GeoEssex
Promoting the geology and landscape of Essex

Maldon District Council
Report on Local Geological Sites

Prepared for Maldon District Council by

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Produced: July 2023
Revised August 2025

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Cover photographs:

Above: Derived rocks and Roman bricks in the wall of St. Giles Hospital, Maldon
Below: The London Clay cliff between Burnham-on-Crouch and Althorne

1. Introduction

The rocks beneath the Essex landscape are a record of the county's prehistory. They provide evidence for ancient volcanoes, deserts, glaciers and deep seas. Some rocks also contain remarkable fossils, from subtropical sharks and crocodiles to Ice Age hippos and mammoths. The geology of Essex is a story that stretches back over 100 million years.

GeoEssex

GeoEssex is the primary source of information about the geology and physical landscape of Essex. The GeoEssex team, or 'Steering Group', consists of professional and amateur geologists, representatives from local authorities, geological and natural history societies, and from Natural England, the Government's nature conservation body.

GeoEssex promotes geology in all its aspects, from quarries, cliffs and boulders to spas, springs and building stones. The fascinating and often magical world of geology is all around us, if only we know where to look.

A primary task of GeoEssex is to identify the best places in Essex to find out about the Earth's distant past and the landscape processes going on today. These sites are called Local Geological Sites, or LoGS (formerly called Regionally Important Geological Sites or RIGS).

GeoEssex aims to advocate and represent geodiversity in planning processes and other initiatives.

Spectacular chalk cliff at Chafford Gorges Nature Park, Thurrock. The cliff represents a section through an ancient sea floor that existed across England about 80 million years ago. The Chalk is present beneath the whole of Essex, appearing at the surface only in the north and south of the county.

Geodiversity

What is geodiversity and why is it important?

Geodiversity is an integral part of the natural environment. It is the variety of rocks, fossils, minerals, landforms and soil, and all the natural processes that shape the landscape.

The only record of the history of our planet lies in the rocks beneath our feet. Here, and only here, can we trace the cycles of change that have shaped the Earth in the past, and that will continue to do so in the future. This is particularly true in Essex, where the record of climate change during the Ice Age is preserved in our quarries and coastal cliffs. The record is unique and much of it is surprisingly fragile.

Apart from the obvious benefits of providing mineral resources such as sand, gravel, chalk and clay, the diversity of the geology is what shapes the landscape, influencing soils, and in turn influencing all of our habitats and species. Geodiversity also has a cultural role to play, influencing the character of our built environment through building stones, providing inspiration to art, and helping to define where we live and our 'sense of place'. It is the link between geology, landscape, nature and people.

And, of course, it must not be forgotten that *almost everything we know about the Earth's distant past has been learnt by studying geological sites*.

Local and national Geodiversity Action Plans

The UK Geodiversity Action Plan (UKGAP) sets out a shared framework for geodiversity action across the UK. It establishes a common aim, themes and targets which link national, regional and local activities. It encompasses how geodiversity can inspire people and what needs to happen to conserve Britain's geodiversity. The Plan for Essex has been drawn up within this framework.

A Local Geodiversity Action Plan (LGAP) has been produced for Essex. It sets out a framework for geodiversity action in Essex. It is an essential document to conserve the County's geodiversity.

The Essex Local Geodiversity Action Plan aims to:

- *Identify, conserve and enhance the best sites that represent the geological history of an area in a scientific, educational, recreational and cultural setting.*
- *Promote geological sites and make geoconservation relevant to people.*
- *Provide a local geodiversity audit (an audit of sites and skills).*
- *Influence local planning policy.*

