AN OUTLINE OF THE GEOLOGY OF YEOVIL, SHERBORNE AND SPARKFORD VALE.[1]

By G. A. KELLAWAY, B.Sc., F.G.S., and VERNON WILSON, Ph.D., B.Sc., D.I.C., F.G.S.

[*Received 2nd October*, 1940.]

I. INTRODUCTION.

YEOVIL and Sherborne have long been renowned as centres for the study of the Lias and Lower Oolites and many authors have published descriptions of the local geology. The well-preserved molluscs and brachiopods occurring in great profusion in the limestone of the Inferior Oolite attracted the attention of fossil collectors in the early days of geology. It is not surprising, therefore, that many specimens have been figured and described by palaeontologists, notably by Davidson, Whidborne, Hudleston and S. S. Buckman. From approximately 1880–1910, the work of the late S. S. Buckman caused attention to be focussed mainly on the Inferior Oolite. During this period he was engaged in a detailed study of the ammonite faunas found around Sherborne and Bradford Abbas. The result of his work not only enabled him to add a great deal to the current knowledge of Jurassic stratigraphy—at that time in a very confused state—but to set forth a number of ideas which have since been accepted as important principles both in stratigraphy and palaeontology. There is neither space nor time to describe these here, and the reader is therefore referred to the writings of Dr. A. Morley Davies [**13***] and Dr. W. J. Arkell [**2**, pp. 14–37], who have both described the implications of his work at some length.

In recent years an increased interest has been taken in the stratigraphical divisions within the Fuller's Earth, and during the resurvey of Sheets 312 and 327 by the Geological Survey, some light has been thrown on this subject. In this connection mention should be made of Miss H. M. Muir-Wood's work on the brachiopods of the Fuller's Earth [**24**] and of the careful collecting of the Rev. J. Fowler, both having greatly assisted our investigations. The local Cornbrash has been described by Professor J. A. Douglas and Dr. W. J. Arkell [**14**], but there is no adequate account existing of the Forest Marble.

The Lias, however, has not received the same degree of attention as the Lower Oolites. In this respect the Lower Lias has been particularly neglected, largely owing to a lack

[1] Much of the information contained in this paper was collected during the re-survey of the 1in. Yeovil Sheet (312); for permission to publish these results we are indebted to the Director of the Geological Survey.

* For List of References see pp. 171–172.

of suitable exposures. The Yeovil Sands and Ham Hill Stone, however, have been described by H. B. Woodward [**37**, Vol. iii, pp. 257–261], S. S. Buckman [**7**, pp. 448–451] and L. Richardson [**28**, 31, pp. 36–37] and the Junction Bed (Upper and Middle Lias), by Charles Moore [**22**, pp. 130–145]. The Rhaetic and Triassic rocks of Sparkford and the Polden areas have been fully treated by Mr. L. Richardson [**27**, pp. 32–50].

Useful references to the Lower Lias, Fuller's Earth and Forest Marble appear in "The Jurassic Rocks of Britain," by H. B. Woodward [**37**], while in the relevant chapters of "The Jurassic System in Great Britain" Dr. W. J. Arkell [**2**] has also indicated certain local problems, some of which are now cleared up, though others remain to be solved. Of the present work, Dr. Vernon Wilson has written the account of the Great Oolite Series and Cornbrash (III), the Palæontological Notes (IV) have been written jointly and the remaining parts by Mr. G. A. Kellaway.

The authors are greatly indebted to Dr. E. B. Bailey, F.R.S., and Mr. C. E. N. Bromehead for many helpful suggestions and for reading the manuscript. Their best thanks are due to Mr. C. P. Chatwin and Dr. C. J. Stubblefield for assistance with the palaeontology; to Dr. H. M. Muir-Wood and Dr. L. F. Spath, F.R.S., for identifying certain brachiopods and ammonites; and to Mr. J. Fowler for kindly presenting most of his collection of fossils from the Sherborne district to the Geological Survey Museum. During the course of their work in the Yeovil-Sherborne district they have had the pleasure of Mr. Fowler's company and assistance in the field, and his extensive knowledge of the local geology has been generously placed at their disposal; for his kindness and invaluable help in many ways they are deeply grateful.

II. GENERAL GEOLOGY AND TOPOGRAPHY.

The geological interest and the beauty of the country around Yeovil and Sherborne have been well described by the Rev. J. Fowler in his book, "Sherborne behind the Seen" [**15**]. The district has no startling scenic features, yet it is very attractive, with a charm all its own.

A glance at a contoured map shows that the greatest eminence in the area with which we are dealing is Corton Beacon (649 feet O.D.). Situated about four miles north of Sherborne, Dorset, the Beacon consists of a thick mass of yellow sand known as Yeovil Sands, resting upon the thin basement limestones of the Junction Bed. The scarp is crowned by the oolitic and sandy limestones of the Inferior Oolite. These formations are conformable with one another and dip gently

eastwards to disappear beneath the clays of the Fuller's Earth in the vicinity of Charlton Horethorne (see Fig. 10).

Standing on the Beacon and looking northwards, the scarp face of the Inferior Oolite may be seen running by way of Castle Cary almost due north to the Mendips. To the south, however, it swings westwards above Sandford Orcas and, after passing Compton and Babylon Hill, dies away south of Yeovil owing partly to the attenuation of the Inferior Oolite and partly to the effect of a large fault along the north face of Coker Hill. This escarpment would be an important watershed were it not for the breach made by the River Yeo (or Ivel) at Yeovil. Nevertheless, the edge of the scarp forms a boundary separating two different types of scenery.

On the west and north lie the vales of Ilchester and Sparkford, broad tracts of Liassic clay drained by the rivers Yeo and Carey. These are tributaries of the Parret, separated from one another by the long low limestone ridge of Camel Hill and rather indefinite humpy clay-lands north of Ilchester

On the west, the Lower Lias clays dip gently east and south-east off hard limestones belonging to the Blue Lias, which form the southerly extension of the Polden Hills, and, with an E.-W. strike, reappear in the faulted inlier of Camel Hill. The Vale of Ilchester is formed of these impervious clays and marls of the Lower Lias with a fringe of Middle Lias marls, on which the rivers have laid terraces of loam and gravel as well as wide flat stretches of brown alluvium. The gravels in the north-east part of the Vale in the neighbourhood of Poddimore, Queen Camel and Marston Magna, are mostly composed of partly rounded limestone fragments derived from the Middle Lias, Upper Lias or Inferior Oolite. They are essentially local gravels which have travelled only a few miles. On the other hand, the gravels associated with the River Yeo usually contain flint, and have been derived largely from the Cretaceous rocks which are now to be found many miles south of the river gap at Yeovil.

The sites of the gravel terraces are frequently occupied by villages since, with the exception of the rivers, they are the sole source of water supply in summer. Ashington, Poddimore and Kingsbury Episcopi are typical of many settlements, both large and small, whose positions have been so determined. Sulphurous and saline waters are not uncommonly found when attempts are made to dig wells in the clays.

Some villages, for example, Muchelney, are situated on 'islands' in the 'moors' above the reach of the winter floods. Others are to be found at important fords or bridge points, such as the crossing of the River Yeo by the Fosse Way at Ilchester.

Owing to the heavy clay soil and the widespread winter floods, there is very little arable land in the Vale and in consequence the landscape seems to be composed of endless green pasture land divided by elm hedges. This gives place on the alluvium to the Sedgemoor type of scenery with long straight rhines lined by rows of pollarded willows. The general relief is so low that the oolite scarp appears quite impressive when viewed from below. At this stage we may also notice the Junction Bed which forms a platform below the Inferior Oolite scarp, closely resembling in appearance the Marlstone plateau in the Cotswolds. This platform varies in width from place to place, being well-developed near Corton Denham (see Pl. 8, A, and north of Yeovil, but has a tendency to merge into the main escarpment elsewhere.

On the west side of the Vale of Ilchester the Blue Lias limestones appear from beneath the clays and, to westward, rise steadily until they reach the edge of the escarpment overlooking King's Sedge Moor. The traverse from Keinton Mandeville or Ilchester up the dip slope of the Blue Lias to its sudden termination at the scarp face is one of the most interesting journeys that can be made in the district. From the top, the wide expanse of Sedgemoor may be seen to stretch away from the foot of the escarpment towards the Vale of Taunton Deane, with the blue outline of the Quantocks in the distance.

Turning next to the country east and south of the Inferior Oolite escarpment, we notice a great difference in the scenery. The even dip slope of the Inferior Oolite, dissected by numerous dry valleys, is largely occupied by arable land, and slopes down to the well-watered valley that marks the outcrop of the Fuller's Earth Clays. The soft sticky clays of the Fuller's Earth are mostly devoted to pasture and park-land that rises in slopes of varying steepness to the tree-crowned escarpment of the Forest Marble limestones. About a third of the way up the clay slope there is a small platform formed by the outcrop of the Fuller's Earth Rock. This feature runs through the district as far south as Clifton Wood. As the Fuller's Earth Rock is a limestone it gives rise to a narrow strip of arable land and is of economic value in that it provides a water supply for a few small villages and hamlets situated in an otherwise waterless belt.

The Fuller's Earth clay outcrop at Halstock and the valley between Bradford Abbas and Charlton Horethorne are drained by the Upper Yeo. The latter river follows the outcrop of the Lower Fuller's Earth clay, which increases greatly in width from Sherborne to Clifton Maybank. This increase is probably due to some thickening of the soft Lower Fuller's Earth clay,

A.—THE INFERIOR OOLITE ESCARPMENT, seen from Camel Hill.

B.—THE OBORNE VALLEY AND FAULTS, seen from Poyntington Fault LINE Scarp.

G.A.K. photos.

[*To face p.* 134.

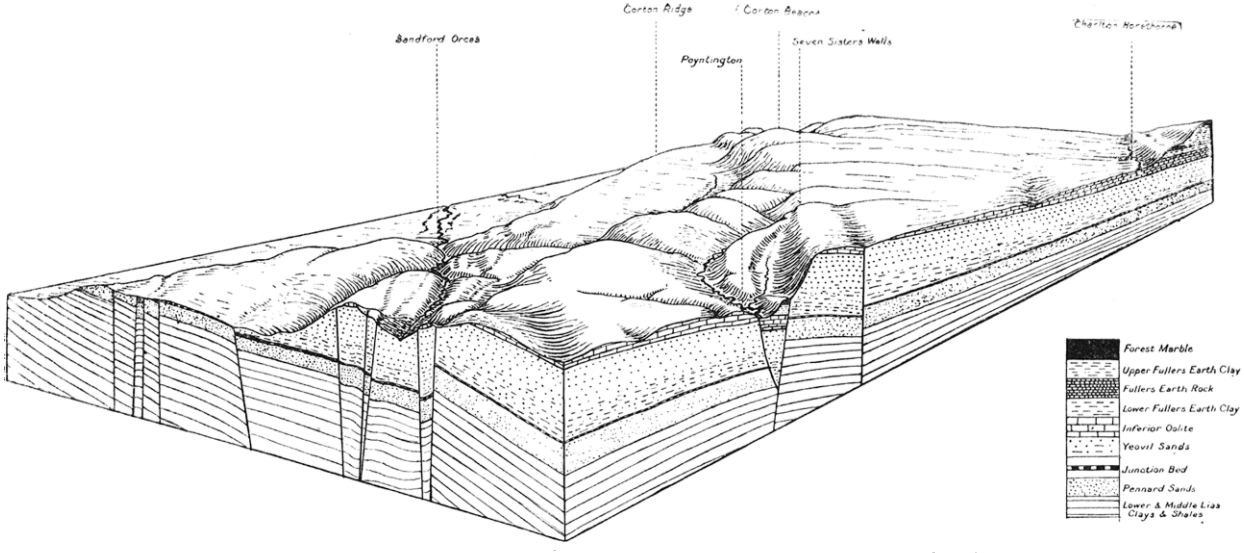

FIG. 10.—Block Diagram showing the Structure of the Country North of Sherborne, Dorset.

coupled with a deterioration of the protective limestones of the Fuller's Earth Rock in a south-westerly direction. The close proximity of the Fuller's Earth Rock of Sherborne Castle to the Inferior Oolite of Castle Farm is exceptional and is probably due to a N.-S. fault (downthrowing to the east) which follows the west side of the Oborne Valley and crosses the Yeo by Castleton Church. East of Castleton, in the tract of flat ground at the mouth of the Oborne Valley, the Fuller's Earth clays are largely obscured by Pleistocene loam and gravel.

South of the area just described, the country west of Lillington Hill exhibits a different pattern of landscape. This is due partly to a diminution in the thickness of the Inferior Oolite between Bradford Abbas and the Chinnocks, but more to the effect of powerful E.-W. faults. It has been found that the Lopen-East Chinnock fault does not pass along the south flank of Coker Hill as shown on the old Geological Survey map (Sheet 18), but is displaced northwards at Coker Hill Bridge by a cross fault. It then follows the north side of the ridge to East Coker, whence it continues beyond Knighton limiting the Forest Marble escarpment at Beer Hacket. Above West Coker village it has a throw to the south of at least 250 feet and brings Upper Fuller's Earth clay against the Yeovil Sands, traces of Inferior Oolite being wedged in between.

Around Chiselborough Hill and Ham Hill the Inferior Oolite is thin and patchy. It is underlain by the massive Ham Hill Stone (including the " Ochre Beds "), which forms a hard limestone cap belonging to the Yeovil Sands and makes the promontory of Ham Hill one of the landmarks of Somerset. The limestone, amounting to 90 feet, has probably been quarried from Roman times onwards and has been extensively used in churches and other buildings both in Somerset and in the adjoining parts of Dorset.

