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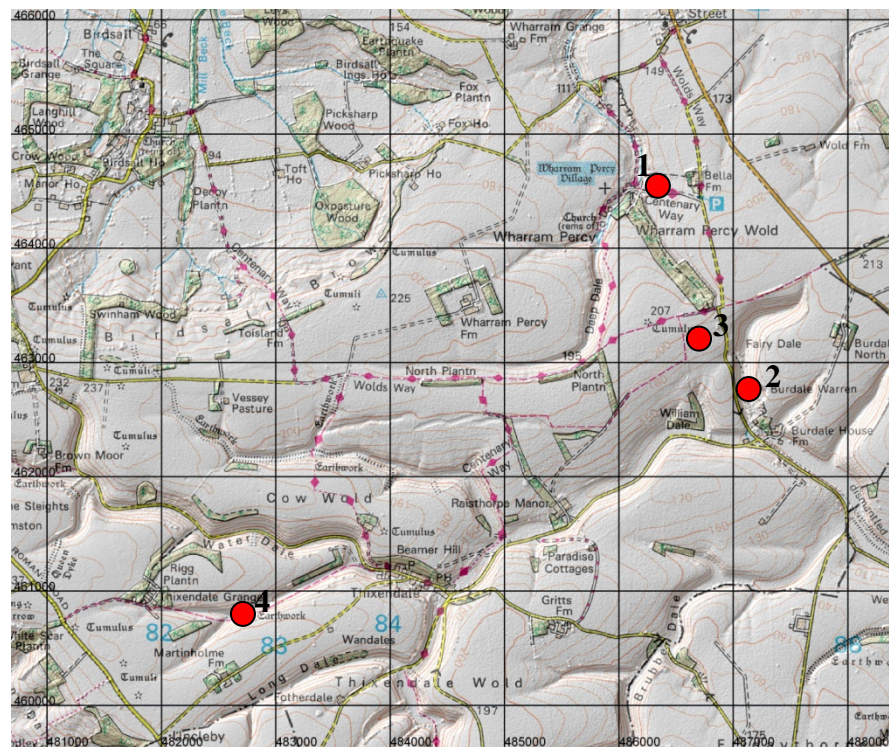


**YORKSHIRE
GEOLOGICAL SOCIETY**

The physical and human landscape of the Yorkshire Wolds: its geological and archaeological heritage. YGS Fieldtrip Guide 21st June 2008

Geology and Landscapes England and Land Use and Development
Programmes, University of York and Ryedale Vernacular Buildings
Materials Research Group

Open Report OR/08/047



BRITISH GEOLOGICAL SURVEY

GEOLOGY AND LANDSCAPES ENGLAND AND LAND USE AND
DEVELOPMENT PROGRAMME

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localities

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S Price, J Ford, R Myerscough & C Neal

Yorkshire Geological Society Field Meeting

21st June 2008

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1 Introduction

The Yorkshire Wolds represents a truly distinctive landscape. Its meandering network of dry valleys, rolling hills and abundant earthworks reflect a long and varied history of geological and archaeological events. Geological processes, including the effects of the last ice age, have provided the fertile soils, building materials and sources of water that have supported human settlement. In turn, human processes, from the Mesolithic onwards, have sculpted the landscape to produce the range of field systems, earthworks and ditches that we see today.

This field trip aims to examine the Chalk foundations of the Wolds and subsequent key archaeological processes and settlements. It will aim to investigate the geological factors that may have influenced the location of settlements and earthworks. Most importantly, the field trip aims to illustrate how geological and archaeological processes act together to shape the character of the landscape and countryside that define the Yorkshire Wolds.

Fieldtrip leaders

Mr Richard Myerscough BA, ADES, FMF. Part time Tutor University of Hull (Institute for Learning) and Ryedale Vernacular Building materials Research Group (Church Fabric coordinator).

Dr Cath Neal University of York

EurGeol Mr Jon Ford BSc MSc FGS CGeol British Geological Survey.

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2 Geological and Geomorphological Overview

The geological setting of the Yorkshire Wolds in relation to other parts of Yorkshire and surrounding areas is shown in **Figure 1**.

2.1 CHALK GROUP

- The Chalk Group (or “Chalk”) of Late Cretaceous age forms the bedrock of the Yorkshire Wolds. From here, the Chalk continues south into the Lincolnshire Wolds then across the Wash to East Anglia where it is predominantly concealed beneath superficial deposits.
- In the Yorkshire Wolds, the Chalk outcrop forms a steep westerly facing escarpment and a gentle (1-2°) easterly dipping dip-slope. The steep westerly facing escarpment is often characterised by landslides where large (often hundreds of metres) blocks of competent chalk have moved downslope and overridden softer Jurassic rocks including impermeable Late Jurassic mudstones of the Ampthill and Kimmeridge Clay Formations.

In general, the easterly dip of the landscape reflects the regional tilt of the underlying rocks towards the coast where it forms spectacular cliffs, including those around Bridlington.

In the central and eastern parts of the Yorkshire Wolds, the Chalk is concealed by glacial and post-glacial sediments (**Figure 2**). A former Pre-Devensian sea cliff is cut into the Chalk bedrock and concealed by younger superficial deposits to the east of the area. The former sea cliff meets the present-day coastline around Sewerby.

- The Chalk in the Yorkshire Wolds occupies a structural setting between the Cleveland Basin to the north and the East Midlands Shelf in the South. The northern boundary is defined by a generally east-west trending fault zone referred to as the Flamborough Head Fault Zone (Kirby and Swallow, 1987). The southern margin is defined by a deep seated structure known as the Market Weighton High. This structure affected sedimentation during Jurassic and Cretaceous times. Sediments overlying the Market Weighton High are generally thinner than those further north and to the south. Late Cretaceous inversion of the Cleveland Basin has since removed much of the Cretaceous sequence here, and has resulted in locally dramatic faulting and folding of the Chalk (e.g. Flamborough Head).
- The Chalk comprises calcium carbonate rich sediment that was deposited in a shallow shelf sea that probably covered most of Great Britain for some 40 million years. Chalk is predominantly composed of the microscopic remains of single celled planktonic coccolithophorids algae (Figure 3). The tests of each organism are made of a number of platelets often referred to as coccoliths (Figure 4). Larger macro fossils and other micro fossils are also present.
- In parts of the Chalk, beds of “marl” occur. Marl generally refers to calcareous mudstones. These form distinctive, laterally persistent beds that contain clay minerals with small amounts of detrital quartz and feldspar (generally less than 2%). The distinctive composition of these marls is interpreted to be inherited from contemporaneous volcanic activity. Flint characterises many of the Chalk Formations but particularly the Welton Formation (with nodular flint) and the Burnham Formation (with tabular flint).
- The Chalk Group is interpreted to be over 500 m thick at its thickest onshore development in the region of Hornsea on the Holderness Coast (Sumbler, 1999).

- The Chalk Group comprises six Formations in Lincolnshire and Yorkshire (Table 1 and Appendix 1).