2. The Geology of Essex

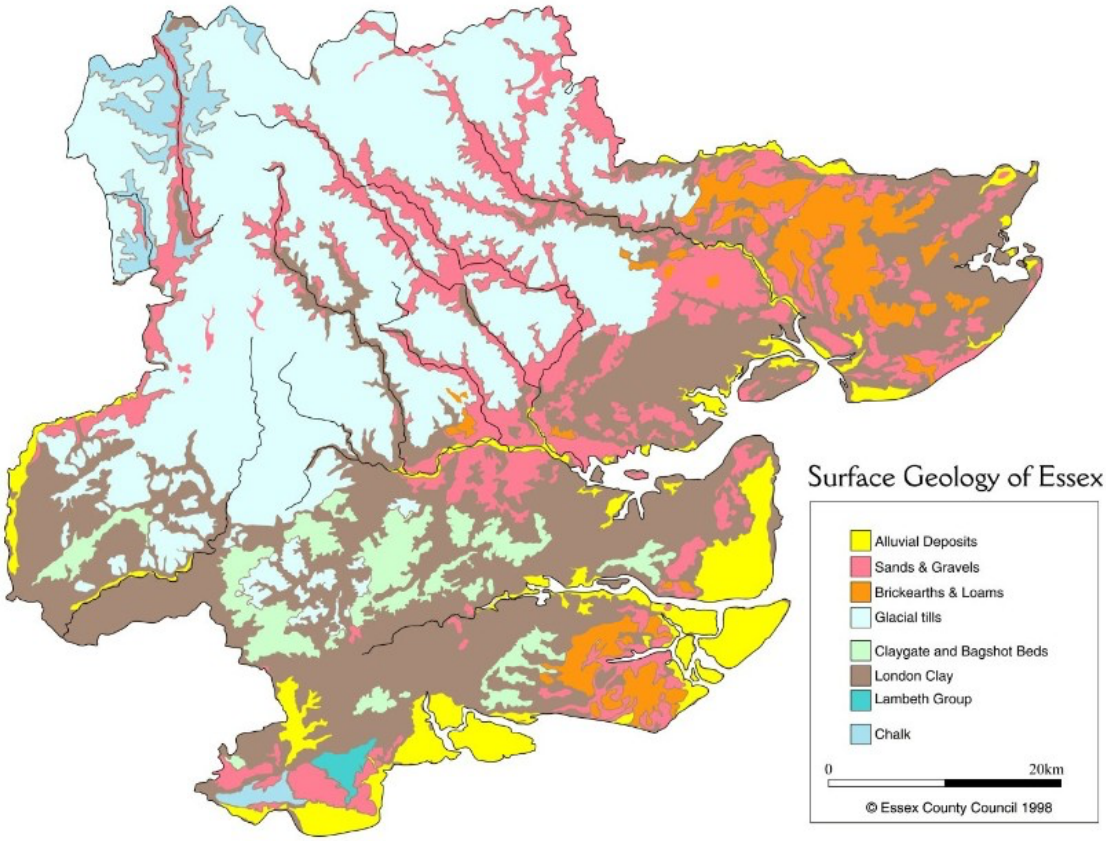
Compared to most other parts of Britain the rocks of Essex and adjoining counties are young in geological terms. Even the oldest surface rock in Essex (the Chalk) is only about 80 million years old. Much older rocks are, however, present at depth. We have some idea about these ancient rocks because of the records of boreholes that have been sunk in search of coal and oil.

The surface rocks of Essex that were formed before the Ice Age (from the Chalk to the Red Crag) are described as the 'bedrock' or 'solid' geology. Much of this bedrock geology is concealed beneath the deposits left behind by glaciers and rivers during the Ice Age. The material laid down during the Ice Age is known as 'Superficial' or 'drift' deposits.

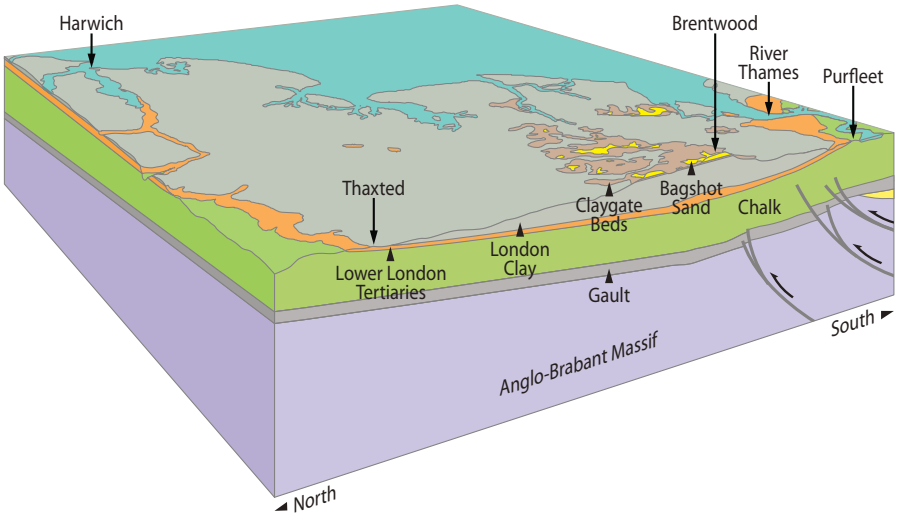
Era	Period or Epoch		Approx. age in millions of years	Geological formations in Essex
Caenozoic	Quaternary Ice Age	Holocene	0.01	Recent peat and alluvium
		Pleistocene	0.45	River terrace deposits and brickearth (loess)
				Boulder clay (till) and glacial gravel
			1	Kesgrave (Thames) sands and gravels
				Norwich Crag (Chillesford Sand)
			2.4	Red Crag
	Pliocene		10	*No evidence of rocks of this age in Essex but derived Miocene and Pliocene fossils are found in the Red Crag*
	Miocene			
	Oligocene		20	
	Eocene		50	Bagshot Sand
				Claygate Beds
				London Clay (includes the Harwich Formation)
	Palaeocene		55	Lambeth Group (Woolwich and Reading Beds)
				Thanet Sand
Mesozoic	Cretaceous		80	Chalk
			100	Gault and Upper Greensand (Beneath Essex)
	Jurassic		150	*No evidence of rocks of these ages beneath Essex with the exception of Jurassic Oxford Clay in a graben (a sunken part of the crust bordered by faults) beneath East Tilbury.*
	Triassic		220	
Palaeozoic	Permian		250	
	Carboniferous		300	
	Devonian		400	Shales and mudstones dating from these periods occur at depth (about 300 meters) beneath Essex
	Silurian		420	
	Ordovician		450	*No evidence beneath Essex, however, boreholes have not been drilled deep enough to confirm.*
	Cambrian		500	
Pre-Cambrian	Precambrian		Age of Earth 4,600	

