

Geology a Suffolk Perspective

Some history, and locally what is to be found under
our feet

A Celebration of Suffolk Geology — Ed Roger Dixon —from preface

Not so long ago — a well know geologist said ‘ **there is no geology in Suffolk**’

I trust this book celebrating the geology and geomorphology of Suffolk has dismissed the idea that post Cretaceous geology as merely as ‘**gardening**’

Current attention on early human occupation of Suffolk and earth Science — is now very much in the news --- with post and current climate/sea level/coastal processes to the fore. (2012)

Post Cretaceous period — 66m years ago to date !

Geology –working definition

- Geology is the study of the Earth's origin, structure, composition and history.
- It includes the development of life.
- The nature of the processes which have given rise to the Earth as we know it today.
- In geology, rock is a naturally occurring mixture of minerals...

Geology - The three big ideas

In geology there are **three big ideas** that are fundamental to the way we think about how Earth works. These ideas are maybe like the sound track to a film - we might not even notice them, but at the same time they affect our perception of what is happening.

1. **Geological Time,**
2. **Uniformitarianism,**
3. **Plate Tectonics**

Geological (Deep) Time,

- **Ka:** "kilo annum," one-thousand years. Kya = thousand years ago.
- Last ice age ended 12Ka

- **Ma:** "mega annum," one-million years. Mya = million years ago.
- Earth age 4570 Ma

- **Ga:** "giga annum," one-billion years. Bya = billion years ago.
- Earth age 4,57 Ga

The annual geological clock 1

Formation of oceans and continents 4.5 – 4 .4 Ga	first week of January
Evolution of the first primitive life forms 3.8 Ga	end of February
Formation of oldest rocks 3.4 Ga	end of March
Evolution of the first multi-celled animals 600Ma	beginning of November
Animals first crawled onto land 360 Ma	end of November
Rocky Mountains were formed 90 Ma	December 16
Extinction of the dinosaurs 65 Ma	December 18

The annual geological clock 2

The last of the glacial ice retreats in UK 12Ka – 50 seconds to midnight 31st December — Suffolk is covered with dumped glacial deposits.

1780 AD – Start industrial revolution and first ever Epsom Derby, Ka .243

Or just 2 seconds before midnight, 31st December

Big idea 2 — Uniformitarianism

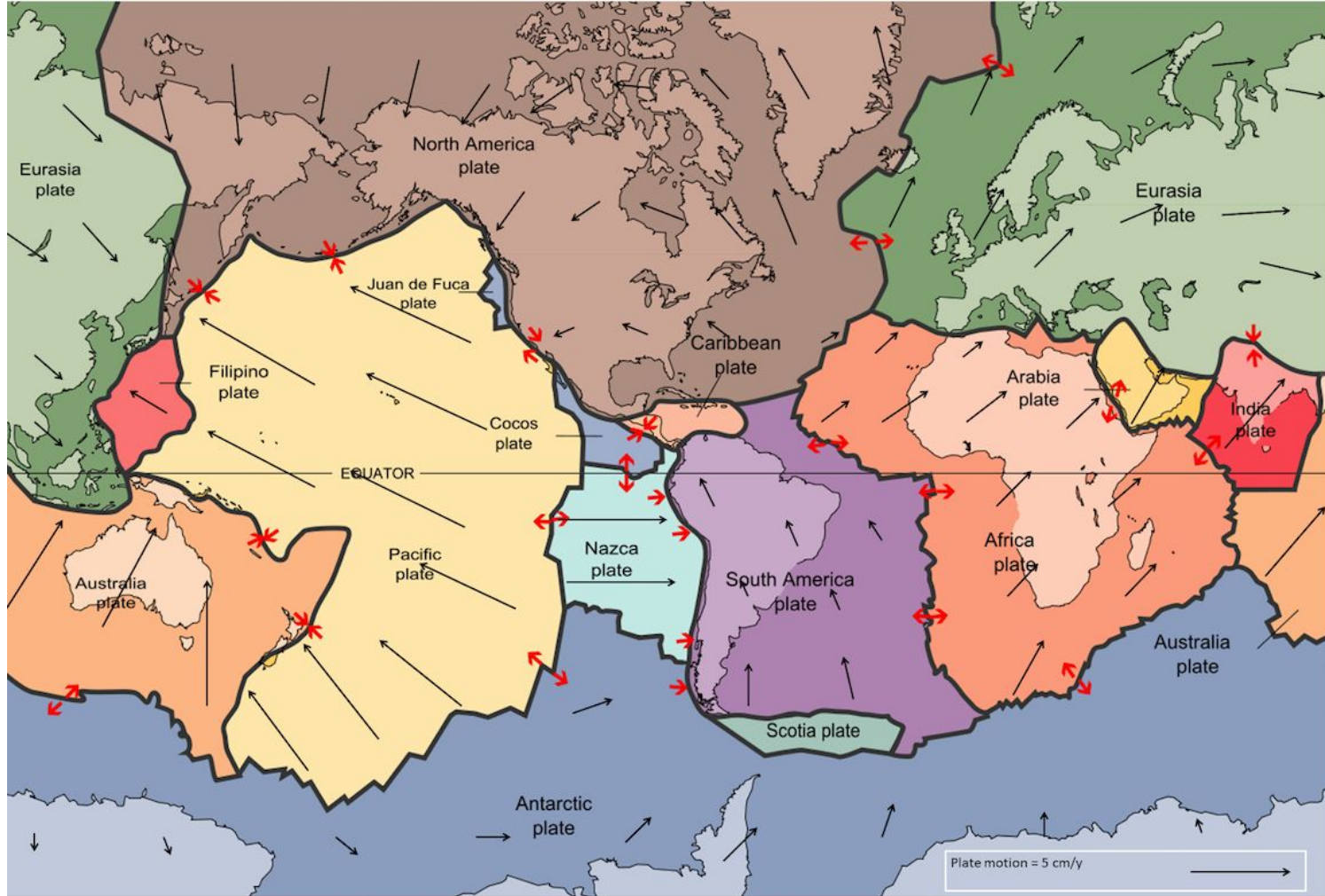
The idea that Earth has always changed in uniform ways,