The most important structural feature in the Yeovil district is the deflection in the strike of the Jurassic rocks from a N.-S. to an E.-W. alignment about an axis running in a north-westerly direction through Sandford Orcas, Milborne Port and Ibberton. The warping which gave rise to this feature was certainly post-Cretaceous and possibly Miocene in date, since it also affects the outcrop of the Lower Tertiary rocks in the adjoining parts of the Hampshire Basin. This axis has been described by Mr. H. J. Osborne White [**36**, p. 5] as " an anticline of depressed form and south-easterly trend . . . accountable in a large measure for the south-eastward embayment of the main boundaries of the Upper Jurassic and Cretaceous strata in N.E. Dorset." While this is an accurate and concise description, the writer would emphasise the change in strike as being more important than the nature of the fold itself. From the vicinity

of Sherborne (Dorset) to Stinchcombe in Gloucestershire, the escarpment of the Lower Oolites runs N. by E. passing athwart the eastern end of the Mendip Hills and thence parallel to the steeply inclined eastern limb of the Bristol Coalfield. West of Sherborne, however, the Oolites strike E.-W. as far as south Petherton, beyond which the outcrop swings southwards and then slightly eastwards into the vale of the River Brit. Presumably, therefore, there is a synclinal axis with an E.-W. direction following the middle of this projection of the outcrop, roughly along the latitude of Ilminster. Similar trend-lines of E.-W. folding are found in the belt north of the Ilminster-Yeovil country. Thus, the anticlinal region underlying the alluvium of Sedgemoor, bounded on the north by the Polden edge, and the Glastonbury Syncline both have a general E.-W. trend.

III. STRATIGRAPHY.

Trias and Rhaetic.

Pre-Jurassic rocks crop out in only two areas within the district. The first of these is in the neighbourhood of Butleigh, Somerton and Langport, the second at Sparkford and Camel Hill.

From the valley of the River Brue westwards through Keinton Mandeville, the ground rises steadily until the edge of the Blue Lias escarpment is reached at Butleigh. There, the steep scarp face, broken by bastion-like promontories of striped red and green Triassic marl, bare of vegetation and scored by small rain gullies, overlooks the village of Compton Dundon with its red fields and apple orchards. Descending from the top of the escarpment, we find first the hard flaggy limestones of the Blue Lias overlying the pale marls and limestones of the true White Lias. Beneath the White Lias there is a series of grey and yellow marls with a lower group of black shales, all largely obscured by soil and vegetation. These beds constitute the Rhaetic formation. They are seldom exposed and for our knowledge of them we are indebted chiefly to the information published by Mr. Linsdall Richardson [**27**], who has carefully examined the local railway- and road-cuttings. Beneath the Rhaetic beds are the brightly coloured Grey, Tea Green and Red Marls of the Keuper.

Though the thickness of these marls in the vicinity of Compton Dundon must be considerable, it is impossible to give an exact figure. Nevertheless, it is recorded [**23**, pp. 457–458] that a boring made in 1815 under the direction of William Smith was eventually abandoned in Red Marl at a depth of 529 feet below the surface. If we add to this figure the thickness of the Keuper Marl in the escarpment, it is obvious that the total thickness

must be in excess of 600 feet. No sandstones or conglomerate were proved in the boring so that the lower part of the Keuper was not reached.[1] The following table summarises what is known of the sequence below the Blue Lias in the Vale of Ilchester :—

Lower Lias :	Blue Lias—Thin limestones with shale partings about 20 feet usually seen.	
	White Lias—Pale limestones and marls, capped by " Sun Bed " 21 feet.	
Upper Rhaetic :	Soft pale marls and clays capped by the Cotham Marble, 5 feet.	
Lower Rhaetic :	Black papery shales with a few thin limestones bands 22 feet.	
Keuper :	Grey marls with some dark shales resting on Tea Green Marl.	600 feet +
	Red and variegated marls with gypsum at some levels.	

Owing to their easterly dip the Rhaetic and Triassic rocks lie deeply buried under most of the Yeovil district. About six miles north of Yeovil, however, they reappear together with the Blue Lias in the Sparkford inlier. This inlier is bounded on the south by a strong E.-W. fault downthrowing to the south, on the north side of which the rocks have a northerly dip of 20°. In this area the Blue Lias is well exposed in the quarries on Camel Hill, while the Rhaetic and Grey Marls are visible in the railway-cutting at Sparkford Hill.

The section by the railway was originally described by Charles Moore [**23**, pp. 461–464], and subsequently by H. B. Woodward [**37**, pp. 78–79] and Mr. L. Richardson [**27**, pp. 46–49]. The Rhaetic part of the section has been remeasured recently and certain corrections made to the existing accounts : these results are summarised in Fig. 11. The section at Sparkford Hill is comparable with those seen by Mr. Richardson in the railway-cuttings at Charlton Mackrell and Langport.

The basement beds of the Rhaetic, as seen in the Sparkford cutting, consist of yellow sandstones with marly partings, from the lowest beds of which *Ostrea* cf. *bristovi* (Etheridge MS.) L. Richardson has been collected.

It is interesting to note that at the base of the Upper Rhaetic at Sparkford Hill there are masses of shelly limestone containing lumps of black shale derived from the Lower Rhaetic. Similar evidence of a non-sequence between the Upper and Lower Rhaetic has been seen at Langport as well as in the north of Somerset [**19**, p. 224]. As Strahan [**26**, p. 73] has pointed out, the Upper Rhaetic represents a temporary reappearance of the Keuper Marl type of deposit sandwiched between the

[1] The thickness of Keuper Marls at Puriton is about 1,300 ft. See W. A. E. Ussher, (28, pp. 246–251).

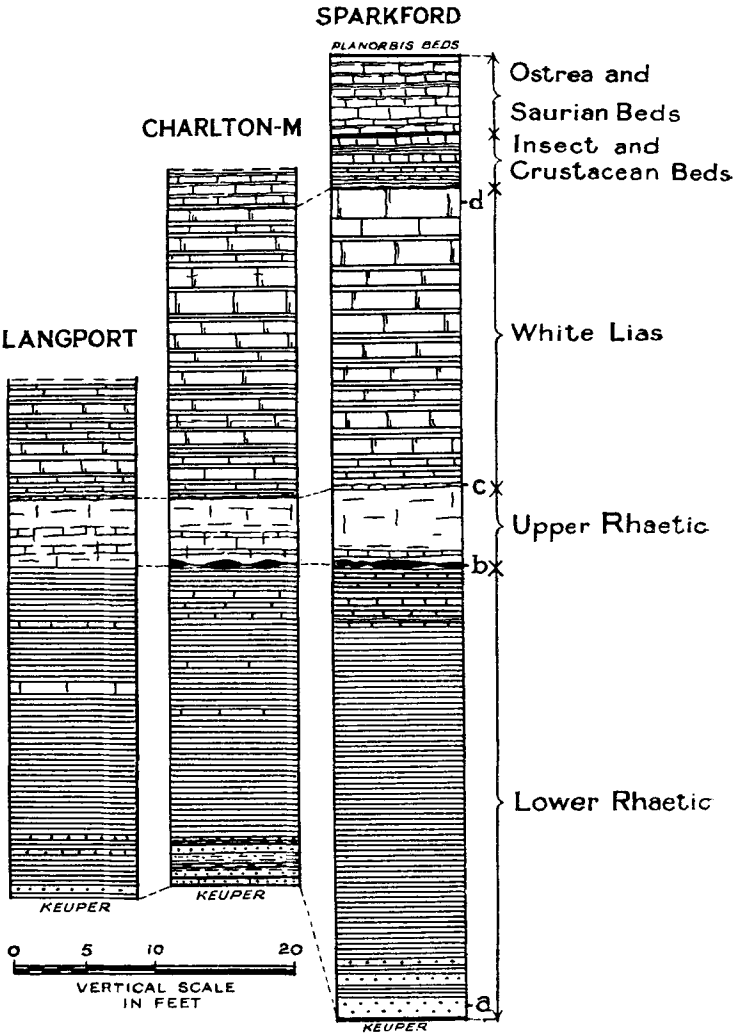

FIG. 11.—COMPARATIVE SECTIONS IN THE RHAETIC AND BASAL LIAS. (a) Sandstone with *Ostrea* cf. *bristovi*; (b) limestone with derived lumps of black shale; (c) limestone equivalent to the Cotham Marble; (d) Sun Bed of the White Lias.

Black Shale group and the Pre-*planorbis* beds, both of which bear marine lamellibranchs. The Upper Rhaetic of West and Central Somerset is particularly barren : it has yielded only a few fish scales and ostracods. Very rarely a band of lamellibranchs occurs, but there are no plant-bearing and marine layers such as occur farther north.

Lower Lias.

The following discussion deals with the local development of the Lower Lias, firstly under zonal headings and secondly in a general description of the thicknesses of the main lithological subdivisions.

White Lias.

The White Lias, here included with the Lias, is sometimes grouped with the Rhaetic and sometimes with the Lower Lias. Both arrangements have advantages, the choice of place being merely a matter of convenience. The fauna of the White Lias consists almost entirely of lamellibranchs, among which *Modiola*, *Pleuromya*, ' *Macrodon*,' *Protocardium* and *Ostrea* are the most common genera. Small gastropods and, more rarely, plants also occur.

Pre-Planorbis Zone (bottom of the Blue Lias.)

As typically developed the Pre-Planorbis Zone consists of the " Insect and Crustacean Beds " overlain by the " Saurian and *Ostrea*-Beds," the total thickness of which amounts to 10 feet at Sparkford and Camel Hill.

The " Insect and Crustacean Beds " consist of about 4 feet of faintly-banded grey limestone alternating with buff coloured shales. They owe their name to the occurrence of insect fragments and the crustacean *Eryon wilmcotensis* H. Woodward. The " Saurian and *Ostrea*-Beds " (6 feet) consist of limestones and shales with less regular bedding than those of the underlying group. There is no division in Central Somerset into *Ostrea*-Beds and *Pleuromya*-Beds such as is found in North Somerset ; *Pleuromya tatei* Richardson and Tutcher and *Ostrea hisingeri* Nilsson (=*Ostrea liassica* Strickland) being associated throughout the whole thickness. Saurian remains are not common, but have been found in comparatively large numbers at Street, just north of the district here under review.

Planorbis Zone (middle of the Blue Lias.)

This zone, 30 feet or more in thickness, is divisible into the subzones of *Psiloceras planorbis* (J. de C. Sowerby) and *Caloceras johnstoni* (J. de C. Sowerby). According to Richardson [**27**, p. 46] there is a slight overlap in the ranges of *P. planorbis*

and *C. johnstoni* at Camel Hill Quarry. Generally speaking, however, the acme of *C. johnstoni* lies above that of *P. planorbis*.

Angulata and Bucklandi Zones (top of the Blue Lias).

In his account of the Sparkford Hill Cutting, Charles Moore [**23**, pp. 461–464] ascribed about 112 feet of strata to these zones. This estimate is probably excessive. The nearest section in the *bucklandi* zone at present available for study is to be seen at the limeworks near Evercreech Station. Here, some 20 feet of hard blue limestones with shale partings are very well exposed. These beds yield large Coronicerate ammonites, *Gryphea incurva* (J. Sowerby), *Spiriferina* sp., and other fossils. The total thickness of the *bucklandi* zone is unknown.

Semicostatum Zone.

H. B. Woodward [**37**, Vol. iii, p. 85] records that at Hornblotton Mill, on the banks of the River Brue, an old brickpit showed about 12 feet of blue shaly clay with "*Ammonites Semicostatus*." Woodward's specimens, one of which is figured here (Pl. 9, Fig. 1), are preserved in the Geological Survey Museum (Reg. No. H.B.W. 2776–2780) and have been examined by Dr. L. F. Spath, who states that it is not possible at present to say whether they have come from the *semicostatum* zone or from the lower part of the *obtusum* zone. The pit is now largely overgrown, but it is still possible to collect specimens of *Arnioceras*. H. B. Woodward [**38**, pp. 163–4] also noted the presence of beds with "*Ammonites brookei*" above others with "*Amm. semicostatus*" in the railway-cutting at Wheat Hill, west of Hornblotton Mill. This cutting is about 35 feet deep and formerly showed a series of shales with layers of cement-stone and decomposed ferruginous bands, having an easterly dip. The same author mentioned "*Arietites brookei?*" from "a strong band of cement-stone . . . striking east and west and dipping southwards," west of Alford Well Farm, near Castle Cary.

Obtusum Zone.

The existence of the upper part[1] of the *obtusum* zone in the Vale of Ilchester has long been known owing to the fame of the "ammonite-marble" of Marston Magna. Specimens of this "marble" were found in the collection of Sir Hans Sloane, who died in 1753. The "marble" consists of large cement-stone nodules up to a ton or more in weight crowded with small ammonites. The size is sufficient in some cases to allow quite

[1] Though outside the area covered by the present paper it may be noted that a lump of limestone collected by H. B. Woodward at Squab Farm, North Wooton, Somerset, includes *Promicroceras* sp. and *Xipheroceras* sp. which Dr. Spath considers may represent a horizon in the *obtusum* zone lower than that of the "Marston Marble."

big pieces to be cut and polished. In the Urban District Council offices at Sherborne there is a fireplace made from the stone.

The cement-stones were found *in situ* by the writer in 1938 during the revision of the Yeovil Sheet. They occur in the bed of the brook a short distance west of the village of Marston Magna. When broken open, the nodules are seen to be crowded with small nacreous ammonites very tightly packed together, but in a perfect state of preservation.

The commonest species is *Promicroceras marstonense* Spath, but solitary specimens of *Praederoceras* cf. *ziphus* (Hehl MS.) Zieten sp., *P.* cf. *trinodum* (Dumortier), *Asteroceras smithi* (J. de C. Sowerby) and *Asteroceras marstonense* Spath also occur.

Oxynotum and Raricostatum Zones.

"*Ammonites oxynotus*" was recorded by Woodward [**37**, p. 85), as occurring near Evercreech Station, and at Prestleigh, in blue clay with impersistent bands of earthy limestone. He also mentioned ammonites found in the clay thrown out from a newly-dug well at Sutton, near Alhampton, Castle Cary. The specimens he collected from the well-sinking have been traced in the collections of the Geological Survey, and include seven specimens of *Echioceras* (*sensu lato*), one of *Bifericeras* and one small *Oxynoticeras*.

