ON THE

Cephalopoda Bed & the Oolite Sands

OF

Dorset and part of Somerset.

BY JAMES BUCKMAN, F.G.S., F.L.S., ETC., ETC.

AT the village of Bradford Abbas, in the county of Dorset, there have been opened during my residence three distinct quarries, namely :—

1. AMBURY QUARRY, near the road between Yeovil and Sherborne, adjoining the farm.

2. EAST HILL QUARRY, on my farm.

3. HALLS QUARRY, to the south of (2), also on my farm.

These three quarries are in a line almost north and south, East Hill Quarry, the central one, being nearly equidistant from the other two, and 1 and 3 are about a mile apart.

A general idea of these may be gathered from the section :

a Inferior Oolite Sands. *b* Inferior Oolite. *c* Fuller's Earth.

These three quarries have mostly been worked for road-mending and rough masonry work. Their difference of level is accounted for by a series of faults. (The surface of the section and the hill behind afford a view of the substrata of my farm, the buildings of which are situate at 4.) The difference in the level of the farm is about 150 feet, the lowest part being situate on Fuller's Earth. This higher geological stratum having been brought down by faulting, as indicated in the section.

The following section will illustrate the general composition of the three quarries :—

ABOUT Feet			Hall's Quarry	Anbury ditto	East Hill ditto	
6	1. Irregular beds of whitish and blue centred Freestones, parted with seams of a white Marl.	1				Fuller's Earth
10	2. Beds of white, sometimes blue, centred Freestones.	2				Inferior Oolite
4	3. Foxy coloured and bluish ironshot Oolite, divided into two stages by a thin band of dark marl.	3				
2	4. Grey and bluish Silicious Oolite.	4				
100 to the base of Babylon Hill.	5. Sands with occassional bands of blocks or nodules of indurated stone.	5				Sands—Inf. Oolite

The beds as here set down are of great interest as regards their fossils, which may now be briefly noted as follow :—

1. Contains examples of *Ammonites subcontractus*, Morris and Lycett, pl. 2. f. 1—2, and *A. arbustigerus*, D. Orbig. The latter, as stated by Morris and Lycett, "described by M. D'Orbigny as occurring both in the Great and Inferior Oolite of Normandy." *Belemnites canaliculatus, Geol. Chelt.* t. 3, f. 8, is not uncommon. Other shells occur, but, as a rule, the rock is very barren.

2. The Freestone beds contain but few Fossils, poor specimens of *Ammonites Parkinsoni*, *Belemnites*, and *Trigonia* are sometimes met with.

3. This bed, of from 2 to 5 feet in thickness, is, perhaps, the richest *fossil deposit* of the Inferior Oolite; and, both in the numbers of species and individuals, it is, perhaps, not surpassed anywhere. We have already ascertained the following, namely :—Species—consisting of—

Cephalopoda ...	65	Species more or less.
Gasteropoda ...	50	
Brachiopoda ...	15	
Mollusca ...	80	

4. Contains but few fossils. *Iosocardia (Ceromya), concentrica*, is the most characteristic. It is here called the "Dew bed."

5. The sands present but few, and those very imperfect, fossils in the purely arenaceous beds, but some of the interpolated bands of stone are full of organic remains; and as I think them so truly Oolitic they will be commented upon presently.

Here it will be seen that the beds 3 and 5 present especial points of interest; it will be my object then to direct particular attention to them.

Now, as regards the bed marked 3, it may be stated that it has generally received the name of THE "*Cephalopod Bed*," to which the abundance of remains of this class fully entitles it. It will be seen that at Bradford it rests on the so-called "Inferior Oolite Sands" of the Ordnance Survey, quoting from a map of 1811, but named "Liassic Sands" by Dr. Wright. This author, in his excellent paper on the *Inferior Oolite*, in the 16th vol. of the *Journal of the Geological Society*, has the following remarks (p. 34) :—

"The Inferior Oolite, which near Yeovil immediately overlies the sands, is comparatively thin, in consequence of the absence of the thick-bedded limestones which impart such a thickness to this formation in Gloucestershire."

The late Hugh E. Strickland took another view of these Dorset beds, as in his description of the Leckhampton Hill section we find the following :—

"(7). Ferruginous beds, consisting of coarse Oolite in the upper part, and of the very peculiar, large-grained Oolite or Pisolite ("Pea-grit") in the lower. A few miles to the south the Pisolite disappears, and is replaced near Painswick, and at Haresfield Hill, by strata containing ferruginous Oolite grains in a brown paste. This is the precise equivalent of the well-known Oolite of Dundry, near Bristol, which may be recognised as far off as Bridport, on the Dorset coast. At Leckhampton the Pisolite rests on a few feet of ferruginous Oolite and sand. The total thickness of this portion of the series is 42 feet." —*Journal of the Geological Society*, vol. vi. p. 249.