— and that the present is the key to the past.

The principle of uniformitarianism is essential to understanding Earth's history.

Plate Tectonics

- A scientific theory that explains how major landforms are created as a result of Earth's subterranean movements.
- The theory, which solidified in the 1960s, transformed the earth sciences by explaining many phenomena, including mountain building events, volcanoes, and earthquakes.
- The Earth's surface is cracked into large pieces called tectonic plates. Tectonic plates slowly move, creating mountains, islands and even re-arranging continents. We can track the history of the plate movements by analyzing fossils and rock layers.



James Hutton

James Hutton FRSE was a Scottish geologist, agriculturalist, chemical manufacturer, naturalist and physician. **Often referred to as the "Father of Modern Geology,"** he played a key role in establishing geology as a modern science.

Born: 3 June 1726, [Edinburgh](#)

Died: 26 March 1797, [Edinburgh](#)

Hutton showed that Earth had a long history that could be interpreted in terms of processes observed in the present. He showed, for instance, how soils were formed by the weathering of rocks and how layers of sediment accumulated on Earth's surface.

JAMES HUTTON – THE FATHER OF GEOLOGY



- ✗ 18th Century Scottish Geologist, questioned belief that the Earth was several thousand years old.
- ✗ Believed in Uniformitarianism – natural processes that operate today must be the same everywhere else and in the past.
- ✗ “The present is the key to the past”.
- ✗ Geologic change is slow, so the Earth must be very old.

