BRITISH GEOLOGICAL SURVEY

TECHNICAL REPORT WA/89/51

Onshore Geology Series

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Geological notes and local details for 1:10 000 Sheet SP51SE (Beckley)

Part of 1:50 000 Sheet 237 (Thame)

A Horton

Geographical index
UK, Oxfordshire, Buckinghamshire, Otmoor

Subject index
Geology, Upper Jurassic, Pleistocene, Callovian, Oxfordian

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1 INTRODUCTION

This account describes the geology of 1:10 000 Sheet SP51SE (Beckley). The area is included in 1:50 000 Sheet 237 (Thame). The district lies within Old Series One-Inch Sheet 45, published in 1863, which was based on a survey by E Hull, H Bauerman, W Whitaker and T Polwhele. An account of the geology of Sheet 45 was given by Green (1864). The area was surveyed at the 1:10 560 scale by T I Pocock (1904-5) and included in the One-Inch Oxford Special Sheet, published in 1908. The geology of that sheet was described by Pocock (1908) and Pringle (1928).

The present survey, at 1:10 000 scale, was carried out in 1986-87 by A Horton. The survey and the publication of this map were jointly funded by the Thames Water Authority and BGS. Stratigraphic palaeontology was carried out by Dr B M Cox. Additional shallow boreholes were drilled for BGS in 1986 by A J Dixon of the Institute of Hydrology.

The centre of the district lies about 22 km (c 14 miles) north-east of Oxford. It includes three main topographic areas: 1) the upland at Beckley, in the south and south-west, and Horton-cum-Studley in the west, 2) the low ground forming the southern half of Otmoor, and 3) the low ridge associated with the Charlton Anticline in the extreme north-west. It includes the village of Beckley and parts of Oddington and Horton. The ground is predominantly arable, with areas of pastureland devoted to sheep and cattle. The soils are predominantly clay on the low ground with sands, sandstones and limestones cropping out on the uplands.

The formations which occur within the sheet area are poorly exposed and detailed information has been obtained largely from boreholes, and records of trenches and of disused quarries.

2 GEOLOGICAL SEQUENCE

The local geological sequence is:

DRIFT		
QUATERNARY	Landslip	
	Alluvium	
	Older Alluvium	
	First Terrace Deposits	
	Calcareous Tufa	
	Head	
SOLID		
JURASSIC	Kimmeridge Clay Formation	
	Ampthill Clay Formation	
	Corallian Formation	Wheatley Limestone Member Beckley Sand Member Arngrove Spiculite Member
	West Walton Formation	
	Oxford Clay Formation	Upper Oxford Clay Middle Oxford Clay Lower Oxford Clay
	Kellaways Formation	Kellaways Sand Member Kellaways Clay Member
	Great Oolite Group:	
	Cornbrash Formation	
	Forest Marble Formation	

3 SOLID FORMATIONS

A large part of the district is covered by drift deposits, but the solid rocks outcrop in two distinct areas. Middle and basal Upper Jurassic formations crop out in the north-west corner of the sheet, where they form part of the Charlton anticlinal structure. Formations younger than the Lower Oxford Clay crop out over the southern and eastern parts of the sheet.

Forest Marble Formation

The highest beds of the formation crop out within Oddington village and form the core of an anticlinal structure rising to an altitude of 66 m, i.e. about 7 metres above the alluvium of Otmoor. They were formerly worked in two quarries, respectively to the south-west [5508 1472] and south east [5524 1476] of Rectory Farm. The beds are no longer exposed, but at least 3 m were present in the former. This is probably the quarry in which Green (1864, p.36) recorded the underlying White Limestone and which still exposed 0.6 m of Cornbrash in 1924 (Pringle, 1926, p.28). Evidence from outcrop and boreholes to the north (Ambrose, 1989) suggests that the formation may range from 3.05 m to 9.65 m in thickness. Limited evidence suggests that the youngest beds comprise pale greenish grey weathering mudstone with thin beds of laminated calcareous siltstone (tilestone) and scattered cemented rippled lenticles or partings of the same lithology. These beds occur above blue-hearted oo-biosparite which is probably interbedded with thin mudstones. The limestone is hard and massive at depth but weathers to flaggy rubble at outcrop.

Cornbrash Formation

The Cornbrash crops out on the lower slopes surrounding the Forest Marble outcrop at Oddington, although a very small faulted patch [5519 1490] lies within the main outcrop of the latter. It also caps the ridge at Logg Farm but is very thin, because Forest Marble limestone crops out in the floor of a small pond [5499 1447] west of the farmhouse, and immediately outside the sheet margins, the Forest Marble was probably exposed beneath Cornbrash in the quarries north [5505 1450] and south [5506 1437] of the farm. A small faulted outcrop [5501 1416] of Cornbrash occurs south of the River Ray. The formation has been extensively quarried in the field [5536 1482] south-west of Medcrafts Farm.

TABLE 1 FORMATIONAL THICKNESSES

Formation/Member thickness (metres)	Borehole Registration No (SP51SE/..)						
	1	2	3	4	5	12	14
Lower Oxford Clay	28.01	26.98	26.52	-	-	-	-
Kellaways Sand Member	2.66	2.55	2.35	2.74	2.66	2.44	2.44+
Kellaways Clay Member	3.09	3.00	3.01	3.43	3.20	3.13+	
Kellaways Formation	5.75	5.56	5.93	6.17	5.86	5.57+	
Cornbrash	0.7+	0.42+	3.00+	0.34+	2.77+		

Some 0.3 m of pale buff to grey biosparite was seen in a shallow exposure [5518 1500] north of Manor Farm. A more complete sequence was proved in Otmoor Borehole C [5708 1331] (see Appendix) where it comprised 3 m of grey fine-grained biosparite and biomicrite (packstone) with indefinite micrite-filled burrows and thin marl and mudstone bands. The total thickness of the formation is probably about 3.0 to 3.5 m.

Lower Cornbrash brachiopods were recorded in the lowest beds of the unit in the Otmoor boreholes. "Characteristic fossils" (probably brachiopods) were also noted by Pringle (1926, p.28) from the pit [5508 1472] south-west of Rectory Farm.

Kellaways Formation

The formation is divided into a lower Kellaways Clay Member and an upper Kellaways Sand Member. Both crop out on the margins of the Charlton Anticline, although they are partly obscured by drift.

The Kellaways Clay Member consists of medium to pale grey silty mudstone. It shows indistinct bioturbation and is generally poorly fossiliferous, although it includes a 0.11 to 0.15 m thick shelly, shell-debris-rich marl at the base.

At surface it weathers to a pale olive to greenish grey clay. The complete sequence, from 3.0 to 3.09 m in thickness, was examined by the author in three cored boreholes. Slightly greater thicknesses were recorded in other boreholes.

