

Wheatley's Geology: Academic controversy but Industrial value

Nigel Banks & Michael Heaton

Contents – Part 1

- **Geology of Wheatley**
 - Introduction
 - Sources of Information
 - Wheatley's Importance in Geology
 - Rock Units and their distribution
 - Oxford Clay
 - Corallian
 - Kimmeridge Clay

Geology: the study of the Earth's History

- **What can geology tell us?**
- What type of soil will I have in my garden?
- Might there be something valuable beneath my house – water, gold, diamonds, oil, gas, coal?
- Will my house be susceptible to subsidence, flooding or landslips?
- Is there a danger of earthquakes?

The Age of the Earth

In the late 18th century it was widely accepted that the Earth formed on October 23rd 4004 BC – based on Bishop Ussher's analysis of the Bible.

But we now know that:

- Earth is 4500 million years old
- Abundant animal life for at least 540 million years – preserved as fossils
 - Divided into three units – **Palaeozoic, Mesozoic and Cenozoic**
 - **Mesozoic** divided into three units – **Triassic, Jurassic and Cretaceous**

Sources of Information

- **British Geological Survey**

- <https://www.bgs.ac.uk/>

- Memoirs (e.g. the Thame memoir (1995))
 - Printed geological maps
 - Online: BGS GeoIndex

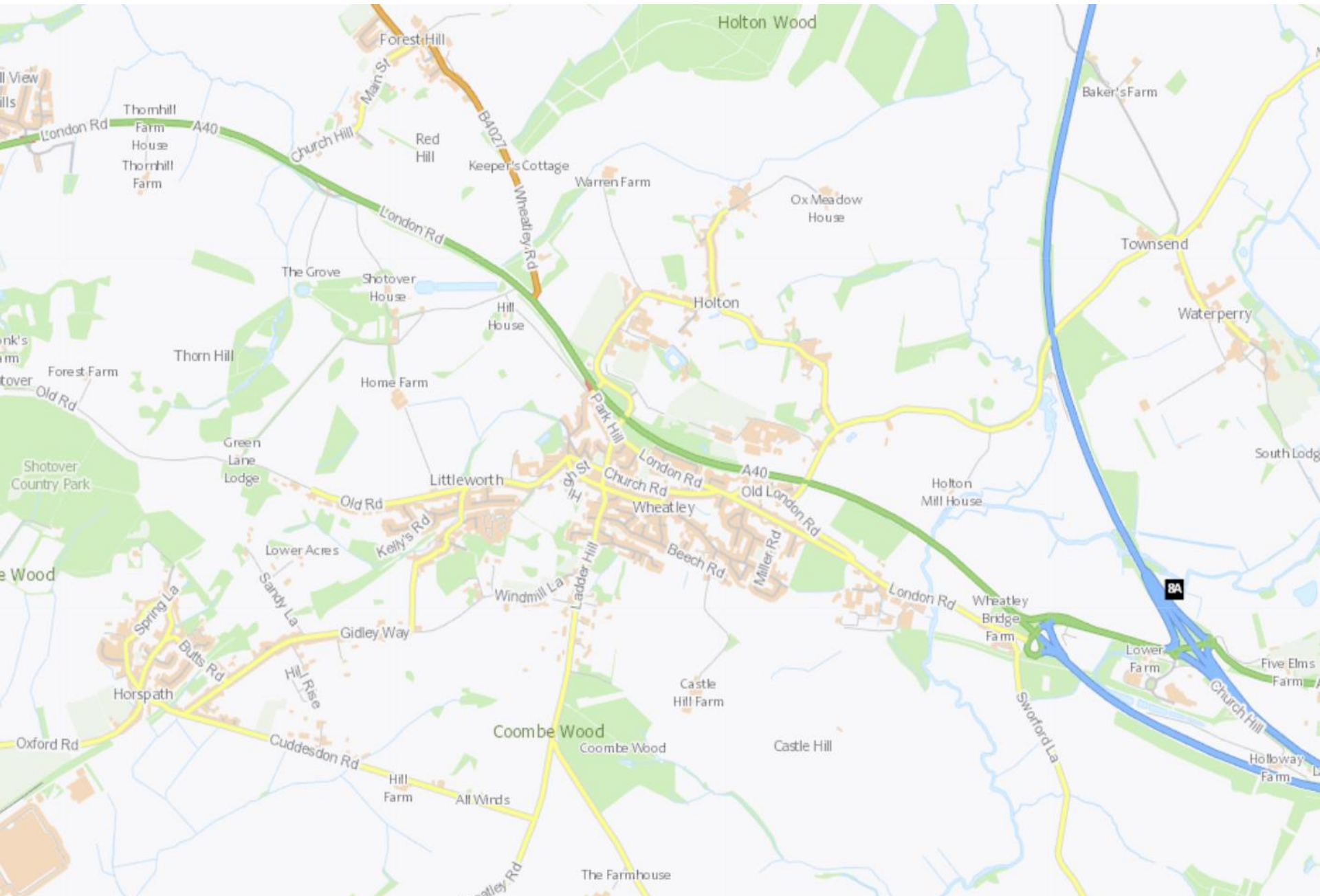
- <https://mapapps2.bgs.ac.uk/geoindex/home.html>

- Geology maps plus borehole, water, elevation and much other data

- **Published books and research papers**

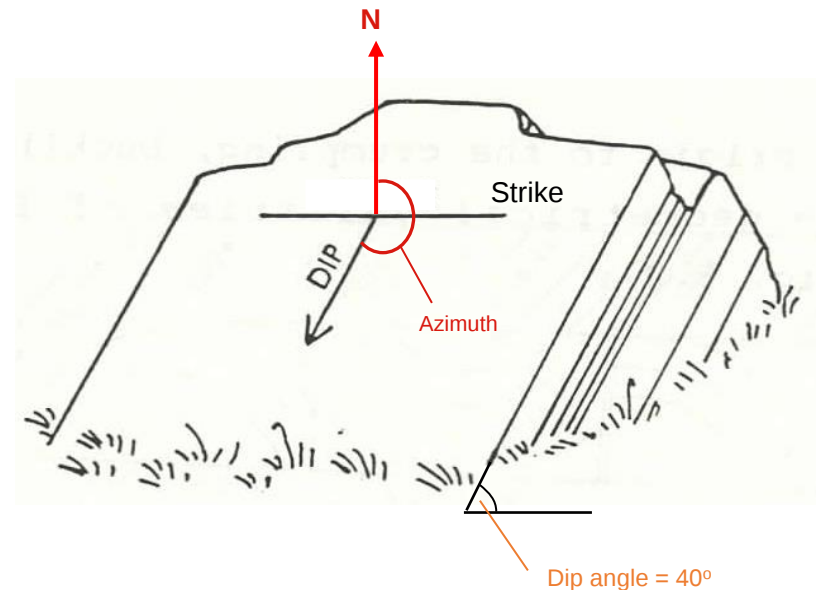
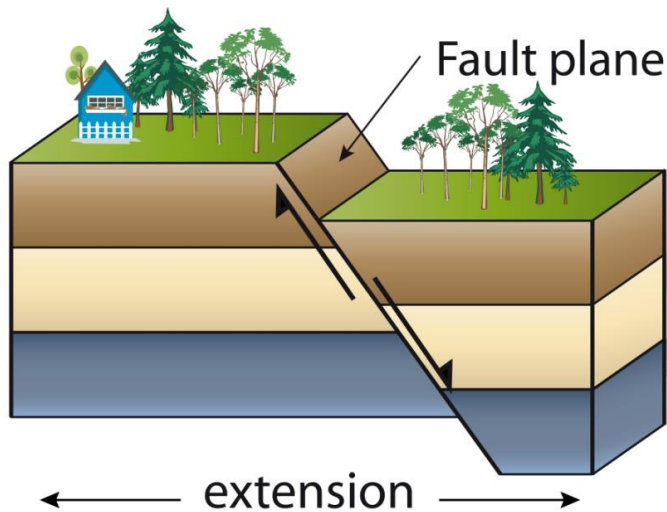
- Arkell's *Geology of Oxford* (1947)
 - Philip Powell, *Geology of Oxfordshire* (2005)
 - Jack Turner's books on local geology

BGS GeoIndex website



Wheatley's Importance in Geology

1. **Wheatley Limestone** – an important local rock unit
2. **Wheatley Fault Zone** – a series of geological faults with a complex history running from Headington to Great Haseley



Complex fault – Kilve, Somerset



Nigel Banks

Wheatley's Importance in Geology

1. Wheatley marks the **eastern edge of Corallian rocks** along the outcrop from Dorset to Yorkshire
2. Wheatley gives its name to an important fossil ammonite– ***Pectinatites wheatleyensis***



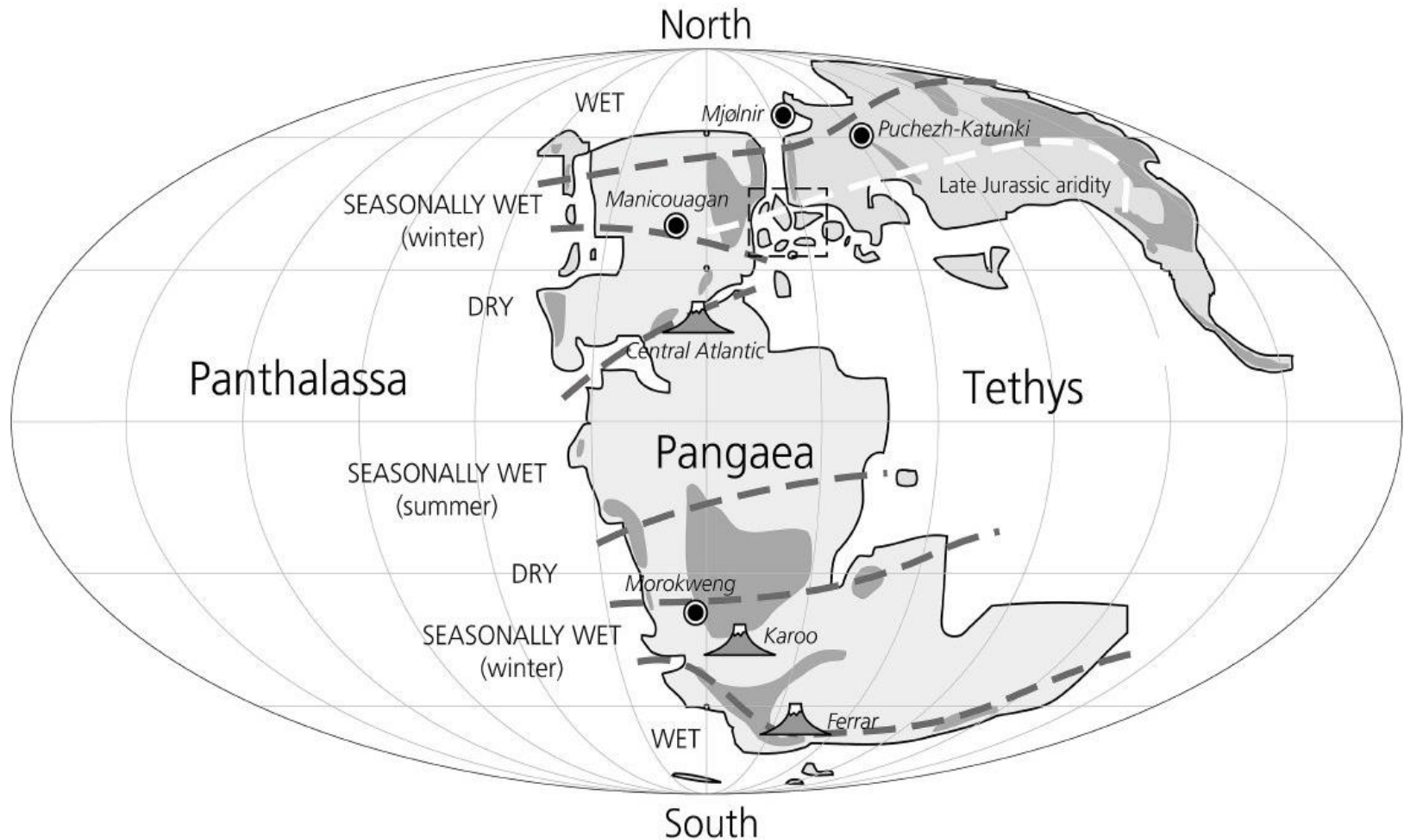
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Rock Units and their distribution

- The rocks around Wheatley range in age from Middle Jurassic up to Lower Cretaceous, roughly from 165 to 130 million years old.
- Ammonite fossils provide a timescale with a resolution of about 1 million years
- The sediments consist of clays, sands and limestones.
- Sediments were deposited in shallow marine environments on a stable, slowly subsiding continental shelf: thicknesses are much less than in the equivalent sections in Dorset and the Weald
- Overall, the rock layers dip gently to the southeast but are locally disrupted by faults and minor folds

