurifer (BUCKMAN) [m] (+) (Fig. 4h–j)
- Sonnia aff. haugi GILLET [?m] (++) (Pl. 1, Fig. 1)
- Sonnia (Euboloceras) pseudotrigonata MAUBEUGE [M] (+)
- S. (E.) spp. [M] (++)

Dundrytes albidus BUCKMAN [M] (++) (Pl. 3, Fig. 2)

- *Fissilobiceras fissilobatum* (WAAGEN) [M] (++)
- *F. ovale* (QUENSTEDT) [M] (++) (Pl. 8, Fig. 1)

“Emileites” [gen. nov.] liebi (MAUBEUGE) [M] (+++ (Pl. 9, Fig. 3–4)

“Trilobiticeras” [gen. nov.] cricki PARSONS [m] (+++)

Otoites tumulosus WESTERMANN [m] (++)

Bradfordia praeradiata (DOUVILLE) [M] (+)

Lissoceras? cf. semicostulatum BUCKMAN [M] (+) (Fig. 7c)
– Beds 8 b and 8 a separable when weathered, boundary undulating between −0.20 to −0.25 m below the top of the erosion plane, but not marked by significant changes in lithology.

– Bed 8 a (−0.20/−0.25 m to −0.50/−0.55 m)

(Witchellia romanoides ammonite faunal horizon (Bj-5))

The bulk of the ammonites, mostly small, concentrated at about −0.30 m, few occurring lower. The limestone is cream to pale brown with small nut-brown ooliths, sometimes harder than the bed above, or weathered to marl with ochreous lenticles and limonitic clay in the lower part.

Ammonite fauna:

Witchellia romanoides (DOUVILLE) [M] (+++) (Pl. 4, Fig. 1)
W. cf. sayni HAUG [M] (+++) (Pl. 6, Fig. 2)
W. cf. jugifera (WAAGEN) [M] (++) (Pl. 5, Fig. 2)
Pele kodites pelekius BUCKMAN [m] (+) (Fig. 4d–e)
P. aff. minimus (HILTERMANN) [m] (+)
P. cf. aurifer (BUCKMAN) [m] (+) (Fig. 4j–k)
Sonninia (Enhoploceras) cf. subdecorata BUCKMAN [m] (++) (Pl. 1, Fig. 2–3)
S. (E.) spp. [M] (+)
Dundrytes albidus BUCKMAN [M] (+)
Fissilobiceras fissilobatum (WAAGEN) [M] (++)
P. ovale (QUENSTEDT) [M] (++) (Pl. 8, Fig. 2)
"Emileites" [gen. nov.] liebi (MAUBEUGE) [M] (++) (Pl. 9, Fig. 5)
"Trilobiticeras" [gen. nov.] cricki PARSONS [m] (++) (Pl. 9, Fig. 6)
Oppelia? sp. [M] (+) (Fig. 7f–g)
Strigoceras compressum BUCKMAN [M] (+) (Fig. 5d)

– inconspicuous undulating parting, change of lithology

– Bed 7 (= Bivalve bed partim of PARSONS) (seen −0.50/−0.55 m to −0.70/−0.80 m)

(Discites Zone, Hyperlioceras subsectum ammonite faunal horizon (Bj-3))

The lowest bed exposed but not more fully investigated: a very hard, more densely sparitic limestone weathering in large blocks with pockets and lenticles of ochreous limonitic clay. Sparsely fossiliferous, containing large bivalves and very rare ammonites.

Ammonite fauna:

Hyperlioceras subsectum BUCKMAN [M] (++)
Sonninia (Enhoploceras) bippicata BUCKMAN [M] (+)
S. (E.) modesta BUCKMAN [M] (+)

Lower part of the bed not seen. According to PARSONS (1979) the bed continues downwards at Grove Farm, where he recorded a thickness of 0.43 m. Neither BUCKMAN & WILSON (1896) nor PARSONS (1979) recorded any ammonites from this part of the succession.

3. Bio- and chronostratigraphy

3.1. General remarks

In his famous account of the Bajocian of the Sherborne district BUCKMAN (1893) introduced his Witchelliae hemera for all the strata between those of an upper Sauzei hemera and a lower Discitae hemera. The beds assigned by him to his Witchelliae
hemera at Dundry (his section XVIII, outline section of the top of Dundry Hill) consisted of “White Ironshot” and included the strata revised here.

By 1896 BUCKMAN & WILSON had refined this part of the succession at Dundry (their tab. IV). The interval between Sauzei and Discitae hemerae was now subdivided into two: the Witchelliae hemera for the upper part, represented by ‘The Upper White Ironshot’, and a Sonniniae hemera for the lower part, ‘The Lower White Ironshot – the fissilobata-ovalis horizon’. These ammonites, then still assigned to the genus Sonninia, are today placed in Fissilobiceras. In their section I (Western End, near Castle Farm, p. 676), they assigned the 43 cm of strata below the erosion plane, the ‘Lower White Ironshot’ – their beds 4–8 (p. 678), matching closely our bed 8 – to this Sonniniae hemera. The higher beds of the restricted Witchelliae hemera were recognized to have been cut out by erosion at the western end of the hill.

In the final hemeral table in BUCKMAN’s Type Ammonites (DAVIES 1930), the Sonniniae hemera was replaced through further subdivision, in ascending order, by the Bradfordia, ovalis and fissilobatum hemerae.

The next step after a long interval was taken by PARSONS (1974, 1977, 1979). He reviewed the somewhat confused evolution of the White Ironshot of Dundry (1979, tab. 3) and abandoned the ‘Lower Ironshot’ in favour of what had become known as the ‘ovalis bed’, bed 8 in his general classification. At Grove Farm, close to our Du-LDW, he could subdivide the bed (0.48 m) by lithology into two, beds 8a and 8b respectively. He was not able to separate their faunas, but most of the recorded ammonites came from a level at about 0.10 m below the top of the bed. At nearby Barns Batch Spinney, the bed could also be subdivided and the ammonite faunas were mainly concentrated at ~0.10/~0.15 and ~0.25 m below the top of the bed. A third component, bed 8c, was inserted by CHANDLER et al. (2006) in the section at South Main Road (Du-SMR).

Lastly, CALLOMON & CHANDLER (1990) revived the concept of the ammonite hemerae of BUCKMAN in terms of their rock equivalents, their faunal horizons, basic biostratigraphical units defined by characteristic fossil assemblages distinguishable from their neighbours in succession by evolutionary, genotypic changes in pheno
typic morphology. The number of such biohorizons is unlimited, depending on the state of knowledge, and increases by insertion as new discoveries are made. In the Inferior Oolite, some 26 such faunal horizons have currently been characterized in the Lower Bajocian, labelled symbolically in the range Bj-1 to Bj-19 and named after their most characteristic species. Those up to and including the Sauzei Zone are shown in Fig. 2, taken from a recent revision by CHANDLER et al. (2006, Du-SMR). Of these, the only ones relevant here are in the range Bj-3 (upper Discites Zone) to Bj-7a, b, Ovale to basal Laeviuscula Zones.

