

Tides of Change



2 million years on the Suffolk Coast

Tim Holt-Wilson



How to use this book

This is an introduction to over 2 million years of change on the Suffolk coast. Rising seas and surging ice sheets have come and gone, leaving a legacy you can discover for yourself. We suggest you start by flicking through the book and finding a few sites that catch your interest, then plan a visit using the map and access details inside the back cover. Some words which may be unfamiliar to you are listed in the glossary. All sites can be visited at your own risk. Please stick to beaches and paths, and follow the Countryside Code.

Dead people don't enjoy life

The seashore can be a dangerous place so treat it with respect. Don't get cut off by a rising tide or crushed under a cliff fall (soft cliffs like ours can give way without warning even in fine weather). And don't push your luck by standing on the cliff edge.

Respect Nature

Please don't trample on vegetated shingle, a surprisingly fragile habitat, and steer clear of fenced areas with ground nesting birds in spring. Dogs on leads near these places too please.

This book is published as part of the Touching the Tide Landscape Partnership Scheme, with grateful acknowledgement of support from the Heritage Lottery Fund

Acknowledgements

Moira Chapman and Corinne Cappell (SCDC) – Felixstowe history
Alister Cruikshanks (UKGE Ltd) - Easton Bavents palaeontology
Roger Dixon (GeoSuffolk) – Red Crag stratigraphy
Bill Jenman - editorial
Ann Trewick (Felixstowe Museum) – Felixstowe history

Photograph credits

All photographs © TD Holt-Wilson unless otherwise credited.

Designer: Rolando Ugolini,
Design & Print, Suffolk.
Tel 01473 620600

1 Introduction

The Suffolk coast is a frontier landscape where the North Sea recycles land, a process which has been happening for million of years. While visitors may experience the beauty and tranquillity of this coast, local towns and villages know that the North Sea gives with one hand and takes away with the other. Shingle can bank up in one place while metres of cliff disappear overnight in another. Dynamic sites such as Orford Ness symbolise the balance between creation and destruction played out by land, sea and air along the Suffolk coast, and they represent true wilderness.

Key factors are the ready availability of mud, sand and shingle, and their lack of resistance to the sea. The Suffolk coast has advanced and retreated many times on the western edge of the North Sea, and its soft sediments have continually been rearranged. It is one of the youngest parts of Britain, and has much in common with the Low Countries; we may contrast it with the indelible granites of Lands End or Ben Nevis. In Eocene times (56 to ~34 million years ago) this area was part of a tropical sea; in the Pliocene, from around 5.3 million years ago, it lay under temperate waters. A mere 450,000 years ago it groaned under an ice sheet perhaps half a mile thick. Each period has left a temporary legacy in the rocks of Suffolk: a wealth of sands, gravels, silts, clays and limestones. The result is a complex archive of evidence about past life, including humans.

Suffolk's geology is rich in evidence for natural environmental change, particularly the succession of climatic shifts over the last 4 million years. Today we are entering the

Shifting tidal bars at the mouth of the River Ore, Shingle Street, Hollesley.



Ice Age drama at Bawdsey cliffs: grey mudstones of the London Clay were plastically deformed by the weight of ice sheet which deposited the brown till at the top of the cliff, so squeezing the gravelly sands of the Red Crag into a trough-like structure.

Anthropocene Epoch, when the effects of human activity are becoming widely marked in the geological record, and human-induced climate change is underway. The closest historical analogue we have for the predicted climate of 2100 AD is the mid-Pliocene warm period, about 3 million years ago, when the earliest Red Crag strata were laid down and global mean temperatures were 2 to 3° C higher than today. Looking forward a thousand years to 3000 AD, the closest likely analogue would be





The Eocene sea-bed c.53 million years ago, at Nacton Cliff. Pale bands of mudstone in the London Clay are evidence of volcanic ash falls into the sea. Carbon dioxide from these volcanoes contributed to making the early Eocene a 'greenhouse' world.

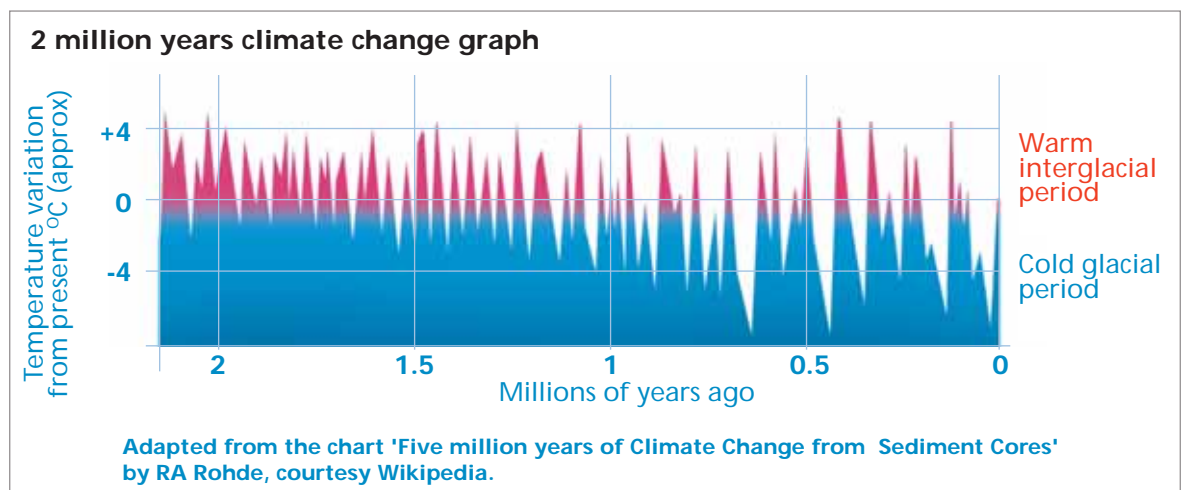
the Earth during the early Eocene Epoch, c.50 million years ago, when the London Clay was being deposited and the world was perhaps 6°C warmer, and there little or no ice at the poles. Suffolk's geology invites us to understand more about the drivers of, and boundaries between, natural and human-generated climate change.

This book is intended as an introductory guide to the coastal geodiversity of Suffolk, the first of its kind. It focuses on the stretch from Pakefield to Felixstowe, taking in a range of publicly accessible geological features and landforms, telling the story of the physical landscape we see today. Many of these places are designated Sites of Special Scientific Interest (SSSI) or County

Geodiversity Sites. Using this book as a starting point, you may go on to discover them in more detail using the resources and references provided. A glossary is provided to give more detail about key words and concepts.

Confronted by the unfamiliar mass of sediments in the crumbling cliffs at Covehithe or the sea-sculpted shingle banks at Bawdsey, visitors may use this book to guide them through visible complexity towards the essentials of what there is to know. In doing so, I hope they will discover some fascinating new places. I also hope they will come to appreciate the dimension of deep time which underlies the world around us: the value of Suffolk's rocks and sediments as windows into the past and a guide to the future, and the temporary nature of everything we see.

The Suffolk coast is a place for contemplation as well as exploration.



2 Origins of the landscape

Suffolk is a land at the frontier of change. The land of Suffolk we see today has been intimately linked with the North Sea for many millions of years. Sea levels have risen and fallen; ice sheets have come and gone: a succession of sands, gravels, silts, clays and limestones have been left behind as evidence, capped by the thin layer of soil we stand on. The land itself is gently sinking, as part of continuing crustal readjustments after the Ice Age. The coastline of the North Sea has always been a point in time, not a fixed line on the map. Only the pace of change has varied.

Eleven thousand years ago, Suffolk was an upland on the edge of a vast plain. Most of what is now the North Sea was undulating lowland covered with lakes and rivers, and a patchwork of birch and pine thickets and herb-rich tundra. Sea levels were some 100 m (300 ft) lower than today, as water was locked up in the great ice sheets. We now call this lost landscape Doggerland, and it was home to a significant seasonal population of human hunter-gatherers; their spear points have been trawled up from the seabed by fishermen many miles out to sea. The land was crossed by herds of woolly mammoth, reindeer and wild horse, and home for birds such as dotterel, ptarmigan and snowy owl. Suffolk's meltwater rivers drained into this hinterland, their valley floors deep below the surface of today's mudflats.

Sea levels began rising about 10,000 years ago as the climate warmed up, driven by variations in the Earth's orbit round the sun. Forests began

thickening and spreading; Ice Age species retreated northwards or became extinct.

Doggerland was progressively submerged by the sea. By 8,500 years ago Britain had become separated from the continent, though what is now the offshore Dogger Bank survived as an island for perhaps another 1500 years.

This period between the end of the Ice and the introduction of farming is known as the Mesolithic period (Middle Stone Age), and our ancestors continued to live by hunting and gathering. Doggerland was the heartland of Mesolithic life in Western Europe. Now our ancestors' encampments lie beneath the present seabed or deep beneath Suffolk's estuaries, swallowed by the rising sea.

