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Geology of the Shepton Mallet area (Somerset)

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Contributor

H C Ivimey-Cook (Jurassic biostratigraphy)

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1.1 Introduction

Apart from the urban sprawl of Shepton Mallet, the area is dominantly rural with only a scatter of small hamlets. The area is mostly underlain by Jurassic sediments, with the Blue Lias occupying over 50 per cent of the ground. Carboniferous rocks occur in some of the deeper valleys in the northern part of the area, with the Mercia Mudstone and Penarth groups cropping out mainly in the south-west. Higher parts of the Lias Group, together with the Inferior Oolite and Fuller's Earth crop out in the east of the area.

The highest ground is about 246 m O.D. in the north-east; the lowest ground is about 70 m O.D. in the south-west. The principal drainage is westwards via the River Sheppey in the north, and unnamed streams in the south-west.

Outside Shepton Mallet, agriculture is the main industry of the region with a predominance of dairy farming on the heavier soils, and arable farming on the lighter soils developed on the Inferior Oolite. There is very little woodland in the area. In the past, quarrying of limestone (Carboniferous, Blue Lias and Inferior Oolite) was an important industry, but extraction is now limited to the Inferior Oolite in the Doulting area.

The Shepton Mallet area of this report comprises 1: 10 000 Sheet ST64SW. Figures in square brackets are National Grid references and fall within 100-km square ST. The grid letters precede the grid numbers.

1.2 Previous work

The area was first geologically surveyed at the 1:63 360-scale by H W Bristow and forms part of the region covered by the Old Series one-inch Sheet 19 published in 1845. Revision of Sheet 19 was undertaken by J H Blake, W A E Ussher and H B Woodward between 1867 and 1871, and a second edition of the map was published in 1873. An explanatory memoir by H B Woodward of this map and maps of the adjoining districts – *The Geology of the East Somerset and Bristol Coalfields* appeared in 1876. A 3rd edition of Sheet 19, incorporating additional information collected during the preparation of J Prestwich's report to the Royal Coal Commission of 1871, was published in 1899. All these maps are hand coloured.

The northern half of the Shepton Mallet map was surveyed on the 1:10 560 scale by D R A Ponsford in 1954-55 and incorporated in the 1: 63 360 scale New Series Sheet 280 (Wells) and published in 1963; there was a second impression in 1967. The map was reconstituted with minor amendments onto a 1:50 000-scale base in 1984. The Memoir by Green and Welch for Sheet 280 was published in 1965; a second edition with some amendments in was issued in 1977.

The southern half of the Shepton Mallet map falls on the New Series Glastonbury (296) Sheet which was first published at the 1:63 360 scale in 1969. This sheet was based on Old Series sheets18 and 19, on Sheet 296 of the Soil Survey of England and Wales published in 1955, and a small area (near Maes Down) surveyed by Prof. M R House in 1954-56. The Glastonbury Sheet was republished without revision at the 1:50 000 scale in 1973.

The southern area and a small area of the northern area was surveyed on the 1:10 000 scale by C R Bristow in 1982, 2000 and 2002, and incorporates notes, observations and sections recorded by Prof. D T Donovan between 1984 and 2002. Some Drift and artificial deposit boundaries have been added to northern part of map.

Liassic macrofossils collected by CRB were identified by Dr H Ivimey-Cook (1992; 1993a; c). Other Jurassic fossils in the BGS collections have been re-examined by Dr Ivimey-Cook (1992). Fossils in the Bristol and Wells museums have been examined by DTD and their determinations have been incorporated in this account.

1.3 Geological Sequence

The solid formations (see Figure 1) mapped during the recent resurvey of Sheet ST64SW are listed in Table 1.

1.4 Geological terminology

In recent years, where possible, geological terminology has been rationalised and unified across the British Isles. Consequently, some generalised, older, terminology (i.e. ‘Lower Lias Clay’) or even more recent names (i.e. Pylle Clay) have been replaced by formally defined units of regional or UK-wide extent. Both the old and new terminology is shown in Table 3.

Thickness (m)	Symbol	Member/*Lithology*	Formation	GROUP	SYSTEM
up to 5	FER	Fuller's Earth Rock *Limestone, micritic, shelly*	Fuller's Earth	GREAT OOLITE	JURASSIC
5 to 10	LFE	Lower Fuller's Earth *Mudstone, calcareous*			
17	InO		Inferior Oolite *Limestone, bioclastic, oolitic*		
0 to 10	BdS		Bridport Sand *Sand, fine-grained, orange*	LIAS	
3	EML	Eype Mouth Limestone *Limestone, micritic, shelly*	Cephalopod Limestone		
1 to 3	MRB	Marlstone *Limestone, oolitic, common belemnites*			
Unconformity					
25 to 45	GAB	Green Ammonite Bed *Mudstone, silty*	Charmouth Mudstone		
0 to 5	SpLI	Spargrove Limestone *Limestone, fossiliferous*			
0 to 20	BVM	Black Ven Marl *Mudstone, dark grey*			
Unconformity					
7 to 20	BLi	*Limestone and thin interbedded mudstone*	Blue Lias		
0 to ?2	C(BLi)	*Mudstone, grey and purple*			
0 to 4	LpMb	Langport (=White Lias) *Limestone, micritic, pale grey*	Lilstock	PENARTH (PNG)	TRIASSIC
0 to 4.8	CtWb	Cotham Member (1.2) (*mudstone greenish grey*)			
			Westbury (3.6) *mudstone, dark grey*		
0 to 4.5	BAF		Blue Anchor *Mudstone, greenish grey*	MERCIA MUDSTONE	
0 to 40	MMG		*Mudstone, silty, reddish brown*		
	br	'Dolomitic Conglomerate' *breccia* (0 to 20?)			
	MMG				
Unconformity					
30 seen	HL		Hotwells Limestone *Limestone, bioclastic, crinoidal, massive*	HOTWELLS	CARBON-IFEROUS
60 seen	CDL		Clifton Down Limestone *Mudstone, calcitic*	CLIFTON DOWN	
25 seen	BO		Burrington Oolite *Limestone, crinoidal, oolitic*	BURRINGTON OOLITE	
25 seen	BRL		Black Rock Limestone *Limestone, dark grey, crinoidal*	BLACK ROCK	
5 seen	LSh		Lower Limestone Shale *Mudstone, dark grey; thin limestones*		
10 seen	PoB		Portishead Formation *Sandstone, reddish brown*	UPPER OLD RED SANDSTONE	DEVONIAN

Table 1. Generalised succession within Sheet ST64SW giving approximate thicknesses in metres. Not to Scale.

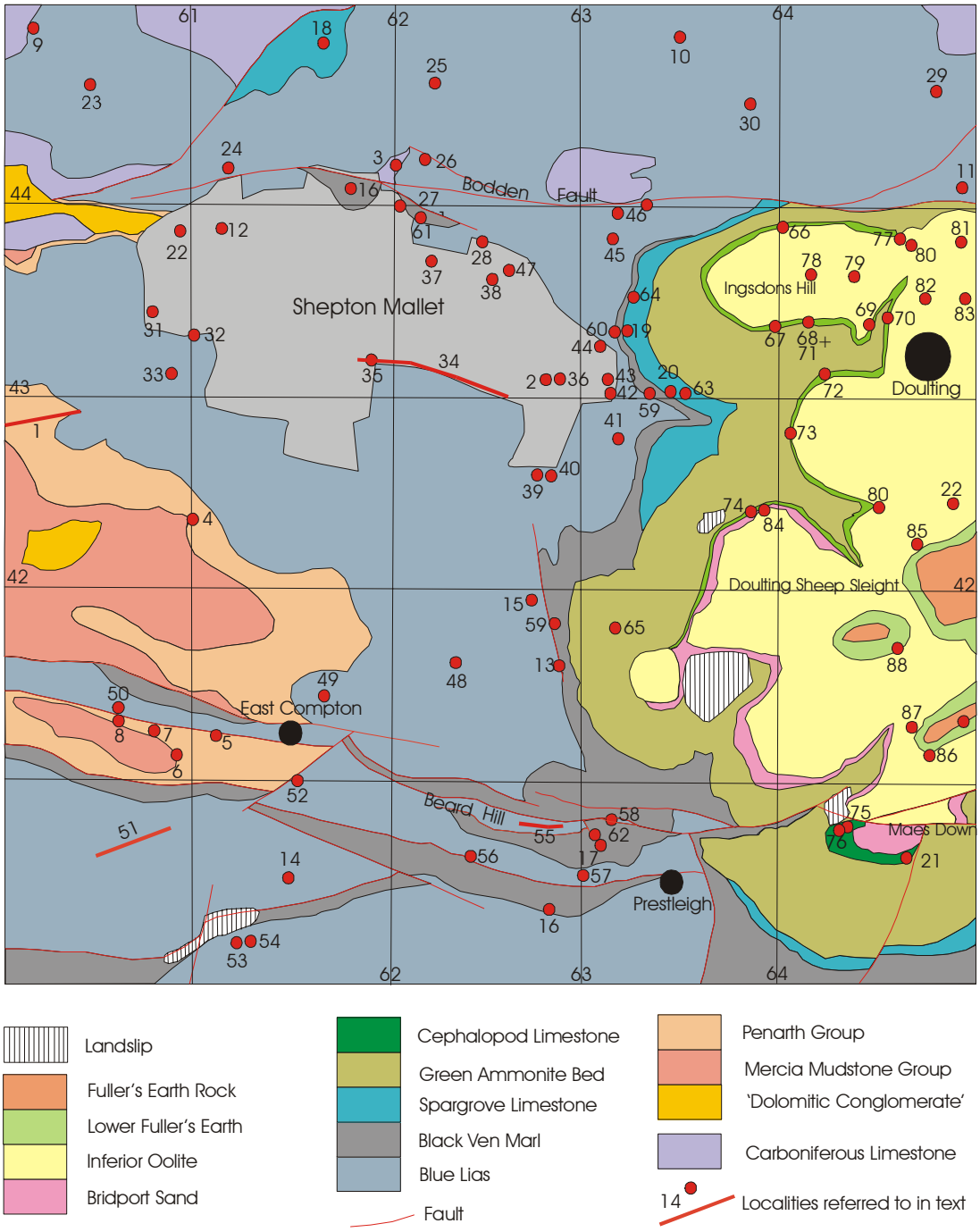

Figure 1. Sketch-map of the Solid geology and landslips of the Shepton Mallet area

2. DEVONIAN AND CARBONIFEROUS

There is only a very small outcrop, mostly hidden beneath drift, of the Devonian Portishead Beds in the north-east of the area. It is not considered further in this account.

Carboniferous strata crop out in the north-west of the area, principally in the bottom of some of the deeply cut valleys. There is an inlier [630 442] north-east of Shepton Mallet, and a small outcrop [649 448] in the north-east of the area. These strata have not been re-examined during the current resurvey and there is no additional detail to that which appears in Green and Welch (1965).

3. TRIASSIC

The Triassic strata are divided into two unequal groups (Table 2): an older, thick, unit of non-marine, dominantly reddish brown (apart from the highest strata), silty mudstones, and a younger, thin unit of lagoonal and marginal marine mudstones and limestones.

Group	Formation	Member
Penarth	Lilstock	Langport
		Cotham
	Westbury	
Mercia Mudstone	Blue Anchor	
	Unnamed ('Keuper Marl')	

Table 2. Lithostratigraphical classification of the Triassic strata

3.1 Mercia Mudstone Group

The Mercia Mudstone (formerly known as the Keuper Marl) consists of a lower, unnamed, unit of reddish brown, silty to sandy mudstones with minor intercalations of siltstone and sandstone, capped by grey and green calcareous mudstone and siltstone of the Blue Anchor Formation (formerly the Tea Green Marl and Grey Marl). Locally, and usually at the base of the group, is a breccia/conglomerate composed dominantly of dolomitised clasts of Carboniferous Limestone and known as the 'Dolomitic Conglomerate'. In the present area, such a deposit occurs in the valley on either side of the Wells Road in the north-west of the area [around 601 440], and west of Lambert's Hill Farm [604 423] where it appears to be in the middle of the group.

3.1.1 Unnamed formation ('Keuper Marl')

The principal outcrop of the Mercia Mudstone Group in the present area, occurs in the west [around 605 420], but there is a small, anticlinal, inlier [605 413] south of Elm Farm, and on either side of the Wells Road in the north-west of the area. The only section reported

was in the railway cutting between Wells and Shepton Mallet [600 428]. This is the Three Arch Bridge section of Richardson (1911) and Duff et al. (1985). The section was measured by Moore soon after it was exposed (Moore, 1867, p. 505) and, apparently independently, by H. B. Woodward, W. A. E. Ussher and J. F. Blake who published it on Sheet 46 of the Geological Survey's Vertical Sections, 1873. The latter section gives more detail and is in reasonable agreement with Moore's. Woodward et al. (1873) recorded celestine and pseudomorphs after halite in the uppermost part of the 'Keuper Marl'.

3.1.2 'Dolomitic Conglomerate

In the present area, the 'Dolomitic Conglomerate' is really a breccia. It is exposed in the lane bank [6013 4230] west of Lambert's Hill Farm and appears to have been quarried in a small way in the field immediately on the other side of the lane. There, large blocks up to 1 m across can be seen with angular clasts of dolomitised limestone up to 10 cm across. Large blocks of breccia have been cleared from the field to the north and placed in a field corner 6008 4246].

Blue Anchor Formation

The formation was formerly well exposed in the Three Arch Bridge section [6015 4287] (Figure 1, Locality **1**; Figure 2), The lower part consists of grey 'marls' and argillaceous limestone, 2.67 m thick according to Moore and 2.79 m according to Woodward et al., i.e. about 2.75 m thick. The thinner upper division includes clay beds up to about 0.3 m thick (see Figure 2). It is 1.27 m thick according to Moore and 1.78 m according to Woodward et al. The total thickness for the Formation according to Woodward et al. is 4.57 m. This is much thinner than in the central Somerset basin where a minimum of about 30.5 m was noted south of Wedmore by Green and Welch (1965, p. 68).

3.2 Penarth Group

The Penarth Group in the area consists essentially of a lower mudstone sequence (Westbury Formation and Cotham Member) and an upper, dominantly, limestone sequence (Langport Member), and is a standard facies for the Somerset area (Figure 2). The Group thins from central Somerset towards the western part of the present area, where it has a maximum thickness of about 9 m. Green and Welch (1965, p. 69) estimate the maximum thickness in the central Somerset basin, presumably within their map area of the Wells (280) sheet, to be 10.7 m. Moore (1867, pp. 461, 462) recorded about 19 m of Penarth Group at Camel Hill railway cutting [approx. 590 250], about 18 km south of the present locality, and further west at Charlton Mackrell railway cutting [525286], Richardson (1911, pp. 40-42) recorded 14.5 m. It is even thinner, if present, beneath east Shepton Mallet, where a borehole [6280 4311] (Locality **2)**, about 2.7 km east of the Three Arch Bridge section showed 1.8 m of black shale, possibly Westbury Formation, beneath 20.9 m of limestones with thin clay beds (?Lilstock Formation + Blue Lias), resting on Carboniferous Limestone. It is reduced to a conglomerate at Waterloo Road, Shepton Mallet, north of the Bodden Fault [c. 620 441] (Locality **3**). There, Moore (1867, p. 507) recorded conglomerate, 0.3 m thick in several beds, resting on Carboniferous Limestone. It was composed of rounded pebbles with many 'Rhaetic' teeth and bones. Moore noted *Rhaetavicula* which indicates that the conglomerate is of Westbury Formation age. The section is now obscured.