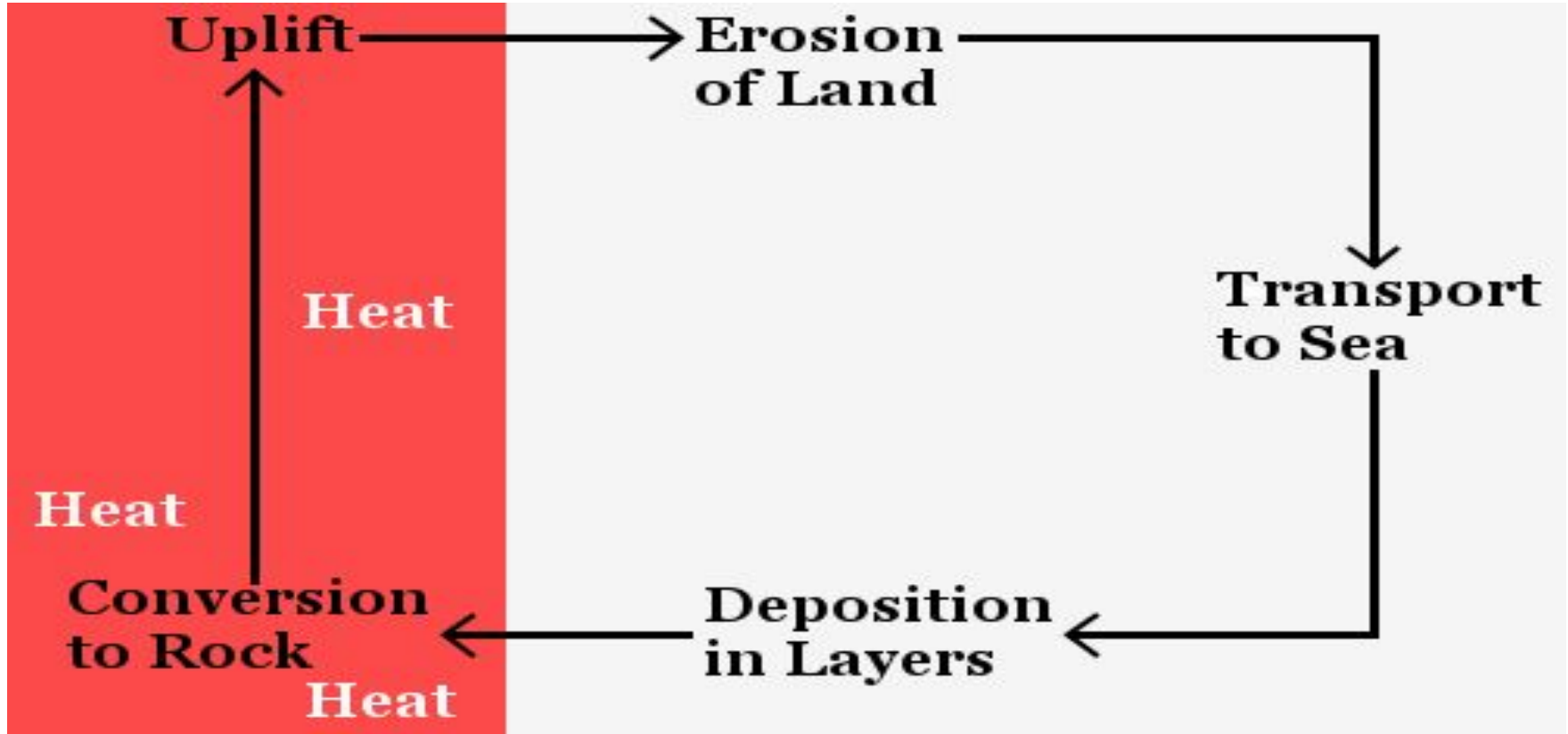
- **James Hutton - Scottish geologist**
- **Described the geological forces that have changed life on Earth over millions of years (erosion, earthquakes, volcanoes, mountain building)**
 - **Changes in Earth's crust due to slow continuous processes**
 - **Idea known as Gradualism**
 - **These changes caused certain species of life to become extinct.**



Hutton concluded that:

- Earth's interior has a very high temperature.
- Earth's heat provides the energy to create new rocks.
- Erosion of land by water and air creates materials such as silt, soil, and small rock particles which are carried into the sea, where layers of these materials are deposited over long time scales.
- As the layers gather, the earliest layers become buried ever more deeply in the earth, where they are turned into stone by the earth's heat.
- Stone is eventually uplifted to form new land.
- The new land is eroded over a long period of time, beginning the cycle again.