By 7,000 years ago the coastline of Suffolk lay some 7 km to the east of its present location, and the land was forested with oak, elm, lime and alder. Some 5,000 years ago, farmers



Mammoth jaw dredged from the North Sea off the Suffolk coast. Photo courtesy Rachel Bynoe, University of Southampton





Progressive sea-level rise in the North Sea basin, between 9600 and 6000 years BP, showing the shrinking of Doggerland and the establishment of a through-connection to the channel after about 7,000 BP. From a display panel at the Landesmuseum Natur Und Mensch at Oldenburg, Germany.

started to clear the forests and divide up the land, marking the start of the Neolithic (New Stone Age).

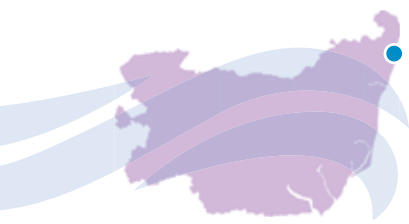
The Suffolk coastline lay much closer to its present day position, and began to resemble the one we know today. Mudflats with tidal channels and creeks slowly spread inland up the lower river valleys, and shingle banks and spits were formed by tidal and long-shore processes.

Slight adjustments in relative sea levels around the North Sea since that time have caused coastal environments to fluctuate. This had big

implications some 1,600 years ago, when rising sea levels in north-west Europe forced coast-dwelling groups of Anglian and Saxon tribal farmers to leave their homelands. They migrated westwards to found Anglo-Saxon England, including the Kingdom of East Anglia.

We are now entering another chapter in the story of Suffolk's evolving coastline. Global warming is predicted to raise sea levels by up to 80 cm (31") by the year 2100, and bring more and more powerful storms. Climate change will reshape Suffolk's coast, making some places uninhabitable but creating opportunities for wildlife habitat creation, as shorelines retreat and coastal marshes move inland.

Humans have a long history of adapting to the challenges of environmental change. The North Sea is a reminder to the people of coastal Suffolk that they must make plans for the future.



3 Pakefield cliffs

Close to the built-up areas of Pakefield and Kessingland, the beach and cliffs offer an escape into a wilderness of sand, sea, wind and tides. The cliffs present a broad, impressive front to the North Sea here; an array of greys, browns, whites and yellows draw the eye.

Visitors will see a dark bed of dense, grey-brown mud at the base of the cliffs south of Lighthouse Gap. This is the Rootlet Bed of the famous Cromer Forest-bed Formation, named after deposits of roughly the same age found in north Norfolk. It tells a story of life on the forested floodplain of a big river during one of the warm periods of the Pleistocene Ice Age. The river was huge, and probably drained much of central England. The mud is compacted, organic-rich sediment containing plant and animal fossils, evidence of life in conditions similar to southern Europe today. On drier ground, the forest was mostly pine and alder, with spruce, birch, oak

and hazel. There were marshy grasslands and reed swamps on the valley floor, with bulrushes and warmth-loving water fern. Animals included familiar species such as wild boar, fallow deer, hippopotamus, lion and spotted hyena; extinct animals included straight-tusked elephant, giant beaver and sabre-toothed cat. We can also add early humans to the fauna.

In 2005, the scientific journal 'Nature' announced that finds of human flint tools at

The brown sediments of the Rootlet Bed can be seen at the base of the cliffs between Pakefield and Kessingland.





© Beverly Curl

Pakefield were the earliest recorded human activity in northern Europe. These included worked flakes and choppers made of black flint. They were found in the Rootlet Bed and overlying river gravel known as the Unio Bed, named after the mussel shells found in it. Magnetic analysis of the sediment along with information derived from the evolution of vole teeth suggested that it could be dated to over 680,000 years ago. The human species was likely to be *Homo heidelbergensis*, thought to be the common ancestor of both modern humans and Neanderthal Man. Heidelbergers in Europe typically averaged about 170cm (5ft 7") in height and were robustly built, with powerful jaws. They made hand-axes and hunted with sharpened wooden spears.

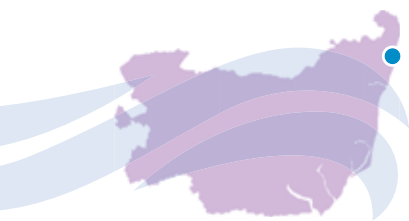
The overlying strata in Pakefield Cliff are evidence for later environmental change. Sea levels rose, depositing a sequence of mostly shallow marine sands and gravels. At the top of the cliff, the solid-looking grey clay containing

A scene at Pakefield during a warm interglacial period 680,000 years ago.

chalk pebbles is a till, laid down beneath a massive ice sheet during the Anglian glaciation about 450,000 years ago. It is known as the Lowestoft Till Formation, a major component of the geology of Suffolk.



The antlers of *Dama roberti*, a newly discovered species of fallow deer, from Pakefield. © Norfolk Museums Service (Norwich Castle Museum and Art Gallery). Photograph by Dr Marzia Breda.



4 Benacre Ness

Benacre Ness is mostly now in Kessingland. Look seawards from the village and you will see a wide expanse of shingle ridges and sandy 'denes'. This is the body of the ness, a broad promontory or foreland made of beach sand and gravel jutting into the sea. Strange to say, it is moving.



As far as we know, Benacre Ness began life in Tudor times near Southwold. Two hundred years ago it was at Covehithe, 4 km (2.5 miles) to the south; a hundred years ago it was at Benacre. It is moving steadily northwards at a rate of about 20 m (65 ft) per year, forming a truly dynamic coastal feature. A hundred years from now, if it continues its present rate of progress, it will probably have reached Pakefield.

'Ness' or 'naze' is a Viking word for a coastal headland. Nesses are found where converging longshore water currents and tidal flows create a complex onshore build-up of shingle. Some nesses, as at Orford, have developed a long spit in the direction of the longshore drift, while others such as Dungeness in Kent, have a stable triangular shape. Scientists disagree how Benacre is being formed. The simplest explanation is that waves and tidal currents build up shingle on its northern side but scour it away from the southern end, thus causing a general northward shift. Sediment is accumulating here while it is being removed from other parts of the coast, as at Covehithe 4 km (2½ miles) to the south. An arrangement of offshore ebb and flood channels and sandbanks may be important for transporting and storing this sediment, which is almost entirely rounded flint pebbles like those found in local cliffs.

The shingle ridges of Kessingland Denes.

The Ness has preserved the shape of its successive phases of growth, rather like the rings in a tree. A series of undulating ridges can be seen running diagonally across the open area of the Denes, marking the positions of successive shingle bars thrown up by north-easterly storms. Tough, salt- and drought-resistant plants such as marram grass, sea kale and sea holly grow in the intervening slacks, while the ridges remain bare. This fragile habitat is one of the reasons the Ness is designated as part of the Pakefield to Easton Bavents SSSI.

The Ness is home to Suffolk's largest regular colony of breeding little terns, please do not approach any fenced areas and keep dogs well away.



Benacre Ness on a quiet day. During storm surges the beach front may temporarily retreat as much as 35 m (115 ft).

5 Benacre Broad

Benacre Broad is one of the best places in Britain to see coastal erosion at work, and also one of the most beautiful. The Broad and nearby cliffs are eroding at a rate of over 3 m (10 ft) per year, but it has been known for 25 m (75 ft) of land to disappear overnight. The effects are dramatically visible at Boathouse Covert and Long Covert, where the trees on the cliff top are undermined with each new storm, and their sea-bleached and sand-blasted remains can be seen on the beach.

The Broad itself is a lagoon of brackish water fringed by woods and reedbeds, and has a strong wilderness feel. It is separated from the sea by a shingle bar, which – like the cliffs – is steadily retreating inland, and gives the Broad its fragile identity. On occasions this barrier is breached and sea water floods into the Broad; the water flows out again when the tide falls, turning it into a forlorn expanse of mud. Moving shingle soon restores the breach, and the lagoon can begin to reform. The shingle bar is usually roped off during the spring, to encourage species such as ringed plover to breed, and there is a small public hide overlooking the Broad. The area is part of the Benacre National Nature Reserve.



Norwich Crag cliffs and fallen birch trees at Boathouse Covert.

The cliffs at Benacre are easily-eroded sands and clays of the Norwich Crag Formation, deposited in shallow marine conditions about 1.8 million years ago. (For more information see the Covehithe and Easton Bavents pages.)