The ammonite assemblage indicates that the well was sunk through both the *raricostatum* and *oxynotum* zones, represented by blue clays with small pyritised ammonites. No evidence for the presence of these zones is known south of Sutton until the Marshwood Vale (Dorset) is reached, with the possible exception of some crushed ammonites (*Eoderoceras* sp. ?) found in shales in the Lambrook, north of Marston Magna.

Jamesoni Zone.

The *jamesoni* zone is now known to be present in the country north and north-west of Yeovil. The best exposure is in the banks of Chilthornehill Lane, about 600 yards north-west of St. Mary's Church, Chilthorne Domer. At this point a rather poor exposure of hard blue shale yields *Gemmellaroceras peregrinum* (Haug) and *Phricodothyris* sp. *Gemmellaroceras* may also be found together with other very poorly preserved ammonites (*Uptonia* sp. ?, *Platypleuroceras* sp. ?) in pale weathered marls and shale in two ponds near Rimpton.

Davoei Zone.

Despite a careful search between Chilthorne Domer and Sparkford, no evidence for this zone has been found. At Evercreech Junction, near Castle Cary, about 20 feet of bluish micaceous clays may be seen at the Somerset Brick and Tile

Works. These beds yield *Androgynoceras* cf. *maculatum* Young and Bird and other Liparoceratid ammonites preserved in brown ferruginous nodules. "*Ammonites bechei*" and "*Amm. davoei*" have been recorded from near Ilminster, but apart from these there appear to be no other records.

General

It will be clear from the above notes that the zonal evidence is too patchy and drawn from areas too widely scattered for the information to be of much assistance in working out the thickness of the Lower Lias clays.

H. B. Woodward [**37**, vol. iii, p. 76] estimated the thicknesses of the various parts of the Lower Lias in the Vale of Ilchester as follows :—

Blue and brown clays	about 200 feet
Clays with bands of limestone	,, 80 ,,
Limestones and Shales (=Blue Lias)	,, 20-40 ,,
White Lias	,, 6-10 ,,
Total thickness	,, 320 ,,

In dealing with the Sparkford district, however, Charles Moore [**23**, p. 467] estimated the thickness of the Lower Lias at 600 to 800 feet !

About twenty years ago a boring was made at the Manor House at Weston Bampfylde. It was so situated that it may be assumed that it commenced in strata not more than 20 feet below the base of the Middle Lias marls. The boring was made to a depth of 246 feet below the surface and proved nothing but blue clay and marl. It ceased before reaching the bands of clay and limestone which overlie the Blue Lias proper. The dip of the rocks in the borehole is not known, but is not likely to be high. To the thickness of the marls proved in the borehole, about 140 feet may be added for the White Lias and the limestones and clays above it, giving a total of at least 380 feet. As a conservative estimate the total thickness of the Lower Lias near Sparkford may therefore be put at 380–400 feet.

It is extremely difficult to separate the marls of the Middle Lias from those of the Lower Lias in the Yeovil district. The only distinguishing characters seem to be that the Middle Lias marls become slightly harder and more sandy near the top. The thickness of these sandy marls may be 50 feet or more.

Middle Lias.

The Middle Lias may be subdivided into the following groups :

The Marlstone 1ft. 6 ins. to 15 ft.	*spinatus* zone
Pennard Sands 50–80 ft.	*margaritatus* zone
Middle Lias Marls 50 ? ft.	

Middle Lias Marls.—Margaritatus Zone.

The Middle Lias marls have already been mentioned in connection with the junction of the Middle and Lower Lias. They consist of loamy micaceous clays with "race" and sometimes with large cement-stone nodules. They are only rarely exposed at the present time, though they were formerly used for brick-making at several places, notably at Ilminster and at Mudford. The nearest pit in work is at Glastonbury, where about 20 feet of sandy micaceous marl with barren cement-stone nodules is exposed at the Avalon Brick and Tile Works. A few minute ammonites (possibly Amaltheids) have been found here. Similar beds near Brent Knoll [**37**, vol. iii, p, 208] have yielded *Amaltheus* cf. *stokesi* (J. Sowerby) (see Pl. 9, Fig. 9) and *Tragophylloceras loscombei* (J. Sowerby). On the main outcrop the marls are said to be 100 feet thick at Ilminster, where "*Ammonites margaritatus*" has been recorded. Nearer Yeovil they are exposed beneath the Pennard Sands in a lane section at Sandford Orcas.

Pennard Sands.—Margaritatus Zone.

The name Pennard Sands is proposed for the yellow sandy strata below the marlstone. At Ilminster this group consists of 20 feet of sand with ironstone nodules resting on "yellow micaceous brick marls with sandstones" 30 feet thick, with *Amaltheus*. Nearer Yeovil the beds thicken and become strongly arenaceous, while at Sandford Orcas they probably attain a thickness of 80 feet.

The clearest section showing the inter-relation of the three divisions of the Middle Lias is at the west end of Pennard Hill. The succession here is as follows :—

Upper Lias clay and limestone—seen in temporary excavations on the brow of the hill.
Marlstone, about 1 foot (seen)
Pennard Sands, about 40 feet
Middle Lias Marls, 40 feet (seen)

The sequence in the Yeovil district is almost identical with that in the Glastonbury Syncline and in a general way resembles that on the Dorset coast, where the Thorncombe Sands and Down Cliff Sands form an arenaceous group resting on a lower division which is predominantly argillaceous. On the other hand, the easily recognised fossil beds of the coast sections, such as the Eype Nodule Bed, the Shell Bed, Starfish Bed and *margaritatus*-Bed are all missing or are inconspicuous : therefore no precise correlation is possible.

Marlstone.—Spinatus Zone.

In the Yeovil district the Marlstone varies from 1 foot to 15 feet in thickness. At Yeovil itself, where the bed is thinner

than anywhere else on the outcrop, it is welded to the base of the almost equally attenuated Upper Lias limestone. At Ilminster it is 8 to 12 feet thick and easily distinguished from the Upper Lias, but the thickness decreases rapidly towards Yeovil, being reduced to 3 feet 6 inches at South Petherton and to 2 feet at Norton-sub-Hamdon. The best available section at Yeovil is seen in an old pit north of the junction of Larkhill Lane and Thorne Lane, where the following sequence may be seen :—

	Yeovil Sands	Sandy shale with thin Sandstone layers	6 ft. (seen)
Junction Bed	U. Lias Limestone	Thin cream-coloured earthy limestone	4 ft.
		Clay parting	
	Marlstone	Hard grey crystalline limestone	1 ft. 6 ins.
	Pennard Sands	Sandy loam	

From Yeovil northwards through Trent and Sandford Orcas, the marlstone thickens again until, at Corton Ridge, it is 15–20 feet thick and consists of ferruginous limestones with brown sandy marl partings. Fossils are abundant and include *Pleuroceras spinatum* (Brugiere), *Lobothyris punctata* (J. Sowerby), rhynchonellids of the *Rhynchonella tetrahedra* type, belemnites and lamellibranchs. It is curious that *Homeorhynchia acuta* (J. Sowerby) does not appear to have been recorded from Yeovil as it is a characteristic Marlstone fossil in many other districts. *Prionorhynchia serrata* (J. de C. Sowerby) is another brachiopod which does not seem to have been found in the immediate neighbourhood of Yeovil, though it is common enough at Ilminster.

Upper Lias.

Of the four zones usually regarded as falling within the Upper Lias, the lowest zone, viz., the *tenuicostatum* Zone, has been seen only around Ilminster [**11**, pp. 449–451]. The next three zones are present throughout the main outcrop from Ilminster to Yeovil and northwards towards Castle Cary. The *opalinum* Zone, here treated with the Upper Lias, is of local occurrence only.

opalinum zone	Very thin beds of marl and sandy limestone frequently missing.
jurensis zone	*aalensis*-Beds, known only at Stowell and Haselbury Mill. Yeovil Sands, including the Dew Bed of Compton and Bradford Abbas and the Ham Hill Stone.
bifrons-commune zone and *falcifer* zone	Upper Lias Limestone of the Junction Bed.
tenuicostatum zone	Thin local development at Ilminster, included by Moore (**22**, pp. 131–133) in the Marlstone.

Upper Lias Limestones.—Falcifer and Bifrons-Commune Zones.

Weathered blocks of Upper Lias Limestone are to be seen in almost all the old walls in Yeovil and the villages on the outcrop of the Junction Bed. This stone is of striking appearance owing to the patches of dark red ochreous matter which invade the pale marly limestone, and to the ammonites and belemnites which are frequently seen on weathered surfaces. The fossils show that both the *Falcifer* Zone and the *Bifrons-Commune* Zone are present in this very condensed deposit which is only about 4 feet thick at Yeovil.

In 1938 a small quantity of stone was drawn from an old pit near Trent Wood on the road from Trent to Sandford Orcas. Ammonites were packed together in great profusion in the limestone and were lying at all angles to the bedding. Most of the specimens had lost their shells and many were encrusted with *Serpulæ*. Though the total thickness of the beds exposed was only two or three feet, they yielded a great variety of ammonites. Several species of *Harpoceras*, including *H.* cf. *mulgravium* Young & Bird, *Hildaites* sp., *Hildoceratoides* sp., *Hildoceras* cf. *bifrons* (Brugiere), and other species of *Hildoceras*, *Haugia ogierieni* (Dumortier), *Frechiella subcarinata* (Young & Bird) and a large number of small Dactyliocerate ammonites, were found. The Upper Lias Limestones at Trent and Yeovil are therefore condensed in comparison with Ilminster, where they are at least 14 feet thick and include a thin representative of the *tenuicostatum* Zone at the base.

Yeovil Sands—Jurensis Zone.

The Junction Bed is succeeded by the Yeovil Sands, a group in which the ammonite succession is only partly known and in which well-preserved fossils are comparatively rare. At Yeovil itself the sands are about 200 feet thick and consist of loose yellow sands with hard doggery beds in the upper part passing down into shaly and marly beds. The best sections in the Yeovil Sands are usually found along the sunken lanes and roads known as ' Hollow Ways.'

The thickness of the Yeovil Sands is variable. At Ham Hill there are about 125 feet of Yeovil Sands beneath the Ham Hill Stone, giving a total thickness of approximately 215 feet for the whole of the *jurensis* zone. At Corton Denham the Sands are probably 180 feet thick, and at Compton (Dorset) at least 140 feet. At Sherborne a boring is stated by Woodward [**37**, vol. iv, p. 80] to have proved only 135 feet of sands.

At Barrington near Ilminster the basement bed of the Yeovil Sands with *Phlyseogrammoceras dispansum* (Lycett) and *Dumortieria* sp. rests upon " Black Clay " with *Hammato-*

ceras, Grammoceras, Haugia and v-script *Hildoceras.* These beds in turn rest upon the *bifrons*-bed. At Yeovil, however, no evidence has yet been found to prove the presence of a *Grammoceras* fauna such as is found at Barrington and White Lackington between the *bifrons* zone and the upper part of the *jurensis* zone.

The higher parts of the Yeovil Sands are characterised by *Dumortieria* and its allied genus *Catulloceras.* Buckman recognised two subzones at the top of the *jurensis* zone based on *Dumortieria,* a lower zone called the *Dumortieria* sub-zone and a later sub-zone taking its name from *Dumortieria moorei* (Lycett). According to Richardson [**31**] the top half of the Yeovil Sands falls in the *moorei* sub-zone. *Dumortieria* aff. *moorei* (Lycett) has been found in one of the hard beds in the Sands at Stoford and Babylon Hill, in the ' Dew Bed ' at Bradford Abbas and (a form near *D. moorei*) in the Sands exposed in the cutting on the Marston Road, north of Sherborne. Poorly preserved *Dumortieria* spp. occur in the Sands at other localities north of Sherborne, notably at Sigwells near Corton Beacon. Further information regarding the occurrence of *Dumortieria* is given later.

The Ham Hill Stone is a huge lenticular mass of shelly limestone up to 90 feet in thickness. It has been extensively quarried on Ham Hill and continues to be worked as a building stone of very high quality. Only about 50 feet of the total thickness is actually workable, but the stone which is produced is a beautiful freestone which has been used in many fine buildings. Though the stone has this thickness on Ham Hill it thins rapidly away in all directions and passes into sands in which lenticles of sandy or crystalline limestone are occasionally developed. The ' Dew Bed ' of Bradford Abbas and Halfway House (Compton) is a harder and more persistent band of sandy limestone of this character. *Dumortieria* spp. and *Rhynchonelloidea cynica* (S. S. Buckman) are sometimes to be found in the Ham Hill Stone which is overlain at Chiselborough Hill by marly beds with *Lioceras* sp. *Homoerhynchia cynocephala* (Richard), *Aulacothyris blakei* Davidson non Walker, and other fossils of the *opalinum* zone. Small patches of the *opalinum* zone also occur at the top of the Yeovil Sands between Sherborne and Corton Denham.

Between the Inferior Oolite and the Sands at Haslebury Mill there is a small thickness of blue sandy marl and clay from which various species of *Pleydellia* and *Cotteswoldia,* including *Pleydellia* cf. *aalensis* (Zieten), have been collected. A similar suite of ammonites was collected from the cores of the Stowell Boring 450–455 feet from the surface [**36**, pp. 7–9]. The *aalensis*-beds at Stowell were found to include the top 5

(or more) feet of the Yeovil Sands, which proved to be over 100 feet thick.

Inferior Oolite.

The literature dealing with the subject of the Inferior Oolite of the district under review is very extensive. Mr. Linsdall Richardson has catalogued 59 items in the bibliography of his revisionary paper published in 1930 [**31**] and this list could now be expanded. The sections seen in the old quarries around Sherborne, Compton (Half-way House), and Bradford Abbas in Dorset were fully described by S. S. Buckman. Only in the case of new or undescribed sections, therefore, are any of the details given here. For accounts of all the other localities the reader is referred to the papers of S. S. Buckman and Mr. Linsdall Richardson.