The overlying Kellaways Sand Member weathers at surface to a pale brown silty loam. In Otmoor A, B and C boreholes [SP51SE/1-3] the member was 2.66 m, 2.55 m and 2.92 m thick respectively. The recovered cores consist of greenish grey to pale grey, medium to fine grained sands and slightly harder weakly cemented sandstones, with some silty with silty laminae, and thin beds of silty and mottled mudstones. The beds are markedly bioturbated with burrows up to 10 mm diameter. Fossils include *Anisocardia*, *Astarte*, *Catinula*, *Chlamys*, *Grammatodon*, *Gryphaea bilobata*, *Isocyprina*, *Myophorella*, *Mytilus*, *Pleuromya*, *Proplanulites*, *Protocardia* and *Procerithium*; some shells occur in growth position.

The shell-debris marl at the base of the Kellaways Clay Member reflects high energy current sorting: the overlying clay represents quiescent marine conditions. Current activity increased during the deposition of the laminated sands and silty sands of the Kellaways Clay Member.

Oxford Clay Formation

The Oxford Clay underlies the vale which includes Otmoor. It is divided into three members: the Lower Oxford Clay crops out over a small area north-west of Lower Farm, Noke, and underlies the north-western half of Otmoor. The Middle Oxford Clay underlies the remainder of Otmoor and crops out on the low ground to the south and east. The Upper Oxford Clay forms the lower part of the steep slope below the Corallian escarpment.

Lower Oxford Clay (Peterborough Member)

The Lower Oxford Clay, which is estimated to be 27 m thick, consists of brownish grey, bituminous mudstones interbedded with pale to medium grey mudstones. The former, which characterise the member, contain between 1 and 6 per cent of organic carbon, are only very slightly calcareous, and range from fissile to blocky in fracture. They are commonly very fossiliferous, and contain bivalves, ammonites, gastropods, belemnites, fish, crustacea, reptilean remains and plant debris. Particular fossils can be used to define subsidiary lithologies. Mudstones with few macrofossils may have a distinctive lithology due to an abundance of foraminifera or chitinous fish debris. Shelly beds can be divided on the basis of their dominant faunas: *Gryphaea* beds are characterised by this robust bivalve and associated belemnites; *Nucula*-rich beds are most common; distinctive fissile beds are packed with the crushed valves of *Meleagrinella,* which are coated by dusty calcite overgrowths; and partings covered by ammonites ("ammonite plasters") are common at some levels.

The ammonites of the Oxford Clay provide the basis of a very detailed biostratigraphic zonation. Only two exposures, both in ditches, provided datable material: the first [5621 1424] consisted of a septarian nodule with *Kosmoceras* ex gr. *obductum* S S Buckman probably from the Obductum Subzone of the Coronatum Zone, and secondly [5635 1449] debris of the Acutistriatum Band with *K.* ex gr. *phaenium* (S S Buckman) and *K. (Spinikosmokeros)* cf. *acutistriatum* S S Buckman with *Bositra buchii* (Roemer).

A distinctive *Lingula*-rich, mottled, very silty, finely micaceous mudstone occurs about 10 to 11 m above the base of the Lower Oxford Clay. At least three pyritic shell beds occur near the base of the member (Table 2). Generally less than 50 mm thick, they consist of *Gryphaea* and other thick-shelled bivalves, belemnites and shell debris set in a silty sand matrix with a pyrite cement. The lowest beds of the member include sandy and silty mudstones and siltstones and are transitional to the underlying Kellaways Sand. The base of the member is drawn below the lowest mudstone bed.

Large medium grey argillaceous septarian limestone nodules up to 1.8 m in diameter and 0.5 m thick, and transected by veins of white or colourless calcite, occur in the Lower Oxford Clay. Field evidence shows the presence of two such septarian nodule horizons, one near the base, the other about 3 m below the Acutistriatum Band (see below). Pieces of the dark grey septarian limestone from a drainage ditch [5627 1424] contained *Kosmoceras* ex. gr. *obductum* (S S Buckman) and tiny shell fragments including *Dentalium?*, probably belong to the higher horizon. Boreholes have proved the presence of at least two other nodule beds, the lithology being proved at 1.44 m, 3.2 m and 4.12 m above the base of the formation. These are probably the four nodule bed horizons which have been recognised to the north of the present area (Ambrose, 1989).

The composite Acutistriatum Band-Comptoni Bed is an important marker which occurs in the upper part of the member, 18.58 to 19.89 m above the base (Table 1). The Comptoni Bed is a shell-debris mudstone packed with the bivalve *Nuculana* and containing the ammonite *Erymnoceras comptoni*. It is a lithologically variable bed with interburrowed horizons and may be cemented in places. The overlying Acutistriatum Band is an ammonitiferous calcareous shale or clayey micritic limestone which is brown when fresh but distinctively pale steel-grey when weathered, particularly along joint surfaces. The Acutistriatum Band was traced beneath the alluvial deposits of Otmoor from debris dredged from drainage ditches. One such exposure [5635 1449] yielded pieces of brownish grey, non-septarian limestone with *Kosmoceras* ex. gr. *phaenium* (S S Buckman) and a fragment of *K. (Spinikosmoceras)* cf. *acutistriatum* (S S Buckman) with *Bositra buchii* (Roemer).

Middle Oxford Clay (Stewartby Member)

The Middle Oxford Clay crops out on low ground and the only exposures lie within the weathered zone. The member was penetrated in a number of motorway boreholes. Percussion samples were obtained from several boreholes drilled by BGS.

The member consists of pale grey, slightly calcareous mudstones with subordinate silty mudstones, and thin, weakly cemented, calcareous siltstone beds; the latter have not been recorded locally. It is generally poorly fossiliferous, and rare ammonites (generally small and pyritised) are associated with bivalves and gastropods occur locally. However, some beds of greenish grey, richly fossiliferous mudstone are packed with the small, crenulate valves of *Bositra buchii;* this lithology is characteristic of the Middle Oxford Clay.

TABLE 2 Levels of Marker horizons in the Lower Oxford Clay

Figures are height in metres above the base

Marker horizon	Borehole Registration Numbers										
	1	2	3	4	5	6	8	11	13	14	15
base Middle Oxford Clay	28.01	26.98	26.52	-	-	-	-	-	-	-	-
base Acutistriatum Band	19.89	19.79	19.15	-	-	-	-	-	-	-	-
Nodule bed	-	-	-	-	-	-	-	-	-	-	-
Lingula bed	10.01	11.40	9.82	-	-	-	-	-	-	-	-
Nodule beds	- -	3.20 -	- -	- -	- -	- -	4.12 -	- -	4.12 1.44	- -	- -
Pyritic shell beds	4.30 3.49 2.94	4.38 3.58 2.60	4.38 3.58 3.24	- 3.25 -	- - 2.67	- - 0.92	- - -	- - 1.83	- - -	- - -	4.27 3.28 1.35
Silty bed	2.47	2.02	2.44	-	-	1.67	-	-	-	-	3.28
top of silty sand beds	1.16	1.50	1.38	-	-	-	-	-	-	-	-

The boundary of the Middle and Lower Oxford Clay is difficult to define, because typical Middle Oxford Clay lithologies are interbedded with pale grey and brownish grey mudstones more typical of the Lower Oxford Clay. The junctions of these lithologies are marked by intensive interburrowing. The base of the Middle Oxford Clay is drawn arbitrarily at the interburrowed horizon above the highest occurrence of the characteristic bituminous mudstone lithology of the Lower Oxford Clay. The difficulty in fixing the junction has resulted in diverse estimates of thickness (Table 1).