Map of Essex Geology

Geological map of Essex showing all the rocks exposed at the surface, bedrock and superficial deposits. An example of a superficial deposit is boulder clay or glacial till left behind by the Anglian Ice Sheet during the Ice Age (shown in pale blue). Map courtesy of the British Geological Survey.



Cross-section through the bedrock of Essex



Essex through geological time

It is difficult to know where to begin with our geological story but the earliest evidence we have is the hard rocks deep beneath Essex that were formed some 400 million years ago in the Silurian and Devonian periods (part of the Palaeozoic era) and form what is known as the 'Palaeozoic basement' of Essex.

Deserts to Dinosaurs

- For a very long time (and before the age of the dinosaurs) these hard Silurian and Devonian rocks formed the surface of the land that was eventually to become Essex. During the Permian and Triassic periods Essex was a desert upland in the middle of a vast continent known as Pangea.
- By 200 million years ago, at the start of the Jurassic period, tropical seas had spread around this land forming a dinosaur-infested, forested island.

Buried Island

- If you could dig down 1000 feet (300 metres) under Essex you would reach the hard rocks of that dinosaur island.
- All trace of forests and animals from this time have been swept away from the eroded surface of the island, so there are no dinosaur fossils in Essex.
- By 100 million years ago, in the Cretaceous period, the sea flooded across the island to spread **Gault** Clay and **Greensand**. The sea then deepened to deposit hundreds of metres of soft white limestone known as **Chalk** all over the island as well as much of what is now Britain.

Pebbles and Clay

- The North Atlantic Ocean, which did not previously exist, began to open out to the west, the land of Essex lifted, chalk hills were worn down and flints were eroded out. Billions of these flints were tumbled on beaches to form layers of sand and beautifully rounded pebbles across our area.
- Around 50 million years ago, in the Eocene period, a deep sea fed by muddy rivers spread across what is now Essex and London depositing a great thickness of clay, the **London Clay,** on the sea floor, together with the remains of many plants such as palms and cinnamon, and animals including birds, sharks, turtles, and tiny horses. Atlantic volcanoes poured their ash into this sea.

The Alps and the Thames

- Colliding continents pushed up south and mid-Essex, bending the crust to form the vale of the Thames river system through mid-Essex. About 2.4 million years ago offshore sandbanks formed red shelly sandstone layers across north Essex known as the **Red Crag**.
- Global cooling led to the Ice Age (the Pleistocene epoch), with many warm periods such as the one we are in right now, which is known as the Holocene. As the sea retreated, the ancestral River Thames spread a succession of flint-rich river gravels across the middle of Essex, through Harlow, Chelmsford and Colchester, and out across the area where the North Sea is now.

Ice and people cover Essex

- During an exceptionally cold stage 450,000 years ago a gigantic ice sheet covered most of Britain and Essex as far south as Hornchurch. The moving ice diverted the Thames towards its present-day course and dumped its load of boulder clay, or glacial till, on top of these old Thames gravels.
- During the past million years of the Ice Age, there have been numerous cold and warm stages (right now we are in a warm period known as the Holocene) and humans have migrated to and from Essex, together with the animals they have hunted. They have left thousands of flint tools and tool-making debris on the banks of the ever-changing Thames and its tributaries.

3. Background to Geological Site designation in Maldon

What is special about Essex Geodiversity?

Essex is an area of predominantly subdued relief with gentle slopes, the result of its underlying geology of soft, relatively young rocks. These generally yield fertile soils. The result is an attractive 'lived in' landscape dominated by arable agriculture, but still retaining forested and heathland areas, particularly where gravels and sands, many of glacial and fluvial origin, have yielded poorer soils.

A mammoth tooth from Essex

Although lacking the more dramatic geology and landforms of many 'hard rock' areas, Essex geology and geomorphology is still of great interest, possessing abundant evidence of the huge environmental and biodiversity changes that our area has witnessed over the last 100 million years. Among the key themes are dramatic and sometimes long-lasting changes in the distribution of land and sea, major shifts in climate, and mass species extinctions. Many of these phenomena are of great relevance today, and so an understanding of our past is essential in interpreting the challenges to come.

Geodiversity's influence on Essex's development

Essex's geodiversity has exerted a major influence on land use, agriculture and landscape.