The area of Benacre Broad was formerly a coastal inlet; it became closed off from the sea

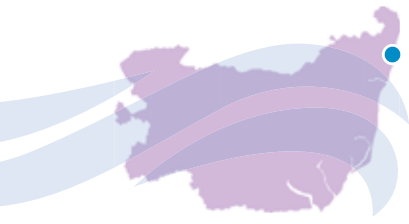


Benacre Broad and blocks of eroded peat left by washover from a storm.

about 300 years ago by the growth of a shingle barrier. The valley here is underlain by layers of freshwater peat and marine alluvium. These beds extend offshore and they are being eroded as the coast rolls back. This is the origin of the lumps of compacted peat scattered on the beach, some of which may be several thousand years old.



Erosion is rolling back the coastline at Benacre Broad. Trees succumb to sand-blasting and sea spray as the shingle bar retreats landwards.



6 Covehithe

Covehithe is famous for losing land to the sea; it is one of the fastest eroding stretches of coastline in Britain. Every year it loses another four to six metres of cliff. This process has been going on for centuries. In the 1780s, the coastline lay over 1 km (0.6 miles) further east.

There was a sheltered inlet of some kind here in the Middle Ages, with an area called North Hals ('northern neck of land'), probably referring to a now-vanished spit or promontory. There was also evidently a cove (creek) with a hythe (landing place). The size of St Andrew's church reminds us of the former wealth and ambition of its builder.

Covehithe's crumbling cliffs are a feast of geological features; the sediments show an intricate variety of colours, shapes and textures. The best time to see them is in winter and spring, when storms have freshened up the exposures and scoured the beach. The most geologically significant strata belong to the Norwich Crag Formation. Pale, blue-grey clays with rusty mottling form a distinctive platform



Road to nowhere. Visitors may see old wartime drain pipes, electricity cables and bundles of barbed wire eroding out of the cliffs. Recently a concrete pillbox was swallowed by the sea.

Reconstruction of a local tundra scene during the Barentian cold period.

© Beverly Curl



feature at beach level. These are the remains of intertidal mudflats about 1.8 million years old, and contain desiccation cracks and fossil worm burrows. Evidence from pollen and marine microfossils show that the climate was cold, and the environment was grassy heathland with sparse tree cover similar to parts of northern Scandinavia today. This time period is known as the Baventian, named after similar deposits at nearby Easton Bavents. Fossil shells may be found in the cliffs or even mingled with modern shells washed up on the beach; they include species now only found in Arctic regions.

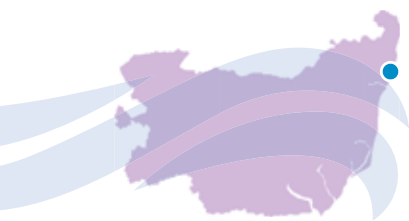
The main part of the cliff is a complex of sands and gravels. The lowest layers belong to the Westleton Beds of the Norwich Crag, and were deposited in offshore sand and pebble banks. Quartz-rich marine sands and gravels of the Wroxham Crag Formation are found higher up. Brown glacial clays of the Lowestoft Formation of Anglian age cap the cliff, and were deposited beneath an ice sheet, perhaps 450,000 years ago. The sequence illustrates a general cooling of the climate in the early Pleistocene period. Tapering ice wedge casts caused by downward-growing fingers of ground ice can sometimes be seen in the sands and gravels.



Sands, gravels and clays of the Norwich Crag formation exposed in Covehithe Cliffs. Similar deposits are forming offshore at the present day.

Eroding cliffs at Covehithe, April 2006. Clay beds of Baventian age are exposed on the beach in the middle distance.





7 Easton Bavents

Easton Bavents cliff is a short walk north along the coast from Southwold. As in the nearby parish of Covehithe, the cliffs are rapidly eroding, and buildings on the cliff top may have only a few years before they become rubble on the beach.

Easton Bavents is one of the most important sites in Britain for studying the environmental history of the early Pleistocene period, about 1.8 million years ago; it is part of the Pakefield to Easton Bavents SSSI. The key strata here belong to the Norwich Crag Formation. Marine sands containing fossil shells and mammal bones are found at beach level or just beneath it, and are occasionally exposed by winter storms. Blue-grey clays can be seen in the foot of the cliff; these were laid down on intertidal mudflats during a period named the Baventian. Research has shown that the landscape of the time was open grassy heathland with a few hardy trees; the climate was cold, but not glacial. As at



Easton Broad, showing the beach bar reinforced with bulldozed shingle, 2006. The eroding cliff at Easton Wood is in the background.

The Norwich Crag, showing a darker horizon of Baventian clay at the foot of the cliff, overlain by sands and gravels of the Westleton Beds. A mass of dumped clay spoil can be seen on the left.



Covehithe, these clays are overlain by sands and gravels of the Westleton Beds and Wroxham Crag, representing offshore sand and pebble banks similar to those forming along the coast today. Brown glacial till deposits of the Lowestoft Formation cap the cliff.

Easton Broad lies a short distance up the coast. It is composed of brackish water floored by peat deposits and separated from the sea by a shingle bar which the Environment Agency artificially maintains using bulldozers, so preserving the lagoon. The beach near Easton Wood is the best place to see the fossiliferous marine sands at the base of the Norwich Crag. These date from a temperate climatic period known as the Antian-Bramertonian – perhaps two million years ago – and contain a wealth of fossil molluscan shells and the remains of animals washed out to sea, including falconer's deer, giant beaver, mastodon, robust horse and southern elephant, all now extinct.

Sand-martins nesting in easily-excavated sandy horizons in Easton Bavents cliff. A mass of dumped clay spoil can be seen in the foreground.



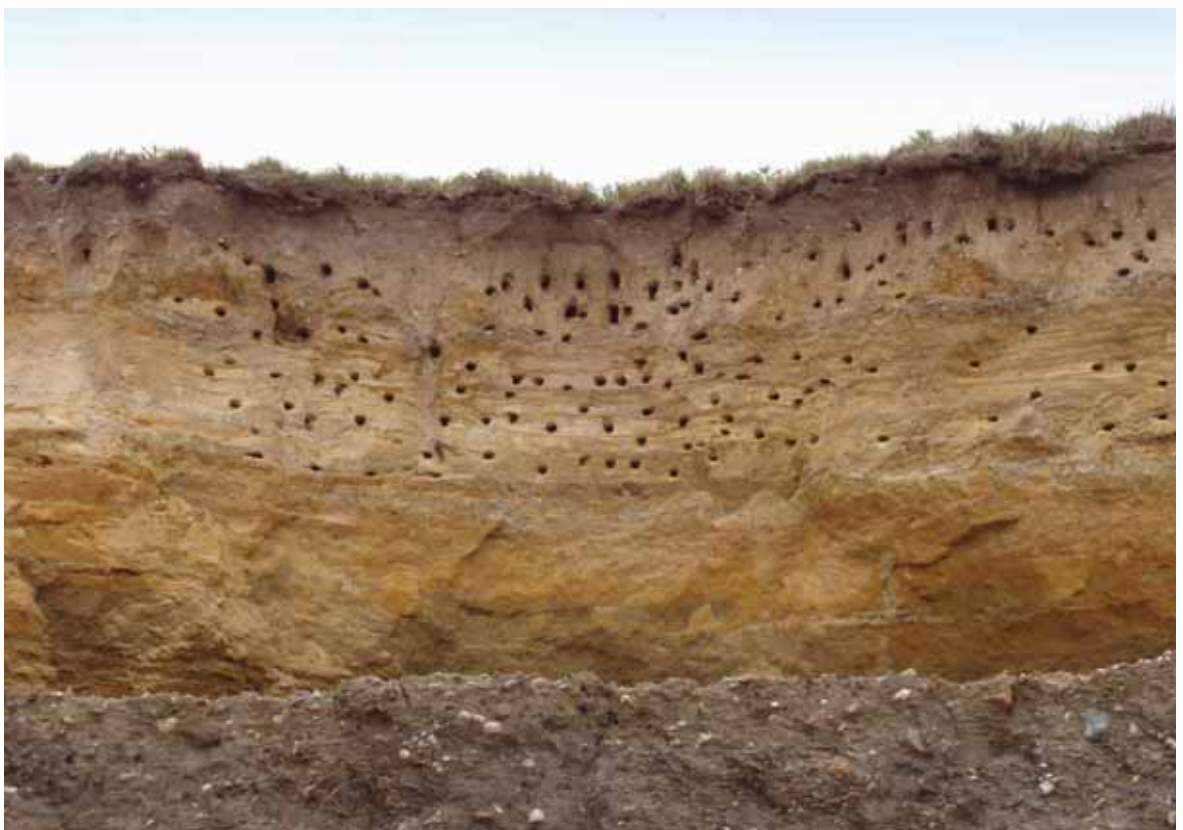
© A. & A. Kennis,
www.kenniskennis.com

Alachtherium cretsii, an extinct species of walrus. A fossil example of its jawbone has been found at Easton Bavents cliff



Credit: Andy Robins, UKGE Ltd

An antler of a large, extinct species of deer Eucladoceros falconeri.