It is possible that the uppermost member, the Langport Member or White Lias, transgresses northward beyond the earlier units of the Penarth Group.

3.2.1 Westbury Formation

This consists dominantly of black, thinly laminated shales ('paper shales') with pyrite, with occasional thin limestone beds, a few centimetres thick at most. The basal bone bed, present at many localities, is not recorded in the Shepton Mallet area, though it is present near Wells about 6.4 km to the north-west (Green and Welch, 1965, p. 84). Woodward et al. (1873), at the Three Arch Bridge section (Figure 1, Locality **1**; Figure 2), record a basal impersistent 'nodular band of hard compact limestone' up to 10 cm thick which may represent the bone bed. Moore (1867) and Woodward et al. (1873)

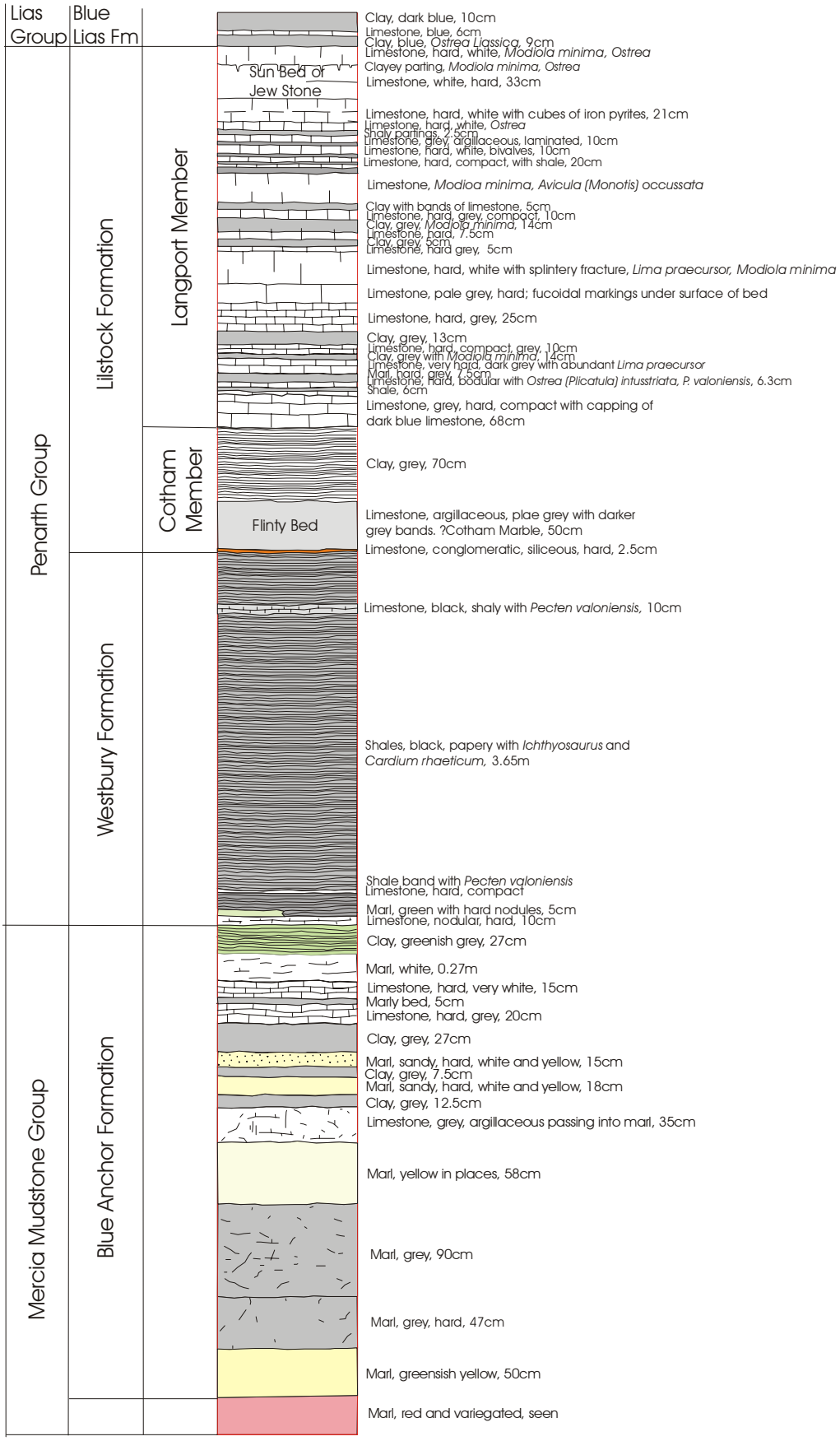

Figure 2. Lithological section through the Penarth Group (after Woodward, Ussher and Blake, 1873)

both record a thickness of 3.66 m for the Westbury Formation. Richardson (1911, p. 60) made the formation slightly thinner at 3.45 m.

Moore (1867) recorded metacarpal bones of the dinosaur *Scelidosaurus,* Woodward et al. (1873) noted *Ichthyosaurus*. Richardson (1911) recorded the fish *Gyrolepis*. Bivalves include *Rhaetavicula contorta* (Portlock), *Chlamys valoniensis* (Defrance) and *Protocardia rhaetica* (Merian), all common elements of the Westbury fauna.

In 1983, the then Nature Conservancy Council re-exposed the upper 2 m of the Westbury Formation (Duff et al., 1985, p. 78) on the south side of the cutting immediately east of the road bridge [6019 4286]. Attempts to preserve the section from infilling of the cutting have been unsuccessful.

3.2.1.1 Cotham Member

In the railway cutting, a basal 'hard siliceous conglomerate limestone with small pebbles of Carboniferous Limestone', 2.5 cm thick, is succeeded by 0.46 m of 'light grey slightly argillaceous limestone with dark grey bands; smooth fracture' (Woodward et al., 1873; Figure 2). Moore thought that this bed might represent the Flinty Bed, a very fossiliferous limestone at Beer Crowcombe, south-east of Taunton (Moore, 1861, p. 486). Woodward et al. (1873) thought that it could represent the Cotham Marble, a nodular algal limestone present in the Cotham Member at many localities. It was succeeded by clay, 0.71 m thick in Woodward et al.'s (1873) section, and 0.91 m in Moore's (1867) version. Duff et al. (1985, p. 79) give a different sequence, presumably measured in a different place from the others:

	Thickness m
Dark green/grey sticky clay	0.60
Green/grey laminated marly limestone with a layer rich in sand grains; broken shells and fish teeth 2 - 5 cm below the top	0.20
Laminated greenish marl grading down into clay	0.20
Light grey/green clay, unfossiliferous	0.25
Total	1.25

They correlated the laminated marly limestone with the light grey, slightly argillaceous, limestone of Woodward et al. (1873), but this seems uncertain. The basal conglomerate is

absent from their section. In view of the dominance of grey clay over limestone in the thin Cotham Member, it has been mapped with the underlying Westbury Formation.

3.2.1.2 Langport Member

The Langport Member, formerly the White Lias, consists of an alternating sequence of hard, pale grey ('white') limestones with thin units of interbedded clay (Figure 2). At the top is a distinctive bed, 0.3 to 0.4 m thick, of hard, porcellanous limestone with a bored and convoluted upper surface. It is this bed, the Sun Bed or Jew Stone, which forms such a good reflective surface and is such an excellent marker on geophysical logs.

3.2.2 Details

3.2.2.1 Langport Member

The Langport Member in the railway cutting section (Locality **1**) consists of typical White Lias facies: alternating beds of hard, grey, whitish-weathering, fine grained limestone, up to about 0.3 m thick, alternating with thin beds of clay. Moore recorded 4.27 m, Woodward et al. 3.89 m, Duff et al. (1985) 3.35 m, but their section is incomplete at the top.

Blocks of Sun Bed are common in brash [6098 4231 and 6101 4220] to the east of Lambert's Hill Farm (Locality **4**).

Large blocks of the Sun Bed were dug out of a shallow trench [6111 4122] just south of the A361 near High House (Locality **5**). Farther south-west, there is a loose block of the Sun Bed, measuring 0.6 by 0.3 by 0.15 m thick, on the surface [6088 4113] (Locality **6**). It consists of a buff-grey, porcellanous limestone with a bored upper surface. Some of the burrows are vertical, circular and 1 cm in diameter; others are sub-horizontal. A few of the burrows are rectangular, 8 by 3 mm and vertical. Another loose block [6079 4128] was seen about 150 m NW (Locality **7**). Limestones low down in the Langport Member dip 14°NE some 200 m west [6059 4130] (Locality **8**).

Debris of porcellanous limestone of Langport type occurs at the western margin of the area on the south-eastern flank of the Ham Woods ravine [at approximately 602 449] (Locality **9**) showing that the Langport Member is present there between the Burrington Oolite (Carboniferous) and the Downside Stone. (DTD)

A possible occurrence of the Penarth Group is in a quarry [635 448] on the east side of the Fosse Way, south-west of Beacon Hill Farm (Locality **10**). The upper part of the

section shows Downside Stone. The lower part was recorded as follows (Donovan, 1958, p. 135):

	Thickness m
Porcellanous limestone of White Lias lithology	1.52
As above, but coarser grained	2.13
Granular, crystalline limestone, in finer- and coarser-grained beds, similar to the top beds of the section (i.e. Downside Stone)	seen 3.50

If the porcellanous limestone is White Lias (i.e. Langport Member), then the beds below it must belong to the Penarth Group and be, perhaps, marginal facies of the Langport or Cotham members. The alternative interpretation of a 'White Lias' type intercalation in the Downside Stone seems unlikely, but cannot be excluded.

4 JURASSIC (LOWER)

4.1 Lias Group

The Lias Group crops out over about 75 per cent of the district and, except for the Bridport Sand at the top, comprise an alternating succession of limestones and mudstones that form part of a coarsening- and shallowing-upwards sequence, dominated in the lower part by limestone, with varying amounts of silt and thin mudstone units, then passing up into more silty strata and thicker mudstone units. These characteristics are used to divide the Lias into lithostratigraphical units (Table 3).

The base of the Jurassic System is taken at the lowest occurrence of *Psiloceras planorbis* in the lower part of the Blue Lias. The Blue Lias thus spans the Triassic/Jurassic Stage boundary, but for convenience, it is treated in its entirety in this chapter.

The Lias ranges in thickness from about 7 to ?20 m in the district. In the adjacent, more basinward, Wincanton district to the east, Lias strata are affected by the syn-sedimentary Warminster Fault. North of this structure, which showed largely down-to-the-south movement during Lias deposition, many units are thin or absent, but nevertheless, the total sequence may be more than 60 m thick.

In the present and adjacent districts, all the Lower Jurassic ammonite zones (Table 3), except the *turneri* Zone (this may be present in the Windsor Hill fissure fill), have been proved. Whilst some subzones are unproven due to non-exposure, others are absent due to non-sequences.

4.1.1 Blue Lias (Formation)

In North Somerset, the Blue Lias consists of three contrasting facies. Around Shepton Mallet [619 444 and 635 448], is a littoral' facies, the *Downside Stone* (Richardson, 1911). Up to 20 m of massive, coarse-grained, detrital limestone, locally conglomeratic, but with no argillaceous beds, and with abundant bivalves and gastropods, but only rare ammonites of Hettangian and earliest Sinemurian (*bucklandi* Zone) age, mark the site of shallow-water deposition on the south flank of the Mendips high. The southern boundary of this facies is more-or-less the line of the Bodden Fault and its eastwards continuation, the Cranmore Fault.

Stage	Zone	Subzone	Green & Welch (1965)	Bristow and Westhead (1993)	This account	
TOARCIAN	*levesquei*	*aalensis*	strata missing	Bridport Sands	Bridport Sand Formation	
		moorei				
		levesquei				
		dispansum		Down Cliff Clay	?missing	
	*thouarsense**	*fallaciosum*	Upper Lias Limestone	Barrington Beds	Eype Mouth Member	Cephalopod Limestone Formation
		*striatulum**				
	*variabilis**					
	*bifrons**	*crassum*				
		fibulatum				
		commune				
	*falciferum**	*falciferum**				
		*exaratum**	missing			
	tenuicostatum	*semicelatum*		Marlstone	Marlstone	
		tenuicostatum				
		clevelandicum				
		paltrum				
PLIENSBACHIAN	*spinatum**	*hawkerense**				
		*apyrenum**				
	*margaritatus**	*gibbosus*				
		subnodosus				
		stokesi		Pennard Sands	?missing	
	davoei	*figulinum*	Lower Lias Clay	Ditcheat Clay	Green Ammonite Bed Member	Charmouth Mudstone Formation
		capricornus				
		maculatum				
	*ibex**	*luridum*		Spargrove Limestone	Spargrove Limestone Member	
		valdani				
		masseanum				
	*jamesoni**	*jamesoni*		Pylle Clay	Black Ven Marl Member	
		*brevispina**	Blue Lias (Downside Stone)			
		polymorphus				
		taylori				
SINEMURIAN	*raricostatum**	*aplanatum*	Strata thin (and not recognised) or absent			
		macdonnelli/ raricostoides*				
		densinodulum				
	*oxynotum**	*oxynotum**				
		simpsoni				
	obtusum	*denotatus*				
		stellare				
		obtusum				
	*turneri**			?strata missing	?strata missing	
	*semicostatum**	*resupinatum*				
		scipionianum	Blue Lias			
		*lyra**		Blue Lias	Blue Lias Formation	
	*bucklandi**	*rotiforme**				
		*conybeari**				
HETTANGIAN	*angulata**					
	*liasicus**	*laqueus*				
		portlocki				
	*planorbis**	*johnstoni**				
		*planorbis**				

*Zones and Subzones proved in the Shepton Mallet area

Table 2. Correlation of the Hettangian, Sinemurian, Pliensbachian and Toarcian strata in the Shepton Mallet area.

Locally, in the Chelynch area, there is a thick bed of mudstone (>0.9 m) in the lower part of the Blue Lias Formation (Locality **11)**.

Moore (1867, pp. 509, 557-565) and Green and Welch (1965, pp. 102-103) listed the fossil fauna of the Downside Stone. It includes the solitary coral *Montlivaltia*, the stalked barnacle *Eolepas rhomboidalis* (Moore) and the inarticulate brachiopod *Orbiculoidea(?) davidsoni* (Moore). The bivalves, names updated as far as possible, are:

Atreta intusstriata (Emmrich), *Cercomya deshayesi* (Terquem), *Chlamys pollux* (d'Orbigny), *Ctenostreon tuberculatus* (Terquem), *Gryphaea arcuata* Lamarck, *Liostrea hisingeri* Nilsson, *Modiolus hillanus* (J. Sowerby), *Myoconcha psilonoti* Quenstedt, *Oxytoma decussata* (Münster in Goldfüss), *Pinna semistriata* Terquem, *Plagiostoma giganteum* J. Sowerby, *P. punctatum* J. Sowerby, *Pseudolimea hettangiensis* (Terquem), *Terquemia arietis* (Quenstedt).

