Geology & the Past, Present and Future of the Naze

The Naze cliffs and beach are an important geological Site of Special Scientific Interest (SSSI).

Legally protected to conserve its special features and maintain its scientific value.

Naze SSSI is most valuable as an accessible site for study and research – including that relevant to global climate change.

Everything that we know about the Earth's past has been learnt by studying geological sites.

Clearance work and geological research February 2017

The rock sequence in the cliff by the Naze Tower

Thin soil – present-day, living, re-cycling layer.
Loess – glacial cyclonic dust-storm silt 20,000y old.

Thames-Medway riverbed sands and gravels 0.5my old
and
Clay layers ?Medway estuary.

—— time gap c.2my

Red Crag: iron-stained tidal sands and shell beds c.2.6my.

—— time gap c.52my

London Clay – tropical seabed mud 55m years ago;
SSSI for bird and plant fossils.

The London Clay

Walton

Rivers, mangroves and sea
55 million years ago

Fossil birds of the London Clay

Reconstruction of *Zygodactylus grivensis*, an Eocene passerine.
© Jack Wood

Bones of an *Eopasser*.

Life reconstruction of *Septencoracias morsensis* a roller-type bird, Lower Eocene Mo-Clay, Denmark.
Bourdon et al. (2016)

Bird bones, including the skull, of a roller-type bird.

Breast bone of an ibis-type bird.

Fossil bones of a *Phorusphacid* 'terror-bird'.

Reconstruction of a 2-metre-tall *Phorusphacid* 'terror-bird'.
Wikimedia Commons Nobu Tamura

London Clay 55 million years old in the Naze cliff and foreshore

Red Crag sea and river estuary 2.5m years ago


Red Crag sand and fossils
Two and a half million years old

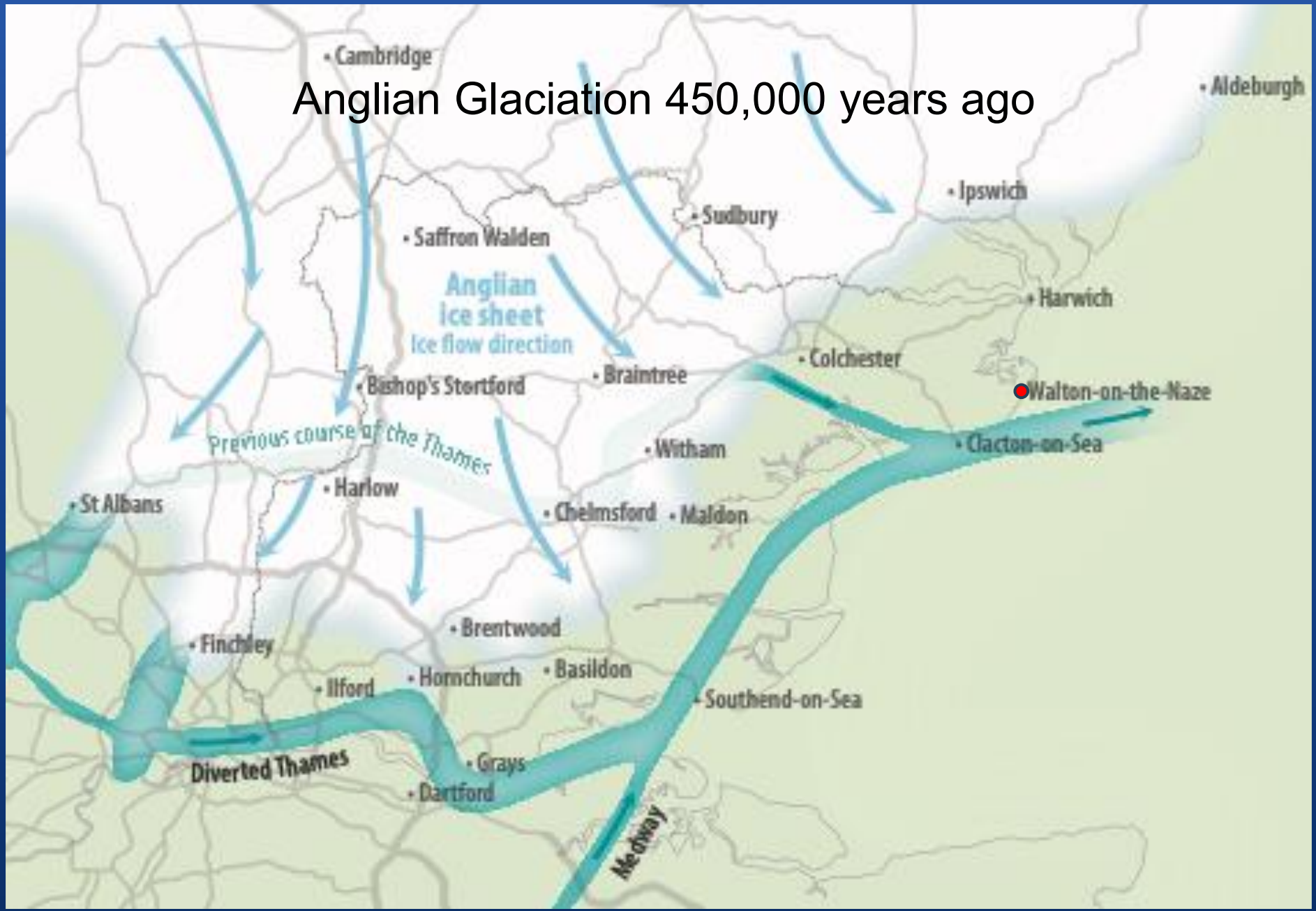
Essex rivers half a million years ago

Thames-Medway river gravel in the Naze cliff.