Hutton's Rock Cycle— basically correct

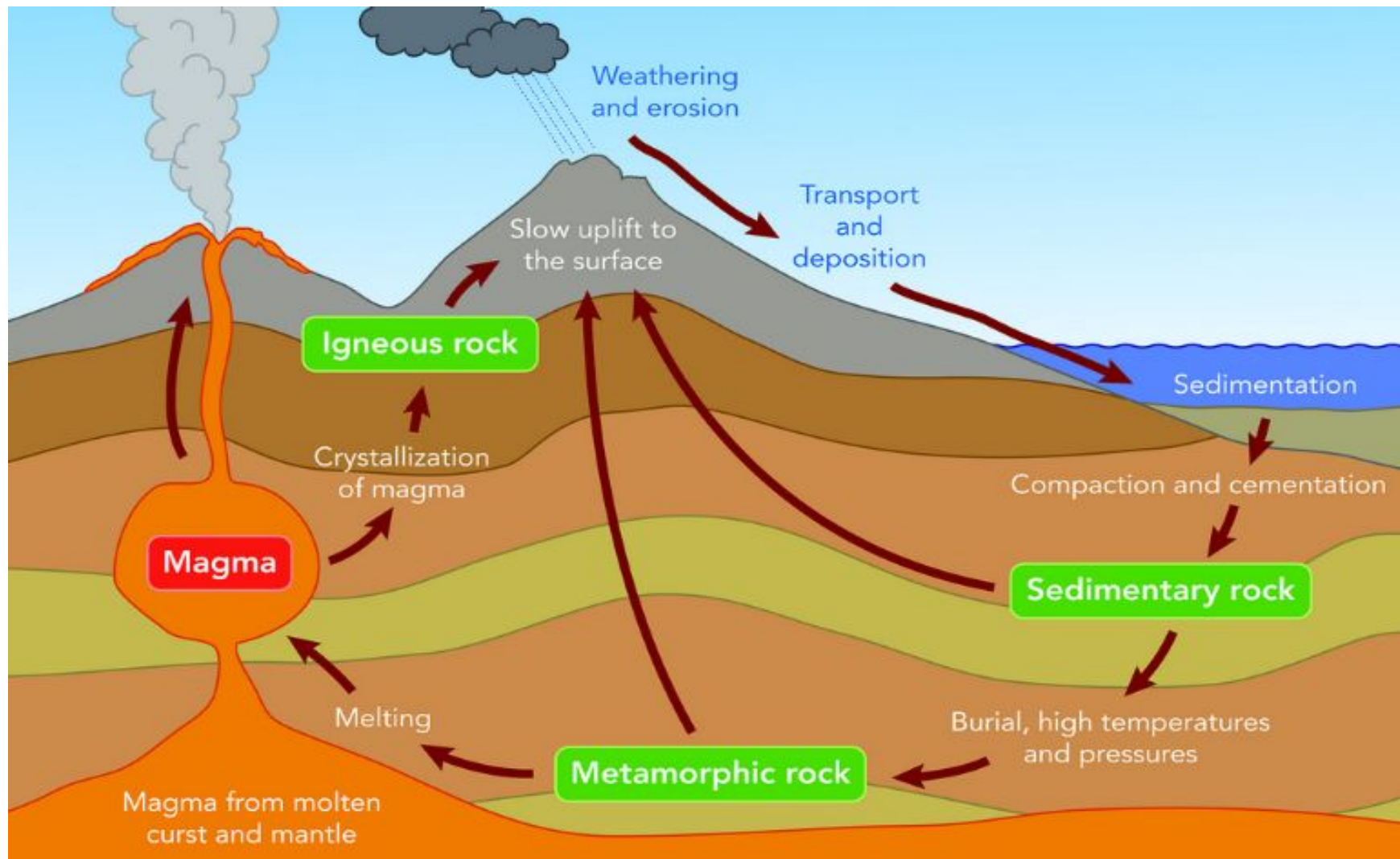


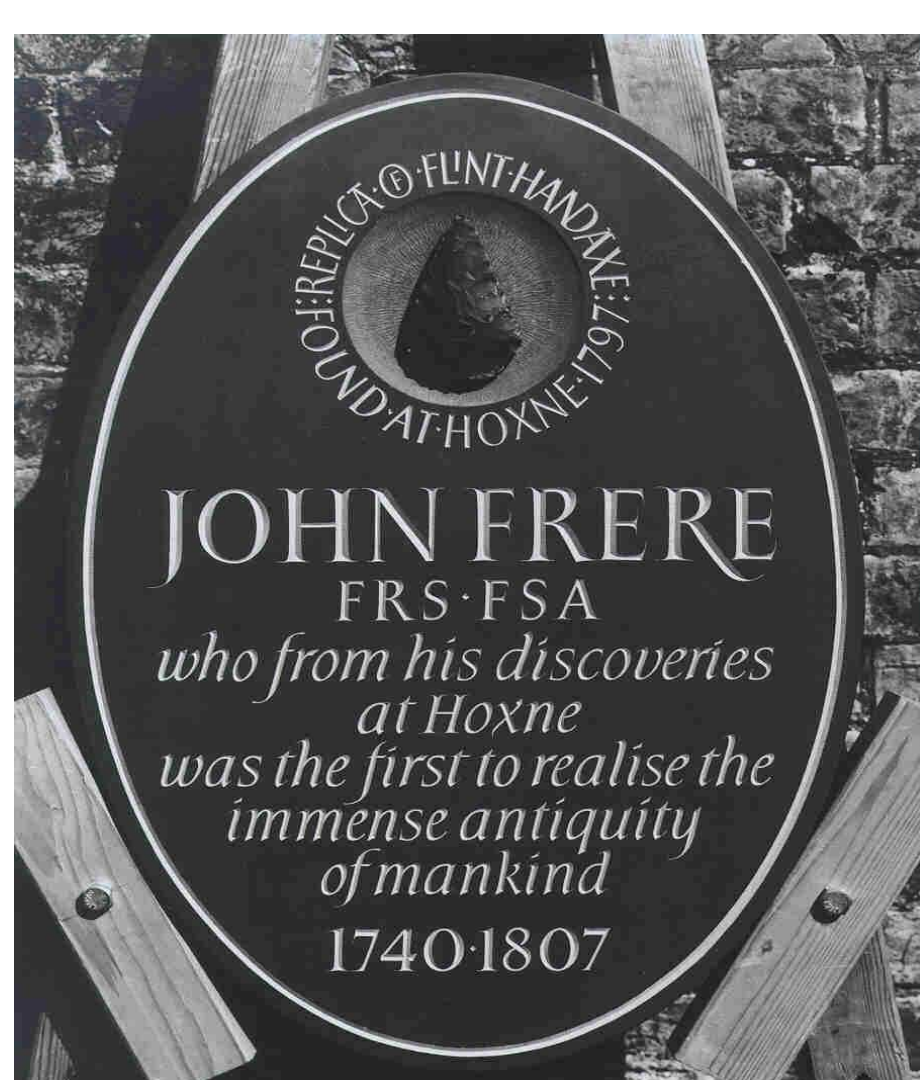
The cycle Hutton envisaged:

could only take place over an immense number of years.

This was, he pointed out, because:

— the **processes of erosion, sedimentation, and uplift take place exceedingly slowly.**





John Frere(1740-1807)

Frere was a country squire and, from 1771, an active member of the Royal Society of Antiquaries.

In 1790 he discovered Stone Age flint implements among some fossilized bones of extinct animals at Hoxne, Suffolk near Diss

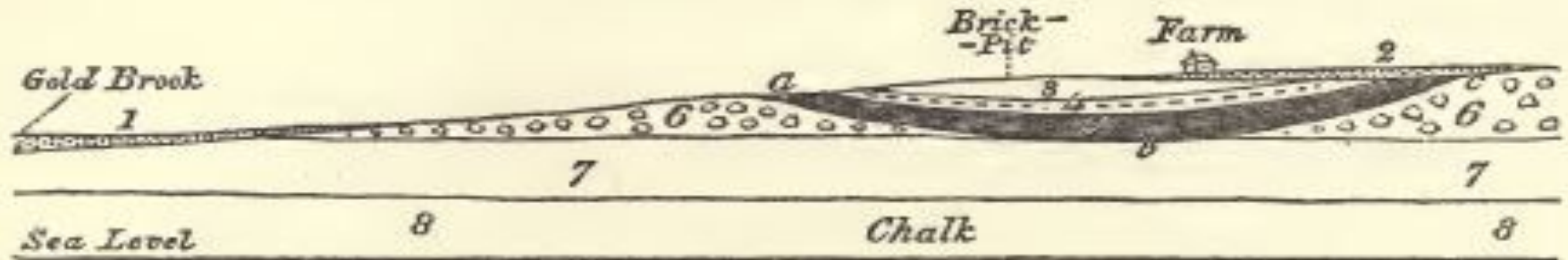
Anticipating later archaeological methods, Frere carefully noted and **described the strata uncovered.**

The then-popular belief was that the Earth had been created in 4004 BC,

So in reporting his findings (1797) Frere nevertheless suggested that the remains may have dated from a time **considerably earlier than 4004 BC.**

His report was politely received but had to wait some 60 years to be appreciated.

Frere — Strata at Hoxne Brick pits — c1860



Section showing the position of the flint weapons at Hoxne, near Diss, Suffolk.
See Prestwich, Philosophical Transactions, Pl. 11. 1860.

- 1 Gravel of Gold Brook, a tributary of the Waveny.
- 2 Higher-level gravel overlying the freshwater deposit.
- 3 and 4. Sand and gravel, with freshwater shells, and flint implements, and bones of mammalia.
- 5 Peaty and clayey beds, with same fossils.
- 6 Boulder clay or glacial drift.
- 7 Sand and gravel below boulder clay.
- 8 Chalk with flints.

So what is the basic underlying geology of Suffolk?

The geology of Suffolk largely consists of a rolling chalk plain –200-300 M thick
(100- 66m years old)

— overlain in the east by Neogene (London) clays(**20-30m years old**)

— isolated areas of Palaeocene sands (**60m years ago**).

A variety of superficial deposits originating in the last couple of million years overlie this 'solid geology'.

What we dig in **our** gardens is mostly **recently deposited** glacial till –swept south by glaciers, — a few meters thick – sometimes washes away to form gravel beds 21

London Clay — not the local glacial TILL clay

- Under our till clay —brown and grey muds and silty muds deposited in a shallow sea during the Eocene Period about 53 million years ago over much of Essex and Suffolk.
- Large rivers carried the sediment out to sea, up to 100m deep, where it settled and compacted on the seafloor. England had a warm subtropical climate, with luxuriant rainforest and mangrove types of vegetation on land.
- These rivers also swept plant debris, logs and branches, seeds and fruits out to sea. Much is preserved now as pyritised (turned to stone /minerals) fossil wood and can be found on Bawdsey, Ramsholt, Harkstead and Nacton beaches
- Sea fossils are to be found in these deposits – sharks teeth /turtles /small birds
- Also find layers of pale hard calcareous mudstones, called “centuria”

So no real hard stone or rocks to be seen in Suffolk?