These are mainly epifaunal genera, although *Cercomya* and *Pinna* live within the sediment. Moore recorded several genera of epifaunal gastropods. The earliest ammonite recorded is *Psiloceras*, probably indicating the *planorbis* Subzone. The latest ammonite is *Coroniceras rotiforme* which proves the subzone of that name. Richardson (in Reynolds, 1912, p. 120) reported evidence for the `*gmuendense*-hemera', i.e. early *semicostatum* Zone. Moore's (1867) record of '*Am. obtusus*', which would be interpreted as a species of *Asteroceras* and therefore Upper Sinemurian, is thought to have been a misidentification.

At Ham Woods, just outside the western limit of the map, Green and Welch (1965, p. 104) recorded `up to 55 feet' (16.75 m) of Downside Stone, and this may be near the greatest thickness. The `50-100 feet' (15-30 m) of Green and Welch (1965, p. 91) seems excessive.

South of the Bodden/Cranmore faults, the Blue Lias consists of coarsely crystalline to fine-grained and argillaceous, bedded limestones, in beds usually less than 0.3 m thick, interbedded with thin mudstones. This 'Bowlish' facies, formerly exposed at Bowlish [6118 4392] (Figure 3; Locality **12**) and near Cannard's Grave [629 416] (Figure 4; Locality **13**), where it is greater than 8 m, and 7.2 m thick respectively (Donovan, 1958b; Green and Welch, 1965), is also of Hettangian and earliest Sinemurian age. The 'Bowlish' facies passes rapidly southwards into the more 'normal' basinal facies of the Blue Lias, either gradually or perhaps abruptly across the

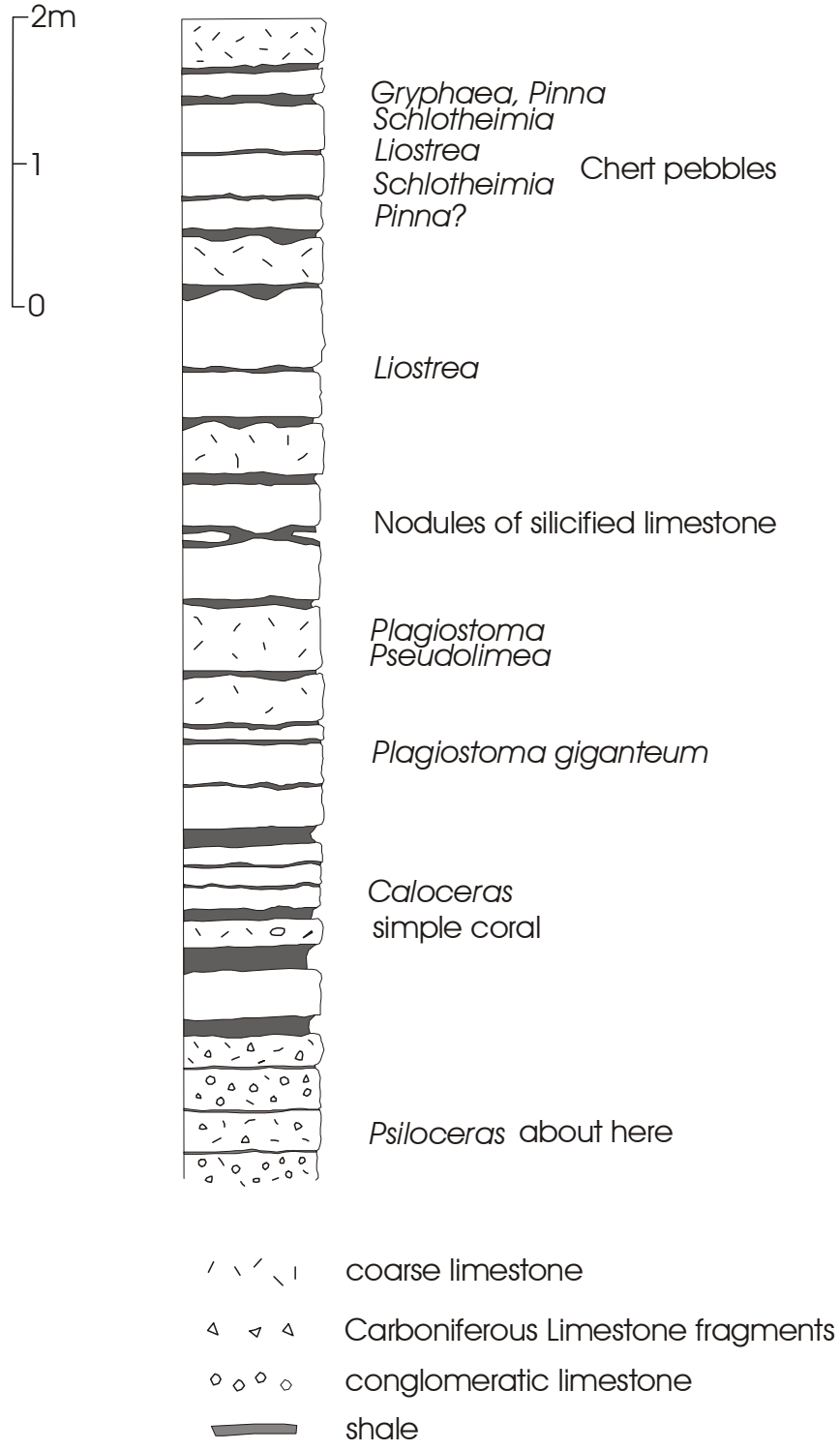

Figure 3. Section through the basal Lower Lias at Bowlish on the approach road to the housing estate

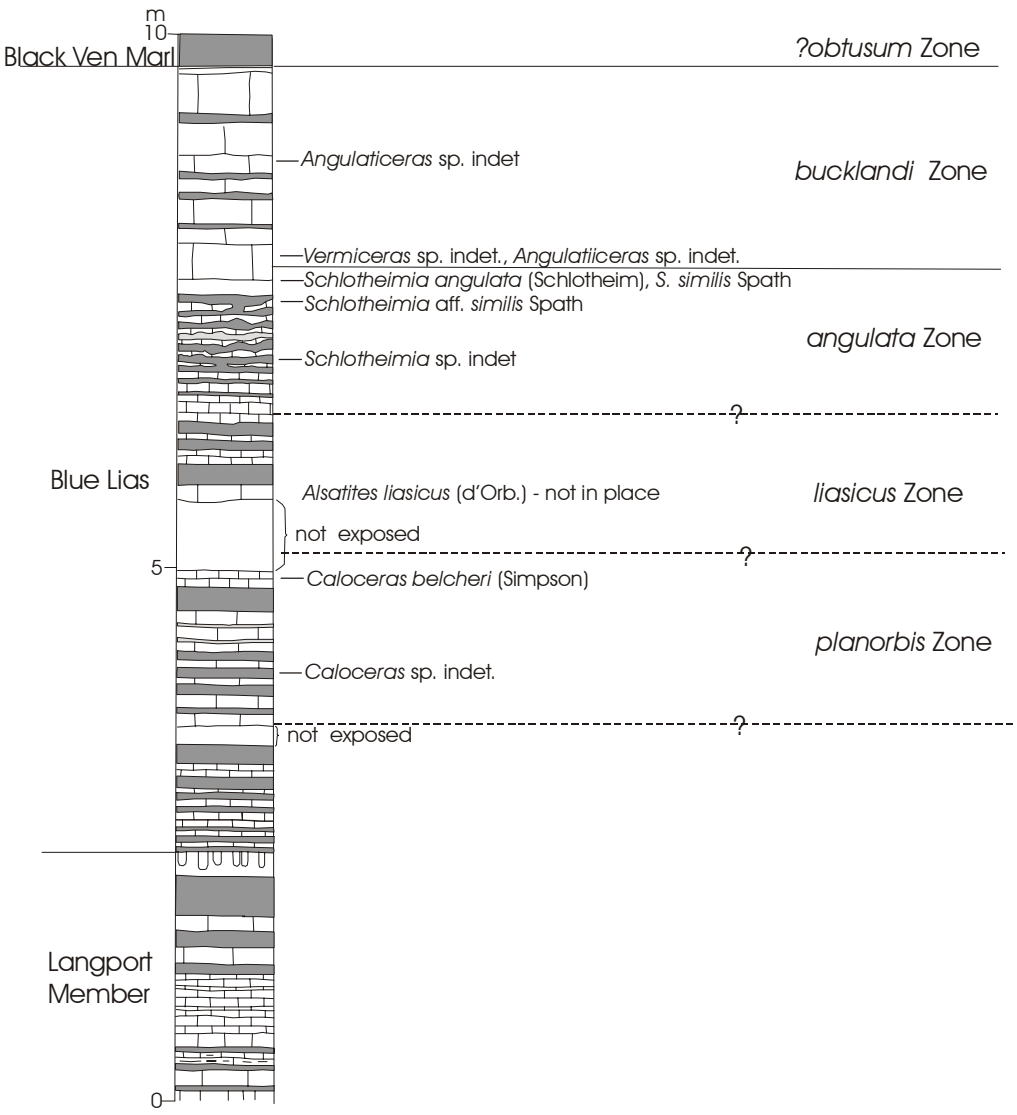

Figure 4. Section in the upper part of the Langport Member, Blue Lias and Black Ven Marl in old railway cutting east of Cannard's Grave

WarminsterFault and its westward continuation through Maes Down and the fault complex passing through Prestleigh and Beard's Hill.

The Blue Lias at outcrop consists of alternating muddy limestones, in beds generally 0.1 to 0.2 m thick, but locally up to 0.3 m, and thin, interbedded silty mudstones. Limestones are dominant, forming up to 80 per cent of the succession. In the more southern, basinward, exposures, mudstones dominate, as in the railway cutting at Pylle [6065 3870] just south of the district.

The Blue Lias ranges from latest Triassic to Early Sinemurian in age. The oldest strata to crop out in the district belong to the *planorbis* Zone (Donovan, 1958b; Green and Welch, 1965). The youngest strata probably belong to the *semicostatum* Zone, *lyra* Subzone, as proved in the south of the area [6156 4048] (Locality **14**)(Ivimey-Cook, 1993a), and seen by DTD during roadworks at Cannard's Grave in 1995 (Locality **15**).

4.1.2 Charmouth Mudstone (Formation)

4.1.2.1 Black Ven Marl (Member)

The Black Ven Marl (the Pylle Clay of Bristow and Westhead, 1993) is equivalent to the Lower Lias Shales of Duff et al. (1985), and the lower part of the Lower Lias Marls of Kellaway and Wilson (1941).

The Black Ven Marl crops out in the south and east of the district; there is a small outlier at Shepton Mallet Cemetery [619 440] (Locality **16**) (Green and Welch, 1965, p.104). The southern outcrops are fault-repeated by strike faults. The characteristic dark grey colour is evident in both weathered and unweathered sections; a few thin muddy limestones occur.

In the south, the member is about 15 to 20 m thick, but it thins northwards. On the west side of Ingsdons Hill, the Black Ven Marl is only about 1 to 2 m thick. On Windsor Hill in the north, the member could not be proved beneath the Spargrove Limestone and is probably absent or very thin.

The member is richly fossiliferous. To the south (Hollingworth et al., 1990) and west (Donovan et al., 1989), the Pylle Clay includes beds that range from the *obtusum* Zone, *stellare* Subzone to the *raricostatum* Zone, *raricostatoides* Subzone. At Cannard's Grave (Locality **13**), the *oxynotum* Zone and Subzone were proved (Figure 4) (Donovan, 1958b), but there was no evidence of the underlying *obtusum* Zone and there, the latter may be

missing, but its probable presence is indicated by *Arnioceras* in the basal part of the Member in a trench [6284 4035] on the north side of the Bristol and West Showground (Locality **16**). At Prestleigh, the *oxynotum* [6314 4075] and *raricostatum* [6311 4072] zones were proved by fossils from brash in a small faulted outcrop (Locality **17**).

4.1.2.2 Spargrove Limestone (Member)

The Spargrove Limestone (Bristow and Westhead, 1993) comprises up to 2.5 m of interbedded muddy limestones, in beds up to 0.1 m thick, and thin silty mudstones, that crop out in the east and north of the district (Locality **18**) (where it was formerly included as part of the Downside Stone facies of the Blue Lias (Green and Welch, 1965, p. 103)). In the Alham Borehole [6793 4118] east of the district, 7.6 m of massive limestones overlie the Blue Lias (the Black Ven Marl is missing, possibly represented by an erosion surface at about 98 m depth). The Jamesoni and Valdani limestones of the Radstock area, north of the Mendips, are an approximate equivalent of rather different lithology (Tutcher and Trueman, 1925; Green, 1992). South of the district, on Pennard Hill, the member is absent.

A rich ammonite fauna (detailed in Bristow and Westhead, 1993; Westhead, 1994, and Ivimey-Cook, 1993a) indicates all subzones between the *jamesoni* Zone, *jamesoni* Subzone, and *ibex* Zone, *luridum* Subzone, with most of the member falling in the latter Zone (Table 3). The *jamesoni* Zone was proved by *Uptonia?* on the west and south-west side of Ingsdons Hill [6327 4346 (Locality **19**) to 6340 4306 (Locality **20**)], and in the lane [6169 4487] on the south side of Windsor Hill (Locality **18**).

4.1.2.3 Green Ammonite Bed (Member)

The Green Ammonite Bed (the Ditcheat Clay of Bristow and Westhead (1993)) equates with the upper part of the Lower Lias Marls of Kellaway and Wilson (1941) and the Belemnitiferous and Micaceous Marls of Wilson et al. (1958).

The member crops out on the east side of the area south of Bodden, and consists of pale to medium grey, silty mudstone and silt, weathering to a characteristic mottled orange and grey; a few siltstone and ironstone nodules, and silty limestones, up to 0.15 m thick, occur. The parent material of the soil from a trial pit [636 438] by the Soil Survey was described as a `micaceous, silty clay loam' with 36 per cent clay (<2 μm) and 54 per cent silt (2-50

μm) (Findlay, 1965, pp. 97, 142). The outcrop is prone to landslips, both large [637 415] and small [6409 4077].

The member is about 45 m thick in the south, thinning to about 35 m on Whitstone Hill, to about 30 m on the west side of Doulting Sheep Sleight, to about 25 m on the west side of Ingsdons Hill, beyond which it is cut out by the Bodden Fault. An erosional remnant occurs north of the present area near Thrupe (Green and Welch, 1965, p. 103).

Fossils are scarce, but include *Androgynoceras* cf. *maculatum* from the old brickpit [6385 3700] north-east of Ditcheat (Kellaway and Wilson, 1941), and *Androgynoceras* sp. on the south side of Pennard Hill (Donovan et al., 1989). These ammonites indicate the *davoei* Zone, *maculatum* or *capricornus* subzones. Just east of the district, a section [6657 3926] with *Beaniceras crassum* and *Lytoceras fimbriatum* show the presumed basal beds of the Green Ammonite Bed to belong to the *ibex* Zone, middle *luridum* Subzone. As the top of the Spargrove Limestone also falls in the *luridum* Subzone, the junction between these two units is there dated fairly precisely, but elsewhere, the top of the Spargrove Limestone may range up into the basal *davoei* Zone (see above).