Ice-fed river in flood, with braided channels and gravel.

Braided river on the Naze beach!

Anglian Glaciation 450,000 years ago



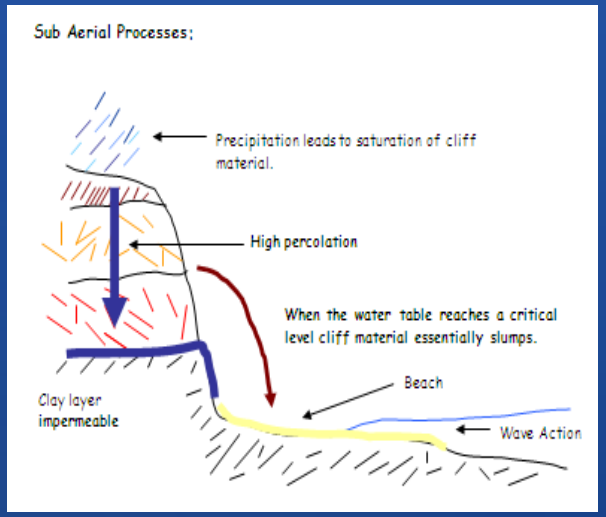
Edgeland Essex – geology now, and changing…

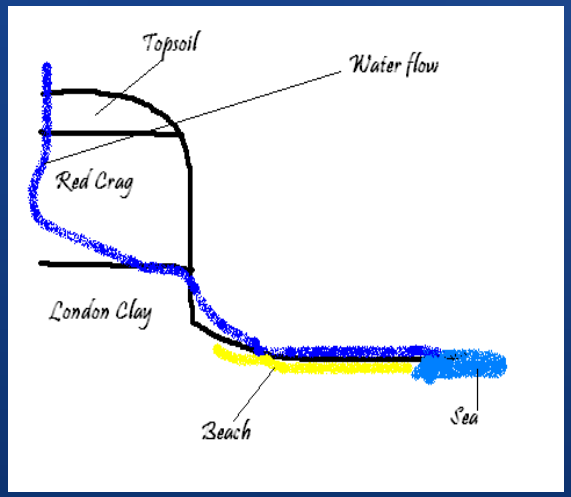
and the land slips into the sea...

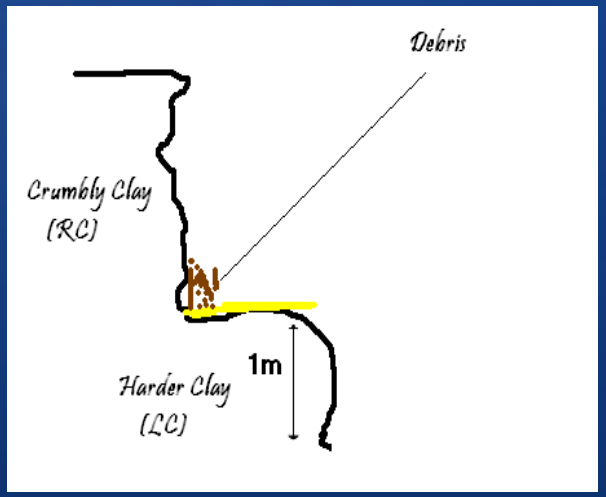
So how are the Naze cliffs going?

The Naze is an important study area.

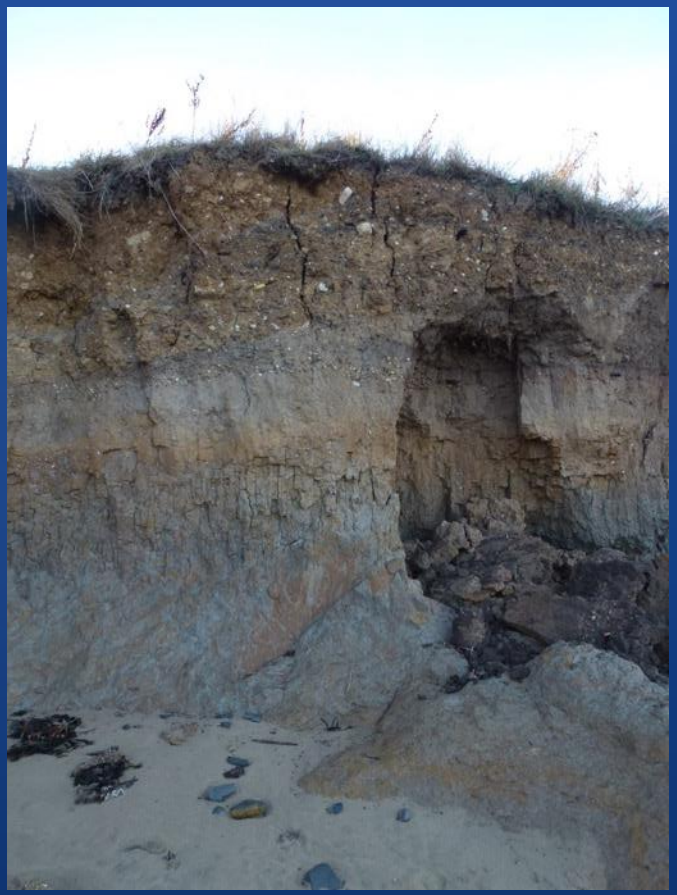
Diagrams from School projects for GCSE to explain coastal erosion at Walton-on-the-Naze







To the north, where the cliffs are low, falls are caused by direct wave action.