Now I have been particular in quoting thus much, as it so clearly expresses the author's opinion—not that the lower beds of the Inferior Oolite are absent in Dorset, but —that the Cephalopoda bed of this county is the equivalent

of the lower Oolitic bed of Leckhampton, or, rather of the "Upper Liassic bed."

Dr. Lycett expresses the same views, he says :—

"Considering the position of the Mollusca bed beneath the freestones, and overlying the Cynocephala stage, it may approximately be placed upon the parallel of the Cheltenham ferruginous Pisolite."—*The Cotteswold Hills*, p. 72.

Mr. Moore has very recently written to the same effect, as in speaking of the section at Half-way House (within a mile of Bradford), he says :—

"The Cephalopoda bed of Half-way House contains many of the organic remains of that zone in Gloucestershire, and amongst the Ammonites may be mentioned, *A. Parkinsoni*, *A. Sowerbyi*, *A. Moorei*, *A. Martinsii*, and *A. variabilis*."—Moore on *The Middle and Upper Lias of the South-West of England. Somersetshire Archæological and Natural History Society*, vol. xiii. 1865-6.[1]

It may be observed in passing, that this small list of Ammonites occurring together in this place must be a hard nut for the zonal theorists to crack.

The last paper on *The Inferior Oolite*, from which we shall now quote, is by Dr. H. Holl. This geologist, after quoting some of the opinions we have already cited, says :—

"The result of my own investigations is at variance with each of these views; and, having followed the beds stratigraphically along the line of their outcrop, I shall endeavour to show that their true position is higher in the series than is stated by any of these geologists, and that they are, in fact, the southern extensions of the Upper and Lower Ragstones of Mr. Hull, the uppermost of which is not represented in the typical section of Leckhampton, having risen above the level of the country, and cropped

(1). Reprinted later in a separate book.

out before reaching the brow of the hills."—*Quarterly Journal Geological Society* for August, 1863.

If, then, we sum up these opinions, we shall find that, while Dr. Holl places our Cephalopod bed so high that it is above Leckhampton Hill, and yet does not account for the Oolitic mass at Leckhampton (which, according to his view, is not found in Dorset), Dr. Wright *now* correllates the Bradford Cephalopoda bed with the Humphresianus zone on the top of Leckhampton, considering the beds below as absent. Other writers, however, consider it to be the representative of the Cephalopoda bed at the base of the Gloucestershire Oolite series.

Now, as, after eight years of work in Dorset, I happen to differ from all these conclusions, it will, perhaps, be as well to state shortly at this point the views I mean to advocate. My notions, then, are :—

1st. That the Dorset Cephalopoda bed is the representative of the Rubbly Oolite at the top of Leckhampton Hill, and of Cold Comfort, and consists of the Gryphite and Trigonia Grits of the *Geology of Cheltenham* (p. 25).

2nd. The so-called "Lias or Oolite Sands" underlying the Bradford Oolite Stone are really the representatives of the lower members of the Inferior Oolite of Gloucestershire, at least for 100 feet of their thickness.

As it may assist in any conclusions as regards the first position, I here give a list of the Cephalopods from the bed mostly in my own village :—

BELEMNITES.

B. canaliculatus, Schl., D'Orbig., &c.
,, Blainvillii, Voltz, Phill. Monograph.
,, terminalis, Phill. do.
,, anomalus, Phill. do.
,, apiciconus, Phill. do.
B. sulcatus, Miller.
,, giganteus Blainc.
,, ellipticus, Miller.
,, abbreviatus, Sow.
,, irregularis, Phill.
,, brevis—new.

Nautilus.

N. latidorsatus, D'Orbig.
,, intermedius, Sow.
,, truncatus, Sow.
,, excavatus, Sow.
,, sinuatus, Sow.
N. clausus, D'Orbig.
,, lineatus, Sow.
,, inoratus, D'Orbig.
,, inflatus (?), D'Orbig.

Ammonites.