A thin micritic marly limestone, the Lamberti Limestone, marks the top of the member. Like all the underlying beds, it is commonly decalcified and hard to locate at outcrop, but has been recognised south-west of Horton [5908 1200].

The estimated thickness of the Middle Oxford Clay is 21 m.

Upper Oxford Clay (Weymouth Member)

The Upper Oxford Clay consists of pale grey, very slightly calcareous mudstone with a few thin silty limestone or calcareous siltstone beds and *Gryphaea*-rich horizons. The base of the Member is drawn at the top of the Lamberti Limestone (see above) which also marks the boundary between the Oxfordian and Callovian stages. A bed of brownish grey mudstone with a basal siltstone, the Panshill Brown Bed and Panshill Siltstone respectively (Horton, 1993), occur 4-5 m above the base. These beds were proved in several boreholes; they have a distinctive low radioactivity gamma-ray signature on geophysical logs.

Although no exposures were observed during the period of the survey, the member was previously exploited in the Horton-cum-Studley or Studley brickpit. Arkell (1936, p.175) records 3 m of "pale-grey soapy clay full of large clean valves of *Gryphaea dilatata* ... containing two or more layers of small ammonites, beautifully preserved as brown limonitic and ochreous casts". The ammonite species indicate the Costicardia Subzone of the Cordatum Zone. The estimated thickness of the Upper Oxford clay is 21 m.

West Walton Formation

Gallois and Cox (1977) suggested that the predominantly argillaceous beds between the Oxford Clay and Kimmeridge Clay formations could be divided into two units: an upper unit, long known as the Ampthill Clay, and a lower, in parts slightly more calcareous and silty unit, for which they proposed the term West Walton Beds, now called the West Walton Formation. The West Walton Formation consists largely of rhythmic couplets of dark grey silty mudstones, which pass upwards into paler grey, smooth mudstones and darker silty mudstones. The former are more silty and contain an abundance of finely comminuted plant debris. The boundaries of the rhythms are typically marked by interburrowing. The base of the formation is drawn beneath the lowest dark grey silty mudstone. This corresponds with a weak, mappable feature. Thin calcareous siltstone beds have been recorded elsewhere but were not proved during the present survey or in site-investigation boreholes. Beds rich in *Gryphaea dilatata* locally produce slight features. Many of these fossils are bored and some valves have been reduced to relics. The estimated thickness of the formation is 17 m.

Corallian Formation

The Corallian Formation comprises the limestone and sand-dominated sediments between the West Walton and Ampthill Clay formations. The type section is taken as the Cumnor Borehole, west of Oxford (Wilson, 1978). In the present district the Corallian Formation comprises three divisions, in upward sequence: the Arngrove Spiculite Member, the Beckley Sand Member and the Wheatley Limestone Member. The first two were formerly included in the Lower Calcareous Grit.

Arngrove Spiculite Member

The Arngrove Spiculite Member, formerly the Arngrove Stone, was first described by Davies (1907). It is developed over a small area extending from the north-eastern suburbs of Oxford to Brill and Wheatley.

The member gives rise to a marked escarpment, either alone, as in the small outcrops at Horton-cum-Studley, or in association with the overlying younger divisions of the Cumnor Formation in the continuous outcrop from south of Woodperry to Otmoor Lane, Beckley, where it dies out. This, its most north-westerly occurrence, is thought to represent a depositional rather than erosional limit.

Throughout most of the district the Arngrove Spiculite consists of a pale bluish grey, medium to fine-grained, well-sorted, sandy spiculite containing milky white opaline pseudomorphs after the spicules of the sponge *Rhaxella*. Because of the voids which result from solution of the spicules, the rock is very porous and consequently of low density, and hand specimens feel notably light and have a cinder-like texture. Characteristically, the Arngrove Spiculite weathers to cuboidal fragments up to 16 cm across. It is richly fossiliferous in parts yielding the ammonite *Cardioceras vertebrale* and burrowing bivalves. Grey clayey silts may be present locally.

No sections were visible at the time of survey but the member was dug, possibly as road aggregate, from three quarries in the most northerly outcrop at Horton-cum-Studley.

The estimated maximum thickness of the Arngrove Spiculite Member is 5 m. Greater apparent thicknesses deduced from the outcrop width, for example south-east of Woodperry [575 104], may result from repetition of strata due to cambering (Horswill and Horton, 1976).

Beckley Sand Member

The Beckley Sand Member rests directly upon the Arngrove Spiculite, although immediately to the south it rests upon the newly recognised Temple Cowley Member. The top is defined by the base of the Wheatley Limestone or its equivalents.

The strata here described as Beckley Sand were formerly included in the Lower Calcareous Grit (Green, 1864; Pocock, 1908), although Arkell (1936) suggested that the Beckley Sand at Benfield and Loxley's Quarry [5665 1035], Beckley was equivalent to the "Berkshire Oolite Series" of Dry Sandford [SU 468 996] and Marcham [SU 459 980], and therefore younger than the Lower Calcareous Grit of that area. However, the Lower Calcareous Grit of the above-mentioned localities is lithologically similar to, and probably contiguous with, the Beckley Sand as defined here.

The Beckley Sand Member crops out extensively south-west and south of Beckley. It gives rise to a reddish brown sandy soil. Field evidence suggests that it mainly comprises medium to fine-grained well-sorted sand; harder beds of pale brown or brownish grey calcareous sandstone give rise to small features, as for example through Stow Wood [5080 1045] and south of Royal Oak Farm [5627 1021]. Beds containing scattered shells and shell debris occur at some levels.

A bed of hard sandstone gives rise to steep promontories [eg 5561 1115] at The Common, north of Folly Farm. Some 2 m of fine-grained loamy sand with thin, medium grey, much-bioturbated, fine-grained, slightly calcareous sandstones near the base of the Beckley Sand was exposed behind a cottage [5657 1120] in Beckley village. In a ditch 270 m to the north-north-east [5655 1143], soft grey sand with rare fragments of bioturbated sandstone and traces of spiculite-bearing sand from about the same horizon was exposed. At a higher level [5567 1131], 2 m of brown sand with calcareous sandstone doggers were exposed in an excavation behind a house. A H Green (1864, p.43) recorded a 'hard lime-cemented sandstone with a thin clay in the middle of it' probably near Woodperry [5760 1065].