Chalk Group Stratigraphy	Thickness	General characteristics
Rowe Formation	Min 90 m	Not exposed at outcrop. Generally known from borehole logs. Probably contains flints.
Flamborough Formation	195 m	White generally without flints. Generally softer than underlying chalk.
Burnham Formation	75 m	White Chalk with tabular flints and echinoids. Commonly thinly bedded compared to the underlying chalk of the Welton Formation.
Welton Formation	55 m	White Chalk with nodular flints and common <i>Mytiloides</i> Bivalve shells. Nodular flints commonly infill burrows.
Ferriby Formation	22 m	White chalk with some marl bands. Common <i>Inoceramus</i> Bivalve shells.
Hunstanton Formation	3 m	Red Chalk and marl without flints. Commonly nodular.

Table 1 Chalk Group stratigraphy summary

North v South

- The Chalk also crops out in other parts of the country. Well known examples include the areas of the North and South Downs and the coastal sections in Kent and Sussex. The boundary between northern and southern chalk provinces is poorly defined but may be taken along a line running through the Wash (Sumbler, 1999).
- There are many lithological and palaeontological differences between the Northern and Southern Province chalks. These differences may in part be accounted for by different depositional environments. In general the northern Chalk is harder than the softer, southern chalk. This may be the result of redeposition of calcite forming as a result of the effects of pressure from burial and tectonic stresses. Tabular flint is more common in the Northern Province and is often pale grey or white in colour compared to the dark grey or black flints of the Southern Province.

2.2 DRY VALLEYS

- The dry valleys of the Yorkshire Wolds comprise a karstic landscape. Karst or karstic landforms develop as a result of the dissolution of soluble rocks (calcium carbonate in the case of chalk) through the action of surface and subsurface water flow.
- The general morphology of the dry valleys of the Yorkshire Wolds is shown in Figure 5. In general they comprise a dendritic pattern of deeply incised valleys on top of the gentle easterly facing dip-slope of the Chalk Group bedrock. Wider valleys are also incised into the steeper westerly facing chalk escarpment. In general, dendritic valleys are more common in the northern part of the Yorkshire Wolds than the south.

The appearance of the steep sided valleys is shown in cross-section in Figure 7. In places, the dendritic dry valleys are cut by other valleys interpreted as glacial meltwater

channels. The detailed Geomorphological discussion of the Yorkshire Wolds landscape is provided by Lewin (1969).

- The dry valleys generally have a flat base filled with clayey gravel or sandy clay. Thin sandy clay or silt is also present on the flanks of the valleys. The deposits at the base of the valley are interpreted as “head”. Head is a solifluction deposit that forms from the gradual down-slope movement of material under the action of freeze-thaw. These deposits are therefore thought to be mainly of Pleistocene age, formed during permafrost conditions as glaciers occupied lower ground in the Vale of York and along the North Sea margin.
- A range of mechanisms have been suggested for the formation of the dry valleys on the Yorkshire Wolds. These mechanisms range from tectonic fracturing (geological fault activity related to crustal processes), mechanical fracturing through frost-heave, sub-surface dissolution and collapse, dissection through scarp retreat and glacial meltwater erosion of frozen ground (permafrost).
- It is likely that the dominant dendritic valleys on the Yorkshire Wolds formed by surface fluvial erosion and headward erosion of valleys under periglacial conditions (Waltham et al., 1997). It is probable that the Yorkshire Wolds were covered by ice during one or more pre-Devensian glaciations. During the Devensian however, the area of the Yorkshire Wolds remained ice-free apart from local snow accumulations. Ice sheets existed in the Vale of York to the west and the Holderness coast area to the east. The Yorkshire Wolds area would have then been subjected to periglacial conditions where the ground was periodically frozen. Under these conditions, meltwater from local snow accumulations may have flowed over frozen or partly frozen ground to incise the valleys and their tributaries. Erosion of the valleys may have also been enhanced by down-slope movement of weathered bedrock under freeze-thaw conditions to form a solifluction deposit that accumulated in the valleys. As the climate warmed following glaciation, it is probable that surface water that once flowed over the surface of the Chalk was able to infiltrate beneath the ground. Subsequently, the former stream valleys were abandoned (Waltham et al., 1997).
- Typically, the valleys of the Yorkshire Wolds are now dry. However, springs are common and represent points at which the groundwater level intersects the land surface. Some of the valleys occasionally contain flowing water and one of the most well known on the Yorkshire Wolds is the “Gypsy Race” that flows from Duggleby Howe in the west to Bridlington in the east.
- Valleys that are incised across the steep, westerly facing chalk escarpment are often associated with extensive spreads of gravel or clayey gravel that interdigitate with glacial deposits in the Vale of York. It is likely that the valleys were incised and acted as conduits for the transport of chalk and flint sediment derived from the Wolds during the Pleistocene.

3 Archaeological Overview

2.3 YORKSHIRE WOLDS

The Yorkshire Wolds represents a significant archaeological landscape which is of international importance. Along with Wessex and Orkney the Yorkshire Wolds has a high density of archaeological monuments and sites from the prehistoric period. In addition to these barrows, linears, cursus monuments and settlements there are exceptional features from other periods such as square barrow cemeteries, chariot burials, ladder settlements, deserted medieval villages and Anglian cemeteries. Far from being a waterless and remote area in the past the Yorkshire Wolds has been an area of preferential human settlement and this is presumably in part a reflection of the specific geological, landscape and topographic resources and facilities.

2.4 WHARRAM PERCY

Wharram Percy, a deserted medieval village, was investigated archaeologically from 1952-1992 and has provided unparalleled information about peasant life in the medieval period. The site is situated in a steep sided valley, but unlike many other Wolds valleys, this has a permanent water source.

The village has been the site of human settlement since the Iron Age and throughout the Roman, Anglian and Norman periods. The outlines of thirty medieval peasant houses survive as earthworks and are thought to have been laid out originally in the tenth century and are mentioned in Domesday. The village had, at some stage, two water mills and was unusual in also having two manor houses on its western edge.

The church of St Martins has mirrored the changing fortunes of the village beginning as a private chapel, having two side aisles added as the village grew and eventually reverting back to a single nave. The osteoarchaeological analysis of 687 skeletons from the cemetery has revealed that the inhabitants of Wharram Percy did not reach full growth until they were thirty years of age, had a diet as rich in seafood and marine fish as those in York and twice the current number of population were left handed (16%). The babies appear to have been breast fed until about 18 months of age, having a similar mortality rate to today, but following weaning signs of malnutrition and disease began to appear.

The village was abandoned soon after AD 1500 and a legal document of 1517 details that Hilton (Lord of the Manor) drove out the last four families and demolished their houses to make space for increasingly lucrative sheep farming. According to folklore the final inhabitant of Wharram Percy was a vagrant who died when the last remaining house fell on him as he slept.

2.5 BURDALE

Following aerial photography analysis a possible Anglian settlement in the valley bottom on the main Thixendale to Fimber valley was identified in 2005 (see transcription below) and this was investigated by the University of York in 2006 and 2007. The site lies along the Malton to Driffield railway embankment and appears to comprise a Romano-British settlement towards the eastern end of the valley with Anglian settlement enclosures across the rest of the site. Illegal nighthawking (metal detecting gangs) has produced material from this site which dates from the first to eighth century AD.