A. subradiatus, Sow.
,, concavus, Sow (?).
,, Murchisonæ, Sow.
,, opalinus, Rein.
,, corrugatus, Sow.
,, lœviusculus, Sow.
,, Tessonianus, D'Orbig.
,, subcostatus, new.
,, subradiatus, D'Orbig., non Sow.
,, discoides, Zeit.
,, discus, Sow.
,, variabilis, D'Orbig.
,, Sowerbyi, Sow.
,, Truellii, D'Orbig.
,, Moorei, Lycett.
,, hecticus, Hartman.
,, Jurensis, Zeit.
,, Ooliticus, D'Orbig.
,, polymorphus, D'Orbig.
,, dimorphus, D'Orbig.
,, Martinsii, D'Orbig.
,, Garantianus, D'Orbig.
,, Parkinsoni, Sow., *and Niortensis the same.*
A. Dorsetensis, Wright., *and Niortensis the same.*
,, Linneanus, D'Orbig.
,, Eudesianus, D'Orbig.
,, Tessonianus, D'Orbig.
,, Edouardianus, D'Orbig.
,, Thouarsensis D'Orbig.
,, Cadomensis, Defrance.
,, pygmeus, D'Orbig.
,, Gervellii, Sow.
,, Brocchii, Sow.
,, Blagdeni, Sow.
,, Humphresianus, Sow.
,, Braikenridgii.
,, longiferus, D'Orbig.
,, Brongniartii, Sow.
,, Deslongchampsii, Defrance.
,, Sauzei, D'Orbig.
,, insignis, D'Orbig.
,, aalensis Zeit. (candidus), D'Orbig., Pl. 63.
Undetermined forms } several.
Undescribed forms }

We have a number of specimens with the terminations to the mouths of the shells beautifully preserved. Indeed, as a rule, the Ammonites from Bradford, Sherborne, and Milborne Wycke might sit for such portraits as those drawn in the *Palæontologie Francaise.* I have made sketches of all these that I could well make out.

The following Ammonites belong to the sands :—

A. Moorei.	A. Jurensis.
,, Murchisonæ.	,, opalinus.
,, Eduardianus.	,, others.

ANCYLOCERAS.

A. annulatus, D'Orbig.	A. subannulatus, D'Orbig.
,, bispinatus, D'Orbig.	

On looking over these lists it will be seen that a fair percentage of Lias forms is represented ; at the same time the mass of these Cephalopods indicate a high position in the Inferior Oolite, and this prevalence must guide us, in as much as it is common for older forms of life to have a more or less wide range upwards, while the reverse would not be possible ; *i.e.*, fossils may range upwards, not downwards, from their starting point.

Again, while some of the shells of these lists are undoubtedly Liassic, yet we now know that many of them have been attributed to the Lias stage, on the assumption that the Dorset Cephalopoda bed was the equivalent of the lower Gloucestershire one : indeed, I have seen specimens from my own Bradford Abbas quarry labelled as from Upper Lias ; but, it is clear that, if this be so the whole series must belong to Upper Lias—a conclusion which no one would agree to.

It should here be mentioned that most of the fossils of the list have been obtained from my own quarry at Bradford Abbas ; at the same time, the same horizon, at no very distant points, will be found to differ greatly as to the prevalence of different species, especially of Ammonites.

Thus, at Bradford, the quarry by my dwelling-house is remarkable for the prevalence of *Ammonites subradiatus* and *A. Sowerbyi*, the latter less frequent than the former, while a cutting at the farm buildings presented more of the latter.

A quarry on the next farm, scarcely a quarter of a mile distant, is remarkable for *A. læviusculus*.

At Half-way House, not half a mile from the latter, *A. Parkinsoni* is a most constant and beautifully-preserved fossil, remarkable both for quantity and size, as they not uncommonly attain to a diameter of as much as 24 inches.[2]

In the quarries close to the town of Sherborne the prevailing Ammonite is *A. Humphresianus*, mixed with *A. Gervellii*, both of which forms are rarely met with at Bradford, while it is worthy of remark that *A. subradiatus* and *A. Sowerbyi* rarely occur at Sherborne.

At Milborne Port *A. Blagdeni* and *A. Brocchii* are common, to the exclusion of those so abundant elsewhere; so that, in a distance of little over five miles, the same bed may be called the *Zone* of any favourite Ammonite out of twenty.

I have thus far confined my observations to the "Cephalopoda bed," as this particular rock is so rich in them, and as the bed itself has been confounded with the one abounding in these remains in Gloucestershire; but, it may be well to remark that, a large list of both *Gasteropoda* and *Conchifera* occurs in the same stratum, and these, like the Cephalopods, afford different species at different quarries: thus, the East Hill quarry at Bradford Abbas has afforded the finest series of univalve shells yet discovered in our British Inferior Oolite, and, indeed, taking all the fossils into consideration, it may be said that this two or three feet of rock yields a richer fauna than the two hundred feet making up the Inferior Oolite in the neighbourhood of Cheltenham.

It will be well now to give a detailed section of the Inferior Oolite of Dorsetshire, for which purpose I shall

(2.) This fossil has been erroneously named *A. Dorsetensis*.

choose that of Hall's Quarry, Bradford Abbas, as it contains the top of the Inferior Oolite, it being covered with the Fuller's Earth.

