

# Geology of the Andover area: Exposed strata - Chalk Group

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This page is part of a category of pages providing a summary of the geology of the Andover district (British Geological Survey Sheet 283), which extends over approximately 600 km<sup>2</sup> of north-west Hampshire and a small part of eastern Wiltshire. Links to other pages in this category can be found at the foot of the page.

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Approximately 265 to 365 m of Upper Cretaceous Chalk underlies the Andover district, forming extensive dip slopes, undulating ground and the dissected primary and secondary escarpments that cross the area.

Most of the lithostratigraphical units typically exhibit surface topographical features, these include the primary and secondary escarpments, and subsidiary escarpments developed on dip slopes (Aldiss et al., 2012)<sup>[1]</sup>. Generally, the West Melbury to lowest Seaford Chalk formations form the primary escarpment, whilst the Newhaven to Portsdown Chalk formations form secondary escarpments.

The nomenclature for the Upper Cretaceous used in this district is shown in **Figure P815491** together with its relationship to the traditional scheme. The current nomenclature is a development of the schemes devised by Mortimore (1983<sup>[2]</sup>, 1986<sup>[3]</sup>), Bristow et al. (1995<sup>[4]</sup>, 1997) and adopted by the Geological Society Stratigraphy Committee in 1999 (Rawson et al., 2001<sup>[5]</sup>; Hopson, 2005<sup>[6]</sup>).

Stage	Foraminiferal zones*			Macrofossil Zones		Subzones		Stratigraphical units					
	1980	UKB	IGS	Zones	Subzones	1	2	3	4	5	6		
CAMPANIAN (part)	80 (part)	17	21	<i>Retemacella macromata</i> s.l. (part)									
	81	18	20	<i>Gemmatrochis quadrata</i>	<i>jevi-A. constricta</i> beds								
SANTONIAN	82	19	18	<i>Officarus pilula</i>	<i>Applousites constricta</i>								
				<i>Clitasterius amplius</i>	<i>Applousites constricta</i>								
CONIACIAN	11	13	13	<i>Micraster verticilliferium</i>	<i>Applousites constricta</i>								
				<i>Phioceras plana</i>	<i>Applousites constricta</i>								
TURONIAN	10	11	11	<i>Terebratulina lata</i>	<i>Applousites constricta</i>								
				<i>Mytiloides latissus</i> s.l.	<i>Applousites constricta</i>								
CENOMANIAN	9	8	8	<i>Neurostroma pulchra</i>	<i>Applousites constricta</i>								
				<i>Neurostroma pulchra</i>	<i>Applousites constricta</i>								
				<i>Neurostroma pulchra</i>	<i>Applousites constricta</i>								
				<i>Neurostroma pulchra</i>	<i>Applousites constricta</i>								
UPPER ALBIAN (part)	6			<i>Stelliochilus alpinus</i>	<i>Applousites constricta</i>								

\*Traditional Chalk subdivisions after Jones-Brown and Hill (1993, 1994, for example). UGS = Upper Gossams s.l. = *sensu lato*.  
 \*Foraminiferal zones after Carter and Hart, 1977; Swickicki, 1980; Hart et al., 1989 (UKB zones) and Wilkinson, 2000 (IGS zones).

Chalk Group correlation for the Southern Chalk Province. P815491.

Chalk accumulated on the outer shelf of an epicontinental subtropical sea of normal salinity and, generally, with little terrigenous input. In Cenomanian times, landmasses were present in south-west

England, Wales, Scotland and Northern Ireland, and farther afield in Brittany. However, much of this land was submerged by later sea level rise, especially from the earlier Turonian onwards.

### **Grey Chalk Subgroup**

This is essentially equivalent to the Lower Chalk Formation of **Bristow et al., (1997)**<sup>[21]</sup>, but the youngest unit in that scheme, the Plenus Marls Member, is now included with the overlying Holywell Nodular Chalk Formation (White Chalk Subgroup). The Grey Chalk is divided into two formations, the West Melbury Marly Chalk overlain by the Zig Zag Chalk, and both typically lack flint.

#### **West Melbury Marly Chalk Formation (WMCK)**

In the Andover district the West Melbury Marly Chalk is 15–20 m thick, and crops out in the north-eastern part of the district around the eastward- and westward-plunging Kingsclere Anticline and again in the north-west around the eastward-plunging closure of the Pewsey Vale Anticline.

The formation is a repetitive sequence of hard limestone and softer marl (calcareous mudstone) couplets, each pair being between 0.5 and 2 m thick at most. The base of the formation is marked by the Glauconitic Marl Member; an arenaceous, glauconitic, marly sandstone which provides a distinctive positive gamma-ray peak in borehole geophysical logs across southern England.