8 Southwold

The seaside resort of Southwold has a grandstand view of the North Sea, resting on an upstanding knoll of gravelly Norwich Crag of the Westleton Beds. These marine gravels were laid down about 1.9 million years ago, and can be seen in old pits near the water tower on Southwold Common.

The town is surrounded by the marshes of the Blyth estuary to the south and Buss Creek to the north, and was probably an island in Roman times when sea levels were higher. Further back in time, someone looking east 10,000 years ago would have seen a broad plain stretching into the hazy distance, with no sea in sight. Southwold then had a view over Doggerland.



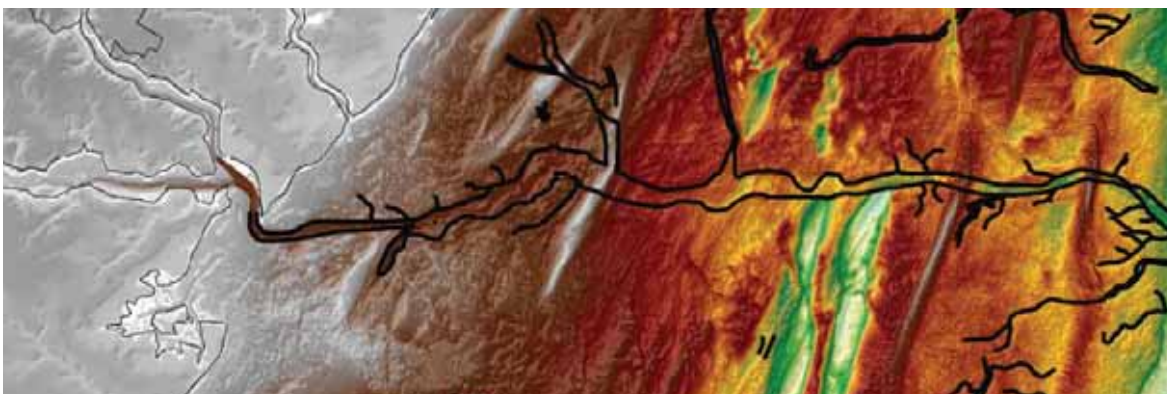
Trawled finds from the bed of the North Sea, including a mammoth tooth (below, centre). Photo courtesy Rachel Bynoe, University of Southampton

At the height of the last glacial period, the Devensian, an ice sheet reached north Norfolk, sea levels were over 100 m (330 ft) lower than present, and the North Sea basin was a wind-swept tundra landscape larger than the modern

UK. Over the years, fishermen up and down the Suffolk coast have trawled up animal bones and teeth in their nets. Some of these have been identified as cold-adapted Devensian species, including woolly mammoth and rhinoceros, wild horse, steppe bison and musk ox.

As climate warmed up after the Ice Age, sea levels rose through the Holocene period, gradually inundating Doggerland. The forested landscape at the heart of Mesolithic Europe gave way to tidal flats similar to The Wash today, and later to open sea. The Mesolithic population of hunters and gatherers progressively retreated to drier ground. Suffolk's rivers flowing into Doggerland became shorter as the shoreline retreated; their courses can be tracked offshore using geological remote sensing techniques. Investigations have revealed evidence for an early Holocene land surface about 5 km (3 miles) off Southwold. Buried tidal flat deposits here mark an offshore extension of the estuary of the early River Blyth, some 6,500 years ago. Onshore, borehole samples have shown that the bed of this river once flowed 14 m (46 ft) below present day Southwold Harbour.

The offshore submerged course of the early Holocene river Stour / Orwell, compiled using bathymetric and seismic data. Image courtesy Relict Palaeo-landscapes of the Thames Estuary Project, University of Southampton.



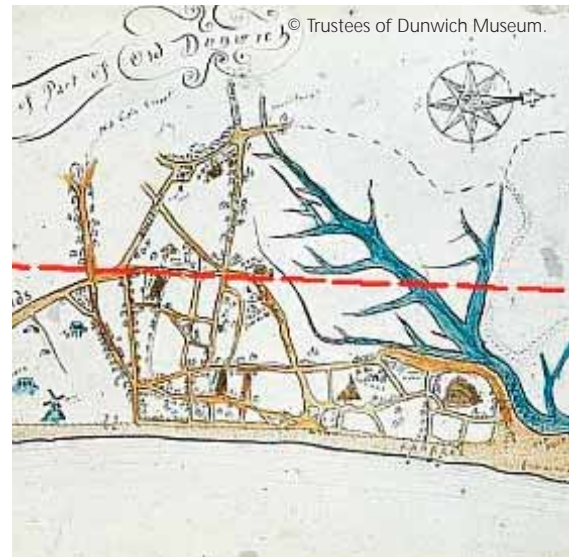
9 Dunwich

Dunwich today is a small, tranquil village overlooking the sea and a wide expanse of grazing marshes fronted by a barrier beach. In the early Middle Ages it was one of the most important North Sea trading ports.

There was an estuary where Dingle Marshes now lie, and ships could anchor in the lee of a shingle spit known as Kingsholm. However a series of storms in the late 13th and early 14th centuries rearranged the coastal geography, blocking the entrance to the port and progressively destroying wide areas of the city.

Since then the coast has retreated at an average rate of 1 m (3.3 ft) per year, although the rate has slowed up over the last 50 years; shifting offshore sand banks may be part of the explanation. Today, geotextile bolsters and gabions buried in the beach are helping to stabilise the cliffs and so protect what is left of Dunwich. A diorama model at Dunwich Museum graphically explains the erosion story, and the last buttress from the tower of All Saints Church, now vanished, has been re-erected in St James's churchyard; masonry from the lost city can be seen recycled in local walls. Recently, the University of Southampton has used remote surveying techniques to map the city's underwater extent.

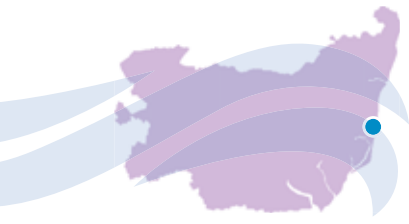
Visitors wishing to see remote prehistory should visit the cliffs at Dunwich Heath. Here the flint-rich Westleton Beds of the Norwich Crag Formation are dramatically displayed. About 1.8 million years ago a complex of sand and gravel bodies were laid down in a wave-dominated, gravelly shoreface environment similar to the present day. In places broad, saucer-shaped gravel bodies can be seen cutting into underlying beds; these are evidence of underwater rip channels transporting beach material offshore. The coastline was evidently nearby at the time. It is also worth a trip inland to see the Westleton Beds displayed at St Helena's Pit in Dunwich Forest or in the old pits on Westleton Heath.



An artist's impression of a map of old Dunwich 1587, from a lantern slide by AR Fisk, c.1910. The old harbour has been blocked by shingle. The red dotted line shows the line of the present coast.



The Westleton Beds at Dunwich Heath cliffs



10 Thorpeness

The picturesque resort village of Thorpeness was developed as Britain's first purpose built holiday resort in the years before the First World War. Since then the eroding beach front and cliffs have been a growing problem, and several techniques have been used to try to halt or at least slow the rate of erosion.

Despite these efforts, the low, sandy cliffs north of the village will continue to erode and naturally provide sediment for coastal processes - and incidentally fresh information for geologists.



Thorpeness cliffs looking north, showing pale sands of the Norwich Crag beneath orange outwash gravels and glacial clays.

The cliffs contain interesting features. Where not obscured by slumped material, a sequence of pale and dark yellow banded sands can be seen; these are shallow marine deposits from some two million years ago. There is some debate about the climatic conditions under which they were laid down. Fossil shells found in this same unit at nearby Aldringham Common suggest the environment was a cool, northerly type, however fossil pollen suggests warmer temperate conditions, with evidence for oak, alder and hornbeam forest onshore.



A fossil-rich block of Coralline Crag on the beach. It includes reef-building bryozoans ('corallines') after which the rock gets its name.

By contrast, grey and brown clays at the top of the cliff were deposited by the Anglian ice sheet about 450,000 years ago, in cold, glacial conditions. They are underlain by overlain by rusty-brown glacial meltwater gravels forming a broad channel feature which cuts into the Crag beneath. Intricate looping patterns can be seen in the clay layer, caused by frost disturbance in the subsoil during the Devensian glacial period, perhaps 16,000 years ago.

Northwards towards Sizewell, the beach extends outwards into a broad promontory of shingle ridges. This is Thorpe Ness, one of smallest of the coastal ness landforms in Suffolk. It may partly be formed on an offshore reef of Coralline Crag, as lumps of this honey-coloured, fossil-rich rock are scattered on the beach, though no outcrop is locally visible. The beach has been designated as part of the Leiston to Aldeburgh SSSI as an example of vegetated shingle; horned poppy, sea spurge and sea kale are growing here. The beach grades into low cliffs capped by dunes of windblown sand with marram grass.