It is those of the Ovale Zone that have so far been least well characterized and it is to their knowledge that the new collections from Du-LDW make a contribution. They are discussed further below.

3.2. The ammonite succession

The lists of species that have been collected are given above in the description of the section.

What follows is an analysis of the assemblages, their classification in the framework of faunal horizons and their correlations with successions elsewhere. Individual taxa are more extensively annotated in § 4 below.


<table>
<thead>
<tr>
<th>Zone</th>
<th>Subzone</th>
<th>Ammonite faunal horizons</th>
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<tbody>
<tr>
<td>Sauzei</td>
<td></td>
<td>BJ-12 <em>Stephanoceras rhytum</em></td>
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<td></td>
<td></td>
<td>BJ-11b <em>Nannina evoluta</em></td>
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<tr>
<td></td>
<td></td>
<td>BJ-11a <em>Stephanoceras kalum</em></td>
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<tr>
<td>Laeviuscula</td>
<td>BJ-10b <em>Sonninia micranthica</em></td>
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<td></td>
<td></td>
<td>BJ-10a <em>Witchellia spinifera</em></td>
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<td>BJ-9 <em>Witchellia rubra</em></td>
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<tr>
<td>Trigonalis</td>
<td>BJ-8b <em>Shirbuirnia trigonalis</em></td>
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<tr>
<td></td>
<td></td>
<td>BJ-8a <em>Euhoploceras nodatipingue</em></td>
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<td></td>
<td></td>
<td>BJ-7b <em>Witchellia pseudoromanoides</em></td>
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<tr>
<td>Ovale</td>
<td></td>
<td>BJ-7a <em>Witchellia gelasina</em></td>
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<td>BJ-6c <em>Witchellia pseudoromani</em> MS</td>
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<td></td>
<td>BJ-6b <em>Shirbuirnia gingensis</em></td>
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<td></td>
<td></td>
<td>BJ-6a <em>Witchellia zugophora</em></td>
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<td>BJ-5 <em>Witchellia romanoides</em></td>
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<td></td>
<td></td>
<td>BJ-4 <em>Bradfordia inclusa</em></td>
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<td>Discites</td>
<td>BJ-3 <em>Hyperlioceras subsectum</em></td>
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<td>BJ-2b <em>Hyperlioceras rudidiscites</em></td>
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<td>BJ-2a <em>Hyperlioceras walkeri</em></td>
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<td>BJ-1 <em>Hyperlioceras politum</em></td>
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</table>

**Fig. 2.** The ammonite faunal horizons in the English Lower Bajocian up to and including the Sauzei Zone (from Chandler et al. 2006).

3.2.1. Lower Bajocian, Discites Zone

Bed 7: Faunal horizon Bj-3, *Hyperlioceras subsectum*
A few new specimens of *Hyperlioceras* of the *H. subsectum*-group and fragments
of Sonninia (Euhoploceras) sp. support earlier finds elsewhere at Dundry and identify the horizon as the highest in the Discites Zone.

3.2.2. Lower Bajocian, Ovale Zone

Faunal horizon Bj-4 is definitely absent here, as at Du-SMR.

Bed 8 a: Faunal horizon Bj-5, Witchellia romanoides

The dominant and characteristic faunal element is the eponymous W. romanoides, a small species, which is abundant. It marks, with one possible exception, the earliest occurrence in Britain of the genus. It is accompanied by its probable microconchs of the morphogenus Pelekodites. Lesser but striking elements are the considerably larger forms of the group of Witchellia [‘Zugophorites’ Buckman] zugophora, assigned at times in the past to the sonniniid Euhoploceras (see the list of faunal horizons above). They may have value for correlation, but not enough material is yet available to characterize range and variability. The type of W. jugifera (the Latin version of Greek zugophora) came from Swabia but from an unknown horizon. Small otoitids variously assigned to Emileites [M] and Trilobiticeras or Otoites [m], discussed further below, are also prominent but have long ranges. The large Fissilobiceras is also striking but is not closely age-diagnostic.

The Bj-5 horizon was originally introduced for the fauna of this bed at Dundry (Callomon & Chandler 1990) and this appears to continue to be the only locality at which it has so far been recognized in Britain. At Bruton it is absent, almost certainly lost in a stratigraphical non-sequence, and this appears also to be the case in the Sherborne-Bradford Abbas area of northern Dorset.

The type of W. romanoides came from the Vallée de Valaury near Toulon in southern France, out of a hard condensed ferruginous bed 0.3–0.7 m thick lying in a sequence of 200 m of poorly fossiliferous but pre-Upper Bathonian limestones. The section was described by Zurcher (1885: 9–10) and the ammonite fauna from this bed was described by D’Ouvillé (1885), including W. romanoides (some additional details are given by Lanquine (1929: 227–229) but they add nothing of significance). The fauna of this bed bears a remarkable overall resemblance to that of Bj-5 at Bruton, but does not help in refining the English succession further.

The distinction between Bj-5 and the underlying horizon Bj-4 is clear. Its most striking feature is the total absence of Witchellia. The citation of W. aff. romanoides in Callomon & Chandler (1990) was in error. Bj-4 was originally introduced (Callomon & Chandler 1990) for the ‘post-discites beds’ of Buckman (1910a: 77 and tab. 3) on Waddon Hill, near Beaminster in south Dorset. As its name implies, Hyperlioceras is now absent, or at best rare. It also already carries the true Fissilobiceras ovale and has therefore been included in the Ovale Zone as its lowest horizon. It also yields Bradfordia in some abundance and is named after the species, B. inclusa Buckman, of which it is the type horizon and Waddon Hill is the type locality.

The relationship of Bj-5 to its overlying horizons, Bj-6a, b, c, presents some problems that are discussed below.

Bed 8 b: [Faunal horizon ‘Bj-6, Fissilobiceras ovale’ olim]

This bed has yielded the most diverse fauna. The frequency of occurrence varies somewhat within the bed and an attempt was made to separate the collections from different levels within it – parts 8 b(i), 8 b(ii) and 8 b(iii). But no clear lithological
breaks could be recognized in a bed that is intensely burrowed. The taphonomy of the smaller specimens suggests that there may have been some mixing in a sediment that remained unconsolidated for a period comparable to that of its accumulation. But the large ammonite discs are flat-lying and undoubtedly in correct relative positions. They make up the most striking element of the fauna, consisting of the distinctive *Fissilobiceras* and another group of large forms of somewhat uncertain affinities, most closely comparable to a common Swabian species tentatively assigned to the genus *Shirbuirnia, Sh. gingensis* (Waagen). These together were Buckman’s “Son-ninia ovalis” (Quenstedt)”, after which the “ovalis Bed” was named. The horizon seemed to be widely recognizable – in the Sherborne area, at Oborne and Sandford Lane, at Bruton and in the Cotswolds – and hence to make a fine marker for correlations.