Well there are a few quirks and surprises

And flint ?



In England, flint was laid down in White Chalk during the Cretaceous

period 85,000,000 to 65,000,000 years ago.

Decomposition of dead siliceous organisms formed layers of flint nodules within the chalk

In the chalk AND in the glacial till



Septaria

- Septaria : Calcareous mudstone concretions from the Eocene London Clay
- Outcrop on the foreshore from Bawdsey southwards along the coast.
- Once used for the manufacture of cement.
- Widely used in Suffolk's Norman churches, most often in conjunction with Caen stone.



The unprotected septaria stonework showing signs of fragmentation. © PAYE Conservation



Coprolites– John Stevens Henslow

Recognised that coprolites, which are the fossilised excrement of animals long extinct,

Dinosaur Poo ! Well some are.

Found in a cliff in Felixstowe while on holiday in 1843 – under the beach huts near Spa Pavilion

Analysed – Contained a high percentage of phosphate of lime, which he believed would provide a highly concentrated fertiliser, (became Fisons)

A Cambridge contemporary of and tutor to and influence on Charles Darwin– importance of minutiae.

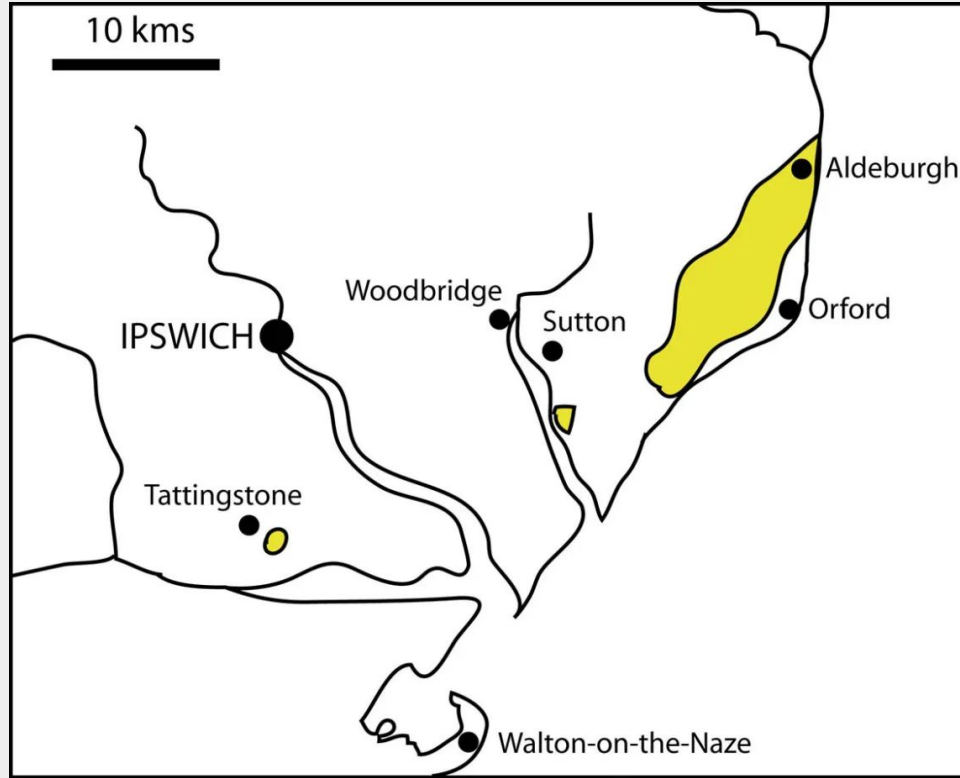


Coralline Crag Only in Suffolk



Coralline Crag

This is found only in southeast Suffolk, in the Orford and Aldeburgh areas and at Sutton. Once the basis of local industries. It has been quarried as a building stone, particularly in the 14th century. It has also been used for farming purposes - as late as the 1920s a quarry (now infilled) at Iken was being worked. The rock was crushed and used for tracks across marshy ground and for lime



Stone for — Building Materials

- Septaria are widely used in Suffolk's Norman churches, most often in conjunction with Caen (Normandy) limestone.
- They outcrop from Bawdsey southwards along the coast and up the Deben and Orwell estuaries on the foreshore and in cliffs. Also obtained offshore by dredging. At Dunwich the stylish Norman/Early English architecture of the Leper Chapel ruin can be seen, with finely carved Caen stone windows and arches and contrasting darker brown septaria.
- Orford Castle owes its imposing dominance to dark septaria. — not any more!!!! Septaria fracture and weather easily, sometimes leading to collapse, as the churches of Orford and Alderton testify

Building materials 2

- Septaria were once used for making 'Roman' cement. Developed in the 1780s, it was made obsolete by C19th Portland Cement.
- Bricks did not become much used until the reigns of Henry VIII and Elizabeth I, when they became most fashionable – for example in Seckford Hall, built in the 1540s, and the Tudor towers of Waldringfield and Hemley churches.
- Later, as their use became more widespread, many local clay and brick pits were developed in the London Clay.