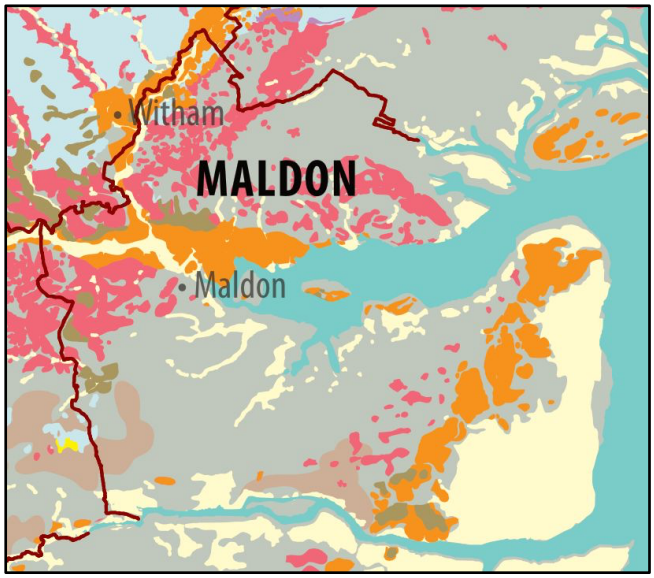
The distribution of less fertile ancient river and glacial gravels has been a major influence on historical land use, resulting in the preservation through to the present day of extensive tracts of woodland and to a lesser extent heathland, in a predominantly arable county. These are of great significance both for biodiversity and recreation.

The chalky boulder clay, or glacial till, found north and west of Chelmsford is highly suitable for cereal cultivation, especially wheat. London Clay outcrops south and east of Chelmsford, especially on the Dengie peninsula, providing soils less suitable for arable agriculture and more suited to pasture. The brickearth of the Tendring district is the basis of the rich agricultural land of this peninsula.

In earlier times rivers penetrating deep inland, together with proximity to the Continent, provided a succession of invaders and colonisers – from Palaeolithic peoples, through to Roman, Viking and Saxon – with easy access.

The deposits of the ancestral Thames and its tributaries and associated glacial outwash deposits have provided Essex with a source of gravel and sand for construction since Roman times. A special kind of gravel naturally cemented by iron called ferricrete was used extensively as a building stone and is found in many medieval churches, notably at St. Andrew's, Heybridge.

The Geology of the Maldon Area



	Recent alluvium	
	Coversand/Brickearth	Ice Age deposits 2.58 million to 11,700 years ago
	Post-Anglian river deposits	
	Glacial Till	
	Kesgrave sand and gravel	
	London Clay	Eocene 54 - 52 million years ago

The pre-Ice Age (bedrock) geology of the district is London Clay which is seen at the surface in much of the south of the area, especially around the Blackwater Estuary and to the west of Burnham-on-Crouch on the River Crouch. It was laid down on the floor of a subtropical sea 54 - 52 million years ago and forms characteristic heavy soils and muddy river foreshores and is renowned for its well-preserved fossils. In the south of the area, on the higher ground as at Purleigh and Althorne, the London Clay is overlain by Claygate Beds.

After a long period for which we have no geological record, about 2.5 million years ago in the early stages of the Ice Age, an ancient course of the Thames flowed across central Essex, north of the Maldon District, and an early course of the Medway crossed eastern Essex, parallel with the present coastline. Later, during the Anglian cold stage, about 450,000 years ago, an ice sheet reached as far south as the high ground around Wickham Bishops and Braxted, though a lobe was able to extend through a gap, now occupied by the River Blackwater, to Maldon and it was thick enough to lay down some outwash gravels on the higher ground.

The ice radically changed the landscape by diverting the early Thames into its present valley and it flowed to the Southend area where it joined the early Medway to continue northward to the Clacton area, about 400,000 to 300,000 years ago. The ribbon of flooded gravel pits stretching across the Dengie Peninsula from Burnham-on-Crouch to Bradwell-on-Sea mark this former route of the Thames-Medway. At broadly the same time, in the Maldon area, the Blackwater and Chelmer were established laying down sands and gravels, which can be traced to Tollesbury and Clacton. At lower levels, these sands and gravels were extensively worked in the extraction pits around Heybridge, Great Totham and Chigborough Farm.

Along the coast, the extensive marshland built up over the last 20,000 years, with interesting shell banks in the Bradwell area, known as cheniers.

Geodiversity and National Planning Policy

The importance of geodiversity as an integral part of nature conservation and the planning system is reflected in The National Planning Policy Framework (NPPF), and in legislation – Wildlife & Countryside Act 1981 and Countryside and Rights of Way Act 2000.

The NPPF states that:

> "Planning policies and decisions should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils" (Paragraph 174).
>
> "Plans should protect and enhance biodiversity and geodiversity" (Paragraph 179).