The Beckley Sand Member was formerly exposed in three large quarries south-east of Beckley village. The first, Messrs Benfield and Loxley's Quarry [567 103], has now been completely infilled, but the section was recorded by Arkell (1936, p.171-2) and showed Wheatley Limestone Member overlying Beckley Sand Member:

		Thickness (metres)
Wheatley Limestone Member		
10	Lydite and cast beds. Rubbly and marly limestone, soft, containing numerous small black lydite pebbles, and full of fossils, the molluscs mainly as casts. Ammonites (see below), some corals, abundant *Serpulae, Exogyra nana* and *Lopha gregarea, Plicatula weymouthiana, Chlamys nattheimensis, C. fibrosa, Lima mutabilis, L. rigida*, etc. Test and spines of *Cidaris florigemma* and test of *Diplopodia versipora*.	seen to 1.83
9	Pebble bed. The pebbles (besides lydites and quartz as above) largely of gritstone and white oolite, bored by *Lithophaga* and encrusted with *Serpulae* and *Exogyrae*, and up to 3 or 4 inches in diameter	0.15
Beckley Sand Member		
8	Sands, brownish, loamy, with up to six or more irregular and impersistent semi-consolidated bands and one more persistent gritstone bed about the middle	about 2.44
7	Gritstone band, with abundant *Gervillia aviculoides;* also *Isognomon subplana, Chlamys fibrosa,* and *Nucleolites scutatus*	0.43 to 0.61

6	Sand, brownish, loamy, shelly, as above, with two impersistent semi-consolidated bands. Many *Exogyrae*, with *C. fibrosa*, *Nucleolites scutatus* and lydites and quartz	0.91
5	Gritstone band, same as 7. *Gervillia aviculoides*, *Isognomon subplana*, *Nucleolites scutatus*	0.38 to 0.43
4	Sand, as above	0.43
3	Ammonite bed. Blue-hearted and purplish-brown gritstone, with many *Gervilliae* and *Isocyprina cyreniformis* (Buvignier). Nearly all the ammonites come from here (except those of quite different appearance from bed 10)	0.30
2	Sand, badly exposed	about 1.83
1	Gritstone, in irregular doggery masses as above, occasionally dug in floor at south end of pit. *Nucleolites*. Foreman says ammonites are sometimes found here	0.30

Callomon (1953, p.85) re-examined the quarry and collected the following ammonites from bed 8: '*Perisphinctes (Arisphinctes) cotovui* Sim., *P. (A.) pickeringius* (Y. & B.), *P. (Kranaosphinctes) trifidus* (Sow.), *P. (K.) decurrens* (Buckman), *Cardioceras (Scoticardioceras) excavatum* (Sow.), *C. (Maltoniceras)* cf. *highworthense* Arkell, C. *(Cawtoniceras) cawtonense* (Bl. & H.), *C. (Subvertebriceras) zenaidae* Ilovaisky, *C. (Vertebriceras) vertebrale* (Sow.), *C. (Sagitticeras)* sp., *Goliathiceras* cf. *gorgon* Arkell', which were associated with the echinoids *Holectypus depressus* Leske, *H. corallinus* d'Orbigny & Cotteau.

The other two quarries have been described by Callomon (1953) and have again been reclassified. The Woodperry Road Quarry [570 108] was also mentioned briefly by Arkell (1943, p.190) and McKerrow and Kennedy (1973). Callomon's sequence (1953, p.83-5) is:

		Thickness (metres)
	Wheatley Limestone Member	
11	Marly Rubble, with limestone lumps	seen 0.90
10	Limestone Band, hard, white, crystalline and unfossiliferous, weathering slabby (east side only, possibly disturbed)	0.38
9	Marly Rubble, greenish, soft	1.07
8	Pendle. Intensely hard, white limestone, weathering flaggy	0.38
7	Rubbly Limestone, argillaceous, hard locally. *Perisphinctes* fragments, inclu. *P. (Perisphinctes) parandieri* de Loriol	0.90

6	Second Hard Band. Massive, crystalline limestone, weathering brown locally. *P. (Perisphinctes) Chlorooolithicus*, *Pseudomelania heddingtonensis* (Sow.)	0.38
5	Marly Rubble, compact locally to limestone. *Perisphinctes* sp., *Nucleolites scutatus* Lamark	0.61
4	Bottom Hard Band: Urchin Bed. Hard, grey crystalline limestone, locally gritstone, and locally merging into sand downwards. Profusion of sea-urchins, *Nucleolites scutatus*. Lamk. Spines of *Paracidaris*, also *Perisphinctes* sp. fragment. *Pseudomelania heddingtonensis* (Sow.), *Pleurotomaria reticulata* Sow.	0.61
3	Oyster Clay. Black, marly clay, crowded with oysters and *Serpulae*. *Pachyteuthis abbreviatus* (Miller), *Gryphaea dilatata* Sow. var. *controversa* Roemer, *Exogyra nana* (Sow.), *Chlamys (Radulopecten) fibrosa* (Sow.), *Serpula spp.* (large)	0.15
	(ERODED SURFACE)	
2	Shell Pebble Bed. Rubbly limestone, a mass of fossils; also round, bored and *Serpula*-encrusted pebbles of limestone and ammonite fragments derived from the Berkshire Oolites; occasional lydites and quartz. *Pleurotomaria reticulata* Sow., *Lima (Plagiostoma) mutabilis* Arkell, *Astarte ovata* Smith (profuse); *Pachyteuthis abbreviatus* Miller, and crushed fragments of *Perisphinctes* spp. derived from below. Ammonites: *Perisphinctes (Perisphinctes) chlorooolithicus* (Gümbel), *P. (Dichotomosphinctes) buckmani* Arkell, *P. (D.) antecedens* Salfeld, *P. (D.) rotoides* Ronchadzé, *P. (D.) ouatius* (Buckman), *P. (Arisphinctes) ingens* (Y. & B.), *P. (A.) cotovui* Simionescu, *P. (A.) helenae* de Riaz, *P. (A.) vorda* Arkell, *P. (Kranaosphinctes) cymatophorus* (Buckman) and *Cardioceras (Scoticardioceras) excavatum* (Sow.)	0.31
	(NON-SEQUENCE, UNCONFORMITY)	