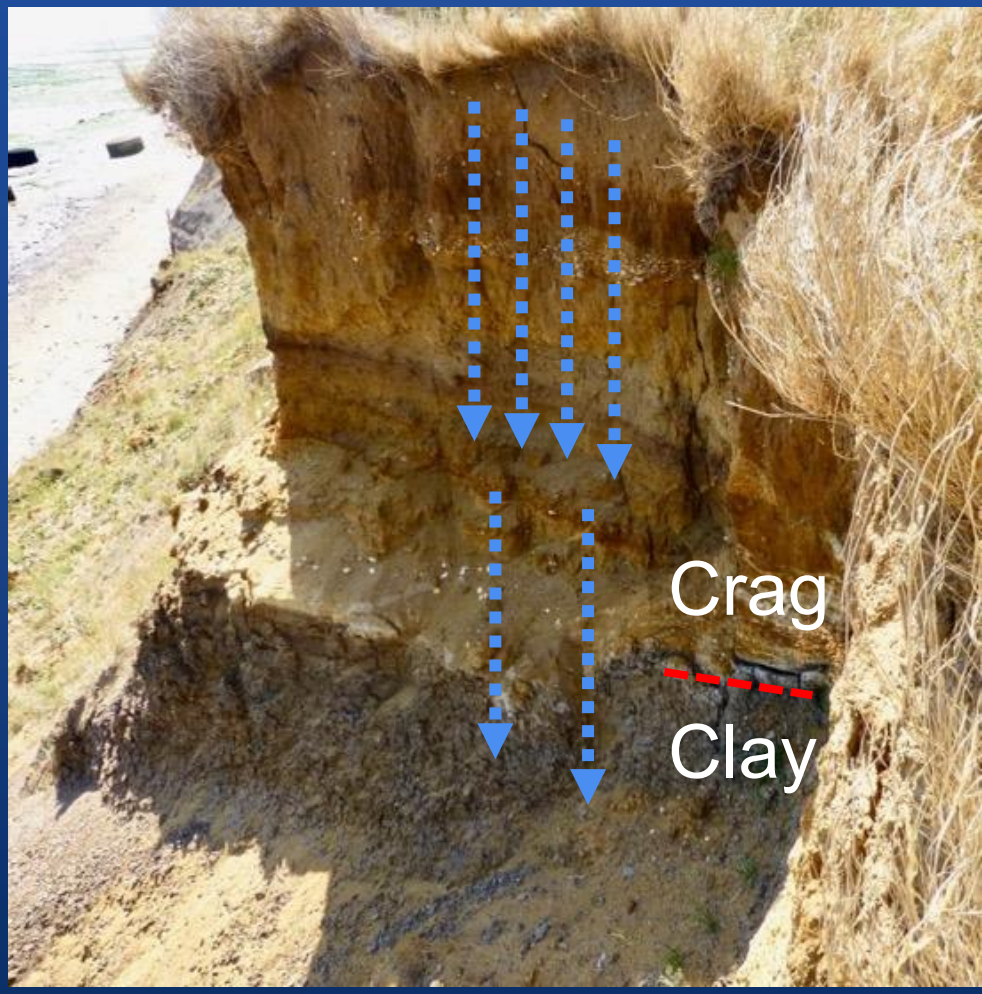
Vertical joint failure in the thick loess above the London Clay leads to collapse.

Rotational slips occur where the cliffs are too high for direct wave action.

The cliff falls are due to instability *throughout the London Clay*.

The Red Crag – London Clay junction

Water filters through the permeable Thames Gravels and Red Crag and continues down into countless micro-fractures in the clay.
Water molecules are absorbed into the clay minerals.
The clay becomes saturated and expands.




Fifty-five million years ago, the London Clay was
building up as layers of mud on the seabed.
At this time, volcanoes to the west were pouring out
huge amounts of ash which covered Europe.
These pale bands in the Naze cliffs are ash-rich layers.

The volcanic ash altered to a clay mineral called *smectite*.
This has the property of swelling when it absorbs water.
Water can get into fissures in dry clay, where it quickly diffuses into all of the clay.
The smectite in the London Clay causes the clay to expand when it becomes wet.


Dry London Clay

As the clay expands it lifts the land, causing 'heave' cracks in buildings.


'Heave' damage in a Colchester house.

In the cliffs, the clay expands outwards from the cliff face.

The clay swells and becomes mobile.

Movements of up to 200mm per day have been measured during periods of heavy rainfall.

The clay flows slowly like thick lava onto the beach where its toe is removed by high spring tides.


Clay removal line
– high spring tides

Diapirs in the London Clay

With the addition of water, the clay becomes swollen and less dense than the surrounding rock. In places, it then moves up as *diapirs*, often along a previous zone of weakness.

Drying clay shrinks

When the clay dries out, it shrinks adding to internal stress.

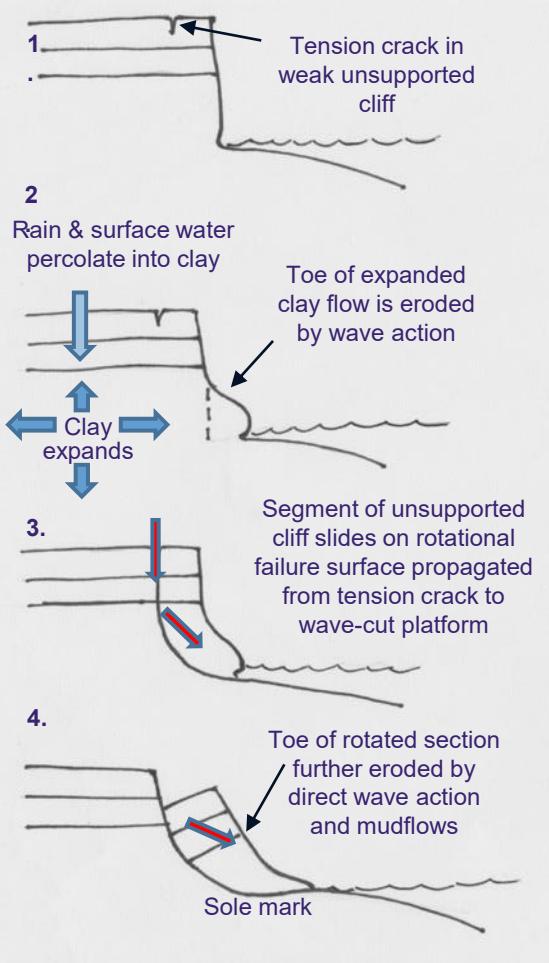
It crumbles easily to create rock falls.