The Inferior Oolite is a limestone formation lying between the Midford Sands (or, as they are known locally, the " Yeovil Sands ") and the clays of the Fuller's Earth. Unlike the Midford Sands it is not markedly heterochronous and, in general, it may be said to commence as a formation with the *murchisonae* zone and to end with the *parkinsoni* zone, as defined in the table of zones and sub-zones given below. The *opalinum* zone is much more conveniently treated as a part of the Upper Lias

In a general sense, the Inferior Oolite is thinnest in the west and thickest in the east of the district, where, east of Milborne Port, as much as 118 feet has been proved. It is therefore interesting to find that this increase in thickness from west to east is not uniformly maintained and that the thinnest Inferior Oolite is found east of Coker in the area around Yeovil Junction.

Lithologically the local Inferior Oolite falls into two major divisions :—

B. The upper part, consisting of the Crackment Limestone, Rubbly Limestones and Sherborne Building Stone.
A. The lower part, consisting of richly ironshot and glauconitic limestone.

Group B corresponds to the Upper Inferior Oolite of most districts, while Group A corresponds to the Lower and Middle Inferior Oolite of other localities such as Dundry and Burton Bradstock. Around Sherborne and Yeovil, however, the Middle and Lower Inferior Oolite are not lithologically distinct from one another, although an arbitrary line can be drawn below the *discites* sub-zone to correspond with its position elsewhere. Throughout the Inferior Oolite the lithology of the beds changes in a most bewildering way, so that it is very difficult to summarise the effects. S. S. Buckman [**8**], L. Richardson [**31**]

and, later, Dr. W. J. Arkell [**2**] have published accounts of these changes as far as they are known.

The table of zones given below is based largely on the work of S. S. Buckman, but certain alterations have been made in the light of recent field experience and in accordance with the revision published by Dr. L. F. Spath [**33**].

TABLE 1.

THE ZONES OF THE INFERIOR OOLITE AND LOWER FULLER'S EARTH OF THE YEOVIL-SHERBORNE DISTRICT.

	Zones.	Sub-Zones.
Lower Fuller's Earth	*fusca*	*Oppelia fusca*
Upper Inferior Oolite	*parkinsoni*	*Zigzagiceras zigzag* *Parkinsonia schloenbachi* *Strigoceras truelli* *Garantiana garantiana* *Strenoceras niortensis*
Middle Inferior Oolite	*humphresianum*	*Teloceras blagdeni* *Stephanoceras humphresianum*[4]
	sauzei	*Otoites sauzei*
	sowerbyi	*Witchellia laeviuscula* *Shirbuirnia trigonalis* *Hyperlioceras discites*
Lower Inferior Oolite	*murchisonae*	*Ludwigella concava* *Brasilia bradfordensis* *Ludwigia murchisonae* *Ancolioceras* spp.[3]
Upper Lias (top of)	*opalinum*	*Lioceras costosum*[2] *Lioceras opalinum*[1]

1 = sub-zone of *Cypholioceras opaliniforme* (S. S. Buckman's classification).
2 = sub-zone of *Tmetoceras scissum* (S. S. Buckman's classification).
3 = sub-zones of *Huddlestonia sinon* and *Staufenia staufensis* (L. F Spath's classification).
4 = sub-zone of *Witchellia romani* (L. F. Spath's classification).

Lower and Middle Inferior Oolite.

At Haselbury Mill, 7 miles S.W. of Yeovil, the Upper Inferior Oolite (5–6 feet thick), rests directly on the *aalensis* beds, so that the whole of the Lower and Middle Inferior Oolite is absent. From this point eastwards to North Coker only some ironshot limestones wedged in a fault near West Coker remain to prove that some at least of the Lower and Middle Inferior Oolite was deposited over the intervening district. At North

Coker there is a road-side section in the village which was visited by members of the Association in 1939 and is as follows :—

SECTION AT NORTH COKER.

(a)	Brown Ironshot Oolite (seen)	2 ft. 9 ins.	*'Terebratula' eudesiana* S. S. Buckman
(b)	Thin dark red clay parting	½ in.	Belemnite
(c)	Irregular bed of buff-grey limestone with tiny ironshot ooliths and large brown pellets	2 ins.	*Ludwigella* cf. *concava* J. Sowerby) *'Terebratula' eudesiana* S. S. Buckman *Brasilia* cf. *similis* (rolled) S. S. Buckman Small gastropods
(d)	Streak of clay		
(e)	Irregular greyish limestone bed. Ooliths and pisoliths scattered through the groundmass	3 ins.	*Graphoceras* (*Platygraphoceras*) cf. *apertum* S. S. Buckman *Graphoceras* sp. *Brasilia* sp. (derived fragments)
(f)	Massive grey-centred limestone with fossils in top 13 ins.	2ft 4 ins.	Small coarsely costate forms of *Ludwigia*
(g)	Sand (seen)	1 ft.	

The beds may be classified as follows :—

(a)	*concava* sub-zone	2 ft. 9 ins.	
(b)—(e)	*concava* and *bradfordensis* sub-zone	5 ins.	*murchisonae* zone 5 ft. 6 ins.+
(f)	*murchisonae* sub-zone	2 ft. 4 ins.	
(g)	Yeovil Sands		

S. S. Buckman [**6**, Suppl. p. cxciv] and Mr. Linsdall Richardson [**31**, pp. 50–51] have recorded evidence for the presence of the *discites*, *sauzei* and *truelli* sub-zones in the Middle and Upper Inferior Oolite from the neighbouring Sheepsleight Farm Quarry (now overgrown) at North Coker.

On the other hand the *aalensis* beds and *opalinum* zone (Upper Lias) is missing at North Coker as the *murchisonae* zone rests non-sequentially on the Yeovil Sands (*moorei* sub-zone).

A section at Yeovil Junction is seen in a small pit in the arable field immediately south of the station, not far from the edge of the railway-cutting. As it presents some extraordinary features, and has never been recorded, a detailed account is given below :—

SECTION AT YEOVIL JUNCTION.

	Ft. ins.
parkinsoni zone (about 3 feet seen) :—	
Soil and rubble—*Parkinsonia* sp. Perisphinctid ammonite. *Acanthothyris spinosa* (Linné). *Ptyctothyris stephani* (Davidson)	9

	Ft.	ins.
Crinoidal and marly limestone—*Mactromya* sp. *Pygorhytis ovalis* (Leske). *Ptyctothyris stephani* (Davidson) ...	1	7
Brashy parting		1
Marly and oolitic limestone—*Patoceras* sp.		4
Crinoidal limestone with patches and streaks of limonite *Garantiana garantiana*(D'Orbigny). *Eudmetoceras* sp. *Goniothyris phillipsi* (Morris). *Ptyctothyris stephani* (Davidson)		5
Ferruginous parting—*Teloceras* sp. (remanié) probably from this horizon		–
— non- sequence —		
Humphresianum zone (about 6 ins. thick) :—		
Crinoidal Limestone with 'worked-up' patches of ironshot Oolite—Gastropods and lamellibranchs coated with limonite and *Serpulæ*. *Lingula* sp.		1
— probable non-sequence —		
Crystalline and ironshot limestone—*Isoarca* sp. *Lingula* sp. ...		3
Hard grey crinoidal limestone with large scattered ironshot ooliths, rolled fossils and pellets of limonite—*Stephanoceras* sp.		2–4
— non-sequence —		
murchisonae zone (1 ft. 3 ins. thick) :—		
Hard grey sandy limestone in several beds—*Cymatorhynchia* sp ? (cf. *R. cymatophorina* S. S. Buckman)	1	2—4
— non-sequence —		
Jurensis zone		
Hard sand rock with ferruginous top		½
Yellow Sand seen in quarry } Yeovil Sands... ...		2
Sands seen in railway-cutting	60	0

At Yeovil Junction and Stoford the Lower and Middle Inferior Oolite is thinner than either at Coker or Bradford Abbas. It is possible that this may have been caused by an anticlinal axis operating between East Coker and Bradford Abbas during the deposition of the Lower and Middle Inferior Oolite. At Bradford Abbas and Halfway House the sequence in the beds below the Upper Inferior Oolite is more complete and the total thickness greater. Thus at the former locality the Lower and Middle Inferior Oolite totals 3–4 feet and at the latter about 5 feet. Farther east, at Louse Hill, these beds are 8 feet thick, while at Sherborne they amount to approximately 20 feet. In the Stowel Boring [**36**, pp. 7–12] the Lower and Middle Inferior Oolite probably totals 35–40 feet.

At Sherborne and Oborne the Lower and Middle Inferior Oolite are both comparatively thick, and this development is maintained for some distance northwards. Thus the *humphresianum, sauzei* and *sowerbyi* zones are all present at Poyntington Hill, while there is also field evidence for the presence of the *murchisonae* zone at this locality. On the outer edge of the escarpment the *murchisonae* zone is well exposed in

Holway Hill Quarry, where it is about 12 feet thick and is overlain by the *discites* sub-zone.

On Corton Downs about a mile north of Holway Hill, the Upper Inferior Oolite rests directly upon the *sauzei* zone, in the absence of the *humphresianum* zone: the Middle Inferior Oolite is represented at this point by about nine feet of strata belonging to the *sauzei* and *sowerbyi* sub-zones. Even farther north at Charwell Fields, the occurrence of conglomeratic ironshot limestones with *Bradfordia* sp. indicates the presence of the *discites* sub-zone. Middle Inferior Oolite may also be developed at Pen Hill, where about twenty feet of Upper Inferior Oolite rests on grey ironshot limestone with a planed-off top. The exposure is situated on the edge of the escarpment in an overgrown quarry separated by a small gully from Hicknoll Sleight, where the *murchisonae* zone has a well planed top and it is probable that there is little or no Middle Inferior Oolite. This progressive attenuation of the Lower and Middle Inferior Oolite reaches its climax south of Compton Pauncefoot, where Upper Inferior Oolite with a conglomeratic base rests directly on the Yeovil Sands.

To account for the thickening and thinning of the Lower and Middle Inferior Oolite and for the way in which different groups of zones disappear and reappear beneath the Upper Inferior Oolite, S. S. Buckman suggested that intraformational movement and penecontemporaneous erosion had operated on an extensive scale. He drew the base of the Upper Inferior Oolite immediately beneath the *garantiana* sub-zone. It is clear that a surface of transgression separates the *garantiana* sub-zone from the underlying rocks over a very wide area, but it is not so easy to decide whether the *niortensis* sub-zone lies above or below this surface. Buckman considered that it lay below and grouped it with the zones of the Middle Inferior Oolite under the stage name "Bajocian." He used the term "Bajocian" not as defined by D'Orbigny, but in a restricted sense. The writer prefers, however, to apply this term as suggested by Dr. Spath [**32**] to cover all the zones from *opalinum* to *parkinsoni* inclusive.[1]

Apart from a possible occurrence in the Hebrides, the beds with *Strenoceras niortensis* (D'Orbigny) have been discovered in Britain only at Burton Bradstock and at Sherborne, Dorset. Buckman suggested that this restricted distribution might be due to the preservation of the beds in slight synclinal flexures beneath the transgressive *garantiana* beds, flexures, which, he believed, had saved them from destruction during the "Bajocian Denudation."

[1] This means that "Bajocian" and "Inferior Oolite" are not in the writers view, interchangeable terms. The former is a stage name based on zones, the latter a lithological division like "Pennant Grit" or "Woolhope Limestone."

More recently the alternative explanation, now generally accepted, has been advanced by Dr. A. Morley Davies [**13**, pp. 230–234]. He suggests that the isolated patches of *Strenoceras*-bearing sediment were laid down at the beginning of Upper Inferior Oolite times in restricted areas sufficiently depressed to receive sediment rather than to avoid erosion. As Dr. Morley Davies has rightly pointed out, not only is there no sign of any missing fauna between the *niortensis* and *garantiana* sub-zones, but there is positive evidence on the continent to suggest that the two faunas occur in unbroken sequence.

In point of fact, the distribution in this country of the *niortensis* sub-zone is probably no more restricted than that of the *humphresianum* sub-zone. The type specimen of *Stephanoceras humphresianum* (J. de C. Sowerby) came from near Sherborne, most probably from Oborne, or from one of the neighbouring quarries. At the present time, these beds are nowhere clearly exposed, though they were seen in 1938 in some excavations for a reservoir on Poyntington Hill, where they were found to consist of ironshot limestones with an extremely rich ammonite fauna, including species of *Stephanoceras* and *Dorsetensia*. S. S. Buckman maintained that a distinct ammonite fauna exists between the *blagdeni* sub-zone and the *sauzei* sub-zone, but, with the possible exception of bed 8 of Frogden, he does not appear to have located it *in situ*. The only other locality in England yielding the typical *Stephanoceras humphresianum* (J. de C. Sowerby) known to the writer is the Chislecombe Quarry at Loders near Bridport (Dorset). Buckman, however, recorded *Stephanoceras* cf. *humphresianum* from the ' Irony Bed ' at Louse Hill, together with *Striirhynchia dorsetensis* S. S. Buckman.[1]

The relative distribution of the sub-zones of the *parkinsoni* and *humphresianum* and *sauzei* zones in the Sherborne district may be summarised as follows :—

parkinsoni zone (pars)	5.	*garantiana* sub-zone—extensive.
	4.	*niortensis* sub-zone—very restricted.
humphresianum Zone.	3.	*blagdeni* sub-zone—fairly wide, but not so wide as 1.
	2.	*humphresianum* sub-zone—very restricted.
sauzei Zone	1.	*sauzei* sub-zone—fairly wide.

The lithology of the *niortensis*-beds also throws some light on the stages in which movements occurred in *niortensis* times.