The Anglian activity consists mainly of curvilinear enclosures, sunken feature buildings and post holes dug into the chalk with spatial patterning in the refuse suggesting separate areas for different craft / industrial activities. The types of finds include frequent animal bone, whetstones and specific Anglian artefacts such as bonecombs. The analysis of this is ongoing.

2.6 LINEAR DYKES

The Wolds are well known for the extensive series of linear earthworks, known locally as dykes, which are in some places upstanding (e.g. Huggate and Thixendale, pictured below) and in other

places appear as crop marks. They are thought to originate in the Late Bronze Age and were then in use during the Iron Age and Romano- British periods as a possible method of land division and boundary markers associated with pastoral agriculture. Giles (University of Manchester) suggests that the position and nature of the earthworks suggests movement from sheltered to exposed ground by a combination of monumental paths and droveways.

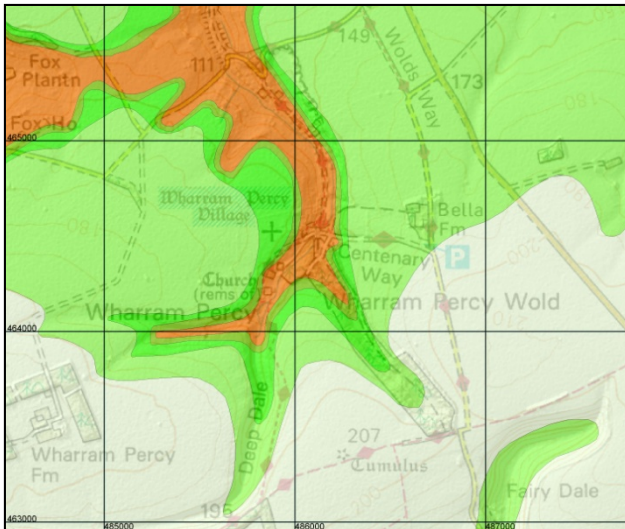
The only dating evidence is Bronze Age pottery found beneath the linear at Sledmere. Archaeological investigations of linears at Fimber, Walkington Wold and Vessey Pasture failed to find any dateable material culture associated with them.

3 Field trip localities

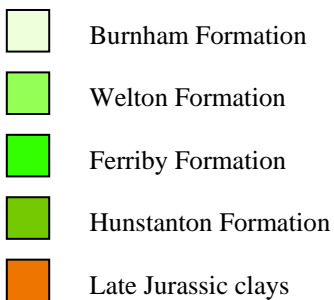
3.1 LOCALITY 1. WHARRAM PERCY VILLAGE

Location: Wharram Percy Deserted Village [SE 8588 6453].

Feature: Investigation of a Wolds deserted Medieval village and appreciation of the possible reasons for its location in relation to the surrounding landscape and geological features.



NOTES



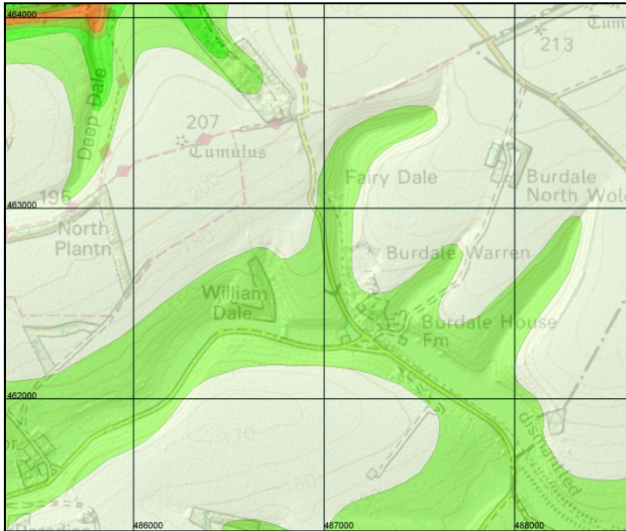
Additional Information:

- See separate guide sheet “Site plan and quick tour” (Figure 11)

3.2 LOCALITY 2. BURDALE QUARRY AND RAILWAY TUNNEL

Location: Burdale Quarry and Burdale Tunnel entrance [SE8724 6274].

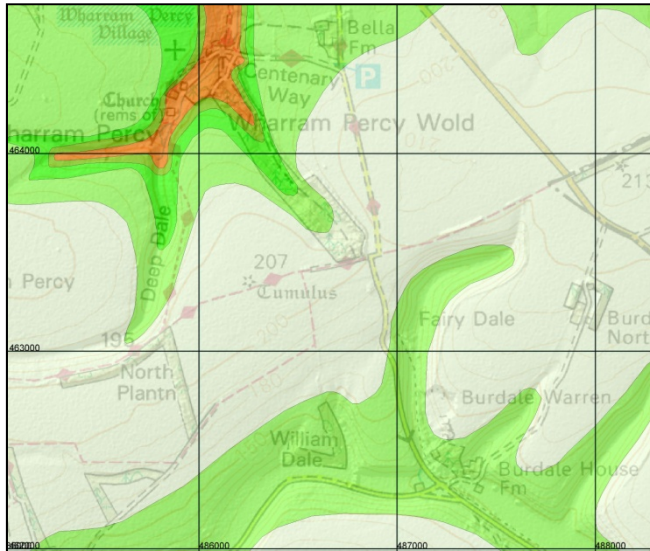
Feature: To view a section through the Chalk rocks and geological structure of the Yorkshire Wolds. To appreciate the influence of the surrounding landscape on the location of the Burdale railway tunnel as evidence of the influence of landscape on modern human activity.



3.3 LOCALITY 3. FAIRY DALE, FAIRY STONES AND BARROWS

Location: Fairy Dale, “Fairy Stones” and elongate burial mounds above it [SE8687 6332].

Feature: To view the location of a series of burial mound earthworks and their Geomorphological setting. To examine the unusual “Fairy Stones” and discuss the origins of it and associated features (dependent on ease of access).



NOTES

- Burnham Formation
- Welton Formation
- Ferriby Formation
- Hunstanton Formation
- Late Jurassic clays

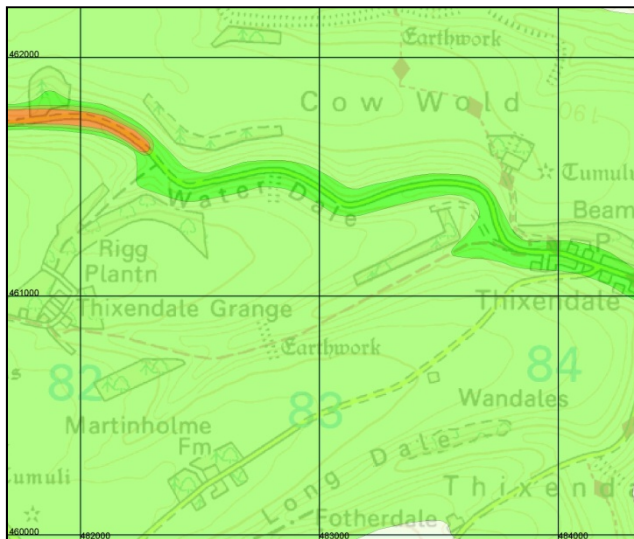
Additional information:

- Barrows are located at prominent positions in the landscape. The ridge between Vessey Pasture and Sledmere appears to have been used extensively for the construction of such barrows
- “Fairystones” of Burdale are shown in Figure 6.