Subsequently, further faunal horizons at about this level were recognized at Bruton. The section in the railway-cutting through Lusty Hill was first described by Richardson (1916: 495) and reproduced in modified form by Dietze et al. (2001, fig. 1), the beds having been renumbered in ascending order as is more the convention today. Some new collections were described by Parsons (1979: 150). The section was intensively resurveyed by two of us (RBC, JHC) in the 1990s (details to be published). The anchor-point in the succession appeared to be bed 5 or the top of the underlying bed 4 (Richardson’s bed 6), with large *Fissilobiceras*, resembling the forms known from Dundry, therefore Bj-6. There were no signs of *Witchellia romanoides*, Bj-5, the earliest forms of this genus known at the time, which would have been expected below. But there were instead two further assemblages of *Witchelliae* in turn not known at Dundry: one below Bj-6, in the main body of bed 4 and one above, bed 6 (Richardson’s bed 4). Above that came a fauna resembling that from Dundry labelled Bj-7. So on the assumption that the three assemblages from beds 4, 5, 6 in ascending order lay above Bj-5 but below Bj-7, the original Bj-6 of 1990 had to be replaced by three, Bj-6a, Bj-6b and Bj-6c, with that of the ‘ovalis Bed’ of Dundry in the middle, Bj-6b: see fig. 1 in Dietze et al. (2001). This scheme was introduced in a first revision of the original table of faunal horizons of 1990 in 1995 (Cal-lomon 1995:140, fig. 3) and is reproduced in the emended version of Chandler et al. (2006) in Fig. 2 above. To avoid confusion between the use of the same specific name to label an ovalis Bed, a faunal *Fissilobiceras ovale* horizon and a standard Ovalle Zone, and misconceptions concerning the type horizon of *F. ovale*, which is most probably Bj-4, Bj-6b was renamed the horizon of *Shirbuirnia gingensis*. The successions of *Witchellia* at Bruton and Dundry are therefore complementary but mutually exclusive. The problem is that the forms of the new assemblage from Bj-6a at Bruton more strongly resemble what have been assumed to be the ancestral stock of the Witchelliinae, namely Fontannesia of the Discites Zone, than they do those of Bj-5 at Dundry, *W. romanoides*. Could it be, therefore, that Bj-6a lies in fact below Bj-5? Could it be that the assemblage at Bruton assigned to Bj-6b is then not the same as that assigned to Bj-6b at Dundry and that the whole packet of strata at Bruton assigned to Bj-6a–6c lies below Bj-5? We cannot answer these questions with the new collections from Du-LDW alone.

Upwards, we cannot positively affirm or exclude the presence of some elements of the assemblages of Bj-7a or Bj-7b in Bed 8, for individual morphospecies of the Witchelliinae tend to range over several faunal horizons (see below). None of the ancillary elements of the faunas are yet sufficiently well known to be reliable guide-
species for close time-correlations. The type horizon of the unmistakable *Emileia* (aff.) *dundriensis* shown here on plates 10 and 11 was in fact Bj-8a at Du-SMR. What the rich new collections suggest is that the ranges of some species are longer than had been supposed. There are indications of some faunal differentiation between Beds 8 b(i), b(ii) and b(iii) but they are insufficient to yield any firm conclusions. In summary, therefore, beds 8 b(i)–8 b(iii) cannot at present be assigned to any specific faunal horizons but continue to include what was the original Bj-6.

4. Notes on the ammonite fauna

4.1. *Sonniniidae* Buckman, 1892

The *Sonniniidae* of Europe are one of the best documented and longest known groups of Middle Jurassic ammonites. Our knowledge has however been based principally on collections from about three levels well separated in time. The evolutionary changes in morphology that had occurred in the intervals inbetween, together with the wide intraspecific variability that characterises all members of the family, led to a profusion of morphogenic taxa the phylectic relationships between which were not clear. Two main groups could however be discerned, forming phylogenetic clades with quite separate roots. They were formally separated by Callomon & Chandler (in Chandler et al. 2006), who took out the group of *Witchellia* as the subfamily *Witchelliinae* (see below). That left the remainder as the subfamily *Sonniniinae*.

4.1.1. *Sonniniinae* Buckman, 1892

The subfamily *Sonniniinae* is clustered around a main phyletic strand leading to the genus *Sonninia* itself. The three levels at which this strand was sampled were roughly as follows.

(a) Main line:

- Bj-1–Bj-3, Discites Zone: *Euhoploceras, acanthode-modestum* group (revised by Sandoval & Chandler 2000)
- Bj-7–Bj-8, Laeviuscula Zone: *Euhoploceras, adicrum* group–*Papilliceras/Prepapillites, arenatus* group (revised by Dietze et al. 2005)
- Bj-11, Sauzei Zone: *Sonninia* s. s.

As more material came to hand, it became increasingly difficult to draw any systematic boundaries between these groups at generic level and so they were all subsumed into the single phylogenus *Sonninia*, retaining some of the other names as morphosubgenera of *Sonninia* for convenience. The interconnecting transients in the Ovale Zone were very poorly known. The new collections from Dundry serve now to illustrate some of these.

(b) Subsidiary elements: Additional lesser but phyletically separate groups within the *Sonniniinae* include *Shirbuirnia* Buckman, 1910 (Laeviuscula Zone) (also reviewed in Dietze et al. 2005), *Pseudoshirbuirnia* Dietze et al., 2005 and *Sonniites* Buckman, 1923 (top Laeviuscula – Sauzei Zones). There are indications of yet others – see below.

The *Sonninia* fauna of the Ovale Zone of Du-LDW contains typical transients (*S. aff. adicra*, Pl. 2, Fig. 1; *S. pseudotrigonata*, Pl. 2, Fig. 2) of the *Euhoploceras* line. Of
special interest are specimens such as S. aff. hangi (Pl. 1, Fig. 1) that represent morphs intermediate between the morphogenera Euhoploceras and Prepapillites. The inner whors are “Euhoploceras”-like, the body chamber compressed with a high keel resembling Prepapillites but lacking papillae. Most specimens from Du-LDW are microconchs or juveniles. The corresponding [M] may be found in morphs centred on “Papilliceras” pseudoarenatum Maubèuge (1951) or “Sonninia” luciusi Maubèuge (1951).