The current Maldon District Local Development Plan (Policy N2 – Natural Environment, Geodiversity and Biodiversity), approved in July 2017, states that:

> "The Council will seek to protect and enhance the biodiversity, geodiversity and recreational value of any identified sites of local importance such as Local Wildlife Sites (LWS), Regionally Important Geological Sites (RIGS), Local Geological Sites (LoGS), Local Nature Reserves (LNR), and any other sites of potential ecological value." (Policy Clarifications 6.18, page 104)

Site designations

The most important geodiversity sites have been declared as **Sites of Special Scientific Interest** (SSSIs) which are statutorily protected for their scientific importance.

The next tier of geodiversity sites are known as **Local Geological Sites** (LoGS) These have replaced the earlier 'Regionally Important Geological Sites' (RIGS) terminology in line with government guidance.

A typical Local Geological Site – Great Totham Jubilee Recreation Grounds – showing exposed gravels from the early Ice Age.

Sites like these are valuable for research and education but can easily be obscured or destroyed.

Local Geological Sites (LoGS) are broadly equivalent to Local Wildlife (species and habitats) Sites ('LoWS') but have a broader remit as they can be designated for their scientific, educational, historical and recreational benefits. Typical Essex LoGS include quarries, pits, walls, boulders, cliffs, springs, and river meanders. Local Wildlife Sites and Local Geological Sites are both designed to provide a system of locally valued, non-statutory sites.

Most importantly, the NPPF gives Local Geological Sites a weighting equal to Local Wildlife Sites, and both are collectively referred to as 'Local Sites'. However, in actuality the attention and priority afforded to the designation and management of LoGS has historically lagged, and continues to lag, well behind that of LoWS.

4. Objectives of current report

Supporting Local Planning Authorities

Biodiversity protection is familiar to planning authorities but geodiversity less so. This report will assist planning authorities in meeting their obligations under the National Planning Policy Framework and helping them identify potential development impacts on LoGS.

GeoEssex is therefore seeking to help Local Planning Authorities fulfil their responsibilities with respect to geodiversity.

> "*Local and neighbourhood plans and planning decisions have the potential to affect biodiversity or geodiversity outside as well as inside designated areas of importance for biodiversity or geodiversity"* (extract from: www.gov.uk/guidance/natural-environment)

Further guidance on statutory obligations is given in Circular 06/2005 (*Biodiversity and Geological Conservation*). Geodiversity should be therefore included alongside biodiversity in local authorities' Local Plans. Identifying these non-statutory sites therefore helps local authorities to meet their obligations.

LoGS can also contribute to *sustainability* programmes by providing information about a key element of the environment that contributes to our natural heritage. In addition, the *awareness raising* and *education* function fits well with the principle of community involvement and enabling people to regain their sense of place.

The Goldhanger village well, a rare example of an artesian well with a wheel pump, drilled in 1921 to a depth of 60 metres into the water-bearing chalk deep below the village.

5. Site selection

Site Selection and Notification to Planning Authorities

LoGS in Essex are identified by **GeoEssex**, a largely voluntary group composed of representatives from the major Essex geological and conservation bodies and supported by the Essex Field Club, Essex Rock & Mineral Society, Essex Wildlife Trust, Natural England and Essex County Council (Place Services). The site selection process is based on clearly defined criteria (see below) and includes scientific, educational, historical, and aesthetic values. When selecting sites GeoEssex aims to gain the support of landowners whenever possible. The majority of LoGS are on private land and site selection does not infer any right of access.

Like LoWS, proposed LoGS are presented to the Local Sites Partnership for endorsement and then passed to local authorities for inclusion in their Local Plans. Local authorities receive a citation and boundary map.

The sites selected as LoGS in the Maldon district are summarised below, together with a list of other sites which are potential LoGS. Other sites may be identified in the future, occasioned by housing or other development and restoration following mineral extraction.

Site protection

Like their biodiversity counterparts, LoGS have no statutory protection and the conservation and management of individual sites relies heavily on the support of landowners. Inclusion within local plans also forms a vital role in the protection of LoGS. An example of a comprehensive natural environment policy incorporating geodiversity can be provided on request.

It is recommended that the Local Sites Partnership should be consulted if any development is proposed that would affect a LoGS.

Site Assessment Criteria

The assessment criteria used for identifying LoGS are based on DEFRA document *Local Sites: Guidance on their identification, selection and site management* (2006). The guidance states that assessment is a matter of judgement but must be based on an understanding of geological principles and processes, and the distribution and abundance of the resource (national, regional and local). Those sites selected must be 'of substantive importance to the geodiversity of the local area.'

There are four value categories: scientific, educational, historical, and aesthetic. A site qualifies for notification as a Local Geological Site if it fulfils the criteria under one or more of these categories. Each site is also given a site assessment score. This score is not a measure of the site's value or importance but a relative assessment of the usefulness of the site in promoting geodiversity.