Section of Hall's Quarry, Bradford Abbas, in descending order :—

			ft.	in.
Fuller's Earth, called Fuller's Earth Rock.	1	Soil (comparatively stiff), Marly Oolite, with nodular masses of white Freestone, containing *Belemnites canaliculatus* and *Ammonites sub-contractus* (Morris and Lycett)	6	0
Trigonia Grit of Cold Comfort.	2	Bed of white Freestone, with irregular cleavage	2	6
	3	Shaly Oolite	2	0
	4	Hard, blue-centred, rough Freestone ..	5	0
Bivalve Bed at Lineover.	5	Foxy-coloured and bluish Freestones, with several species of Astarte	1	6
	6	A thin band of Marl, charged with Nucula and small univalves		6
Gryphite Grit of Leckhampton.	7	Cephalopoda bed, containing a large list of Ammonites Terebratula Philipsii, &c.	2	6
Lower Beds of Inferior Oolite of Gloucestershire.	8	Hard, Silicious Oolite, graduating into sands—"Dew Bed"	2	0
	9	Sands, with Freestone bands, as made out from deeper sections	100	0

The section of Half-way House is much the same, but here it is not capped with Fuller's Earth.

The Marly band with Ironstone nodules is rich in *Astarte excavata*, *A. obliqua*, a small form of *Lima proboscidea*, and two new species of Myaconcha, *M. Longirostris*, *M. truncata* (nob), besides *M. crassa*.

These two latter, it would seem, take the place of the *Perna mytiloides* (Bronn), which so abounds at the Lineover section at Cold Comfort.

As regards the Cephalopoda bed in the Bradford sections, it should here be mentioned that towards the bottom it is highly charged with univalves, with which are *Astarte elegans* and *Opis trigonalis* among the bivalves.

At Milborne Wycke the sands resolve into perfect white Oolite. The section occurs in a road cutting through a hill, at the bottom of which is a stream.

Section at Milborne Wycke, near Sherborne (in descending order):—

			ft.	in.
Trigona Grit.		Soil.		
	1	White Oolite of irregular cleavage, with few fossils	15	0
Gryphite Grit.	2	Cephalopoda bed, white and chalky in appearance, with occasional markings of green (Phosphate of Iron), charged with *Bel. ellipticus*, *Ammonites Blagdeni*, *A. Gervellii*, *A. cadomensis* and *A. subcostatus* (nob) prevail	2	0
Sands at Bradford.	3	White Oolite Freestone in irregular blocks, with a few Belemnites Terebratula, &c., as both 1 and 2	20	0
	4	Layers of Oolitic Freestone, embedded in Marl, to bottom of section	10	0

1. *Rhynconella spinosa, Ter. spæroidalis.*
2. The usual Inferior Oolite Ammonites, *A. Humphresianus*, as well as the above-named.
3. 4. } Very unfossiliferous.

Now, if we compare this section with that of Ham Hill, in the opposite direction, as being to the left of Bradford, or west of Yeovil, we shall find that in this admitted section of nearly 100 feet of Inferior Oolite Stone the Cephalopoda bed is absent, and fossils are exceedingly rare.

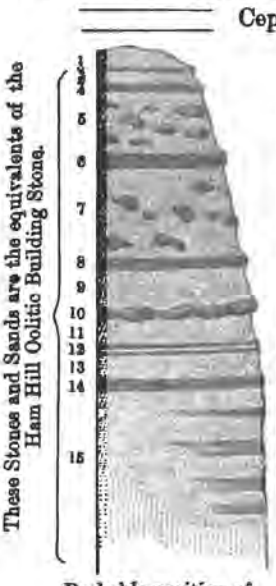
Section at Ham Hill, Somerset :—

			ft.	in.
		Probable position of Cephalopoda bed denuded ..		
Freestones, &c., of Leckhampton	1*	Soil.		
	1*	"Ochre beds," a soft bedded sandy Oolite, not the best building stone	50	0
Shelly Oolite of Leckhampton	2*	Yellow and Ochreous beds, best building stone	30	0
Pea Grit of Leckhampton and Cotteswolds	3*	A grey harder Oolite	10	0
		Sand.		
		Probable position of Midford Sands, see Phillips' *Valley of the Thames.*		

* These beds are the equivalents of the Sands at Bradford, but here wholly Oolitic, and both at Ham Hill and Bradford the Pecten dimissus is a common shell.