World Geography in the Jurassic

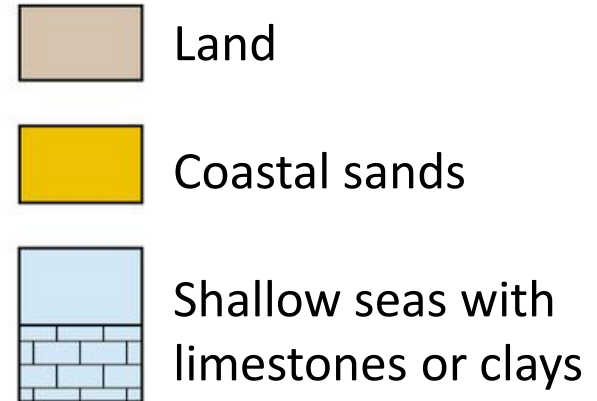
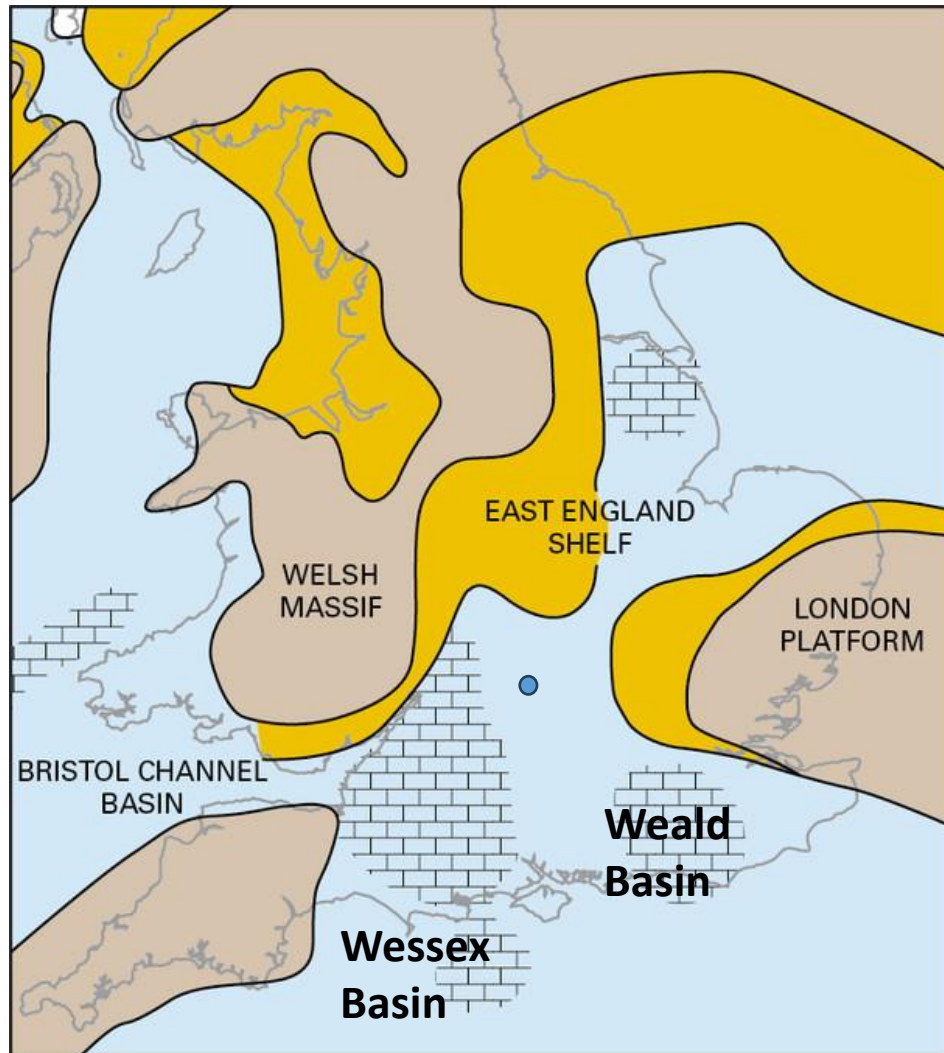


Continental flood basalt province



Impact crater (>30 km)

Upper Jurassic Palaeogeography



Formation Thicknesses (feet) & Ages

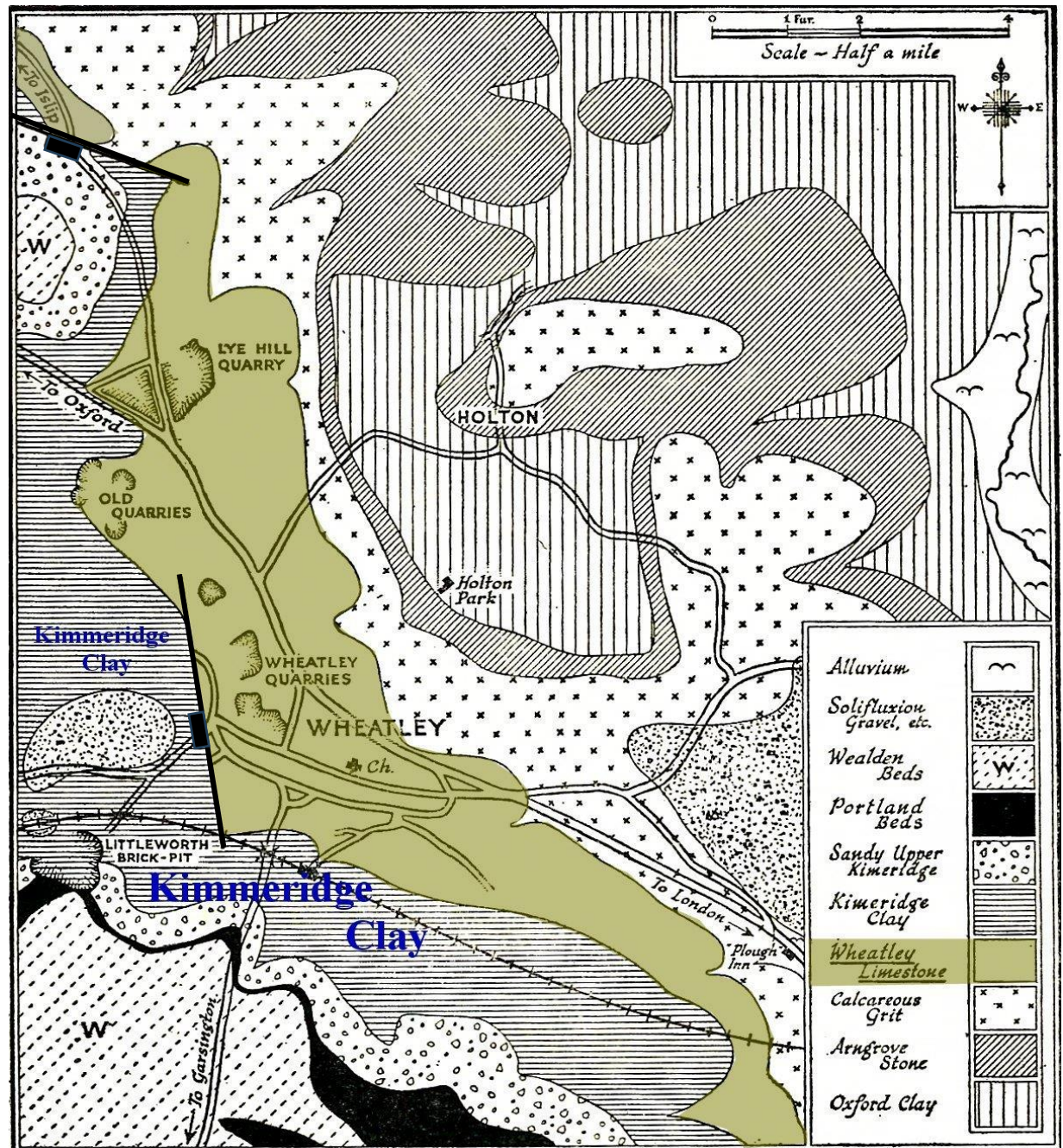
Formation	Oxford	Dorset	Ages (ma)
Wealden (Shotover Sands)	60	1000-2000	140-130
Portland & Purbeck Beds	40	650	152-145
Kimmeridge & Ampthill Clays	150	800-1600	157-152
Corallian	100	240	160-157
Oxford Clay	300	500	166 -160
TOTAL	650	3200-5000	

In the Oxford area the average rate of sedimentation was 20 feet per million years (or 1 inch in 4200 years)

Geological Map of Wheatley

From Arkell (1947)
Oxford Stone

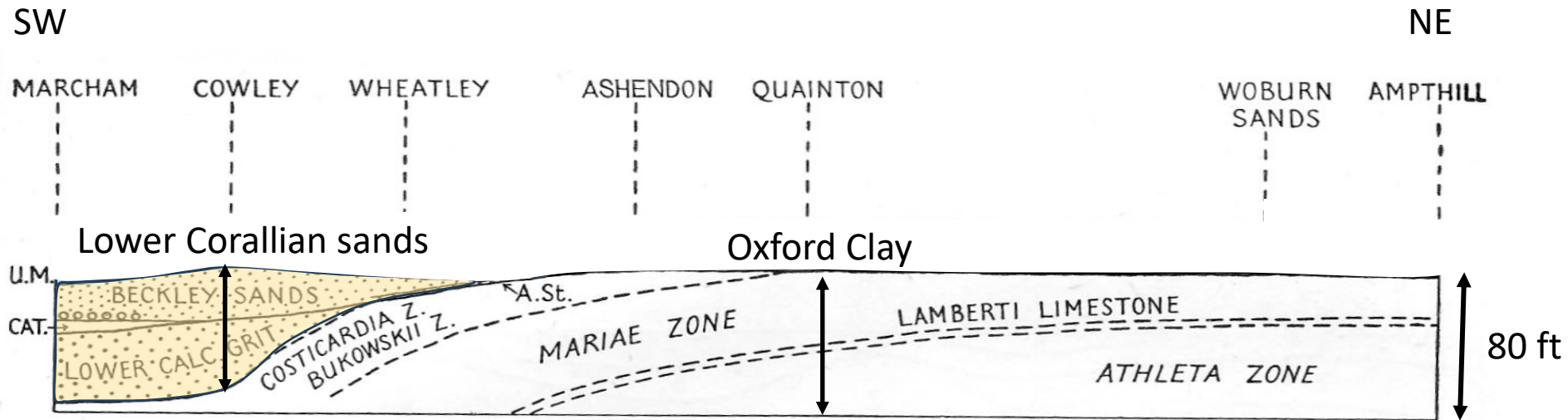
Present A40 not yet built



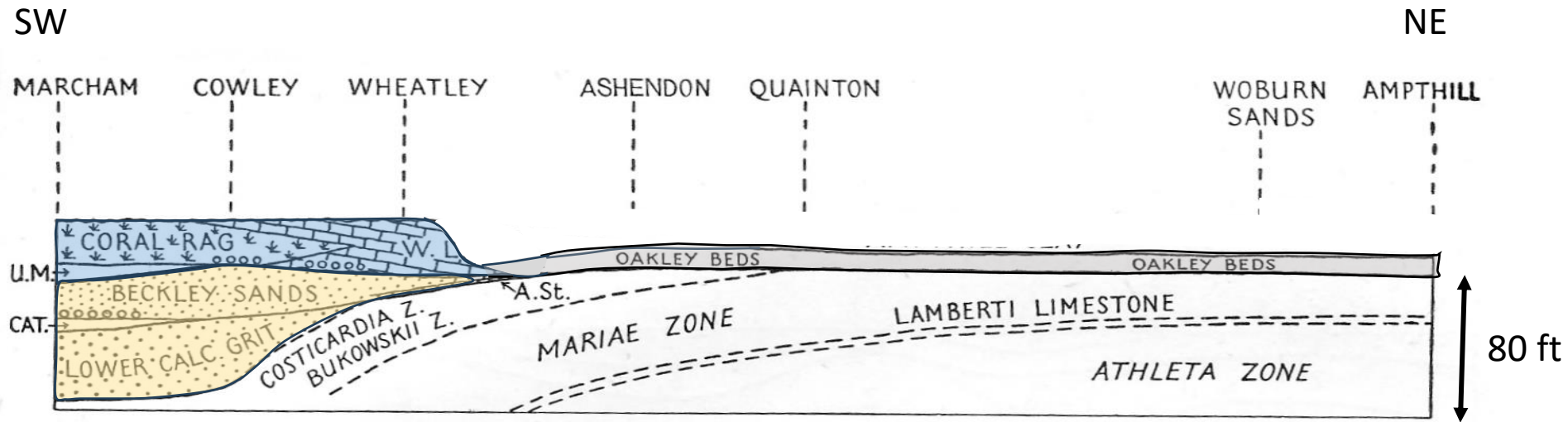
Corallian

- A complex mixture of limestones, sands and clays showing marked lateral variations across England from Dorset to Yorkshire
 - A major change occurs near Wheatley where thick sands and limestones pass abruptly laterally northeastward into thin clays (Oakley Beds).
- The sands form locally important aquifers and have also been quarried
- The limestones have been quarried for building stone (Wheatley and Headington) and for making agricultural lime and cement.