Specimens resembling ‘Dundryites’ albidus Buckman (1926, TA 6, pl. 687) are fairly common in bed 8 b (Pl. 3) and range upwards into the Laeviuscula Zone. The holotype came from Buckman & Wilson’s section I, bed 6, ‘Western End, near Castle Farm’ (see § 2 above), the equivalent of our bed 8 b(i). Smaller specimens (topotype, Pl. 3, Fig. 2) show a strong resemblance to Witchellia (cf. Pl. 4, Fig. 3a) in their coiling, flat-sided whorl-section and steep, sharp-edged umbilical walls. The keels are however set on a rounded to fastigate venter rather than the subquadrate venter, tending to bisulcate, typical of Witchellia (cf. Pl. 4, Fig. 3b). The most striking difference however lies in the relatively complex septal sutures (Pl. 3, Fig. 1), seen equally clearly in Buckman’s type, differing from the more simplified sutures typical of the Witchelliinae and resembling more closely those of the Sonniniinae. For this reason we exclude the taxon from the Witchelliinae and revive Buckman’s genus Dundryites. D. albidus is then possibly the ancestor of Sonninites (type species S. *felix) in the Sauzei Zone.

4.1.2. Witchelliinae Callomon & Chandler, 2006

These range through bed 8 (see lists above) but dominate in the lower part, bed 8 a. The variability of the forms at any one level can be wide so that morphospecies based on individual morphs, of which the literature carries many, can have long vertical ranges. In many cases the precise horizon of the types is not known. Conversely, individual morphospecies can make poor age-diagnostic guide-fossils. Exceptions occur when material is abundant and the variability can be mapped. In such cases the general conclusion that all the morphs of a genus occurring together are merely intergrading variants of a single biospecies is reconfirmed (see Chandler et al. 2006).

One such case here is that of bed 8 a, the horizon of the Witchellia romanoides assemblage, the type horizon of the original English faunal horizon Bj-5. The variability of this assemblage is in fact rather low. The typical size is relatively small (Pl. 4, Figs. 1, 3, 4), the whorl-section compressed with flat sides and sharp umbilical edge, the keel subdued and bordered by narrow flat margins or even sulci, the ribbing faint or subdued, lacking tubercles or spines. Another typical specimen was figured by Parsons (1979, pl. 1, figs. 3, 5) from the same level at nearby Barns Batch. The species Ludwigia romanoides Douvillé was based on two syntypes (1885, pl. 3, figs. 3, 4) and came from a condensed bed at a locality in SE France (see above, § 3, bed 8 a). We refigure casts of them here photographically for the first time (Pl. 4, Figs. 2, 5) and designate Douvillé’s syntype I (pl. 3, fig. 4, here Pl. 4, Fig. 2) to be the lectotype.

A somewhat larger, more strongly-ribbed variant is shown here on Pl. 6, Fig. 2 as W. cf. sayni. It is transitional to forms one of which, from the same locality as L. romanoides, was also figured by Douvillé (1885, pl. 2, fig. 1), as Ludwigia corrugata. This in turn became, together with the other four specimens on Douvillé’s pl. 2, a syntype of Witchellia sayni Haug, 1893 (Haug 1893: 308). A cast of this specimen
is also figured here on Pl. 6, Fig. 1 and designated lectotype of the species sayni. Yet larger but also closely related forms are represented by *Witchellia jugifera* (WAA-GEN, 1867). A cast of the lectotype (designated by DIETZE et al. 2005: 60), from Gingen in Swabia, is also figured here on Pl. 5, Fig. 3. Closely related to this species is then the equally large *W. (‘Zugophorites’) zugophora* BUCKMAN (1922, TA 4, pl. 341). This came from Leckhampton in the Cotswolds, from the Gryphite Grit, a bed whose precise age could not be determined more closely than Ovale Zone (PARSONS 1980).

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**Fig. 3.** *Witchellia connata* (BUCKMAN) [M]. a–b: nearly complete adult; bed 8, loose; SM X40300. c–d: nearly complete adult; bed 8 b(ii); SM X40301. – All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Going upwards, the variability of the forms we assign to *Witchellia* in beds 8 b becomes higher. Besides typical *W. romanoides*, which persists, there occur many of the other morphospecies that have been described in the past from the Ovale and Laeviuscula Zones of southern England. The distributions over the range of variability do however change with time, from the rather smooth forms of Bj-5 to increasingly more strongly ribbed ones. One of these is shown on Pl. 6, Fig. 3, which, although still of similar size to *W. romanoides*, matches precisely the inner whorls of the type of *W. zugophora*. Two others (Fig. 3) closely match the type of *W. ('Zugella') connotata* (Buckman) (1927, TA 7, pl. 750), whose origin is however also uncertain. A specimen of intermediate size (Pl. 7, Fig. 2) resembles wholly septate *W. ('Dundryites') pavimentaria* (Buckman) (1927, TA 7, pl. 751) and another large one on Pl. 7, Fig. 1 resembles *W. patetfactor* Buckman (1923, TA 4, pl. 410), from the upper Laeviuscula Zone, Bj-10. An involute, smooth morph is figured on Pl. 5, Fig. 1 as *W. cf. rubra*. One feature that does seem to persist throughout the whole range of *Witchellia*, and is now confirmed at the lower end of the range, is the occurrence together at all levels of small and large forms, undoubtedly macroconchs, differing essentially only in adult sizes, by factor of two or more: *W. romanoides – jugifera* in Bj-5, *W. spinifera – platymorpha* in Bj-10. It raises the suggestion of possible ontogenetic polymorphism as cause. Similar observations can be made in other, not closely related groups of Middle Jurassic ammonites (see below in the Otoitidae).

![Fig. 4](image)

**Fig. 4.** a–b, d–g: *Pelekodites pelekus* Buckman [m]. a–b: complete adult with base of the lappet, matching exactly the holotype from Dundry (Buckman 1923, TA 4, pl. 399); bed 8 b(ii); SM X40302. d–e: bed 8 a; SM X40303. f–g: bed 8 b(i); SM X40304. – c: *Pelekodites* **aff.** *minimus* (Hiltermann) [m]; bed 8 b(ii); SM X40307. – h–k: *Pelekodites* **cf.** *aurifer* (Buckman) [m], complete adults with lappets. h–i: bed 8 b(ii); SM X40305. j–k: bed 8 a; SM X40306. – All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
The presumed microconchs of *Witchellia* are also abundant (Fig. 4). Three monotypic nominal genera were based on type-species from Dundry: *Pelekodites *pelekus* BUCKMAN, 1923, *Spatulites *spatians* BUCKMAN, 1928 and *Maceratites *aurifer* BUCKMAN, 1928. Of these, two could be closely matched with specimens in the new collections: *P. pelekus* (Figs. 4a–b, d–g, beds 8 a, 8 b(i) and 8 b(ii)) and *P. cf. aurifer* (Figs. 4h–k, beds 8 a–8 b(i)). The types of these came however from higher levels. A small specimen (Fig. 4c) may be compared with 'Sonninia’ *minima* HILTERMANN (1939: 174, pl. 12, figs. 4, 6). The original descriptions were not precise, but re-examination of the specimens shows the matrix to be more ferruginous, with larger brown ooliths, than anything in bed 8, pointing to levels in the ‘Upper White Iron-shot’, Laeviuscula Zone, well above the Ovale Zone. (The type of *Sp. spatians* came unambiguously from Bj-10a or Bj-10b. Another very similar lappeted microconch is *Nannoceras *nannomorphum* BUCKMAN (1923, TA 5, pl. 445), from the Discites Zone, supporting the suggested root of the dimorphic lineage of *Witchellia* in the genus *Fontannesia* BUCKMAN, 1902).

