

# GUIDE TO THE CHALK GROUP OF SOUTHERN ENGLAND

## 1. Introduction

The purpose of this guide is to explain the new stratigraphy being used by BGS (British Geological Survey) for the CHALK GROUP of Southern England. This new stratigraphy is being used on the BGS 1:50,000 Geological Maps when the areas are re-surveyed and the maps republished. The guide is based on a study of a selection of the new maps for the South East together with information obtained from the BGS. As far as I am aware this gives the complete picture as far as Southern England is concerned, but it does not include the chalk which occurs elsewhere (eg. Norfolk and Yorkshire).

In the 1990's the BGS began replacing the traditional Lower, Middle and Upper Chalk divisions with new divisions which broadly, but not exactly equated with the formations described here. However, initially, these new divisions were treated as members within the Lower, Middle and Upper Chalk formations and not as formations in their own right. The new stratigraphy as described here was formally adopted in 2001 and has been used on maps published since then.

The hierarchy of the stratigraphy is Group, Subgroup, Formation, Member, Band. The main mapping unit on the 1:50,000 BGS maps are the formations with different colours being used for these and the members. Bands are not generally mapped. There are also many informally named members and bands which are not covered here.

## 2. Summary

The descriptions are given with the oldest rocks first. The abbreviation given after the name is the code used on the 1:50,000 map. The traditional Lower/Middle/Upper division are also shown, however, these terms are now obsolete and are provided for reference only. It should be noted that new formations do not exactly equate with the traditional divisions. (See Appendix B for details).

### 2.1 Grey Chalk Subgroup (Gck)

#### 2.1.1 West Melbury Marly Chalk Formation (WMck) - *LOWER CHALK\**

- Melbury Sandstone Member (Mels)
  - Bookham Conglomerate Bed
- Glauconitic Marl Member (GM)
- Cambridge Greensand Member (CGS)

#### 2.1.2 Zig Zag Chalk Formation (Zck) – *LOWER CHALK*

- Totternhoe Stone Member (TtSt)

#### 2.1.3 Beer Head Limestone Formation (none) – *LOWER CHALK*

### 2.2 White Chalk Subgroup (Wck)

#### 2.2.1 Holywell Nodular Chalk Formation (Hck) - *MIDDLE CHALK\**

- Plenus Marls Member (None) – *LOWER CHALK\**
- Melbourn Rock Member (Mels)

#### 2.2.2 New Pit Chalk Formation (NPck) - *MIDDLE CHALK*

#### 2.2.3 Lewes Nodular Chalk Formation (LeCk) – *UPPER CHALK*

- Chalk Rock Member (CkR)
- Kensworth Nodular Chalk Member (none)
- Top Rock Bed (Trk)

#### 2.2.4 Seaford Chalk Formation (Sck) - *UPPER CHALK*

- Stockbridge Rock Member (STRK)

#### 2.2.5 Newhaven Chalk Formation (Nck) – *UPPER CHALK*

- Margate Chalk Member (MaCk)

#### 2.2.6 Culver Chalk Formation (Cck) - *UPPER CHALK*

- Tarrant Chalk Member (TCk)
- Spetisbury Chalk Member (SpCk)

#### 2.2.7 Portsdown Chalk (Pck) - *UPPER CHALK*

- Studland Chalk Member (StCk)

### 3. Detailed Descriptions of the Formations

This section describes the lithology of each formation and of the formally named members and bands within them .

#### 3.1 West Melbury Marly Chalk Formation (WMck) - Grey Chalk Subgroup - 15 to 25m

Buff, grey off-white, soft marly chalk and hard grey limestone arrange in couplets.

The **Melbury Sandstone Member** is a richly fossiliferous, glauconitic, fine grained sand and weakly cemented sandstone. The Bookham Conglomerate Bed is clasts of very glauconitic shelly sandstone, up to cobble size, commonly with a phosphatic rind, together with phosphatised shells in a matrix of sandy glauconitic chalk.

The **Glauconitic Marl Member** is a calcareous glauconitic sand and glauconitic sandy silty chalk with phosphatic nodules.