Leper Chapel Dunwich

- Limestone from Caen –Normandy –window and arches
- Septaria (brown) Suffolk plus local Mudstone concretions from local London Clay

A real shortage of quality stone /rock locally for building – why in pre railway era most domestic /agricultural buildings were timber framed and some infilled with brick from 16c

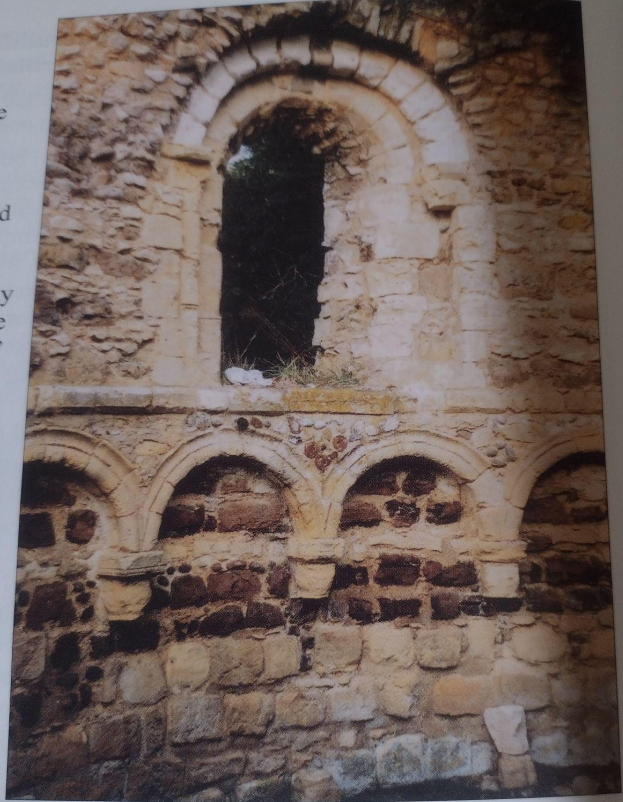
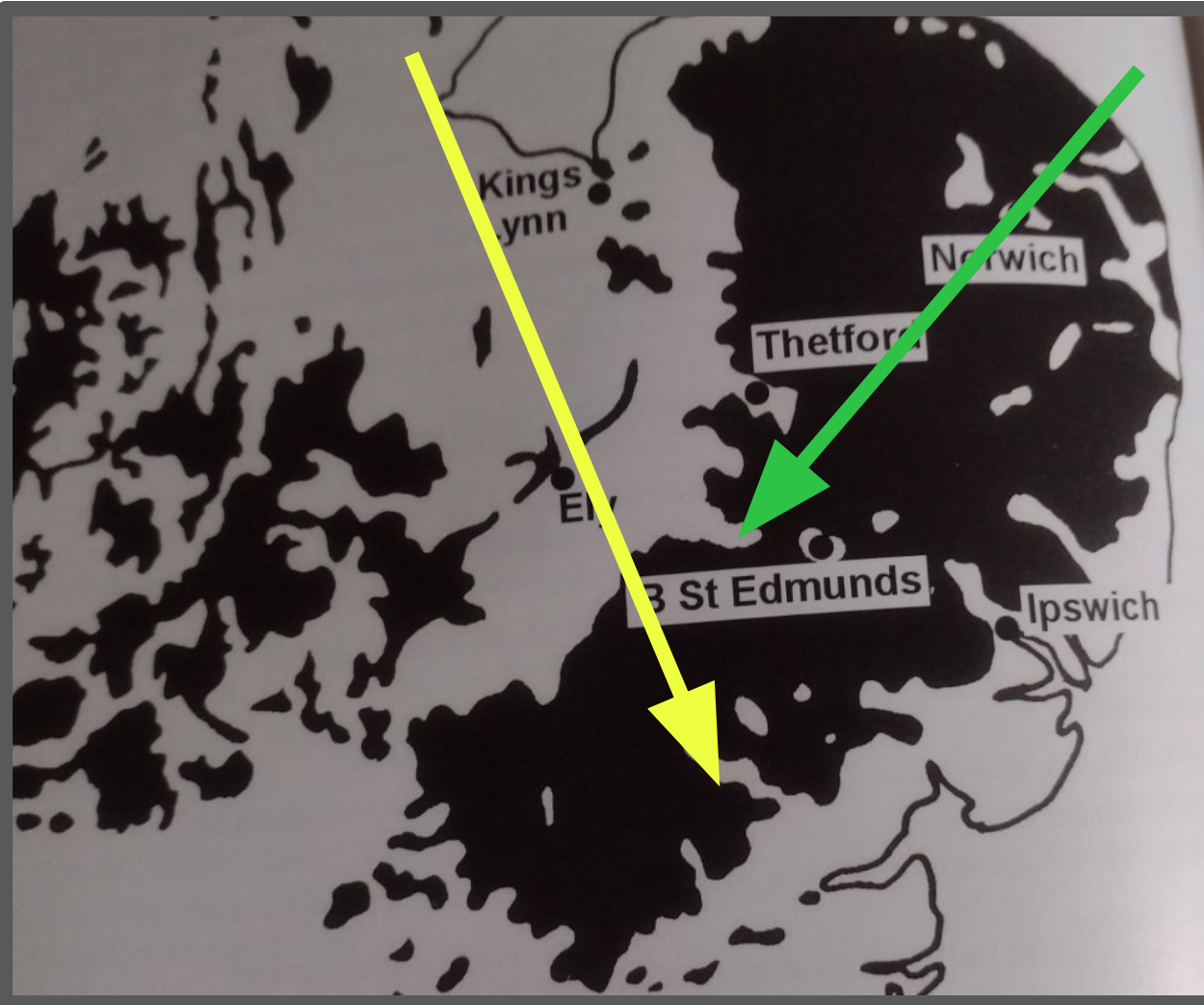