### 4.2. Hammatoceratidae BUCKMAN, 1887

*Fissilobiceras* is one of the most common ammonites from bed 8 a up to bed 8 b(ii) (Pl. 8). The genus has been recently reviewed in detail by DIETZE et al. (2005). Most of the specimens belong to the morphospecies *F. ovale* (QUENSTEDT), which when complete can reach sizes up to 0.5 m.

The ammonites from bed 8 figured by CALLOMON & CHANDLER (1990, pl. 1, fig.1; pl. 2, fig. 1) as *Sonninia ovalis* are more evolute than the typical forms of *Fissilobiceras*, whose intraspecific variability in this character is otherwise low. Their systematic position remains somewhat uncertain. The suture-line of the smaller of the two, a wholly septate nucleus (pl. 2, fig. 1) does have a typically fissilobate complexity but that of the larger one (pl. 1, fig. 1) is less so, more like that of a sonniniid. It was therefore tentatively assigned to the sonniniid genus *Shirbuirnia*: cf. *Sh. gingenensis* (WAAGEN) trans α (DIETZE et al. 2005, fig. 23), from the Ovale Zone of Donzdorf in the eastern Swabian Alb (see map in DIETZE et al. 2005, fig. 1). Its name was then used to re-label the horizon Bj-6b (CHANDLER et al. 2006, see Fig. 2 here) for the reasons given above (§ 3.2.2.).

### 4.3. Strigoceratidae BUCKMAN, 1924

The genus *Strigoceras* [M] and its microconchiate counterpart *Cadomoceras* [m] are in course of revision (SCHWEIGERT et al., in preparation) so comments here will be brief. The strigoceratids appear first in the Upper Aalenian. They are fairly common in the beds under investigation (Fig. 5), showing a variability between almost smooth and coarsely ribbed forms, the ribbing ranging from regular to irregular. Here again, a variety of morphospecies has been defined in the past.

The oldest of the appropriate names appears to be one introduced by ETHERIDGE in WRIGHT (1860: 24) in a faunal list of ammonites found at Dundry: *Amm. truellei* (var. *compressus*) d’Orb. There was no description, so even regarding *compressus* as an available name (which it is not, preoccupied), it is a nomen nudum. It was revived by BUCKMAN (in BUCKMAN & WILSON 1896: 701) as *Strigoceras compressum* (ETHERIDGE), with sufficient description to make the name now available: *Str. compressum* (ETHERIDGE MS) BUCKMAN, 1896. A specimen from the ‘West End, Castle Farm’
section out of what is clearly our bed 8 a was finally figured by Buckman in 1924 (TA 5, pl. 468) as a ‘topotype’ (and under yet another new generic name, Varistrigites). It was in J. W. Tutchers’s collection and is now in the Natural History Museum, London (C.41727). It could not have been in the type series of whatever Buckman had at his disposal in 1896, even if this included whatever Etheridge had collected and named. It would now be almost impossible to retrace this type series. Yet the figured toptype is a fine example of an eminently recognizable species and to conserve this we propose to designate Buckman’s toptype of 1924 as neotype, Ovale Zone, horizon Bj-5. New specimens of strigoceratids from the Ovale Zone of Dundry are shown in Fig. 5.

4.4. Otoitidae Mascke, 1907

A revision on the Otoitidae from the Inferior Oolite of southern England is in progress so only a brief treatment will be given here.

Typical ammonites of the genus Emileia s.s. and Otoites occur in the Ovale Zone of Dundry Hill. The large and evolute specimen shown on Pl. 10, Fig. 1 (Pl. 11, Fig. 2) is close to paratype 3 of E. dundriensis (Callomon & Chandler, 2006), while the phragmocone on Pl. 11, Fig. 1 resembles paratype 2. The lower range of typical Emileia s.s. and its phyletic roots remain largely unknown but the new discoveries take the genus down into at least the upper Ovale Zone. Small, coarsely-ribbed but otherwise typical Otoites occur in bed 8 b(i). They include a form close-
ly resembling *Otoites tumulosus* Westermann (1956, pl. 10, fig. 3). The holotype of this species came from Dundry Hill, but not from the Ovale Bed. Its matrix is that of the Laeviuscula or Sauzei Zone (C. Parsons, pers. comm. V. D. 2006). The coarsely-ribbed and small form (Pl. 10, Fig. 2) has already been well described as *O. douvillei* by Parsons (1977) and shows that the Ovale Zone is at a critical point in the evolution of the dimorphic pair *Emileia/Otoites*.

The interpretation of the type species of *Emileites*, *Em. malenotatus* Buckman (1927, TA 6, pl. 702) has long been uncertain because of a poor figure of an imperfect type specimen. Its precise origin appears also to be in some doubt, although Buckman, in the legend to his plate, surmises it to have been the Lower White Ironshot of Dundry. In this he was followed by Parsons (1979). Investigation shows that this ammonite is totally septate at its maximum diameter of 42 mm and that it has the beginning of a planulate stage. Part of the phragmocone and the entire body chamber are missing. We now have an almost exact match in an incomplete adult specimen from bed 8 b(ii) that carries at least a part of the body chamber (Pl. 9, Fig. 1). Assuming a body chamber of three-quarters of a whorl, the maximum size would have been some 90 mm. Another complete phragmocone from the same level is shown in Pl. 9, Fig. 2. These ammonites show features typical of *Emileia s.s.*: coronate inner whorls with depressed whorl section later becoming semi-circular and more planulate. The primary ribbing shows long ribs that fade on the body chamber towards the mouth border. Later members of this group are *E. catamorpha* Buckman in the Laeviuscula Zone and *E. multisida* Buckman and *E. polymera* sensu Rioult in the Sauzei Zone. We therefore treat this group at present as a subgenus of *Emileia*, running in parallel with it into the Sauzei Zone. This would be another example in which a possible explanation for the size differences may lie in ontogenetic polymorphism. It is seen already in *Docidoceras* of the Discites Zone. The subgenus *Emileites* in this sense is most commonly found around Bj-8.