Arkell's Model of the Corallian Edge



Arkell's Model of the Corallian Edge



Corallian Corals and Bivalves

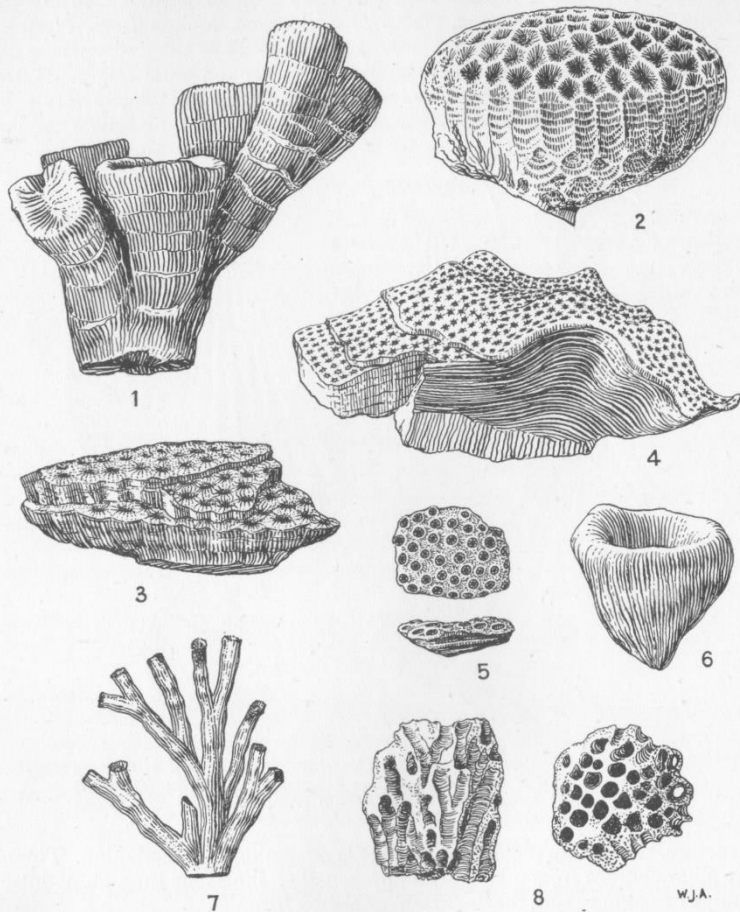


FIG. 10. Reef-building corals of the Oxford district (half natural size). 1, *Thecosmilia annularis* (Fleming). 2, *Isastrea explanata* (Goldfuss). 3, *Thamasteria arachnoides* (Parkinson). 4, *Thamasteria concinna* (Goldfuss). 5, *Stylina delabechii* Edwards and Haime (Steeple Ashton). 6, *Montlivaltia dispar* (Phillips) (Kingston Bagpuize). 7, *Rhabdophyllia phillipsi* Edwards and Haime (Cumnor Hill). 8, *Cladophyllia conybeari* Edwards and Haime, side view and top view of hollow moulds in limestone (Wytham Hill).

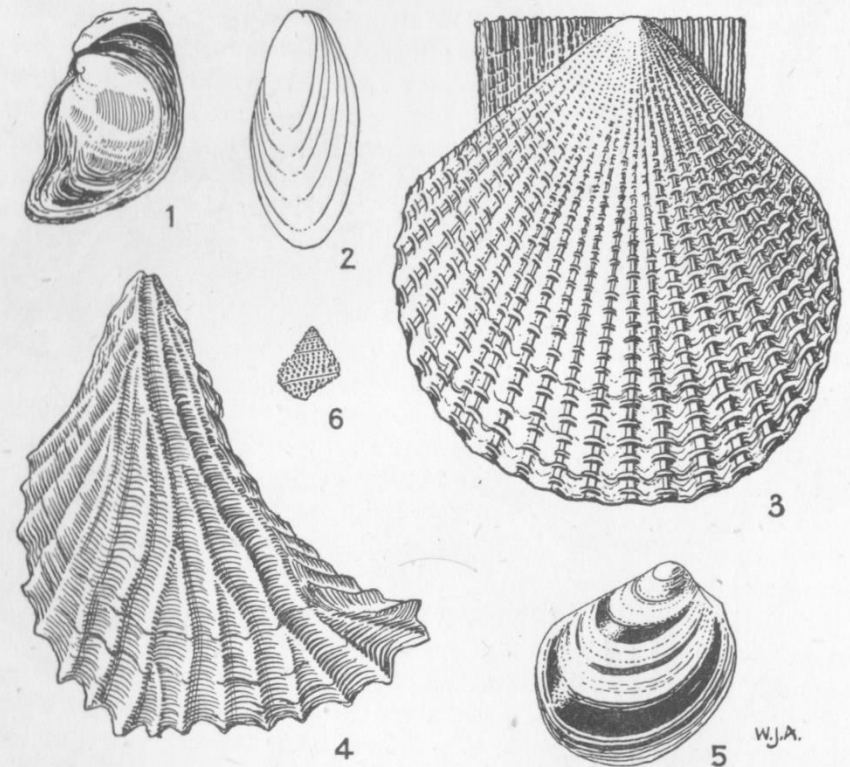


FIG. 11. Reef-dwelling mollusca of the Coral Rag (natural size). 1, *Exogyra nana* (Sowerby). 2, *Lithophaga inclusa* (Phillips). 3, *Pecten* (*Chlamys*) *nattheimensis* de Loriol. 4, *Ostrea* (*Lopha*) *gregarea* Sowerby. 5, *Lima* (*Plagiostoma*) *zonata* Arkell. 6, *Littorina muricata* (Sowerby).

Arkell (1947)

Wheatley Limestone



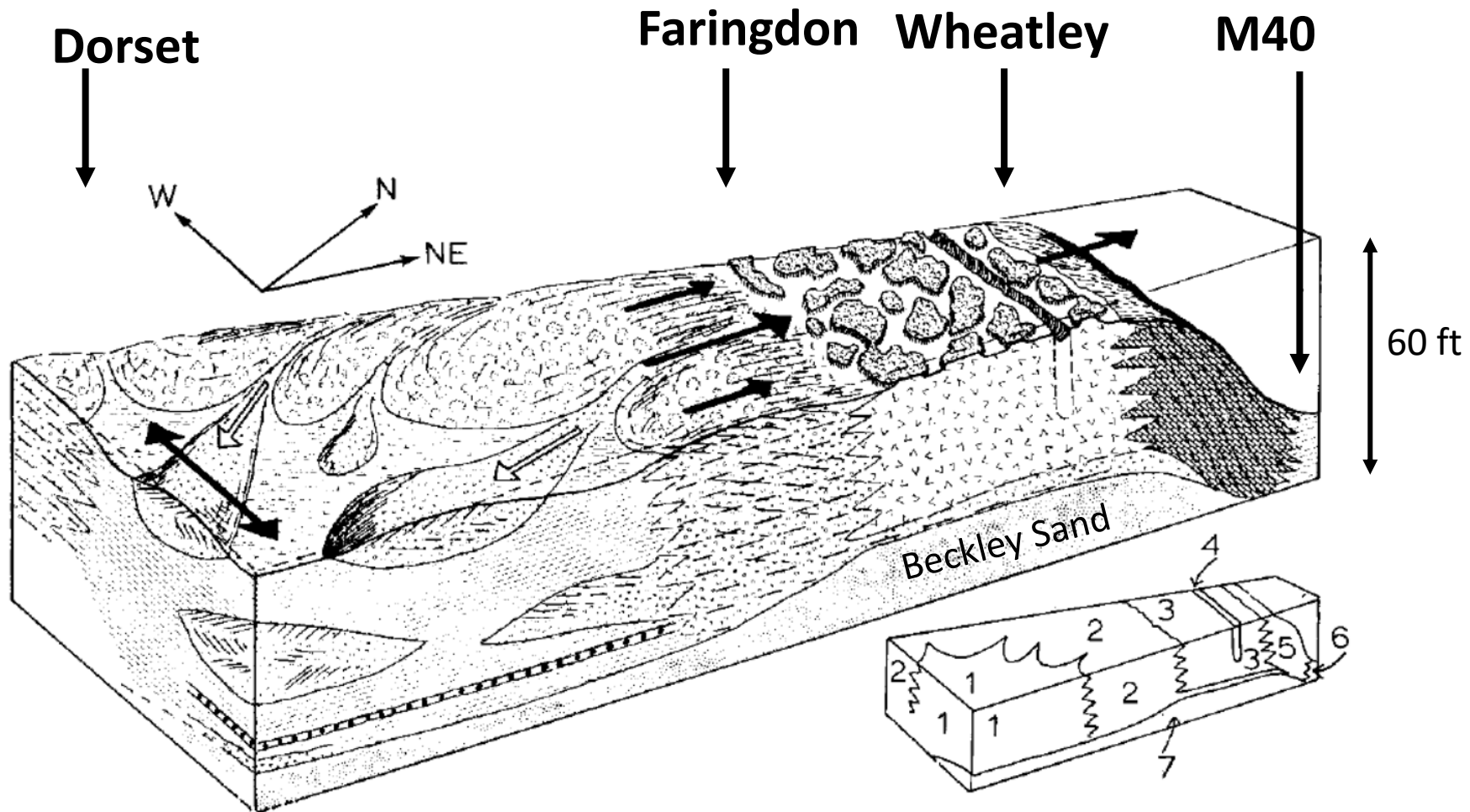
Corallian limestone dips at Wheatley



Corallian limestone dips at Wheatley



Regional model of Corallian limestones



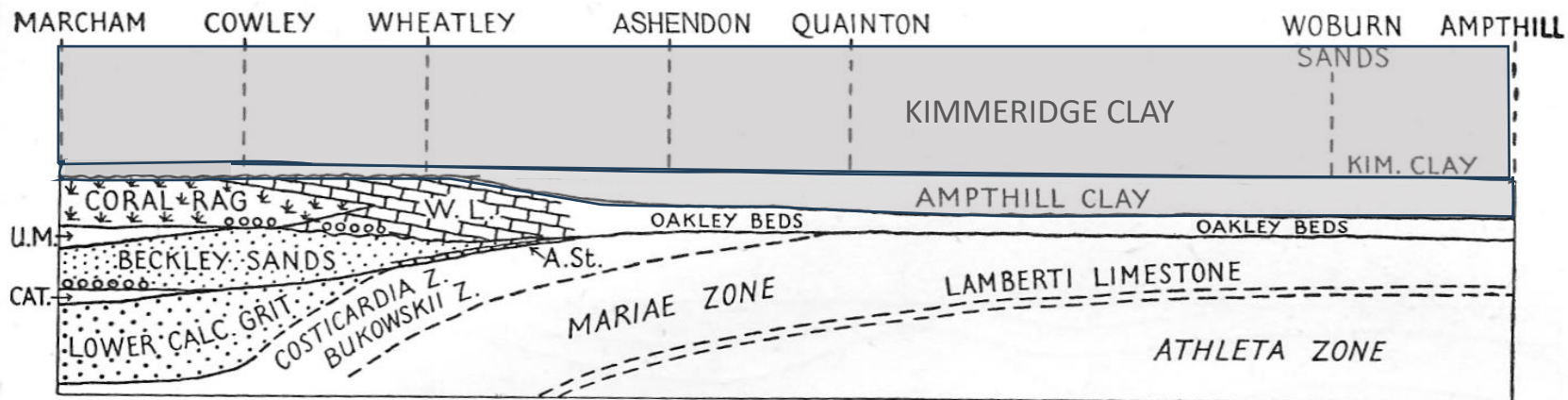
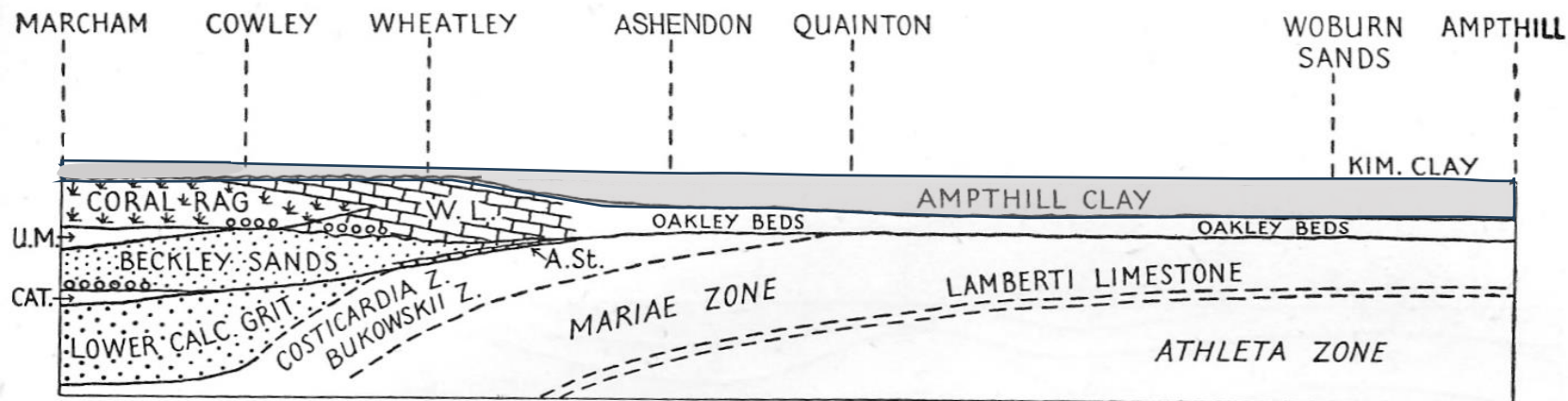
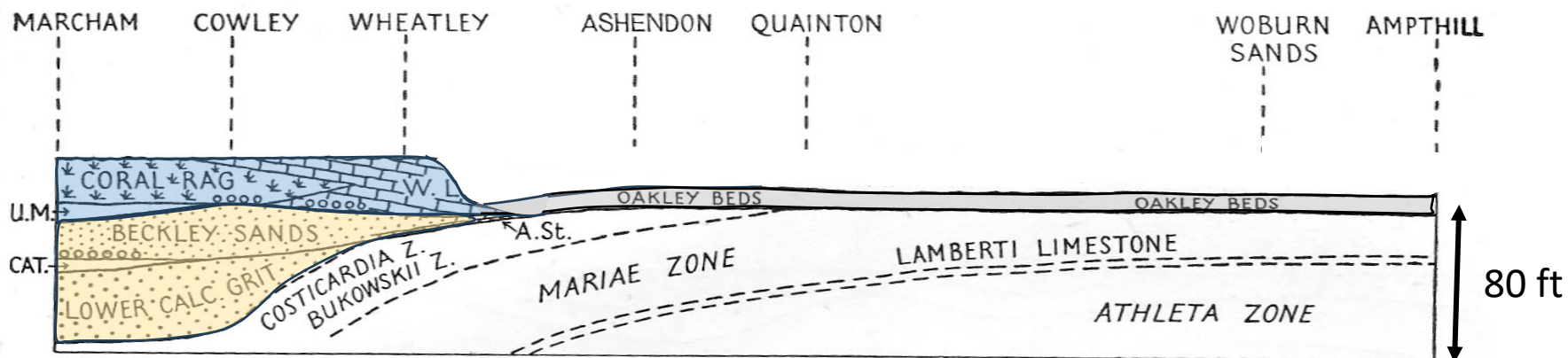
Adapted from R. C. L. Wilson (1968)