Thorpe Ness, showing shingle beach bars backed by sand dunes and a line of low cliffs.

11 Aldeburgh

The cultivated seaside resort of Aldeburgh is a quiet place, except when swept by storms from the North Sea. Despite first appearances, coastal erosion is part of the Aldeburgh story.

Five hundred years ago there were as many as six streets lying on the seaward side of the town; these have now disappeared, as has the fishing hamlet of Slaughden a mile to the south. In Tudor times, the Moot Hall stood in the middle of a broad Market Place; today it stands close to the sea front, looking distinctly vulnerable. In future, Aldeburgh will have to deal with rising sea levels as well as periodic storms.



© British Geological Survey P236203

Storm damage to cottages at Crag Path, 1898.

Aldeburgh is sited on a low rise, underlain by a ridge of economically useful Coralline Crag and Norwich Crag bedrock, once exploited in many local quarries; three of them have been designated as SSSIs for their geological importance. The Coralline Crag yielded soft, lime-rich sandstone used for building and making up roads, and the Norwich Crag yielded clays for making the characteristic red Aldeburgh bricks. These can be seen in many parts of the town, often framing panels of flint cobbles from the beach, both knapped and naturally rounded types.

The River Alde describes a wide meander round Aldeburgh Marshes before turning abruptly southwards towards Orford. Standing at Slaughden Quay, the river is separated from the sea by less than 100 m (330 ft) of ground; it is not difficult to imagine it may once have flowed eastwards. Research has shown that there is a



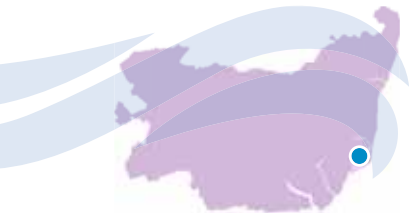
© British Geological Survey P205645.

Aldeburgh Brick Pit, 1931, showing beds of the Chillesford Clay Member (Norwich Crag) exploited for brickearth. Beds of glacial sand and gravel are lying on top.

buried valley here, carved in the Crag bedrock some 14 m (45ft) below sea level. Its easterly course can be traced offshore into the North Sea basin for over 7 km (4 miles), and at Slaughden it is floored with peat deposits dating back about 8,500 years, to Mesolithic times. As sea levels rose, the coastline retreated landwards to a position about 1.6 km (1 mile) offshore, perhaps some 3,000 years ago during the later Bronze Age. Under the influence of southerly longshore drift, a shingle spit then began growing across the mouth of the Alde, diverting the river southwards. This is the origin of the spit of Orford Ness, which has now reached some 16 km (10 miles) long.



Coastal defences: the Martello Tower at Slaughden is protected by rock armour and groynes. The beach is regularly recharged by bulldozers.



12 Orford Ness and Shingle Street

Orford Ness is one of the most interesting coastal landforms in Britain. It is a complex shingle feature comprising a storm beach, a ness and a spit, the longest in Europe.

The whole system is 10 miles (16 km) long, and extends from Aldeburgh as far as Shingle Street. The site has to be visited to be fully appreciated, though aerial photographs convey something of its strange beauty. Public access is carefully managed by the National Trust via ferry access from Orford. The whole site is part of the Alde-Ore SSSI. The site is important for its value for wildlife as well as geodiversity: it is one of the best examples of vegetated shingle habitat in Europe.

Orford Ness is the largest of the Suffolk nesses. Its origins are linked to a coastal spit which began developing in the Aldeburgh area about 7,000 years ago. The spit gradually extended southwards by longshore drift. By the 12th century it had reached the port of Orford, and

had reached its present extent by the 18th century. The Ness has formed at the point where the Suffolk coast changes alignment, from roughly north/south to north-east/south-west. Instead of rounding the 'corner' of the coastline at this point, the developing spit continued building southwards, and the result is the cape or promontory we see today.

Extensive saltmarshes (the King's and Lantern Marshes) developed on the landward side of the barrier; some were reclaimed for grazing land in the early Middle Ages.

Parallel shingle ridges known as 'fulls' mark successive growth stages of the Ness. These may be many hundreds of years old. The circular shape in the foreground is the remains of a 20th century military installation.





The spit at Shingle Street ness at low tide, October 2013.

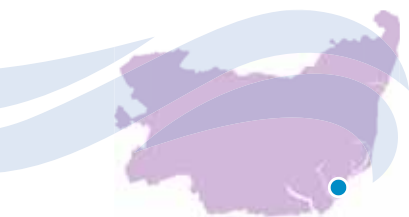
Each ridge marks a single storm event. The striped vegetation shows the way that storm waves breaking on a beach sort shingle. The smaller lighter pebbles are thrown into a ridge, and this finer material allows stripes of vegetation to develop over time. The smaller proportion of coarser, heavier, pebbles are thrown further and accumulate in the trough behind. This sorting explains why, contrary to expectations, the vegetation grows on the apparently more exposed ridges. The intimate geomorphology and ecology is very fragile; once the pebbles are mixed, by tramping feet or passing vehicles, the distinctive vegetation pattern and ridge structures are lost for ever.

The southern tip of the Orford spit lies at North Weir Point, near Shingle Street, where the River Alde estuary meets the sea. The landforms here are a beautiful illustration of coastal processes at work. The tip changes shape from year to year, according to variations in the supply of shingle and the effect of storms; sometimes it partly breaks up. The mouth of the estuary is a complex of shifting shoals and channels which



The Stony Ditch, a tidal channel draining reclaimed saltmarshes on the lee side of Orford Ness. The distinctive shapes of Cold War 'pagodas' can be seen on the horizon, built for testing explosive detonators.

are regularly rearranged by the tides. Sediment also builds up on the landward side of the estuary, where a small ness at Shingle Street is developing a spit of its own.



13 East Lane, Bawdsey

The tough, cylindrical walls of Bawdsey's Martello Tower were built to defend Suffolk against seaborne attack in the Napoleonic Wars. If it were not for hard rock defences on the beach the Tower would already have fallen into the sea.

In recent years, the soft coastal sands and clays at East Lane beach have been rapidly eroding; for example some 17 m (56 ft) of cliff was lost here in 2005. The Tower is standing on a solidly defended promontory, while the adjacent beach to the south has been left to bear the brunt of North Sea storms. This exposes some interesting geology.



A bay has developed in undefended Red Crag cliffs at Bawdsey.

The London Clay is best seen at low tide, where the blue-grey, silty clay forms a wave-cut platform on the foreshore. It was deposited in a warm sea in tropical conditions during the Eocene period, about 50 million years ago, when Britain lay much closer to the Equator. The water is thought to have been between 200 and 500 m (656 and 1640 ft) deep. Pieces of fossil wood can readily be found, presumably washed out to sea from forests and mangrove swamps on the Eocene mainland. Diligent searching and sieving will reveal fossil fish, bird and reptile bones and teeth in the clay, and also plant remains including fruits and seeds.

The London Clay also extends up into the cliff, where it is overlain by fossil-rich sands and gravels of the Red Crag. The Crag was deposited on an eroded seabed of London Clay about 2.55 million years ago. It contains abundant fossil



A specimen of fossil wood embedded in London Clay.

shells and occasionally mammal remains such as whale bones and even rhinoceros teeth. There are many brown, phosphate-rich mudstone pebbles; these were known as coprolites, and exploited commercially in Suffolk in the 19th century as a source of fertiliser. The grey-brown, sandy deposit at the top of the cliff is a glacial till, deposited by the Anglian ice sheet about 450,000 years ago. At some time during the Ice Age the boundary between the Crag and the London Clay was distorted into a series of spectacular undulations, caused by ground-ice activity in the subsoil. See photo on page 3.



The Red Crag basement bed, showing flints and brown, phosphate-rich mudstone pebbles.

14 Bawdsey

The Deben estuary meets the sea at Bawdsey. Powerful longshore and estuarine currents come together, and the result is Bawdsey Bar, a coastal spit which shifts shape constantly according to fluctuations in water energy and sediment supply.

The shingle banks are almost entirely flint pebbles, but fragments of mineralised bones and teeth may sometimes be found in it, also rare 'boxstones'. These are pieces of brown sandstone often containing the cast of a fossil of Miocene age; the best place to see them is probably Ipswich Museum. As no Miocene beds have yet been found in Suffolk, the 'boxstones' probably represent the broken up remnants of such a bed incorporated into the basal strata of the Red Crag or Coralline Crag. Dark grey lumps of London Clay derived from elsewhere on the coast may also be found; they often contain round holes where bored by piddock shells.