The bulk of the otoitid ammonites found in the Ovale Zone of Dundry Hill (Pl. 9, Figs. 3–5) are smaller and have a development of the shell similar to that seen in the inner and middle parts of the phragmocone of *Emileites malenotatus*. The specimens reach a maximum diameter of only about 40 mm, at which diameter the true *Em. malenotatus* is still septate. But they differ from *Em. malenotatus* in never losing their coronate whorl-section. The primary ribbing persists to the end of the body chamber and is most prominent low on the whorl-side, on the umbilical slope. The general character of this group is *Pseudotoites*- or *Frogdenites*-like. Parsons (1977) already recognized that this small-sized, coronate group and the group of *Emileia* proper represent two different clades within the Otoitidae, but he did not state that the type specimen of *Emileites malenotatus* belongs to the “*Emileia*-clade”. So neither the generic name *Emileites* nor the specific name *malenotatus* are available for members of this small-sized, cadiconic group, but this is a matter to be considered elsewhere. An available specific name is “*Docidoceras* liebi Maubeuge. For the moment we identify our Dundry specimens as “*Emileites*” [gen. nov.] liebi (Pl. 9, Figs. 3–5). As also already pointed out by Parsons, the [m] of this group is the coronate taxon “*Trilobiticeras* cricki Parsons (Pl. 9, Figs. 6–8).
The upper part of bed 8 has yielded a specimen of a *Stephanoceras* unlike any other so far found in Britain (Fig. 6: *St.* aff. *richardsoni* (Dietze et al., 2001)). The earliest *Stephanoceras* proper known there occurs in the Aalenian, Concavum Zone (Callomon & Chandler 1990, pl. 3, fig. 1, Aa-12/13; pl. 2, fig. 2, Aa-14/15). Specimens from the Lower Bajocian, Discites Zone, Bj-1, -2, include *St.* ['*Docidoceras*'] *perfectum* Buckman (1922, TA 4, pl. 314) (and see Chandler & Sole 1996). Then there was a gap until the boundary Ovale/Laeviuscula Zone, Bj-7a, with *St.* *richardsoni*. Occasional specimens have also been found higher in the Laeviuscula Zone, but the genus becomes abundant only in the Sauzei Zone (Bj-11a) and thence upwards into the Humphriesianum Zone.

The new specimen resembles *St. richardsoni* (and its closely related *St. brutonense* (Dietze et al., 2001)) in its highly evolute and densely ribbed bodychamber, but differs from them in the inner whorls, which are more involute and coarsely ribbed in *St. richardsoni*. The nearest comparisons are with material from elsewhere in Europe. Similar bodychambers are found in the 'early stephanoceratids' of the Tethyan Province, *St.* ['*Coeloceras*'] *longalvum* (Vacek) from San Vigilio in northern Italy.

**Fig. 6. Stephanoceras** aff. *richardsoni* (Dietze et al.) [sp. nov.] [M]; bed 8 b(ii); SM X40312. a–b: nearly complete bodychamber of 1.6 whorl, maximum diameter 200 mm. c–d: nucleus of the same specimen in position as found. – Reduced × 0.5. Black spot on lateral view indicates the beginning of the bodychamber at the last septum.

### 4.5. Stephanoceratidae Neumayr, 1875

The upper part of bed 8 has yielded a specimen of a *Stephanoceras* unlike any other so far found in Britain (Fig. 6: *St.* aff. *richardsoni* (Dietze et al., 2001)). The earliest *Stephanoceras* proper known there occurs in the Aalenian, Concavum Zone (Callomon & Chandler 1990, pl. 3, fig. 1, Aa-12/13; pl. 2, fig. 2, Aa-14/15). Specimens from the Lower Bajocian, Discites Zone, Bj-1, -2, include *St.* ['*Docidoceras*'] *perfectum* Buckman (1922, TA 4, pl. 314) (and see Chandler & Sole 1996). Then there was a gap until the boundary Ovale/Laeviuscula Zone, Bj-7a, with *St. richardsoni*. Occasional specimens have also been found higher in the Laeviuscula Zone, but the genus becomes abundant only in the Sauzei Zone (Bj-11a) and thence upwards into the Humphriesianum Zone.

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(lectotype refigured in WESTERMANN 1964, pl. 6, fig. 1, age uncertain, possibly Lower Bajocian but probably Middle Aalenian (CALLOMON et al. 1995), and type species of a new genus *Riccardiceras* WESTERMANN, 1995) or *St. telegdirothi* (GECZY) from Hungary (redescribed with stratigraphy by CRESTA & GALACZ 1990). Similar forms are cited as common at Cap Mondego in Portugal (FERNÁNDEZ-LÓPEZ et al. 1988) and one of these from the Ovale Zone figured by ROCHA et al. (1990, pl. 3, fig. 5) is particularly close. But the closest match with the Dundry specimen seems to be with the ‘*Riccardiceras*’ cf. *richardsoni* figured by DIETZE et al. (2001, fig. 5) from the Ovale Zone of the Scheffheu, near Blumberg in southwestern Germany. The rarity of stephanoceratids in the Aalenian and Lower Bajocian of southern Britain and Germany is a reflection of their bioprovincialism.

4.6. Oppeliidae Douville, 1890

The conventional family Oppeliidae contains two clearly distinguishable phyletic strands from its early stages: the Oppeliinae proper and the Bradfordiinae CALLOMON, 1981 (p. 143). Of these, the Bradfordiinae can be traced back in England to

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**Fig. 7.** a–b: *Bradfordia* cf. *praeradiata* (DOUVILLE) [M]; bed 8 b(ii); SM X40313. – c: *Lissoceras*? cf. *semicostulatum* BUCKMAN; bed 8 b(i); SM X40315. – d–e, i: *Hebetoxites hebes* BUCKMAN, topotypes. d: bodychamber fragment; bed 8 b(ii); SM X40317. e: small specimen, [?m]; bed 8, loose; SM X40318. i: juvenile; bed 8 b(ii); SM X40319. – f–g: *Oppelia*? sp. [M]; bed 8 a; SM X40316. – h: *Bradfordia* cf. *costidensa* IMLAY [M]; bed 8 b(ii); SM X40314. – All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Bradfordia costata Buckman, 1910 in the Concavum Zone (Aa-15) of the Upper Aalenian (Chandler & Sole 1996) and then traced upwards relatively unchanged into the Sauzei Zone. The most striking and conservative features are a broad, smooth, spiral depression low on the whorl-side at the raised sharp edge of a steep to overhanging umbilical wall, secondary ribbing confined to and persisting on the latero-ventral shoulder high on the whorl-side, and smooth rounded venters. Typical forms are relatively common at Dundry (Fig. 7a–b, h) and another typical form was described by Douville from Toulon as Oppelia praeradiata (1885, pl. 3, fig. 7, non fig. 6, the lectotype, of unknown age, from Normandy). The forms illustrated here (Fig. 7) from Dundry are more densely and finely ribbed than B. praeradiata and B. costata described by Buckman (1910b). The most fine-ribbed of them, Fig. 7h, is most closely matched by a species from Alaska described by Imlay (1964), B. costidensa, from the Talkeetna Mountains.