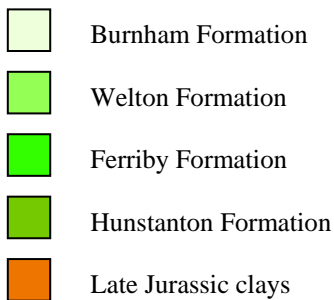
3.4 LOCALITY 4. THIXENDALE DRY VALLEY AND LINEAR DITCHES

Location: Thixendale dry valley on the footpath of the North Wolds Walk [SE8276 6084].

Feature: Thixendale dry valley and a series of parallel earthworks known as linears or entrenchments.



NOTES



Additional Information (Fenton-Thomas, 2005):

- | | |
|----------------------|---|
| Welton Formation | • One of the most distinctive archaeological features of the Yorkshire Wolds are the series of linear earthworks of banks and ditches known as “linears” or entrenchments. |
| Ferriby Formation | |
| Hunstanton Formation | • Linears follow the topography of the landscape closely, either parallel to dry valleys or cutting across the “headlands” between them. In places (e.g. Fridaythorpe) they connected dry valley heads to enclose the areas between them. They were |
| Late Jurassic clays | apparently constructed to delineate land boundaries. |
- They are constructed as at least two rows of ditches and embankments but can be up to five or six. They are commonly up to 2 m deep.
 - Some dating evidence suggests that construction began at the end of the Bronze Age (c.1000-800BC).
 - Some settlements elsewhere on the Wolds were constructed close to these linear earthworks.
 - Many generally east-west trending ancient trackways (e.g. Towthorpe Ridgeway between Aldro and Sledmere) terminate at the western edge of the Wolds to line up with the prominent topographic features of the York and Esckrick Moraines in the Vale of York. These morainic features were deposited during the last glacial maximum when ice was located in the Vale of York. These topographically high ridges may have provided access across the low-lying and poorly drained Vale of York from the Dales in the west to the Wolds in the east.
 - Very few remain as upstanding earthworks. Many have been subsequently removed as a result of agricultural activity.

References

British Geological Survey holds most of the references listed below, and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at: <http://geolib.bgs.ac.uk>.

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Appendix 1 Figures

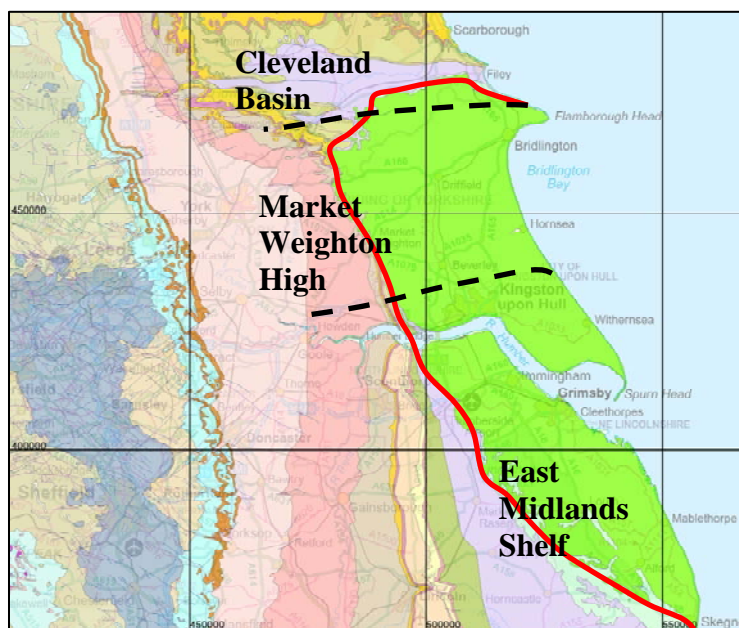


Figure 1 Summary bedrock geological map and main structural domains in relation to the Chalk Group (shown in green) in Yorkshire and Lincolnshire. Boundaries approximate.

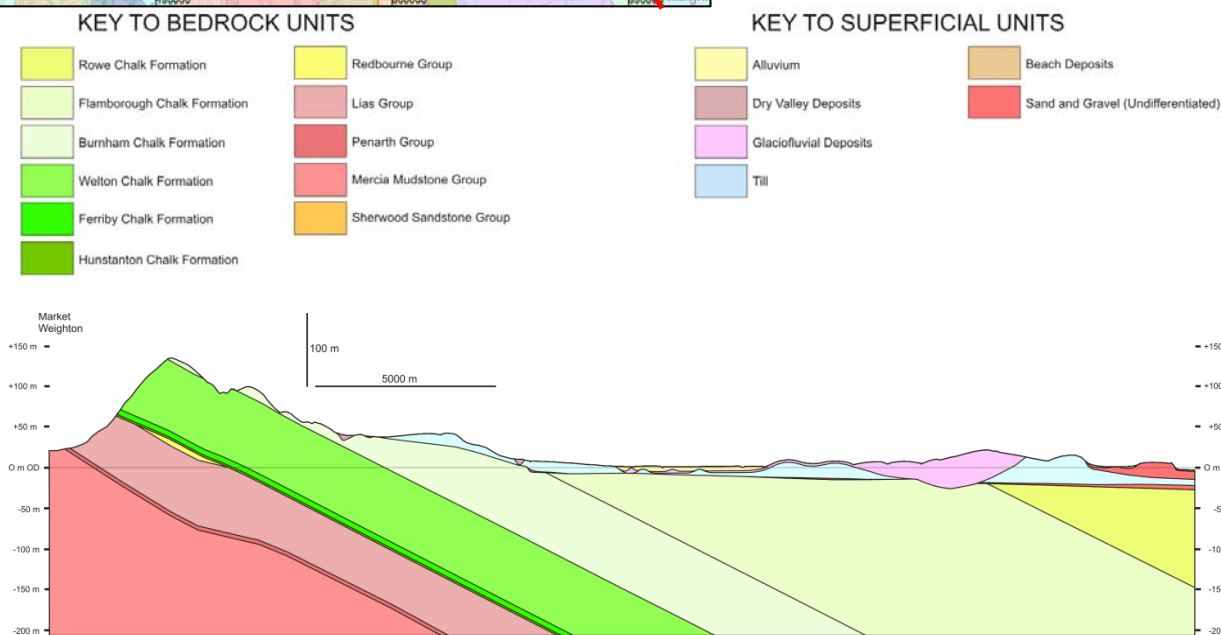


Figure 2 Schematic cross section highlighting bedrock geology beneath the Yorkshire Wolds