The accompanying section is that of the road cutting ascending Babylon Hill, between Yeovil and Sherborne :—

Section of Babylon Hill :—



		ft.	in.
1.	Sand	5	0
2.	Sandy Oolite		9
3.	Sand	1	6
4.	Sandy Oolite	1	0
5.	Sand with occasional Stone ...	10	0
6.	Sandy Oolite	2	6
7.	Sands with irregular Stone ...	15	0
8.	Stone	2	0
9.	Sand	5	0
10.	Irregular masses of stone ...	2	9
11.	Sand	4	0
12.	Two bands of Stone ...	1	6
13.	Sand	3	6
14.	Stone	2	0
15.	Sands with occasional layers of stone at the upper part...	50	0

In the Hollow-ways leading to Bradford, and again at the Yeovil Junction, the same section is repeated in its main characters, and it is impossible, on looking at any one of these (without knowing how soft the sands are), not to be struck with the general similarity in bedding and colour with the Ham Hill stone; and I take it, then, that while at Ham Hill the rock became wholly consolidated into a more or less hard Freestone, at Bradford it has only been partially hardened.

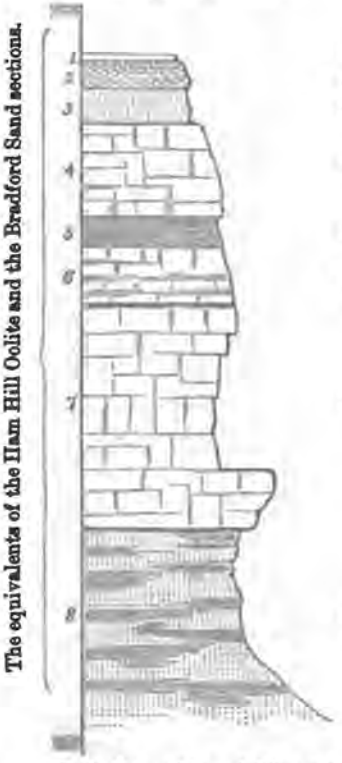
In both, fossils are rare, but at Ham Hill the stone is mostly made up of comminuted shells; so the stone beds at Bradford are occasionally full of fossils, perfect specimens

of which are rare, but still so fossiliferous is its aspect as to have got for some of the layers the name of the Shelly bed, and there is reason to think that it really does correspond with the Shelly Oolite of the Cotteswolds.

The following section of the escarpment at Crickley Hill, Gloucestershire, in 1855, will explain the correlation now sought to be established.

Section at Crickley Hill Quarries :—

—— Probable position of Dorsetshire Cephalopod bed.



		ft.	in.
1.	Soil		8
2.	Rubbly Oolitic debris	4	0
3.	Sandy bed	6	0
4.	Hard Freestone in large blocks, "building stone"	15	0
5.	A kind of Pisolitic Ragstone	5	0
6.	Oolitic Freestone, parted by seams of Pisolitic Stone ...	9	0
7.	Hard blocks of brownish Oolite ...	35	0
8.	Sandy Oolite, containing large blocks of Ragstone, occasionally Pisolitic (as traced to the outcrop) ...	25	0

—— Probable position of Gloucestershire Cephalopod bed.

Upon this section we have the following notes :—

"Some of bed (7) consists of seven layers of hard stone, some of which are as much as 3 ft. 6 in. thick, parted by thin seams of Oolitic sand."

"The bed (7) presents a fine example of the smooth-faced 'lissens' of the quarrymen."

"The blocks of stone include fine specimens of *Lima proboscidea*, *Gervillia Hartmanni*, *Modiola plicata*, *Belemnites compressus*, &c."

Now, although the list from our sand—or infra Cephalopoda beds—as yet is not large, the following will sufficiently indicate their Oolitic character :—

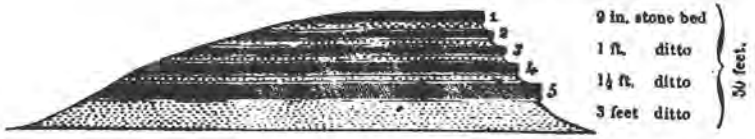
Belemnites compressus.
,, tricanaliculatus.
,, subtenuis.
,, abbreviatus.
Ammonites Moorei.
,, Murchisonæ.
,, Eduardianus, D'Orb.
,, opalinus.
,, Jurensis
others.
Nautilus latidorsatus.
,, inornatus.
Ostræa bullata.
,, Marshii (young).
Gryphæa Buckmanni, Lycett (frequent).
Lima densipunctata, Rom.
,, grandis.
Astarte elegans.
,, pullus.
,, obliqua
Astarte clathratus.
,, rigida.
Avicula complicata (Buck.) *Geol. Cheltn.* t. 6 f. 5.
Gervillia Hartmanni.
,,
Pinna Hartmanni.
,, ampla.
Pecten lens.
,, annulatus.
,, discites.
,, demissus.
Trigonia[3] (both costated and clavellated forms).
Lucina Bellona, M. and L.
Ceromya (Isocardia) concentrica.
Tancredia donaciforme.
Cardium.
Serpula socialis.
Ossicula of Apiocrinus.
do. of Pentacrinus.
Spines of Cidarides.