The second clearly-defined strand is based on Oppelia itself, going back to the type species O. subradiata (Sowerby) at the base of the Humphriesianum Zone. Then there are various other genera known over only short ranges that seem to fall somewhere in between, including Amblyoxyites Buckman, Toxamblyites Buckman, Stegoxyites Buckman and perhaps Hebetoxyites Buckman. But the leading question relates to the relationship between the Bradfordiinae and Oppeliinae themselves. It has long been assumed that the latter developed from the former, but where and when has remained mysterious. The earliest occurrence of anything resembling Oppelia is therefore of great interest. One candidate is Praeoppeilia gracilobata (Vacek) from the Middle Aalenian, Bradfordensis Zone of San Vigilio (Callomon et al. 1995). We have now a specimen (Fig. 7f–g) from bed 8 a that also seems closer to Oppelia than it does to Bradfordia, taking the range down from Bj-13 to Bj-5. Another specimen in this group (Fig. 7c) bears some resemblance to Lissoceras semicostulatum Buckman (1923, TA 4, pl. 400), from the Laeviuscula Zone at about Bj-8, a genus also of cryptogenic origin then ranging up almost unchanged into the Cretaceous.

Finally, Hebetoxyites *hebes Buckman (1924, TA 5, pl. 475), whose type also came from the ‘Lower Ironshot’ of Dundry, probably also from the West End quarry (teste Buckman), at a level equivalent to our 8 b(ii). Specimens of this species are rare at Dundry and we have found it only in the higher part of bed 8 (Fig. 7d, e, i, topotypes). Hebetoxyites lacks strigations and a hollow floored keel, characteristic of strigoceratids. On these grounds we exclude it from the Strigoceratidae (Fernández-López 1985) and leave it in the Oppeliidae s. l. for the present.

5. Conclusions

The new excavation at Dundry, Little Down Wood, was aimed at providing a more detailed look at a part of the Inferior Oolite that has been poorly documented in the past. It lies in the Ovale Zone of the Lower Bajocian Stage, in beds that have been widely lost through intra-formational erosion in Dorset or, where developed in expanded sequences in the Cotswolds, in beds that are almost devoid of the critical time-diagnostic guide-fossils, the ammonites. At Dundry the Ovale Zone is in part represented by a single bed, bed 8, that is very rich in ammonites. In terms of the biostratigraphical classification adopted today for most of the Inferior Oolite of
England, it forms the type succession for two of the original ammonite faunal horizons introduced in 1990, that of Bj-5, *Witchellia romanoides* in the lower part and that of Bj-6, *Fissilobiceras ovale* in the upper part of the bed. There were reasons to believe that the latter might, with very precise collecting, be further divisible. The bed was therefore opened and a large collection of ammonites made from it.

The fauna of Bj-5 was amply represented but yielded nothing stratigraphically very new. It did however strengthen the correlation with two almost equally precise horizons abroad, in the Ovale Zone of Swabia and in an area near Toulon in southern France. Similarly, despite best efforts and the recovery of a large collection, attempts to recognize further biostratigraphical subdivisions in Bj-6 were unsuccessful. What has however been achieved is the amplification of the taxonomy of many of the ammonite groups, previously known only from scattered records. These include genera of great interest in the framework of the evolution of the ammonites as a whole, especially in times in the Bajocian that saw a great world-wide diversification of these molluscs. An incoherent complexity of morphgenera and morphospecies is being condensed into a much simpler, more natural, phylogenetic classification, especially in the Bajocian. To this end, the new collections are of great significance. Their fuller evaluation will take time.

### 6. References


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Plate 1

Fig. 1. Sonninia aff. haugi Gillet [sp. nov.?]. This species seems to be intermediate between the morphogenera Euboploceras and Prepapillites/Papilliceras. Bed 8 b(i); SM X40320.

Fig. 2. Sonninia cf. subdecorata Buckman [m]. Adult, the last sutures approximated. Bed 8 a; SM X40321.

Fig. 3. Sonninia cf. subdecorata Buckman [m]. Another adult but wholly septate, probably large [m]. Bed 8 a; SM X40322.

All figures natural size. Black spots on lateral views indicate the beginning of the body chamber at the last septum.
Plate 2

Fig. 1. *Sonninia aff. adicra* (WAAGEN) [M]. Bed 8 b(ii); SM X40323.

Fig. 2. *Sonninia pseudotrigonata* MAUBEUGE. Wholly septate with no apparent simplification or approximation of the last visible sutures, hence probably [M] (cf. Pl. 1, Fig. 3). Bed 8 b(ii); SM X40324.

All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Plate 3

Fig. 1. *Dundryites aff. albidus* Buckman [M], complete phragmocone. Note the complex sutureline. Bed 8 b(ii); SM X40325.

Fig. 2. *Dundryites albidus* Buckman [M], topotype, complete phragmocone, diameter 92 mm (the holotype is septate to 62 mm). Bed 8 b(i); SM X40326.

All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Plate 4

Fig. 1. *Witchellia romanoides* (DOUVILLE) [M], typical example. Bed 8 a, ammonite faunal horizon of *Witchellia romanoides* (Bj-5); SM X40327.

Fig. 2. *Witchellia romanoides* (DOUVILLE) [M], complete phragmocone. Cast of lectotype (designated here), DOUVILLE’s syntype I (1885, pl. 3, fig. 4). ‘Couche ocreuse, ?Ovale Zone of the Vallée de Valaury’ (S France); SM X40330, Original STL EM 1705.

Fig. 3. *Witchellia romanoides* (DOUVILLE) [M], typical example. Bed 8 b(ii); SM X40328.

Fig. 4. *Witchellia romanoides* (DOUVILLE) [M], larger variant. Bed 8 b(i); SM X40329.

Fig. 5. *Witchellia romanoides* (DOUVILLE) [M], no sutures visible but the uncoiling umbilical sutures suggests a nearly complete adult. Cast of DOUVILLE’s syntype II (1885, pl. 3, fig. 3), same locality and bed as Pl. 4, Fig. 2; SM X40331, Original STL EM 1702.