Richard Street, Wheatley Parish Newsletter 2023: "Wheatley on Sea"



SW

NE



Kimmeridge Bay, Dorset



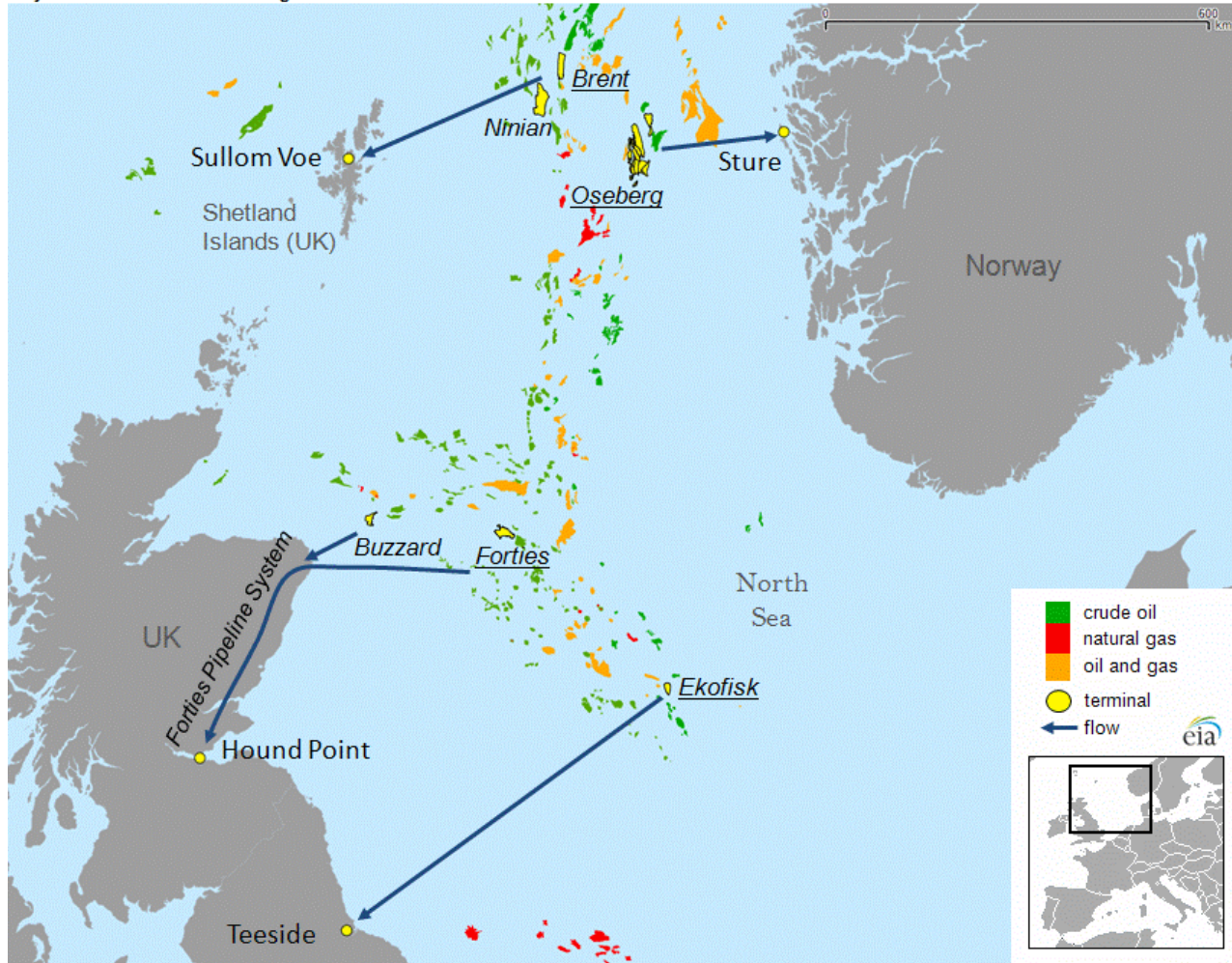


Kimmeridge Clay oil shale



Most of the North Sea oil comes from the Kimmeridge Clay source rock

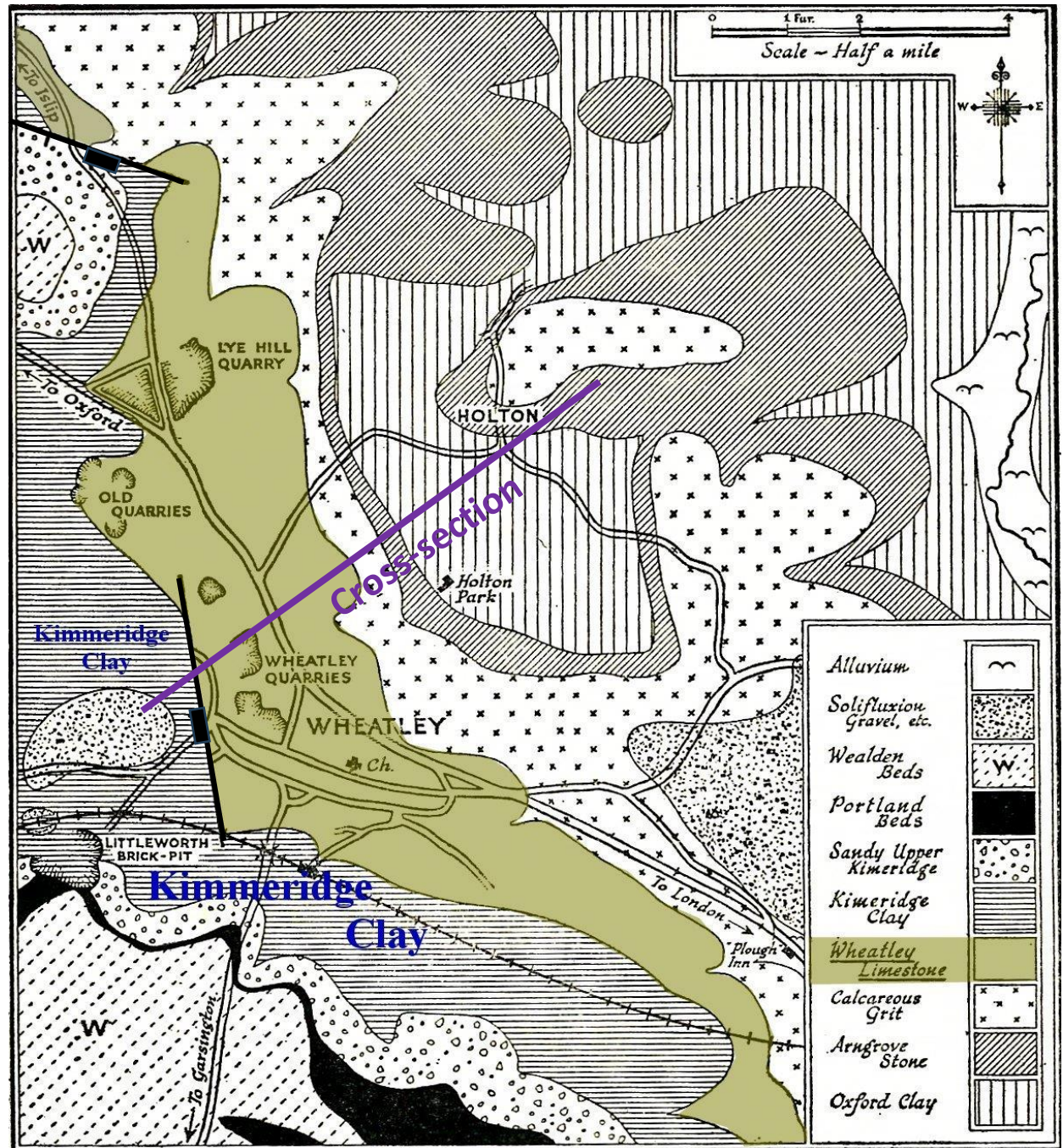
Key North Sea oil and natural gas fields and terminals



Geological Map of Wheatley

From Arkell (1947)
Oxford Stone

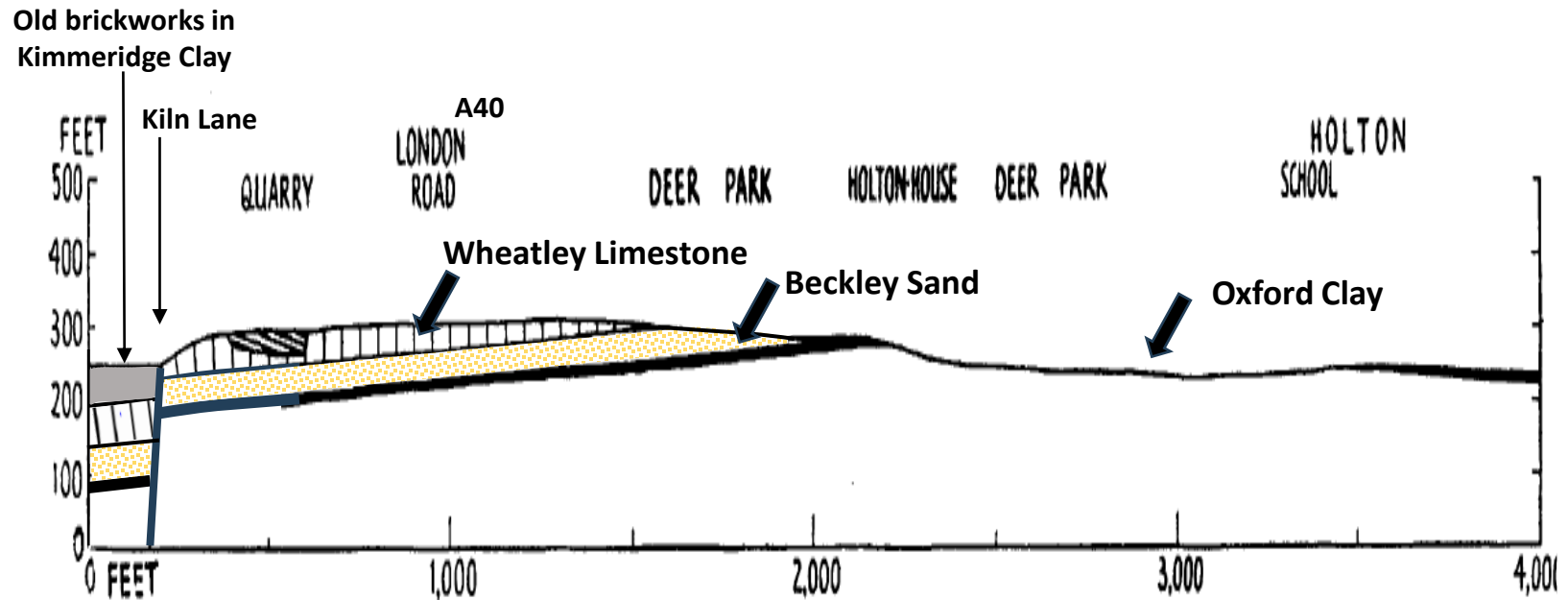
Present A40 not yet built



Geological Section through Wheatley & Holton showing fault along Kiln Lane

SouthWest

NorthEast



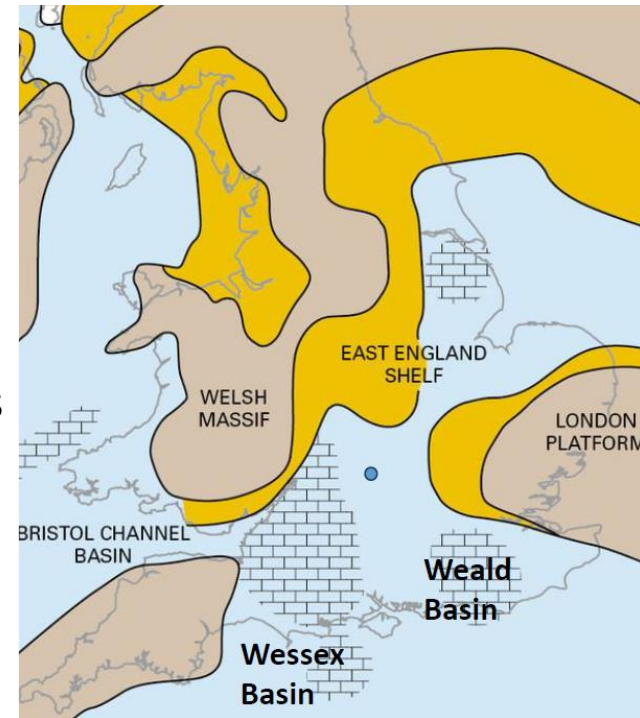
Modified from Arkell (1941)

Summary

- The Earth is very old.
- Wheatley's geology is interesting and somewhat controversial.
- The BGS GeoIndex website is a great source of information.