The **Cambridge Greensand Member** is a glauconitic marl. Thin but distinctive condensed basement bed of pale greenish marl rich in phosphatic nodules (coprolites) at base. Much dark green glauconite as sand-sized grains disseminated or concentrated in pods and layers giving a sandy texture. Rare erratic pebbles at base.

#### 3.2 Zig Zag Chalk Formation (Zck) - Grey Chalk Subgroup - 35 to 50m

Named from Zig Zag Hill near Shaftsbury in Dorset. Mostly firm, pale grey to off-white blocky chalk with a lower part characterised by rhythmic alternations of marls and marly chalks with firm white chalk. Thin gritty, silty chalk beds act as markers in the sequence.

The **Totternhoe Stone Member** is a harder unit, typically brownish-grey fine grained calcarenite. Has been described as sandy because it contains coarse shell fragments. Phosphatic in part with dark brown pellets a few millimetres across up to nodules several centimetres across. Fossiliferous. Locally used as a building stone.

### 3.3 **Beer Head Limestone Formation** (none) - Grey Chalk Subgroup - about 10m

Complex thin sequence of bedded coarse calcareous sandstone, bioclastic limestone calcarenite and shell –detrital limestone, with distinct nodularity and well developed hardgrounds. Glauconitic and phosphatic. This formation sits above the Upper Greensand and below the Plenus Marls Member.

### 3.3 **Holywell Nodular Chalk Formation** (HCK) - White Chalk Subgroup - 25 to 35m

Generally hard nodular chalks with thin flaser marls and significant proportions of shell debris in part. Base marked by the interbedded coloured marl and chalk succession characteristic of the Plenus Marls member .

The **Plenus Marls Member** is interbedded marl and chalk.

The **Melbourn Rock Member** is a hard to very hard off-white, blocky fractured chalk with numerous nodular chalk beds and thin anastomosing (net like pattern) marls.

### 3.4 **New Pit Chalk Formation** (NPCK) - White Chalk Subgroup - 35 to 50m

Principally blocky, white firm to moderately hard chalk with numerous marls or paired marl seams. Flint occurs sporadically in the upper part in the deeper basin areas . In some localities flint, in seams, occurs to the base of the formation most notably over structural highs, towards the margins of the outcrop.

There are no formal members, but distinctive marl and flint beds can be found over much of Southern England.

### 3.5 **Lewes Nodular Chalk Formation** (LeCk) - White Chalk Subgroup - 35 to 60m

Composed of hard to very hard nodular chalks and hardgrounds (which resists scratching with finger-nail) with interbedded soft to medium hard chalks (some grainy) and marls; some flaser chalks. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and iron – stained (usually marking sponges). Brash is rough and flaggy or rubbly and tends to be dirty. First regular seams of nodular flint some large, commence near the base and continue throughout.

The **Chalk Rock Member** is very hard chalk and chalkstone, some nodular, including mineralised hardground surfaces, and marl seams.

The **Kensworth Nodular Chalk Member** is a very hard nodular chalk and chalkstone, including mineralised hardground surfaces.

The **Top Rock Bed** is a hard cream limestone with scattered brownish phosphatic nodules commonly green coated at the top. Mineralised hardground or chalkstone bed.

### 3.6 **Seaford Chalk Formation** (SCK) - White Chalk Subgroup - 50 to 80m

Firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls known from the lowest beds.

The **Stockbridge Rock Member** is a very hard porcellanous, creamy white chalk to very hard chalk. In the higher part of the Seaford Chalk Formation.

### 3.7 **Newhaven Chalk Formation** (NCK) - White Chalk Subgroup - 50 to 80m

Composed of soft to medium hard, smooth white chalks with numerous marl seams and flint bands, including abundant Zoophycos flints (notably at levels near the base). The formation is known to contain distinct phosphatic chalks of limited lateral extent.

The **Margate Chalk Member** is a marl free smooth white chalk with little flint, weakly developed indurated iron-stained sponge beds.