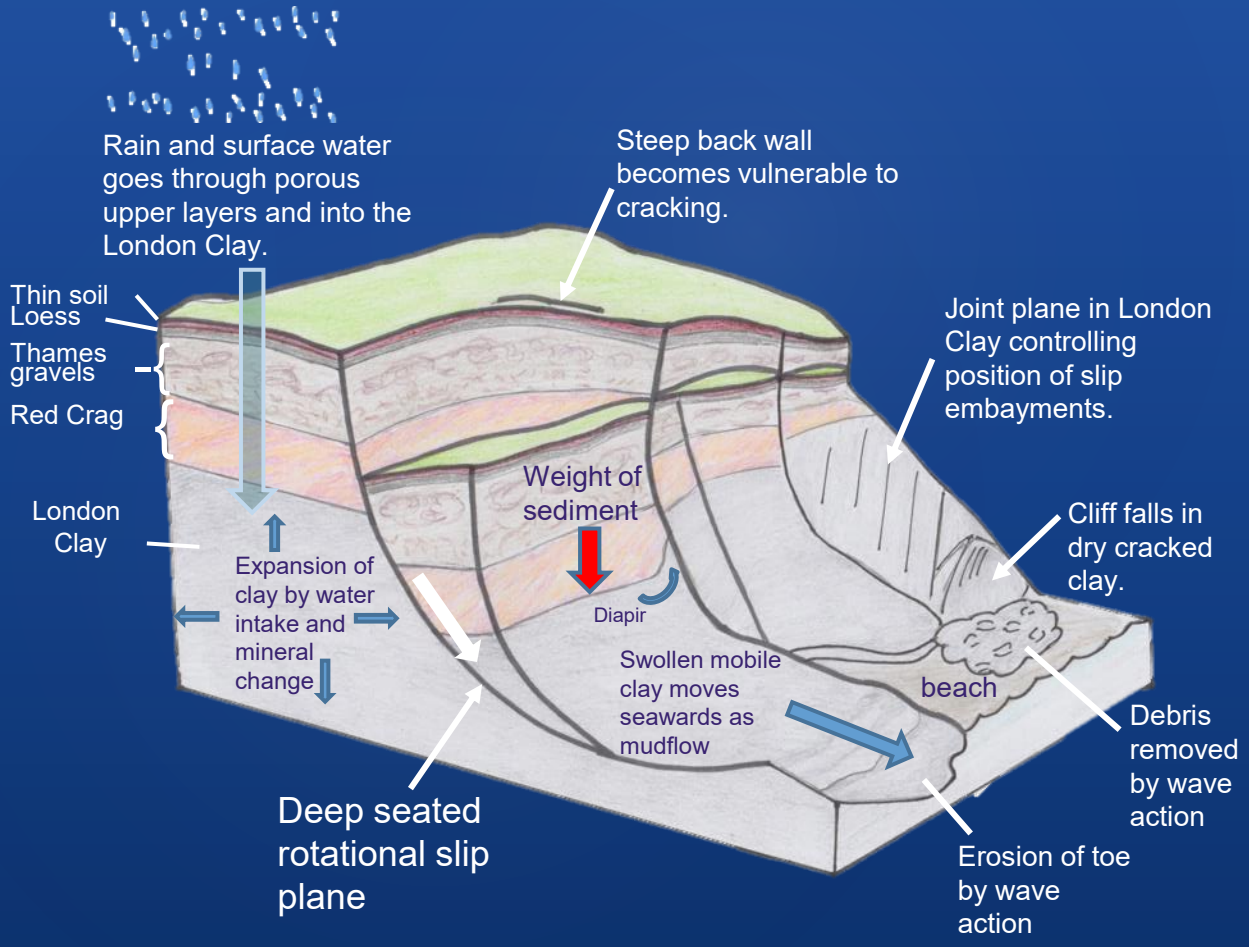
Prominent joint planes

Many planar shear surfaces at high angles further destabilize the cliffs and may control the position of rotational slips.

Previous rotational slip structures in London Clay are visible at low tide as sole marks on the wave-cut platform.