4.1.3 *Dyrham Formation*

In the present area, the Dyrham Formation (Pennard Sands of Bristow et al. 1999) is apparently absent, being cut out beneath the Marlstone. However, because the upper, very silty part of the Green Ammonite member has not yielded any fossils, it is impossible to say whether the Dyrham Formation is represented by silty clay at the top of that member, or to determine the possible extent of the unconformity below the Marlstone/Beacon Limestone Formation.

4.1.4 Cephalopod Limestone (Formation)

The Cephalopod Limestone (Beacon Limestone Formation of the revised Frome (281) sheet, 2000), better known as the Junction Bed, is a thin, but widespread, condensed deposit, 1 to 3 m thick, that spans the Pliensbachian/Toarcian Stage boundary and encompasses six ammonite biozones (Table 3). The Cephalopod Limestone is divisible into a lower Marlstone [Rock Bed] and an upper Eype Mouth Member (the Barrington Beds of Bristow and Westhead, 1993; the Upper Lias Limestone of Kellaway and Wilson (1941)). The Marlstone comprises oolitic, belemnitiferous, grey, commonly

ferruginous-weathering calcarenite, with mudstone clasts and pebbles. The thickness is about 1.5 m, although 3 m were recorded at Maes Down [c.645 406] (Locality **21**) (Richardson, 1906). Fauna from Pennard Hill, south of the district, indicate that the Marlstone ranges from the *margaritatus* Zone up into the *tenuicostatum* Zone, *semicelatum* Subzone (Table 3). The Eype Mouth Member comprises up to 3 m of sparsely oolitic micrites and calcarenites with common ammonites and rare belemnites. They span the *falciferum* to *thouarsense* zones.

In the district, the Cephalopod Limestone is mostly mapped as an undivided unit. In places, such as north-west of Maes Down, it is appears to be cut out beneath the Bridport Sand.

4.1.5 Bridport Sand (Formation)

Fine-grained silty sands and calcareous sandstones, principally of mid to late Toarcian age, with some of earliest Aalenian age, crop out in an arc through western Dorset and south Somerset. Within this tract, they have been variously named (Arkell, 1933), but the term Bridport Sand has now been adopted for these sands.

The member crops out in the east of the district and commonly forms the steep slopes of scarps capped by Inferior Oolite.

The base of the Bridport Sand in the present district is probably locally unconformable, cutting out the Cephalopod Limestone in places. Locally, some or all of the formation has been removed by erosion prior to the deposition of the Inferior Oolite.

Characteristically, yellow and orange-weathering, friable, silty, fine- and very fine-grained sandstones are in rhythmic alternation with more calcareous sandstone doggers. The maximum thickness is about 10 m.

4.2 Controls on Lias deposition

The Lias of the north Somerset region can be divided into three palaeogeographical domains, - the *Radstock Shelf*, north of the Mendip Hills (and not considered further in this account)), the *Mendips Littoral Area*, and the *Central Somerset Basin* lying south of the Mendips (Kellaway and Wilson, 1941).

A 1 to 3 km wide 'littoral', or near-shore, high-energy, shoal environment developed on both sides of the axial area, and is characterised by the Downside Stone facies of Hettangian and Lower Sinemurian age. Such sediments, commonly thicker than their offshore equivalents and particularly well-developed around Shepton Mallet, are limited to the south by the Bodden and Cranmore faults. The southwards transition, (through the Bowlish facies) into 'normal' facies in the Central Somerset Basin, in which the southern part of the present district mostly falls, is rapid (Green, 1992). In the basin, up to 650 m of shales, thin limestones and sands represent 'normal' deposition in a relatively deep-water, offshore, marine-shelf environment (Cope et al., 1980a; Duff et al., 1985).

The Pylle Clay/Black Ven Marl wedges out northwards at Shepton Mallet and may not have been deposited over the Mendip ridge, though it could also have been removed by erosion before the succeeding shallow-water limestones were deposited. The Spargrove Limestone is the approximate equivalent of the Jamesoni Limestone in the Radstock area to the north, both being relatively condensed deposits. North of the Shepton Mallet area, loose blocks were noted [605 469] (Green and Welch, 1965, p. 103; as Downside Stone, but with a brachiopod fauna said to be of Lower Pliensbachian age). There, it has presumably overlapped earlier members to rest on Upper Palaeozoic rocks, but the mapping is unclear due to extensive areas of Head. It is unknown whether the Spargrove/Jamesoni Limestone was once continuous over the Mendip summit; it could have been, as it overlaps southwards on to Carboniferous Limestone at Upper Vobster [707 497].

The Green Ammonite Bed/Ditcheat Clay may have been deposited continuously across the Mendips, as the change to muddy sedimentation after limestone in the Shepton Mallet and Radstock areas evidently marks a transgression. The northernmost occurrence south of the ridge is near Thrupe, where a stream section showed clay with *Androgynoceras* sp. juv.

cf. *maculatum* (Young & Bird) resting on Spargrove Limestone (Green and Welch, 1965, p. 103).

Toarcian sediments deposited across the Mendips axis were largely removed by erosion in the Early Bajocian. A major transgression in the Late Bajocian finally fully submerged the axis (Duff et al., 1985).

4.3 Details

4.3.1 Blue Lias

4.3.1.1 Downside Stone

West of Shepton Mallet, a water bore [6090 4396] (Locality **22**) just south of the Bodden Fault proved 3.5 m of rock and soil, on 12.95 m of sandy stone with layers of clay (mainly Downside Stone facies, but with some conglomerate beds and a band of Blue Lias type), on the Penarth Group (Green and Welch, 1965, p.204).

In the north-west of the area, the Downside Stone is poorly exposed, but enormous blocks of conglomeratic limestone which have been dragged off the fields along Ham Lane [approximately 604 446] (Locality **23**) probably represent the basal and/or marginal facies. Just outside the northern limit of the map, conglomeratic Liassic limestone was noted in swallets [6378 4533; 6417 4553]; at the former locality overlying Silurian volcanics or Old Red Sandstone (Barrington and Stanton, 1977, p. 37).

North of the Bodden Fault, in the Bowlish Quarry [6125 4420] (Locality **24**), Downside Stone rests with angular unconformity on Black Rock Limestone. Similarly, in the old quarry [6222 4466] (Locality **25**) of Hobbs Bros., the unconformable junction of the Downside Stone and Black Rock Limestone can still be seen. The surface of the Black Rock Limestone is irregular, with a relief of 0.3 m or more. The Downside Stone is a pale cream colour, coarse-grained, cavernous-weathering limestone with bluish chert near the base. Bivalves, gastropods and belemnites abound and include *Cercomya deshayesi* (Terquem), *Ctenostreon tuberculatus* (Terquem)*, Dimyopsis intusstriata* (Emmrich), *Lima (Plagiostoma) valoniensis* (Defrance) and *Liostrea* cf. *laevis* (Tawney) (Donovan, 1958a, p. 135; Green and Welch, 1965, p.103). The basal Downside Stone is presumably of Hettangian age, but the presence of belemnites is of interest as they do not normally appear until the Sinemurian in this area.

The Viaduct Quarry (the Edenbridge Quarry of Reynolds (1912, p. 128)) [6212 4420] (Locality **26**), now an SSSI, formerly exposed up to 9 m of Downside Stone with few well marked bedding planes, although in the lower half, a number of shelly beds up to 0.3 m thick, occur. A conglomerate, up to several centimetres thick, but thinning northwards, can be seen in the quarry face near the base of the section. It was first noted by Woodward (1876, p. 100). The clasts consist of greenish chert and smaller angular quartz pebbles; impressions of `ammonites of the *Angulata* zone' occur (Cope in Duff et al., 1985, p. 102). The conglomerate rests on a hardground consisting of bored, pale grey, sandy limestone with shell fragments and rare, poorly preserved ammonites which include *Psiloceras* occur (Cope in Duff et al., 1985), and *Alsatites* and `*Waehneroceras*' (probably *Macrogrammites*) (Copestake and Getty, 1981 (circa)). A fine example of *Coroniceras rotiforme* (J. de C. Sowerby) found loose by Dr Nicol Morton (now in Bristol City Museums) shows that the section extends up to the *bucklandi* Zone, *rotiforme* Subzone. Thus all of the Hettangian and part, at least, of the *bucklandi* Zone of the Sinemurian are present.

Downside Stone was formerly well exposed along the east side of Waterloo Road, Shepton Mallet [6200 4413 to 6195 4397] (Locality **27**). The section was first noted and sketched by De la Beche (1846, p. 278, fig. 38). Moore (1867, p. 508) published a more detailed diagram (Figures 5 and 6). De la Beche's sketch shows the main Lias section faulted against Carboniferous Limestone to the north; the latter showing a planed surface with a thin `Rhaetic' [i.e. Penarth Group] conglomerate overlain by Lias. Much of this section has been walled up, but exposure remains in a roadside quarry [6197 4405]. Moore's diagram shows the Downside Stone penetrated by four fissure fills (`veins of Lias'), but recent re-examination of the second from the southern end of his diagram (at the southern end of the quarry) showed that it is in fact a fault breccia, and the northernmost one is the fault bringing up Carboniferous Limestone. This must call into question the other `veins' which are now obscured by the retaining wall. Moore (1867, p. 508) measured a section which totals 25 feet (7.6 m) in thickness, but the total originally exposed, allowing for dip and the faults, must have been greater than this.

Downside Stone was formerly well exposed in the railway cutting [6212 4415 to 6248 4387] (Locality **28**), south-east of the Viaduct Quarry. At one point [6230 4400],

Psiloceras (Caloceras) intermedium (Portlock) indicative of the *johnstoni* Subzone was found (Green and Welch, 1965, pp. 103-104).

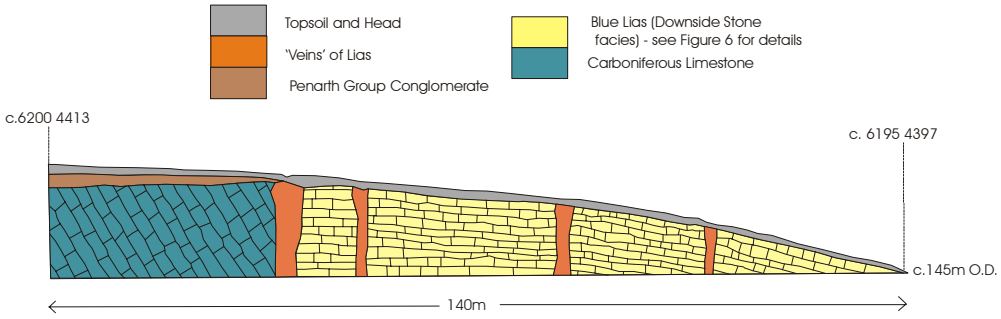

Figure 5. Section at Shepton Mallet (after Moore, 1867, p.508)

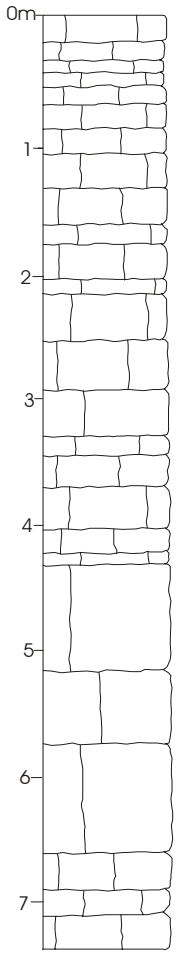

Figure 6. Section in Blue Lias (Downside Stone facies) at Shepton Mallet (after Moore, 1867, p.508) - see Figure 5 for location

In the quarry [6346 4478] (Locality **10**) at Beacon Farm, Donovan (1958a, p. 135) recorded the following section:

	Thickness (m)
Limestone, buff, crystalline, the lower part coarse-grained, with shells, the upper becoming finer with fewer fossils	2.59
Conglomerate, with pebbles of Carboniferous Limestone and chert, passing up into the bed above	0.05
Limestone, comparatively fine-grained	0.46
Limestone, porcellanous of White Lias lithology, with veins and specks of calcite	0.12
Similar to bed above, but coarser grained and less pure	0.17
Limestone, granular, crystalline, in finer and coarser grained beds similar to the top beds of the section; gastropods and bivalves, mainly preserved as moulds	3.50

The conglomerate is identical to that seen in the Viaduct Quarry above. If the porcellanous limestone is really the White Lias, then the lower part of the section represents the Triassic Langport Member**,** but a loose specimen of *Caloceras* confirms that at least part of the section falls in the Hettangian.

An old quarry [6480 4467] (Locality **29**) north-west of Newman Street formerly exposed about 3 m of limestone with thin clay interbeds. Between here and the Beacon Farm quarry, loose finds of *Coroniceras rotiforme* and *Gryphaea* [639 445] (Locality **30**) indicate the presence of early Sinemurian beds.

Just east of the present area, an active swallet [651 441] exposes 0.9 m of grey and purplish mudstones with limestone bands which yielded *Liostrea irregularis* (Münster) and *Psiloceras (Caloceras)* sp. of the *johnstoni* Subzone (Green and Welch, 1965, p. 102).

Just outside the northern boundary of the map, in Windsor Hill Quarry [c. 615 451], a fissure fill of Downside Stone facies in the Carboniferous Limestone yielded abundant bones of the therapsid reptile *Oligokyphus* (Kühne, 1956). The fissure fill strikes approximately east and west at the southern boundary of the quarry, here formed by Ham Lane. It was said to be `one foot wide or less' by Kühne (1956, p. 5) (`usually less than 1 m' – (Savage, 1977, p. 91)), and exposed intermittently for a length of about 50 m. The fill is described as a pebbly, ferruginous, cream-brown sandy limestone, about 80 per cent soluble in cold HCl. The insoluble residue consisted of clayey material and rounded quartz grains. The pebbles are predominantly Carboniferous chert and limestone. Kühne (1956)

recorded an invertebrate fauna, including the ammonites *Arnioceras* and *Promicroceras*, which indicate a Sinemurian (*semicostatum* and/or *turneri* Zone) age, though brachiopods of both earlier and later ages were found. Some of these were believed to be derived. However, the Bristol University geological collections include a specimen of the ammonite *Schlotheimia similis* Spath in coarse, granular, crystalline limestone with chert fragments, and clearly not derived, which indicates a late Hettangian (late *angulata* Zone) horizon. Fish teeth included both Rhaetian and early Liassic species. Belemnites, poorly preserved, were thought to be Pliensbachian. Kühne wrote that `the time of deposition of a sediment containing a mixed fauna is determined by the youngest components of this fauna', and dated his *Oligokyphus* accordingly, but it seems more likely that the fill accumulated over a period of time, or was perhaps composite, like some other local fissure fills (Wall and Jenkyns, 2003) and the age of the *Oligokyphus* is therefore less closely defined than Kühne thought.

