



Kent Coastal Network

Towards integration on the Kent Coast

This topic paper is part of a KCC coordinated project to develop an Integrated Coastal Action Plan for Kent. The aim is to generate wider discussion and it is accompanied by a consultation response form.

Title: Geology and Geomorphology

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Introduction

Geology literally means 'study of the earth'. Geology affects the type of plants and animals that can be found in any area and the type of materials that are available to us for building and other uses. Geomorphology provides a record of how landscapes have developed and palaeontology provides a record of prehistoric life, the Kent coast has a rich fossil record.

Geology is particularly apparent where materials are exposed at the coast.

Sediments laid down in the Cretaceous and Tertiary and Quaternary periods are represented as layers of sands, clays, limestones and gravel deposits.

Kent has a varied coastline ranging from chalk cliffs in Dover and Thanet to areas of London Clay (used for bricks and rich in fossils) and at Dungeness, the largest shingle structure in the United Kingdom. This has developed since Britain became an island over 5,000 years ago. Gravel and shingle have formed a key component in the construction industry.

Geology overlaps with the historic environment, where it reveals human activity; this is the case within the Quaternary period which covers 2.5 million years ago until the present.

This topic paper

- Summarises the Geology and Geomorphology resource for the Kent coast.
- Invites comment from all coastal stakeholders about the issues affecting/constraining the Geology and Geomorphology resource in Kent. The responses will be used to ensure a well informed and supported plan is developed.

A finite resource

The majority of geological knowledge is derived from the study of exposed rocks and fossiliferous deposits. Such sites are a vital part of our historical heritage. In many cases these sites are being lost to future generations to enjoy and understand through natural processes such as erosion or climate change or through human neglect such as over-mining or vandalism. It is vital that policies are in place to protect these sensitive and finite resources.

Geological knowledge is not only important in itself, but it also has several vital practical applications, ranging from building materials to knowledge that will be vital in understanding the potential future impacts of climate change and associated environmental hazards.

Geological conservation

Geological conservation is an integral part of the work of Natural England. It is essential that we conserve our geological heritage for future generations, not only for research, but for education and enjoyment by all. In England, there are approximately 1215 Sites of Special Scientific Interest (SSSI's) with a notified geological interest, representing almost a third of the total number of SSSI's in the country. In addition to this, geological conservation outside of the SSSI's is supported through involvement with the voluntary conservation sector.

Coastal SSSI's in Kent: -

- Dungeness
- white cliffs of Dover
- Folkestone Downs
- Medway Estuary
- Sandwich Bay
- Tankerton Slopes
- Thanet Coast
- The Swale

Protected Sites

Candidate geological Sites of Special Scientific Interest (SSSI) have been identified through the Geological Conservation Review (GCR), a systematic site selection exercise carried out throughout Great Britain between 1977 and 1990 (Ellis et al, 1996).

In addition to the SSSI designation, there are about forty five National Nature Reserves (NNR's) in England with nationally important geological interests.

Kent coast example; Folkestone Warren (SSSI)

Grid Reference – TR 276386

This coastal section, comprising steep chalk cliffs and foreshore exposures is located just to the east of Folkestone. The eastern part of the site, particularly the cliffs exposing the Gault Clay and the Folkestone Beds, can be accessed from the seafront at the eastern end of Folkestone where car parking is available near to the golf course. The main mass of the Warren and the landslip can be accessed by steps that lead down the cliff from Capel-le-Ferne.

The coastline between Folkestone and Dover exposes rocks of Cretaceous age (142-65 million years old), including two rock exposures of particular importance. The series of cliff sections at the western end of the site, with some 50m of Folkestone Beds (Lower Greensand) and Gault, represents the most important single locality for studying these rocks in England. The Gault Clay exposures in East Wear Bay yield beautifully preserved fossils, including

ammonites, bivalves and crabs and have also produced the fossilised remains of a number of types of marine reptiles including turtles, ichthyosaurs, plesiosaurus and pliosaurs.

The high chalk cliffs at the back of the Warren, are largely inaccessible, but are an internationally important reference site providing extensive and nearly continuous cliff and shore exposures of the Cenomanian, Turonian and Coniacian Stages of the Cretaceous Period (Lower, Middle and early Upper Chalk). The site is historically very important as many geological principles, such as using fossils as means of correlating rock sections were tested here during the early development of geology.