Land Ownership Notification

Where the landowner is identified as a public body e.g. a local authority, Forestry Commission etc., notification is by letter to that authority. For sites under private ownership, where the landowner can be identified, they will be informed by letter.

6. Additional Sources of Information

Scientific literature

If a LoGS has been referred to in the scientific literature some of these references are given in this document. If a site has been referred to in the scientific literature this means that the site is of historical interest and some of these sites will have potential for research.

Site interpretation

If a site is accessible or simply visible to the general public, it is the aim of GeoEssex to provide interpretive information where possible and practical. This could be in the form of interpretive boards or leaflets. Such interpretation will be with the cooperation of landowners and other interested parties.

Other organisations

British Geological Survey - www.bgs.ac.uk
Other geological resources, maps and borehole information are available on the website of the British Geological Survey.

Essex Field Club - www.essexfieldclub.org.uk
The Essex Field Club, founded in 1880, exists to promote the study of the county's natural history, and geology. The club has a centre for Biodiversity and Geodiversity in Wat Tyler Country Park at Pitsea, near Basildon, with extensive collections. It is open to the public most weekends. Their website provides comprehensive data on a large number of wildlife and geological sites which can be searched in a number of ways. Details of several hundred geological sites across Essex can be found here which includes LoGS and potential LoGS.

Earth Heritage Magazine - www.earthheritage.org.uk
Earth Heritage magazine is produced for the geological and landscape community by Natural England, Scottish Natural Heritage, the Countryside Council for Wales.

Essex Rock & Mineral Society - www.erms.org
The Essex Rock and Mineral Society, founded in 1967, is the club for Essex geological enthusiasts.

GeoEast
GeoEast is the East of England Geodiversity Partnership. It is a partnership of organisations active in conserving and promoting Earth heritage in this region.

GeoEssex - www.geoessex.org.uk
Background geological information for Essex, together with a selection of sites in each district (SSSIs and public accessible sites) can be found on the GeoEssex website

Geologists' Association - www.geologistsassociation.org.uk
The Geologists' Association, founded in 1858, is Britain's largest society for amateur geologists.

Quaternary Research Association - https://www.qra.org.uk
The Quaternary Research Association researches 'Ice Age' geology, palaeobiology and Palaeolithic archaeology and has published several field guides covering many sites in southern and eastern Essex.

Books and articles relating to Essex geology and geoconservation

ALLEN, P., CHESHIRE, D.A. AND WHITEMAN, C.A. 1991. **The glacial deposits of southern East Anglia**. In: EHLERS, J., GIBBARD, P.L., AND ROSE, (eds) **Glacial Deposits in Great Britain and Ireland**. Balkema, Rotterdam, pp. 255-278.

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ALLEN, P., BAIN, D.R., BRIDGLAND, D.R., BUISSON, P. AND 20 OTHERS. 2022. **Mid-Late Quaternary Fluvial Archives near the Margin of the MIS 12 Glaciation in Southern East Anglia, UK: Amalgamation of Multi-Disciplinary and Citizen-Science Data Sources.** Quaternary 22, 5 (3), 37. (On-line, open access)

BRIDGLAND, D.R. 1994. **The Quaternary of the Thames**. Chapman and Hall. Geological Conservation Review Series.

CLAYTON, K. 1960. **The landforms of parts of southern Essex**. Transactions of the Institute of British Geographers, 28, 55-74.

ELLISON, R.A. 2004. **Geology of London**. Special Memoir for 1:50,000 Geological sheets 256 (North London), 257 (Romford), 270 (South London) & 271 (Dartford). British Geological Survey.

GIBBARD, P.L. 1994. **Pleistocene History of the Lower Thames Valley**. Cambridge University Press.

HOSE, T.A. (ed). 2016. **Geoheritage and Geotourism: A European perspective**. The Boydell Press.

LUCY, G. 1999. **Essex Rock: A look beneath the Essex landscape**. Essex Rock and Mineral Society.

MERCER, I. & MERCER, R. 2022. **Essex Rock: Geology beneath the landscape** (2nd edition updated and greatly expanded).

PROSSER, C., MURPHY, M. and LARWOOD, J. 2006. **Geological Conservation: A Guide to Good Practice**. English Nature.

SUMBLER, M.G. 1996. **British regional geology: London and the Thames valley**. British Geological Survey. Fourth edition. HMSO.

WHITAKER, W. 1889. **The Geology of London and of Part of the Thames Valley**. Memoirs of the Geological Survey. HMSO.

WHITEMAN, C.A., BRIDGLAND, D.R., ALLEN, P. AND CHESHIRE, D.A. 1995. **Maldon Cutting (TQ 842067)**. In: Bridgland, D.R., Allen, P. and Haggart, B.A. (eds), **The Quaternary of the Lower Reaches of the Thames, Field Guide.** Quaternary Research Association, pp. 247-254.