Ammonite fossil – a recent story

A recent visitor came back to see the (damaged) Ammonite which, after digging up in his Church Road garden, he had deposited in Wheatley Library c. 2000 – but is no more! Perhaps it was the one that Rev. Edward Elton referred to in his diary in November 1864 as being almost perfect & 9" in diameter and found in the Littlemore cutting of Wheatley-on-Sea.

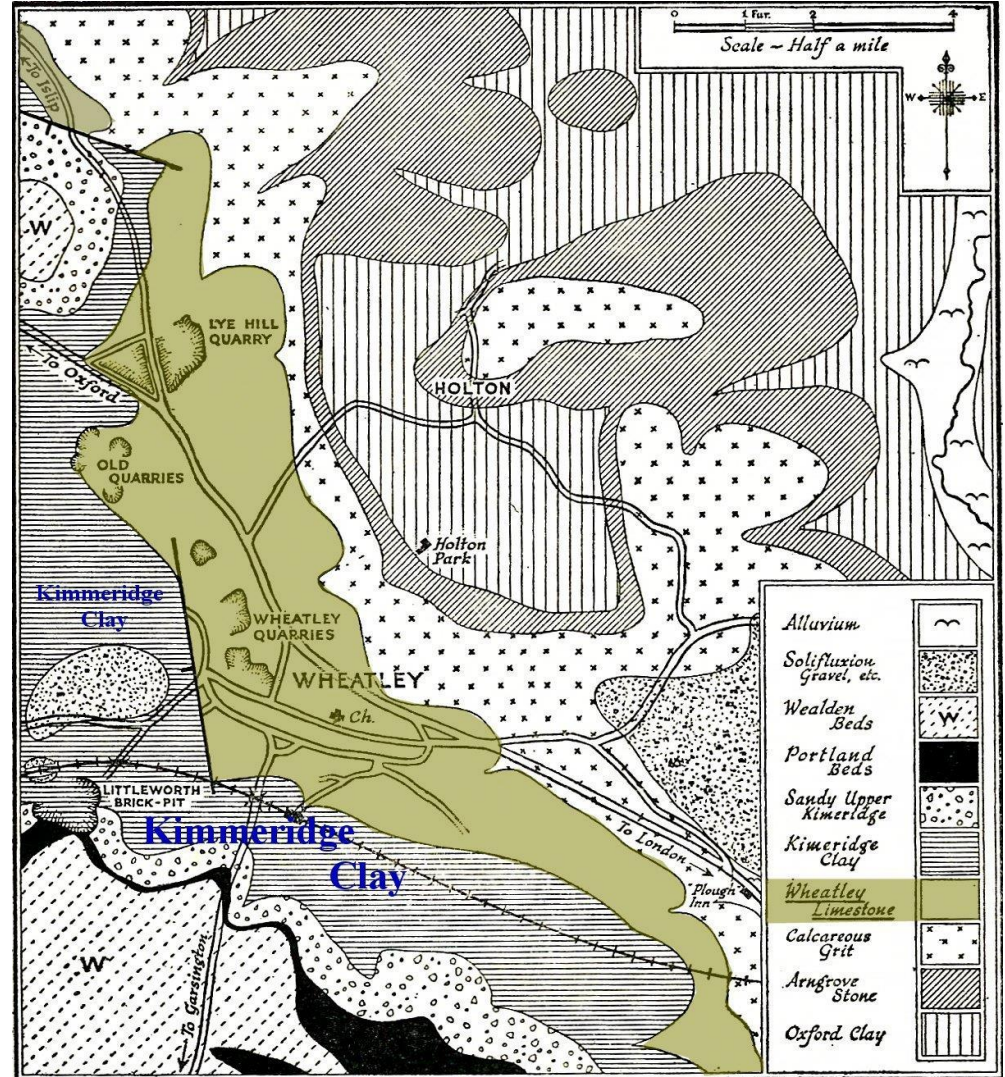


Upper Jurassic
Palaeogeography,
130-160 million years ago. The
blue spot is Wheatley

	Period	
1	1200-1800	Stone quarrying

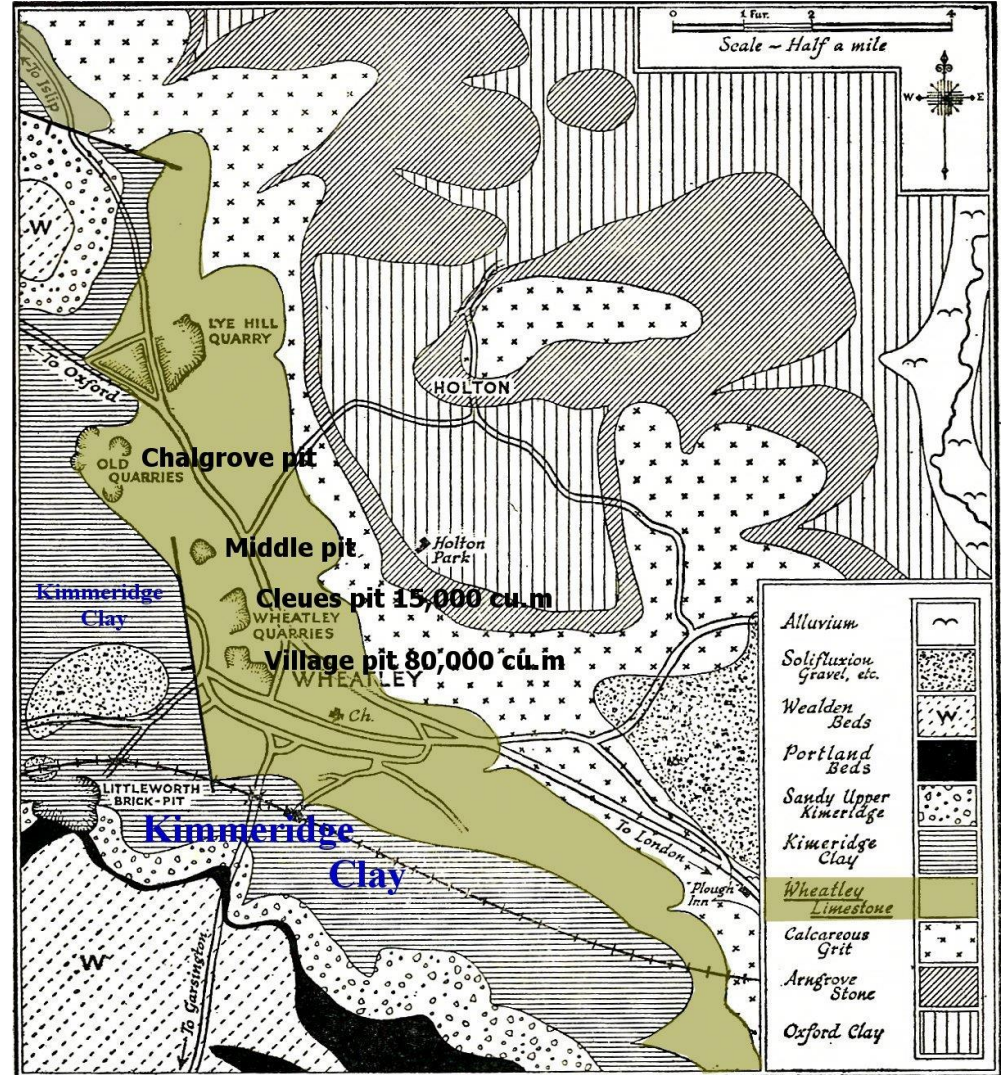
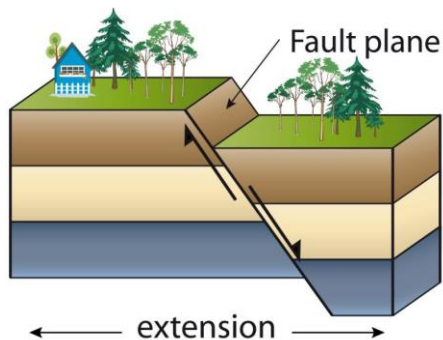
Limestone seam

Map acknowledged to
Arkell, W.J. 1941. 'Stratigraphy and
Structures East of Oxford'



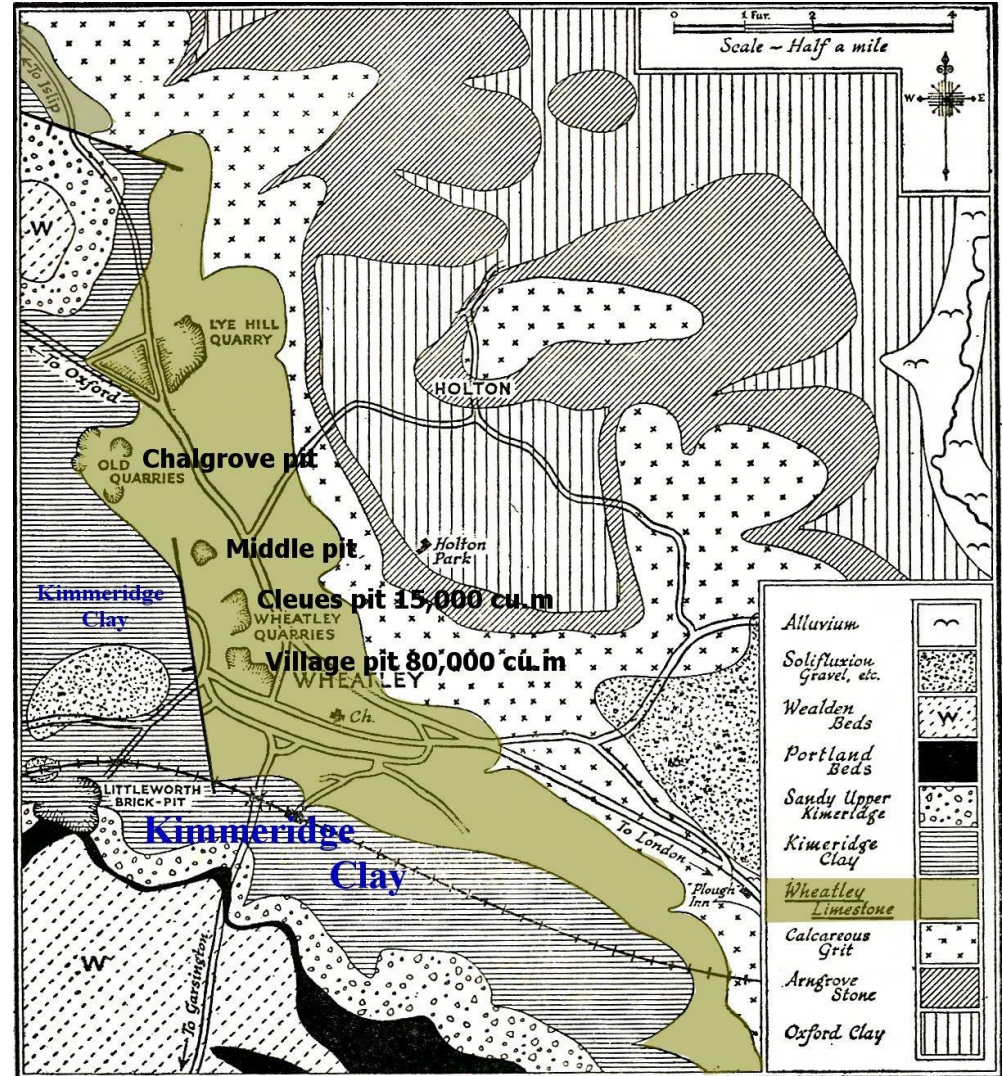
Limestone seam and Kimmeridge clay both accessible

I am grateful to Nigel for explaining why the Kimmeridge Clay pit and the limestone were found very close to each other. There is a geological fault running down Kiln Lane that downthrows the clay on the west side so it is at a similar level to the older limestone.



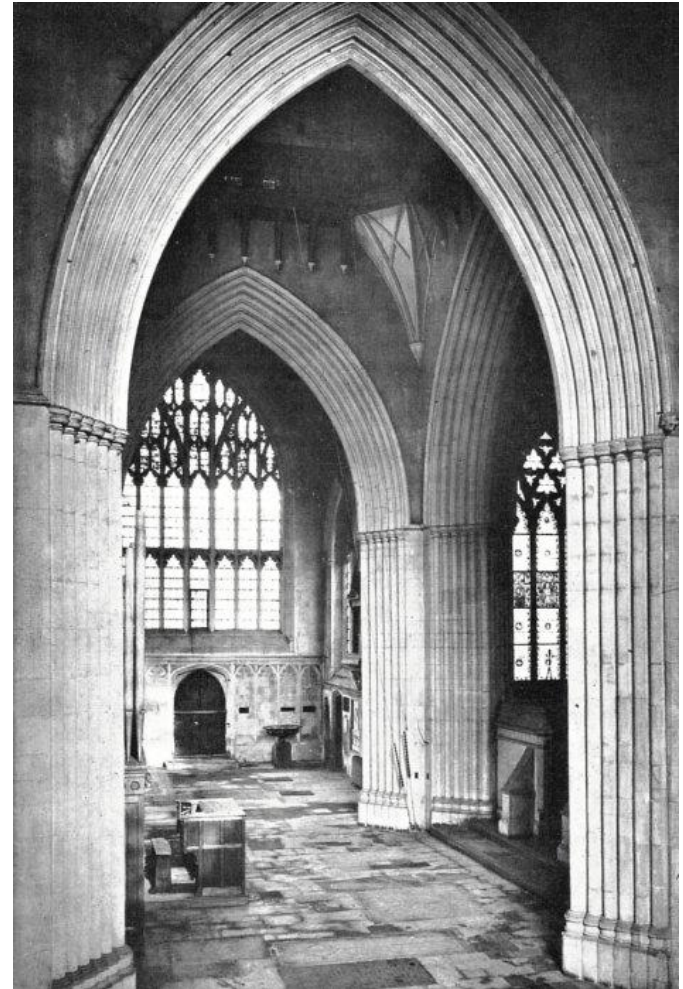
Limestone seam

The quarry which produced the earliest and best stone at Wheatley during the thirteenth and fourteenth centuries was called “Chalgrove”. This was within the ‘Royal Forest’ so required the King’s permission to be quarried.