Beckley Sand Member

1c	Sand, evenly-laid, ferruginous, wedged out in north by Bed 2	up to 0.61
1b	Sandy Limestone, gritty, yellow, passing into sand locally; is in contact with Bed 2 in the north end of the quarry and there becomes welded to it in an apparently single band. The ammonite fauna includes: *Perisphinctes (Perisphinctes) chlorooolithicus* (Gümbel), *P. (Dichotomosphinctes) antecedens* Salfeld, *P. (D.) rotoides* Ronchadzé, *P. (D.) magnouatius* Arkell, *P. (D.)* sp. undescribed aff. *ouatius* (Buckman), *P. (D.)* sp. undescribed aff. *maltonensis* Arkell, *P. (Arisphinctes) maximus* (Y. & B.), *P. (A.) cotuvui* Simionescu, *P. (A.) cotovui* Simionescu, *P. (A.) helenae* de Riaz, *P. (A.) vorda* Arkell, *P. (Kranaosphinctes)*	

	cymatophorus (Buckman) *Cardioceras (Scoticardioceras) excavatum* (Sow.)	0.20
1a	Sand, evenly laid, brown, ferruginous with impersistent doggers and layers of gritstone; giant ammonites. *Perisphinctes (Arisphinctes) maximus* (Y. & B.), *ingens* (Y. & B.), *ingens-cotovui*, *cotovui* Simionescu, *cowleyensis* Buckman, *pickeringius* (Y. & B.), *helenae* de Riaz, *P. (Kranaosphinctes)* sp. undescribed aff. *decurrens* (Buckman), sp. indet., *bullingdonensis* Arkell (one body-chamber), *Cardioceras* sp., a brood of nuclei in the body-chamber of one of the above	seen to 1.22

The sequence at the Horton Road Quarry [570 104] was described as follows:

		Thickness (metres)
	Wheatley Limestone Member	
11	Rubble	seen 0.61
10	Limestone, hard, white, weathering slabby	0.30
9	Marly Rubble, absent at south end	0.46 to 0.91
8	Pendle. Crystalline limestone, weathering slabby	0.31 to 0.61
7	Rubbly Limestone, variable, marly to massive (with thin, hard band locally above, up to 1 ft thick)	1.22
6	Limestone, hard, massive, variable to gritstone	0.46 to 0.61
5	Rubble, variable, hard locally	1.07 to 1.22
4	Bottom Hard Band: Urchin Bed. Massive limestone, variable to gritstone or rubble. *Hyboclypeus wrighti* Étallon, *Perisphinctes* sp.	0.91
3	Oyster Clay. Black, marly clay, with many oysters. *Exogyra nana, Serpulae, Chlamys (Radulopecten) fibrosa* (Sow.)	0.15
2	Shell Pebble Bed. Compact limestone, with many fossils mainly as casts. *Perisphinctes (Arisphinctes)* cf. *maximus, P. (A.) cotovui, P. (A.) pickeringius, P. (A.) laevipickeringius, P. (A.)plicatilis, P. (A.) helenae, P. (A.) vorda, P. (A.) kingstonensis, P. (A.)* spp. fragments, *P. (Dichotomosphinctes) antecedens, P. (Kranaosphinctes) decurrens, Cardioceras (Cawtoniceras) cawtonense; Nucleolites scutatus* Lamk., *Paracidaris florigemma* (Phillips) spines; *Pachyteuthis abbreviatus* Miller; *Pleurotomaria reticulata* Sow., *Bourguetia saemanni* (Oppel), *Procerithium muricatum* (Sow.), *Pseudomelania heddingtonensis* (Sow.), *Natica (Ampullina) arguta* Phillips; *Trigonia reticulata* Agassiz, *Chlamys (Radulopecten) fibrosa* (Sow.), *Mactromya aceste* (d'Orb), *Pleuromys uniformis* (Sow.), *Astarte ovata* Smith, *Isognomon subplana* (Étallon), *I. promytiloides* Arkell, *Gervillella aviculoides*	

(Sow.), *Ostrea delta* Smith, *Gryphaea dilatata* Sow. var. *controversa* Roemer; *Serpula* spp. (large) 0.20 to 0.30

Beckley Sand Member

1b	Gritstone	0.30
1a	Sands, yellow, with layers of gritstone. *Cardioceras (Scoticardioceras) excavatum; Nucleolites scutatus* Lamk., *Chlamys (Radulopecten) fibrosa* (Sow.)	seen 1.22

Callomon (1953) was able to correlate the sequences between the two quarries and suggested that the bed numbers given to the sections relate to specific persistent horizons. He noted the persistence of the pebble bed at the base of the Wheatley Limestone Member (bed 2, Arkell's bed 9) and suggested that Arkell's beds 4 to 8 at the Benfield and Loxley's Quarry are absent at the Woodperry Road Quarry, having been cut out below the non-sequence.

The total thickness of the Beckley Sand Member is estimated from the width of the outcrop to be circa 30 m. The evidence suggests that the Beckley Sand originally comprised a calcareous sand containing scattered shell debris, with shelly shell-debris-rich bands. Leaching of lime associated with oxidation has removed much of the scattered shell detritus leaving only the better-cemented bands and residual doggers. Ammonites, which abound at some levels, indicate that the Beckley Sand Member lies within the *vertebrale* Subzone of the *densiplicatum* Zone.

Wheatley Limestone Member

Arkell (1927, 1933, 1943 and 1947) introduced the term Wheatley Limestone for a shell-detrital, sparsely oolitic limestone which is partly equivalent to the Coral Rag but locally occurs both above and below the Coral Rag, as in the present district. The two extensive outcrops to the south of Beckley are predominantly in the biosparite facies, the Wheatley Limestone. In contrast, the fault-bounded outcrops south-west of the B4027, Islip to Forest Hill Road are largely of Coral Rag facies. It has not been possible to define the outcrops of these facies at the 1:10 000 scale because they appear to interdigitate and there are no exposures. Both facies are therefore shown as Wheatley Limestone Member on the map. The base of the member is drawn at the change from calcareous sandstone lithologies of the underlying Beckley Sand to the limestones of the Wheatley Limestone. This boundary is generally marked by an erosional surface overlain by a pebble bed.

The Member has been worked extensively for building stone, aggregate and lime, and the outcrop contains many partially restored shallow diggings. Some 0.5 m of pale fawn massive biosparite is still visible in an old quarry [5736 1059] north-west of Woodperry. Three large quarries were working this century. Benfield and Loxley's quarry [567 103] (Arkell, 1936, p.171; Callomon, 1953, p.85) showed only the basal beds (see Beckley Sand Member). These consisted of fossiliferous rubbly and marly limestones with many small black lydite pebbles, which rested on a thin 'Pebble bed' with quartz and lydite pebbles as above, but also with intraformational pebbles of 'white oolite' and of 'gritstone' (Beckley Sand Member lithology), both of which are bored and encrusted with serpulids and oysters. This basal pebble bed is present in the other two major quarries. At the time of the survey, the Woodperry Road Quarry [570 108] had been developed for housing and the original quarry face converted to rock gardens. The section has been described in detail by Callomon (1953, p.83-5; see Beckley Sand Member), Arkell (1943, p.190) and McKerrow and Kennedy (1973, p.33). Alternations of massive well-cemented biosparite with soft shell-debris marl and marly limestone could still be recognised in 1986); the basal beds were obscured. Partial exposures were still visible in the Horton Road Quarry [570 104] (Callomon, 1953, p.86, see Beckley Sand Member). The section on the north face [5705 1046] was:

	Thickness (metres)
Pale grey, shelly, fine-grained biosparite	0.9
Lumps of leached, porous biosparite in shell-debris marl	0.4
Grey, hard, fine-grained biosparite	seen to 0.5

Some 2.6 m of biosparite limestones were seen 50 m to the WSW. Though the basal beds of the member are no longer visible, they were described in the original quarries as being very fossiliferous pebbly limestones with pebbles of quartz, lydite, oolitic limestone, calcareous sandstone and derived ammonite fragments. The pebbles were bored and encrusted with oysters and serpulids, suggesting a non-sequence at the base of the Wheatley Limestone Member. In the Woodperry Road and Horton Road quarries, the pebble bed is succeeded by a black clay crowded with bivalves, *Nanogyra nana (Sowerby)*, *Chlamys (Radulopecten) fibrosa* (sow.), *Gryphaea dilatata* (sow.), *var.*

controversa Roemer with *Pachyteuthis abbreviatus* (Miller) and serpulids. Evidence of this clay was noted near the base of the outcrop [5633 1039] to the west of New Inn Road, Beckley.