(3). As this genus is now being reviewed by Mr. Lycett we abstain from naming them more particularly, and especially as this matter is said by Mr. Lycett to be full of interest.

Most of the fossils in the above list occur in the hardened layers of "*Shelly Oolite*" which mark different stages in the sand. Occasionally these stones are mere masses of agglomerated shells, and must contain remains of a very large list of species, but they are so broken as to render their complete determination next to impossible.

As an evidence of the position of these we give the following section at Yeovil Junction :—

Section at the Yeovil Junction.



1. CEPHALOPODA BED. The top bed or Gryphite Grit of Leckhampton.
2. Sandy stone, with but few shells.
3. Do. with *Ammonites Jurensis* as much as 22 in. across.
4. Sandy Oolitic stone, occasionally separated into potlids, in which occur *Nautilus inornatus*.
5. Shelly Oolite, containing a long list of ascertained Oolite fossils, and probably a still longer list not made out.

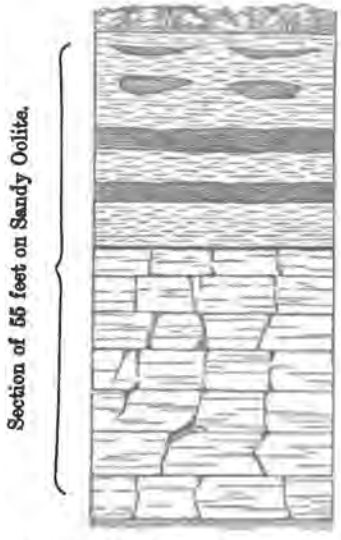
The above is a fine section on the west of the village of Bradford Abbas. It corresponds with the one to the east, the village reposing in a valley caused by faulting, the highest stratum of which consists of Fuller's Earth.

One point of interest in a section near the junction will be found in the appearance presented by the lower beds of sand, which break up into blocks, which, at a distance, both in colour and form, have the appearance of stones in a quarry of Ham Hill stone, and it is only when one

ascertains how soft they are that we become aware of the absence of lime and the presence of sand. And, indeed, in a cutting near my own farm, veins of white, powdery carbonate of lime—probably derived from shells—will be found in horizontal layers here and there in the sand.

We give a sketch of the section just adverted to :—

Section in the Sand near the Yeovil Junction.



From what has been already advanced it follows not only that the Dorset Cephalopod bed cannot be the equivalent of the Gloucestershire one, it being near the top, instead of at the bottom, of the inferior Oolite—nay, as some consider it as part of the Lias itself;—but that the so-called Lias Sands of Dorset are in reality the equivalent of the Inferior Oolite, and represent the mass of that rock as it occurs at Leckhampton and Crickley Hills, near Cheltenham.

In order to show this the more clearly we now take Dr.

Wright's section of the Oolites at Cleeve Hill, and by its side place—a plan of what we consider the Dorset equivalents. These latter are taken from three points—Sherborne, Bradford Abbas in Dorset, and Ham Hill in Somerset. It should, however, be remembered that the different members vary in thickness, even in quarries very near to each other, so that our plan[3] may better be considered as affording a relative view of the position of the different beds concerned, rather than as containing exact admeasurements.

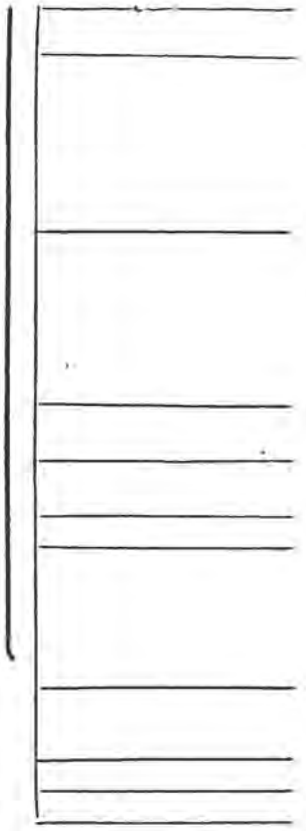
It will be clearly seen from the diagram that the Dorset and Gloucester so-called Cephalopoda beds occupy very distinct positions, but if we revert to our list of these shells from Dorset, it will be found that most of them have been made out from D'Orbigny's *Palæontologie Francaise, Terrains Jurassique*, and it may be said that the list has been made up from specimens much of the same character as the continental examples.