Chronological references to Wheatley stone

1286, the King's bridge over the Thame.
1278 and 1290, Merton College.
1303-4, the Oxford Dominicans.

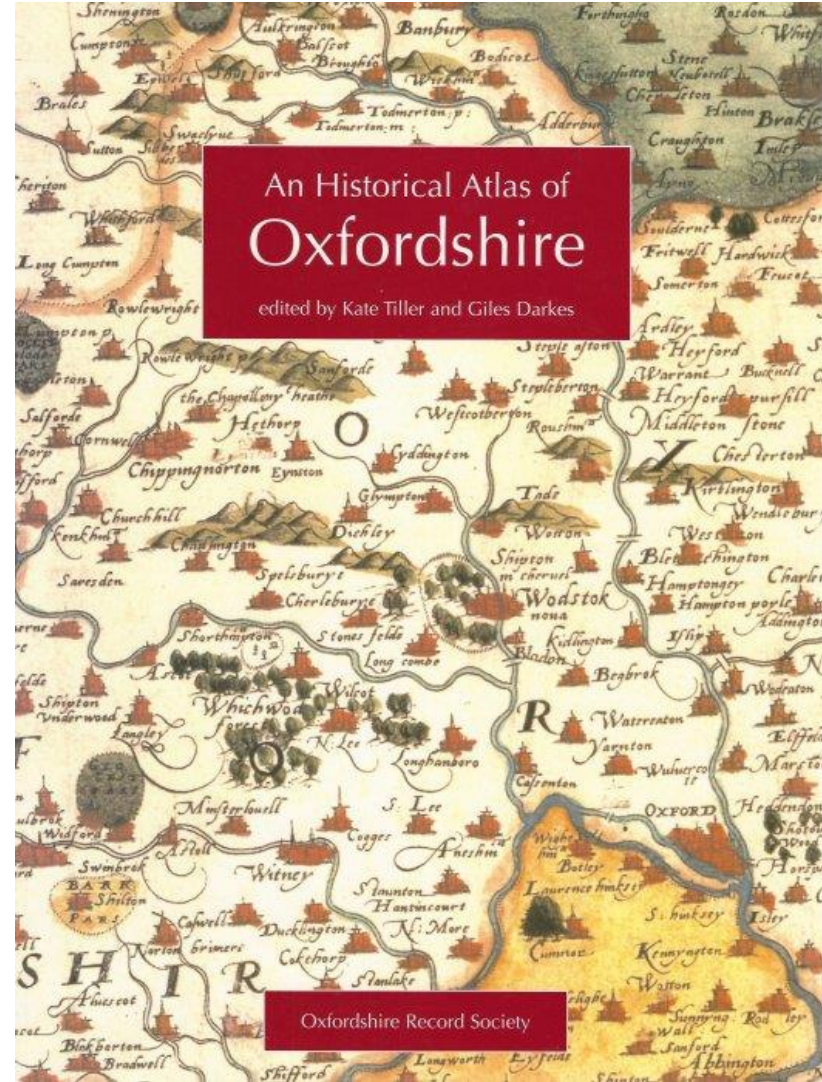


Merton College chapel

Historical research

This research centred on the incomes of villages across Oxfordshire. It was based on the lay subsidies, known as tenth and fifteenths, this being the part of the value of moveable, personal goods of lay persons, but levied on the township or parish. One fifteenth applied to rural areas.

It enabled us to see the relative incomes of Wheatley in the two years of 1334 and 1524.

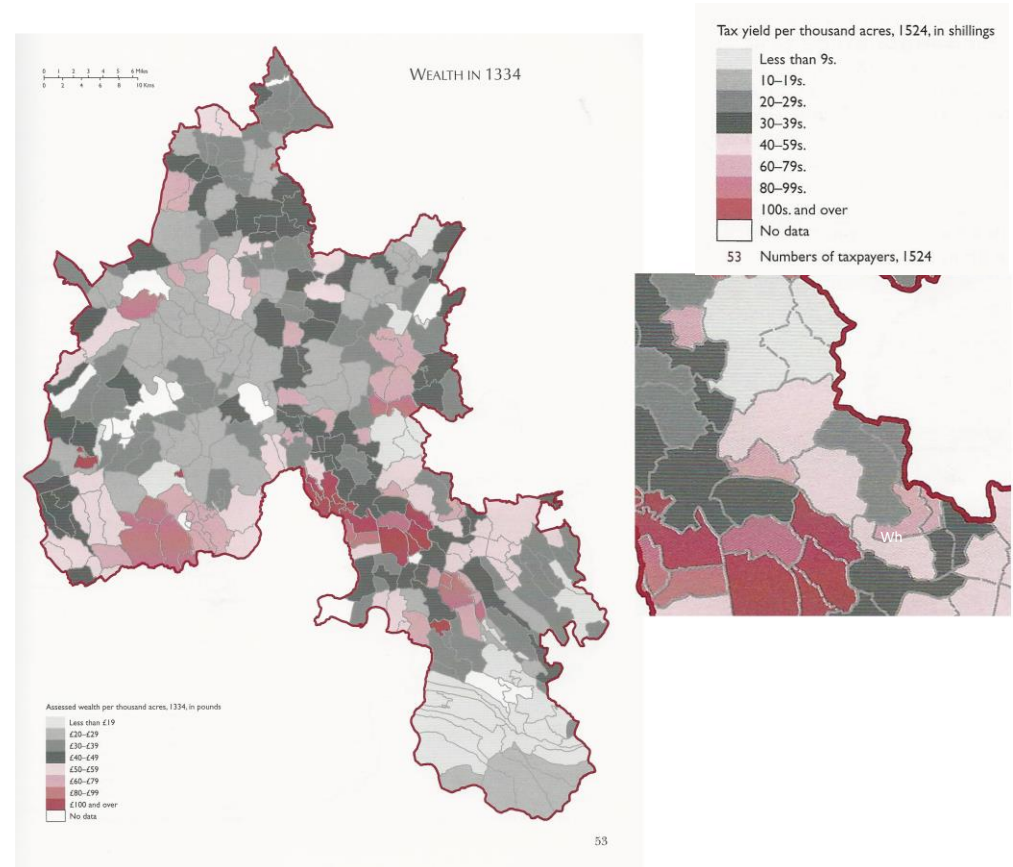


Chronological references to Wheatley stone

1334 Village/parish wealth map

This map shows, in the darkest red colouring, the ten or so of the wealthiest villages in Oxfordshire in 1334.

Wheatley was one of these.



Chronological references to Wheatley stone

1344, for Windsor Castle.

1353, for Wallingford Castle.

1362-5, for Windsor Castle.

1375-6, Cuddesdon church.

1378-9, Abingdon Abbey (by water from Sandford).

1378-9, Queen's College.

1382, Exeter College.

1383, Wallingford Castle again in 1395.

1396-1400, New College after being founded by William of Wykeham in 1379.

By 1400, Headington Quarry had usurped Wheatley's dominance.

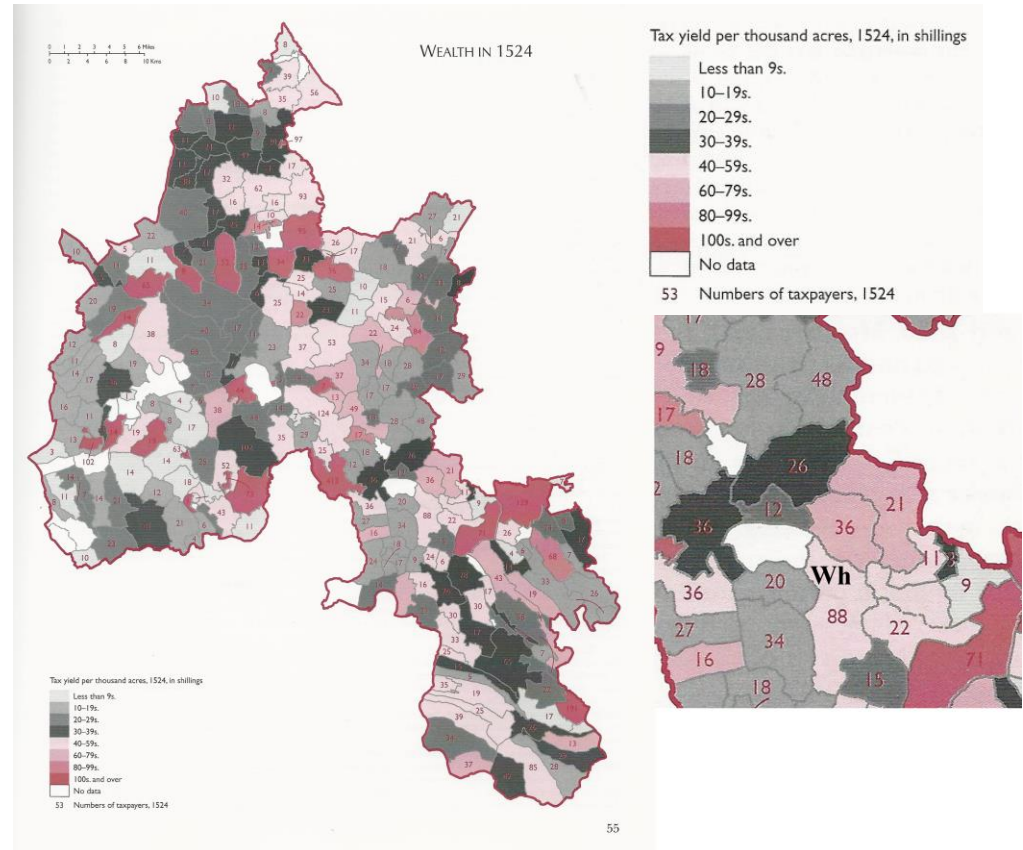
1474, Magdalen College.

1525, Christ Church.

Chronological references to Wheatley stone

By 1400, Headington Quarry had usurped Wheatley's dominance.

1524 Wealth map.
Now only half the wealth of 1334.



Stone construction types



Drystone walls



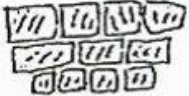
Random rubble, uncoursed



Coursed rubblestone



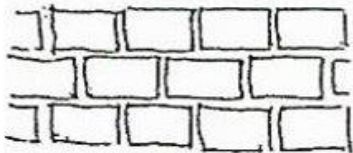
Roughly squared and dressed



Squared and dressed blocks



Ashlar in courses

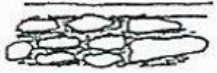


Regular ashlar, fine joints

But this tells you nothing about the age of the building, only the budget for the construction and the stone available.

Ashlar is just the finest stone construction.

Stone construction types



Drystone walls



Random rubble, uncoursed



Coursed rubblestone



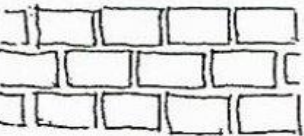
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Ashlar in courses

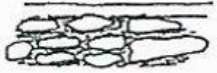


Regular ashlar, fine joints



The King and Queen, 16th century, roughly squared and dressed with some good quoins (corner stones).

Stone construction types



Drystone walls



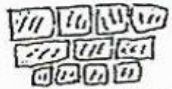
Random rubble, uncoursed



Coursed rubblestone



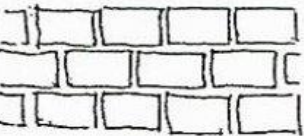
Roughly squared and dressed



Squared and dressed blocks



Ashlar in courses



Regular ashlar, fine joints



Cromwell House, 100 High Street, original date not known but possibly 1700s (and Wheatley's finest stonework), the original in Ashlar in courses, with the extension (c. 1800) somewhere between roughly squared and dressed and coursed or uncoursed rubblestone, but with good quoins and a better return facade.

The Old Parsonage 25 High Street

Dates back to 1612, but
current house built in
the 1700s.

Note that this had been
two dwellings in some
previous era



A photograph of the George Inn in 1985. The building is a two-story stone structure with a prominent arched entrance on the ground floor, which is currently closed with a black metal gate. Above the arch is a small rectangular sign that reads "George Inn". The upper floor features several windows with white frames and multiple panes. The building is situated on a street with other historic buildings in the background. A large tree with green leaves is visible on the right side of the frame. The sky is clear and blue. The overall scene is a well-maintained historic street.

1570 George Inn
re-facaded in
the 1700s

1648,31-33

1985

31-33 High Street dates
from 1648.
It may have also been re-
facaded when it became
the Maidenhead Inn in
1774



44 High Street, when The Common Room in 1988. Known to have been built second half of 1700s at a similar time to 46 High Street, with its 1776 datestone.