Red Crag features in the cliffs east of Bawdsey Manor. This is the largest exposure of these beds in Britain, and it has been designated as a SSSI. Rusty coloured, fossil-rich sandstones can be seen in the upper half of the cliff, with their surface sculpted by wind, rain and sea spray. The beds show a slanting structure known as cross-bedding, indicating they were deposited as

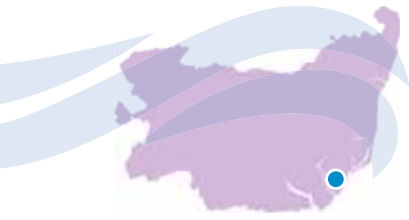
submarine dunes or sand-waves; their size suggests a water depth of 20 to 30 m (65 to 98 ft), and their orientation suggests a current flow direction towards the south-west, which is similar to the Suffolk coast today. The beds were deposited about 2.55 million years ago.



Red Crag cliffs, showing cross-bedding structures. Introduced holm oak, tamarisk and silver ragwort give the cliffs a Mediterranean aspect.

Bawdsey Bar at low tide, October 2013.





15 Sutton Knoll

Rockhall Wood caps the low hill known as Sutton Knoll. Four old Crag quarries cluster around its flanks, providing geologists with a window into the late Pliocene Suffolk of around 2 to 3 million years ago. Information panels have been erected by the GeoSuffolk group beside the footpath which passes the site.

Sutton Knoll has been researched since the 1830s when the pioneering geologist Charles Lyell visited, and it is now a geological SSSI. This is a key site for understanding the Coralline Crag. Quarries show a succession of beds, from shelly, silty sands up into cross-bedded, sandy limestone. Fossil pollen from the upper unit reveals information about local forests, about 3.4 million years ago. Our familiar pine, spruce, oak and elm trees were present, but also others typical of warmer conditions in the late Caenozoic era, including hemlock, umbrella pine, sweet gum and wingnut. GeoSuffolk has created a small arboretum of species from Pliocene genera on the site.

The Coralline Crag is an isolated outcrop surrounded by Red Crag: it formed an island in the sea in Red Crag times, some 2.55 million years ago. Shelly Red Crag sands and gravels are banked up against the remains of a degraded



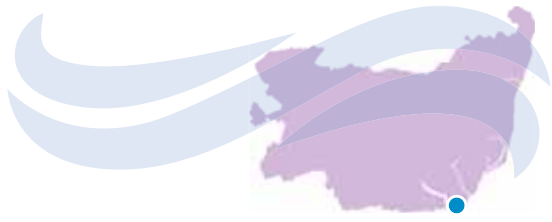
A Coralline Crag exposure, showing sand martin holes in sandy limestones of the Sudbourne Member.

cliff of Coralline Crag resting on London Clay. Fossil shells have been found in their original life positions among the boulders at the foot of the cliff. Mussels and barnacles were attached to rocks, with clams, whelks and winkles living between them, while piddocks bored into the soft clay at the cliff base. Thus Sutton Knoll offers a unique opportunity to study aspects of marine ecology around a Pliocene island.



© Roger Dixon: artist Louis Wood.

'Suttona Antiquior' - an artist's impression of the 'Pliocene Island' at Sutton Knoll.



16 Felixstowe

The Edwardian holiday resort of Felixstowe owes much of its charm to the Red Crag hill on which it stands overlooking the sea. The seaward side has been steepened by erosion over many centuries to form a cliff-line, used to grand effect by hotels and also the Seafront Gardens, with their rockeries and terraced paths.

Natural springs are an important feature here: water percolates down through the sandy Crag until it reaches an underlying layer of impervious London Clay and emerges to feed ornamental pools and cascades. The iron-rich water had reputed health-giving properties, so Felixstowe gained fame as a fashionable spa in Edwardian times.

The water also tends to make local slopes unstable and prone to landslips, as it lubricates

Red Crag outcropping in East Cliff, c.1905, before the Seafront Gardens and Spa Pavilion were constructed.

the upper surface of the London Clay. This can be seen at Fagbury Cliff overlooking the Container Port, where tree growth has been disturbed by subsidence.

The Red Crag contributed to the town's prosperity in the mid Victorian period through the brown phosphatic nodules known as 'coprolites'. Ground up, these were used as fertiliser, and prompted a mini 'gold rush' in local parishes. Interestingly, the nodules contain high levels of uranium, which is why Felixstowe is the hot-spot for radioactive radon gas in Suffolk.

Image courtesy Suffolk Coastal District Council.



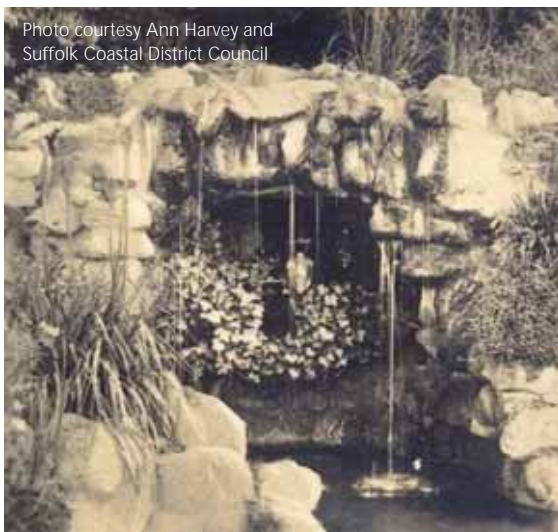


Photo courtesy Ann Harvey and Suffolk Coastal District Council

The Dripping Well, as seen during the heyday of the Seafront Gardens in the 1930s.

Landguard Point is the southernmost tip of Suffolk, an elongated mass of sand and shingle banked against a concrete breakwater. It is part of a SSSI designated for the value of its vegetated shingle habitat. Two hundred years ago it was an active coastal spit, building out where the tidal waters of the Orwell and Stour estuaries met the southward longshore coastal current, with saltmarshes developed in its lee and offshore shingle banks at its tip. The marshes are now reclaimed and underlie Britain's biggest container shipping port, while the dynamics of the spit have been tamed by the breakwater.

The London Clay is underlain by the Harwich Formation which contains bands of lime-rich cementstone 'septaria'. Slabs of this rock may be seen washed up on the lower beach north of Cobbold Point. Two centuries ago, it was extracted from local cliffs and estuary shores and even dredged up from the seabed as a raw material for making 'Roman cement'.

Landguard beach viewed from the breakwater. Studies have shown that sediment moves southwards down the coast as far as this point, then moves offshore rather than continuing across the mouth of Harwich Harbour into Essex.



Glossary

Anglian

A major glacial period during the middle Pleistocene Epoch, about 450,000 years ago. Suffolk was covered by an ice sheet from the north-west which extended as far south as Hornchurch in Essex. When it retreated it left behind thick deposits of till or 'boulder clay', and also beds of outwash sands and gravels deposited by meltwater.

Antian-Bramertonian

A stage (time period) during the early Pleistocene Epoch, about 2 million years ago. Originally identified as two separate temperate climatic stages (Antian and Bramertonian) on the basis of their fossil pollen record, the two are now considered to represent one single period. Sediments of the Norwich Crag Formation were being deposited at this time.

Baventian

A stage (time period) during the early Pleistocene Epoch, about 1.85 million years ago. Conditions in Suffolk were probably similar to parts of the Arctic today, with an environment of pine and birch forest, heathland and peat bog. It is named after the deposits in the cliff at Easton Bavents.

Bytham River

A major river which is thought to have flowed north-eastwards across Suffolk in early Pleistocene times, between about 0.85 and 0.5 million years ago. Its sediments are characterised by a distinctive suite of quartz-rich pebbles derived from the Midlands.

Bryozoan

Bryozoa (literally 'moss animals') or polyzoa are colonial filter-feeding invertebrates. They have an encrusting or a branching mode of life. They are a notable component of the Coralline Crag beds of Suffolk, where they represent the vestiges of a bryozoan fauna which was formerly more widespread before the onset of cooler climatic conditions in late Pliocene times.

Caenozoic

The Era which follows that of the Mesozoic, including our own Holocene Epoch. It is characterised by the dominance of grasses, birds and mammals.

Coprolites

Literally, 'fossilised animal droppings', this name was erroneously given in the 19th century to the brown phosphate-rich nodules found in the lowermost beds of Crag strata in Suffolk. Ground up and spread on the land, they made an effective 'superphosphate' in the days before artificial fertilisers. The credit for this discovery goes to Professor John Henslow, from Hitcham in Suffolk, who visited Felixstowe in the 1840s, and saw the potential of the nodules. The industry had become uneconomic by the early 20th century.

Coralline Crag

A formation of sandy, fossiliferous, marine limestones found only in south-east Suffolk. The name 'Coralline' is derived from their notable content of bryozoan (polyzoan) fossils, initially mistaken for corals. These beds were laid down between about 4.0 and 3.6 million years ago. It is thought that sea water temperatures then were slightly warmer than today.