In the work just quoted many of our truly Oolitic examples are put down as from Lias; nay, more, very important conclusions have been founded upon the assumption that they are Liassic, when, after all, it now appears that the very fossils so confidently appealed to as an evidence of Lias *are from near the top of the Inferior Oolite.* Shall we say then, not that the fossils decided this question, but that these were quoted as Liassic, *after* the Gloucestershire Cephalopoda bed at the bottom, and the Dorset bed at the top, had been decided to be identical; and if further evidence were required upon this point it will be sufficient to state that we have examined specimens from our own quarry which had been labelled as from the Lias.

(3). See next page.

DORSET AND SOMERSET—BUCKMAN.	GLOUCESTERSHIRE—WRIGHT.
The Dorset and Somerset equivalents of the Inferior Oolite, Gloucestershire. The equivalents of the Sherborne and Bradford Abbas Oolites, including the Dorset Cephalopoda bed	TRIGONIA GRIT. Ammonites Parkinsoni, and Corals. Thecosmilia gregaria, Thamnastræa, Isastræa, &c. Gryphæa sublobata, Lima proboscidea, Trigonia costata. CHEMNITZIA GRIT. Chemnitzia procera. Rubbly Oolite. BRACHIOPODA BED. Terebratula Phillipsii, in clusters. ROAD STONE. Ammonites Humphriesianus, Chemnitzia Sœmanni.
	OYSTER BED. Ostrea flabelloides, Lima Etheridgii. Not known. Yellow and Brown Sands, with lenticular nodules of Sandstone.
This is a hard bed in the sands of Bradford Abbas, and contains serpula socialis and Pecten discites, and P. dimissus.	Hard wavy Sandstone. Serpula socialis, abundant. Marly Oolite. UPPER FREESTONE, with old Terebratula fimbria.
The equivalent of the Sherborne and Bradford Abbas Sands, "Midford Sands" in part, consisting of bands of Oolitic stone and more or less indurated sands	Thin flaggy Oolite. OOLITE MARL. Lucina Wrightii, Terebratula fimbria. Thin hard bands of Limestone. Thin beds of fine-grained Oolitic Limestone.

Also the equivalent of the Ham Hill building stone, which is simply the Dorset sands more Oolitic and compact .. ..



Hard rubbly Oolitic Marl in broken masses.

Lower Freestone, the Upper Terrace.

Lower Freestone, the Lower terrace.

Hard beds of pisolitic Oolite.

Buff-coloured pisolitic Limestone.

Rox Stone. Pseudodiadema depressum, Acrosalenia Lycetti, Trochotoma carinata.

Pea Grit. Pygaster semisulcatus, Ammonites Murchisonæ, Patella rugosa, Hinnites velatus, Avicula complicata, Terebratula simplex, T. plicata.

Coarse ferruginous Oolite.

Position of the Gloucestershire Cephalopoda bed, ammonites abundant

Liassic Sands. Highly ferruginous.

Upper Lias. Ammonites bifrons.

As regards this point, it should be stated that both continental and English geologists have fallen into the same error, and yet the investigations of the *one* are *confidently appealed to as harmonising with and as confirming the views of the other.*

We see then that instead of there being an abrupt termination of Lias Cephalopoda upwards, we now find that many of the species really extend to near the top of the Inferior Oolite; so that, after all, the species of this important family, so constantly appealed to as separating the Lias from the Oolite in Gloucestershire and Dorset, extend to nearly the top of the Inferior Oolite of the latter county, while in neither district do they go downwards below the position of that bed in Gloucester, a fact which to us seems conclusive, that the Cephalopoda bed of the latter county is truly Oolitic.

It may, however, be urged, that if the Cephalopod beds of the two districts be so wide apart, the species will in no case be identical, and we are free to admit that, had the distinctive characteristics of these beds been made out before, many of the fossils would have got other names. Indeed, had it not been universally assumed that the Ironshot Oolite, so full of Ammonites in Dorset, was the counterpart of the Ironshot Cephalopoda bed of Frocester, the knowledge of the Ammonites would, perhaps, have been more confused than it is now, on account of the necessity a strict zonalist might be under to make the fossils of these two zones specifically distinct.

Again, as such fossils as the following

Ammonites Parkinsoni.	Ammonites Murchisonæ.
,, Humphresianus.	

were found not to harmonise with the Cephalopoda of the Cephalopoda bed in Gloucestershire, we find our friend,

Dr. Wright, constructing a table, which he calls a "Tabular view of the Inferior Oolite in the south of England," &c., in which we have four different zones marked out, three named after the above Ammonites, and allocated to the Inferior Oolite of Cleeve, Dundry, Bradford, &c., and another as at the base, named the "*Zone of Ammonites Jurensis*," and said to belong to "*the Sands of the Upper Lias*," with "*Leckhampton, Dundry, and Yeovil*" given as "*type localities*." This table will be found in the *Journal of the Geological Society*, vol. xvi. facing p. 5.