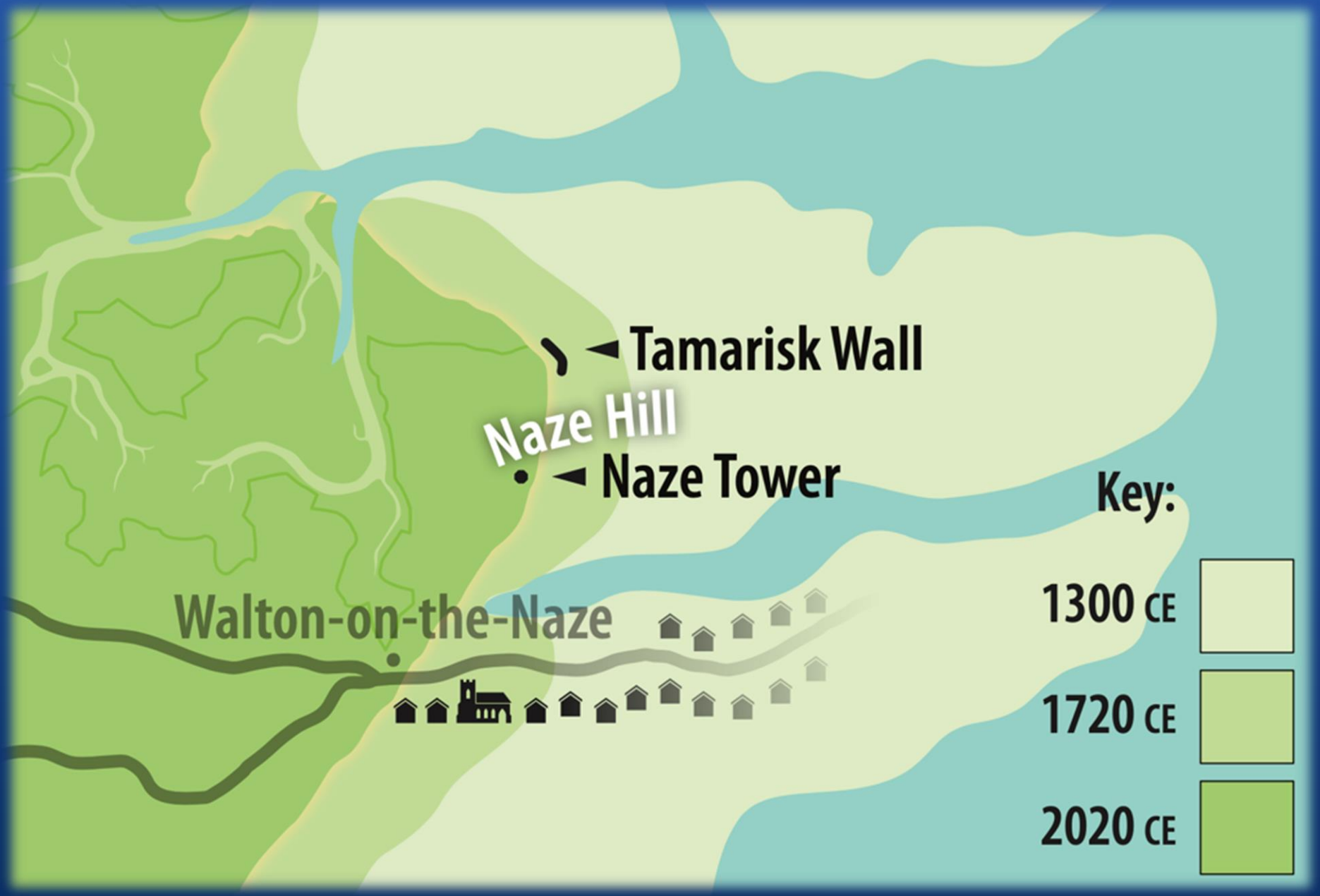
How the cliffs are going?
– *ideas that fit the evidence*





compiled by R M Mercer 2018

As clay is removed by wave action, the cliffs above lose their support and fail by rotational slip.


Tamarisk Wall
Naze Hill
Naze Tower
Walton-on-the-Naze
Key:
1300 CE
1720 CE
2020 CE

Naze Hill
...so far

Information on the Naze, its past and future, is contained within the book **“Essex Rock – geology beneath the landscape”**

available at the Naze Centre.

In both the Tower and the

EWT Centre

there are three useful charts of
Rocks, Fossils and Pebbles

plus displays of Naze finds

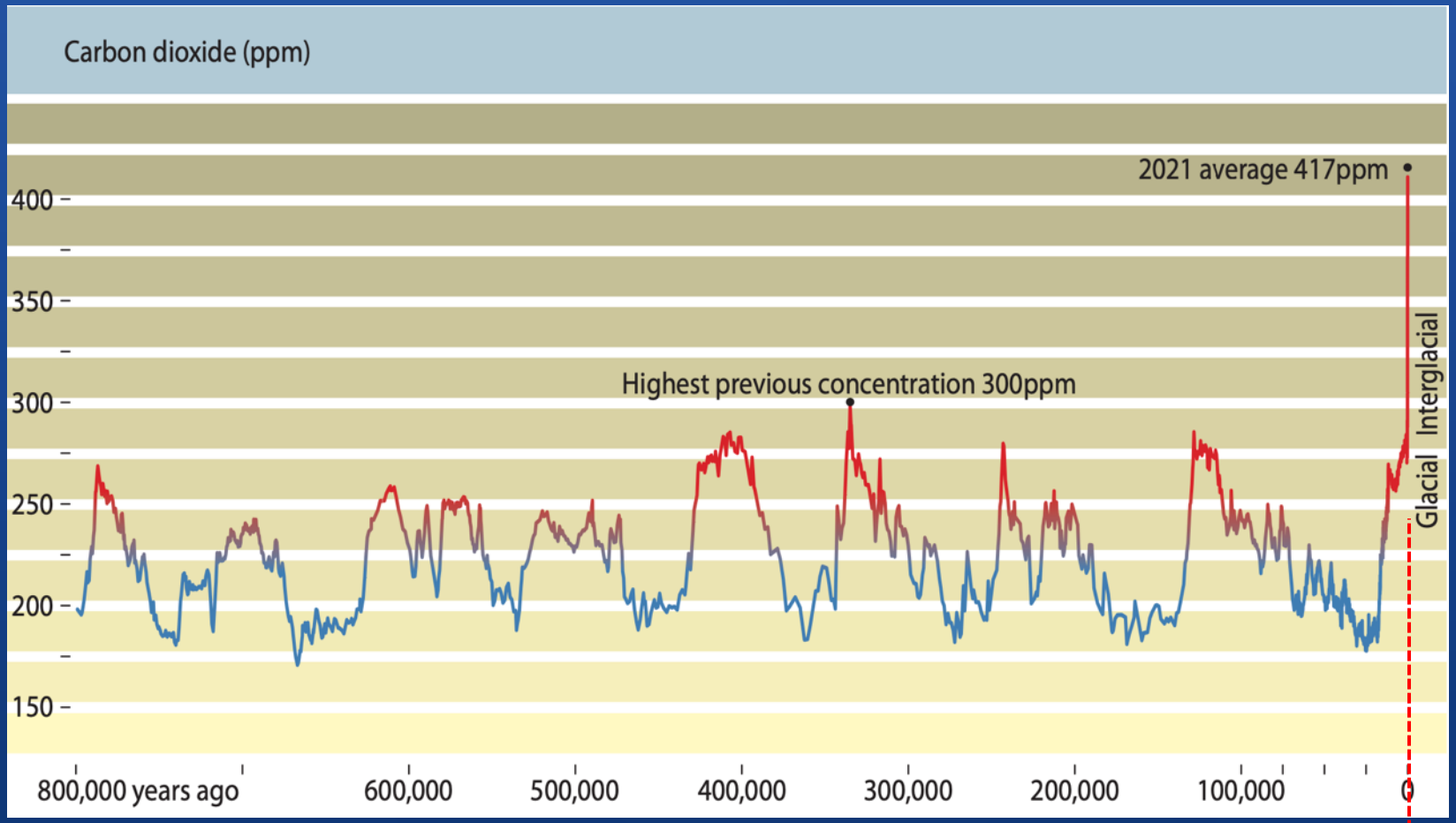
The Naze cliffs and beach provide the best chance to see geology in Essex.