4.3.1.2 Bowlish facies

An 8-m section [6110 4387] (Locality **12**) on the new road to a housing estate was recorded by DTD (Figure 3). The conglomeratic beds at the base with *Psiloceras* are clearly close to the base of the Blue Lias. The top of the section lies very near the top of the Hettangian stage as indicated by the incoming of *Gryphaea*. Above the measured section, excavations produced large *Coroniceras* spp. which indicated the *rotiforme* subzone. The Blue Lias/Bowlish facies is at least 10-12 m thick here. Fossils from higher beds in the same section are recorded by Duff et al. (1985, p. 97): *Arietites bucklandi* up to 0.5 m across, corals, gastropods including large *Pleurotomaria*, and numerous bivalves, especially *Gryphaea, Plagiostoma giganteum, Pinna, Pecten, Placunopsis* and *Liostrea*. Many of the shells and the tops of some of the limestones have white-banded algal overgrowths. Fish teeth have been found in the conglomeratic beds.

The suburb of West Shepton is largely built on the upper surface of the Blue Lias, Bowlish facies. Excavations have yielded fossils indicating the Hettangian-Sinemurian boundary, as in a housing estate [608 434] (Locality **31**) where ammonites included *Caloceras* sp. and *Schlotheimia* indicating mid- to late Hettangian, but also *Vermiceras* and *Coroniceras schloenbachi* indicating the *bucklandi* zone of the Sinemurian. Indications of several successive horizons in a small flat area seem to indicate that the

ammonite subzones are rather thin in the upper part of the Bowlish facies here. Surface finds at the Cricket Ground [609 431] (Locality **32**) include *Schlotheimia postangulata* Lange from the *angulata* Zone. Nearby, brash from a trench [6102 4335] (Locality **33**) yielded *Schlotheimia* sp. (DTD)

Penarth Group and Blue Lias were exposed in the cuttings, now largely filled or obscured, of the former Great Western Railway. Moore (1867, pp. 505-506) recorded the junction of the Blue Lias and Langport Member in the railway cutting [c. 602 429] (Locality **1**) on the west side of Shepton Mallet (Figure 7). He recorded 15 feet (4.6 m) of Lias, including a 3 feet (0.91 m) bed of clay which may indicate transition to the basinal facies. Following the line to the (former) GWR station [617 432], Moore noted late Hettangian and early Sinemurian ammonites. **'**Downside Stone' [presumably Bowlish facies**]** was seen in the old railway cutting [6180 4318 to 6260 4300] (Locality **34**) farther east (most of the westernmost 200 m have now been filled in). A section in the railway cutting is described by (Duff et al., 1985, p. 93). There [619 432] (Locality **35**), a 2.6 m section showed some twelve to fifteen beds of pale grey sandy and shelly limestones with thin interbedded clays, 2 m thick, overlain by 0.6 m of disturbed clay and stone. The fauna from the beds includes *Arietites bucklandi, Cenoceras, Pleurotomaria anglica, Pleuromya, Chlamys, Pecten* and *Plagiostoma* indicative of the *bucklandi* Zone. The limestones are of a type intermediate between the Downside Stone and Blue Lias.

Blue Lias was also seen in an old quarry [629 431] (Locality **36**) 1.14 km south-east of Shepton Mallet church (Moore, 1867, p. 506; Woodward, 1893, p.87).

In the eastern part of Shepton Mallet and the hamlet of Charlton, many old quarry faces remain, probably dating back several centuries as the quarried areas have been subsequently built up. A section at Quarr [6223 4374] (Figure 8; Locality **37**)

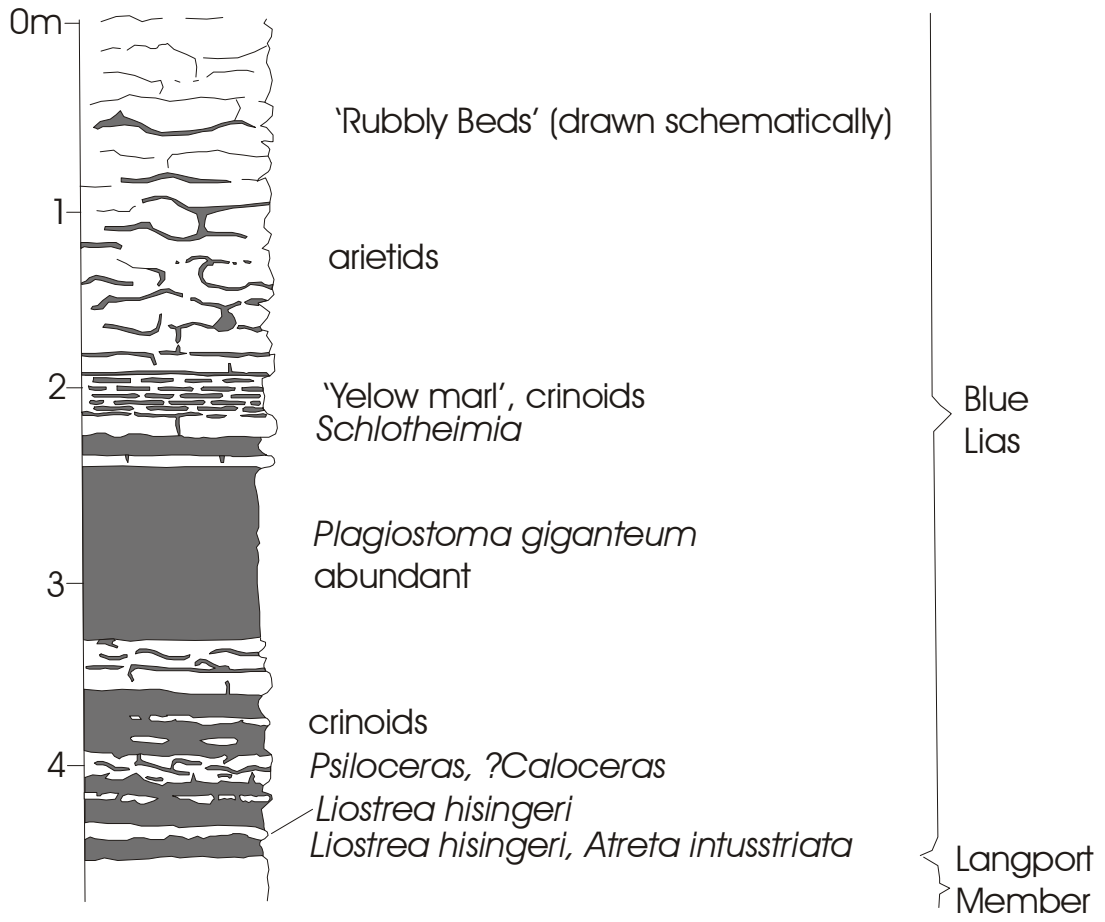

Figure 7. Railway cutting [c. 610 430] west of Shepton Mallet (after Moore, 1867, pp. 506-7)

showed 3 m of massive limestones with some thin shale partings. A bedding plane at the top of the section carried impressions of several *Arietites* up to 0.3m or more in diameter, indicating the late *bucklandi* or *semicostatum* Subzone. The southern limit of Messrs Matthew Clark's lorry park, on the south side of Town Lane, is a quarry face about 210 m long [6237 4360 to 6257 4353] (Locality **38**), exposing about 4 m of strata (Figure 9). *Gryphaea arcuata* Lamarck and *Cardinia* spp. are common, but no ammonite was seen.

A temporary (in 2000) exposure [6320 4284] (Locality **41**) south of Charlton exposed about 1 m of bedded limestone in beds 0.1 to 0.15 m thick, and with no interbedded shale; fossils included common *Gryphaea* and an impression of *Vermiceras*

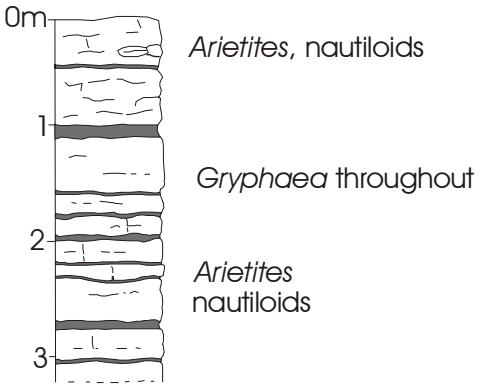

Figure 8. Quarr, Shepton Mallet [6223 4374]

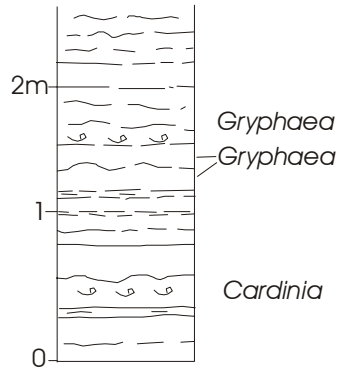

Figure 9. Old quarry, trailer park, Town Lane

conybeari (J. Sowerby) indicative of the *bucklandi* Zone, *conybeari* Subzone. Similar limestones are exposed along the lane to the north [6322 4287, 6319 4296 and 6314 4304]. In the field on the north side of the River Sheppey, there is much limestone brash with common *Gryphaea* [6327 4303 (Locality **42**), 6322 4312 (Locality **43**) and 6314 4332 (Locality **44**)]. Close to this last locality were found small, poorly preserved ammonites (??*Arnioceras*) together with fragments of larger, poorly preserved ?arietid body chambers. Arietitids would indicate the *bucklandi* or *semicostatum* Zone and the *Arnioceras,* the *semicostatum* or higher, so if they all come from the same source, then the *semicostatum* Zone is indicated. As the Black Ven Marl crops out just to the east and a little higher than these ammonites, it supports the *semicostatum* Zone assignment.

A little farther north, a section [6322 4385] (Locality **45**) on the Fosse Way yielded a *bucklandi* Zone fauna including *Spiriferina walcotti* (J. Sowerby)*, Gryphaea dumortieri* Joly*, Pleuromya* cf. *angusta* L. Agassiz and *Coroniceras (Metophioceras)* sp. (aff. *conybeari* J. Sowerby). Another section [6325 4398] 140 farther north-north-west (Locality **46**) yielded *Lima (Plagiostoma) giganteum*, *Pseudolimea hettangiensis* and *Pseudopecten priscus* (Schlotheim) (Green and Welch, 1965, p. 103).

All these old quarries are in the upper, Sinemurian (*bucklandi* and *semicostatum* zones), part of the Bowlish facies of the Blue Lias, with beds of coarse, crystalline limestone up to 0.3 m or more thick, separated by partings or by thin, more shaly beds. However, boreholes east [626 436] (Locality **47**) and south-east [628 431] (Locality **2**) of Shepton Mallet church proved respectively 19.8 and 21.3 m of Blue Lias above thin shales of the Penarth Group (Green and Welch, 1965, p.103). The Hettangian part of the Blue Lias is therefore presumed to be present at depth in the area.

The railway cutting, now filled, south-east of Cannard's Grave [c. 628 416] (Locality **13**) formerly exposed a complete section through the Blue Lias (Figure 3; Donovan, 1958). It was 7.3 m thick, with shales forming about one-third of the total thickness.

Roadworks near Cannard's Grave [around 627 421] (Locality **15**) in 1995 revealed to DTD and Hugh Prudden, a limestone pavement beneath topsoil. The limestone was pale grey and crystalline, weathering to a yellowish brown. It contained disarticulated bivalves, gastropods and ammonites, including small *Arnioceras* and *Coroniceras* indicative of the lower part of the *semicostatum* Zone. The Black Ven Marl crops out as a small outlier in one area [626 420] on the south-west of the site, and as part of the main outcrop on the east of the site.

Just west of Cannard's Grave, limestone brash with common *Gryphaea* occurs [6230 4165] (Locality **48**). Farther west, much mudstone and limestone debris has been dug out of a ditch [6175 4140] (Locality **49)** south of East Compton Farm. Limestone dipping at 7°E northwards is exposed in a gateway [6058 4137] (Locality **50**) 400 m SE of Elm Farm.

Limestone floors much of the unnamed stream [6055 4069, 6071 4073 to 6075 4076, 6090 4084] (Locality **51**) which flows south of East Town. Farther upstream, on the south side of the valley, brash of pale grey limestone [6150 4103] (Locality **51)** yielded *Pleurotomaria* sp., *Camptonectes* sp., *Hippocardium?, Liostrea hisingeri* (Nilsson), *Lucina limbata* Terquem & Piette, *L.* sp., *Mactromya arenacea* (Terquem), *M.* sp., *Modiolus hillanoides* (Chapius & Dewalque), *M.* sp., *Pinna* sp., *Plagiostoma?, Pseudolimea* sp. (Ivimey-Cook, 1993a, p. 5). The fauna is not age-diagnostic, but a Lower Sinemurian age is likely.

The unnamed stream close to the southern margin of the map, is floored by limestone [6118 4018 to 6128 4022] (Locality **53**). Close by, limestone brash [6130 4022] (Locality **54**) yielded *Piarorhynchia* sp., *Coroniceras (Paracoroniceras)* cf. *charlesi* (Donovan), echinoid spines and a ichthyosaur vertebrum, indicative of the *semicostatum* Zone, ?*lyra* Subzone (Ivimey-Cook, 1993a, p. 5). To the north-east, on the north side of the stream, brash [6156 4048] (Locality **14**) included *Coroniceras* cf. *lyra* and *C.* cf. *quadratum* Donovan, indicative of the *semicostatum* Zone, *lyra* Subzone (Ivimey-Cook, 1993a, p. 5).

An extensive old quarry [6275 4078 to 6296 4077] (Locality **55**) occurs on Beard Hill Quarry (Duff et al., 1985, p. 94, photo 4). At the western end of the section, some 6.5 m of planar bedded, but with undulating tops and bottoms, limestones can be seen (Figure 10). Occasional large specimens of *Arietites* indicate that most of this section falls in the *bucklandi* Zone (Duff et al., 1985), but the occurrence of *Arnioceras* towards the top of the section shows that it extends up into the *semicostatum* Zone. The presence of nautiloids (presumably *Cenoceras*) is unusual in such a shallow-water facies. At the eastern end of the section, the beds dip 15°E at 50°E.