Outcrops of rubbly, shelly, coralline biosparite [5608 1068] and coarse, coralline, shelly biomicrite [5520 1047] were noted in field brash north-west and north of Royal Oak Farm. Coralline biosparite was noted west [5525 1003] and east [5576 1003] of Lodge Farm. However, in the almost completely infilled quarry [5502 1060] north of the Elsfield Road, 1 m of interbedded flaggy biosparite and rubbly, friable biomicrite were exposed. It is probable that the northern limit of the Coral Rag facies occurs in the south-western extremity of the present district.

The estimated thickness of the Wheatley Limestone Member preserved in this area is 12.0 m. The member contains a rich and varied fauna dominated by bivalves, with rare ammonites. Corals are most abundant in the south-west suggesting that this area was proximal to a coral patch reef complex. Shell-debris is the dominant sediment to the north-east and was probably swept from the reef complex into deeper water in this direction.

Ampthill Clay Formation

This formation does not crop out within the district, but is probably present at depth beneath the Kimmeridge Clay within the Lodge Farm Fault Trough.

Kimmeridge Clay Formation

Upper Kimmeridge Clay crops out in the low ground of the Lodge Farm Fault Trough. Dark grey, very shelly mudstone was seen below tufaceous loam in the stream bed [5568 1000] south of Lodge Farm. A bed of fine-grained sand overlies these clays and gives rise to a weak feature which is limited by the normal faults defining the fault trough. A borehole [SP51SE/62, 5564 1008] at Lodge Farm proved 3 m of pale grey to brown fine to medium-grained sand with a weakly cemented, calcareous sandstone band and interbedded dark grey clayey sands beneath about 2 m of tufaceous gravel (Head). A small outcrop of clay to the north-east probably overlies this sand, suggesting that the formation may be synclinally folded within the fault trough.

Some 15 m of Kimmeridge Clay crops out locally; the total thickness preserved within the fault trough is probably about 30 m. The unexposed beds comprise grey mudstones with thin nodular cementstone bands. The sequence is entirely marine with richly fossiliferous horizons.

4 DRIFT DEPOSITS

Head

Head deposits occur on the slopes in the southern half of the sheet. They consist generally of reddish brown, clayey sand with scattered pebbles, which reflect the source material lithologies. They are poorly sorted and generally less than 1.5 m thick. They were deposited by solifluxion, hill wash and soil creep, processes which continue at a greatly reduced scale at the present day.

The oldest deposits, south of Lower Farm [552 128], are probably the remnants of a once more extensive sheet derived from steep-sided valleys in the Corallian escarpment. Up to 1.5 m of reddish brown clayey sand with a thin basal pebble bed are present in places. The deposit is generally extensively cryoturbated and the outcrop has been arbitrarily defined to include sequences thicker than about 0.6 m. Beyond the outcrop shown on the map, the edges of the deposit have been incorporated into a deep sandy clay soil which contrasts with the heavy soils of the Oxford Clay and West Walton formations. East of Beckley the Head is confined to the floors and slopes of valleys. A small outcrop is present north of Horton.

Calcareous Tufa

Springs rising at the base of the Cumnor Formation are saturated with calcium carbonate derived by leaching from the Beckley Sand and Wheatley Limestone Member. The lime is deposited on plant material, sand grains and pebbles. In the outcrop [551 108] south-west of Folly Farm, the Calcareous Tufa forms a sheet on the slope of the West Walton Formation outcrop. East of Upper Park Farm, Beckley, several springs around the valley head have given rise to coalescing aprons of Calcareous Tufa [573 114]. The calcareous sediment has subsequently been transported downstream and incorporated passing into calcareous alluvium, which consists of white particles ranging in size from small pebbles to silt.

First Terrace Deposits

Deposits of reddish brown, clayey sand occur around the periphery of Otmoor and extend beneath the alluvium. Rarely more than 1 m thick, in places they include a basal lag deposit of pea-size gravel, composed of weathered flint, quartz, quartzite sandstone and local Jurassic fossil fragments. The deposits do not form a clearly defined terrace, but rise gradually to levels at 1 m or so above the alluvium, or circa 59 to 61 m AOD.

A second suite of sand and clayey sand deposits attributed to the First Terrace extends along a line from near The Spinney [5787 1284], south-eastwards to near Danesbrook Farm [5936 1063]. These outcrops are more clearly separated from the adjacent alluvium and cryoturbated pockets beyond the mapped outcrops suggest a formerly more widespread distribution. The deposits have not been levelled systematically, but the limited evidence indicates that their surface level falls north-westwards from about 65 m OD to 60 m OD near Otmoor, suggesting deposition by a stream flowing north-westwards to Otmoor. In contrast, the modern drainage is southwards to the Danesbrook and thence to the River Thame.

Older Alluvium

An outcrop of loamy clay [593 102] south of Danesbrook Farm is lithologically distinct from the adjacent modern alluvium of the Moorbridge Brook. It grades topographically into the adjacent First Terrace Deposits which lie at a slightly higher level. It probably represents an early stage of ponding of the Moorbridge Brook.

Alluvium

The southern part of Otmoor lies in the north-western part of the district. Its surface is almost flat, apart from man-made embankments and drains. Spot heights and the surface levels of boreholes indicate that the ground surface falls from about 59 m OD in the north and along the eastern edge to about 58 m OD at the outfall of the River Ray south of Oddington. The level of the alluvium rises slightly around the margin of the outcrop. A section in a drain [5519 144] east of Logg Farm showed both the surface and the base of the alluvium rising about 0.6 m over 30 m. These higher marginal deposits may be slightly older than the main spread of alluvium, or they could have resulted from periodic higher level flooding.

A thin humic soil overlies up to 2 m of pale grey to pale brownish grey silty alluvial clay, which becomes slightly more silty and sandy downwards in places and contains rare scattered small pebbles in the lower part. Locally, a lag deposit composed largely of intact *Gryphaea* shells occurs at the base. The deposit is difficult to distinguish from weathered *in situ* Oxford Clay, from which it has largely been derived. A distinguishing character is the presence of secondary calcite particles (race) in the alluvium which are rare in the Oxford Clay. Peat has been recorded at only one place [5626 1402], where a channel at least 1.6 m deep contains brown humic shelly clay, which overlies grey clay with a thin peat seam.