Many visitors come to the Naze to find fossils, flint artefacts and objects of all kinds.

see *“Things Found at the Naze”* Facebook Group.

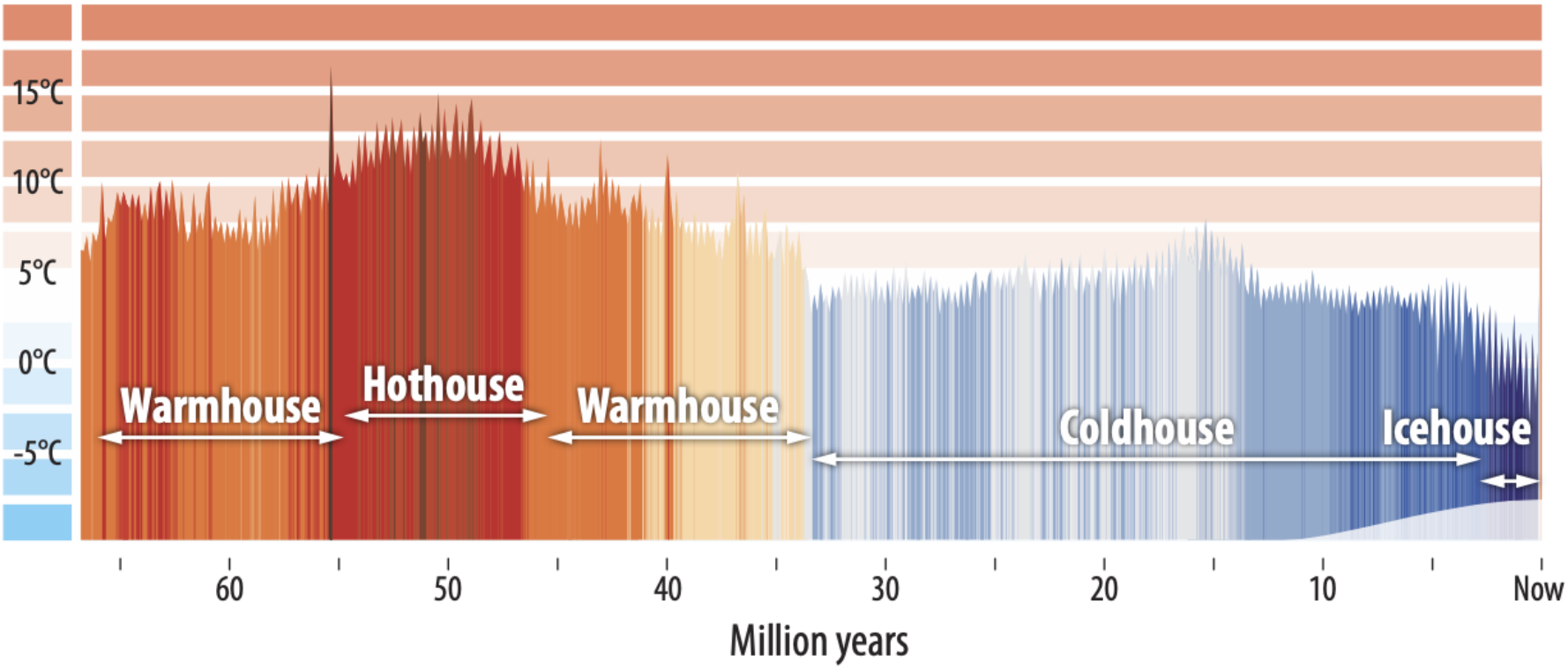