A selection of scientific books and papers, etc. relating to the Maldon area

COLLINS, J. S. H. and SAWARD, J. 2006. **Three new genera and species of crabs from the Lower Eocene London Clay of Essex, England.** Bulletin of the Mizunami Fossil Museum, 33: 67-76.

GEORGE, W. and VINCENT, S. 1976. **Some river exposures of London Clay in Suffolk and Essex.** Tertiary Research, 1(1): 25-28.

GEORGE, W. AND VINCENT, S. 1977. **A foreshore exposure of London Clay at Steeple, Essex.** Tertiary Research, 1(4): 105-108.

GEORGE, W. & VINCENT, S. 1982. **An exposure of London Clay at Maylandsea (Lawling Creek), Essex.** Tertiary Research, 4(2): 39-43.

RAYNER, D., MITCHELL, T., RAYNER, M. & CLOUTER, F. 2009. **London Clay Fossils of Kent and Essex.** Medway Fossil and Mineral Society.

SAWARD, J. 2015. **Fossil Crustaceans from the London Clay of Essex.** Essex Naturalist, 32 (New Series): 274-282.

TSHUDY, D. & SAWARD, J. 2012. **Dinochelus steeplensis, a New Species of Clawed Lobster (Nephropidae) from the London Clay (Eocene) of England**. Journal of Crustacean Biology, 32, no.1: 67-79.

7. List of Sites

The following is a representative list of geological sites in the district. For completeness it includes geological SSSIs, but these sites are statutory sites and do not form part of this report.

The list gives an idea of the range of sites that can qualify as Local Geological Sites (LoGS).

Note: *Not all the sites described here are accessible, some are on private land and can only be viewed from footpaths that pass through or alongside the site. Inclusion of a site on this list does not, therefore, imply any right of access.*

Sites of Special Scientific Interest (SSSIs)

Bradwell Chenier Ridges (part of Dengie SSSI)
Along this section of coast, between the salt marshes and the upper tidal flats there are large ridges composed almost entirely of cockle shells known as 'chenier' ridges. Up to 3 metres high and 25 metres long, they result from the erosion of the tidal flats by waves winnowing away at the finer sediment to expose the shells. The area is a nature reserve administered by the Essex Wildlife Trust and is accessible at all times. Parking is available at Eastlands Farm.

Goldsands Road Pit SSSI
Goldsands Road Pit provides a valuable section in the "East Essex Gravels". The gravels here were deposited by the Thames-Medway, a river formed by the confluence in the Southend area of the Lower Thames and Medway, which flowed north-eastwards across eastern Essex. Deposits of gravel to the west that occur at a greater elevation are of Medway origin and predate the confluence of the two rivers. This gravel (known as Southminster Gravel) provides the earliest proof for the presence of the Thames in the area, and that it is of late Anglian age (about 400,000 years old). Private land with permission to visit required from the quarry operator.

Lofts Farm Pit SSSI
The Blackwater terrace gravel in this area has produced some remarkable fossils dating from the (Devensian) last glacial stage, about 20,000 years ago - one of the coldest periods of the Ice Age. In the early 1980s a layer of peat in the former Lofts Farm Pit yielded a cold-climate mammalian fauna with bones of reindeer, woolly mammoth, woolly rhinoceros, hyaena, bison and wolf. The finds included the tusk of a mammoth. The site is now restored and no geology is visible, but the former pit (now a lake) can be viewed from the adjacent footpath.

Maldon Cutting SSSI
This former railway cutting (now the Maldon by-pass) is of considerable importance in the Pleistocene (Ice Age) sequence in Essex. The sequence of strata here comprises glacial till, overlain by gravel and silt. The first of these has been termed Maldon Till, for which this is the 'type site', and a complex glacial stratigraphy has been set up on the basis of the succession at this locality. No geology is currently visible as the sides of the cutting are covered with trees.

Maylandsea Foreshore (part of Blackwater Estuary SSSI)
The foreshore on the east bank of Lawling Creek, north of Maylandsea, has yielded large numbers of London Clay fossils, particularly crustacean remains. The SSSI citation states that this section of 'soft rock' coastline is of national geological importance. The site demonstrates the maximum transgressive extent of the London Clay and contains a deeper-water fish fauna than is found at the Isle of Sheppey in Kent. These sediments make up the deepest water facies known in the London Clay, and the assemblage of fossils reflects this, with species which are not seen at Sheppey or other sites.

The Cliff, Althorne SSSI
Also known as Butts Cliff this is one of the most important London Clay sites in Britain. A cliff on the outer bend of the River Crouch near Burnham-on-Crouch is being eroded and London Clay fossils can be found in the beach shingle below the cliff. The site has yielded fossil bird bones (including two type specimens) and is of considerable value in expanding the limited knowledge of small Eocene birds species and avian evolution. The site also yields numerous fossil fish remains (mostly as shark teeth) and crustacea. It is the type locality for several fish species and a crab.

Local Geological Sites (LoGS)

LoGS agreed by Local Sites Partnership.