The topographic map of Otmoor is dominated by the man-made peripheral (ring) dyke which now acts as a main drain and serves as a bypass, in the north, for the waters of the New River Ray. The original course of the River Ray is clearly marked by man-made banks. Traces of an older dendritic tributary system can be seen on aerial photographs and, on the ground, as shallow hollows, parts of which are prone to flooding.

Much of Otmoor remains as a wilderness, very poorly drained and supporting only poor pastures and wetlands. The south-west corner has been 'improved' for agriculture and the features which characterised the historic Otmoor have been destroyed. This area, now mostly arable land, has been enclosed by a deep ditch and associated bank, and open and subsurface drains transect the area. Water levels are kept low by pumping water into the peripheral drain and thence to the River Ray.

Like most wild wetlands, Otmoor has its catalogue of myths and legends. Phillips (1871, p.39-40) recognised the origin of Otmoor: 'That a lake once existed here is likely, but that the present land surface is its dried bed, is not a safe supposition. The river may have flowed through a contracted lake in the midst of a wider marsh, and innumerable inundations may have spread a level sediment over the area. These effects may have grown less and less by the wearing down of obstacles in the channel, and by what appears to be certain, a great reduction of the rainfall since the immediate post-glacial times'. Arkell (1947) described the area as comprising old alluvial deposits with peat and humus. On the basis of a pedological survey of Otmoor, Marker and Cooper (1961) concluded that the soil analyses were more akin to Oxford Clay and hence that Otmoor was an Oxford Clay vale and not an alluvial basin. Their analyses reflect the dominance of derived Oxford Clay sediments within the alluvium.

The development of Otmoor is discussed by Ambrose and Horton (1991). The early stages of the development of Otmoor are not known. Once the proto-Ray had cut through the hard beds of the Cumnor Formation, downcutting in the West Walton Formation and Oxford Clay would have been rapid. Although controlled by the base level in the River Cherwell, particularly under periglacial conditions, expansion of the clay vale would have been limited by the slower erosion of the Cumnor Formation escarpment by spring sapping and landslipping, and downcutting would have continued until the River Ray reached more resistant horizons, firstly the Kellaways Sand Member and then the Cornbrash. The distribution of the First Terrace shows that Otmoor, as a discrete landform, was in existence during their deposition.

During its downcutting the River Ray may have had more than one course. These could at times have functioned simultaneously. Four outlets from the clay vale to the Cherwell and Thames valleys have been suggested: 1) the depression [560 161] between Merton and Oddington, running north of Charlton on Otmoor, 2) the present channel [528 139] of the Ray south of Oddington to Islip, 3) the broad depression [544 119] running south-west from Lower Farm, past Noke to Wood Eaton, and 4) via the present channel of the Moorbridge Brook [591 108].

The limited evidence of the surface profile of the terrace deposits in the Moorbridge Brook suggests that they were laid down by north-westward flowing tributary of the River Ray. The headwaters of this stream were captured by the Moorbridge Brook and the drainage directed to the River Thame. The possible outlet [550 128] past Lower Farm is now perched metres above the outcrop of the adjacent First Terrace deposits. Nevertheless, the extensive deposits of Head which now floor the broad valley to the south-west of the present district suggest that at least part of the drainage of the Otmoor may have escaped that way in earlier times. The existing outlet of the Ray, past Oddington, has probably functioned as the main escape route of the waters of the Otmoor area. The present route was undoubtedly superimposed, because it was incised into the resistant Kellaways Sand and subsequently the Cornbrash south-west of Oddington. The hardness of these beds retarded downcutting. Lateral erosion and periglacial peneplanation would have been initially enhanced but as the climate ameliorated, increased ponding by the rock barrier would have enhanced alluvial deposition. Flooding was recurrent. A situation that was only partially improved when the Army deepened the stream bed through the narrow Cornbrash outcrop (SP51SW) during the 1939-45 war. Previously this outcrop in the stream bed acted as a barrier, encouraging flooding upstream and limiting the egress of waters to the Cherwell.

LANDSLIP

The steep slope below the Cumnor Formation escarpment is prone to landslipping. The back-scars of landslip commonly occur at or near the base of the Arngrove Spiculite Member, or when it is absent, the overlying Beckley Sand Member. Movement commonly affects the entire West Walton Formation outcrop. Clear evidence of landslipping (uneven ground, seepage lines, and wet areas) occurs between Folly Farm and Upper Park Farm, Beckley. South of this the slopes are much smoother and there is no evidence of active movement, although farming with improved land drainage may have destroyed the characteristic landforms of old landslips.

The landslip north-east of Horton [597 129] appears to affect only the Upper Oxford Clay. There is no conclusive evidence of failure of the West Walton Formation although uneven topography on the slope immediately west of Studley Priory suggests that landslips may be present there.

STRUCTURE

The regional dip of the Jurassic strata is less than 1° to the south-east (1 in 560 to 1 in 1050), but this is locally modified by folding, faulting and superficial movements.

The extreme north-west of the district, around Oddington, includes part of the Charlton Anticline (Arkell, 1947) which was formerly known as the Islip Anticline. This structure is complex and the present outcrops form part of one of the component NE-SW trending periclines which are best developed in the country to the north-west of this district (Ambrose, 1989). The structure is asymmetric and has a steeper limb to the south-east, although the dip appears to flatten out rapidly beneath the Otmoor alluvium. Three approximately WNW-ESE faults transect the structure, whilst an intersecting NNE-SSW fault, inferred from geophysical evidence obtained by K Ambrose roughly parallels the axis of the pericline at Oddington. All these faults probably reflect structures within the basement rocks.

Three faults displacing the Oxford Clay have been recognised. The Otmoor Fault [5800 1425] is concealed beneath alluvium and has been postulated on the basis of borehole evidence. The Studley Fault [5930 1245], with a WSW-ENE trend, extends from Beckley Park to Horton. It has a downthrow of 2 to 4 m to the north. The third fault [5680 1210] has a northerly trend and crosses Otmoor Lane, NNE of Beckley. It has a downthrow to the west of less than 4 m.

The south-western extremity of the district forms part of the Wheatley Fault Zone (Arkell, 1947). The structure is limited by the NW-SE trending Stow Lodge Fault (Arkell, 1943) [5570 1018] which has a downthrow to the south-west of between 5 and 25 m. To the south-west, the proximal Lodge Farm Fault has similar trend and also downthrows to the south-west (30 to 33 m); it passes into a westerly fault with an opposite downthrow of up to 4 m to the north. This part of the fault truncates the NNW-SSE trending Shepherd's Pit Fault [5534 1020] which defines the south-western margin of the Lodge Farm Fault Trough. This fault has a downthrow to the ENE of at least 30 m. Within the Fault Trough the strata are probably synclinally folded.