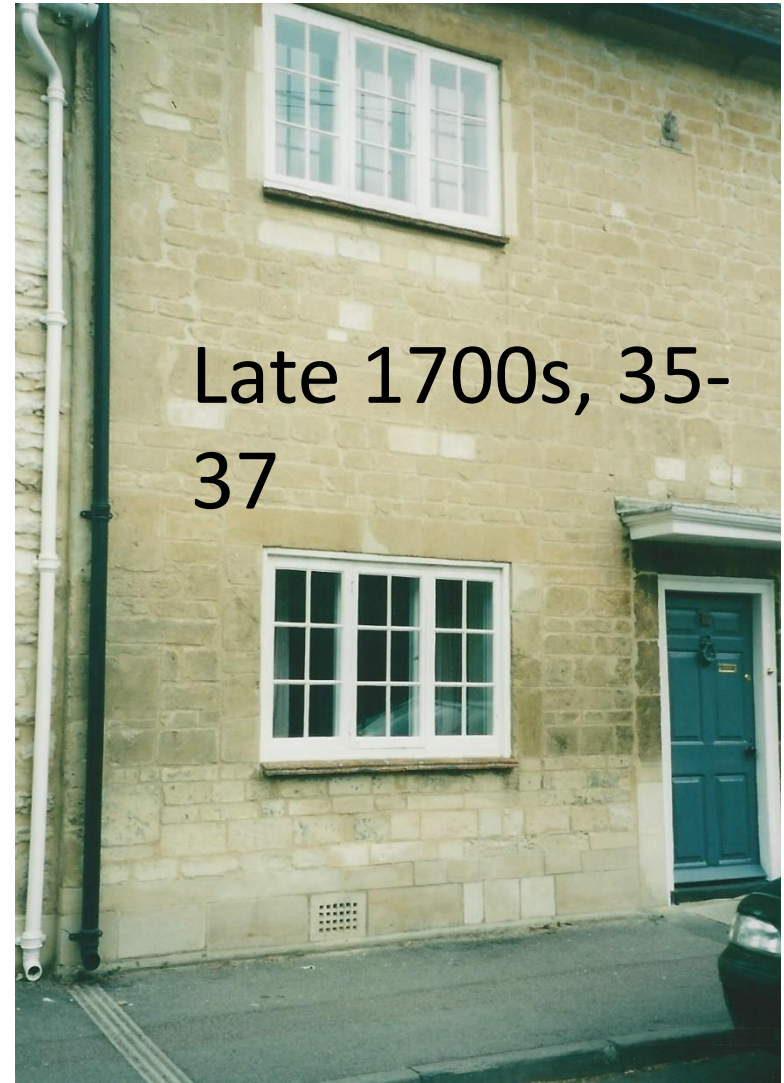
...and, maybe, 48 High Street, but all the original stonework is hidden from sight!



So, was this stone locally sourced?

It is almost certain that the stone for this part of the High Street, including the Manor, was sourced from Wheatley quarries other than the stone for 35-37 High Street, which was of a much lighter colour.

So, it seems that in this period, there was good quality stone coming from these quarries



Stone construction types



Drystone walls



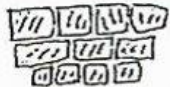
Random rubble, uncoursed



Coursed rubblestone



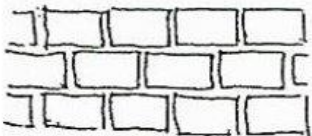
Roughly squared and dressed



Squared and dressed blocks



Ashlar in courses



Regular ashlar, fine joints



However, closer to 1800, the quality of the stone being quarried had deteriorated to largely coursed rubblestone. There are many examples either side of 1800 including 53 High Street which is typical of the local stone quality in this era.

**So as the quality deteriorated,
what was it used for?**

**Lower quality limestone was converted to
agricultural lime**

Lower quality limestone converted to agricultural lime

Extant lime kilns in Westfield Road

Three of an original ten.

Used to convert lower quality limestone into agricultural lime by heating at over 1000 degrees centigrade in these kilns.



Lower quality limestone converted to agricultural lime

Extant lime kilns in Westfield Road

Three of an original ten.

Used to convert lower quality limestone into agricultural lime by heating at over 1000 degrees centigrade in these kilns.

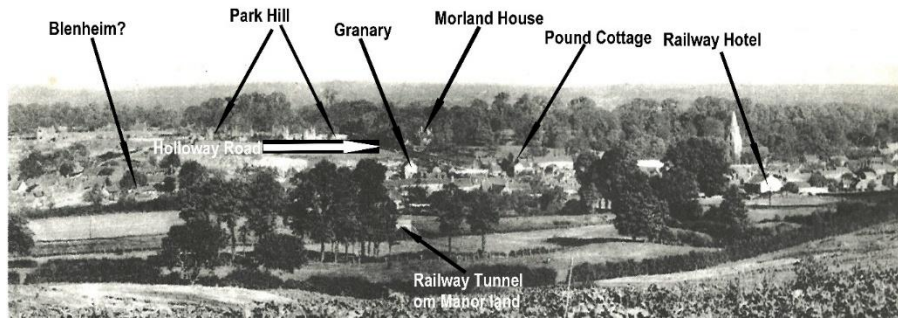
Believed to be the only existing such kilns in Oxfordshire.



Before we leave Wheatley Limestone...

It is too simple to restrict the quarrying to the main pits described earlier. Previous Wheatley residents dug for their fortune 'wherever'! With Nigel's considerable help, we now know that quarrying took place.

On the north side of Church Road east of the school buildings, west of the Church.

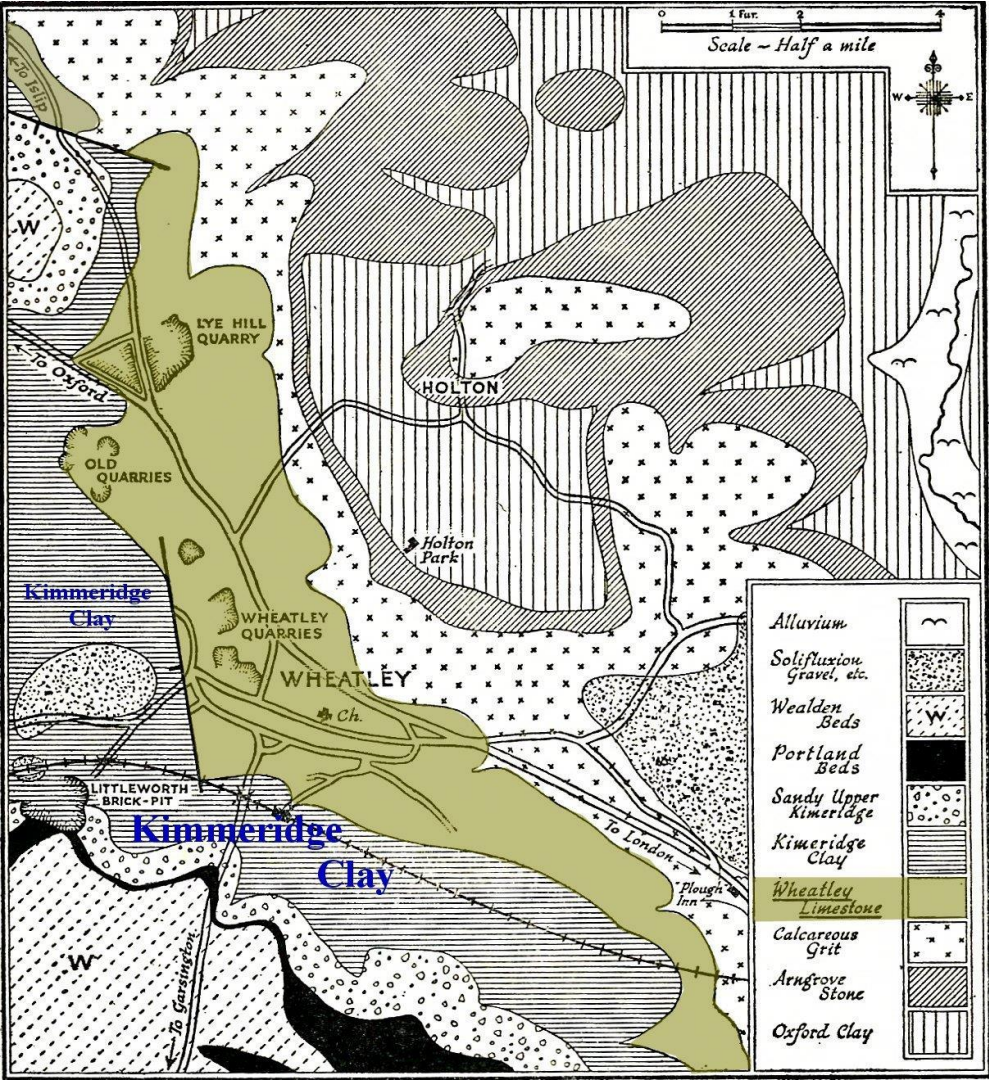


On the site of, and before, the Merry Bells development
Probably immediately north of Farm Close Lane

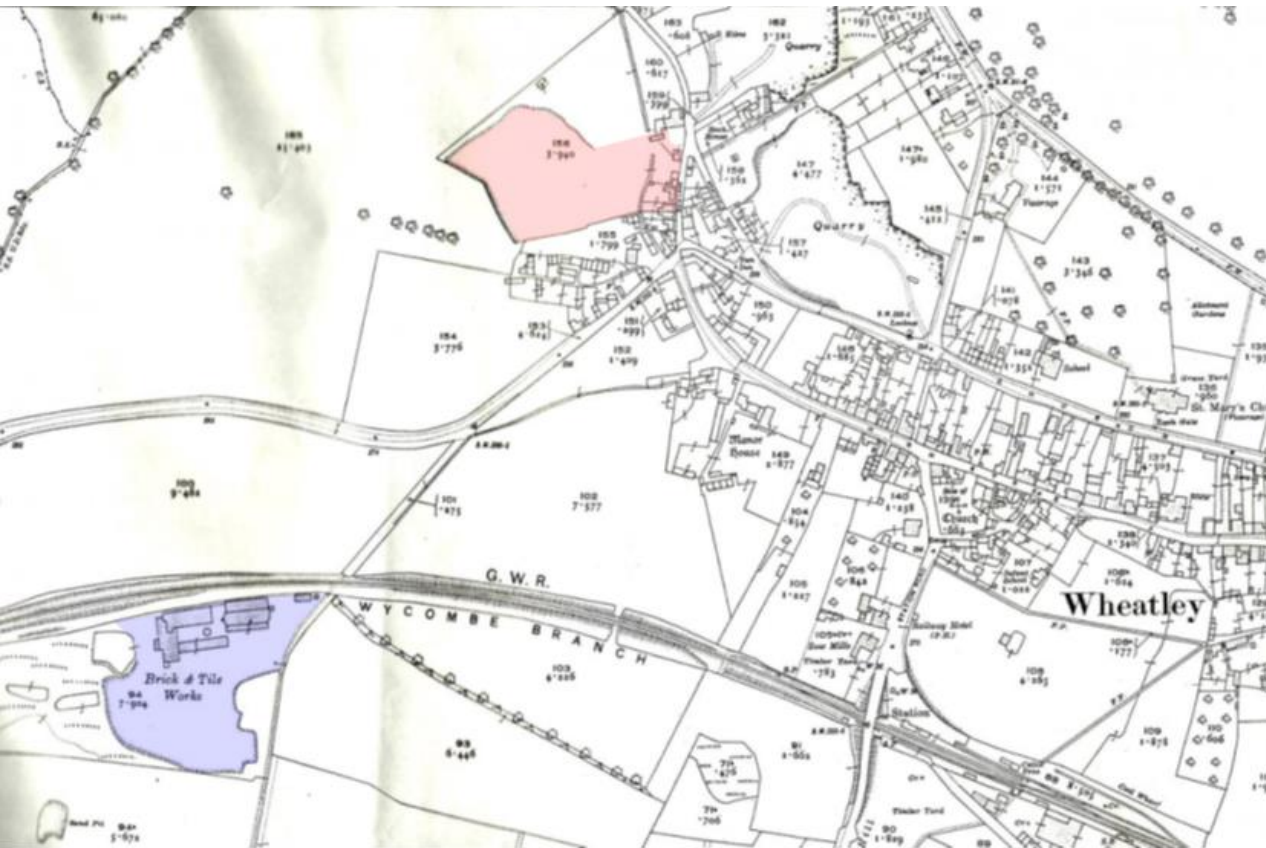
As far as we can tell, no stone buildings were added in Wheatley after about 1800, as the quality of stone was not good enough, and the 1908 geological survey suggest that this had ceased for any purpose. However, lime-burning continued for a few more years in the three remaining of probably ten lime kilns in Westfield Road. In 1911, there were four members of the Cooper family, led by John Hussey Cooper, involved in lime burning and that, by 1921, it was just Joseph Cooper.