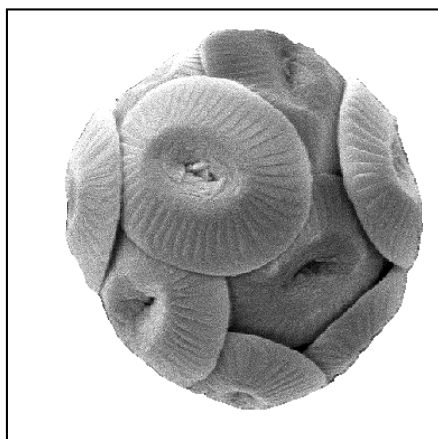


Figure 3 “Fossil Coccolithus” showing platelets or coccoliths

<http://comenius.susqu.edu/bi/202/CHROMALVEOLATA/EUKARYOMONADAE/coccolithus-ucl.gif>

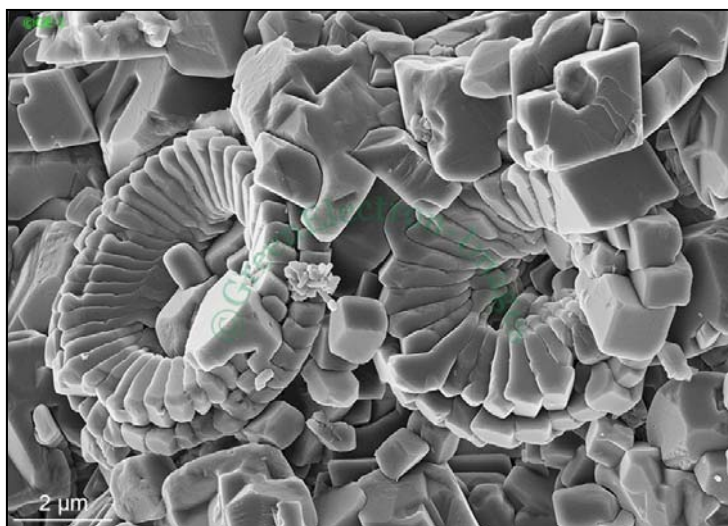


Figure 4 Coccolith debris and micrite in Chalk, Burdale

<http://www.greenelectron-images.co.uk/sem/coccoliths/chalk-2.html>

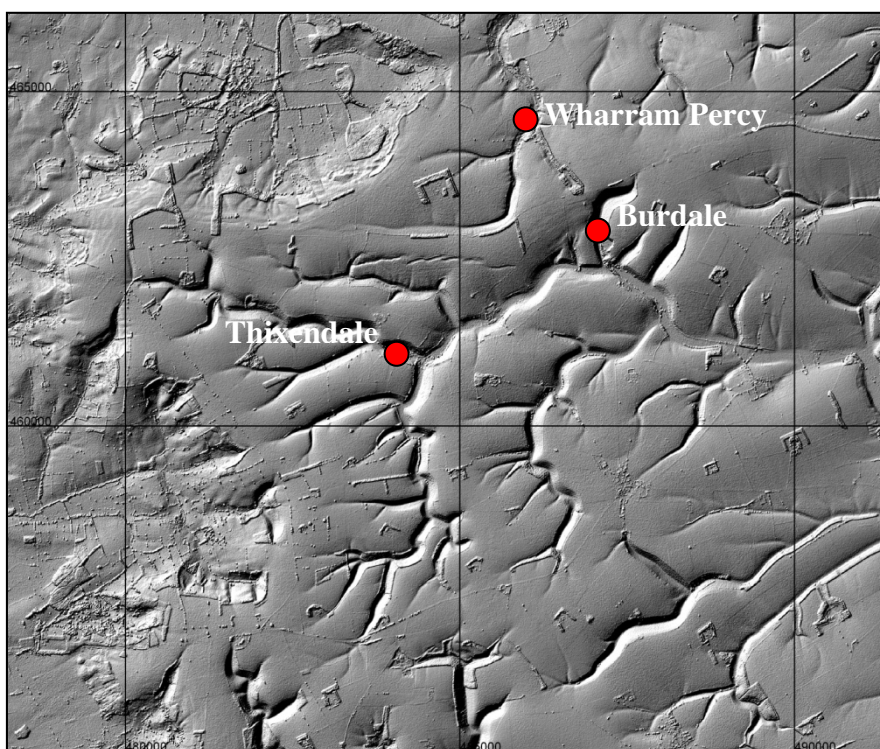


Figure 5 NextMap shaded relief map of the northern part of the Yorkshire Wolds (Intermap Technologies Inc).



Figure 6 Photograph showing the "Fairystones" of Burdale (R.Myerscough)