Superficial folding or cambering, with the development of associated dip and fault structures, probably affects the Corallian Formation, particularly where its members crop out above the steep clay slope formed by the West Walton Formation. Thus near Beckley the base of the Beckley Sand has apparent dips of up to 3° away from the highest ground.

ECONOMIC GEOLOGY

There are no mineral workings at the present time. The Wheatley Limestone and Beckley Sand Members were formerly extensively exploited, probably for building stone, aggregate and building sand. The Arngrove Spiculite Member was probably worked for road aggregate in a quarry [599 128] north of Studley. Davies (1907) described other quarries in the Spiculite to the north as having been dug in 'gravel'.

The most important industry is agriculture, and arable cultivation is becoming increasingly dominant. Even the poorly-drained, low-lying Oxford Clay outcrops are being ploughed. Drainage has already destroyed a part of the Otmoor wetland and unless measures are taken to preserve it, this significant conservation area will be lost for ever.

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APPENDIX 1 SELECTED BOREHOLES

1 Otmoor Borehole A

[5681 1361] SL circa +58.8 to 59.1 m OD

	Depth (m)
Alluvium	to 1.94
Middle Oxford Clay Member	to 4.30
Lower Oxford Clay Member	to 32.31
Kellaways Sand Member	to 34.97
Kellaways Clay Member	to 38.06
Cornbrash	seen to 38.76 TD

2 Otmoor Borehole B

[5670 1326] SL circa +58.8 to 59.1 m OD

	Depth (m)
Alluvium	to 2.29
Middle Oxford Clay Member	to 4.62
Lower Oxford Clay Member	to c 31.60
Kellaways Sand Member	to 34.15
Kellaways Clay Member	to 37.15
Cornbrash	seen to 37.57 TD

3 Otmoor Borehole C

[5708 1331] SL circa +58.8 to 59.4 m OD

	Depth (m)
Alluvium	to 2.40
Middle Oxford Clay Member	to 8.38
Lower Oxford Clay Member	to 34.90
Kellaways Sand Member	to 37.25
Kellaways Clay Member	to 40.26
Cornbrash	seen to 43.26 TD

4 **Otmoor Borehole 1**

[5520 1417] SL +58.52 m OD

	Depth (m)
Alluvium	to 1.83
Lower Oxford Clay Member	to 5.79
Kellaways Sand Member	to 8.53
Kellaways Clay Member	to 11.96
Cornbrash	seen to 12.80 TD

5 **Otmoor Borehole 2**

[5566 1479] SL +58.83 m OD

	Depth (m)
Alluvium and Lower Oxford Clay Member	to 5.72
Kellaways Sand Member	to 8.38
Kellaways Clay Member	to 11.58
Cornbrash	seen to 14.33 TD

6 **Otmoor Borehole 6**

[5586 1466] SL +58.83 m OD

	Depth (m)
Alluvium and Lower Oxford Clay Member	to 9.45
Kellaways Sand Member	seen to 10.06 TD

7 **Otmoor Borehole 8**

[5794 1422] SL +59.13 m OD

	Depth (m)
Alluvium, Middle and Lower Oxford Clay undifferentiated	to 31.70
Kellaways Sand Member	seen to 32.31 TD

8 **Otmoor Borehole 9**

[5690 1297] SL +59.13 m OD

	Depth (m)
Alluvium, Middle and Lower Oxford Clay undifferentiated	to 35.51
Kellaways Sand	to 36.27 TD

9 **Otmoor Borehole 10**

[5696 1254] SL +62.48 m OD

	Depth (m)
Alluvium	
Middle Oxford Clay Member	to 22.25
Lower Oxford Clay Member	to 49.30
Kellaways Sand Member	seen to 49.61 TD

10 **Otmoor Borehole 11**

[5696 1253] SL +59.74 m OD

	Depth (m)
Alluvium	to 1.53
Middle Oxford Clay Member	to 13.72
Lower Oxford Clay Member	seen to 30.56 TD

11 **Otmoor Borehole 12**

[5533 1301] SL +59.44 m OD

	Depth (m)
Alluvium	to 2.13
Lower Oxford Clay Member	to 25.60
Kellaways Sand Member	seen to 27.20 TD

12 Otmoor Borehole 14

[5570 1411] SL +58.52 m OD

	Depth (m)
Alluvium and Lower Oxford Clay Member undifferentiated	to 10.97
Kellaways Sand Member	to 13.41
Kellaways Clay Member	to 16.54
Cornbrash	seen to 16.84 TD

13 Otmoor Borehole 15

[5604 1332] SL +58.83 m OD

	Depth (m)
Alluvium	to 2.06
Lower Oxford Clay Member	to 26.52
Kellaways Sand Member	seen to 27.51 TD

14 Otmoor Borehole 16

[5735 1476] SL +59.13 m OD

	Depth (m)
?Middle and Lower Oxford Clay Members undifferentiated	to 27.74
Kellaways Sand Member	seen to 30.18 TD

15 Otmoor Borehole 17

[5722 1414] SL +58.8

	Depth (m)
Alluvium	to 2.29
?Middle and Lower Oxford Clay Members undifferentiated	to 28.27
Kellaways Sand Member	seen to 29.18 TD

16 Beckley Road

[5647 1076] SL +133.8 m OD

	Depth (m)
Beckley Sand and ?Arngrove Spiculite Members	seen to 27.43 TD

55 BGS Lower Farm No 1 Borehole

[5536 1229]

	Depth (m)
Head	to 1.1
?Lower Oxford Clay	to 7.15 TD

56 BGS Beckley Road Borehole

[5898 1185]

	Depth (m)
Middle Oxford Clay	to 9.8 TD

57 BGS Lower Farm (Beckley) Borehole

[5657 1224] SL circa +65.5 m OD

	Depth (m)
Upper Oxford Clay Member	to c 8.0
Middle Oxford Clay Member	seen to 10.0 TD

58 BGS Mill Lane Borehole

[5950 1279]

	Depth (m)
Upper Oxford Clay Member	to c 7.0
Middle Oxford Clay Member	seen to 10.0 TD

59 **BGS West Hill Farm Borehole**
[5880 1291]

	Depth (m)
Upper Oxford Clay Member	to 9.6
Middle Oxford Clay Member	seen to 10.0 TD

60 **BGS Middle Park Farm Borehole**
[5781 1147]

	Depth (m)
Upper Oxford Clay Member	seen to 10.0 TD

61 **BGS Danesbrook Farm Borehole**
[5941 1057]

	Depth (m)
Upper Oxford Clay Member	seen to 10.0 TD

62 **BGS Lodge Farm (Stanton St John) Borehole**
[5564 1008]

	Depth (m)
Head (gravel)	to c 2.0
Kimmeridge Clay Formation (Sand)	seen to 5.0 TD