[1] Mr. J. W. Tutcher is of the opinion that *Striirhynchia dundriensis* (a similar species) occurs at the old north Main Road Quarry, Dundry, Somerset, in beds of slightly later date than the ironshot limestone of the Sauzei Zone. No specimens of *Striirhynchia* have been found in the Brown Ironshot of the other quarries on Dundry Hill.

Thus at Clatcombe and Frogden Quarry, Oborne, *Strenoceras niortensis* (D'Orbigny) occurs in an ironshot limestone and at Louse Hill in a ferruginous rubble, but at Poyntington Reservoir and at Combe Hill near Milborne Port it is found altogether with *Baculatoceras* and *Heimia* spp. in pale yellow sand and sandy limestones which pass upward with a perfect gradation into grey sandy limestone with *Garantiana* spp. These sandy beds closely resemble those described by Buckman as overlying the *niortensis*-ironshot at Clatcombe and Frogden Quarry. This evidence points to at least one change in the conditions of sedimentation within the sub-zone of *Strenoceras niortensis*.

Whatever process led to the restriction of the *niortensis*-beds to Sherborne and the Vale of Bridport, a similar explanation probably holds good for the *humphresianum*-beds. While it is highly probable that the original area of deposition of both these sub-zones was in itself strictly limited, yet this limitation was undoubtedly due to warping of the sea floor. In many instances this was coupled with penecontemporaneous erosion and the formation of condensed and remanié deposits.

This evidence strongly suggests that the intra-formational movements which culminated in the "Bajocian Denudation" were spread over a considerable period of time and that they started in Dorset slightly earlier than suggested by Dr. W. J. Arkell [**1**, pp. 408–9].

Upper Inferior Oolite.—Parkinsoni Zones.

The Upper Inferior Oolite forms a more compact division than the Lower and Middle groups and does not exhibit the same sporadic variation in thickness nor so many localised non-sequences. Between Sherborne and Milborne Port the sequence is as follows :—

Crackment Limestone (20 feet +)—*zigzag* sub-zone
'Rubbly Beds' (about 20 feet)—*schloenbachi* ?, *truelli* and (part of) *garantiana* sub-zones
Sherborne Building Stone (about 20 feet)—*garantiana* sub-zone.

These lithological subdivisions are not recognisable at Haselbury Mill S.W. of Yeovil, where the *garantiana*—*schloenbachi* sub-zones are represented by about 5 feet of limestone capped by the '*zigzag* Bed' (4 inches thick) with *Morphoceras* and *Procerites*. At Stoford, however, the *schloenbachi* sub-zone is succeeded by 5 feet of thin limestone bands alternating with thicker clay partings capped by clay with *Ostrea knorri* Voltz. This is the first appearance of the Crackment Limestone facies of the *zigzag* sub-zone. The beds beneath include representatives of

the *garantiana*, *truelli* and *schloenbachi* sub-zones according to Mr. L. Richardson [**31**, pp. 166–169] and are the same total thickness as at Haselbury Mill. They consist of limestones, often crinoidal, with marly and ochreous partings, and show many indications of deposition in shallow water.

Garantiana—Schloenbachi Sub-Zones.

Excluding the Crackment Limestone, the description of which is given below, the Upper Inferior Oolite is thin at Bradford Abbas. Consisting of a few inches of marl and limestone the *garantiana* sub-zone begins at Baggerbush Lane Quarry and East Hill Quarry to assume the characters of the *Astarte-obliqua*-Bed of Halfway House and Louse Hill. This bed is a most useful datum line, being easily recognised by the presence of swarms of large *Astarte*. Most of the fossils from the *Astarte* Bed are encrusted with *Serpula*, and the stratum has other features common to condensed deposits.

Unfortunately, the presumed passage of the condensed *Astarte-obliqua*-Bed into the much expanded Sherborne Building Stone and part of the ' Rubbly Beds ' cannot be seen owing to a lack of exposures west of the town of Sherborne. Two miles from Louse Hill (where the *Astarte*-Bed is 5 inches thick) at Redhole Lane Quarry the *garantiana* sub-zone is at least 25 feet thick.

The succeeding ' Fossil Bed '[1] (of Halfway House) represents the *truelli* sub-zone. It is one of the most famous fossil-bearing limestones of the Inferior Oolite and has yielded numbers of large ammonites, including *Parkinsonia parkinsoni* (J. de C. Sowerby) and *Parkinsonia dorsetensis* (T. Wright). At Louse Hill, half a mile east of Halfway House, the ' Fossil Bed ' is replaced by brownish limestone weathering to a rubble and on the banks of the main road a little nearer Sherborne the same bed may be seen passing into limestones with marly partings. These beds are the equivalent of the ' Rubbly Beds ' which succeed the Sherborne Building Stone at Sherborne. The best section in the ' Rubbly Beds ' and Building Stone is Redhole Lane Quarry [**31**, pp. 72–73], where there are eighteen feet of rubbly limestones with earthy partings resting on the " Stone used for lime " (5 feet) : the latter yields *Garantiana garantiana* (D'Orbigny). Beneath the " Stone used for lime " about twenty feet of massive limestone is exposed (this is the Sherborne Building Stone), which has been used extensively for walling purposes. It weathers to a pleasant yellowish-grey colour and frequently shows clusters of *Sphaeroidothyris*, known to the quarrymen as " gooseberries."

[1] The ' Fossil Bed ' of Halfway House belongs to the *truelli* sub-zone ; the ' Fossil Bed ' of Claytons Quarry and Baggerbush Lane to the *discites* and *concava* zones, and that of Sandford Lane to the *sauzei* and *laeviuscula* sub-zones.

Fossils are not common in the Building Stone nor in the overlying 'Rubbly Beds.'[1] The clusters of *Sphaeroidothyris* and a huge *Nautilus* sp. are the commonest fossils, but the writer has found *Garantiana garantiana* (D'Orbigny) in the Building Stone at Sandford Lane Quarry. The remains of *Megalosaurus bucklandi* Von Meyer [**25**], now preserved in Sherborne School Museum, were obtained from a Building Stone quarry in Sherborne and the cone of *Araucaria cleminshawi* Mansel-Pleydell, also in the School Museum, is thought by Mr. L. Richardson to have come from the same beds.

Buckman [**8**, p. 496] noticed that the fossils of the 'Fossil Bed' of Halfway House (*truelli* sub-zone) appear about 7 feet above the Building Stone at the Limekiln Quarry, Sherborne, but that the principal bed in which they are found is 8 feet higher. A similar fauna occurs in the 'Rubbly Beds' at Sheeplands, Sherborne. In 1939 many specimens of *Parkinsonia* sp. (cf. *P. truelli*) were seen in a temporary excavation at this point, together with a large reptilian (?) bone and a chert pebble embedded in the limestone. The origin of the chert pebble is at present unknown. It may have been carried by drifting tree roots (fossil wood is not uncommon) or by masses of seaweed, or, alternatively, it may have been used by some animal as an aid to digestion!

To the north of Sherborne the Building Stone does not deteriorate in quality as rapidly as to the east or to the west. The last known trace of it could formerly be seen in an abandoned quarry near the source of the River Yeo, immediately west of the Poyntington Fault. Only a few feet of Upper Inferior Oolite are now visible in this quarry, which is largely blocked by slipped material. North of this point the Building Stone and 'Rubbly Beds' pass into coarsely oolitic or flaggy limestone more like the Doulting Stone of the Mendips. About 15 feet of these limestones are exposed on Littleton Hill near Compton Pauncefoot and similar beds occur at Waterloo Crescent and Charlton Horethorne.

East of Sherborne, the Building Stone and Rubbly Beds pass into sandy limestones with *Garantiana* spp. overlain by grey limestones with marly partings in which *Parkinsonia* spp. and brachiopods of *truelli* date are quite abundant.

There is no direct evidence for the presence of the *schloenbachi* sub-zone at Sherborne, although stout-whorled *Parkinsonia* spp. may be found on the fields above Lenthay, ½ mile west of town. It is probable that this sub-zone is very thin throughout the district or even absent in places.

[1] "The Rubbly Beds" is a name applied to any of the less massive limestones above the workable building stone. In some places the weathered top of the Building Stone may contribute to them.

Zigzag Sub-Zone.

We have seen that the most westerly development of the Crackment Limestone (*zigzag* sub-zone) is at Stoford, South of Yeovil. From this place to Bradford Abbas it thickens to about 10 feet and at Halfway House it is 20 feet or more. The main outcrop, however, follows the lower edge of the Inferior Oolite dip slope from Bradford Abbas to Sherborne, thence to Crackment Hill and Milborne Port. Mr. L. Richardson measured a thickness of nearly 20 feet in a section on the main road at Crackment Hill, but this is probably not the complete thickness. The beds rest on rubbly limestone of the *truelli* and *schloenbachi* (?), sub-zones of which 12 feet were visible.

The junction of the Crackment Limestone with the Lower Fuller's Earth Clay near Ven House, Milborne Port, was exposed in excavations in the early spring of 1938. Clays with an occasional hard calcareous mudstone or shale band rested upon the following beds :—

Thin pink limestone	1 ft. 6 ins.	
Clay	1 ft. 6 ins.	*Oppelia* sp. (= *O. fusca* auctt. non Quenstedt) = *Gonoxyites limosus* S. S. Buckman, *Acanthothyris* spp. *Sphaeroidothyris lenthayensis* (R. and W.)
Marl and clay	1 ft. 9 ins.	
Limestone and clay	5 ft. 9ins.	
Limestone with clay and sandy partings	10 ft. 6 ins.	*Acanthothyris* spp., *Sphaeroidothyris* sp.
Ochreous limestone with sandy partings (seen)	2 ft. 0 ins.	*Gonolkites* sp. *Procerites* spp.
		Total seen 23 ft.

The base of the Crackment Limestone was not seen in these exposures, and, indeed, may have been as much as 20 feet below the lowest bed visible in the trenches.

Procerites occurs with *Zigzagiceras* at Halfway House and with *Morphoceras* at Stoford. These forms, together with *Gonolkites* (a form of *Parkinsonia*), *Oppelia* and Perisphinctid ammonites, *Sphaeroidothyris lenthayensis* (Richardson and Walker) and *Acanthothyris obornensis* S. S. Buckman and Walker, are the most characteristic fossils of these beds.

At Ven House the passage of the Crackment Limestone into the clays of the Lower Fuller's Earth is gradual, with upper beds becoming more argillaceous and eventually passing into the overlying Lower Fuller's Earth Clay. The latter contains occasional brown siltstone bands with *Lopha costata* (J. de C. Sowerby) near the base. At a slightly higher horizon in the Lower Fuller's Earth an exposure below Henover Wood near

Milborne Port yielded *Siemiradskia* sp. and *Prohecticoceras* sp. ? together with poorly preserved fragments of an *Oppelia*.

The Great Oolite Series and Cornbrash.

Under this heading is described the series of strata which overlies the Inferior Oolite in this area and includes the Lower Fuller's Earth, Fuller's Earth Rock, Upper Fuller's Earth, Forest Marble and Cornbrash. In the past, some confusion has arisen through the correlation of certain brachiopod-bearing beds in the Fuller's Earth on the south coast with the Fuller's Earth Rock, though they exhibit differences in lithology and fauna ; in the present account it is hoped that this difficulty will be settled.

Lower Fuller's Earth.—The clays of the Fuller's Earth are hardly ever exposed in this area and consequently little is known of them. They are soft grey clays and form the floor of the Yeo Valley between Oborne and Clifton Maybank, south-west of Yeovil, and of its tributary streams westward as far as East Coker. They also form a belt of wet ground from the vicinity of Maperton southward to Sherborne Park. Exposures are rare, though occasionally a few feet are seen in the banks of some of the small tributaries of the River Yeo. Fossils are equally rare, though *Prohecticoceras* sp. and *Siemiradszkia* sp. have been found near Henover Wood, Milborne Port and *Oppelia fusca* (Quenstedt) at Halstock. At Stoford Quarry, near Yeovil Junction [**31**, p. 52 ,Pl. vii] *Ostrea knorri* Voltz occurs profusely as an oyster bed at the base of the Fuller's Earth Clay ; this bed is separated from the underlying Crackment Limestone by two feet of shaly clay.

The Lower and Upper Fuller's Earth clays are separated by the Fuller's Earth Rock which generally forms a well-marked, low escarpment. In the upper few feet of the Lower Fuller's Earth, immediately underlying the Fuller's Earth Rock in the Haydon-Maperton district, there occurs a great profusion of the oyster, *Ostrea acuminata* J. Sow., almost amounting to a shell bank of restricted extent. It has not been recorded at this horizon immediately below the Fuller's Earth Rock anywhere between Haydon and the South Coast.

Fuller's Earth Rock.—The Fuller's Earth Rock enters the area from the north and forms a fine escarpment from Maperton southward to Henover Hill, near Haydon, where it is displaced by the strong Poyntington Fault. It reappears in Sherborne Park and extends south-westward as a low arable platform through Thornford to Clifton Wood. Between Maperton and Thornford it maintains a uniform thickness of about 35 feet, but west of Thornford this thickness is reduced and from the vicinity of

Stoford, southward to Beaminster, it is represented by a line of intermittent nodules of unfossiliferous argillaceous limestone. The rock is a cream-coloured argillaceous limestone in fairly thick beds. In the Maperton-Haydon area the upper part of the Fuller's Earth Rock was first shown by Woodward [**37**, p. 237] to be composed of rubbly brachiopod beds ; subsequently, Richardson [**26**, p. 213] recorded a section near Maperton in which these rubbly beds were again identified. In this area the Fuller's Earth Rock has yielded a rich fauna of Ornithellids and other brachiopods, numerous Cadicone ammonites belonging to the Tulitidae and many lamellibranchs.