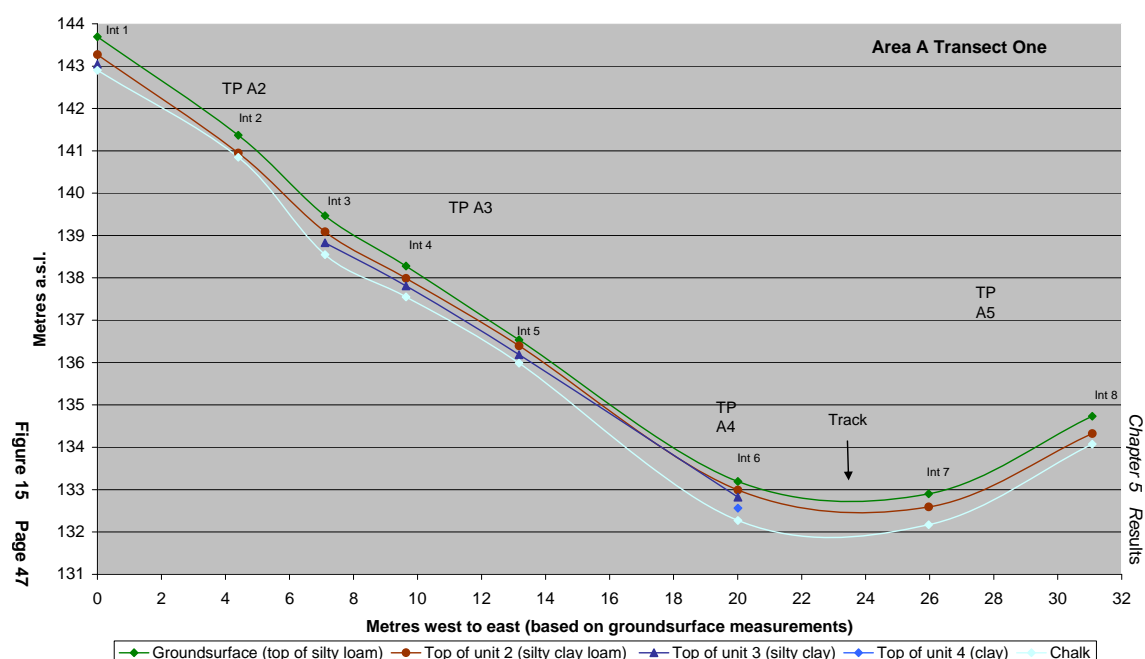
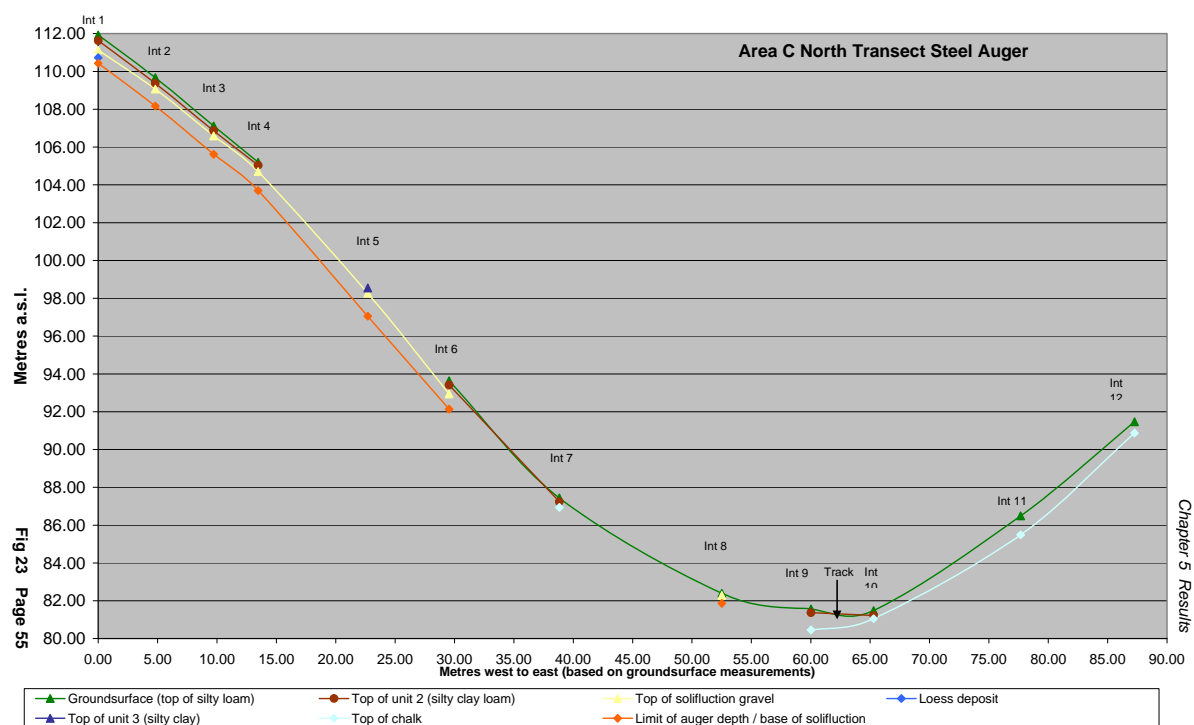


Figure 7 Transects across Cowlam Dale Dry Valley [SE97 65] showing the morphology of the valley and its underlying deposits (Neal, Unpublished).

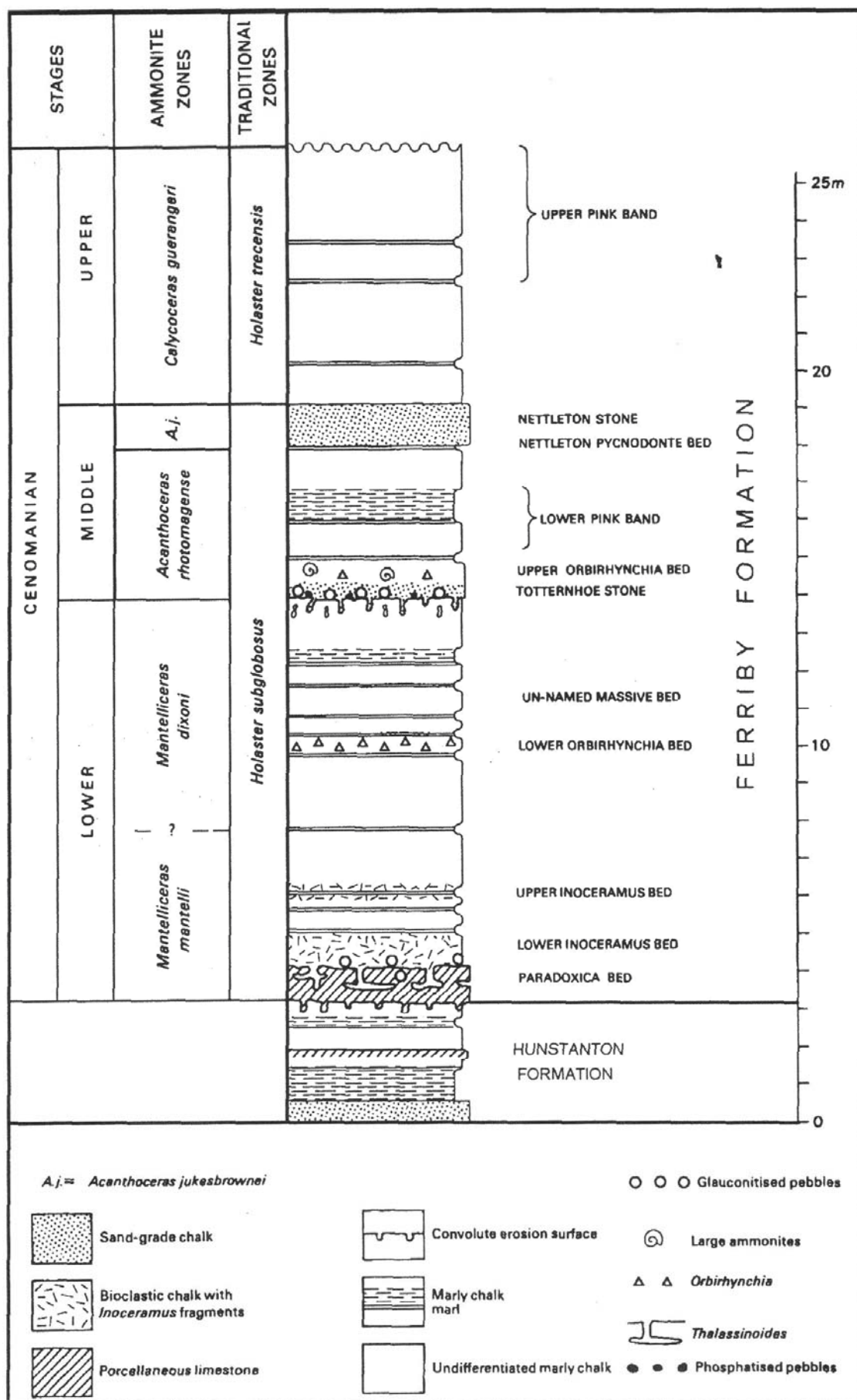


Figure 8 Stratigraphy of the Hunstanton and Ferriby Formations (from Sumbler, 1999).