Folkestone Warren itself consists of a series of landslides which includes both Chalk and Gault, and has probably been more intensively studied than any other landslide of comparable size in Great Britain. This is largely because it is crossed by the main Folkestone-Dover railway line, which on occasion has been displaced by slipping (notably in 1915), creating an immediate demand for detailed studies and monitoring. The site has suffered twelve major slips since 1765, and is now protected by a complex of coastal defence works.

Management of geological SSSI's

Selection and subsequent notification to the owners and occupiers of a site's designation as an SSSI is only the initial step in conserving its geological interest. Long-term conservation of geological sites often requires a positive approach to management, through, for example, clearance of vegetation to maintain rock exposures.

Geological site types

The Earth Science Conservation Classification (ESCC) has been used since 1990 by all of the UK statutory conservation agencies to classify geological sites. The ESCC was revised in 2003 in the light of practical experience in using the original classification. The revised ESCC has sixteen site types organised into three major categories.

The three main categories are:

- Exposure or extensive – often coastal cliffs and foreshore.
- Finite – often mineral or fossil deposits.
- Integrity - sites are geomorphological and are characterised by the need for holistic management.

The distinctions between the three main categories are important, reflecting very fundamental differences in conservation strategies. The classification allows generic threats and conservation strategies to be defined for the different site types.

Geological Groups in Kent

A diverse range of formal and informal groups operate in the county who are actively engaged in the study, conservation and preservation of the geological and geomorphologic sites that exist on the coastline. Groups include:

Regionally Important Geological/Geomorphological Sites (RIGS)

Regionally Important Geological and Geomorphological Sites (RIGS) were established in 1990 by the Nature Conservancy Council (NCC) and continue to be actively supported by the UK statutory conservation agencies.

RIGS do not have formal statutory protection in the same way as SSSIs. However, local RIGS groups notify the planning authorities of the sites which have been declared in their area and encourage formal protection through the planning process. RIGS can be listed on local development plans.

The Kent RIGS Group is organised by a committee whose members are elected annually.

The major task of conducting site surveys or letting contracts for such work, requires that most committee members are professional geologists or palaeontologists, or have particular experience in their allocated tasks.

Affiliated to Geologists' Association. Contact <http://www.kentrigs.org.uk>

Kent Geologists' Group

The aim of the group is to encourage the knowledge of geology in Kent, and this is achieved by means of a programme of both indoor and outdoor meetings. Indoor meetings include talks by guest speakers, workshops and quizzes.

Field meetings concentrate on Kent geology with visits led by experts to such classic sites as Herne Bay, Sheppey and Folkestone.

Local group of the Geologists' Association. Contact <http://www.kgg.org.uk>

Sheppey Fossil Study Group

Contact <http://www.sheppeyfossils.com>

Medway Fossil & Mineral Society

Affiliated to the Geologists' Association. Contact <http://www.mlms.org.uk/>

Rock Doc

Based in Thanet, Dr Alasdair Bruce runs RockDoc Ltd which focuses on protection of the geological resource and education through public events
Contact cllr-alasdair.bruce@thanet.gov.uk

Threats to conservation of geological sites

The basis of geological conservation is to maintain the geological features of interest for ongoing and future scientific study.

a) Inappropriate development

Developments which result in geological interest features being concealed or destroyed represent major threats to geological conservation.

Shoreline management projects, such as coastal defence schemes often have an adverse effect on the geological resource – see “integration of..” section.

b) Natural degradation

This is a serious problem on many geological sites. Uncontrolled vegetation encroachment and slumping of faces are the commonest problems, resulting in geological features becoming obscured.

c) Irresponsible recreational activities

Rock climbing is not generally damaging to geological sites but can be problematic on some geomorphological sites which are designated for surface features on the rocks. Rope abrasion and general wear and tear can cause significant damage on such sites, particularly if the rocks are relatively soft, such as the sandstone crags of Kent and Sussex. Promotion of good conservation practice by national and local climbing organisations combined with good management practice by site owners helps to minimise damage.

d) Irresponsible specimen collecting

Such collecting of fossils or minerals is a serious problem on certain sites. In extreme cases, irresponsible collecting can result in partial or complete destruction of a geological interest feature.