Between Sherborne Park and Clifton Wood it retains the essential lithological characters of the Rock in the Maperton-Haydon area with a tendency towards softer marly beds intervening between the harder beds. Also, it is considerably less fossiliferous both in numbers and species in this area ; *Tulites subcontractus* (Morris and Lycett) and *Pholadomya lyrata* J. Sow. are not uncommon and a few minute Rhynchonellids occur in the lower beds. In the past, one of the most informative sections in these beds was the Troll (or Trill) Quarry about three-quarters of a mile west of Thornford. Here, some 8 feet of hard, nodular, cream limestones with intervening softer marly beds were described by Buckman [**9**, vol. vi, pp. 50–1], who considered that the ammonite fauna indicated an earlier development of the Fuller's Earth Rock in this locality than in the areas farther to the north-east. Accordingly he termed these beds the ' Thornford Beds ' and the Fuller's Earth Rock in the Maperton-Haydon district, which he considered to be of later date, he called the ' Milborne Bed.'

The beds at Troll have yielded *Tulites subcontractus* (Morris and Lycett), *Pholadomya lyrata* J. Sow., *Pseudomonotis*, and brachiopods represented by dwarfed and immature forms of *Rhynchonelloidella wattonensis* Muir-Wood, *Kallirhynchia platiloba* Muir-Wood, *Ornithella haydonensis* Muir-Wood and *Rugitela cadomensis* (Eudes.-Deslong.).

About a third of a mile west of Troll Quarry in the roadside at Trill Dairy House, similar beds to those seen at Troll, have yielded ' *Terebratula* ' *linguifera* Dav. and *Rugitela cadomensis* (Eudes-Deslong.) in abundance. Thus in the Trill district the brachiopod fauna is little different from that found in greater profusion in the Maperton-Haydon area, where presumably conditions were slightly more favourable to its existence. Further, on the above brachiopod evidence there is no justification for Buckman's original distinction between ' Thornford Beds ' and ' Milborne Beds ' [**9**].

Between Maperton and Thornford the Fuller's Earth Rock maintains a uniform thickness of about 35 feet, but west of Thornford this thickness is reduced as already stated.

Wattonensis-Beds

The Fuller's Earth Rock of William Smith and all later stratigraphers is a lithologically distinctive horizon carrying a rich fauna in which Ornithellids predominate, and as such it is recognisable from the Cotswolds southward to the vicinity of Clifton Wood, 2 miles south of Yeovil. Farther south, from Beaminster to the Dorset coast, there is no trace of this Fuller's Earth Rock.

Certain rubbly 'Brachiopod Beds' occurring towards the middle of the Fuller's Earth Clay, described by Buckman [**11**] on the Dorset coast, were believed by Dr. Arkell [**2**, pp. 245–260] to be equivalent to the upper part of the Fuller's Earth Rock in the Maperton-Haydon area. However, in a recent monograph of the brachiopod fauna of these beds by Miss H. M. Muir-Wood [**24**] it is shown to be quite distinct from that of the Fuller's Earth Rock in the Maperton-Haydon area. Buckman's 'Brachiopod Beds' consisting of dark argillaceous limestone bands with intervening clays at Eypesmouth and Watton Cliff, persist inland; in places they give rise to a definite feature a short distance below the Forest Marble escarpment and Dr. F. B. A. Welch [**34** and **35**] has been able to map these beds northward to the Beaminster district. Where encountered they yield a rich brachiopod fauna in which the two most common species are *Wattonithyris wattonensis* Muir-Wood and *Rhynchonelloidella wattonensis* Muir-Wood. Other common brachiopods are *Rhynchonelloidella smithi* (Dav.), *Wattonithyris nunneyensis* (Buckman), *Rugitela bullata* (J. de C. Sow.), *R. cadomensis* (Eudes.-Deslong.), *R. powerstockensis* Muir-Wood, *Tubithyris whatleyensis* (Buckman), *T. powerstockensis* Muir-Wood, and *Acanthothyris powerstockensis* Buckman and Walker. *Trigonia elongata* J. de C. Sow. var. *lata* Lycett, *Amberleya fowleri* sp. nov. and a small *Nucula* are also very common, and two specimens of *Morrisiceras fornicatus* (Buckman) have been obtained.

The term '*wattonensis*-Beds' is suggested for these beds in preference to the 'Brachiopod Beds' of Buckman.

It is important to realise the absence of any Ornithellids from these beds, and the relative greater abundance of species of *Rugitela* compared with its occurrence in the Fuller's Earth Rock.

On the old geological map (Sheet 18) the Fuller's Earth Rock is repeated by a fault between Beer Hackett and Sherborne Park. When this ground was recently re-surveyed it was found that the Fuller's Earth Rock was not repeated by faulting, but that the apparent double outcrop was due to two successive rock bands separated by clay. The lower band is the Fuller's Earth Rock, while the higher one comprises the 3 to 5 feet of the

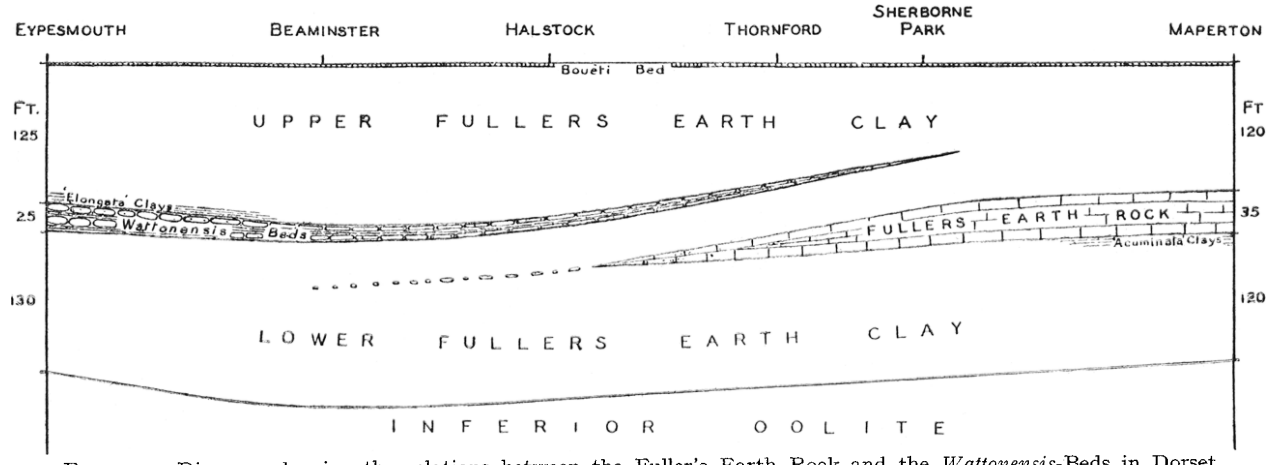

FIG. 12.—Diagram showing the relations between the Fuller's Earth Rock and the *Wattonensis*-Beds in Dorset and East Somerset.

wattonensis-Beds, which have persisted into this district from the vicinity of Beaminster. In this area the *wattonensis*-Beds consist of two beds of hard, buff argillaceous limestone parted by a thin clay band, and they give rise to a well-defined feature from Beer Hackett almost to Sherborne Park, where they thin out completely. Along the outcrop they are visible in many stream-and ditch-sections from which most of the diagnostic fossils mentioned above have been collected. In its weathered state the limestone might easily be confused with the Fuller's Earth Rock; this lithological similarity may probably have misled the surveyors of the old one-inch map into mapping a repetition of the Fuller's Earth Rock in this district. The relations between these two rock horizons in the Fuller's Earth are summarised in Fig. 12.

Upper Fuller's Earth.—Grey clays of the Upper Fuller's Earth occur between the *wattonensis*-Beds and the *boueti*-Bed, which is regarded as the base of the overlying Forest Marble. On the Dorset coast the lowest few feet of these clays are crowded with shells of the oyster *Ostrea hebridica* Forbes var. *elongata* Dutertre and an occasional specimen has been recorded inland as far as Powerstock. H. B. Woodward [**37**, vol. iv, p. 238] recorded small iridescent ammonites from these clays between Maperton and Holton.

***Boueti*-Bed.** At the top of the Upper Fuller's Earth is a one-foot band of cream-coloured, earthy limestone in which *Goniorhynchia boueti* (Davidson) abounds. It is a persistent and constant bed traceable from the Dorset coast as far inland as Wincanton. In the area between Lillington Hill and Sherborne Park it is exposed in numerous streams and ditches and has yielded *Kutchirhynchia* sp., *Avonothyris* sp., *Obovothyris* sp., *Trigonia elongata* J. de C. Sow. var. *gracilis* nov., *Serpula oblique-striata* Lycett *S. flaccida* Goldfuss, *Apiocrinus* sp., and polyzoan and sponge incrustations.

It has also been traced by Mr. Fowler farther west of Sherborne Park and round Highmores Hill.

Forest Marble. The limestones of the Forest Marble build some of the finest topographical features in this area. It forms the long ridge of Coker Hill, south-west of Yeovil, extending from Coker Hill Bridge to East Coker; also the equally prominent east-west ridge, south of Coker Hill, on which stands the village of Hardington, while south of Pendomer the Birts Hill-Abbotts Hill ridge is also formed of Forest Marble. Similarly, southward-dipping beds build the high, wooded area south of Sherborne extending from Lillington Hill north-eastward to Haydon, where they are displaced to the south by the Poyntington fault, on the east side of which the feature continues from Holt Hill

near Caundle Marsh northward beyond Maperton. In these areas the Forest Marble consists of a central mass of flaggy sandstones and current-bedded shelly limestones sandwiched between two thick masses of grey clay, totalling up to 110 feet in thickness. The central hard beds have been extensively worked in the past ; on Lillington Hill the flagstones have been used for walling, while around Lillington and Long Burton the shelly limestones are worked for road metal and ornamental purposes. H. B. Woodward [**37**, vol. iv, p. 347] has recorded 130 feet of Forest Marble beds in the road section at West Hill, south of Sherborne, of which the clay in the upper part is given as 50 feet. Recent investigations point to the thickness of this clay being only about 30 feet. The upper beds of the central part are thin reddish brown sandstones which may represent the first appearances of the Hinton Sands ; they are well exposed in the road leading up Gainsborough Hill, south of Gainsborough Dairy and at Charlton Hill, north-east of Charlton Horethorne. Subdvision of the Forest Marble can only come after detailed stratigraphical research covering the whole of its outcrop, and in the meantime the old facies term must remain. Towards the top the upper clays contain the small osyters. *Ostrea hebridica* Forbes and *Exogyrae* in abundance.

Cornbrash. The cream and grey limestones with intervening marly bands of the Cornbrash overlie the Forest Marble. Outliers of these beds occur on the high Forest Marble ridge south of Sherborne and their outcrop is continuous between Haydon and Long Burton. A well dug recently in Long Burton passed through 10 feet of Cornbrash and the fossils collected from it indicate the presence of all the zones of the Lower and Upper Cornbrash in this district. A small quarry in these beds at Lillington has also yielded the fauna of the whole of the Cornbrash. These limestones have a considerable outcrop farther west around Yetminster, where, apparently, they belong to the Lower Cornbrash only. Another outlier of these beds occurs at the eastern end of Coker Hill, around East Coker. Here, Prof. J. A. Douglas and Dr. W. J. Arkell [**14**, p. 150] have recorded only the Upper Cornbrash in a section near the old lime-kiln south-west of the cross roads at the corner of Coker Park. Recent work has revealed the fauna of both zones of the Lower Cornbrash in this section. Other outliers occur farther south around Sutton Bingham and Closeworth, where the Upper and Lower Divisions of the Cornbrash are both present.

IV. PALAEONTOLOGICAL NOTES.

The Lower Lias.

With the exception of Dr. Spath's description of the ammonites of the 'Marston Stone' [**32**] the only mention of ammonites

from the Lower Lias clays is made by H. B. Woodward [**37**, vol. iii, pp. 84–85]. Some of Woodward's specimens have been traced in the collections of the Geological Survey, with the kind co-operation of Mr. C. P. Chatwin, and certain of them are figured here.

Arnioceras sp. (Pl. 9, Fig. 1).

The specimen here figured (Specimen No. 62457, Geol. Surv. Coll.) is an impression preserved on dark, papery shale. It is described as "*Ammonites semicostatus*" by H. B. Woodward [**37**, vol. iii, p. 85]. The specimen is flattened; the proportions are as follows:—

S. 56 : 28—45

Horizon: *semicostatum* zone or (Lower) *obtusum* zone (see p. 141).

Locality: An old brickyard, Hornblotton Mill, near Alford, Somerset.

Bifericeras sp. (Pl. 9, Fig. 6), X 2.

Specimen No. 62461, Geol. Surv. Coll., collected by H. B. Woodward and recorded by him as "*Ammonites Birchii*" [**37**, vol. iii, p. 85].

Horizon: *oxynotum* zone.

Locality: "Well-sinking west of Sutton near Alhampton," Somerset.

Oxynoticeras sp. juv. (Pl. 9, Fig. 10) X 2.

Specimen No. 23948, Geol. Surv. Coll., recorded by H. B. Woodward (*ibid*, p. 85) as "*A. simpsoni.*"

Horizon: *oxynotum* zone.

Locality: "Well-sinking west of Sutton near Alhampton," Somerset.

Echioceras ("*Plesechioceras*") cf. *typus* S. S. Buckman (Pl. 9, Figs. 4 and 5, nat. size).