On the south side of Beard Hill, an old quarry [6243 4064] (Locality **56**) in a different fault block exposes a 3 m section dominantly of thin-bedded, dark grey, limestones in beds 0.1 to 0.3 m thick interbedded with thin (1 to 10 cm thick) grey silty shale. Farther east, in the same fault block, another old quarry [6298 4049 to 6312 4050] (Locality **57**) exposes a 4.5 m section [6298 4050] dipping 10°NNE:

	Thickness (m)
Limestone, thinly bedded in beds 0.1 to 0.3 m thick, with thin (up to 10 cm) of grey silty mudstone or clayey silt	2.00
Limestone, nodular, with irregular (?rippled) tops and bottoms; silty mudstone irregularly present and thickest in troughs; in the basal limestone, *Coroniceras (Arietites)* cf. *bucklandi* was collected by Matthew Bristow	1.00
Limestone, planar-bedded	0.16
Mudstone, silty, dark grey	0.12
Limestone, planar-bedded	0.30
Limestone, nodular with irregular tops and bottoms in beds 7 to 15 cm thick, alternating with thin (up to 10 cm thick) grey, silty mudstone	0.95

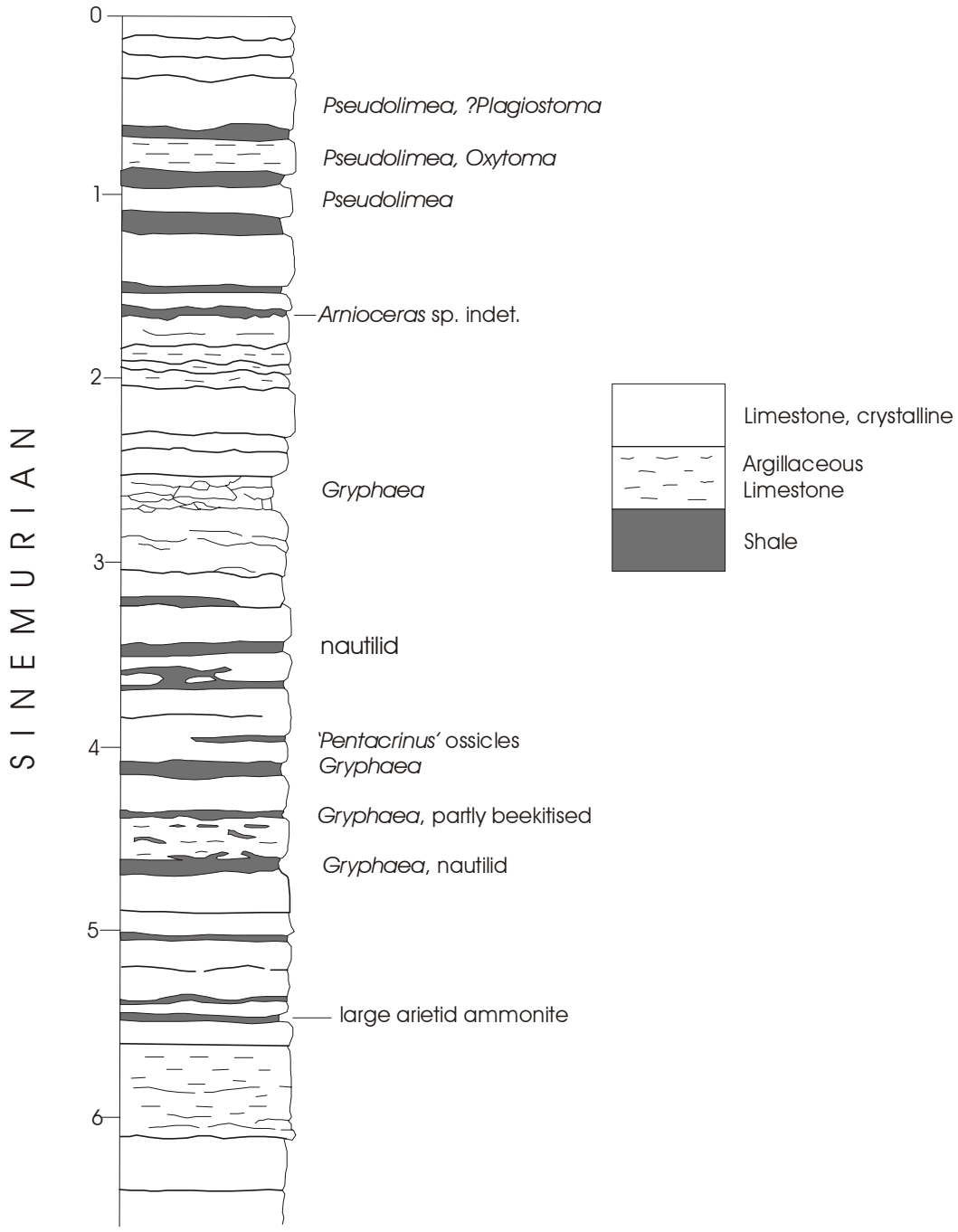

Figure 10. Beard Hill Quarry [628 408], Prestleigh

All the limestones are argillaceous and dark grey on fresh fractures with scattered brachiopods and bivalves (including *Gryphaea*). The *Coroniceras* indicates the late *bucklandi*/basal *semicostatum* Zone. At the eastern end of this section, one of us (DTD) saw a slightly different section [6304 4050] in the same part of the sequence (Figure 11). These exposures show a slightly higher proportion of shale to limestone than Beard Hill Quarry (Locality **55**), indicating the transition, gradual or across growth faults, from the shale-starved Bowlish facies to the basinal Blue Lias south of the present area.

Further to the west a thin fault sliver [6310 4082 to 6322 4080] (Locality **58**) of limestone with *Gryphaea* occurs within the Black Ven Marl on the east side of the A371.

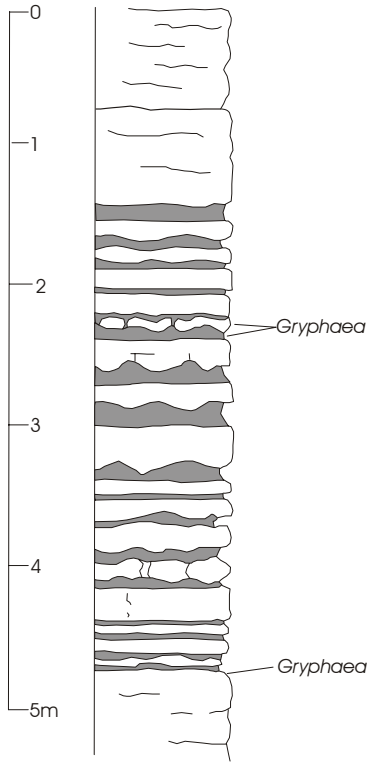

Figure 11. Section through the Blue Lias 290m west of the Prestleigh Inn [6304 4050]

4.3.2 Charmouth Mudstone Formation

4.3.2.1 Black Ven Marl

In the south of the district, the Black Ven Marl occurs in a series of strike-faulted outcrops. There is little exposure, but the outcrop can readily be proved by augering. In a trench [6284 4035] (Locality **16**) on the north side of the Bristol and West Showground, one of us (DTD) found obtained a small fauna with *Arnioceras* in the base of the member and indicating an age not later than *obtusum* Zone; more probably late *semicostatum* or *turneri* Zone.

Farther north, in a ploughed field on another fault block, DTD found *raricostatum* Zone fossils [6311 4076] (Locality **17**) and a probable *Oxynoticeras* [6314 4074] indicative of the *oxynotum* Zone. The fossils were found in blocks of grey limestone, commonly shelly, representing nodules or occasional beds within the predominantly mudstone member.

In the Cannard's Grave section (Locality **13**) recorded by Donovan (1958), the Black Ven Marl was exposed on the east side of the cutting [6290 4170]. The relationship to the Blue Lias in the cutting was not ascertained, but is probably faulted. Woodward (1893) recorded 9 m of clay at this locality. Fossils collected loose by DTD and in the BGS collection include: *Bifericeras bifer* (Quenstedt), *B. nudicostata (*Quenstedt), *B. parvum* S S Buckman, *B.* cf. *quadricostata* (Quenstedt), *B. wrighti* (Bovier), *Eoderoceras?* sp. cf. *E. anguiforme* (Buckman ex Simpson), *E.* sp. indet., *Gemmellaroceras* sp., *Oxynoticeras oxynotum* (Quenstedt), *Palaeochioceras* aff. *spirale* (Trueman & Williams), *P.* sp. nov. and *Paracymbites* sp. indet. Collectively, they indicate a range from the *Oxynotum* Zone and Subzone to the *raricostatum* Zone, *macdonnelli* Subzone.

Just to the north-north-west of the above section, a borehole [6286 4181] (Locality **59**) proved 11 m of stiff dark grey silty clay'.

The Black Ven Marl has a wide outcrop south-west of Bullimore Farm [around 631 421], but from the farm northwards, the member appears to thin and is not so easy to trace. Nevertheless, dark grey clay was augered at several points [6328 4251, 6326 462, 6334 4279, 6337 4282 and 6338 4286] between the farm and the River Sheppey.

North of the Sheppey, on the south side of Ingsdons Hill, dark grey clay was augered [6350 4295] east of Northover, and seen in the ploughed field, with belemnites, [6330 4308] (Locality **59**) to the north-west of Northover. The most northerly point where

dark grey clay was seen in this tract was 80 m east of the Fosse Way [6318 4344] (Locality **60**).

On the north side of Shepton Mallet there is a small, partially fault-bounded crop of Black Ven Marl (Locality **16**). Some 3 m were proved in an excavation for a gas holder [6185 4403]. From the clay a small fauna, including *Furcirhynchia* sp., *Pseudopecten priscus* and belemnites, was obtained. The cemetery nearby [c. 6170 4406], yielded *Gleviceras* sp. aff. *guibalianum* S S Buckman indicative of the *raricostatum* or early *jamesoni* Zone (Green and Welch, 1965, p. 104). Dark grey clay was augered in the sides of the bank [6181 4404] by the easternmost chapel. Farther east, a small pond [6215 4390] (Locality **61**) may indicate another small outlier of Black Ven Marl.

4.3.2.2 Spargrove Limestone

In the pasture-covered fields in the south-east of the area, the Spargrove Limestone forms a slight positive feature, but is rarely exposed. It floors a ditch [6500 4029] in the extreme east. Westwards from this point, the member can be proved by augering. It was seen as brash in a ditch [6422 4001] 700 m WSW of Maes Down Farm. Its most westerly occurrence in this tract was in an auger hole [6384 4044] east of Prestleigh.

West of Prestleigh, a small fault-bounded outcrop [6308 4080] (Locality **62**) of Spargrove Limestone was noted by one of us (DTD) in 1984 in the field east of the A371. There, limestone brash and clay with abundant belemnites yielded *jamesoni* Zone fossils.

From Prestleigh northwards, no trace of the Spargrove Limestone could be found over a 2 km-tract. However, it reappears at Bullimore Farm [633 423] and can be readily traced by augering as far as the River Sheppey. The outcrop width in this tract is up to 200 m.

North of the Sheppey, the outcrop is about 100 m wide and limestone with belemnites can be followed over a distance of 900 m on the west and south-west side of Ingsdons Hill, although the exact position of the Spargrove Limestone against the Bodden Fault is uncertain. Within this tract, large body chamber fragments of *Uptonia* are common [6327 4346 (Locality **19**) to 6340 4306 (Locality **20**)]. They include *U. lata* Quenstedt at the latter locality, whilst nearby [635 430] (Locality **63**), Mr D. Ponsford found a specimen of *Platypleuroceras* aff. *brevispina* (J. de C. Sowerby indicative of the *jamesoni* Zone, *brevispina* Subzone (Ivimey-Cook, 1993c, p. 12). In addition, poorly preserved fragments of *?Platypleuroceras* were found in the northern part [6327 4346] (Locality **19**). The

northernmost record of fossils in this tract include *Acanthopleuroceras maugenesti* (d'Orbigny) and *Tragophylloceras ibex* found by DTD in brash [6322 4360] (Locality **64**) of coarse, thin-bedded limestone.

A hitherto unrecognised outcrop of Spargrove Limestone occurs on the south side of Windsor Hill [around 616 448]. There, a wide, flat-lying, pasture-covered, area is believed to be underlain by Spargrove Limestone, although *jamesoni* Zone fossils have only been found at one locality. An overgrown section [6169 4484] (Locality **18**) in about 1.5 m of thin-bedded limestone along the lane north of the old railway line has yielded *Platypleuroceras* aff. *brevispina* (J de C Sowerby)(from near top of section), *Uptonia jamesoni* (J de C Sowerby)(not in situ, but probably from the upper half of section), *Uptonia? (Metadoceras?) submuticus* (Oppel)(from upper surface of second limestone bed from bottom of section, i.e. about 0.75 m above road level), *U.* sp., *Tragophylloceras undulatum* (Wm Smith) and *Liparoceras* sp. Collectively, the *jamesoni* Zone is indicated, but the fauna could range up into the base of the *ibex* Zone.

4.3.2.3 Green Ammonite Bed

Much of the outcrop of the member is pasture covered and consequently there is little detail of lithology. It was formerly worked for bricks at Brickyard Farm (known as the Cannard's Grave Brickworks in 1885) [6320 4185] (Locality **65**), but there is no recorded section. Deep augering on the west side of hill proved blue grey clay respectively at 1.8 m [6373 4267], 1.9 m [6386 4275] and 2.1 m [6403 4262].

Augering in the bed of the River Sheppey proved medium to dark grey clay in several places [6393 4307, 6398 4312, 6404 4317, 6412 4322, 6418 4324 and 6423 4324] superficially resembling the Black Ven Marl.

4.3.3 Cephalopod Limestone Formation

The Cephalopod Limestone has been seen in several exposures around Ingsdons Hill. At the most northerly exposure [c. 6402 4391] (Locality **66**) near Bodden (No. 7 of Richardson, 1916), the following fossils were from ironshot limestones of the Eype Mouth Member: *Haugia navis* (Dumortier), *Hildoceras walcotti* (J. Sowerby), *Dactylioceras* sp., and *Harpoceras* sp.' indicating the *falciferum* to *bifrons* zones. Some of the ironshot limestone is built into local walls.

The base of the outcrop can be readily traced around Ingsdons Hill by a line of springs [6360 4370, 6392 4337, 6410 4340, 6421 4338, 6444 4331 to 6447 4338]. DTD collected ammonites from loose blocks by a spring [6393 4336] (Locality **67**) on the west side of the hill. Strongly ironshot grey limestone (ooliths up to 1 mm) contained *Hildoceras bifrons* (Bruguière)/*semipolitum* S. S. Buckman and *Phymatoceras* sp. These ammonites indicate the upper part of the *bifrons* Zone. A fine-grained grey limestone, not ironshot, yielded *Cleviceras exaratum* (Young & Bird) and *Hildoceras* cf. *lusitanicum* Meister, indicating *exaratum* and *falciferum* subzones respectively.

A little farther east, a ditch section [6421 4340] (Locality **68**) in sandy and ironshot limestones' yielded *Dactylioceras* sp., *Grammoceras audax* S S Buckman, *G. sp., Harpoceras falciferum* (J. Sowerby), *Harpoceras* sp*., Haugia variabilis* (d'Orbigny), *Haugia* sp*., Hildaites* cf. *orthus* (S.S. Buckman), *Hildaites* sp., *Hildoceras bifrons* (Brugiere), *Hildoceras* sp., *Orthildaites* sp. and *Pachyiytoceras jurense* (Zieten) (Ivimey-Cook, 1992, pp. 14-15; Green and Welch, 1965, p. 107). The ammonites (identified by Dr M.K. Howarth) indicate the *falciferum, bifrons, variabilis* and *thouarsense* zones (*striatulum* Subzone). Continuing eastwards, an exposure [6445 4336] (Locality **69**) of pale brown, peloidal limestone in a copse yielded *Pseudogibbirhynchia moorei* (Davidson), *Zieliera lycetti* (Davidson), *Pseudopecten* cf. *dentatus* (J.de C. Sowerby), *Dactylioceras* sp., *Grammoceras penestriatulum* S S Buckman, *G. audax* S.S. Buckman and *Hildoceras bifrons* (Brugière) (Ivimey-Cook, 1992, pp. 14-15; Green and Welch, 1965, p. 107). The ammonites (identified by Dr M.K. Howarth) indicate the *bifrons* Zone and *striatulum* Subzone. Richardson (1916, p. 489) recorded *Grammoceras toarciense* (d'Orbigny) in this same general area (his locality 4). As at Bodden, the *falciferum* to *bifrons* zones are indicated.