MaG2 - Chantry Wood Boulder, Wickham Bishops
Large sarsen boulder in private woodland.

MaG3 - Goldhanger Village Well
The village pump is a rare example of a wheel pump, 25 metres deep with a further 35 metres of 'artesian bore'. This total depth would take the well and borehole through the mostly impervious London Clay and Lower London Tertiaries into the water-bearing Chalk. The pump is a listed building.

MaG4 -Jubilee Recreation Ground, Great Totham
Former gravel pit, now a recreation ground in centre of Great Totham. Steep banks with gravel exposures laid down about 450,000 years as outwash from a glacier that was halted by the high ground of Wickham Bishops, Braxted and Tiptree.

MaG5 - St Giles Leper Hospital, Maldon
12th century Grade 1 listed ruin of Leper Hospital chapel, built of an interesting patchwork of rock types including locally sourced erractics.

MaG6 -Steeple Bay Foreshore, Steeple
Extensive foreshore area that has yielded large numbers of London Clay fossils, particularly crustacean remains, such as lobsters and crabs.

MaG7 - West Maldon Landslip
Classic rotational London Clay landslip on the steep ground on the south bank of the River Chelmer producing characteristic hummocky ground. A public footpath traverses the site. Part of Hilly Fields Local Wildlife Site.

MaG8 - Woodrolfe Creek Saltmarsh, Tollesbury
The best and safest place to view saltmarsh in Essex, with its creeks and tidal flats, is at Tollesbury. Here the marsh is criss-crossed by paths to enable boat owners to reach their vessels.

MaG9 - Stansgate Foreshore, Stansgate
Foreshore area that has yielded London Clay fossils, particularly crustacean remains, such as lobsters and crabs.

Other sites of geological interest in the district

For completeness, the following sites also contribute to the geodiversity of the district.

Asheldham Pit (TL 973 017)
The line of flooded gravel pits stretching across the Dengie Peninsula from Burnham-on-Crouch to Bradwell-on-Sea was the route of the northward-flowing Thames-Medway River. One of these pits is Asheldham Pit (a former Essex Wildlife Trust nature reserve) which provided exposures of Asheldham Gravel, laid down by this river about 300,000 years ago. A section for scientific and educational study was excavated by GeoEssex volunteers at the west end of the pit when the reserve was leased to the trust, but this is now totally overgrown. It is now private land with no access possible.

Chapel of St. Peter-on-the-Wall, Bradwell -on-Sea (TM 031 082)
The famous chapel of St. Peter-on-the-Wall was built in 654 AD. It contains a remarkable patchwork of rock types salvaged from other buildings, including the Roman fort which existed on this site. It is a Grade 1 listed building and among the oldest, largely intact, church buildings in England. It is still in regular use as a chapel.

Chigborough Lakes Nature Reserve (TL 877 086)
Essex Wildlife Trust nature reserve consisting of flooded gravel pits. There were formerly exposures of Blackwater terrace gravel and brickearth of the same age (Devensian or last glacial) as Lofts Farm Pit SSSI only 500 metres to the west. (no gravel now visible at Lofts Farm).

Great Braxted Church (TL 585 215)
One of the best churches in Essex for the variety of natural stones in its external fabric. However, access is not always available as the perimeter gate is closed for the majority of the time.

Northey Island Foreshore (TL 873 059)
Foreshore platform of London Clay on the west side of the island has yielded fossils, but is currently obscured by silt and debris. The island is owned by the National Trust and access is only possible with a permit.

Osea Island Foreshore (TL 904 063)
London Clay fossils can be found on the foreshore at low tide. Stems of fossil crinoids occur in abundance. The island is private property and can only be reached at low tide by a causeway from the mainland.

St. Andrew's Church, Heybridge (TL 855 081)
Church walls with interesting locally sourced stone including London Clay septaria and blocks of ferricrete, probably from quarries at nearby Chigborough.

St. Lawrence and All Saints Church, Steeple (TL 935 030)
Church rebuilt in 1882 reusing material from previous church. A great deal of local cement stone (septaria) was used giving a pleasing effect. Stones were originally collected from the nearby foreshore and some contain fossils.

Clementsgreen Creek Submerged Forest, Stow Maries (TQ 834 965)
A 600 metre (650 yard) section of foreshore reveals fallen tree trunks from a submerged land surface. Possibly over 5,000 years old and dating back to a time when sea level was lower, the Crouch a freshwater river and the coastline much further east. Although many of the trunks have unfortunately been covered by debris from repair work to the sea wall, there are still some to be seen. Part of Crouch and Roach Estuaries SSSI.

St. Margaret's Church, Woodham Mortimer (TL 822 052)
The parish church of St Margaret's is a fine example of the use of local septarian nodules for building construction, which are clearly visible in the external walls.

The west wall of St. Andrew's Church, Heybridge, with lines of ferricrete, London Clay septaria and other stone from local quarries. Photo: Jeff Saward, 2023.