Now it so happens that nowhere in the Yeovil district have we these four zones marked, but in my own quarry and those in the district the Ammonites of these so-called four zones are inextricably mixed in about three feet of rock, and Dundry furnishes nearly the same list of Ammonites as Bradford.

If the Jurensis zone of Gloucestershire be found near Yeovil, it will be towards the bottom of the so-called "Sands of the Upper Lias," containing in part, if not wholly, the Midford Sands of Professor Phillips.[4]

Now, in a paper entitled *Note on the Midford Sands*, by Mr. H. B. Woodward, F.G.S., we have the following notes upon Dr. Wright's statements :—

"Dr. Wright pointed out that wherever the sands are well exposed (and he gave sections in Gloucestershire and Dorsetshire) they are overlain by a brown, ironshot, marly Limestone, containing 'an immense quantity of individuals of several species of Ammonites, Nautili, and Belemnites, with a few shells of other Mollusca,' and he maintained that this 'Cephalopoda bed,' in its organic remains, belonged rather to the Lias than the Oolite formation."[5]

(4). See *Geology of Oxford*, p. 109.
(5). *Geological Magazine*, vol. ix. No. 11.

If, then, this view be correct, my Bradford Abbas quarry at its base consists of this very "brown, ironshot, marly Limestone," belonging to the Lias; in other words, as it is a famous locality for *A. Jurensis* it would be called the "Zone of A. Jurensis," which, indeed, would be to split a stone to make a division between the Lias and Oolite. If, however, we recognise the fact that the Dorset Cephalopoda bed occupies the top of a thick mass of Oolite, which is here sandy in its composition, and that this thick mass is the true equivalent of the Inferior Oolite of Crickley Hill, which latter, again, is the equivalent of the Ham Hill, then the Gloucester Ammonite bed would be at the bottom of these representative sands if present, but though we find the A. Jurensis to pass through these sands into the Humphresianus zone or the Parkinsoni zone—whichever may be chosen,—yet we have not found any true Cephalopoda bed below the one we have described, though we are far from supposing it to be impossible.[6]

Speaking of the Ham Hill or "Stoke Section," Mr. Moore says as follows :—

"The workable freestone at this spot is 58 feet thick, and almost entirely composed of comminuted shells, united by an irony cement, and is a remarkable deposit; for, though attaining so considerable a thickness, it does not appear to be represented in any other locality."[7]

Here, then, we claim for the first time to have pointed out the representative of this deposit in the thick mass of sands and unbedded concretionary Limestones which

(6). Since this was written we have found bands at the bottom of the sands much charged with Ammonites, which we hope soon to work out.

(7). *Proceedings of the Somersetshire Archæological and Natural History Society*, vol. xiii. 1865-6.

occur at Bradford Abbas, Babylon Hill, and other districts, both in Dorset and Somerset.

These beds have no claim whatever to be classed with the Oolite Sands of Gloucestershire, as the latter occupy a much lower horizon. It is, however, curious that the lithology of the Cephalopoda bed of Dorset and the one at Gloucester should be so much alike, and is interesting as showing how little reliance can be placed on structure.

The Brachiopoda are by no means so abundant as in the Cotteswolds, but the following are common in the Cephalopoda bed :—

Terebratula Philipsii.
,, perovalis.
,, perovalis var ampla.
,, sphæroidalis.
Terebratula Buckmanni.
Rhynconella concinna.
,, spinosa.

We have hitherto dwelt principally upon the Cephalopods of this fine fossil bed, as they furnish such an extensive list, and as we nowhere know, in so small a thickness of rock of such an exhibition, both in the number of species and the frequency of individuals of very many of the forms ; but it must not be thought that this rock is poor in other groups of fossils, as, on the contrary, we find that this particular bed, of from 2 to 4 feet in thickness, has yielded about fifty species of Gasteropoda, whilst nearly all the *Lamellibranchiata* of the Cotteswold, and some few we have not met with there, are found in the rock in question.

Echinodermata are well represented, but neither these nor the *Zoophyta* seem so numerous as in the Cotteswold strata.

Plants are nearly absent, but fossil wood, and the remains of some form of Cycad have been found both at Bradford Abbas and at Half-way House.

In concluding this paper, I would thank Dr. Wright for the loan of a fine collection of Ammonites, which he kindly sent me for examination. My best thanks are also due to the Managers of the Bristol Institution, for their kindness in sending me their Oolitic series of Ammonites for study.

It should here be stated that in compiling the list of Cephalopods a great mass of notes have been made, with which it has been thought inexpedient to burden the text.