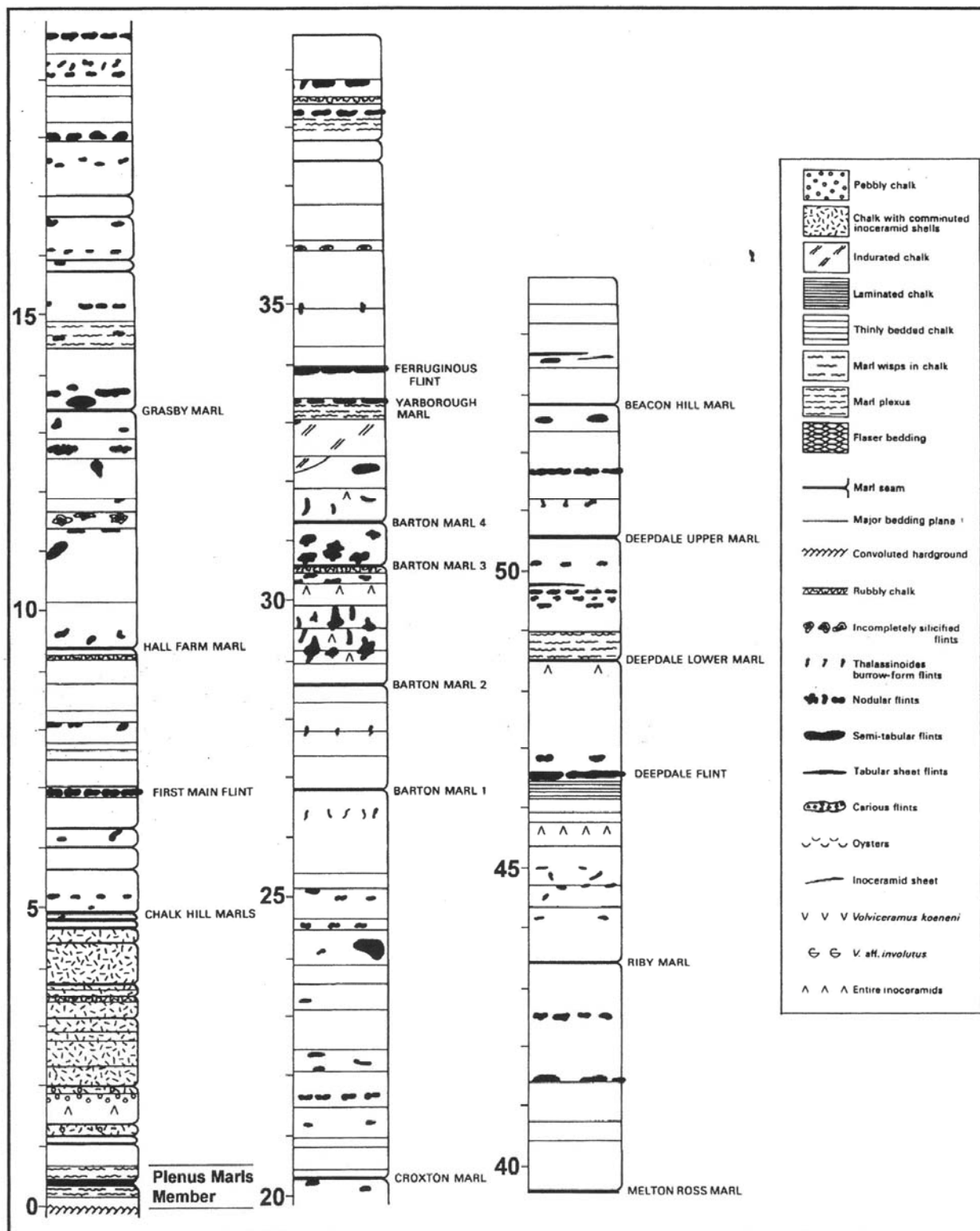
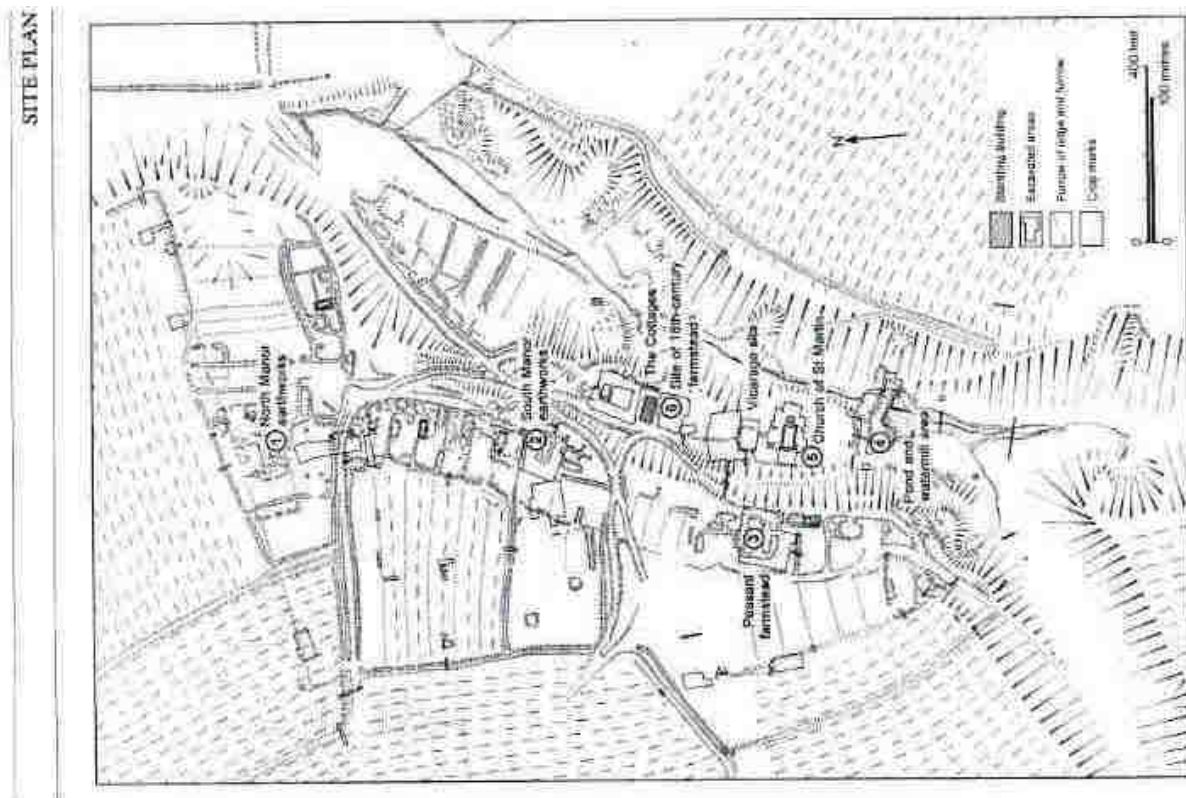


Figure 9 Stratigraphy of the Welton Formation (from Sumbler, 1999).