The formation was recognised in this area by the marly (calcareous mud), wet soils and frequent hard grey limestone brash within a low sloping platform at the base of the primary scarp.

The West Melbury Marly Chalk generally forms an aquitard between the Upper Greensand and the Zig Zag Chalk due to its high clay content.

#### **Zig Zag Chalk Formation (ZCk)**

In the Andover district the formation is 30 to 50 m thick and is exposed on the flanks of the Kingsclere Anticline in the north-east and the closure of the Pewsey Vale Anticline in the north-west parts of the district.

The base of the formation is commonly at a strong negative slope break at the base of the Chalk escarpment. This abrupt change in slope appears to correspond with the incoming of thick beds of firm to hard, blocky chalk, above the gently sloping ground underlain by the West Melbury Marly Chalk. The upper limit of the Zig Zag Chalk is taken at the base of the Plenus Marls Member.

The Zig Zag Chalk Formation comprises medium-hard, pale grey, blocky chalk, with some thin limestones near the base. The lower part of the formation has a higher marl content and some distance above the base hard, pale grey splintery limestones with conspicuous *Sciponoceras* may occur. The upper part of the Zig Zag Chalk tends to be pale grey to white, firm, marly chalk with common *Inoceramus atlanticus* (Heinz), *I. pictus* J de C Sowerby and the echinoid *Holaster subglobosus* (Leste).

### **White Chalk Subgroup**

The White Chalk Subgroup is essentially the combined Middle and Upper Chalk formations of **Bristow et al. (1997)**<sup>[21]</sup>. It is now divided into seven formations (**Figure P815491**), of which, the oldest six occur in the Andover district. The base of the White Chalk Subgroup is taken at the base of the Holywell Nodular Chalk Formation, which in present practice includes the Plenus Marls Member. In general, the subgroup is characterised by pure white chalk, hard and nodular at some levels, with common flint horizons in the middle and higher parts. A maximum of 295 m of White

Chalk is estimated to crop out in the district.

#### **Holywell Nodular Chalk Formation (HCK)**

The Holywell Nodular Chalk Formation is between 10 and 30 m thick in the Andover district and crops out in the base of valleys in the central northern part of the district and also associated with the Pewsey Vale and Kingsclere anticlines.

The Holywell Nodular Chalk generally comprises hard, nodular chalks with flaser marl seams throughout. Three units can be identified. In ascending stratigraphical order, these are the Plenus Marls Member, the Melbourn Rock Member and an unnamed succession of hard, nodular and grainy chalks with abundant shell debris, most notably species of *Mytiloides*.

The Plenus Marls Member is rarely well exposed, but is present along the whole outcrop of the Holywell Nodular Chalk Formation. It consists of an alternating succession of blocky white chalk and medium grey silty marl beds, mostly between 1 cm and 20 cm thick.

Overlying the Plenus Marls is the Melbourn Rock Member, a very hard, grainy nodular chalk generally lacking in shell detritus. The top of the Melbourn Rock is recognised by the incoming of abundant bivalve shell debris. The Member is up to 3 m thick and often forms a strong positive feature and characteristic brash that can be traced around the outcrop. The overlying unnamed unit of shell detrital and grainy chalks forms a narrow outcrop in the face of the primary scarp. In places, mainly on the less steep slopes, they form a positive feature. The top of the Holywell Nodular Chalk Formation is characterised by the transition to smoother, softer New Pit Chalk Formation, but in practice is taken at the top of the highest recognisable shell detrital chalk during surveying.

#### **New Pit Chalk Formation (NPCK)**

In the Andover district, the unit is between 20 and 30 m thick. In general the New Pit Chalk forms moderately to steeply sloping ground, within the primary scarp, often with a characteristic buttressed form, above the first positive feature indicating the Holywell Nodular Chalk Formation, and below another strong positive feature indicating the base of the overlying Lewes Nodular Chalk and the overlying Lewes Nodular Chalk, and often forms a slight negative feature in the scarp.

The formation is usually softer than both the underlying Holywell Nodular Chalk and the overlying Lewes Nodular Chalk Formation. The formation comprises smooth, firm, massively bedded, white chalks with marl seams and has marked jointing (see **Plate P670041**).

The base of the New Pit Chalk is marked by the disappearance of generally pink shelled *Mytiloides*-rich nodular and grainy chalk. The upper limit is marked by the incoming of common flints and hard nodular chalks, the latter typically between Glynde Marl 1 and Southerham Marl 2 in the standard Sussex succession. Flints are rare in the New Pit Chalk Formation. Where present they are small and occur in the uppermost beds.