### 3.8 **Culver Chalk Formation** (CCK) - White Chalk Subgroup - 65 to 75m

Soft white chalk, relatively marl free with flint seams. Flints are generally large and in the upper part tabular.

The **Tarrant Chalk Member** is a soft white chalk with relatively widely spaced but large flint seams.

The **Spetisbury Chalk Member** is a firm white flint with regular large flint seams, some tabular in the lower part and of the *Zoophycus* type in the upper part.

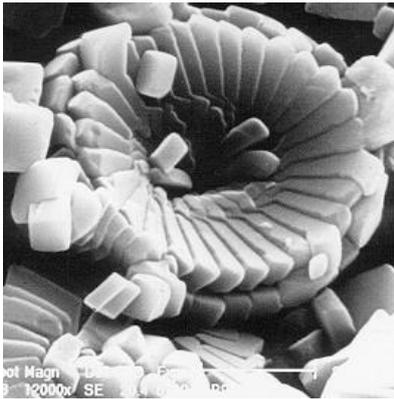
### 3.9 **Portsmouth Chalk Formation** (PCK) - White Chalk Subgroup - about 60m

Composed of white chalk with marl seams (particularly in the lower part) and flint bands, although less flinty than the Culver Chalk Formation. The lower part contains several belts rich in inoceramid shell debris as well as isolated marl seams and pairs of marl seams that likewise contain much inoceramid shell debris.

The **Studland Chalk Member** is a marl free, soft chalk with large irregular flints.

## 4. Components of the Chalk

The Chalk is part of the Upper Cretaceous and ranges in ages from about 100 million years to 65 million years. It consists mainly of coccolith biomicrites formed from the skeletal elements of minute planktonic green algae, associated with varying proportions of larger microscopic fragments of bivalves, foraminifera and ostracods. The planktonic coccoliths and many of the foraminifera (the planktonic species) lived floating in the upper levels of the oceans. When they died their skeletons sank to the bottom, combining with the remains of bottom living bivalves, foraminifera and ostracods, to form the main components of the Chalk



**A scanning electron microscope photo of a coccolith.**

One of most of the prominent components of chalk is flint. Flint is present as nodular seams, tabular beds and as lining to fractures. Flint is a random mosaic of quartz crystals (silica) only a few microns in diameter, interspersed with minute water-filled cavities. The origin of the silica is the skeletons of sponges and other organisms. This has been redistributed in the form of nodules during several stages of crystallisation. At first flint was deposited as a precipitation near organic remains such as burrow-fills. Further accretion gave rise to layer of tabular flints or isolated nodules. Uncompressed fossils are found in flint which shows that the replacement started early in the lithification of the chalk. However, flint can also occur as layer along joints and faults which shows that it remained mobile and recrystallised during folding and faulting. Fine grained quartz also occurs throughout the chalk, but comprises less than one percent of the rock.

The marl seams comprise both quartz and clay minerals.

Phosphate minerals are widespread and is often most noticeable where deposition ceased for a time and the upper surface of the sediments became compacted (hardgrounds). Glauconite occurs in minute quantities and is also often concentrated at hardgrounds as encrustations or replacements. Sometimes pyrite occurs as concretions or radiating crystals.

## 5. Glossary of Terms

**Anastomosing** – Branching and rejoining irregularly to produce a net like pattern.

**Bioclastic** – Term applied to sediments made up of broken fragments of organic skeletal material.

**Biomicrites** – formed from a poorly sorted accumulation of shell fragments

**Calcarenite** – Limestones of grain size (1/16mm to 2mm).

**Corpolites** - From faeces.

**Couplets** - Alternating layers

**Flaser** - sedimentary bedding pattern created when a sediment is exposed to intermittent flows, leading to alternating layers.

**Glauconitic** -Containing glauconite . A layer latticed mineral (Al,Fe, Mg) a common constituent of marine sediment. Green in colour.

