Aspects of Geological Interest in Burwell, Cambridgeshire.

Introduction

Burwell is a "Fen Edge" village which lies to the North East of Cambridge. It has a long history, some of which was dependant on the geology of the underlying rock. It has evidence of some form of settlement since the Palaeolithic age, through the Bronze age, Roman occupation to the present day.

Overview of geology underlying Burwell

The village gently slopes from the High Town area around St Mary's church down to the fen level at North Street (NNW extent). The bulk of the bedrock is Lower Chalk, younger than 100Ma and the village straddles the Totternhoe Stone horizon.

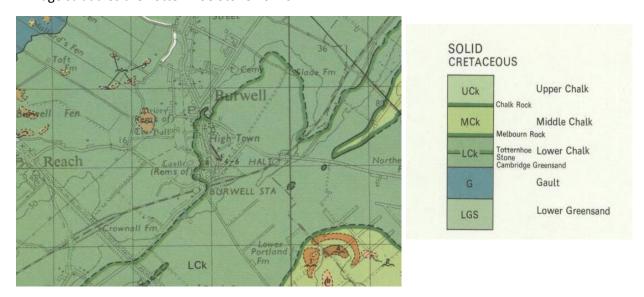


Fig 1. BGS map of area. Copyright NERC

Out into the fen to the North West the Gault clay is the oldest of the formations and comes near the surface and this was the source for the Burwell Brick industry. It is unconformably overlain by the Cambridge Greensand - a glauconitic sandy marl - which is the basal unit of the Lower Chalk. This layer has been extensively mined in the past for its abundant phosphate nodules.

The Lower Chalk in this area is estimated to be around 55-70m thick and consists of bluish grey chalky marl or blocky grey white argillaceous chalk. Flint nodules are not common in this facies as any mobilised silica will be sorbed by the highish argillaceous content. The Totternhoe Stone is a recognisable horizon roughly in the middle of the Lower Chalk approximately 6m thick. It is harder than the rest of the Lower Chalk and can contain horizons of phosphate nodules. It is often also typified by springs from its base. The rock above the Totternhoe is more porous than the less pervious marl below, giving rise to the springs.

The Totternhoe Stone is locally termed Burwell Rock or Clunch and has been extensively quarried in the past from the SE part of the village. Stone from Totternhoe Quarry is still worked near Bedford for specialist restoration masonry.

The nomenclature of these horizons has changed over the years and is shown in figure 2 below.

	Stage		Formation	Previous Nomenclature	Age Ma
	Turonian	Middle Chalk		White Chalk	91.8
			Holywell Nodular Melbourn Rock		93.9
100	Cenomanian	Lower Chalk	Zig Zag Chalk	Grey Chalk	
			Totternhoe Stone		
			West Melbury Marl		
			Cambridge Greensand		100.5
			Gault clay		

Figure 2 Stratigraphy of the Burwell area

In 1932 a borehole on the ridge next to the Church on Stock's Green (shown in Fig 10) recorded chalk and Totternhoe Stone for just over 10 m and it was noted there was an outflow of "hard" water. Below this was Chalk Marl (West Melbury Marl).

The Marl typically contains less fossil remains than the Totternhoe Stone, which has a plentiful fauna of shell debris and shards. A rich fauna of smooth and lightly concentric ridged shelled bivalves have been identified in the mid Lower Chalk of the Burwell area (Entolium Orbiculare) as have examples of a radiating rib shell bivalve (Plicatula Inflata). Other bivalves such as Pecten (various) and Inoceramaus are also relatively common. Smooth shelled Terebratulid brachopods can be found in these beds. Many examples of fossil finds from these horizons can be seen displayed in the Sedgwick Museum.





Figures 3 and 4: example of Terebratulid from the Clunch

In terms of lithology, the proportion of terriginous material decreases from the Marl upwards though the Lower Chalk. A study in the Burwell area found that the chalk may contain up to 30% of Kaolinite: Illite, Smecitite (an interlayered swelling clay) and Vermiculite also being present (Perrin 1957).

Gault clay

The Gault clay is a sequence of clays, mudstones and thin siltstones with bands of phosphatic nodules. Grey coloured Gault clay was quarried on the flat fen areas around Burwell since 1830's. It was the source for the successful brick making industry in Burwell. The main brick pit and the factory set up in 1926, off Factory Rd, is now a fishing lake and access is not possible (Figure 7). From the aerial photos, there is nothing left of the original substantial brick work buildings and the lake edges have been contoured.