Crag

A traditional name given to the fossil-rich, sandy beds which outcrop in the coastal parts of Suffolk. A high lime content made these sediments useful for marling the fields to 'sweeten' sandy soils, hence the many crag pits found in the Suffolk Sandlings. The name has been adopted by geologists to describe a sequence of beds of Pliocene and early Pleistocene age outcropping in East Anglia: the Coralline, Red and Norwich Crag.

Cromer Forest-bed

A formation of freshwater and marine sediments found in Suffolk and Norfolk, deposited between about 1.7 and 0.5 million years ago.

The freshwater deposits have notably yielded evidence of fossil mammals such as the West Runton Elephant and the earliest human occupation of northern-Europe, as at Happisburgh and Pakefield.

Cross-bedding

A sedimentary structure characterised by inclined bedding planes within a generally horizontal rock unit, caused by the progressive deposition of sediment at the front of dune or ripple bed forms.

Devensian

A stage (time period) of the late Pleistocene Epoch, between about 115,000 and 10,000 years ago. It is a predominantly cold period culminating in a major glaciation about 20,000 years ago when ice sheets reached north Norfolk, and Suffolk was part of the tundra zone.

Eocene

An Epoch of the early Caenozoic Era between about 56 and 35 million years ago. Due to continental drift, Britain lay close to the Equator and had a tropical climate; the land area where Suffolk now is lay beneath the sea.

Geodiversity

The natural range (diversity) of geological features (rocks, minerals, fossils, structures), geomorphological features (landforms and processes) and soil and water features that make up the landscape. It forms the non-biological foundation for all life, including human.

Harwich Formation

A formation of sandy and silty clays and clay-mudstones ('cementstones') of early Eocene age, deposited in a tropical sea about 55 million years old. It contains layers of volcanic ash, thought to be derived from volcanoes in the region of Denmark, of which the most notable is the Harwich Stone Band; this historically provided material for building stone and cement making

in Suffolk. It is difficult to distinguish this formation from the overlying London Clay Formation; both contain stone bands.

Holocene

An Epoch of the late Caenozoic Era and the Quaternary Period, between about 10,000 years ago to the present day. Its beginning corresponds with the onset of warming conditions at the end of the last glacial period (the Devensian stage). It is characterised by increasing human impacts on the Earth's systems. There is current debate about whether we have now entered a new Epoch, the Anthropocene, characterised by visible impacts of human life in the geological record.

Jurassic

An Epoch of the Mesozoic Era between about 201 and 145 million years ago, during which dinosaurs were the dominant group of animals and the first birds evolved. The area of Suffolk was on the edge of a land area known as the London-Brabant Massif, about 30° north of the Equator (the same latitude as Cairo today).

Kesgrave Formation

A formation of sands and gravels outcropping in the south-eastern part of Suffolk, laid down by the ancestral River Thames between about 1.7 and 0.5 million years ago. Its sediments are characterised by a distinctive suite of quartz-rich pebbles derived from western Britain.

London Clay Formation

A formation of marine clays and clay-mudstones of Eocene age, deposited in tropical seas about 53 million years ago. The London Clay outcrops on the coast and along the sides of valleys in south-east Suffolk. The clays were used here for brick-making. It is difficult to distinguish this formation from the underlying Harwich Formation; both contain stone bands, though these are thinner and sparser in the London Clay.

Longshore drift

The process by which sediments are moved along a shoreline by wave action. In general terms, waves, pushed by the prevailing wind, tend to wash material up a beach at an angle to the shore, but wash it back down again perpendicularly. The net effect is that each wave moves some sediment along the beach in a zigzag fashion. Over time, or in a major storm, very large amounts of material can be moved.

Lowestoft Formation

A suite of glacial tills, silts, sands and gravels of middle Pleistocene age deposited by an ice sheet from the north-west during the Anglian glaciation, about 450,000 years ago. It underlies much of Suffolk, Norfolk and Essex, notably forming the 'boulder clay' plateau landscape.

Mastodon

The popular name for a group of elephant-like animals called the Gomphotheres. They had distinctive mammilated teeth, and either one or two pairs of tusks. Mastodon specimens in Suffolk have only been found in the Craggs.

Mesolithic

A period in prehistory spanning the time between the Palaeolithic and the Neolithic. It was characterised by a mobile human lifestyle based on hunting and gathering, and lasted in Suffolk from about 10,000 to 6,500 years ago.

Miocene

An Epoch of the Cenozoic Era between about 23 and 5 million years ago. It is only represented in Suffolk by material reworked into later Crag deposits.

Neogene

The second Period in the Cenozoic Era, spanning from the beginning of the Miocene to the beginning of the Quaternary (23 to 2.5 million years ago).

Ness

The Saxon term for a promontory, now incorporated into modern place names.

Norwich Crag

A formation of marine sands, silts and clays of early Pleistocene age, between about 2.4 and 1.8 million years old, outcropping in eastern Suffolk and Norfolk.

Palaeocene

An Epoch of the early Cenozoic Era between about 64 and 56 million years ago. Due to continental drift, Britain lay close to the Equator and had a tropical climate; the land area where Suffolk now is lay beneath the sea. The Palaeocene began with the mass extinction event which concluded the Age of the Dinosaurs. It ended with a Thermal Maximum event, characterised by a hotter planet with unstable climate, possibly related to increased volcanic activity which released extra carbon dioxide into the atmosphere.

Pliocene

An Epoch in the late Cenozoic Era, between about 5 and 2.5 million years ago. The global average temperature in the mid-Pliocene was 2–3 °C higher than today, and average sea levels were 25 m (82 ft) higher. Later, the tectonic closure of the Isthmus of Panama led to cooler waters in the North Atlantic, while shifts in global climate led to the onset of colder conditions in the northern hemisphere.

Pleistocene

An Epoch in the Quaternary Period, between about 2.5 million and 10,000 years ago. Its ending corresponds with the end of the last glacial period (the Devensian stage). It is characterised by cyclical shifts in the Earth's climate between cold (glacial) and warm (interglacial) periods, driven by variations in planetary orbit round the sun.

Pyritisation

A mineralisation process whereby organic materials in wet sediment become replaced by iron pyrites (iron sulphide) through bacterial action.

Quaternary

The third Period in the Caenozoic Era, spanning from the beginning of Pleistocene to the present day (2.5 million years ago onwards), including the Holocene.

Red Crag

A formation of fossil-rich, marine sands and silts of late Pliocene and early Pleistocene age, between about 2.9 and 2.5 million years old, outcropping in eastern Suffolk and parts of Essex and Hertfordshire. It is called 'red' after the high content of iron oxide in the sediment, and it contains some ironstone layers. It was laid down as sand banks and intertidal sand flats on the western edge of the shallowing North Sea basin.

Roman cement

A natural cement made by calcining and grinding a lime-rich clay or mudstone in a process patented in 1796. It gave rise to an important industry in south-east Suffolk until it was superseded by the Portland cement making process in the early 19th century.

Spit

A naturally mobile promontory of material, normally sand and/ or shingle, deposited by longshore drift, which projects out from a headland. Orford Ness is a classic example.

Terebratulids

A Class of marine animals with shells belonging to the Phylum Brachiopoda (Lamp Shells).

Till

Unsorted, crudely stratified material deposited directly by glacial ice; otherwise known as 'boulder clay'.

Unconformity

A term used to describe a break in the orderly sequence of strata in the geological record, caused by erosion or non-deposition of sediment at one time horizon.

Westleton Beds

A distinctive suite of coarse, water-rounded, flint-rich gravels and sands of shallow marine origin, belonging to the Norwich Crag Formation and about 1.9 million years old. They are thought to have originated as beach-face and high-energy tidal channel deposits.

Wroxham Crag

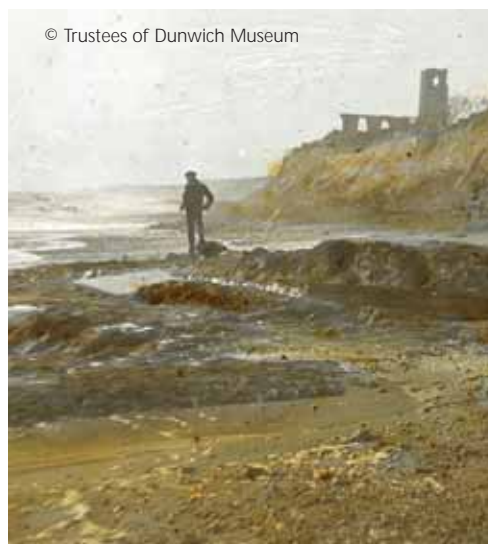
A formation of marine sands, silts and clays of early Pleistocene age found in north-eastern Suffolk and eastern Norfolk, deposited between about 1.7 and 0.5 million years ago. It is distinguished from the Norwich Crag by a higher percentage of non-flint, quartz-rich pebbles introduced to the area by the ancestral River Thames and Bytham River.