The macrofossil fauna is much sparser than in the Holywell Nodular Chalk, and comprises brachiopods (both terebratulids and rhynchonellids) and local horizons of thin-shelled *Mytiloides* spp. bivalves and *Inoceramus*. These thin-shelled *Mytiloides* are generally in the *hercynicus/subhercynicus* group and are most common in the lowest beds where they tend to be flattened and preserved as chalky moulds and associated with large terebratulid brachiopods; whilst the inoceramids are characterised by the *lamarki* species in the middle of the formation with *cuvieri* dominating in acmes at the top of the formation and often closely associated with the New Pit Marls.

### Lewes Nodular Chalk Formation (LeCk)

The formation is between 45 and 75 m thick in the Andover district and crops out in the base and steep sides of the major valleys dissecting the primary Chalk escarpment.

The Lewes Nodular Chalk comprises interbedded, hard to very hard, nodular chalks, with soft to medium-hard chalks and marls. The first persistent seams of flint occur near the base. The flints are typically black or bluish black with a thick white cortex. The Lewes Chalk is divided into two informal units by the Lewes Marl and associated underlying Lewes Flints, the latter comprising a ramifying system of black cylindrical burrow-form flints. The lower unit consists of medium- to high-density chalk and conspicuous, iron-stained, hard, nodular chalks. The upper unit usually comprises low- to medium-density chalks with evenly spaced, thin, hard, nodular beds. However, in the Andover district, the beds of nodular chalk which serve to distinguish the Lewes Nodular Chalk from the overlying Seaford Chalk are absent. This is due to a lithological change to soft and smooth-textured chalk below the level of the Shoreham Marl 2 which is used by **Mortimore (1986)**<sup>[3]</sup> to divide the Lewes Nodular Chalk and the Seaford Chalk formations. The top of the Lewes Nodular Chalk Formation in this area may be as low as the Beachy Head Zoophycos horizon, which spans the Light Point Beds and Beachy Head Beds of **Mortimore (1986)**<sup>[3]</sup>.

The hardgrounds at the base of the Lewes Nodular Chalk (Chalk Rock Member) can be identified in brash and animal burrows; for example, near Charldown Bottom Copse (SU 4066 5897). The Chalk Rock Member is also exposed at Portridge House Quarry on the northern limb of the Kingsclere Anticline (**Plate P670000**).



New Pit Chalk Formation, Laundry Cottages Pit, Sydmonton [SU 48589 58999]. Large blocky to massive firm to moderately hard, smooth, white chalk with common marl seams near the top of the formation. Marl seams, at the level of the hammer and about a metre above it are commonly anastomosing this, and the included fauna (including common *Inoceramus cuvieri*), indicate the upper

part of the New Pit Chalk Formation in the *T. lata* Zone. The marls present may well be the New Pit Marls. Although the face is not a true dip section, the strong northerly dip, on the northern limb of the Kingsclere Anticline, is readily apparent. Hammer is 28cm in length. Photo P M Hopson P670041. P670041.



Portridge House Quarry, [SU 47613 59081], Burghclere, about 400 m south-east of Duncroft Farm. Steeply dipping nodular chalks, hardgrounds, anastomosing marl seams and flints of the Chalk Rock Member, Lewes Nodular Chalk Formation on northern limb of Kingsclere Anticline. The convoluted, glauconitised hardground indicated at the top of the hammer is interpreted as the Hitch Wood Hardground that is placed at the top of the Chalk Rock Member. The fauna from the 14.5 m of the Lewes Chalk Formation at this exposure, including common *Micraster leskei* (large form), *M. normanniae*, *Cremnoceramus deformis erectus* and *C. waldorfensis hannoverensis* indicate the strata range from the topmost *plana* Zone up into the lower part of the *cortestudinarium* Zone. Hammer is 28 cm in length. Photo P M Hopson. P670000.



A typical view of the Seaford Chalk Formation. View of the quarry on the north side of Bury Hill [SU 3452 4379] off Foundary Road, Anna Valley, near Andover. The quarry exposes the higher part of the Seaford Chalk Formation characterised by regular flint courses and the lower part of the Newhaven Chalk Formation (uppermost right) characterised by marl seams and poorly defined small nodular and finger flint seams. Photo P M Hopson. P785772.

Synsedimentary faulting in the north-western part of the Andover district has resulted in a thickening of the Lewes Nodular Chalk Formation. This is particularly apparent in the area around Hippenscombe.