Some examples of the bricks made are held at Burwell Museum. They are characterised by their bright yellow colouration which is said to be due to the "lime" content of the clay. The mineralogy in this area is likely to be dominated by Illite - Kaolinte - Quartz. The Calcium content is normally provided by the macro fossils.

Near to the original site, a small artisanal brick maker still uses the Gault clay from a stockpile that came from the pit. The brick and tile products are moulded by hand and fired on site. The clay is forced through a milling machine that crushes any fossil content which is then mixed to a smooth clay paste. The claim is that the crushed fossils add Calcium to the mix, giving the pale yellow colour.





Figure 5: Example of new Burwell Brick and the brickmaker

The Cambridge Greensand

The base of the Lower Chalk is defined as the Cambridge Greensand - a glauconitic sandy marl which may contain as little as 75% chalk. It is from this layer that the so called "Coprolites" phosphate nodules were mined from 1846 until the late 1870's when for various reasons (cheaper sources, less demand) the commercial mining died out. Shallow pits were dug all along the Fen edge of the Burwell / Reach / Swaffam Prior area to collect these small buff brown hard nodules from the Cambridge Greensand which was to be found a few metres below the surface all along the Fen edge. The nodules were washed out to be ground and processed at a local factory on Burwell Lode. Only a few examples of the pits, now water filled, survive eg the fish pond in the grounds of Angelsey Abbey. The factory was mostly destroyed and the site is used as a storage facility off Factory Rd. Again numerous fossils from these beds are on display in the Sedgwick Museum.



Figure 6: examples of Phosphate nodules from Fen

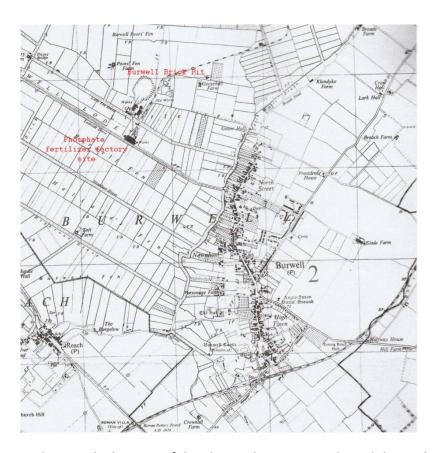


Figure 7: showing the location of the Chemical Manure Works and the Brick pits

The remains of the "Big Mill" which was used to grind the nodules can still be seen off Newmarket Rd beside the Doctor's surgery. Examples of the "coprolite" nodules can be seen in Burwell and Ely museums.

Melbury Marl Cement Quarry off Ness Rd

A cement plant was operating to the north of Burwell (52°17'26"N; 0°21'32"E) from 1892 to 1932. It was operated by R. Stephenson & sons. The source rock was the Chalk Marl (West Melbury Marl Chalk Formation: 97-100 Ma) with a minor amount of Chalk from the pits in Burwell brought in by train. All of the kiln and associated buildings are now gone and the pit is flooded and surrounded by trees and scrub.

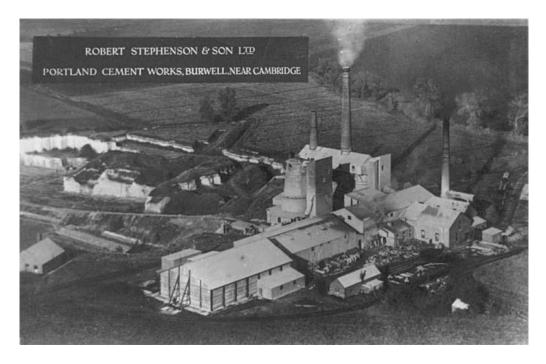


Figure 8: ©The Cambridgeshire Collection. This shows the plant some time before 1920

The site can be reached by using a farm track (permissions to be sought), but there is nothing instructive to be seen.



Figure 9: the flooded cement pit.

The Lower Chalk exposures

1) The Spring.

Most of the village is around 20m above OD, but the site of the exposure described is at the foot of a west facing scarp face in a low valley to the west of the High Town. The valley is due to natural features coupled with some human activity (the digging of building materials for the medieval King Steven's Castle nearby).