Resources and further reading

You can discover more about the origins and development of the Suffolk coast online at

www.touchingthetide.org.uk

Dunwich beach after a storm, 19th October 1911, showing building wreckage and the ruins of All Saint's church on the cliff top. From a lantern slide by A.R. Fisk.



Visitor Information

USEFUL INFORMATION

Ordnance Survey maps

OS Explorer Maps 231 (Southwold & Bungay), 212 (Woodbridge & Saxmundham) and 197 (Ipswich, Felixstowe & Harwich). See www.ordnancesurvey.co.uk/.

Tide Tables

Available for user-selected locations from the UK Hydrographic Office – see www.ukho.gov.uk/easytide/EasyTide/SelectPort.aspx

ACCESS DETAILS

Pakefield Cliffs

TM 537 885 (approx). Accessible from Pakefield village via a walk (about 1 km) along the beach. Visitors to the Holiday Centre may use an access point in the cliffs near the coastguard lookout at Lighthouse Gap.

Benacre Ness

TM 539 860 (approx). Directly accessible on foot from Kessingland village.

Benacre Broad

TM 530 830. Accessible along the beach via public footpaths from Benacre, Kessingland, and Covehithe. Visitors may use a bird hide which overlooks the south-east corner of the Broad.

Covehithe

TM 528 820 (approx). Accessible along the beach via public footpaths from Benacre and Covehithe. Please park cars carefully along roadsides, as there are no public car parks.

Easton Bavents

TM 514 777 (approx). Car parking north of Southwold pier. Charges apply - see www.southwold.info/local-info.html.

Dunwich

Dunwich village - TM 478 705 (approx). free car parking near the beach café, and limited parking in the village.

Dunwich Heath - TM 479 677 (approx). car park managed by the National Trust; charges apply – see www.nationaltrust.org.uk/dunwich-heath-and-beach/.

Sizewell

TM 578 628. Car parking near the beach café; charges apply – see www.suffolkcoastal.gov.uk/yourdistrict/carparks/.

Thorpeness

The Ness TM 477 606. Car parking near the beach and Thorpeness Mere café; charges apply – see www.suffolkcoastal.gov.uk/yourdistrict/carparks/.

Aldeburgh

TM 460 568. Car parking in the town. Charges apply – see www.suffolkcoastal.gov.uk/yourdistrict/carparks/.

Orford Ness

TM 450 490 (approx). Access is managed by the National Trust only through booked excursions via a ferry from Orford Quay. Charges apply – see www.nationaltrust.org.uk/orford-ness/. Limited car parking for the quay is available in Quay Street car park (charges apply) – see <http://www.orford.org.uk/community/new-orford-town-trust/car-parking/>.

Bawdsey, East Beach

TM 356 395. Access by car via East Lane, with free parking. East Beach may be reached by walking back up the Lane to a concrete track leading towards the Martello Tower.

Bawdsey

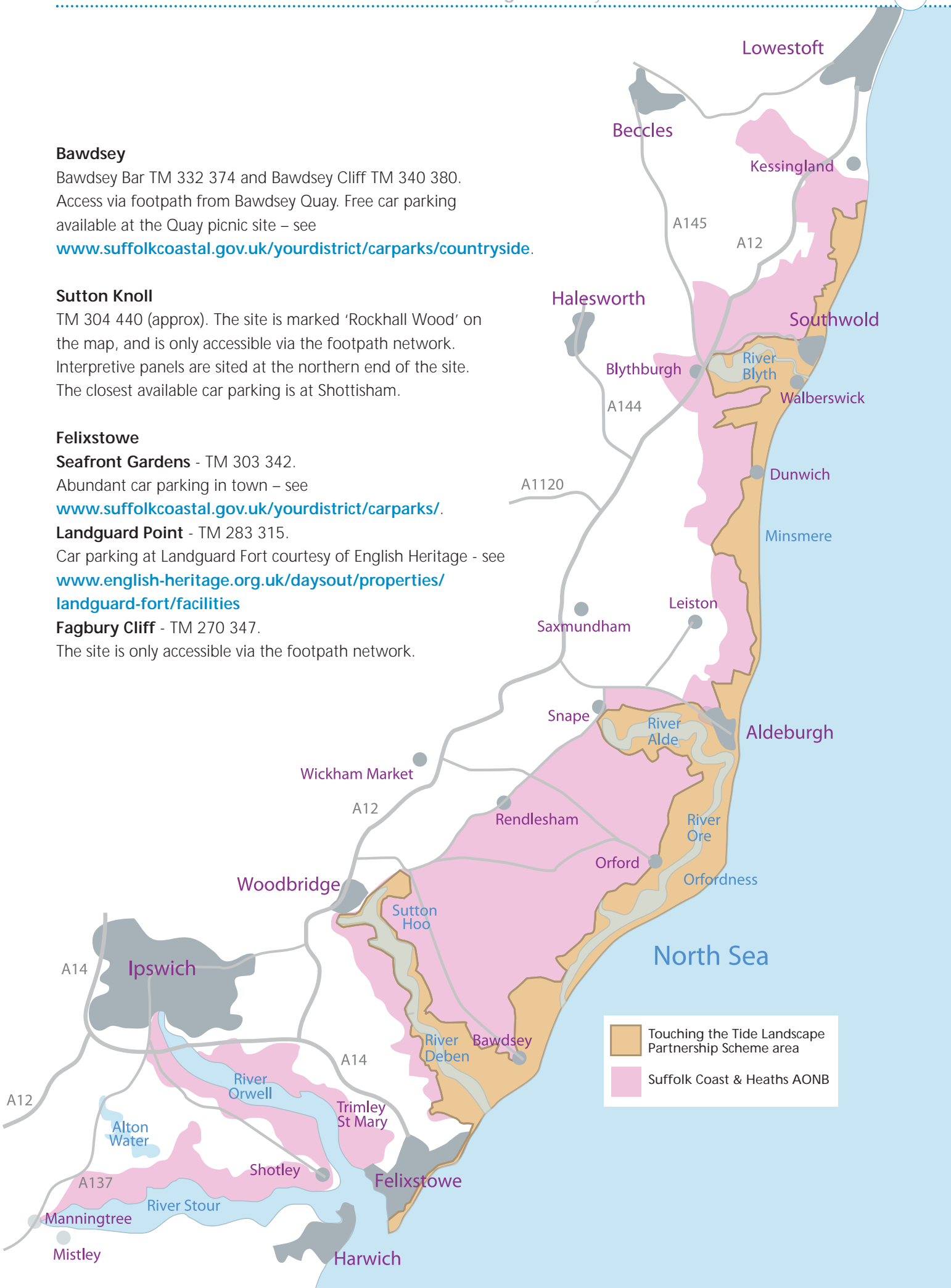
Bawdsey Bar TM 332 374 and Bawdsey Cliff TM 340 380.
 Access via footpath from Bawdsey Quay. Free car parking available at the Quay picnic site – see www.suffolkcoastal.gov.uk/yourdistrict/carparks/countryside.



Sutton Knoll

TM 304 440 (approx). The site is marked ‘Rockhall Wood’ on the map, and is only accessible via the footpath network. Interpretive panels are sited at the northern end of the site. The closest available car parking is at Shottisham.

Felixstowe

Seafront Gardens - TM 303 342.
 Abundant car parking in town – see www.suffolkcoastal.gov.uk/yourdistrict/carparks/.
Landguard Point - TM 283 315.
 Car parking at Landguard Fort courtesy of English Heritage - see www.english-heritage.org.uk/daysout/properties/landguard-fort/facilities
Fagbury Cliff - TM 270 347.
 The site is only accessible via the footpath network.



	Touching the Tide Landscape Partnership Scheme area
	Suffolk Coast & Heaths AONB



This book is an introductory guide to the coastal geodiversity of Suffolk, the first of its kind. It focuses on the stretch from Pakefield to Felixstowe, taking in a range of publicly accessible geological features and landforms, telling the story of the physical landscape we see today. Many of these places are designated Sites of Special Scientific Interest or County Geodiversity Sites. Using this book as a starting point, you can go on to discover them in more detail using the resources and references provided. A glossary is provided to give more detail about key words and concepts.

I hope readers will discover some fascinating new places. I also hope they will come to appreciate the dimension of deep time which underlies the world around us: the value of Suffolk's rocks and sediments as windows into the past and a guide to the future, and the temporary nature of everything we see. The Suffolk coast is a place for contemplation as well as exploration.

Tim Holt-Wilson