The presence of the Marlstone, of *margaritatus* Zone age, is proved by finds of *Amaltheus margaritatus* (de Montfort) by Mr A. Bentley (now in Bristol City Museums) at [645 474 (Locality **70**) and 6423 4340 (Locality **71**)].

On Doulting Hill, springs [6443 4315, 6437 4315, 6415 4309, 6401 4300, 6415 4257 and 6424 4254] mark the base of the Formation. Fragments of probable *Grammoceras toarciense* (d'Orbigny) were found by Richardson (his locality 12c) in a roadside section [c. 6423 4311] (Locality **72**) west of Doulting. Farther south-west, Richardson (1916, p. 491, locality 12b) saw another section [c. 6405 4277] (Locality **73**) in which, beneath the basal bed of the Inferior Oolite, he saw beds 3, 4 and 5 of the section below.

On the north side of Doulting Sheep Sleight, the base of the formation can again be traced by a line of springs [6432 4236, 6431 4229, 6425 4226, 6409 4243, 6400 4245 and 4395 4247]. Close to this last locality, Richardson (1916, p. 490, locality 12a) recorded the following section [c. 6390 4242] (Locality **74**):

	Thickness (m)
Inferior Oolite	
1. Conglomerate Bed with *Terebratula* of the *T. decipiens* Group	not given
Bridport Sand	
2a. Sands, yellow, incoherent	
2b. Sands, yellow, indurated	4.5 to 6.0 m
3. Clay, blue, crowded with belemnites	0.15
Cephalopod Limestone	
Eype Mouth Member	
4. The Blue Ironshot Beds'. *Grammoceras* sp., *Rhynchonella moorei* Davidson and *Cincta lycetti* (Davidson) found loose	not given
5. Limestone, blue, richly ironshot but weathering brown and full of ammonites *Haugia navis* (Dumortier), *Dactylioceras* cf. *braunianum* (d'Orbigny), *Hildoceras bifrons* (Brugière), *H.* aff. *hildense* (Young & Bird), *Harpoceras* sp. etc.	0.60
6. The Pink Bed'. Limestone, very hard, sparsely ironshot, and of a pinkish tinge	not given
Marlstone?	
7. Yellowish brown rock	0.60
8. Clay, fawn coloured	0.60

Richardson attributed the beds to the *falciferum* Zone (Bed 6) to *thouarsense* Zone, *striatulum* Subzone (Bed 4).

At Maes Down, Richardson (1906, pp.368-9) recorded a detailed section [6467 4062] (Locality **21**) in the Cephalopod Limestone:

	Thickness (m)
Eype Mouth Member	
Clay, brown and bluish	Not stated
Limestone, dark green, earthy with dark yellow spots resulting from the decomposition of ferruginous granules *Hildoceras bifrons, Dactylioceras* cf. *hollandrei* Wright non *d'Orbignyi*, *Rhynchonella* cf. *jurense* (Quenstedt) and *Pecten substriatus* Roemer	0.41
Clay, dark purplish	0.10
Limestone, brownish grey, somewhat earthy, but hard in places, devoid of ferruginous granules, *Polyplectus capellinus* (Quenstedt), *Cryptaulax scobina?* (Deslongchamps)	0.05
Marlstone	
Limestone, pale brown, ironshot	0.07
Clay, brown	0.07
Limestone, hard, dark, ironshot, top layer crowded with belemnites, *Belemnites paxillosus* Schlotheim, *Terebratula punctata* Sowerby, *Rhynchonella tetrahedra* (Sowerby), *Cypricardia pellucida* Moore	3.05

Some 2 m of strata were still exposed in 1982, including the Marlstone at the base. From this section were collected *Dactylioceras* sp., *Harpoceras falciferum* J. Sowerby, *H.* sp. and a belemnite. In loose rubble at the bottom of the section were found *Quadratirhynchia* sp., *Dactylioceras* sp., *Harpoceras* sp., *Nodicoeloceras* sp. and *Pseudolioceras* sp. (Ivimey-Cook, 1993c, p. 12). The fauna suggests the *falciferum* Zone. Specimens collected by DTD include *Harpoceras serpentinum* (Schlotheim), *Hildaites murleyi* (Moxon) from the Eype Mouth member, and *Pleuroceras hawskerense* (Young & Bird) and *P*. cf. *solare* (Phillips) from the Marlstone, indicating the *hawskerense* and *apyrenum* subzones. A small *Dactylioceras* sp. indet. at the top of the Marlstone may indicate that this extends in age into the Toarcian, as on Pennard Hill to the south. The Marlstone also yielded the brachiopods *Gibbirhynchia micra* Ager and *Tetrarhynchia quadrata* (S. S. Buckman); large belemnites, probably *Passaloteuthis bisulcata* (Blainville) are conspicuous.

Westwards from this quarry, the Eype Mouth Member has a fairly wide outcrop. At the western end of Maes Down, there is much micritic limestone debris with *Harpoceras*

[6428 4078] (Locality **72**), with oolitic, belemnitic limestone a little lower down the slope [6426 4076] (Locality **73**).

4.3.4 Bridport Sand

Yellow sand was noted by DTD on the north side of Pitt's Wood [6458 4385] (Locality **77**).

Around Ingsdons Hill, no Bridport Sand has been mapped, although it has been proved in trial pits [c. 642 436 (Locality **78**) and 644 436 (Locality **79**)] where it was described as greenish-yellow, fine-grained, micaceous sands with an indurated top beneath Inferior Oolite on top of the hill (Richardson, 1916, p. 489). Possibly the Inferior Oolite has cambered over the Bridport Sand, as it has Whitstone Hill [633 415] farther south.

The recorded sections in the railway cutting [c. 6440 4245] (Locality **89**) south of Doulting are ambiguous. Woodward (1876, p.124) recorded 'Midford' Sands beneath the Inferior Oolite in the cutting, whereas Richardson (1916, p. 490) stated that the Inferior Oolite rested on blue arenaceous shaly clay', which in turn rested on grey, more micaceous sandy clay'. These two beds, the ?Green Ammonite Bed, totalled 1.8 m in thickness. Just to the west-south-west of the cutting, fine-grained orange sand was augered in two places [6421 4222 and 6413 4229]. Some 200 m farther south-west, Richardson (1916, p.490, locality 12a) [6390 2420] (Locality **74**) recorded between 5.4 and 6.0 m of Bridport Sand between the Inferior Oolite and Cephalopod Limestone Formation (see above).

The outcrop of the Bridport Sand widens as it is traced around Doulting Sheep Sleight and fine-grained orange and yellow sand can readily be augered, or seen thrown out from badger setts [6367 4202]. The outcrop narrows on the steeper slopes on either side of the valley through Farncombe [641 410 to 646 413 to 6140 4093], but nevertheless, fine-grained sand can be augered along the crop.

Maes Down is an up-faulted block of Bridport Sand. The most easterly outcrop in the area is in another faulted block [6493 4087] on the other side of Maes Down Hill, where the formation is about 7 m thick.

5 JURASSIC (MIDDLE)

5.1 Inferior Oolite

The lithostratigraphical and biostratigraphical classification of the Inferior Oolite is shown in Table 4. Only the Upper Inferior Oolite, of Upper Bajocian and Lower Bathonian age, is preserved in the area. Most of the Inferior Oolite can be divided into five beds which can be recognised, but not mapped separately, across the area. These are, in ascending sequence, the **Conglomerate Bed** (the equivalent of the Upper Trigonia Grit), the **Upper Coral Bed, Doulting Stone, Anabacia Limestone** and **Rubbly Beds**. Although apparently concordant with the Bridport Sand, the base of the Inferior Oolite is commonly pebbly and conglomeratic and marks a substantial non-sequence.

<table>
<tr><td></td><td></td><td>ZONE</td><td>SUBZONE</td><td colspan="4"></td></tr>
<tr><td rowspan="10">BATHONIAN</td><td rowspan="3">LOWER</td><td rowspan="3">zigzag</td><td>yeovilensis</td><td colspan="4">FULLER’S EARTH</td></tr>
<tr><td>macrescens</td><td rowspan="3">Doulting Beds</td><td>Rubbly Beds</td><td rowspan="10">Upper Inferior Oolite</td><td rowspan="10">Inferior oolite Formation</td></tr>
<tr><td>convergens</td><td rowspan="2">Anabacia Limestone</td></tr>
<tr><td rowspan="7">BAJOCIAN</td><td rowspan="7">UPPER</td><td rowspan="2">parkinsoni</td><td>bomfordi</td></tr>
<tr><td rowspan="2">truellei</td><td>Doulting Stone</td></tr>
<tr><td rowspan="3"></td><td>Upper Coral Bed</td></tr>
<tr><td rowspan="3">garantiana</td><td>acris</td><td>Upper Trigonia Grit = Conglomerate Bed</td></tr>
<tr><td>tetragona</td><td colspan="2" rowspan="3">absent</td></tr>
<tr><td>subgaranti</td></tr>
<tr><td>dichotoma</td></tr>
</table>

Table 4. Classification of the Inferior Oolite in the Shepton Mallet area

The formation only crops out in the north-east of the area, where it is has a maximum thickness of about 17 m.

The most complete section through the Inferior Oolite is that described by Richardson (1907) in the railway cutting [6490 4245] (Locality **22**) south of Doulting:

	Average thickness (m)
Fuller's Earth	
Clay, pale grey and yellow	not stated
Inferior Oolite	
Rubbly Beds	
Limestone, pale brown, rubbly, mixed with a little marl	c. 2.44
Anabacia Limestone	
Limestone, somewhat sparry, white, with even-sized oolite granules. Top bed bored by *Lithophaga*, and less commonly by annelids. *Anabacia complanata* (Defrance), *Strophodus magnus* Agassiz, *Trigonia* sp. indet., 0.4 to 1.52 m	0.96
Doulting Stone	
Limestone, brownish, slightly oolitic. At the western end of the cutting, this deposit is a massively bedded (with a pebbly layer at the base), and at the eastern end is a whitish, more generally oolitic, flaggy limestone, which has the top portion much bored by annelids (up to 0.2 m deep), and less so by *Lithophaga*. Oysters occur on the upper surface, 0.81 to 3.05 m	1.98
Limestone, brownish, oolitic, massively bedded in places, but on the whole, not weathering well; top bed bored in places	4.26
Limestone, brownish, oolitic, massively bedded, with a hollow' bed at the top	2.28
Limestones, brownish, not so thickly bedded, having more conspicuous marly partings. *Pecten (Syncyclonema) demissus* Phillips very common in the upper part; large *Nautilus*	4.88
(Non-sequence: Upper Coral Bed and Dundry Freestone absent)	
Upper Trigonia Grit	
Conglomerate Bed - limestone, pale grey, crystalline, containing pebbles of yellow-stained limestone and of a pale grey, fine-grained sandstone much bored by *Lithophaga,* and frequently having *Serpulae* in the crypts; *Terebratula sphaeroidalis* Sowerby abundant, especially in the lower portion of the bed, *Pecten (Syncyclonema) demissus, Nautilus* sp., *Perisphinctes* cf. *davidsoni* S. Buckman, belemnite fragments	0.40
(Non-sequence: the whole of the Bajocian and Aalenian and part of the Toarcian absent)	
Cephalopod Limestone	
Clays, bluish, micaceous, arenaceous, shaly	0.61

5.2 Fuller's Earth Formation

The formation is incomplete in the present area and only the Lower Fuller's Earth and the lower part of the Fuller's Earth Rock are present.

5.2.1 Lower Fuller's Earth

The Lower Fuller's Earth consists of about 10 m of pale grey, calcareous, shelly mudstones. The rich fauna, dominantly of brachiopods and bivalves, with scarce ammonites (see Details) is not age diagnostic, but probably falls in the *tenuiplicatus* and *progracilis* zones. In the basal beds, the bivalve *Catinula lotharingica* (de Grossouvre) = *'Ostrea knorri'* is typical of the Knorri Beds.

5.2.2. Fuller's Earth Rock

The Fuller's Earth Rock occurs as three small hill caps in the east of the district. There is no exposure, but brash of micritic limestone is common.

5.3 Details

1. 5.3.1. Inferior Oolite

On Ingsdons Hill, Richardson (1916, p.489, localities 5 and 6) saw some 5.4 m of Doulting Stone – 'not considered suitable for commercial purposes' - in two trial pits [c. 642 436 (Locality **78**) and 644 436 (Locality **79)**]. At the base of the Doulting Stone was the Conglomerate Bed (the Cockly Bed of the workmen) with specimens of the *Terebratula decipiens* group, resting on the Bridport Sand.

The Inferior Oolite has been extensively worked between Chelynch and Doulting. Old pits occur in Pitt's Wood [646 438] (Locality **80),** probably the main source of stone for Wells Cathedral, and Chelynch Wood [649 438] (Locality **81**), but there is no recorded section, although dips of 6°SSE have been recorded in them [6456 4383 and 6500 4389]. In 1955, the main quarry being worked was on the west side of Chelynch Road [6475 4350] (Locality **82**). There, 6 m of massive limestone [Doulting Stone] overlay 7.2 m of rubbly limestone, as proved in the bottom of the pit (Green and Welch, 1965, p. 107, pl. IIB). In this pit, Richardson (1907, p. 396) recorded the Anabacia Limestone, overlain by 0.76 m of Fuller's Earth, the latter presumably now completely removed by quarrying. The Rubbly Beds are therefore absent in this and the adjacent quarry (see below) to the east. The dip in the quarry was 4°SSW. In another quarry [6480 4335], now a playing field,

some 6 m of fragmental and oolitic limestone dipping at 12° slightly west of south was exposed.