	Period	
2	1742-1939	Brick industry

Here is the Arkell map again showing the Kimmeridge clay



Main clay excavation sites



RED is the original brickworks, from 1742, based on the Old House in Westfield Road

BLUE is the later brickworks in Littleworth, from 1890s

Geological map 1989 extract, showing another clay pit





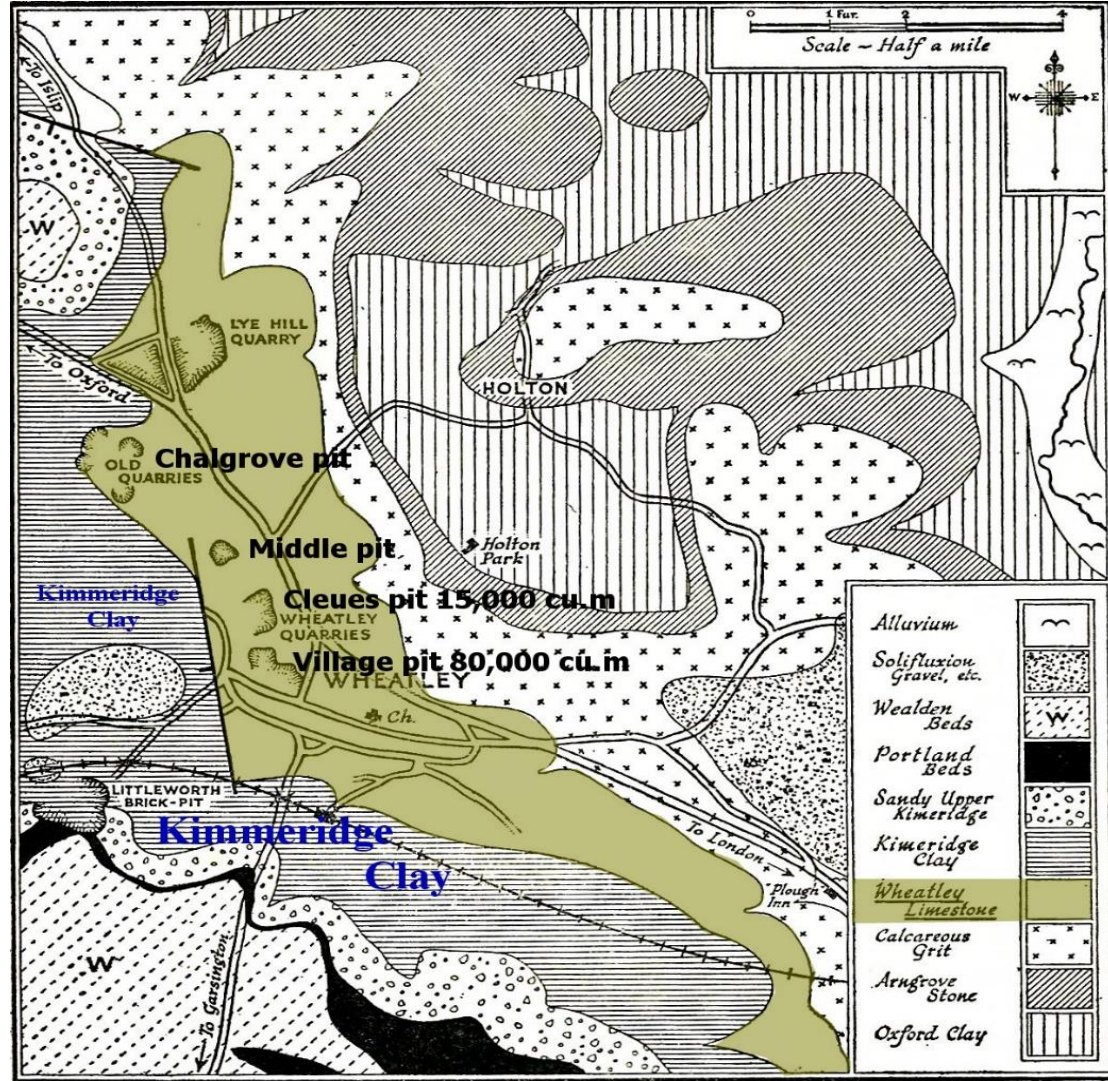
Howe Close location shown relative to old clay pits

Littleworth pit in pink,
Howe Close pit in light blue
Howe Close was not built in the
location of Howe barn (from 1937
map).

As the 1989 geological map shows
it was built on the site of an earlier
clay pit excavation due east of the
disused Littleworth clay pit.

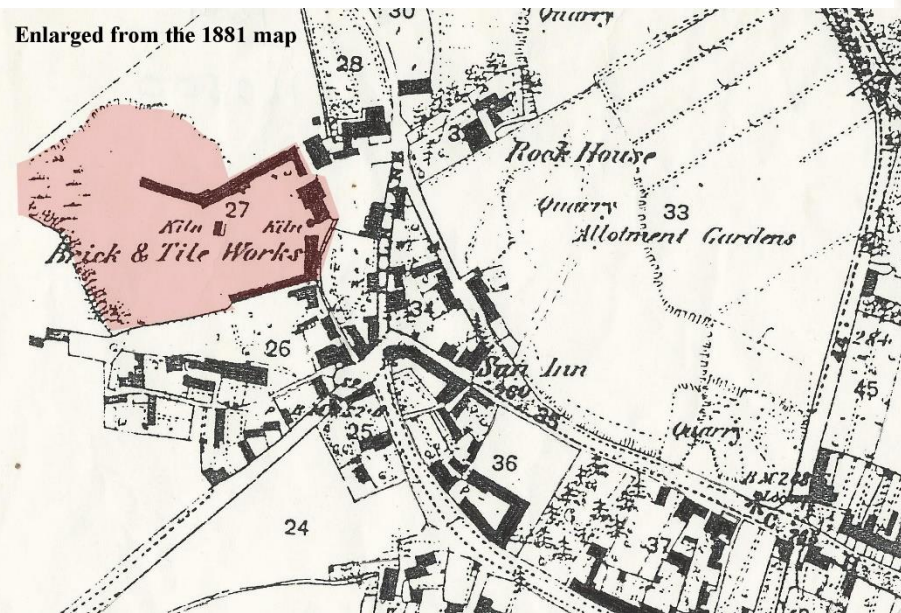
This map shows that the Kimmeridge Clay is mostly found south of the old railway line as the previous slides show.

In 1989, a borehole was drilled adjacent to No 19 Howe Close (slightly to the right of this picture) which showed that the Wheatley limestone was 12 metres down below the Kimmeridge Clay.



Brick & tile works before 1900

Showing how close the Clay seam was to the limestone deposits



First reference to a brickworks was in 1742

'Old House', Westfield Road

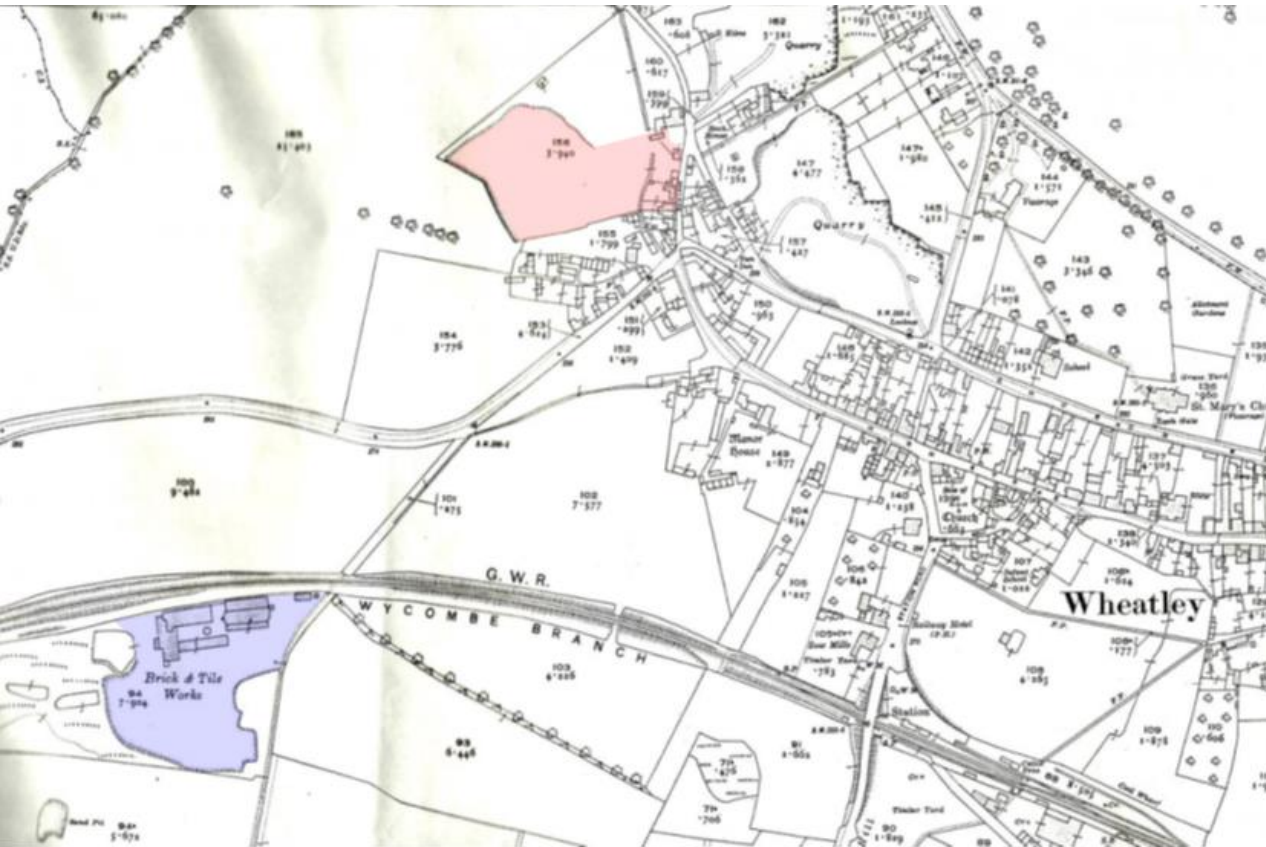


Experimented with adding lime

But this causes them to 'blow' as they weather

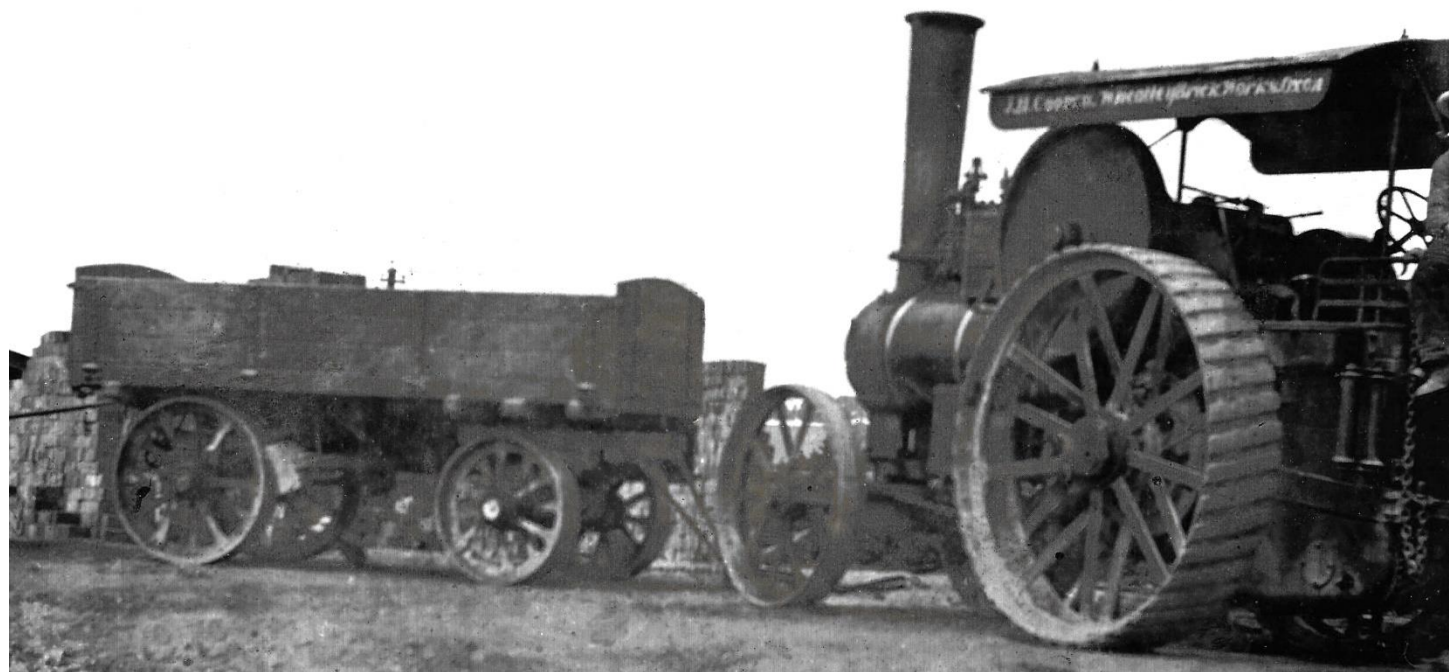


Brick & tile works from mid 1890s



RED is the original brickworks based on the Old House in Westfield Road

BLUE is the later brickworks in Littleworth



Clay diggers in the 1930s



**Undated, but there was a workforce of
some 30**



Lautrec, 1a Kiln Lane

The house was built in 1902 or 1903, and it is believed that it was built with bricks from the Littleworth brickworks.



Lautrec, 1a Kiln Lane

The house was built in 1902 or 1903, and it is believed that it was built with bricks from the Littleworth brickworks.

The bricks on Lautrec have finger imprints on them.



Lautrec, 1a Kiln Lane

The house was built in 1902 or 1903, and it is believed that it was built with bricks from the Littleworth brickworks.

The bricks on Lautrec has finger imprints on them.

The house was named after Toulouse Lautrec, because it once had two loos!



The presence of a brickworks led to re-facading of stone frontages by brick in the mid 1800s when it was fashionable

64 High Street re-facaded in 1860s

4 High Street re-facaded in 1847



Lynton House, 83 High Street



An internal wall is dated 1756, so it is likely that this was re-facaded in the mid 1800s. The cellar is some 1.4 metres below the current road level. This suggests that the bedrock (typically found on the north side of the High Street) is at a significantly lower level than it is towards the east end of the High Street, where the houses are all raised up as the steps show



There were many later brick buildings in Wheatley

Photo of pair of semis erected by Thomas Munt in 1935/6, now numbers 75/77 High Street.

Whether these and other early 20th century houses used the local brickworks is not known.

But the brickworks, latterly bought by the London Brick Company, closed in 1939



In conclusion...

Wheatley has a rich industrial history based on its geology and helped by the fault which brought stone and clay to the surface at the same level either side of the fault line down the middle of Kiln Lane.