#### **Seaford Chalk Formation (SCh)**

The Seaford Chalk Formation is between 60 and 70 m thick, and outcrops over a wide area of the Andover district. It underlies much of the Chalk dip slope and the broad interfluvial areas between the primary escarpment and the negative break of slope below the secondary Chalk escarpment. Topographically, the Seaford Chalk Formation forms the characteristic smooth convex slopes of the major ridges between the dry, southward-draining valleys across much of the central section of the map district.

The Seaford Chalk Formation (**Plate P785772**) is composed primarily of soft, smooth, blocky, white chalk with abundant seams of large nodular and semitabular flint, and thin harder nodular chalk beds near the base. The flints in the lower part of the unit are often highly carious, whereas higher in the succession the flints are black and bluish black, mottled grey, with a thin white cortex. These flints commonly enclose shell fragments. Some of the large flint bands, notably the Seven Sisters Flint (**Mortimore, 1986**)<sup>[3]</sup> (15–20 m above the base of the formation), form almost continuous seams and in places create local topographical features. The Seven Sisters Flint is distinguished from other large flints by its significant inoceramid bivalve content of *Platyceramus* and *Volviceramus*, an association that is typical of the lower part of the Seaford Chalk. *Platyceramus* also occurs in the upper part of the Seaford Chalk, associated with *Cladoceramus* (**Mortimore, 1986**)<sup>[3]</sup>.

Thin, planar, district flints, are also common in parts of the succession.

Another particularly characteristic semitabular flint occurs near the top of the Seaford Chalk in the Andover district, about 11 m below the base of the Newhaven Chalk Formation. This flint is generally about 10 cm in thickness, of uniform appearance, and tends to fracture vertically. The blocks thus formed are up to 50 cm across and are fairly conspicuous in ploughed fields. This flint bed is tentatively correlated with Whittaker's Three Inch Band of the North Downs (described by **Robinson, 1986**<sup>[8]</sup>), which is probably equivalent to the Rough Brow Flint of the Sussex coast (**Mortimore, 1986**)<sup>[3]</sup>. However, in this district, no biostratigraphical detail closely associated with an exposure of this flint horizon has so far been found to support this correlation.

About 5 m below the Newhaven Chalk is a thin (1-2m) horizon of intensely hard porcellanous indurated chalk (the 'Winchester Hardground' of **Farrant, 1999**). This interval is now formally called the Stockbridge Rock Member, and is shown on the 1:10 000 maps as a limestone unit. It contains abundant sponge spicules, most commonly as moulds, together with some complete sponges. This is readily identifiable in the brash and forms a useful marker horizon. It occurs at about the level of Barrois' Sponge Bed and the Clandon Hardground of the North Downs (**Robinson, 1986**<sup>[8]</sup>) and may equate with the Whitway Rock of the Newbury area (**Sumbler, 1996**)<sup>[9]</sup>. In Kent, Rowe's Echinoid Band, a bed 0.3 m thick containing an acme occurrence of *Conulus* sp. with other echinoids, occurs just above Barrois's Sponge Bed (**Robinson, 1986**)<sup>[8]</sup> and mapping demonstrates that this occurs just above the Stockbridge Rock Member. The Stockbridge Rock Member occurs widely between Salisbury and Winchester, but appears to be quite sporadic and intermittent in the west and north of that district. Within the Andover district, the Stockbridge Rock Member is mapped intermittently in the central southern area. Its patchy distribution may be partly explained by the state of plough, but is more likely to be due to variations in the degree of cementation and represent a synsedimentological feature developed within a limited palaeogeographical area. As yet it has not been seen in section, so its true origin is open to debate. Field evidence from the Winchester area (**Farrant, 2000**)<sup>[10]</sup>, suggests that there might be several thin hard bands between 5 m and 10 m below the base of the Newhaven Chalk in those areas, each separated by thin intervals of softer chalk.

#### **Newhaven Chalk Formation (NCK)**

The Newhaven Chalk is up to 70 m thick in the Andover district and crops out extensively over the southern quarter of the district, capping the heavily dissected secondary escarpment. It is locally well exposed in old pits and railway cuttings. In the classic South Downs succession of Sussex, the base of the Newhaven Chalk typically forms a prominent double negative feature break at the base of this scarp. In the east of the district, the lower of these two features is the most dominant and marks the base of the Newhaven. However, in the south-west corner, the most prominent negative break of slope instead occurs within the *M. testudinarius* Zone, about 10 m above the base of the formation. The lowest ten metres of the Newhaven Chalk in this area caps the spurs extending out from the scarp foot. The base of the formation is commonly marked by an extremely faint negative break of slope a short way above a rounded positive break of slope, which in this part of the district seems to be caused by the indurated horizon at the top of the Seaford Chalk.