In Richardson's time, the main quarry was on the east side of the Doulting-Chelynch road [649 435] (Locality **83**):

	Thickness (m)
Topsoil	0.45
Inferior Oolite	
Anabacia Limestone	
Limestone, white, oolitic, sparry, somewhat rubbly in the upper part, but flaggy and more regularly bedded below. Fossils abundant in a zone 0.3 m thick, commencing 0.5 m above the Doulting Stone: *Terebratula* (probably '*T. globata'*), *Pecten (Syncyclonema) demissus* Phillips, *Trigonia costata* (Sowerby) *Ostrea, Lithophagus inclusus, Anabacia complanata, Strophodus magnus* Agassiz. Called 'Ridding' by the quarrymen	1.52
Doulting Stone	
(a) 'Hard'. Suitable for rough masonry, but generally burned. Freestone, coarse, pale yellow and greyish, rarely oolitic, with much calcite crystallizing out in the cavities; *Pteria digitata* (Deslongchamps), *Limea duplicata* (Sowerby), *Honomya* cf. *crassiuscula* Morris & Lycett, *Strophodus magnus* Agassiz, *Serpula* cf. *limax.* Top bed bored by *Lithophagi*; it has oysters adhering, waterworn 1.06 to 1.22 m	1.06
(b) Doulting Freestone. Freestone, pale brown and grey, highly calciferous, often without partings 4.26 to 4.88 m	4.26
(c') Limestone, yellowish grey, compact, splintery, obscurely oolitic with dark yellow staining along cracks. The top portion is bored, oyster-strewn, and contains pebbles of a greenish rock. By the quarrymen, this stone is called the 'Ragstone', and therefrom Mr S. S. Buckman records *'Rhynchonella subtetrahedra*' and '*Trigonia costata*' seen	0.30
[c''. Limestone, not exposed, but in railway cutting]	1.98]
[d. Limestone, not exposed, but in railway cutting	4.88]
(Non-sequence: Upper Coral-Bed and Dundry Freestone absent)	
Upper Trigonia *Grit*	
'Conglomerate-Bed'	0.40

In the Doulting Bridge [Bramble Ditch] Quarry [647 423] (Locality **85**), Richardson (1907, p. 393) saw an 8.1 m section in the Inferior Oolite:

	Thickness m
Fuller's Earth (see p. 47)	
Inferior Oolite	
Rubbly Beds	
Limestone, pale brown, rubbly, oolitic mixed with a little marly matter; *Ammonites (Perisphinctes)* cf. *evolutoides* Siemiradzki, *Holectypus hemispaericus* (Agassiz), *?Lucina clypeata* Witchell, *Protocardia clypeata*, (Witchell), *Isocardia minima* Soweby, *Volsella* [=*Modiola*] *gibbosa* (Sowerby), *Pleuromya goldfussi* (Lycett), *Corbicella complanata* Lycett, *Berenicea* (Clypeus-Grit form), *Rhynchonella hampenensis* S.S. Buckman, *Terebratula globata* auctt. non Sowerby, *Acanthothyris spinosa* (Schlotheim)	1.22
Marly, sandy layer	0.07
Anabacia Limestones	
Limestone, rubbly, yellowish grey, shelly at the base	0.48
Similar bed, but with fewer shell fragments	)
Limestone, yellowish grey, oolitic, *Terebratula* (probably *'T. globata'*), *Trigonia*; *Anabacia complanata* common along a horizon at 0.15 m above the base	)0.50) 0.91
Clay parting, chocolate coloured	0-0.05
Doulting Stone	
Freestone, yellowish grey, bored at top	1.82
Freestone with two well-marked partings and a 'hollow bed' at the base	3.05
Freestone, massive, which have been cut with the saw	not stated

To the west, brash [6394 4242] (Locality **84**) near the old railway line to the west yielded *Sphaeroidothyris sphaeroidalis*, possibly from the Conglomerate Bed.

About 1 km south of the Bramble Ditch Quarry is an old roadside quarry [6473 4136] (Locality **87**). There, Richardson recorded:

	Thickness (m)
Rubbly Beds	
Limestone, pale brown, rubbly, oolitic, *Terebratula globata* auctt., non Sowerby, *Pleuromya goldfussi* (Lycett), *Holectypus hemisphaericus*, seen	0.61
Anabacia Limestones	
Limestone, brownish, oolitic, shelly at the base where *Acanthothyris spinosa* is not uncommon, *Pecten (Syncyclonema) demissus* Phillips, at 1.77 m down	2.59
Doulting Stone	
Limestone, brownish, less hard, but more massively bedded; top bed bored by *Lithophagus inclusus*	0.61

Farther south, on the east side of the road is the old Farncombe Quarry ('Farmcombe Quarry of Richardson (1907, p. 394; 1909b, p. 211)) [6475 4115] (Locality **86**) in which was seen:

	Thickness (m)
Fuller's Earth (see p.48)	
Inferior Oolite	
Rubbly Beds	
Limestone, pale brown, rubbly, oolitic, full of *Terebratula globata* auctt. (*Clypeus* Grit form) especially at 1.32 m down, *Rhynchonella hampenensis* S. Buckman, *Acanthothyris spinosa* (Schlotheim), *Pleuromya goldfussi* (Lycett), *Holectypus hemisphaericus* (Agassiz)	1.67
Marl, arenaceous	0.08
Anabacia Limestones	
Limestone, hard, brown, oolitic; top bed bored and covered with oysters	2.28
Doulting Stone	
Similar limestone, with much bored and oyster-covered top bed	2.44 seen

5.3.2 Fuller's Earth Formation

At Doulting, the quarry on the west side of Chelynch Road [6475 4350] (Locality **82**) formerly exposed 0.76 m of Fuller's Earth resting on Anabacia Limestone (Richardson, 1907, p. 396). It was presumably from this thin remnant of Fuller's Earth, now completely removed by quarrying, that the specimen of *Oecotraustes (Paraoecotraustes) splendens* Arkell was obtained (Arkell, 1951-1958, p.70).

In the Doulting Bridge [Bramble Ditch] Quarry [647 423] (Locality **85**), Richardson (1907, p. 393) saw some 2.2 m of Fuller's Earth, as follows:

	Thickness (m)
Clay, pale grey and yellow with dark patches; *Terebratula globata*, auctt, non Sowerby, *Aulacothyris mandelslohi* (Oppel), *Acanthothyris midfordensis* sp.nov., *Terebratula doultingensis* sp. nov., *T. sphaeroidalis* Sowerby (immature), *?Belemnites (Belemnopsis) parallelus* Phillips, *B. (B.) bessinus* d'Orbigny, *Berenicea* cf. *verrucosa* (Milne Edwards), *Serpula plicatilis* Münster (in Goldfüss), *Ostrea knorri* Voltz, *Goniomya angulifera* (Sowerby), *?Alectryonia* sp. indet.	1.22
Limestone, white, rubbly, earthy, in several beds mixed with clay *Pholadomya ovalis* (Sowerby)	0.36
Clay, pale yellow, with dark patches and a conglomeratic deposit at the base which infills crevices in the bed below. At the base is a layer of a reddish sandy material. Some of the fossils of the top bed, occur also in this bed	0.61
Inferior Oolite (see p. 46)	

Richardson (1907, p.396) saw a thin remnant of Fuller's Earth in the quarry on the west side of the Maesdown road [6469 4131] (Locality **87**):

	Thickness (m)
Fuller's Earth	
Clay, pale grey and yellow: *Terebratula globata, Acanthothyris midfordensis* sp. nov., *?Alectryonia* (fragment), *Ostrea knorri* Voltz, *Serpula volubilis* Münster, *S. plicatilis* Münster, *Goniomya angulifera* Sowerby, *Belemnites (Belemnopsis) bessinus* d'Orbigny	0.76
Inferior Oolite	
Anabacia Limestone	
Limestone, white oolitic	0.30

On the south-east side of the outlier [645 418] north of Farncombe Farm, one of us (DTD) in 1986 collected a small fauna from clay from a hole [6462 4170] (Locality **88**) just south of the reservoir. The fauna included *Oppelia (Oxycerites)* or *Oecotraustes, Acanthothyris midfordensis* Richardson & Walker, *Kallirhynchia superba* S.S. Buckman, *Wattonithyris midfordensis* Muir Wood and common *Catinula lotharingica* (de Grossouvre) = *'Ostrea knorri'*.

In the old Farncombe Quarry [6475 4115] (Locality **86**), Richardson (1907, p. 395) saw:

	Thickness (m)
Fuller's Earth Formation	
Clay, pale grey and yellow with bluish grey patches: *Terebratula globata* auctt., non Sowerby, *T. doultingensis* sp. nov., *T. sphaeroidalis* Sowerby (immature), *Acanthothyris midfordensis*sp. nov., *A. doultingensis* sp. nov., *Rhynchonella voluta* sp. nov., *R. plateia* sp. nov., *Aulacothyris mandelslohi* (Oppel), *Zeilleria emarginata* (Sowerby), *Seroula volubilis* Münster (in Goldfüss), *S. plicatilis* Münster (in Goldfüss), *S. quadrilatera* Goldfüss, *Stromatopora waltoni* Haime, *S.* aff. *waltoni* Haime, *S.* sp., *Berenicea compressa* (Goldfuss), B. *cf. verrucosa* (Milne Edwards), *Pholadomya ovalis* (J. Sowerby), *Ostrea knorri* Voltz, *Ostrea* sp., *Belemnites (Belemnopsis) bessinus* d'Orbigny, *?B. (B.) parallelus* Phillips	0.61 seen
Inferior Oolite (see p. 47)	

Specimens in the BGS collections from this quarry include *Montlivaltia* sp. and *Procerites* sp. (the latter from 'the base of the Fuller's Earth' (Ivimey-Cook, 1992, p. 16).

6. DRIFT

6.1 Landslip

Landslips in the present area are mainly associated with two of the Liassic mudstone members: the Black Ven Marl and the Green Ammonite Bed. A small slip [6032 4188] occurs on the Mercia Mudstone just north of Elm Farm. Most of the slips on the Green Ammonite Bed are associated with springs issuing from the overlying Bridport Sand and/or Cephalopod Limestone.

In the south-west of the area, a long slip [6086 4007 to 6133 4031] occurs in the Black Ven Marl on the steep slope below a fault scarp of the Blue Lias.

The largest of the slips on the Green Ammonite Bed is a roughly circular area some 350 m diameter just east of Whitstone Hill [637 415]. Smaller slips occur to the north [6365 4235] and south-east [643 409].

7 REFERENCES

Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

Arkell, W.J. 1933. *The Jurassic System in Great Britain.* Oxford: Clarendon Press.

Arkell, W.J. 1951-1958. Monograph of the English Bathonian ammonites. *Monograph of the Palaeontographical Society London,* Report No.

Barrington, N., and Stanton, W.I. 1977. *Mendip. The complete caves and a view of the hills.* Cheddar: Cheddar Valley Press.

Cope, J.C.W., Getty, T., Howarth, M.K., Morton, N., and Torrens, H.S. 1980a. A correlation of Jurassic rocks of the British Isles. Part One: Introduction and Lower Jurassic. *Geological Society of London Special Report,* Report No. No.14.

Copestake, P., and Getty, T.A. 1981 (circa). *Geological conservation review. Hettangian - Pliensbachian (unpublished).*Nature Conservancy Council.

De La Beche, H.T. 1846. On the formation of the rocks of South Wales and South Western England. *Memoir of the Geological Survey of Great Britain,* Vol. 1, 1-296.

Donovan, D.T. 1958a. Easter Field Meeting: The Lower and Middle Jurassic rocks of the Bristol district. *Proceedings of the Geologists' Association,* Vol. 69, 130-140.

Donovan, D.T. 1958b. The Lower Lias Section at Cannard's Grave, Shepton Mallet, Somerset. *Proceedings of the Bristol Naturalists Society,* Vol. 29, 393-398.

Donovan, D.T., Bennett, R., Bristow, C.R., Carpenter, S.C., Green, G.W., Hawkes, C.J., Prudden, H.C., and Stanton, W.I. 1989. Geology of a gas pipeline from Ilchester (Somerset) to Pucklechurch (Avon), 1985. *Proceedings of the Somerset Archaeological & Natural History Society for 1988,* Vol. 132, 297-317.

Duff, K.L., McKirdy, A.P., and Harley, M.J. 1985. *New sites for old. A student's guide to the geology of the east Mendips.* Peterborough: Nature Conservancy Council.

Findlay, D.C. 1965. The soils of the Mendip district of Somerset. *Memoir of the Soil Survey of Great Britain (England and Wales).*

Green, G.W. 1992. *British Regional Geology, Bristol and Gloucester region (3rd edition).*London: HMSO for British Geological Survey.

Green, G.W., and Welch, F.B.A. 1965. Geology of the country around Wells and Cheddar. *Memoir of the Geological Survey of Great Britain.* Sheet 280 (England & Wales).

Hollingworth, N.T.J., Ward, D.J., Simms, M.J., and Clothier, P. 1990. A temporary exposure of Lower Lias (Late Sinemurian) at Dimmer Camp, Castle Cary, Somerset, south-west England. *Mesozoic Research,* Vol. 2, 163-180.

Ivimey-Cook, H.C. 1992. Lower and Middle Jurassic fossils from Sheet 297 and immediately adjacent areas. Part 1. Collections made before 1992. *British Geological Survey Technical Report,* Report No. WH/92/316R.

Ivimey-Cook, H.C. 1993a. Lower Jurassic fossils from ST 63 NW; ST 64 SW; ST 52 NW and ST 54 SE, Glastonbury. *British Geological Survey Technical Report,* Report No. WA/93/104R.

Ivimey-Cook, H.C. 1993c. Lower and Middle Jurassic fossils from ST62NE and ST63SE. *British Geological Survey Technical Report,* Report No. WH/93/130R.

Kellaway, G.A., and Wilson, V. 1941. An outline of the geology of Yeovil, Sherborne and Sparkford Vale. *Proceedings of the Geologists' Association,* Vol. 52, 131-174.

Kühne, W.G. 1956. *The Liassic therapsid Oligokyphus.* London: Trustees of the British Museum.

Moore, C. 1861. On the zones of the Lower Lias and the *Avicula contorta* Zone. *Quarterly Journal of the Geological Society,* Vol. 17, 483-516.

Moore, C. 1867. On Abnormal Conditions of Secondary Deposits when connected with the Somersetshire and South Wales Coal-basins; and on the age of the Sutton and Southerndown Series. *Quarterly Journal of the Geological Society of London,* Vol. 23, 449-568.

Reynolds, S.H. 1912. *A geological excursion handbook for the Bristol district*. Bristol: J W Arrowsmith.

Richardson, L. 1906. On a section of Middle and Upper Lias rocks near Evercreech, Somerset. *Geological Magazine,* Vol. 3, 368-369.

Richardson, L. 1907. The Inferior Oolite and contiguous deposits of the Bath-Doulting district. *Quarterly Journal of the Geological Society of London,* Vol. 63, 383-436.

Richardson, L. 1909b. Excursion to the Frome district, Somerset. *Proceedings of the Geologists' Association,* Vol. 21, 209-228.

Richardson, L. 1911. The Rhaetic and contiguous deposits of west, mid and part of east Somerset. *Quarterly Journal of the Geological Society of London,* Vol. 67, 1-74.

Savage, R.J.G. 1977. *The Mesozoic strata of the Mendip Hills*. *In*: Savage, R J G (Ed.). *Geological excursions in the Bristol district*. Bristol: University of Bristol**:** Pp. 85-100.

Tutcher, J.W., and Trueman, A.E. 1925. The Liassic rocks of the Radstock District (Somerset). *Quarterly Journal of the Geological Society of London,* Vol. 81, 595-666.

Wall, G., and Jenkyns, H. 2003. The age, origin and tectonic significance of Triassic-Jurassic sediment-filled fissures in the Mendip Hills (south-west England). *Geological Magazine (in press).*

Westhead, R. K. 1994. Geology of the Chesterblade-Wanstrow district (Somerset). 1:10 000 sheets ST64SE (Chesterblade) and ST74SW (Wanstrow). *British Geological Survey Technical Report*. WA/93/90,

Wilson, V., Welch, F.B.A., Robbie, J.A., and Green, G.W. 1958. Geology of the country around Bridport and Yeovil. *Memoir of the Geological Survey of Great Britain*. Sheet 312 and 327 (England and Wales).

Woodward, H.B. 1876. Geology of east Somerset and Bristol coalfields. *Memoir of the Geological Survey of Great Britain.*

Woodward, H.B. 1893. The Jurassic Rocks of Britain, Vol. 3. The Lias of England and Wales (Yorkshire excepted). *Memoir of the Geological Survey of Great Britain*.

Woodward, H.B., Ussher, W.A.E., and Blake, J.F. 1873. Section No. 15, Vertical sections Sheet 46. *Geological Survey of England and Wales*.