Responsible specimen collecting, is not considered to be a damaging activity on the majority of geological SSSI's, which are classified as exposure sites. Indeed, on actively eroding coasts, where important material would be lost to the sea if not collected, and responsible specimen collecting is an essential part of geological conservation.

It is generally only on certain finite sites, where the resource is limited and practically irreplaceable, that irresponsible specimen collecting can cause serious damage to or even total destruction of the resource.

It is frequently impossible for site owners to prevent determined collectors from removing material without consent. Since January 2001, the new Countryside and Rights of Way Act gives much greater powers to take legal action against individuals who cause damage to SSSI's.

While the threat of large fines may act as a deterrent, it is preferable that all collectors develop an ethical and sustainable approach to collecting. The irresponsible activities of a few people can destroy the resource for all others to study and enjoy, now and in the future.

Best Practice Guidance for Fossil and Mineral Collecting

Specimen collecting is an important aspect of geology and an important part of geological conservation, as long as it is undertaken in a responsible and sustainable fashion.

Conservation of important geological features cannot be achieved solely by legislation. Awareness-raising initiatives and the involvement of local people in geological conservation are vital for effective site conservation.

Therefore, communication through sign-boards, production of leaflets, open days and media articles are key parts of successful geological conservation.

This type of work is very resource intensive and requires input from knowledgeable local geologists.

Activity and distribution of resource: -

Sheppey, Seasalter and Tankerton - London Clay, a marine and estuarine sediment created 50 million years ago. The clay has been and is still utilised to make bricks and is famous for its rich fossil resource of plants, fish, birds, reptiles and mammals.

Beltinge - Sands laid down as marine sediments over 50 million years ago are exposed as cliffs. The sand has been exploited within the construction industry and produces large numbers of fossilised sharks' teeth.

Thanet and Dover – Chalk, a form of limestone composed of the remains of microscopic marine organisms. The thick layers of chalk are exposed as coastal cliffs. The chalk is a rich resource for fossil hunters.

Folkestone - Gault Clay, clay used in the making of bricks and is the most famous place in Kent to find fossil ammonites.

Hythe - Kentish Ragstone, a form of limestone important in the construction of building and roads.

Dungeness and Swalecliffe - Gravels laid down over the past two million years when the environment has been shaped by major climatic episodes including glaciations and warmer temperate periods.

Although the ice sheets did not reach Kent, the influence of the alternating cold and warm phases are clearly visible in the landscape. The gravel provides a rich fossil record that includes the remains of Woolly Mammoth and Rhinoceros and early humans in the form of flint tools.

Dungeness, the largest shingle structure in the United Kingdom has developed since Britain became an island over 5,000 years ago. Gravel and shingle have formed a key component in the construction industry.

Regulators

Natural England

The role of Natural England is to conserve and enhance the natural environment for its intrinsic value, the wellbeing and enjoyment of people and the economic prosperity that it brings. This includes the protection of the geological and geomorphic environment.

The geology of England is spectacular, diverse and of great importance in the historical and continued development of geological science. At the heart of Natural England's remit is the conservation of our geological heritage for future generations, not only for research, but for education and enjoyment by all.

The science of geology enables us to understand the history of the Earth and the life it supports. The geological record encompasses almost four billion years of history and reveals how life has evolved, how continents have drifted, how climates and sea-levels have changed and how natural processes have shaped the landscape.

Integration of Geology and Geomorphology on the Kent Coast

Biodiversity

Natural England actually describe the geological resource as 'geodiversity' –

"The term 'Geodiversity' is used to emphasise the links between geology, geomorphological processes, soils and landscape. Geodiversity is important in helping us to understand current and future environmental change, and it

plays a key role in influencing natural processes, landforms, soil types, habitat distribution, land use, and landscape character.”

Conserving England’s geodiversity: making the transition into Natural England, Prosser; 2005

There is clear overlap and association with the following elements of the biodiversity theme. In many cases it is the presence of in-situ geology that creates the conditions for the requisite landscape, habitat or environment to exist.

Coastal Saltmarsh	Development – sea defences
Coastal Sand Dunes	Recreational misuse
Coastal Vegetated Shingle	Development – sea defences
Littoral & Sublittoral Chalk	Fossil collection
Maritime Cliff & Slope	Fossil collection
Marine	Gravel extraction
Mudflats	Fossil collection

In some cases a conflict may arise due to one or more of the threats cited in relation to geological conservation.