Thank you

Evidence



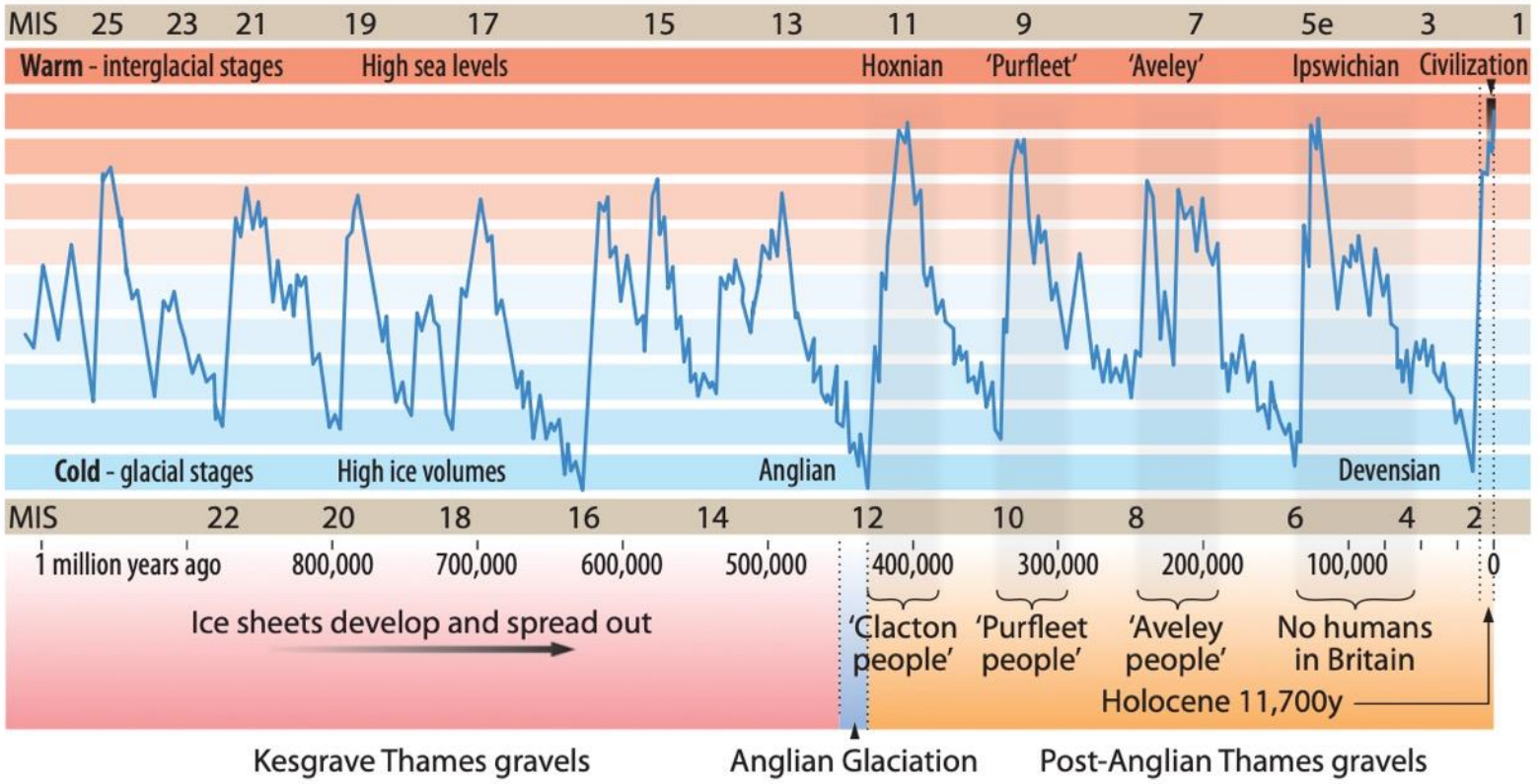
Rate of change

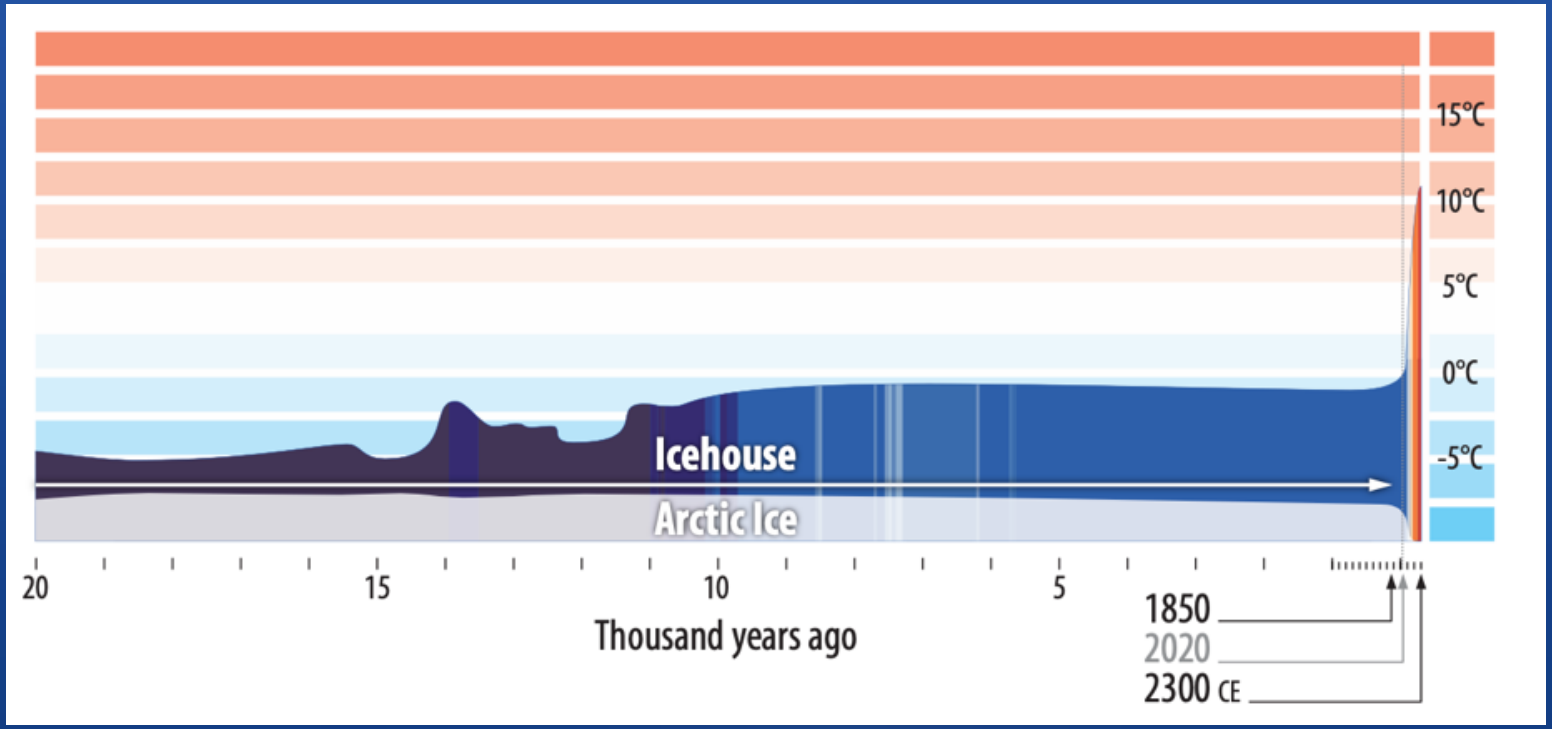
Climate change in Essex since the time of the dinosaurs