**Hardgrounds** - A hardground is essentially, a lithified seafloor.

**Lithified** - changed into rock.

**Marl** - Calcareous mudstone.

**Phosphatic** - Fine grain mixture of various calcium phosphates. All marine sediments contain some phosphates. These may be concentrated by downward-percolating groundwater . Pebbles (nodules) may be the result of mechanical concentration.

**Stratigraphy** – the character of the rocks and the correlation of beds in different localities.

**Zoophycus** - trace fossil probably produced by a worm.

## CHALK GROUP STRATIGRAPHY

Subgroup	Formation	Description	Members	
<b>White Chalk Subgroup</b>	<b>Portsdown Chalk Formation (PCK)</b>	<b>White chalk with marl seams and flint bands.</b>	<b>Studland Chalk Member</b>	
	Culver Chalk Formation (CCK)	Soft white chalk, relatively marl free with flint seams.	Tarrant Chalk Member Spetisbury Chalk Member	
	Newhaven Chalk Formation (NCK)	Soft to medium hard, white chalks. Marl seams and flint bands.	Margate Chalk Member	
	Seaford Chalk Formation (SCK)	Firm white chalk with flint seams	Firm white chalk with flint seams	
	Lewes Nodular Chalk Formation (LeCk)	Composed of hard to very hard nodular chalks, with interbedded soft to medium hard chalks	Chalk Rock Member Kensworth Nodular Chalk Member Top Rock Bed	
	<b>(Middle Chalk)</b>	<b>New Pit Chalk Formation (NPCK)</b>	<b>Principally blocky, white firm to moderately hard chalk with numerous marls or paired marl seams.</b>	
		Holywell Nodular Chalk Formation (HCK)	Generally hard nodular chalks with thin flaser marls and significant proportions of shell debris in part.	Plenus Marls Member Melbourn Rock Member
	<b>Grey Chalk Subgroup</b>	<b>Beer Head Limestone Formation</b>	<b>Complex thin sequence of bedded coarse calcareous sandstone, bioclastic limestone calcarenite and shell – detrital limestone.</b>	
	<b>(Lower Chalk)</b>	<b>Zig Zag Chalk Formation (Zck)</b>	<b>Mostly firm, pale grey to off-white blocky chalk .</b>	<b>Totternhoe Stone Member</b>
		<b>West Melbury Marly Chalk Formation (WMCK)</b>	<b>Buff, grey off-white, soft marly chalk and hard grey limestone arrange in couplets.</b>	<b>Melbury Sandstone Member</b> <b>Glauconitic Marl Member</b> <b>Cambridge Greensand Member</b>

## APPENDIX B - CHALK GROUP - Stratigraphy Comparison

2001 onwards (this document)	1990's Interim	Pre 1990 (Traditional)
Portsdown Chalk Formation	Portsdown Chalk Member	Upper Chalk (note 1)
Culver Chalk Formation	Tarrant Chalk Member	
Newhaven Chalk Formation	Spetisbury Chalk Member	
Seaford Chalk Formation	Newhaven Chalk Member	
Lewes Nodular Chalk Formation	Seaford Chalk Member	
	Lewes Nodular Chalk Member	
New Pit Chalk Formation	New Pit Chalk Member	Middle Chalk (note 2)
Holywell Nodular Chalk Formation	Holywell Nodular Chalk Member	
Beer Head Limestone Formation	Beer Head Limestone Member	(note 2)
Zig Zag Chalk Formation	Zig Zag Chalk Member	Lower Chalk (note 1)
West Melbury Marly Chalk Formation	West Melbury Marly Chalk Member	

### Notes

1. Some of the bands previously included at the top of the Middle Chalk are now in the Lewes Nodular Chalk Formation which equates to the lower part of the traditional Upper Chalk.
2. The Plenus Marls Member was previously included in the Lower Chalk, but is now in the Holywell Nodular Chalk Formation which mainly equates to the lower part of the traditional Middle Chalk.
3. The Glauconitic Marl Member, the Melbury Sandstone Member and the Cambridge Greensand Member now part of the West Melbury Marly Chalk Formation were traditionally treated as part of the Upper Greensand .