The specimen illustrated in Fig. 5 (Specimen No. 62458, Geol. Surv. Coll.) is preserved in pyrites and is slightly distorted. The ribs on the body chamber are prorsiradiate and bend forward on the shoulder of the shell before dying away on the venter. Venter rounded and faintly costate, some of the costae being a continuation of the main ribs, while others arise between them. Carina low and rounded, but is quite distinct and is bounded by small sulci. Body chamber at least one whorl in length (the position of the last suture is marked by a cross on the photograph). Though the specimen is fairly closely septate, the spacing of the septa is rather irregular. The character of the later sutures is not clearly seen in the specimen, but at about 18 mm. some details are visible. At this diameter

I S is bifid and higher and narrower than E S. I L is usually bifid, but the development of a small lobule low down on the dorsal side of E S may give a trifid appearance. 2 L is V-shaped at this diameter. The proportion and costation of this shell may be compared with that of *P. typus* S. S. Buckman :

Echioceras (" *Plesechioceras* ") cf. *typus* (Pl. 9, Fig. 5)
S. 28. 24. 20. 56.
Costal Formula (from 33 mm.) S. 14. 13. 12. 12. 11. 11. 12. 10. 10. 11.

Plesechioceras typus S. S. Buckman (TA. DCXCIV).
S. 34. 24. 20. 53.
Costal Formula (from 33 mm.) S. 15. 15. 15. 13. 14. 12. 12. 10. 10. 9 (T & W., p. 722).

Through the kindness of Dr. L. F. Spath the specimen described above has been compared with the type of *P. typus* (British Museum Collection), which it closely resembles in nearly every respect. The details of the venter are not so clearly seen on the type as on our specimen, but this is due to a difference in preservation.

The small septate specimen illustrated in Fig. 4 (Specimen No. 62459, Geol. Surv. Coll.) is also comparable with *P. typus*.

Horizon : *raricostatum* zone.

Locality : Sutton, near Alhampton, Castle Cary, Somerset.

Remarks : The position of the genus *Plesechioceras* Trueman and Williams 1925 is in need of clarification. In 1856 Von Hauer figured a shell which he called *Ammonites tardecrescens*. In 1867 Dumortier figured an ammonite from the Rhone Valley which he described as " *Amm. tardecrescens* (Von Hauer)." The two figures show certain differences, however, and therefore S. S. Buckman in his revision of the genus *Echioceras* renamed Dumortier's specimen *E. delicatum* sp. nov. (T.A. 96c, 1914). Presumably Buckman did not compare the specimens, or even photographs of these specimens, in which case it would have been far better to have allowed Dumortier's identification to stand pending a full investigation.

Professor A. E. Trueman and Miss Williams in founding the genus *Plesechioceras* (Trans. Roy. Soc. Edin., 1925, p. 706) stated the genotype to be " a specimen identified with *A. delicatum* S. S. Buckman (T.A. 96c, 1914) founded on Dumortier (1867, xxxi, 3–5), J.W.T. Coll., No. 17." But a genotype implies a species rather than a specimen, and the specimen here referred to cannot be the holotype of Buckman's species which was Dumortier's specimen. Therefore the genotype of *Plesechioceras* Trueman and Williams is either Buckman's species or the species which they considered to be identical with it. In 1927 Buckman renamed Mr. Tutcher's specimen (J.W.T. Coll. No. 17)

Plesechioceras typus nov. (T.A., Pl. DCXCIV) and claimed it as the genotype of *Plesechioceras*. It might be argued that the founders of the genus had in mind the characters exhibited by the specimen subsequently named *P. typus* by Buckman, but strictly speaking *Echioceras delicatum* S. S. Buckman should be regarded as the genotype of *Plesechioceras*. The holotype of *P. typus* S. S. Buckman is now in the collection of the Natural History Museum.

Echioceras cf. *lepidum* Trueman and Williams (Pl. 9, Fig. 3).

Description : This specimen was collected by H. B. Woodward. Shell evolute with large umbilicus. Ribs on body chamber prorsiradiate with slight peripheral curvature. Shell appears to be smooth up to about 1.5 mm. At about 22 mm. periphery is semi-fastigate in appearance.

E. cf. *lepidum* S. 23. 19—70
E. lepidum T. & W. S. 56. 21. 21. 62. 5
E. cf. *lepidum* (commencing at 25 mm.)

Costal formula 7. 9. 10. 9. 9. 9. 9. ?. 9. 9. 10. 9.7. 7. 8. 8. 6. 5. 6. 5. 5.

Septa rather widely spaced and successive sutures show some variation in detail, but in general resemble that given for *E. lepidum* (Trueman and Williams, p. 705, Fig. 3h). The last two sutures are marked in white on the figure. The specimen has been compared with the type of *E. lepidum* (British Museum Collection). It is perhaps slightly more umbilicate than *E. lepidum*, but the ribbing and general appearance is similar. Though the bodychamber of our specimen is nearly a whorl in length it is probably immature.

Horizon : *rariscostatum* zone.

Locality : Sutton, near Alhampton ; Castle Cary, Somerset.

Gemmellaroceras peregrinum (Haug). (Pl. 9, Fig. 11).

A specimen preserved in hard blue shale, identified by Dr. L. F. Spath with Haug's species (Specimen No. 62463, Geol. Surv. Coll.).

Horizon : *jamesoni* zone.

Locality : Chilthornehill Lane, Chilthorne Domer, near Yeovil, Somerset.

Middle Lias.

Amalthesus cf. *stokesi* (J. Sowerby). Pl. 9, Fig. 9, X 2.

The specimen recorded by H. B. Woodward (vol. iii, p. 208) is recorded and figured here under the above name. Fossils

are so rare in the Middle Lias Marls that any ammonite, even if poorly preserved, is of great importance stratigraphically.

Horizon: Middle Lias Marls (*margaritatus* zone).

Locality: "Near Brent Knoll Railway Station, Somerset."

Upper Lias.

The fauna of the Upper Lias limestones is now fairly well known and may therefore be omitted from this account. That of the Yeovil Sands, however, has never been adequately described and there are no good figures of even the most characteristic species. S. S. Buckman [**6**] has figured two species of *Catulloceras* (*ibid.* Pl. xli, Figs. 7 and 8, and xxxix, Figs. 1 and 2) and eleven species of *Dumortieria*, including such forms as *D. prisca* S. S. Buckman (*ibid.* Pl. xxxvii, Figs. 9–11) and *D. falcofila* (Quenstedt) from the *Dumortieriae* sub-zone, and *D. linearis* (Pl. xxx, Figs. 15–17) from the *moorei* sub-zone. A number of other forms such as *D. yeovilensis* S. S. Buckman (Pl. xxxvii, Figs. 16 and 17), of which the exact stratigraphical position is not known, are also figured and described. The same author has figured a *Phylloceras* from the "Sandrock of Yeovil Sands, *Moorei*" of Stoford, as *Xeinophylloceras Xeinus*, nov. [**9**, vol. iii, Pl. cclxvi, A and B). A typical *Dumortieria* like *D. moorei* (Lycett) from the top (30 feet?) of the Yeovil Sands is figured herein, together with the characteristic brachiopod *Rhynchonelloidea cynica* (S. S. Buckman) and a number of lamellibranchs from the *moorei* sub-zone, some of which are new.[1]

Dumortieria aff. *moorei* (Lycett) (Pl. 9, Fig. 2).

The specimen here figured (Specimen No. 62454, Geol Surv. Mus. Coll.) was collected by Mr. Fowler from the upper part of the Yeovil Sands exposed in the road-cuttings on Charlock Hill N.W. of Sherborne, Dorset Our specimen closely resembles Lycett's type (Spec. No. 25312 Geol. Surv. Mus. Col.) and also Buckman's figure of another specimen belonging to the same species [**6**, Suppl. p. clxxxii, Fig. 179). The proportions of our specimen are as follows:—S. 50: 40. 20. 37. The form of the fine lineation on the last whorl resembles that of *D. moorei* (Lycett), but the connate costae on the inner whorls are like those of *Cotteswoldia bifax* S. S. Buckman [**6**, Suppl. p. cxxxvi, Fig. 110a). Buckman distinguished *Cotteswoldia* from *Dumortieria* by the form of the radial line, on which evidence our shell falls within the *D. moorei* group. The close resemblance of certain forms of *Dumortieria* and *Cotteswoldia* were supposed by Buckman to be due to homoeomorphy and he therefore kept the two groups rigidly distinct, placing *Cotteswoldia* in the

[1] Since this was written Mr. Fowler has sent us a beautiful specimen of *Montlivaltia* from the Yeovil Sands between Sherborne Golf Links and Holway.

Hildoceratidae and *Dumortieria* in the Polymorphidae. There can be little doubt, however, that there are passage forms between the two genera and between *Cotteswoldia* and *Pleydellia*.

Trigonia charlockensis sp. nov. (Pl. 10, Figs. 4a, 4b, 5a and 5b).

A costate *Trigonia* from the upper part of the Yeovil Sands (*moorei* subzone) from the Sherborne-Marston Magna road-cutting at Charlock Hill, 2 miles N.W. of Sherborne Station. This shell is more triangular and more convex than *T. denticulata* Agassiz, from which it also differs in having the marginal carina less oblique, and in possessing a wider area. It is less convex than *T. costata* J. Sow., the area is narrower and the concrescent ribbing on the anteal portion of the shell does not exhibit any flexuring. In *T. costata*, on the other hand, the ribs become horizontal about the middle of the valve and are deflected slightly downward at the marginal carina.

Material.—Right and left valves collected from the above-mentioned locality, and a left valve (22970) from the Yeovil Sands at Yeovil Junction Station. Syntypes. Specimens Nos. 62452 and 62453; also 22970, Geol. Surv. Museum Coll., presented by the Rev. J. Fowler.

Trigonia formosa Lycett, near var. *lata* Lycett 1879. (Pl. 10, Fig. 2).

The specimen here figured exhibits characters common to *T. formosa* Lycett and also to the variety of the same species designated '*lata*' by Lycett. Its ribs are more strongly tuberculated and more numerous than in *T. formosa*. In this respect it resembles *T. formosa* var. *lata*. The breadth of the area is nearer that of *T. formosa*, which is less than in var. *lata*. The median furrow on the area is also more clearly defined than in *T. formosa*; the escutcheon is less depressed than in var. *lata* and carries no ornament.

Horizon: Upper part of the Yeovil Sands.

Locality: East end of Chiselborough Hill, N.W. of East Chinnock.

Specimen No. 62464, Geol. Surv. Col..

Tancredia donaciformis Lycett 1850. (Pl. 10, Fig. 3; Text-Fig. 13).

FIG. 13.—*Tancredia donaciformis* Lycett. Characters of Hinge line. × 2.

Our specimen of a left valve of this shell is identified with *T. donaciformis* Lycett [**21**, p. 424, Pl. xi, Fig. 8; see also Cox, **12**, pp. 569–575]. It has the following dimensions:

Length 32.9 mms. Height 18.6 mms. Hinge well developed, consist-

ing of a large triangular cardinal tooth separated from the nymph by a deep triangular pit and from the anterior dorsal margin by a more elongate triangular pit ; posterior cardinal tooth also well developed.

Horizon : Yeovil Sands (*moorei* subzone).

Locality : Sherborne-Marston Magna road cutting at Charlock Hill, 2 miles N.W. of Sherborne Station.

Specimen No. 62451, Geol. Surv. Museum Coll., presented by the Rev. J. Fowler.

Astarte cf. *elongata* S. S. Buckman 1878. (Pl. 10, Fig. 7).

Notes : Shell fairly large, elongate and moderately inflated. Ornament consists of regular, concentric ribs on the umbones, fading at a distance of about 20 mms., and leaving only fine concentric growth-lines on the remainder of the smooth shell. Other details obscure.

Horizon : Yeovil Sands (*moorei* sub-zone).

Locality : Sherborne-Marston Magna road cutting at Charlock Hill, 2 miles N.W. of Sherborne Station.

Specimen No. 62450, Geol. Surv. Museum Coll., presented by the Rev. J. Fowler.

Rhynchonelloidea cynica (S. S. Buckman) 1895 (Pl. 9, Figs. 7a, 7b, 8a and 8b).

In his revision of the *Rhynchonella cynocephala* group, S. S. Buckman (*Q.J.G.S.*, vol. 51, pp. 448–454) renamed *Rhynchonella Beneckei* Davidson (Mon. Pal. Soc., vol. 5, Pl. 20, Figs. 8–10) as *Rhynchonella cynica* nov. In 1917 the same author (Pal. Indica, vol. iii, mem. 2, p. 38) referred *Rhynchonella cynica* to the genus *Rhynchonelloidea* S. S. Buckman 1914.

This shell is not uncommon in the upper part of the Yeovil Sands (*moorei* sub-zone). The specimens illustrated here were collected by Mr. Fowler from the Yeovil Sands of Charlock Hill. Two specimens, Nos. 62455, 62456, are figured in order to illustrate the variation in form of the anterior margin.

Horizon : Yeovil Sands (*moorei* sub-zone).

Locality : Sherborne-Marston road cutting, Charlock Hill, 2 miles N.W. of Sherborne Railway Station.

Wattonensis-Beds.

Amberleya fowleri sp. nov. (Pl. 10, Fig. 6).

Shell turreted, composed of more than five angular whorls. Body whorl large, with main keel ornamented with large rounded tubercles ; the base has seven finely tuberculated spirals. Aperture not seen. The upper slope of the whorl is ornamented with fine transverse growth-lines, passing slightly obliquely

backwards from the suture to the main keel. In the upper part of the spire a line of tubercles is developed between the suture and the main keel, and in the highest part of the spire these tubercles are replaced by transverse angular ribs. The lesser keel immediately below the main keel is much more finely tuberculated and in the highest part of the spire the two keels are equally developed and reticulate.

Spiral angle 45°. Sutural angle 15°.

Remarks: This species has many characters in common with *A. sowerbyana* Hudleston, from which it differs, however, in having a greater sutural angle, the main keel is more strongly tuberculated and a great number of spirals occur in the base. The ornament on the immature whorls is comparatively stronger than in *A. sowerbyana*. This species is named after the Rev. J. Fowler.

Horizon and Locality: *Wattonensis*-Beds at Gaul Hill, near Lake Farm, Thornford.

Holotype. No. 62449, Geol. Surv. Museum Coll., presented by the Rev. J. Fowler.

Boueti-Bed.