Figure 10 Stratigraphy of the Burnham Formation (from Sumblar, 1999).



Site Plan and Quick Tour

Section numbers correspond to the main text and to the plan.

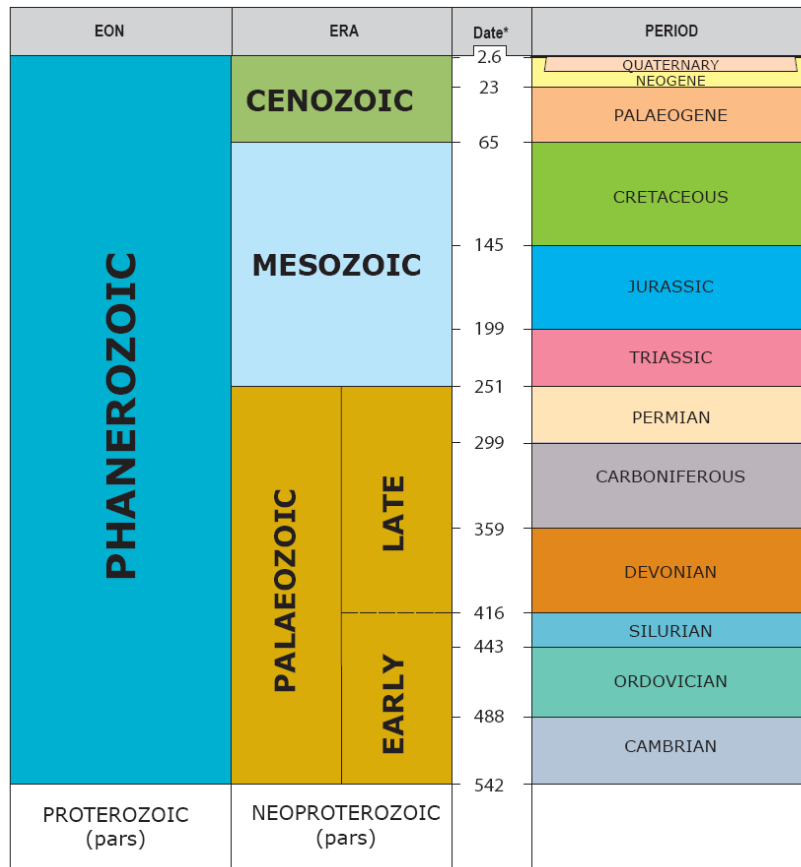
- 1 The tour begins at the north end of the village, on the earthworks of the twelfth and thirteenth-century North Manor. Its site stands beside the easiest climb from the stream to the plateau - a sunken way in use since the Iron Age and which continues west towards Malton and south to Thixendale. The earthworks are identified on the plan. Walk south, along the edge of the plateau and across the low banks which divide the gardens and yards of the medieval peasant houses.
- 2 The position of part of the South Manor is marked on the ground. The hollows are the traces of chalk quarries, the stone used for building or fertilizer. To the west the archaeologists found the site of an extensive Anglo-Saxon farmstead. Several hollow-ways link the plateau houses to the water supply and main roadway in the valley.
- 3 The outlines of two medieval peasant houses are marked out on the ground, near the edge of the plateau opposite the church tower. The earliest two-room house dates from the thirteenth century and the longer house, with a living room, inner store room and byre, is fifteenth century. It is the typical medieval house plan built by the peasants with materials obtained nearby, and the earthworks of many more can be seen on the plateau and in the valley.
- 4 From the plateau the pond is clearly visible, with the old path to Thixendale, now a footpath, crossing the dam. The pond is a reconstruction of the fourteenth century fish pond, with its dam built over the remains of the Saxon mill.
- 5 Follow the path from the dam to the church. Inside the church an outline of the tenth-century stone church is marked on the floor, and changes in the shape and size of the building are indicated on the plan. The blocked arches of the north and south aisles can be seen on the outside of the building, and the south wall some work includes fragments of medieval gravestones.
- 6 The site of the medieval vicarage and those of the sixteenth and eighteenth centuries lie to the north of the church. Beyond them the site of the farm built in the 1770s, the last farmhouse built at Wharram Percy, is set out in front of the cottages. The cottages were converted from part of the 1770s outbuilding and were last occupied by the Glasspool and Milner families. The building became the headquarters of the Wharram Percy excavations until 1990. The courtyard of the farm buildings stood on the north side. The footpath back towards the car park crosses the crofts of medieval houses in the valley bottom.

Further reading

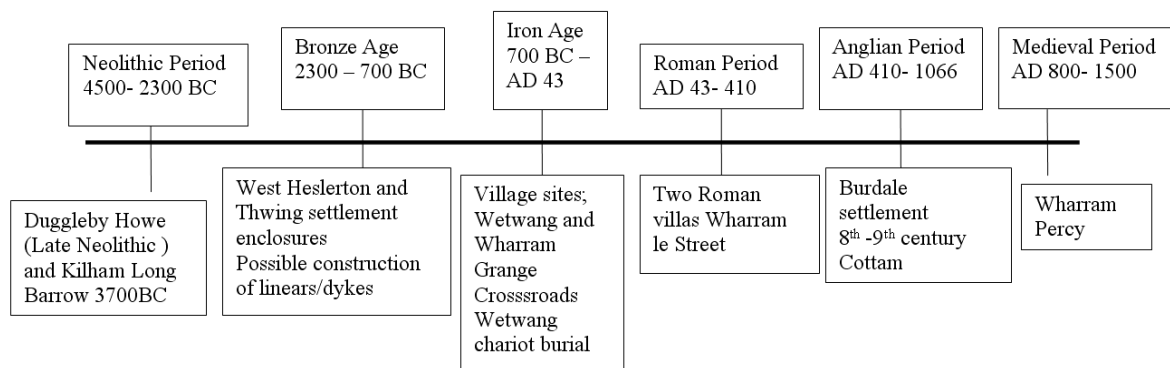
Users of this guide are referred to *Wharram Percy: Dearthed Medieval Village* by Maurice Beresford and John Hurst, published for English Heritage by Batsford Ltd in 1990, ISBN 0-7134-6144-4.

Figure 11 Wharram Percy Site Plan and Quick Tour (English Heritage publication)

Geological and Archaeological Timelines



Geological Timescale Based on 'A Geologic Time Scale 2004' by F M Gradstein, J G Ogg, A G Smith, et al. (2004), and the International Stratigraphic Chart, 2006 (ICS) with additions. *Millions of years



Event	Years ago	If Chalk deposition began one week ago...	
Chalk deposition began	100,000,000	Monday	0:0:0
Chalk deposition ended	70,000,000	Wednesday	9:36:0
Start of last ice-age	115,000	Sunday	19:21:48
End of last ice-age	10,000	Sunday	23:35:48
Wharram Percy first occupation	2,100	Sunday	23:54:55
Wharram Percy depopulated	500	Sunday	23:58:47
YGS founded	171	Sunday	23:59:35