Quality of the Water Environment

This theme relates to the Kent coastal environment in the following terms: -

Water quality	Safety and health of fossil collectors
Air quality	Erosion of limestone cliffs
Pollution	Degradation of sites/Safety and health of collectors
Litter	Safety and health of collectors
Climate Change	Loss of sites

Historic Environment

The coastal and maritime historic environment provides the greatest cross-over of all the themes contained on this place.

The historical theme refers to the physical remains of all human activities relating to the coast in the recent and prehistoric periods. The theme crosses the boundary of geology and archaeology. A clear example is the use of flint in order to manufacture stone tools and the deposits of mammalian remains contained within river gravels now exposed on the modern inter-tidal zone.

The impact of pollution, erosion, sea-level change and human activity place many of these sites at risk. Many sites have already been lost.

Industry

Pollution and gravel extraction.

Recreation

Water based activities: - Motor boating, personal watercraft, off-road driving/motorcycling, quad bikes. These activities are supported via a network of local clubs. However, unregulated and uncontrolled access into geologically sensitive areas needs to be examined.

Regeneration and Coastal Towns

The coastal regeneration theme can be defined as the improvement of environmental, economic and social conditions, usually through physical change.

Coastal towns – many coastal towns in Kent are also areas that present a rich and diverse geological resource and can be utilised to create work and tourism.

Green infrastructure – this refers to wider landscape regeneration, this often involves creating better access to and use of coastal areas that are geodiverse.

Shoreline Management

Coastal protection schemes represent a significant threat because a large proportion of geological SSSI's are situated on the coast. Hard coastal defences, which permanently conceal rock outcrops, are directly damaging.

Other forms of defence, which alter the dynamics of the shoreline system, can cause indirect damage by inhibiting erosion, which is essential for the maintenance of exposure in cliffs.

Similarly, any developments which perturb natural processes can damage or destroy active geomorphological systems, on the coast or elsewhere.

A wide range of structures constructed to protect the communities and farmland of Kent can be seen along the coastline:

- Groynes - structures of rock and timber situated in the sea to control beach movement such as those at Whitstable and Dymchurch
- Breakwater - rock or concrete arms to protect an area from wave action can be seen at Herne Bay
- Revetment - a sloping stone or concrete surface to protect shoreline from wave action such as the ones at Reculver or Folkestone Warren
- Beach replenishment - the mechanical import of material to a beach such as done at Hythe
- Beach reprofile - the movement of beach material from downtide to uptide

What are the effects of these interventions? How do they impact on the areas outside of the area they are intended to protect?

Tourism and the Visitor Economy

Beaches – Kent has a great resource here, Thanet is very well provided for and has 10 blue flag beaches, the best performance anywhere in the county. Many beaches present a rich geological resource at both states of the tide.

Heritage sites – whether it's Dover Castle or Chatham Dockyard, Kent. There is an opportunity to overlay geology into these sites. For example, how flint and other local rocks were used by the Romans and Normans to build forts and castles.

Nature Reserves – areas such as the North Kent Marshes, Romney Marsh and Dungeness, could make more of their geological interest.

Policy directions for Geology and Geomorphology on the Kent coast

This theme should build on the strategic approach developed by Natural England in order to formulate a clear and coherent plan for coastal geology/geomorphology.

Questions for discussion: -

Do you agree with the strategic approach being taken by Natural England to formulate a clear and coherent plan for coastal geology/geomorphology?

Should Shoreline Management projects take better consideration of damage to geological sites and disruption of geomorphological processes?

Can ICAP assist with the development of the RIGS code of conduct for coastal fossil collecting?

Will greater educational/leisure use of the coastal geological resource in Kent assist with some of the conservation issues?

Credit:

Natural England - <http://www.naturalengland.org.uk>

Kent Archaeological Projects – kaparch@talktalk.net

Kent Geologists Groups – <http://www.kgg.org.uk>

Kent RIGS - <http://www.kentrigs.org.uk>

Mapping Kent – mappingkent@gmail.com

Medway Mineral and Fossil Society – <http://www.mlms.org.uk/>

Rock Doc Ltd

Sheppey Fossil Study Group – <http://www.sheppeyfossils.com>

Timescapes - <http://www.timescapes.spaces.live.com>