Trigonia elongata J. de C. Sow., var. *gracilis* nov. (Pl. 10, Figs. 1a, 1b and 1c).

In form this new variety of *T. elongata* J. de C. Sow. resembles the varieties *lata* and *angustata* recognised and described by Lycett, but its surface ornament is finer than either of these varieties. At a height of 55 mm. it has 29 ribs (cf. *T. elongata* the most closely ribbed specimen of the seven figured by Lycett has only 19 ribs at a height of 52 mm.), which terminate abruptly at the marginal carina with a slight deflection towards the base of the shell. In the upper part of the shell the post carinal furrow undercuts the marginal carina, but towards the basal margin it dies away completely. The area and escutcheon are also more finely ornamented than in *T. elongata* and its varieties. In the right valve the raised posterior part of the area bears seven radial costellae, while only six radial costellae occur on the depressed anterior part of the area. The inner carina is strongly developed and almost as coarsely crenulated as the marginal carina. The tuberculated escutcheon is not so wide as in var. *lata*, and beneath the strongly incurved portion of the umbo it exhibits an early stage of minutely tuberculated concrescent ribs. The grooved cardinal teeth in the right valve are set at an angle of 40° to one another and are separated by a pronounced triangular septum. The ligamental plates are also well defined.

Horizon and Locality: *boueti*-Bed, near Crackmore Lodge; Highmores Hill, 2 miles N.E. of Sherborne.

Type specimen No. 62448, Geol. Surv. Museum Coll., presented by V. Wilson.

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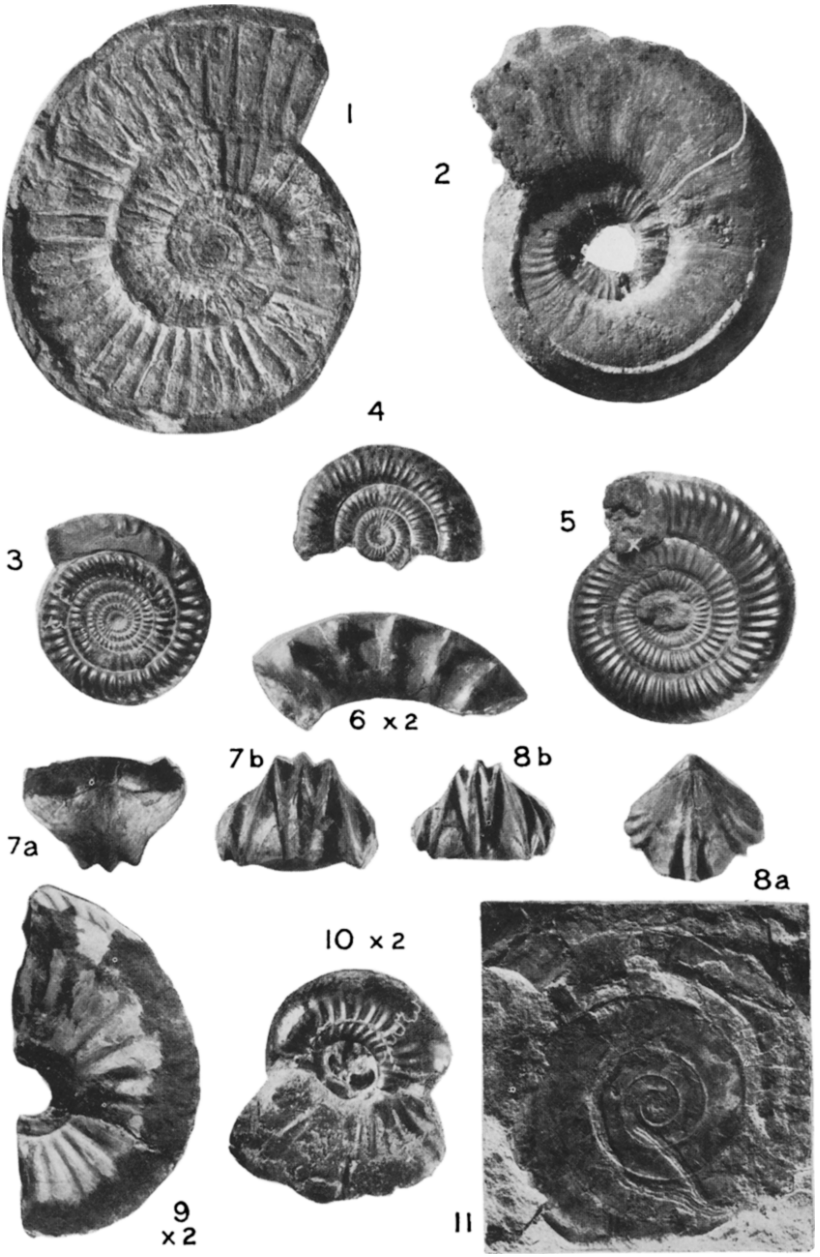
EXPLANATION OF PLATES 8–10.

All figures are natural size unless otherwise stated and the numbers refer to those in the registers of the Palaeontological Department of the Geological Survey.

PLATE 8.

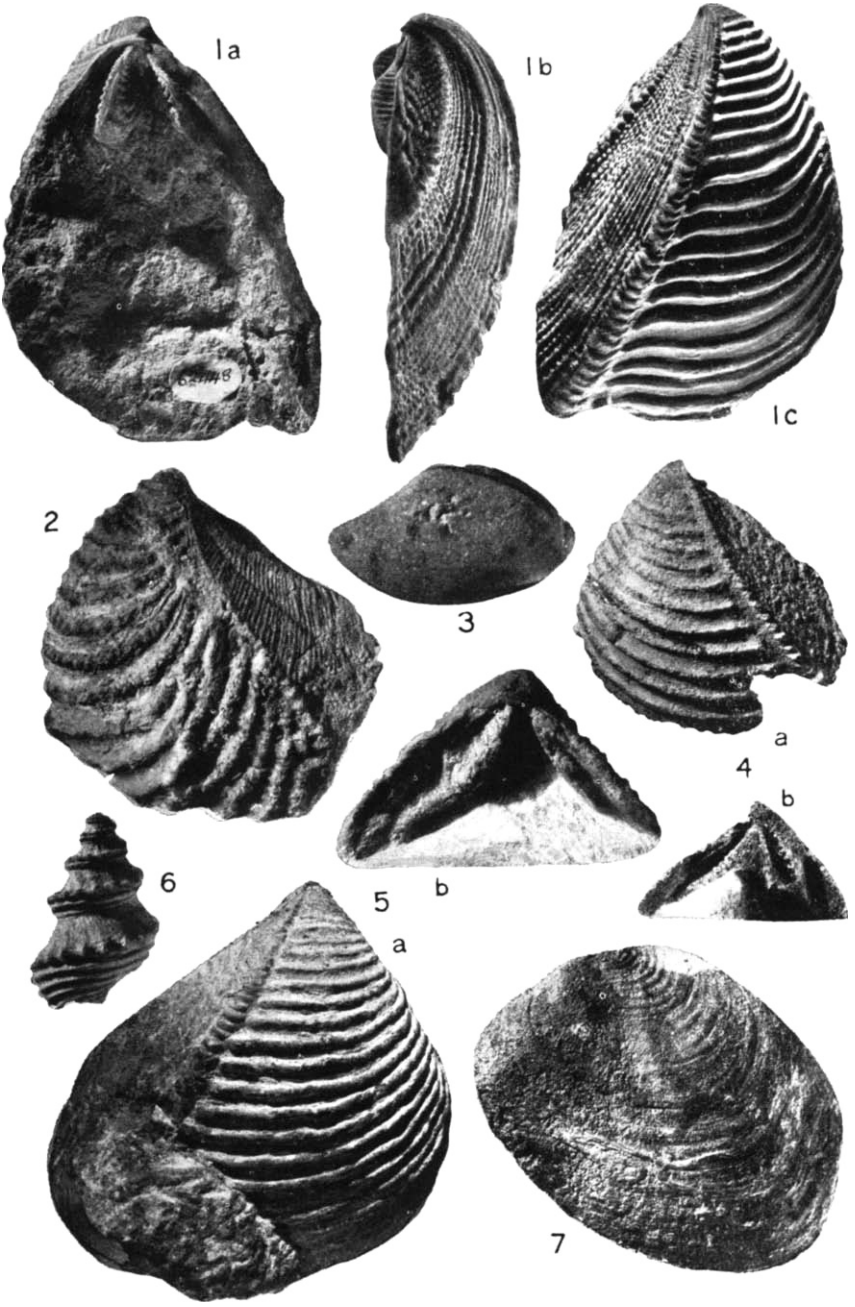
FIG. A. View from Camel Hill looking E. by S. Rhaetic and Triassic rocks with northerly dip outcrop in the banks of road in the left foreground. Immediately above is seen Sparkford Hill (densely wooded)—a part of the same E.–W. ridge, but separated from Camel Hill by a minor fault. South (right) of Sparkford Hill and Camel Hill the Triassic rocks are faulted against Lower Lias clays forming low ground in the middle distance. In the distance is the escarpment of the Inferior Oolite, with



J. Rhodes photos.

LIASSIC AMMONITES AND BRACHIOPODS FROM THE YEOVIL DISTRICT.

[*To face p.* 172



J. Rhodes photos.

FOSSILS FROM THE YEOVIL SANDS, *wattonensis*-BEDS AND *boueti*-BED.

[*To face p.* 172.

Corton Beacon forming the highest point. On the extreme right the edge of the Junction Bed platform gives the skyline.

FIG. B. The view is taken from the edge of the outcrop of the Inferior Oolite overlooking the Yeo Valley north of Oborne Village, which is seen in the middle distance. Immediately beneath the foreground is the erosional scarp of the major fault which runs through Poyntington and which is joined at this point by a north–south fault which follows the last (left) side of the Oborne Valley. The steep eastern face of the Oborne Valley and the well-marked saddle on the spur in the middle of the picture mark the line of the Oborne fault. The skyline is formed by the Forest Marble escarpment with the Fuller's Earth clays forming the intervening valley.

PLATE 9.

FIG. 1. *Arnioceras* sp. *semicostatum* zone or Lower part of the *obtusum* zone. Old Brickpit, Hornblotton Mill near Alford, Castle Cary, Somerset. No. 62457.

FIG. 2. *Dumortieria* aff. *moorei* (Lycett). The gammiradiate radial line has been marked in white. Upper part of Yeovil Sands *moorei* sub-zone (*jurensis* zone). Cutting on the Sherborne —Marston Magna road, Charlock Hill, two miles N.W. of Sherborne Railway Station, Dorset. No. 62454.

FIG. 3. *Echioceras* cf. *lepidum*. Trueman and Williams. The last two sutures marked in white. *raricostatum* zone Sutton, near Castle Cary, Somerset. No. 62460.

FIG. 4. *Echioceras* ("*Plesechioceras*") cf. *typus* S. S. Buckman. *raricostatum* zone. Sutton, near Castle Cary, Somerset. No. 62459.

FIG. 5. *Echioceras* ("*Plesechioceras*") cf. *typus* S. S. Buckman. Position of last suture marked, showing body chamber to be at least one whorl in length. *raricostatum* zone, Sutton, near Castle Cary, Somerset. No. 62458.

FIG. 6. *Bifericeras* sp. *oxynotum* zone. Sutton near Castle Cary, Somerset. No. 62461. x 2.

FIGS. 7, a, b. *Rhynchonelloidea cynica* (S. S. Buckman). Yeovil Sands *moorei* zub-zone (*jurensis* zone). Cutting on Sherborne-Martson road, Charlock Hill, two miles N.W. of Sherborne Railway Station, Dorset. No. 62456.

FIGS. 8a, b. As above, another specimen to illustrate the variation in the folding of the anterior margin of the shell. No. 62455.

FIG. 9. *Amaltheus* cf. *stokesi* (J. Sowerby). Middle Lias Marls, *margaritatus* zone. Near Brent Knoll railway station, Brent Knoll, Somerset. No. 62462 x 2.

FIG. 10. *Oxynoticeras* sp. juv. Suture marked in white. *oxynotum* zone, Sutton, near Castle Cary, Somerset. No. 23948 x 2.

FIG. 11. *Gemellaroceras peregrinum* (Haug.) *jamesoni* zone (*peregrinum* sub-zone). Chilthornehill Lane, Chilthorne Domer, near Yeovil, Somerset. No. 62463.

PLATE 10.

FIGS. 1a, 1b. 1c. *Trigonia elongata* J. de C. Sow,. var. *gracilis* nov. Three views of a right valve. *boueti*-Bed, near Crackmore Lodge. Highmore Hill, N.E. of Sherborne, Dorset. No. 62448.

FIG. 2. *Trigonia formosa* Lycett near var. *iata* Lycett. Yeovil Sands, east end of Chiselborough Hill, N.W. of East Chinnock. No. 62464.

FIG. 3. *Tancredia donaciformis* Lycett. View of a left valve. Yeovil Sands (***moorei*** subzone), Sherborne-Marston Magna road cutting, Charlock Hill, two miles N.W. of Sherborne Station, Dorset. No. 62451.

FIGS. 4a, 4b, 5a, 5b. *Trigonia charlockensis* sp. nov. (Syntypes). Views of left (4a 4b) and right (5a, 5b) valves. Yeovil Sands (***moorei*** subzone). Sherborne-Marston Magna road cutting, Charlock Hill, two miles N.W. of Sherborne Station, Dorset. Nos. 62452 and 62453.

FIG. 6. *Amberleya fowleri* sp. nov. (Holotype). The specimen lacks the extreme tip of the spire and the aperture. *wattonensis*-Beds, Gaul Hill, near Lake Farm, Thornford. No. 62449.

FIG. 7. *Astarte* cf. *elongata* S. S. Buckman. View of a left valve lacking part of the umbo. Yeovil Sands (***moorei*** subzone). Sherborne-Marston Magna road cutting, Charlock Hill, two miles N.W. of Sherborne Station, Dorset. No. 62450.