The Newhaven Chalk Formation is composed of soft to medium-hard, blocky, smooth, white chalks with regular marl seams and flint bands. Typically, the marls vary between 20 and 70 mm thick but, in this area, they are generally little more than a few millimetres. This thinning of marl seams probably reflects the influence of positive synsedimentary structural features within the basin (**Mortimore, 1986**<sup>[3]</sup>; **Mortimore and Pomerol, 1987**<sup>[11]</sup>; **Mortimore and Pomerol, 1991**<sup>[12]</sup>). The flints are generally much smaller and less continuous than those in the underlying Seaford Chalk. Tabular and district flints are not so well developed, but finger, horn and *Zoophycos* flint forms are

more common. Channels with hardgrounds and phosphatic chalks occur locally in the succession elsewhere but none have been identified during the survey of this district.

### **Culver Chalk Formation**

This formation, up to 15 m thick in the Andover district, forms small isolated outliers on the western part of the crest of the secondary Chalk escarpment.

The Culver Chalk is composed of soft, white chalks without significant marl seams, but with some very strongly developed nodular and semitabular flints. A particular concentration of large flints, the Castle Hill Flints, occurs near the base of the unit as defined (at the Castle Hill Marls) by **Mortimore (1986)**<sup>[3]</sup>.

The most notable outcrop occurs on the high ground south of Tidworth in the south-western part of the district where the large nodular flints characteristic of the base of the formation are commonly present in the field brash.

## **References**

1. [↑](#) Aldiss, D T, Farrant, A R, and Hopson, P M. 2012. Geological mapping of the Late Cretaceous Chalk Group of southern England: A specialised application of landform interpretation. *Proceedings of the Geologists' Association*, Vol. 123, 728-741.
2. [↑](#) Mortimore, R N. 1983. The stratigraphy and sedimentation of the Turonian-Campanian in the southern province of England. *Zitteliana*, Vol. 10, 27-41.
3. [↑](#) [3.0](#) [3.1](#) [3.2](#) [3.3](#) [3.4](#) [3.5](#) [3.6](#) [3.7](#) Mortimore, R N. 1986. Stratigraphy of the Upper Cretaceous White Chalk of Sussex. *Proceedings of the Geologists' Association*, Vol. 97, 97-139.
4. [↑](#) Bristow, C R, Barton, C M, Freshney, E C, Wood, C J, Evans, D J, Cox, B M, Ivimey-Cook, H I, and Taylor, R T. 1995. Geology of the country around Shaftesbury. *Memoir of the British Geological Survey*. Sheet 313 (England and Wales).
5. [↑](#) Rawson, P F, Allen, P W, and Gale, A S. 2001. A revised lithostratigraphy for the Chalk Group. *Geoscientist*, Vol.11 (1), 21.
6. [↑](#) Hopson, P M. 2005. A Stratigraphical framework for the Upper Cretaceous Chalk of England and Scotland, with statements on the Chalk of Northern Ireland and the UK Offshore Sector. *British Geological Survey Research Report*, RR/05/01.
7. [↑](#) [7.0](#) [7.1](#) Bristow, C R, Mortimore, R N, and Wood, C J. 1997. Lithostratigraphy for mapping the Chalk of southern England. *Proceedings of the Geologists' Association*, Vol. 108, 293-315.
8. [↑](#) [8.0](#) [8.1](#) [8.2](#) Robinson, N D. 1986. Lithostratigraphy of the Chalk Group of the North Downs, south-east England. *Proceedings of the Geologists' Association*, Vol. 97, 141-170.
9. [↑](#) Sumbler, M G. 1996. *British Regional Geology: London and the Thames Valley*. (London: HMSO for the British Geological Survey.)
10. [↑](#) Farrant, A R. 2000. *Geology of the Bourne River, Salisbury to Bulford Camp, Wiltshire*. British Geological Survey Technical Report, WA/00/24.
11. [↑](#) Mortimore, R N, and Pomerol, B. 1987. Correlation of the Upper Cretaceous White Chalk (Turonian to Campanian) in the Anglo-Paris Basin. *Proceedings of the Geologists' Association*, Vol. 98, 97-143.
12. [↑](#) Mortimore, R N, and Pomerol, B. 1991. Upper Cretaceous tectonic disruptions in a placid chalk sequence in the Anglo-Paris Basin. *Journal of the Geological Society of London*, Vol. 148, 391-404.

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