Figure 2. The stylish Norman/Early English architecture of the Leper Chapel ruin at Dunwich, with finely carved Caen limestone windows and arches and contrasting darker brown local septaria, mudstone concretions from the London Clay.

Till — Geological Definition

- Till, — unsorted material deposited directly by glacial ice and showing no stratification.
- Till is sometimes called boulder clay because it is composed of clay, boulders of intermediate sizes, or a mixture of these.





Till cover – East Anglia

Deposits overlay chalk and older alluvial clay

Ice ages –dumping from both Scandinavia and separately the north /north west directions

Ice dumps are scraped debris as it moves within body of the glacier –and separately in terminal moraines when it melts and retreats

Pakefield



Modern visitors walk by 700 000 year old dark-coloured muds containing flint flakes made by earlier humans. Glacial boulder clay at the top of the cliff shows that a major Ice Age separated the two sets of humans.

Dunwich Cliffs



A landslip exposes a fresh face of Norwich Crag sand and gravel ('Westleton Beds'). The pebbles from erosion of this gravel in the cliffs supply much of the shingle for Orford Ness and other beaches to the south.

Thorpeness or Thorpenesse or Thorpe Ness



This shows glacial deposits on Norwich Crag sand. Good exposures in the cliff such as this tend to degrade very quickly -

Thorpeness - the beach to the north of the cliffs shown above forms one of the Suffolk 'nesses'.

Suffolk Nesses

THORPE NESS – is one of the Suffolk nesses

– large curved beaches extending above high water which protrude from the coast at intervals.

Others include Orfordness, Kessingland Ness, Lowestoft Ness and Winterton Ness (in Norfolk).



latter triple with two interstadials.

East Anglia, particularly Norfolk and Suffolk, is a very important region for students of glacial phenomena and the deposits left by the later glaciations. Here earlier landscapes have been destroyed by the succession of ice sheets a hundred or more feet thick which in their passing sometimes overturned earlier strata as by a giant plough. A fact which seems seldom to have been recognised is that each new glaciation largely destroyed earlier formations, in particular the deposits of the preceding temperate to warm interglacials with relics of the mammalia of the age and their prehistoric hunters. The indestructible artifacts of flint are however found, sometimes in large numbers, in river gravels of a later era having been redeposited by flood water and mixed with fossils, etc., of the later period. Sandy or silty beds within the tills possibly indicate a temporary recession and readvance of the ice. Examples of this type of phenomena have been recorded from Peyton Hall Pit, Hadleigh, and from the quarry of Needham Chalks Ltd., Needham Market.

Evidence of the tremendous power of moving ice sheets over land may be seen in Runton Cliff, near Cromer where a mass of chalk 600 yards long and about fifty feet thick has been pushed up over the Weybourne Crag. Near Ely a mass of Gault, Greensand,

That is it

Thanks for source materials include

A Celebration of Suffolk Geology 2012 - ed Roger Dixon –a u3a member

Geo Suffolk //Ipswich museum

And not least Wikipedia – and my camera phone.