Tendring, Essex: Geodiversity Characterisation Report, 2009

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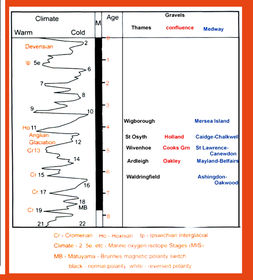
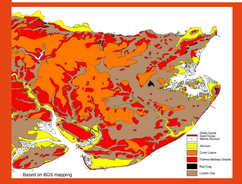
TENDRING'S GEODIVERSITY

Age (in millions of years)	PERIOD OR EPOCH	GEOLOGICAL FORMATIONS IN TENDRING
0.1	HOLOCENE	Saltmarsh, shingle spits, beaches, peat and alluvium
	PLEISTOCENE	Head
		Loam and brickearth
		Interglacial channel deposits
0.5		Thames-Medway gravels *(post-diversion Thames)*
		Outwash gravel from the Anglian ice sheet
		Kesgrave Gravels from pre-diversion Thames and the Medway
2	PLIOCENE	Red Crag
10	MIOCENE	Red Crag 'coprolite bed' *(Miocene rocks & fossils found at the base of the Red Crag*
30	OLIGOCENE	*No evidence in Tendring*
50	EOCENE	London Clay
		Harwich Formation *(the oldest rock exposed at the surface in Tendring)*
55	PALAEOCENE	Woolwich & Reading Beds
65		Thanet Sand
100	CRETACEOUS	Chalk
		Gault & Upper Greensand
180	JURASSIC	*No evidence beneath Tendring*
200	TRIASSIC	
250	PERMIAN	
300	CARBONIFEROUS	
400	DEVONIAN	
430	SILURIAN	Hard Silurian shales and mudstones *(encountered in Harwich and Weeley boreholes)*
460	ORDOVICIAN	
540	CAMBRIAN	*No evidence beneath Tendring*
4,600	PRECAMBRIAN	

Present beneath Tendring but not at the surface

The Tendring Peninsula lies between the Rivers Stour and Colne on the Essex coast. The Report was designed as a geodiversity audit for planning and management purposes and to develop geodiversity in the District.





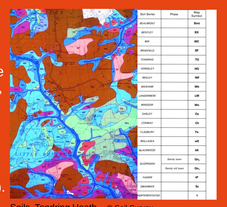
The Last Ice Age

Periglacial wastes

From the tropical climates of the Eocene, Tendring plunged into extreme cold on a number of occasions during the Ice Age. When the ground was frozen, it cracked, forming angular patterns, and on thawing became unstable, forming 'involutions' now seen in quarry faces and cliff faces.

Soils

The soils of Tendring mostly correlate with the underlying geology (TG, BF on brickearth), but some soils relate to geomorphology, particularly the valley slopes (Wn, Wh) or to groundwater levels (Ch).



Soils, Tendring Heath © Soil Survey

The Eocene Period: tropical seas and rainforests

Life in the London Clay Sea

The London Clay was deposited on the floor of a subtropical sea during the Eocene period (~50 million years ago). There are fossils of sharks and fish, along with crocodiles and giant turtles. There are 'land' fossils also, wood, fruit, horse, brought to the sea by rivers. The fossils are washed out of the cliffs and can often be found on the beaches of Essex.

Life in the Eocene rainforest

The first skeleton of *Hyracothenium*, the earliest ancestor of the horse, was discovered at Harwich in the 19th century. It was no larger than a small dog, had toes instead of hooves and lived in the rainforest on the shores of the London Clay Sea.

This fossil gives us a glimpse of the early evolution of mammals following the extinction of the dinosaurs. The skeleton is now in the Natural History Museum

Volcanic ash and earthquakes

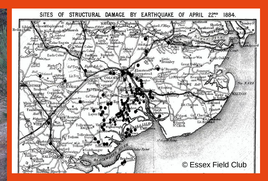
Evidence of Eocene volcanoes

During the Eocene period the North Atlantic ocean was just starting to open. This was accompanied by intense volcanic activity in western Scotland.

Evidence of this is present at sites in north Essex, such as Wrabness Cliffs; the pale bands in the London Clay contain volcanic ash from these eruptions.

Seismic activity is not restricted to the deep past, as the map of structural damage caused by an earthquake in 1884 shows.

Wrabness Cliffs



The Pliocene Period: Red Crag

The Red Crag, a shelly sand stained by iron oxide, was deposited during the Pliocene period (~ 3 million years ago). Almost 300 species of shellfish from this ancient marine environment have been recorded in these deposits.

Neptunia contraria, a sinistral (left-handed) whelk from the Red Crag
© G. Lucy

The Pleistocene Period: The Thames and Medway in Tendring

In the early part of the Pleistocene period, around 600,000 years ago, the Thames and Medway flowed through Essex and the Tendring Peninsula and across what is now the southern North Sea to become a tributary of an early River Rhine. Sands and gravels deposited by this ancestral Thames, containing characteristic pebbles from upstream in the Thames valley, have been mapped across the area.