The temperature scale shows variation from global surface average 1961-1990

The Current Ice Age





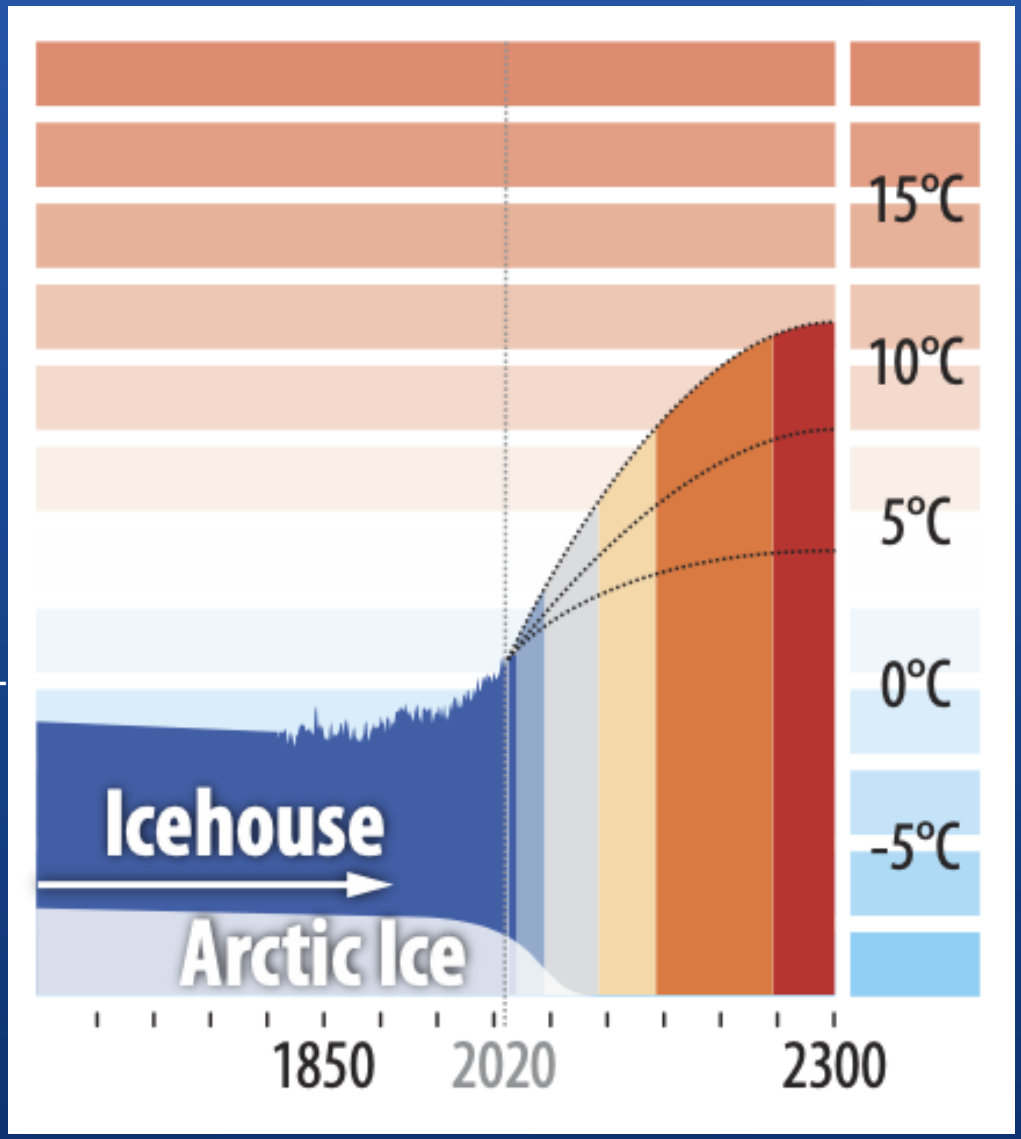
The last 20,000 years

The temperature scale shows variation from global surface average 1961-1990

Think… ***Rate*** of change

NOW

surface average 1961-1990 –



Think… ***Rate*** of change