All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Plate 5

Fig. 1. *Witchellia cf. rubra* (BUCKMAN) [M], nearly complete. The type horizon of “*Rubrileiotes*” *ruber* is in the upper part of the Laeviuscula Zone (Bj-9). Bed 8, loose; SM X40332.

Fig. 2. *Witchellia cf. jugifera* (WAAGEN). An adult, the last sutures strongly approximated: a variant of *W. romanoides* [M] or [m] of *jugifera*? Bed 8 a; SM X40323.

Fig. 3. *Witchellia jugifera* (WAAGEN) [M]. Cast of lectotype. Sowerbyi-Bank, ammonite faunal horizon of *Pseudoshirburnia oechslei* (Ovale Zone) of Gingen an der Fils (S Germany); SM X40324, Original BSPG AS XXII 36.

All figures natural size. Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Plate 6

Fig. 1. *Witchellia sayni* HAUG [M]. Cast of lectotype (designated here, DOUVILLE 1885, pl. 2, fig. 1, 1a). Same source as *W. romanoides*, ‘couche ocreuse, ?Ovale Zone of the Vallée de Valaury’ (S France); SM X40335, Original STL EM 1719.

Fig. 2. *Witchellia cf. sayni* HAUG [M], adult, intermediate between *W. romanoides* and *W. sayni*. Bed 8 a; SM X40327.

Fig. 3. *Witchellia cf. zugophora* (BUCKMAN) [M], small adult variant with crowded last sutures. The type specimen of “*Zugophorites* zugophorus” is septate up to a diameter of about 108 mm, this specimen to 50 mm. It matches in sculpture the inner whorls of the type precisely: the main difference lies in the difference of sizes. This may reflect a form of ontogenetic polymorphism – see text. Bed 8 b(i); SM X40328.

All figures natural size. Black spots on lateral views indicate the beginning of the body chamber at the last septum.
Plate 7

**Fig. 1.** *Witchellia cf. patefactor* (Buckman) [M], partially preserved with test. The type horizon of *W. patefactor* lies at the top of the Laeviuscula Zone (probably Bj-10). Bed 8 b(ii); SM X40338.

**Fig. 2.** *Witchellia pavimentaria* (Buckman) [M]. Bed 8, loose; SM X40339.

All figures natural size. Black spot on lateral view indicates the beginning of the body chamber at the last septum.
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1a

1b

2a

2b
Plate 8

Fig. 1. *Fissilobiceras ovale* (Quenstedt) [M]. Nearly complete adult, maximum diameter 340 mm; note the fissilobate septal suture. Similar giants – some with more rounded umbilical walls and then assigned to *F. fissilobatum* (Waagen) – occur throughout the whole of bed 8. Bed 8 b(i); SM X40340.

Fig. 2. *Fissilobiceras ovale* (Quenstedt) [M]. Wholly septate inner whorls, for comparison with Pl. 8, Fig. 1. Bed 8 a (–45/–50 cm); SM X40341.

All figures reduced × 0.5. Black spots on lateral views indicate the beginning of the body-chamber at the last septum.
Plate 9

**Fig. 1.** *Emileia (Emileites) malenotata* (Buckman) [M]. Incomplete phragmocone with part of the body chamber. The inner whorls exactly match the holotype of *Emileites malenotatus* Buckman (1927, TA 6, pl. 702), which is an incomplete phragmocone. Bed 8 b(ii); SM X40342.

**Fig. 2.** *Emileia (Emileites) malenotata* (Buckman) [M]. Complete phragmocone. Bed 8 b(ii); SM X40343.

**Fig. 3.** *“Emileites”* [gen. nov.] *liebi* Maubeuge [M]. Nearly complete specimen with some body chamber. Compare the coronate body chamber and accentuated primary ribbing at mid-whorl seen in this species with the more planulate coiling seen in *E. malenotata* (Pl. 9, Figs. 1–2), the body chamber carrying long primary ribbing that fades (see text). Bed 8 b(i); SM X40344.

**Fig. 4.** *“Emileites”* [gen. nov.] *liebi* Maubeuge [M]. Complete and perhaps reworked specimen with nearly complete body chamber. Bed 8 b(i); SM X40345.

**Fig. 5.** *“Emileites”* [gen. nov.] *liebi* Maubeuge [M]. Complete but juvenile specimen of a coronate and small variant with a broader whorl-section. Bed 8 a; SM X40346.

**Fig. 6.** *“Trilobiticeras”* [gen. nov.] *cricki* Parsons [m]. Complete specimen of a small variant with lappets. Note the coronate stage with the prominent primary ribbing on the lateral edge of the whorls up to the body chambers in Figs. 6–8, resembling that in *“Emileites” liebi* [M], the supposed sexual dimorphic counterpart. Bed 8 a; SM X40347.

**Fig. 7.** *“Trilobiticeras”* [gen. nov.] *cricki* Parsons [m]. Larger variant, complete with lappets. Bed 8 b(ii); SM X40348.

**Fig. 8.** *“Trilobiticeras”* [gen. nov.] *cricki* Parsons [m]. Another complete specimen with lappets. Bed 8 b(ii); SM X40349.

All figures natural size. Black spots on lateral views indicate the beginning of the body chamber at the last septum.
Plate 10

**Fig. 1.** *Emileia (Emileia) aff. dundriensis* Callomon & Chandler [M]. The first half of the last whorl of the bodychamber is artificial; maximum diameter 250 mm. The inner whorls are slightly more coronate and the coiling still more evolute than in the bulk of the type material of *E. dundriensis*, from the Trigonalis Subzone of the Laeviuscula Zone. Gift from J. Huxtable to one of the authors (V. D.); by preservation from bed 8 b(ii); SM X40350. For ventral view, see Pl. 11, Fig. 2. – Reduced × 0.5.

**Fig. 2.** *Otoites douvillei* Parsons [m]. Complete specimen with lappets. Bed 8 b(ii); SM X40351. – Natural size.

**Fig. 3.** *Otoites tumulosus* Westermann [m]. Nearly complete specimen lacking the peristome. In contrast to the small *O. douvillei*, which is restricted to the Ovale and lowermost Laeviuscula Zone, the larger forms like *O. tumulosus* range into the Sauzei Zone. Bed 8 b(ii); SM X40352. – Natural size.

Black spots on lateral views indicate the beginning of the bodychamber at the last septum.
Plate 11

**Fig. 1.** *Emileia (Emileia) dundriensis* Calommon & Chandler [M]. Incomplete phragmocone. Bed 8 b(ii); SM X40353. – Natural size.

**Fig. 2.** *Emileia (Emileia) aff. dundriensis* Calommon & Chandler [M], ventral view of specimen shown on Pl. 10, Fig. 1; SM X40350. – Reduced × 0.5.

Black spot on lateral view indicates the beginning of the bodychamber at the last septum.