Over a period of some 200,000 years, the Thames and Medway changed their courses, moving south-eastwards and also cutting down to lower levels. The gravels of the early Thames are the basis of the extensive sand and gravel quarries at Ardleigh, Wivenhoe and elsewhere.

Early humans in Essex

Some of the most celebrated evidence for early human occupation, probably *Homo heidelbergensis* (below), has been discovered in Essex. These people used flints, striking off flakes for cutting and scraping. Possibly the oldest flakes were found at Wivenhoe, dating to c.475,000 years ago. Very important finds came from Clacton, dating to c.400,000 years ago.

A distinctive stone tool industry, the Clactonian, was named after Clacton-on-Sea. Excavation of the Pleistocene deposits at Clacton also led to the discovery of the famous Clacton spear, the oldest-known wooden implement in the world. The implements came from a series of channels running between Jaywick and Clacton.

Marsh environments

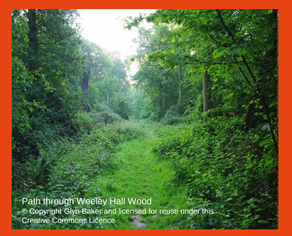
In the way that soils in the Tendring District correlate with the underlying geology, many of the District's habitats are directly influenced by soils and, particularly along the coast, by geomorphological processes. The most important habitats are the Stour and Colne estuaries and the tidal embayment of Hamford Water. The rich invertebrate fauna of the mudflats provide a food source for internationally important numbers of wading birds and the saltmarsh vegetation is of national nature and conservation importance supporting nationally important plant species. Within the Colne estuary, the exposed mudflats, shell banks and shingle pools at Colne Point support highly localised plants such as the scarce sea heath, hold a large range of marine invertebrates and algae and provide a feeding ground for waders. The area is also important for other invertebrate populations.

The saltmarsh and grazing marsh habitats that occur in the upper reaches of the Colne and Stour estuaries and Holland Haven are also recognised as being of national importance for nature conservation. These sites generally support a diverse mix of saltmarsh and coastal grazing marsh habitats of high avifauna value. They also support distinct and diverse assemblages of aquatic plant and invertebrate species that reflect the salinity of the water, which can range from fresh to brackish across a single marsh.

© Essex Wildlife Trust

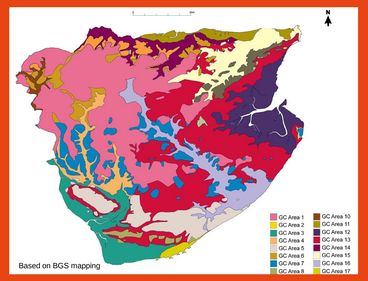
Ancient woodland

Tendring is also noted for its Ancient Woodlands. Three are of national importance. In Riddles Wood, the varied soils derived from the Kesgrave Sands and Gravels in the west and the London Clay in the east results in a diversity of woodland types and a rich and varied ground flora. At Weeley Hall Wood the diversity of woodland types again reflects the varied soils; sandy loams and gravels overlie London Clay and moderately to strongly acidic soils occur on the loess. In Bullock Wood, situated on an almost level plateau with acidic soils developed over brickearth, the principal woodland is the nationally rare Lowland Hazel-Sessile Oak type, modified in places by the presence of Sweet Chestnut *Castenea sativa*. Other notable habitats in the District are a range of grassland types, from coastal pasture to acid grassland.



MANAGEMENT AND PLANNING

Geodiversity Characterisation is a new procedure in the 'tool kit' of geodiversity conservation that can be applied to recognize and manage geodiversity at a landscape scale, beyond the boundaries of protected areas. The project has used GIS based mapping of the geology, topography, soils, hydrology, location and extent of past and present mineral working, and specific datasets from the EHER, combined to define large Geodiversity Character Areas (GCAs). These are then broken down into more specific and detailed Geodiversity Character Zones (GCZs) which are suitable for informing strategic planning and master planning activity.



Based on BGS mapping

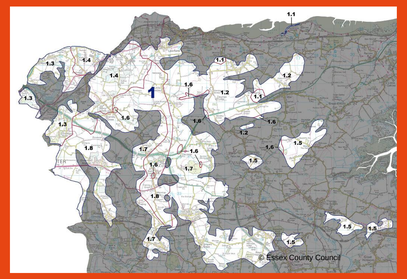
GCA 1 Tendring Plateau

This area comprises the Tendring Plateau which covers much of the north-west portion of the Tendring Peninsula. The Plateau is flat or gently undulating, dissected by a number of stream valleys. The area is largely covered by brickearth deposits which cover gravels that were deposited by ancient courses of the Rivers Thames and Medway. The brickearth gives rise to rich and fertile soils which have been exploited for agriculture since the earliest prehistoric agrarian communities

Geodiversity Characterisation Zones

The **GCAs** are sub-divided into **GCZs** where there are clear variations in the natural landscape and topography, e.g. valleys, plains, coastal slopes. Similarly clear divisions of soil types would be used to subdivide **GCAs**. In addition, if there are similarities within an area, these would be used to define a Zone, e.g. a highly industrialised zone or an intensively quarried area.