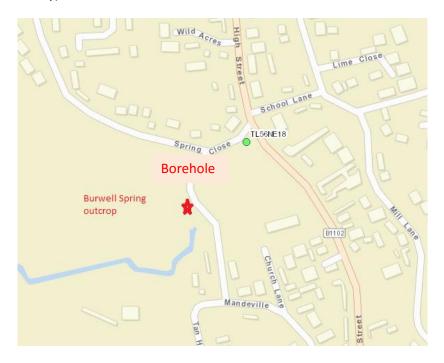


Fig 10. showing location of outcrop and the site of a nearby borehole

Located a few metres to the west of the Guildhall, the exposure is at the base of a low cliff (approx 8m) and is marked by shallow channels showing the chalk outcrop with the associated springs. (lat N52 11' Long EO 19')



Fig 11. Image of the head of the stream showing outcrops

The outcrops line this spring and range from 0.9m to 0.6m high. The chalk is blocky in nature and is of a buff brown colour. It is very soft and gritty - with little discernible clear bedding. There are some surfaces dipping $^{\sim}$ 11 deg , 76 deg E. This seems in agreement with the general orientation of strata in this area. Some shell fragments of the typical bivalves can be seen in these beds.

Each exposure is jutting out from the bank and the lower ones on the rhs of the picture above (Fig 11) have been disrupted by soilification processes. Fig 12 shows the blocky nature of the rock where a spring issues



Fig 12. Showing blocky nature of Totternhoe stone

The lowest horizon seen (under water) appears to be softer better bedded chalky marl. This is taken to mark the base of the Totternhoe Stone with the Melbury Marl below. There are other exposures of this boundary in this corner of the stream.



Fig 13. Showing the boundary between the Totternhoe and the Chalk Marl below

Moving downstream, some other exposures of the Marl can be seen in the sides and floor of the stream

2) Clunch pits

The Totternhoe Stone (clunch) was quarried in Burwell for local building stone. Some sign of the quarrying activity can be seen in the fringes of the Bloomsfield housing development in the High Town area. This quarry might have been referred to as Carter's Pit in various publications. Working of the main seam ended in 1952.

A cliff wall is still accessible and displays the normal blocky nature of these horizons.

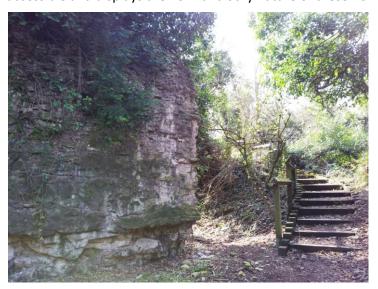


Figure 14: View of quarry face in Carter's Pit (Bloomsfield)

The quarry face continues behind some of the gardens in this housing estate. One of the peculiarities of this rock is that it must be cut and shaped whilst still moist and fresh. Once it dries, it becomes crumbly and difficult to work. Many of the local dwellings, walls and the church are made with stone from these quarries.

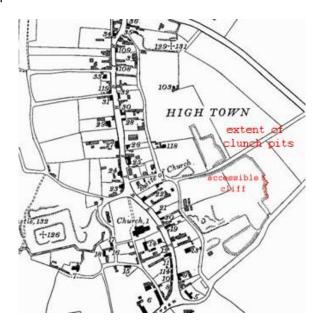


Figure 15 Location of the Clunch Pits in Burwell

Penning and Jukes-Browne (1881, p. 46) remarked of Carter's Pit, Burwell, that the lowest beds exposed were used only for interior work but that the over-lying 'bond' stone, 3 ft thick, if properly dried became very hard and made a good building stone

The earliest recorded use of stone from these quarries is 1252 and the last stone was worked from them in around 1952



Figure 16: Old photo of Carter's Pit, Burwell. Looking E.

http://geoscenic.bgs.ac.uk/asset-bank/action/viewFullSizedImage?id=67260&size=800

Acknowledgements

Various BGS on line sources for Fig1 and Fig 17

Handbook to the Natural History of Cambridgeshire By John Edward Marr, Arthur Everett Shipley

Cambridge University Press 1904

The clay mineralogy of some tills in the Cambridge district: Perrin.R M S, 1957 Clay Minerals Bulletin, 3, 193-205

Penning and Jukes-Browne (1881, p. 46)

Sedgwick Museum, Downing St, Cambridge

Burwell Museum, Mill Lane, Burwell

Engineering Geology of British Rocks and Soils: Gault Clay. BGS Technical Report WN/94/31. Fortster, A et al 1995

The Countryman, Jan, 2010, 'Clunch Time For Building.' (Article on the clunch pits of S. Cambs.)

Bernard O'Connor: Digging for Dinosaurs (2009) www.bernardoconnor.org.uk

P. Lesley Cook, "The Cement Industry" in P. Lesley Cook et al, Effects of Mergers: Six Studies,
Routledge, 2003, ISBN 0-415-31346-5
Peter J. Jackson, Cement Manufacture by UK Companies, 1914-1994, JOPET, 1999

Reg Nicholls 2016.