GCA 1 The brickearth zone of Tendring Plateau, sub-divides into:
GCZ 1.1 Stour coast
GCZ 1.2 Bradfield and Wix
GCZ 1.3 NW Tendring plateau
GCZ 1.4 Ardleigh and Lawford
GCZ 1.5 Oakley Ridge and Holland Valley
GCZ 1.6 Gravel patches within the brickearth
GCZ 1.7 Stour Valley and Alresford Creek
GCZ 1.8 Alresford and Little Bromley



GCZ 1.1

Patches of fossiliferous brickearth along the Stour

Summary
Fossiliferous interglacial brickearth deposits at Wrabness and Mistley on the banks of the Stour. This contrasts with the plateau brickearth which is rarely fossiliferous. This makes GCZ 1.1 separate and important palaeontologically.

Then follows detailed descriptions of **Geology, Soil, Topography/Geomorphology** and **Human exploitation**

GCZ Scoring

The scoring of zones is on a scale of 1 (low) to 3 (high):

Rarity – how common or extensive the geological characteristic is over the District. Thus, the Clacton Channel scores 3 as the sediments laid within the channel were deposited over a relatively small area and over a relatively short time. The London Clay scores only 1 as it was deposited over much of the District over a long period of time.

Cultural association – the association between geology and humans including early human occupation, e.g. the Clacton Channel, or later industrial links, such as the former copperas industry, both scoring 3.

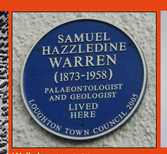
Amenity value – combines value for appreciation of the natural, historical or scientific significance of a zone for education or recreation, including elements such as access and visibility.

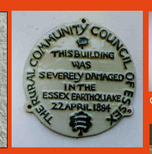
Capacity for change – the ability of the geology to absorb change. Threats could be caused by development or extraction. Natural threats are also considered, i.e. sea-level change, coastal erosion, slope processes. The capacity for change will depend upon various factors such as thickness of the deposit, extent, location and durability.

TOURISM AND EDUCATION

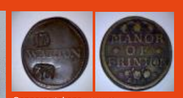
Evidence for the geological diversity of Tendring can be seen in myriad places, in buildings constructed of local rocks such as the church at Great Bentley, the spa at Dovercourt, plaques commemorating famous geologists or geological events or copperas tokens given to the collectors of iron pyrites nodules.

Great Bentley Church
© G.Lucy





Wall plaques © G.Lucy



Copperas tokens © W. George

© G. Lucy

INDUSTRIES RELATED TO GEOLOGY

Prehistoric flint working (Wivenhoe, Clacton)
Building stones (flint, London Clay septaria)
'Roman' cement (from septaria in the London Clay)
Phosphate (coprolites from Red Crag, for agricultural chemicals)
Copperas (iron pyrites from the London Clay was used to make ferrous sulphate for black dyes, inks and sulphuric acid)
Medicinal springs and spas (Dovercourt)
Brick and tile making
Lime burning
Salt (a mineral, extracted from the sea)
(Coal – Weeley, none found)
Water supply (from the Chalk)
Sand and gravel extraction

GEOLOGY TODAY

Landslips, Walton

Human interference:
beach aggradation, Jaywick

THE CONTRIBUTION OF GEODIVERSITY TO THE CHARACTER OF TENDRING

The geological diversity of Tendring is one to be vey proud of. It underpins much of the history, agriculture and industry of the area and helps to give it a cohesive identity.

The extensive spreads of gravel overlain by the loess and coversand (brickearth/coverloam) are free draining but the silt content stops the soils being too dry as well as minerals, making the soils particularly fertile. The varied geology has supported many industries, some sounding strange to modern ears. Today there is still an industrial reliance on geology, though lacking the quaintness of the past. The water supply industry taps the aquifer in the Chalk and the extensive sand and gravel industry exploits the deposits of the early Thames

With an abundance of nine geological SSSIs and an industrial history related to geology, there is much that needs conserving by planners and developers. To assist in this, besides the Tendring Geodiversity Characterisation Report, a gazetteer of geological and related industrial sites has been compiled by Gerald Lucy. This rich geodiversity gives Tendring great interest. Walton is well known for its London Clay and Red Crag fossils, with Harwich and the Stour estuary less well known but of equal importance. This interest should be encouraged and can be extended further by displays, lectures, information sheets, pamphlets and signboards, direct at schools, libraries, visitors (through information centres) and local community groups.